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Neolithic 'Celtic' Fields? A Reinterpretation of the Chronological Evidence from Céide Fields in North-western Ireland

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It has long been claimed that the coaxial stone boundaries of Céide Fields, County Mayo, are a phenomenon of the Irish Early Neolithic—analogous to later prehistoric 'Celtic' fields in all but age. This study argues that the age disparity is an artefact of the research methods, and that the age of the main Céide Fields complex has been overestimated by as much as two-and-a-half millennia.

Keywords: Neolithic, Bronze Age, field systems, agriculture, settlement, peat, pollen

INTRODUCTION: CÉIDE FIELDS IN CONTEXT

Céide Fields has been described as the 'oldest enclosed landscape in Europe' (Lucas, 2010). Intensive survey of this complex on the coast of north-western Ireland has traced the mesh of stone field boundaries beneath oceanic blanket peat. The complex is a textbook example of a 'Celtic' field system—a well-documented phenomenon of the Middle to Late Bronze Age and Iron Age in Europe. The site of Céide Fields, however, has been consistently assigned to the Early Neolithic. Clearly, compelling evidence would be necessary to sustain this chronological anomaly, particularly in what was one of the last areas in Europe to adopt agriculture. The following critical analysis of the available chronological data will demonstrate that no such evidence has come to light. Rather, the data indicate that Céide Fields conforms to the established European chronology, and was established in the later Bronze Age.

Céide Fields is an extensive grouping of peat-covered stone boundaries on the Atlantic coast of northern Co. Mayo in north-west Ireland. At the heart of the complex is Céide Hill, a spur projecting northwards from the Maumakeogh mountain, separating the Behy and Glenulra valleys (Caulfield, 2011b: 119). The place name 'Céide' means flat-topped hill in Irish (e.g. Flanagan & Flanagan, 1994: 49). On the middle and lower slopes of Céide Hill, a network of long parallel boundaries connected by shorter cross-walls constitute the main Céide Fields complex (e.g. Caulfield et al., 2011a: fig. 6) (see Figure 1). These are 'the regular ladder fields of Céide', that 'dominate [...] the archaeological imagination' (Warren, 2009: 144–45). A candidate for World Heritage status, Céide Fields is 'iconic for Irish archaeology' (Caulfield et al., 2011b:1).

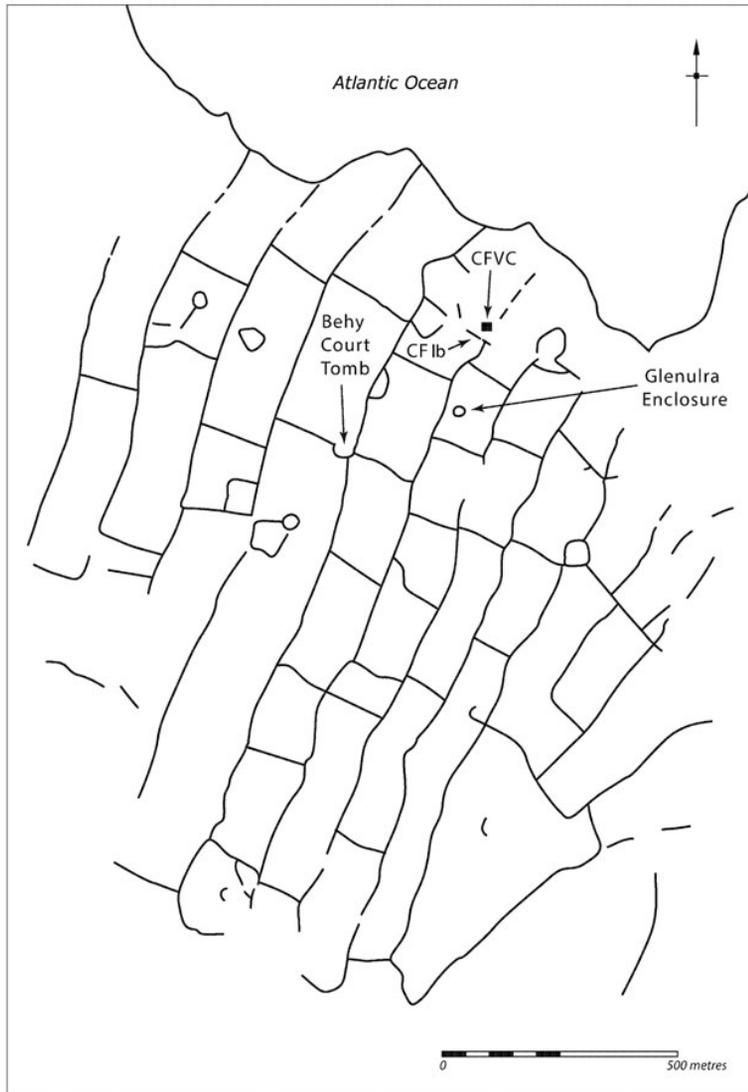


Figure 1. Plan of the sub-peat boundaries on Céide Hill (after Caulfield et al., 1998: fig. 2). The area shown is identified by Caulfield et al. (2011a: fig. 6) as the main Céide Fields complex. Missing detail around the Behy court tomb has been added, as per Caulfield et al. 2011a: fig. 6. By permission of the journal *Radiocarbon*.

Being systematically laid out according to one major axis—in this case predominantly northeast–southwest—the Céide Hill complex is identified by Fleming (e.g. 1987) among the ‘coaxial’ field systems of Britain and Ireland. Coaxial systems are themselves a subset of the wider European phenomenon of ‘Celtic’ fields. These are found in many parts of north-western Europe, including Sweden, Denmark, Germany, the Netherlands, and Britain, but generally they are seen as a phenomenon beginning in the Middle Bronze Age around 1500 BC, and extending into the Roman period, possibly as late as the fourth century AD (e.g. Fowler, 1983: 94; Spek et al., 2003; Chadwick, 2008c; Richardson, 2008).

A number of recent studies in southern England have suggested that early coaxial field systems may have been constructed in the final centuries of the Early Bronze Age, after 1800 BC (Lewis & Batt, 2006; Nowakowski et al., 2007: 24–25, appendix 1; Bradley et al., 2016: 169). The Céide Fields, however, have long been attributed to the Neolithic (e.g. Caulfield, 1978; 1983; Cooney, 1997) and more recently to the earlier Neolithic (e.g. Cooney, 2000; Rowley-Conwy, 2004; Bradley, 2007; Cooney et al., 2011; Warren et al., 2011).

Just a few short sections of the sub-surface boundaries on Céide Hill have been observed by archaeologists, the complex having been ‘preserved intact by a cover of blanket bog’ (Caulfield et al., 1998: 629). The plans of the complex are the outcome of years of painstaking fieldwork, probing the peat with steel and bamboo rods. Although the early sketch plans (see Caulfield, 1974; 1978) have been redrawn and extended, the inevitable—sometimes significant—errors present in the primary data remain largely uncorrected (see O’Keeffe & Ciuchini, 2010). The written archive for earlier research at Céide Fields ‘is poor’, and has only recently been brought towards publication (Caulfield et al., 2009b: 4).

Archaeological excavations at Céide Fields have been limited in scope. Where excavation has taken place, the objective was to expose the remains, but not examine them in detail, ‘... it being the policy not to move or disturb the stones’ (Byrne et al., 2009a: 22). The sections of the boundaries that have been observed are typically 0.5–0.7 m high and slope gently to either side to give a lateral spread of stones of up to 2.5 m (Molloy & O’Connell, 1995: 222). This low, broad profile gives the boundaries the appearance of linear clearance cairns (see Figure 2); there are no obvious gateways between the fields.

For Caulfield ‘[t]he fields are much too large and the area too exposed to have been suitable for cereal growing’ (1981: 97), although he acknowledges that the height of the stone boundaries would have been insufficient to control sheep, goats, or deer (Caulfield, 1983: 200). Whether cattle could have been effectively controlled without additional measures such as hobbling (see Molloy & O’Connell, 1995: 222) or the augmentation of the stone boundaries with fencing/hedges is open to question. No evidence of such practices has been presented. Similarly, there is no apparent evidence for drove-ways between the fields or stock-handling facilities (see Herring, 2008: 73). The limited excavations that have taken place on Céide Hill have, however, yielded evidence for tillage (see below). Elsewhere, the long axial boundaries characteristic of many ‘Celtic’ fields have typically been interpreted as evidence of cultivation, allowing ‘the plough-team an uninterrupted progression from one end to the other’ (Harding, 2000, 153; Johnston, 2013: 323–24). As intensification and crop diversity increased, further cross-walls may have been added.

Caulfield has further proposed that the regularity of the Céide Fields was ‘clearly not the result of piecemeal clearance and enclosure’ (1981: 97). The field system has instead been interpreted as having been laid out as a ‘single operation’ to a predetermined plan (see also Caulfield, 1983: 197). This remains the consensus interpretation (e.g. Cooney et al., 2011: 616). Researchers investigating similar field systems elsewhere, however, have challenged such a perspective. In place of a grand plan, it has been argued that the structure of similar field systems may have emerged within traditions of tenure (e.g. Johnston, 2005). In this model, fields may have been added, or larger fields subdivided, according to the developing requirements of kin groups or communities (e.g. Chadwick, 2008b).



Figure 2. (A) Junction of the cross-wall (from bottom of picture) with the main southwest–northeast coaxial wall (running left to right) near to the Behy court tomb; (B) section of exposed field wall close to the Céide Fields Visitor Centre (CFVC). Ranging poles divided into 0.5 m segments.

It could be further argued that a field system of the size and regularity of Céide Fields was the product of an intermediate phase in a developing sequence of land allotment. Intuitively, earlier phases might include unenclosed clearings, individual enclosed fields, and small irregular groupings of fields (see Roberts, 2008: 197). Perhaps it is the lack of excavation, and the lack of precision in palaeobotanical sequences, that account for the apparent absence of such a sequence at Céide Fields. Possibly earlier boundaries were incorporated into the later coaxial field system (see McOmish, 2011: 4). The problem with the suggestion that Céide Fields was the work of ‘immigrant farmers with an already established neolithic economy’ (Caulfield, 1983: 205) is that no early fourth millennium BC field system has been identified anywhere else in Europe.

At Céide Fields during the early 1990s archaeologists removed a section of a cross-

wall as part of drainage works connected with the construction of the Céide Fields Visitor Centre (CFVC) (Byrne et al., 2011: 78–80). The site is centrally located among the main complex of field walls on Céide Hill (Byrne et al., 2009a: 5). A distinct black, charcoal-rich layer of peat, c. 2.5 cm thick, covered the adjacent mineral soil, and was observed between, but not beneath, stones in the lateral spread of the boundary (Molloy & O’Connell, 1995: 212–13). The apparent absence of peat beneath the stones led the excavators to determine that the construction of the wall took place before the peat began to accumulate, but probably ‘not by more than a century or so’ (Byrne et al., 2011: 78). A pollen core (CF 1b) was extracted from the downslope edge of the cross-wall (see Figure 3; location marked in Figure 1). Two radiocarbon dates from the black, charcoal-rich peat layer, and one from the peat above, constitute the only radiocarbon-dated peat samples recovered from a context in direct association with a field wall at Céide Fields. The samples returned three later Bronze Age/iron Age radiocarbon dates (Table 1).

Table 1. Radiocarbon dates from pollen core CF 1b.

Lab code	Sample	Height above mineral soil (cm)	¹⁴ C years BP	¹⁴ C years cal BC
GrN-20631	CF I-1	0–1	2760 ± 40	1010–810
GrN-21116	CF I-3	1–2	2870 ± 40	1200–910
GrN-20632	CF I-2	7–8	2250 ± 50	410–190

Source: Molloy & O’Connell (1995: table 2); cal BC dates after Cooney et al. (2011: table 12.6).

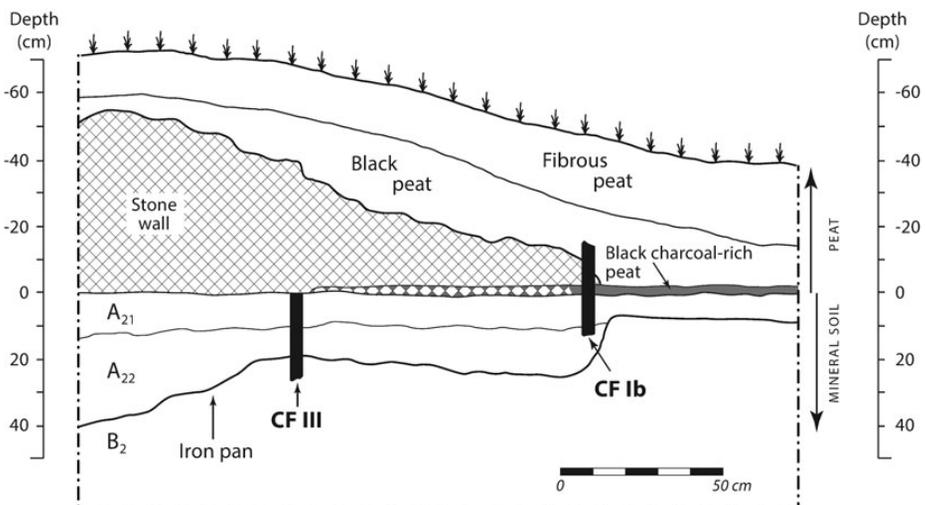


Figure 3. Sketch of an excavated section of field wall near the Céide Fields Visitor Centre showing the position of soil cores CF 1b and CF III (after Molloy & O’Connell, 1995: fig.17). Features shown from centre of wall (left of diagram) northwards. The amount of organic material recovered from core CF III, extracted from beneath the ‘kernel’ of the wall and sealed by a large stone (Byrne et al., 2011: 80), was deemed insufficient for the purposes of radiocarbon dating (Molloy & O’Connell, 1995: 213). By permission of the Niedersächsisches Institut für historische Küstenforschung, Wilhelmshaven.

A number of trenches opened in advance of the construction of the Visitor Centre produced apparent evidence for tillage: plough-marks (most of which share the southwest–northeast alignment along the long axial boundaries), as well as evidence of stone clearance and possible lynchets (Byrne et al., 2011: 82–85). This was taken to indicate that there was an arable component to Neolithic farming on Céide Hill, supplementing the main ‘beef crop’ (Caulfield, 1983: 203). A sample of infill material from the sub-peat plough-marks, however, returned a Late Bronze Age/Iron Age radiocarbon date: 750–380 cal BC (GrN-20032: 2390 ± 40 bp) (Byrne et al., 2011: 83).

There is no direct evidence for Neolithic animal husbandry on Céide Hill. Caulfield (1983: 200) bases his projections for the scale of beef production on the ratio of cattle bones in bone assemblages at other prehistoric and early historic sites in Ireland. While the acidic peat constitutes adverse conditions for the long-term preservation of bone, calcined bone (burnt white) has been found in such conditions (Schulting et al., 2011: 36). It may again be the case that the lack of formal excavation at Céide Fields is to blame for the absence of evidence in support of the cattle ranching hypothesis. Animal bone did not feature in the assemblage of the Behy court tomb, although human bone ‘in good condition’ was recovered (Fibiger, 2011: 45).

In short, the evidence that the stone boundaries on Céide Hill represent ‘the oldest field systems known’ (Caulfield et al., 1998: 632) is ‘equivocal’ (Thomas, 1996: 4). However, for Caulfield et al. (1998), proxy dates from plant materials preserved in the blanket peats secure the Neolithic interpretation of Céide Fields beyond doubt.

DATING THE CÉIDE FIELDS

The Behy court tomb (see Figure 1 for location) provides reliable evidence for a human presence on Céide Hill during the Neolithic. The excavation of the monument during the 1960s led to the discovery of a section of field wall that met with the edge of the cairn (Herity, 1971: 262). It was immediately clear, however, that the wall—which incorporated stone quarried from the cairn—was later than the monument. Two of the excavation directors, Ruaidhrí de Valera and Seán Ó Nualláin, considered that the wall might post-date the Neolithic monument by millennia (Caulfield, 2011a: 109). The third director, Michael Herity, felt that ‘a systematic search for and an investigation of pre-bog fences’ might extend knowledge of farming life in Neolithic and earlier Bronze Age Ireland (1971: 264). In 1967, Herity engaged Seamus Caulfield to assist with further research into sub-peat boundaries in the north Mayo peatlands.

The 2009 stratigraphic report from the 1960s excavations at the Behy court tomb records the field wall extending from the monument. The wall branches in two directions: one branch joins ‘the large field walls which divide the area into large rectangular fields’; the other forms a small D-shaped enclosure to the south of the monument (Warren et al., 2009: 4). The authors of the stratigraphic report note that the wall clearly post-dates the collapse of the cairn, further cautioning ‘... there are numerous permutations of the relationship between this wall and the major field walls forming the surrounding rectangular fields’ (Warren et al., 2009: 12). A section of what appears to be the nearest ‘major’ field wall remains exposed in the cutaway bog close to the Behy tomb

(see Figure 2); the wall extending from the monument is not, however, visible above ground. The stratigraphic report concludes that '[w]ithout additional excavation it would be impossible to firmly establish the relationship between this enclosure wall and the field walls' (Warren et al., 2009: 4). Nevertheless, for Caulfield (1978: 141), the excavations have shown that 'these post-tomb walls also post-dated the main field walls'. This uncorroborated assertion continues to inform assessments of the age of Céide Fields (e.g. Cooney et al., 2011: 615).

In a further recent summary of the excavations at the Behy monument, another of the original excavation directors makes the (albeit unsupported) assertion that the post-tomb wall 'appears to be associated with robbing of the main N-S field wall in this area' (Ó Nualláin et al., 2011: 26). In the chronology for Céide Hill that accompanies this report, Warren et al. (2011: 134–38) set aside the reservations expressed in the stratigraphic report to concur that the 'long linear wall appears to have been robbed in antiquity, probably to build [the] small pre-peat wall that runs away from Behy'. Being 'pre-peat', Warren et al. (2011: 134–38) go on to argue that the latter wall may be Late Neolithic [3100–2500 cal BC]—'most likely early in this period'. By extension, they reason that on the basis of immediate archaeological relationships, the long linear N-S wall—'clearly part of the main [Céide Fields] field system'—'has a robust *terminus ante quem* of, most likely the Late Neolithic; the most likely context for this wall is therefore the early/middle Neolithic' (Warren et al., 2011: 134–38).

Even assuming that the axial N-S boundary is substantially earlier than that abutting the Behy tomb, it is a considerable further interpretive leap to assume that the covering of blanket peat places both boundaries in the Neolithic. Two publications in particular—Caulfield 1978 and Caulfield et al. 1998—are fundamental for the Neolithic interpretation of Céide Fields. These are critically reviewed below.

DATING EVIDENCE FROM CAULFIELD 1978

The interpretation of radiocarbon dates obtained in the early 1970s, and published in Caulfield 1978, underpins the characterisation of Céide Fields as Neolithic. Of the four dates obtained on Céide Hill (Table 2), three were extracted from a soil core 'close to the Behy tomb' (Caulfield 1978: 141, my emphasis). Of these, none have calibrated error margins that fall exclusively prior to 2500 cal BC—the beginning of the Irish Chalcolithic. Indeed, the two error margins that begin in the Neolithic are 810 and 730 years respectively. Besides this imprecision, there are problems with making inferences from vaguely located and uncertain source material.

Oceanic blanket peat accumulating on hillsides is inherently unstable, being especially vulnerable to erosion by redeposition (e.g. Faegri & Iversen, 1989: 138–39; Evans & Warburton, 2007: 49–53). The accumulation and erosion of peat is dependent on complex interrelationships between factors such as topography, hydrology, aspect, vegetation, the nature of the underlying mineral soil, the actions of people and animals, and exposure to wind and precipitation (e.g. Edwards & Hiron, 1982). Peat typically forms first in low-lying basin deposits, on summit plateaux, and within 'initiation foci' such as hillslope depressions (see Figure 4). The relatively stable plateaux and valley deposits above and below the Céide Hill boundaries are frequently ten times deeper than the c. 0.4 m recorded at the site of the Behy core (e.g. Caulfield, 2011b: 117; see below).

Where data are gathered from 'only one or two sites per hillslope (particularly in the absence of exhaustive sub-peat topographic surveys), then the possibility of spurious inferences are highly likely' (Edwards & Hirons, 1982: 36). The samples in Table 2 are recorded as having been extracted from basal peat. The interface between the peat and the underlying mineral soil—particularly on sloping ground—is a zone of intense hydrological activity (see below). The excavation records for the Behy monument make multiple references to evidence for hydrological disturbance: 'downwash', 'water-rolled stones', 'colluvium' (see Warren et al., 2009: 12; Ó Nualláin et al., 2011: 10–13, 25–26). Such remobilisation and redeposition is also in evidence at the micro-scale. While the 810-year error margin in the calibrated date range for UB-153 F does overlap with the calibrated range for UB-155, the more precise (360-year) error margin for UB-155 indicates a younger age for this sample which is lower in the stratigraphy. Commenting on this anomaly, the radiocarbon laboratory warned of 'considerable movement of humic substances' within the core profile (Smith et al., 1973: 223).

Humic substances are derived from the decay of organic matter, and distributed through the peat profile by the movement of water. Humic acid (the fraction extracted from UB-153 F) typically contains most carbon, and so may also have the greatest influence on combined samples such as UB-155 (see Shore et al., 1995: 375). Several studies have shown that humic acid typically returns dates which are considerably older than particularly the humin fraction, as well as other materials in secure association (e.g. Shore et al., 1995; Blaauw et al., 2004: 1541; Swindles et al., 2013: 1496). 'The salient fact', as Shore et al. (1995: 375) put it, 'remains that different fractions of the same bulk sample can contain significantly different levels of ^{14}C and not that the same level of ^{14}C occurred in the atmosphere over different periods of time.'

Table 2. Radiocarbon dates from Behy/Glenulra.

Lab code	Sample	Sample material	Relative height (cm)	^{14}C years cal BC
UB-153 F	Behy monolith	Peat, humic acid	24–28	2840–2030
UB-155	Behy monolith	Peat, combined fine particulate and humic acid fractions	30–34	2130–1770
UB-158 F	Behy monolith	Peat, fine particulate fraction	36–38	2860–2130
SI-1464	Glenulra	Bulk charcoal	Not recorded	3510–2880

Source: Caulfield (1978: 141), with additional details from Smith et al. (1973: 222–23); cal BC dates after Cooney et al. (2011: table 12.6).

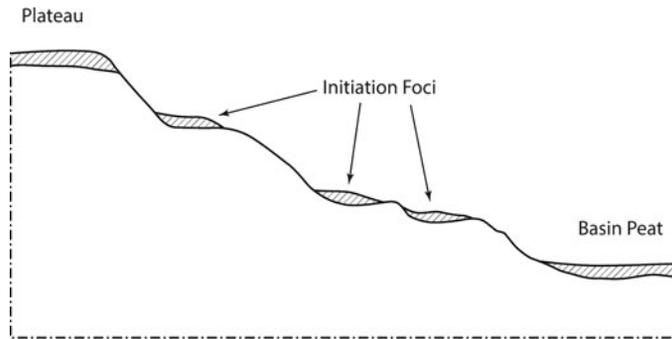


Figure 4. Hypothetical hillside showing variations in topography and peat foci (after Edwards & Hiron, 1982: fig. 2). The site of the Behy tomb may represent a focus of early peat initiation on Céide Hill. By permission of the Quaternary Research Association, London.



Figure 5. Looking down into the chamber of the Behy court tomb. The roof-stone is at the present ground level (see Figure 2). Ranging pole divided into 0.5 m segments.

The sample location of the 'Behy monolith' appears to be a poor proxy for the site of the Behy monument, which is described as 'encased in two metres of bog' (Caulfield, 2011a: 107). Although the precise nature of the sub-peat topography is unknown, visual inspection suggests that the Behy tomb may be situated in a topographic hollow. The roof-stone at current ground level is c. 2 m above the floor of the tomb (see Figures 2 and 5). Indeed, the monument may have served to inhibit accumulating peat from being washed downslope or otherwise eroded. Even so, Ó Nualláin et al. (2011: 48) observe: 'any accumulations of peat were limited into the Late Neolithic and Early Bronze Age, and the [Behy] tomb must have remained a visible feature of the landscape to later occupation'. One such 'later occupation' led to the removal of stone from the monument for the construction of field walls. No more than this can be reliably inferred from the excavation record.

Warren and colleagues tell us (2011: 132) that 'No classic Early Neolithic houses are known from Céide Hill' but such houses have been postulated in the area. The assertion that Céide Fields was 'a countryside of homes scattered through the landscape surrounded by their garden walls' (Caulfield, 1992: 1) rests on the evidence from a c. 500 m² enclosure (with internal area of c. 300 m²) in the townland of Glenulra, often presumed to have contained a circular Neolithic house (e.g. Cooney, 2000: 68; Lucas, 2010: 2). The recently completed stratigraphic report from excavations at the enclosure in the early 1970s describes a 'horseshoe shaped' stone spread c. 7 m across within the enclosure (Caulfield et al., 2009a: 13). The authors caution, however, that it is 'possible that what appears as a single horseshoe shaped foundation on the aerial photographs is not actually a single cohesive structure' (Caulfield et al., 2009a: 14). Elsewhere within the enclosure, a series of postholes were identified, but these 'do not form a conclusive pattern, and multiple interpretations of their layout are possible'; and there was 'no conclusive evidence to indicate which, if any, of these postholes were in use at the same time' (Caulfield et al., 2009a: 15).

The source of the charcoal that provided the final radiocarbon date from Céide Hill in Table 2 (SI-1464) has been narrowed, albeit tentatively, to one of three charcoal-rich spreads located in the western part of the Glenulra enclosure. One of these spreads—it is not clear which—appeared to overlie one of the postholes (Caulfield & Warren, 2011: 59). The enclosure is located on reasonably steep ground, and Caulfield and Warren caution that '[i]t is not clear if these spreads of charcoal rich material should be considered to be small open hearths or are deposits of burnt material from elsewhere' (2011: 59). *If* the dated spread could be shown to be that which overlaid the posthole, and the dated material had not been redeposited, then Caulfield and Warren's (2011: 59) assertion that this spread must post-date 'at least' this posthole holds. The stratigraphic report cites SI-1464 with the following caveat:

It is probably from the charcoal spread c127, although it is possible that it came from one of the other charcoal spreads in that area. Additionally there is no information presently to hand regarding the material that was sampled and, as such, this bulk date should be treated with considerable caution. At best, the radiocarbon date suggests some activity in the mid-late Neolithic (Caulfield et al., 2009a: 12–13).

A further radiocarbon date (3498–3352 cal BC; UBA-16676) has recently been obtained 'from a charcoal spread/hearth, probably from the same feature' that yielded SI-1464 (Caulfield & Warren, 2011: 59). Similar reservations should therefore apply.

A small number of possibly Neolithic lithics and pottery sherds, some of which may be Carinated Bowl pottery, were recovered from one of two 'debris layers', although the nature of these contexts is not recorded in the site archive (Caulfield et al., 2009a: 8). Caulfield et al. (2009a: 8) suggest that the debris layers may have overlain the horseshoe-shaped feature, but offer this only 'as a very tentative solution to an unresolved issue'. *If* the putative Neolithic artefacts found in the soil relate to some form of structure, this, for Caulfield et al., 'raises the possibility that this is a prehistoric house' (ibid.: 14). The presence of the possible Neolithic material among debris overlying the primary context, however, must raise the possibility of redeposition from further upslope—perhaps the result of activity connected with the Neolithic Behy court tomb.

By way of an alternative interpretation, Caulfield et al. (2009a: 13–14) suggest that the potential structure within the Glenulra enclosure, which was light and possibly unroofed, may in fact have functioned as an animal pen. This interpretation has been advanced for a similarly-sized stone foundation' excavated in advance of the Visitor Centre. Byrne et al. (2009b: 39) caution that other comparable small stone foundations associated with the stone boundaries—often seen as indicative of a pattern of dispersed settlement during the Neolithic (e.g. Lucas, 2010)—'are not particularly well understood at present, nor are they convincingly dated'.

In the absence of further Neolithic structural or artefactual evidence, the Neolithic interpretation of the Céide Hill boundaries has been sustained largely by inferences from the analysis of botanical proxies.

DATING EVIDENCE FROM CAULFIELD ET AL. 1998

A project to establish a radiocarbon laboratory at University College Dublin utilised 'samples (mainly pine stumps) from the North Mayo blanket bog zone' to test the facility (O'Donnell, 1997: xi–xii; Caulfield et al., 1998: 629–30). Dates from forty-four pine samples and two peat samples were published and interpreted in Caulfield et al. 1998. The majority of the error margins (typically 300–500 years) fall within the Middle to Late Neolithic. The premise underpinning the interpretation of the dates was that the timber samples provide *termini ante quos* for the initiation of peat growth, which in turn 'must' post-date the stone boundaries constructed on mineral soil (Caulfield et al., 1998: 629). The problem with this assumption is that, while pockets of peat developed at dispersed locations during the Neolithic, it is not the case that the entire region was preserved 'Pompeii-style' by a 'synchronic' blanketing of peat (O'Brien, 2009: 6; *contra* Caulfield et al., 1998: 629). As Warren et al. (2011: 139) acknowledge, '... in several places within [the Céide Fields] system archaeological dates are now showing that the landscape was free of bog into at least the Bronze Age, if not the Iron Age'.

The locations of the samples—some of which are tens of kilometres from Céide Hill—are plotted in Figure 6. Only samples revealed through natural erosion or the hand cutting of peat for fuel were available for dating: the samples were not therefore chosen systematically for their archaeological relevance (see Kullman, 1994: 249). The assumption that the sampled timbers were found *in situ* (Caulfield et al., 1998: 629), i.e. fixed in place in the blanket peat in which they grew thousands of years ago, underpins the dating method. The principle is illustrated by an exhibit at the CFVC (see Figure 7). The premise is that the remains of the pine trees were trapped precisely in the positions in which they grew, providing exact stratigraphic—and, by extension, relative chronological—markers (Caulfield et al., 1998: 629). This does not take account of the underlying topography, peat hydrology, or physical characteristics of the samples, none of which were systematically recorded.

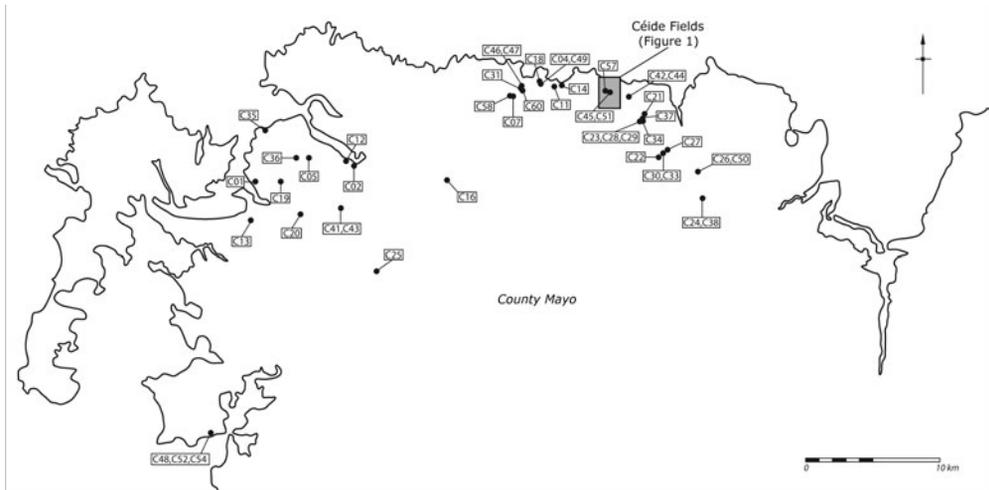


Figure 6. Map of North Mayo (with National Grid coordinates) showing location of Céide Fields (after Caulfield et al., 1998: fig. 1). The locations of the dated samples taken from Caulfield et al., 1998 (table 2), have been annotated here. The grey box (centre-right) represents the outline of Figure 1 in this article, i.e. the area of the main Céide Fields complex. By permission of the journal Radiocarbon.

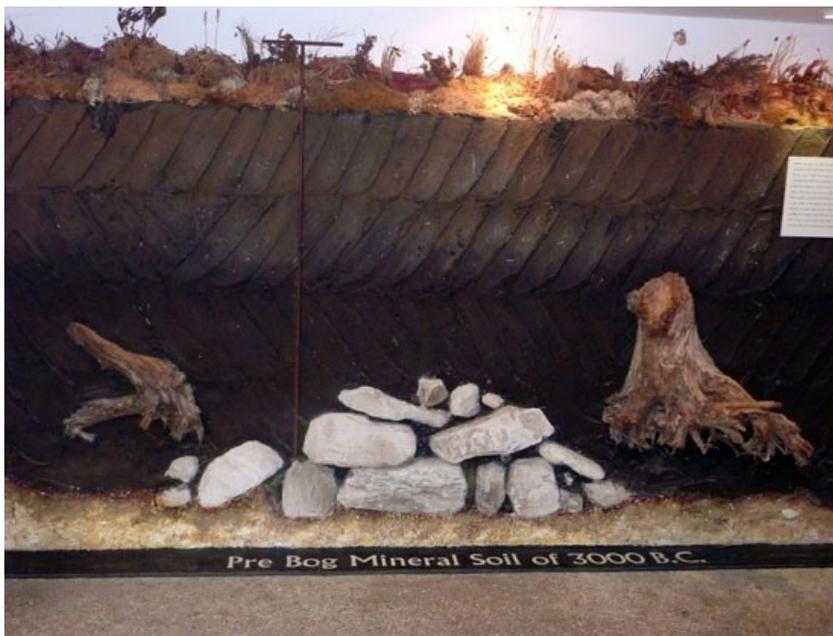


Figure 7. Exhibit at the Céide Fields Visitor Centre illustrating the probing method for locating sub-peat field walls. Relative dating was based on the present stratigraphic relationship between datable timber samples and the stone field walls.

Pinus sylvestris growing in peatland habitats typically develops only shallow root systems, which do not extend beyond the aerated upper layers of the peat. This can render the trees unstable, especially where exposure to strong winds causes the trees to sway (e.g. Eckstein et al., 2009: 138). The trees are also at risk of sinking under their own weight as they grow (Birks, 1975: 185–86). Unstable trees on sloping ground are susceptible to ‘gravitationally induced downslope transport’, particularly when, during wetter conditions, the waterlogging of the peat increases soil-creep, and, in extreme cases, induces mass movements such as peat slides (Kullman, 1994: 251; Warburton et al., 2004).

Just three samples in Caulfield et al. (1998) were recovered from Céide Hill (Table 3). UCD-C51 (‘near tomb’) is described as ‘lying horizontally in the bog’ (p. 632). The remains of a tree lying horizontally are clearly not *in situ*. Similarly, sample UCD-C57 (‘65 m west of tomb’) was recorded as ‘an outer remnant of a very large trunk of a *fallen* pine’ (Caulfield et al., 1998: 632; my emphasis). The final Behy timber sample (UCD-C45) ‘lay on the mineral soil 1 m from a pre-bog wall’. Whether this too was a fallen tree is not clear as no further details are recorded. Kullman (1989: 16) cautions that large timber subfossils resting at the lowest points in the small-scale topography should not be presumed to be *in situ*, as, even in the absence of mass movements of peat, such samples ‘could reasonably have been transported 5–10 m downslope from their original growing positions’.

Table 3. Radiocarbon dates for pine samples on Céide Hill.

Lab code	Location	Height above mineral soil (cm)	¹⁴ C years BP	¹⁴ C years cal BC
UCD-C45	Behy, 1 m from wall	0	4450 ± 60	3360–2910
UCD-C51	Behy, near tomb	5	4500 ± 60	3370–2930
UCD-C57	Behy, 65 m west of tomb	0	4420 ± 50	3340–2900

Source: Caulfield et al. (1998: table 2); cal BC dates after Cooney et al. (2011: table 12.6).

The calibrated date range for UCD-C57 extends to 2900 cal BC, marginally the youngest in the calibrated ranges for the three Behy timbers. The age ranges for each of the three peat samples in Caulfield 1978 (also recorded as ‘near’ the Behy tomb) all fall after 2900 cal BC. So, as Cooney et al. (2011: 622) observe: ‘Where it is possible to compare dates for stumps growing on or just above the mineral soil and dates for the base of the peat in a single area, that of the Behy court tomb, the stumps ... are earlier than the base of the peat.’ Neither the age of the peat, nor, by extension, the age of the stone boundaries, can be reliably inferred from the pine subfossils.

Caulfield et al. (1998) selectively incorporate palaeoenvironmental research published in Molloy and O'Connell (1995). Among Molloy and O'Connell's findings not included are radiocarbon dates from three short peat cores in the vicinity of the Behy monument. Again, the oldest dated peat sample, including a retested sample as well as material from below the surface of the mineral soil, all have calibrated age ranges that fall after the latest range for the Behy pine samples.

Two of the pine samples in Caulfield et al. (1998) were recovered from a deep peat basin in the townland of Glenulra, beneath Céide Hill. Cooney et al. (2011: 622) exclude these from their chronological models as they 'seem to relate to early, localised pockets of peat growth'. The location of the samples (both given the same grid reference) is at a remove from the established complex on Céide Hill, which peters out approximately 0.5 km away on the hillside to the west (see Figure 8). Molloy and O'Connell (1995: 194) chose this peat basin for deep pollen coring, as the unusually deep deposits 'offered the opportunity of obtaining a core, the base of which might predate the laying out of the field system'. The date for pine sample UCD-C44 (5370 ± 70 bp; 4350–3990 cal BC), at the interface between the peat and the mineral soil, was taken to provide an indicative age for 'a layer of timber at a depth of c. 5 m which almost certainly consists of pine stumps' (Molloy & O'Connell, 1995: 202; cal BC date after Cooney et al., 2011: table 12.6). O'Connell and Molloy (2001: 103–04) determine that this is representative of the 'pre-Neolithic environment' across Céide Fields: 'a fully wooded landscape with pine playing a dominant role'.

The stated objective of Molloy and O'Connell's research was 'the reconstruction of past environments, and in particular, that relating to the Neolithic' (1995: 189). At intervals in a single core (GLU-IV) bulk samples of material were radiocarbon dated. Molloy and O'Connell were satisfied that the mid-points of the calibrated age ranges at 1σ (68% probability) exhibited 'good internal consistency'. Assuming a constant rate of peat accumulation, they interpolated a time versus depth curve using these values (1995: 198–200). Having assigned a notional age to each depth of peat, the relative percentages of pollen types within chosen strata were incorporated into a model of environmental change over time.

Molloy and O'Connell's working hypothesis was that the archaeological evidence for the age of the field systems was 'particularly strong' (1995: 189). Being predicated on this prior belief, Molloy and O'Connell's environmental reconstruction cannot be taken as a substitute for Caulfield's dating programmes (but see, *contra*, Cooney et al., 2011: 622). There were many constraints on the precision of Molloy and O'Connell's findings. The chances of the mid-points of calibrated radiocarbon age ranges at 1σ representing true calendar ages are practically zero (Taylor, 1987: 123). Blackford (2000: 194) argues that conventional radiocarbon determinations at 1σ with age ranges typically of between 200 and 500 years are not sufficiently precise for environmental modelling.

Given its susceptibility to erosion, reworking, and redeposition, oceanic blanket peat is poorly suited for pollen analysis (Faegri & Iversen, 1989: 138). Downslope drainage features such as the Glenulra basin are especially vulnerable to inwash from above

(e.g. Walker, 2005: 25, 29; Swindles et al., 2013: 1494). It is not simply surface run-off that will be washed downwards; subsurface networks of peat-pipes (typically ranging in diameter from a few centimetres to over half a metre) are an intrinsic feature of blanket peatlands in Ireland, channelling water, particularly at the interface between the peat and the mineral soil (e.g. Holden & Burt, 2002; Dykes & Warburton, 2007).



Figure 8. Extraction of a core from the peat basin at Glenulra for detailed pollen analysis. The pyramid-shaped Céide Fields Visitor Centre is visible on the horizon to the west (photograph: M. O'Connell, 8 November 1993). By kind permission of M. O'Connell.

Setting these issues aside, Molloy and O'Connell identify a sequence of change in the Glenulra basin deposits that begins with a heavily forested pre-Neolithic environment (their pollen zone 4; 0.526–0.502 m). This is followed, in their pollen subzone 5a (0.498–0.494 m), by a return to 'more typical wet bog conditions and relatively fast and steady peat accumulation' (Molloy & O'Connell, 1995: 203). The substantial rise in Cyperaceae (sedges) in subzone 5a is indicative of an increasingly wet bog surface (Molloy & O'Connell, 1995: 202): '*Sphagnum* began to play an important role[;] pine was no longer growing in the basin' (O'Connell & Molloy, 2001: 104). The increase in Poaceae (grasses) was relatively small, as 'would be an expected consequence of increased bog surface wetness and the local establishment of *Sphagnum*' (Molloy & O'Connell, 1995: 203). A decline in *Ulmus* (elm) pollen within this

stratum 'suggests that the classical Elm Decline, datable to c. 5100 bp, is represented here' (Molloy & O'Connell, 1995: 203). Here, then, are two triggers for a decrease in the proportion of arboreal pollen that require no human intervention. O'Connell and Molloy (2001: 104), however, determine that '[b]ecause the regular layout of the extensive field walls required an open landscape, it is likely that the main field system was laid out during this time'. For the purposes of their refined chronology for Irish field systems using Bayesian statistics, Cooney et al. (2011: 622) concur:

The establishment of the Céide Fields is best dated by the start of the major clearance episode visible in the Glenulra pollen record [zone 5a], which suggests that they were laid out in 3960–3540 cal BC (95% probability; fig. 12.37: start clearance), probably in 3845–3635 cal BC (68% probability).

O'Connell and Molloy (2001: 104) caution that subzone 5a has rather low temporal resolution, being 'the weakest part of the chronology'.

Sphagnum remains at elevated levels for much of Molloy and O'Connell's subzone 5b (0.490–0.474 m); however, along with the Cyperaceae and *Hydrocotyle vulgaris* (pennywort), *Sphagnum* begins to decline around the midpoint of the subzone, which is taken to suggest 'some drying out of the bog surface' (Molloy & O'Connell, 1995: 203). This corresponds with an increase in the proportion of non-arboreal species indicative of grassland, and might reflect heath developing on the surrounding mineral soil (Molloy & O'Connell, 1995: 203). In predictable succession, the recovering landscape sees a proportional increase in arboreal pollen in subzone 5c (0.470–0.450 m). *Corylus* (hazel), which can regenerate rapidly, shows an especially strong recovery (O'Connell & Molloy, 2001: 104), as does *Alnus* (alder), another pioneer species.

Subzones 5b and 5c are taken to correspond with the 'major phase' of Neolithic farming activity. The conjectural 'reduced, though still substantial, level of farming' in subzone 5c—seen as indicated by the decline in grasses and other non-arboreal species—is taken to be followed by the abandonment of the field system in subzone 6a, as arboreal species continue to recover. In this model, subzone 6b sees a return to full woodland cover (O'Connell & Molloy, 2001: 104–06). Although Molloy & O'Connell acknowledge that profile GLU IV does not show when peat began to grow over the nearby field system, the increased proportion of pine pollen in subzone 6b was taken as 'undoubtedly, reflecting the regional colonization by pine of peat surfaces which now, at least partly, cover the stone-wall field system' (Molloy & O'Connell, 1995: 203–04).

Accepting that the evidence from the Glenulra basin may be rather narrow, Cooney et al. (2011: 622–25) incorporate dates from regionally dispersed pine stumps in Caulfield et al. (1998) to model the re-generation of the woodland corresponding with zone 6. They conclude that current evidence indicates that Céide Fields fell into disuse in the 'second half, probably from the third quarter' of the fourth millennium cal BC. This corresponds to the chronology proposed by Warren et al. (2011: 136–38).

WITHOUT PARALLEL?

The environmental sequence proposed by Molloy and O'Connell (1995) might be seen as entirely natural, requiring no human intervention (Whitefield, 2015: 173). The strata in pollen core GLU IV are imprecisely dated. The location of the core in the Glenulra basin is at a remove from the stone boundaries on Céide Hill. The pollen

percentages observed in this complex catchment on the windswept coastal plain cannot be straightforwardly aligned with (poorly dated) human activity on the hillsides above. Pollen core GLU IV *does not* date the boundaries on Céide Hill. The correlation of the inferred environmental sequence with the construction and decline of Céide Fields is predicated on circular reasoning: Molloy and O'Connell attribute a window of reduced forestation to farming in the Neolithic based on the prior belief that the boundaries must have been laid out during the Neolithic.

In fact, Molloy and O'Connell's research casts doubt on the Neolithic chronology for the field system on Céide Hill. The only radiocarbon-dated samples so far recorded in direct association with one of the stone boundaries (core CF 1b; see Table 1) are indicative of later Bronze Age construction. This evidence from soil core CF 1b can also be reconciled with the Late Bronze Age/Iron Age date (GrN-20032) for infill material from the nearby plough-marks. Molloy and O'Connell argue that the palynological evidence for sustained cereal cultivation at this time is 'particularly strong' (1995: 213). Could this post-Neolithic activity explain the clearance of the stone from the land? As O'Connell and Molloy (2001: 101) have observed, 'areas that now have a thin covering of peat probably remained free of bog until at least the late Bronze Age'.

In summing-up their findings, Molloy and O'Connell (1995: 221) noted the 'considerable evidence not only from GLU IV and the BHY series of profiles, but also from other sources' for Middle to Late Bronze Age settlement among the field systems. Archaeological research, meanwhile, tended to play down (Caulfield, 1978: 142)—or even fail to discuss (Caulfield et al., 1998)—the significance of the post-Neolithic evidence. Such omissions are no longer tenable. Byrne et al. (2011: table 41) list fourteen radiocarbon dates obtained from pre-peat material excavated in the vicinity of the CFVC from contexts thought to be associated with human activity. All post-date the supposed later fourth millennium cal BC abandonment of Céide Fields; all but one fall into the Bronze Age.

It has been suggested that the Céide Fields are part of a wider corpus of Neolithic field systems in Ireland (e.g. Cooney, 2000: 46), forming part of an island-wide 'settlement signature' in the early fourth millennium BC (Smyth, 2011: 28). The examples of field systems cited by Cooney (2000: 46) in support of this view date, however, to the Bronze Age or later (see O'Connell & Molloy, 2001: 122). Whitefield (2015: 180–204) has shown that no field system in Ireland has been reliably dated to the Neolithic, much less the Early Neolithic. Another of the proposed signature components of the earlier Neolithic in Ireland are rectangular timber buildings, typically taken to be the houses of immigrant farmers (e.g. Smyth, 2014). No such structure has been identified among the Céide Fields. If Neolithic dwellings were present on Céide Hill, the evidence, or more accurately the lack of evidence, suggests that these were light, impermanent structures, in marked contrast to the field walls. All that has been established regarding the temporal relationship between the field walls and the earlier Neolithic monuments in the landscape is that the Behy monument *predates* the nearest field wall.

It is clear that Céide Fields represents an extensive and well-preserved example of a coaxial field system at the western edge of Europe. There can be no question of the importance of the complex to international scholarship. The research potential of Céide Fields has, however, been compromised by the continuing insistence that the field system is treated within an exclusive (Neolithic) evidential category. Much could be gained through greater engagement in comparative and collaborative studies with

researchers investigating later prehistoric field systems in Britain and Continental Europe (see Chadwick, 2008a: 1), as well as elsewhere in Ireland (e.g. O'Brien, 2009; Jones et al., 2010; Jones, in press).

Archaeological research at Céide Fields has been generously funded over the years (Caulfield et al., 2011a: iv) but it has been limited in scope. There has been significant overreliance on the data from the probed surveys, little of which has been tested for accuracy by excavation. This overdependence on spatial data may have contributed to the conflation of evidence from the Neolithic with that from later episodes of human engagement with the landscape (see O'Brien, 2009: 7). The important work of bringing the Céide Fields research archive towards publication has highlighted the pressing need to test the anomalous chronology to modern scientific standards. This cannot be achieved through the recalibration of legacy dates from poorly understood or irrelevant contexts. A new programme of targeted excavation and high-precision dating is required.

Field systems are notoriously difficult to date, and the difficulties encountered in dating the various examples in north Mayo are by no means unique (e.g. Fyfe et al., 2008). Nevertheless, greater chronological accuracy and precision is achievable. The application of modern excavation techniques and recording methods would militate against some of the problems with the archive dates from Céide Hill. The selection of locations for new excavations and palynological studies could benefit from the significant body of expertise in field systems research developed internationally since the last major fieldwork campaigns on Céide Hill. Excavations at wall junctions, for example, would be one way of investigating sequences of construction. Accelerator Mass Spectrometry (AMS) radiocarbon dating would allow far greater precision in the dating of new samples. Multiple stratified series of high-precision dates would improve our understanding of the complex taphonomic conditions at particular locations, and may help unpick sequences of development within the archaeology (see Chadwick, 2013: 26). Complementary techniques include soil micromorphology analyses, which would help identify incidences of redeposition and erosion (see Guttman, 2005: 30). Optically stimulated luminescence (OSL) dating has also been applied in combination with other methods to the problem of dating field walls (e.g. Häggström et al., 2004; Hamilton et al., 2007). Refinements to this technique, which measures the date mineral grains in buried sediments were last exposed to sunlight, have significantly improved precision (e.g. Duller, 2004; 2008).

It is not only technical advances that have the potential to increase understanding of human engagement with the Céide Fields landscape through time. Recent re- search into the archaeology of land allotment (e.g. Wickstead, 2008; contributions in Chadwick, 2008a) has demonstrated the value of critical engagement with the un-challenged assumptions that underpin many characterisations of prehistoric farming landscapes. Notions of farming practices, community structures, and cultural identities that draw largely on perceptions of modern or recent historical rural life have long influenced characterisations of the Neolithic Céide Fields. Uncritical and at times bucolic evocations of 'a Neolithic landscape consisting of megalithic burial monuments, dwelling houses and enclosures within an integrated system of stone walls' (Lucas, 2010: 1), which '[i]n many ways [...] was little different to much of the Irish countryside today' (Caulfield, 1992: 1), are not supported by the evidence. It is essential that future work at Céide Fields is carried out within a critical research framework. The starting point must be the suspension of the paradigm that defines the coaxial field system on Céide Hill as Neolithic.

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