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2. Transforming our understanding of Neolithic and Chalcolithic society (4000–2200 BC) in Ireland

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Introduction

The Neolithic is a transformative period marked by major cultural, social and technological change across Europe. Its global significance, long-term social impact and its spread from several origin points continue to be widely discussed. Occurring towards the end of a process involving the spread of agriculture from the Near East around 9000 BC (Robb 2013), the Neolithic period in Ireland is commonly defined chronologically as between 4000 and 2500 BC. In this paper, its final phase is considered to also include the 300 years prior to the start of the Bronze Age c. 2200 BC. The concept of transformation can be applied to this time-span from a number of perspectives, in terms of the establishment of agriculturally based societies on this island and the changes that ensue, but also how our knowledge has been advanced by recent discoveries.

The immediate geographic and socio-cultural context of the Neolithic in Ireland and Britain is north-west Europe where there has been a focus on the building of monuments as a distinctive feature of Atlantic European societies (e.g. Scarre 2002). In Ireland, there are over 1500 megalithic tombs dating from the Neolithic and into the Early Bronze Age (Cody 2002). Research on these and other related sites has long played a key role in the interpretation of the Neolithic. Taking an island-wide view and using a fairly coarse chronology, one of the current writers (Cooney 2000) presented a broad landscape-based understanding of the Neolithic that was heavily influenced by monuments, particularly megalithic tombs. While some elements of that view remain valid, the sheer volume of new evidence coming from development-led archaeology, notably the work on motorway schemes, and methodological developments have overtaken these interpretations in the last decade and a half. As Smyth (2014) has demonstrated, large-scale development-led projects, such as the linear transects provided by motorway routes, have revealed a diversity and wealth of settlement

evidence. This requires a reassessment of the scale, duration and extent of Neolithic activity across the island. At the same time, the application of Bayesian statistical approaches to radiocarbon dates has enabled us to think about time-scales of generational lengths (Cooney et al. 2011; Whittle et al. 2011). Allied to interpretive perspectives aimed at providing as complex a view of the past as possible (Whittle 2003), the development and integration of a range of approaches such as environmental archaeology (archaeobotanical and zooarchaeological), isotopic analysis (data on diet and mobility) and lipid analysis (function of pottery) and their application to archaeological data sets is enabling us to talk about the character of human life and activities that was just not possible previously. So it is timely to examine the impact of archaeology on NRA road schemes on our understanding of the period.

Taking a broad chronological view, the discoveries from the roads schemes have been made widely accessible in several forms including monographs on individual road schemes, thematic monographs and the NRA Archaeological Database. The approach taken in this paper, is to situate the results of that work for the Neolithic period in a wider context, to identify key social developments and changes over time, and highlight major issues of debate. The archaeological record has been enriched by the work of a number of research projects which have drawn on and brought to wider attention the importance of the evidence from developer-led excavations. These notably include the Cultivating Societies project by Whitehouse and colleagues (e.g. Whitehouse et al. 2014; McClatchie et al. 2014; 2016 McLoughlin et al. 2016), which is a multi-disciplinary study assessing the evidence for agriculture in Neolithic Ireland from 375 excavated sites and its wider social implications. Similarly, the work of Smyth (e.g. 2012; 2014) mentioned above, has focused on the wealth of evidence for settlement and houses from over 270 sites throughout the Irish Neolithic. In addition, the publication of excavations at key Neolithic sites such as the causewayed enclosure of Donegore Hill, Co. Antrim (Mallory et al. 2011) and the portal tomb at Poul nabrone, Co. Clare (A Lynch 2014) provide another important source of data to inform discussion.

The chronological categories used by the Cultivating Societies project are employed here to provide a framework (**Table 1**), while key sites are used as foci to highlight the important implications of the Neolithic evidence from motorway routes. The emphasis of the discussion below is to consider the archaeological record as resulting from the

activities of people who could have utilised a range of places or structures and worked materials at a range of scales, from implements held in the hand to the monumental, to create the distinctive and challenging character of the Irish Neolithic (see Smyth 2014, 150) and to see the material world of this period as an entangled ensemble which people created through their myriad and linked interactions with things and their surroundings (Hodder 2012; Lemonnier 2012).

Uncertain beginnings (Early Neolithic I)

While the beginnings of the Neolithic have generally been set around 4000 BC, in reality, the number of sites from this period that can be securely dated to before 3750 BC is very small. As will be discussed, there is currently insufficient evidence available to incontrovertibly support Early Neolithic beginnings before 3800 BC.

In recent years a site that has become prominent in the discussion of the earliest evidence for the Neolithic is the causewayed enclosure at Magheraboy, Co. Sligo, which produced controversially early radiocarbon dates (Danaher 2007; **Illus. 1**). Located about 50 m above sea level off the summit of a ridge, excavation of over 1 ha of the eastern portion of the site within the road corridor of the N4 Sligo Inner Relief Road revealed an enclosure of irregular shape with a maximum dimension of 150 m and an estimated total area of 2.02 ha. A single segmented ditch circuit was generally accompanied by an internal palisade. There was a possible entrance on the southern side. Adjacent to this a 14 m-long rectangular timber structure was built at right-angles to and continuous with the palisade on its inner side. Fifty-five pits were identified in the interior of the enclosure. The material from the ditches, palisade and pits included Carinated Bowl pottery, leaf-shaped arrowheads, scrapers and blades and a couple of polished stone axeheads, at least some of which was carefully deposited. These are all highly characteristic of Early Neolithic sites dating from the period 3750–3600 BC (see Early Neolithic II below). However, radiocarbon dates from carefully selected charcoal samples suggested a construction date of 4065–3945 BC for the site (Cooney et al. 2011, 584). Whitehouse et al. (2014, 187) provide two additional dates on short-lived material (a cereal grain and a hazelnut) which would place the use and possibly also the construction of the site to the period after 3750 BC.

Unsurprisingly, much of the discussion about this site has focused on its dating (e.g. Cooney et al. 2011; Whitehouse et al. 2014). In Ireland, the closest comparator for the site is the other known causewayed enclosure at Donegore Hill whose construction dates imprecisely to sometime between 3855–3665 BC (Mallory et al. 2011; Cooney et al. 2011, 584). More broadly, both Donegore Hill and Magheraboy can be situated within the tradition of causewayed enclosures which are a central feature of the Neolithic of southern Britain. The Gathering Time project—a major dating programme on the Early Neolithic of Britain—has shown that the construction of those causewayed enclosures largely dates from just before 3700–3500 BC. The radiocarbon dates from Donegore are broadly compatible with the time when these enclosures first appeared in Britain, but those from Magheraboy are significantly earlier (Bayliss et al. 2011).

This created a key dilemma for Neolithic studies. Arising from Gathering Time, Whittle et al. (2011, 863–4) proposed that the Neolithic first appeared in south-east England by 4000 BC, before spreading across the rest of Britain and Ireland through the acculturation of local people, as well as small-scale colonisation over the next 200 years. Assessing the range of Irish evidence as part of this project, Cooney et al. (2011, 663) modelled the start of the Neolithic as being either between 3815–3769 BC (Model 3) or 3750–3680 BC (Model 2) (Model 1 was rejected outright). Clearly then, if the early date of Magheraboy is correct, it has major implications for our understanding of how and when the Neolithic began not just in Ireland but also across Britain.

The initial dates from Magheraboy remain incompletely explained and at odds with existing knowledge of the period because they remain one or two centuries earlier than any other unequivocal evidence for the Neolithic. Whitehouse et al. (2014, 7) point out that the situation at Magheraboy whereby pre-3750 BC dates were obtained from charcoal samples which potentially suffer from ‘old wood’ effects, but post-3750 BC dates were obtained from short-life samples from the same features, is an issue at several other of the earliest Neolithic sites (McLaughlin et al. 2016, 141).

If the early dates and material culture are accepted as genuine indicators that farming communities had constructed a causewayed enclosure there during the 40th and 39th centuries BC, then it becomes necessary to explain why an assemblage of

characteristically Early Neolithic objects including a porcellanite axe from Antrim was deposited in Sligo 200 years before anywhere else on this island (see below and Cooney et al. 2011, 665–8). Equally, this scenario also demands that we explain how a contemporary Neolithic presence remains so unidentifiable elsewhere on this island. Such explanations are difficult to support and it remains the case that the activities and materials present at Magheraboy accord much better with a date of 3750–3600 BC.

Much more robust evidence for Early Neolithic beginnings before 3750 BC is provided by the recent dating of the unburnt human remains from the portal tomb of Poul nabrone (A Lynch 2014; Schulting 2014). Modelling of these dates suggest that this monument was in use from 3820–3745 BC, with burial activity continuing over the next 200–300 years (Schulting 2014). This is based on the convincing argument that these human remains represent successive primary inhumations (Beckett 2014; O’Donnabhain & Tesorieri, 2014). This tells us that people on the Burren had built a megalithic monument and were placing selected individuals in it from the end of 39th century BC. Interestingly the isotopic evidence from the earliest dated individuals at Poul nabrone suggests that these people lived locally and relied on a wholly terrestrial diet based on plant foods with limited consumption of animal protein. While this is directly comparable to other Neolithic human assemblages (Ditchfield 2014; Schulting et al. 2012), it is significant to note that it is not distinctively different from that for some later Mesolithic people (Warren 2015a, 5–8; Woodman 2015).

So, apart from Poul nabrone, there is currently little clear-cut evidence for a Neolithic presence on this island dating from 4000–3800 BC. Significantly, there is also a paucity of obviously Late Mesolithic sites from these two centuries. It remains the case that after the 1990s/2000s boom in excavation, we still have few definitive archaeological traces for interactions between farming groups and indigenous inhabitants on this island other than the early domestic cattle bones from Ferriter’s Cove, Co. Kerry, and possibly also at Kilgreany Cave, Co. Waterford (Woodman et al. 1999; Meiklejohn & Woodman 2012; Woodman 2015, 330–2). Clearly, our ability to identify and interpret archaeological evidence from the early fourth millennium BC (and probably also the very late fifth millennium BC) is quite limited and consequently, there is a considerable gap in our understanding about what was happening across these centuries.

Following in this vein of thought, it should be noted that there is evidence for continuity of place and practice from the Mesolithic into the Neolithic. For example, at Clowanstown, Co. Meath, excavations in a wetland area on the route of the M3, revealed a long sequence of activity from the later Mesolithic into the Early Neolithic (Mossop & Mossop 2009). Basket fish-traps of late sixth/early fifth millennium BC date were followed by Late Mesolithic platforms dating from 4250–4000 BC. At least 200 years later, low mounds with alternating layers of burnt stone, charcoal-rich soil and white clay were constructed (Murphy & Ginn 2013; Warren & Kador 2013). These produced sherds from Early Neolithic Carinated Bowls, burnt and unburnt animal bone and charred cereals dating from 3800–3700 BC (Whitehouse et al. 2014). The Clowanstown mounds are closely paralleled at Cherryville (7), Co. Kildare (Breen 2009), excavated on the route of the Kildare town bypass. There are hints then of a sense of continuity; while the process of Neolithisation in Ireland is likely to have been the result of both the input of new people and new ideas, there was also interaction with people who had a long history of knowledge and inhabitation of the island.

The house horizon (Early Neolithic II)

In contrast to the limited evidence for the earliest Neolithic, the impact of newly established ways of life, traditions of practice and use of novel resources including settlement, monument building and farming are most evident in the period 3750–3600 BC. McClatchie et al. (2014; 2016) have demonstrated that the earliest known evidence for cereals dates from the period following 3750 BC. This is widespread and dominated by emmer wheat, but also a number of other species occur. Critically, it appears that as in other parts of north-west Europe (Bogaard 2004; Bogaard & Jones 2007), early farmers in Ireland were not shifting cultivators but practiced longer term fixed-plot agriculture. This was complemented by the novel use of domesticates—cattle, sheep/goat and pig—whose remains dominate the limited available evidence for the Early Neolithic faunal record (McCormick 2007; Schulting 2013). Alongside these introduced resources, which probably included red deer (Carden et al. 2012, Bergh & Hensey 2013), a range of other wild mammals and gathered plant foods including hazelnuts and fruits were also used (McCormick 2007; McClatchie et al. 2014). Smyth and Evershed (2015) have established, using organic residue analysis of Carinated

Bowls, that the consumption of milk and dairying was practiced as was the use of pottery for the processing of meat products from the 38th century BC onwards. A model of a subsistence system focused on a mix of domesticated plant and animal products seems appropriate. As McClatchie et al. (2014, 214) point out, it is probable that the range of activities associated with this lifestyle must have created a specific sense of place and ‘ownership’ associated, for example, with fixed cereal plots and herds of animals, especially cattle. The creation of a sense of place would have been amplified by the transformation of the landscape, opening the woodland cover for agricultural clearances and other activities (Whitehouse et al. 2014, 10–14).

The most dramatic illustration of this sense of place, which has largely been brought to attention through development-led archaeology since the 1990s, is the Early Neolithic rectangular house tradition. There are now over 100 of these timber-built structures known and their ongoing publication (e.g. McGonigle 2013) continues. A dating programme focused on these sites and critical analyses of those dates strongly indicates that these houses were only built and used over a period of up to 100 years from 3720–3620 BC (McSparron 2008; Cooney et al. 2011; Smyth 2014; Whitehouse et al. 2014). As Smyth (2014, 23) points out, the significance of these houses is that they represent a distinctive and novel settlement form and appear (and disappear) across the island at roughly the same time. The relatively substantial nature of these timber buildings makes analysis of their construction and use meaningful. Their striking homogeneity suggests that they represent a distinctive form of cultural and material engagement at a specific time in the early fourth millennium BC. They have features shared with but are different in detail to rectangular houses in Scotland (Sheridan 2013). They provide an important focus for an examination of the Early Neolithic. A key issue is how these houses fit with the other evidence of Early Neolithic activity.

A good place to understand the importance of this house tradition is at Monanny 1, Co. Monaghan. Here a cluster of these houses (single houses also occur) was discovered on the route of the N2 Carrickmacross Bypass (**Illus. 2**; Walsh 2006; 2009; Smyth 2014). The site was located at the base of the south-facing slope of a drumlin with a small river to the south. Three Neolithic structures were uncovered, all defined by foundation trenches, associated with a number of pits and gullies. House A measured 10 m by 7 m, with post-holes in key structural positions. About 20 m to the north, Houses B and C

were located close to each other. House 2 was 13.5 m by 8 m and divided into two rooms, with post-holes again in key positions. House 3 measured 12 m by 7 m and had evidence of additional external supporting posts. The internal features suggest that this house may have been divided into two equal-sized rooms. The walls of all three structures appear to have been constructed of oak planks, the roof was supported by the corner posts and there was evidence for an entrance area in each case.

The location of Monanny represents a typical choice for such settlements and Smyth (2014, 22–5), following up on earlier discussion by Cooney (2000) and Ó Drisceoil (2007), suggests that the pattern seen at Monanny may represent a fixed or ideal unit of settlement or household size in the Early Neolithic. The range of objects—dominated by Carinated Bowl sherds and lithic tools—recovered from the houses and the exterior features give indications of activities carried out in different areas. This pottery was among the assemblage examined by Smyth and Evershed (2015) for organic residue analysis, producing evidence for dairying and also the consumption of meat products. The construction of House B appears to have been celebrated by the deposition of a stone axehead in the foundation trench (Walsh 2009, 63; Smyth 2014, fig. 4.5). At the end of their use, Houses A and B appear to have been dismantled and the posts and planks removed. The end of the use of House C was marked by the structure being completely burnt down.

What we see at settlements such as Monanny is a widely shared practice of life that, as documented by Smyth (2014), was conducted in a particular way by the people who lived there. Moving out from the detail of a particular site we can begin to think more broadly about Early Neolithic lifestyles including the ways in which the dead were treated. Schulting et al. (2012) have demonstrated that the date range of 3700–3570 BC is currently the most probable timeframe for the initial use of court tombs. The similarity of this date to that of the house horizon is notable. While recognising that there were other ways of treating the selected remains of particular individuals in the Early Neolithic (Sheridan 2006), it still strengthens the evidence for the arguments that these rectilinear timber and stone structures can be seen respectively as Early Neolithic houses for the living and the dead (Cooney 2000).

The debate continues about the exact beginnings of the passage tomb tradition (Whittle et al. 2011, 848–53; Sheridan 2010; Bergh & Hensey 2013; Hensey 2015), but there is agreement that the intensive period of activity which included the construction of developed passage tombs at Brú na Bóinne, Co. Meath, and other cemetery complexes such as Carrowkeel, Co. Sligo, peaked in the centuries between 3300 and 3000 BC (Whittle et al. 2011; Bayliss & O’Sullivan 2013; Hensey et al. 2013; Kador et al. 2015; Schulting et al. forthcoming). This is a point which warrants further discussion and to which we will later return. There is also agreement that simple passage tombs were definitely in use at the same time as the earliest use of court tombs and Early Neolithic houses. Bergh and Hensey’s (2013) dating of 25 bone and antler pins from two of the simple passage tombs within the Carrowmore tomb complex in County Sligo indicates that deposition within these monuments was occurring from 3775–2950 BC. In light of this and their critical evaluation of the problematically early charcoal dates obtained by Burenhult (1984; 2001), there is now no evidence that megaliths had been built at Carrowmore before c. 3750 BC. Similarly, recent dates from the multi-phase passage tomb at Baltinglass, Co. Wicklow, also indicate that it was in use from c. 3700/3600 to 3400 BC (Schulting et al. in press). An earlier date of 3946–3715 BC (UBA-14759; 5031 ± 25 BP) was also obtained from cremated human bone within the first phase of this monument comprising a small simple passage tomb. While hinting at the possibility that a Neolithic monument existed at Baltinglass pre-3750 BC, this evidence is not sufficiently robust to be considered alongside that from Poul nabrone. What is clear is that by 3750 BC, people had developed a highly structured social landscape involving the use of court tombs, portal tombs and passage tombs, very tangible traces of which are still visible today.

For those living within these landscapes, we should also envisage lives and practices that focused on intensive garden agriculture and herding of domesticated animals, particularly cattle (Schulting 2013). The description by Whitehouse et al. (2014, 19) of a ‘spatially heterogeneous landscape of varying intensity and use depending upon local circumstances and population densities’ matches with the archaeological evidence from development-led projects leading to the discovery of a wide range of settlement evidence. Pits represent a particularly frequently occurring example of this. As we have seen above, these occur with structures, but also, on their own or associated with ephemeral traces of settlement activity. They take the form of either clusters or single

features and their fills and contents suggest a range of roles (see below and Smyth 2012; 2014, 114).

Cultural material in pits and other Early Neolithic features provides the opportunity to show how Early Neolithic people created their material surroundings by using both local resources and accessing materials, in some cases over considerable distances, through networks of contact and exchange. Here one might suggest that there appears to be an interesting contrast between pottery and lithics, the two materials that dominate the archaeological record. Pottery of this period took the form of Carinated Bowls, the earliest form of which is Sheridan's (1995; 2007) Traditional Carinated Bowls. These are commonly found in court tombs and Early Neolithic houses and there is no unequivocal evidence that their use pre-dates 3750 BC. It would appear to be made locally (Sheridan 1989), as perhaps occurred at Monanny (Walsh 2009), but with techniques and forms that were widely shared across, but also far beyond, this island (Grogan & Roche 2010; Pioffet 2014).

In relation to lithics there is a considerable variety between sites in terms of both the amount of lithics present and the balance between finished tools and debitage (production waste). Although this may reflect variations in depositional practices, it is likely, in at least some cases, to reflect the primary working of flint and other stone resources off-site, close to primary or secondary sources (see Smyth 2014, 106–7; Brady 2007). Stone axes are a good example of the potential complex web of resource use and networks of contact that underpinned Early Neolithic life in Ireland. We can document the use of widely available sources such as shale, the use of specific sources in Ireland such as porcellanite and porphyry (porphyritic andesite) as early as the 38th and 37th centuries BC, as well as noting the more limited occurrence of axeheads from non-Irish sources, particularly tuff axeheads from Great Langdale in Cumbria, western Britain (Cooney & Mandal 1998; Cooney 2000, Whittle et al. 2011; Dempsey 2013).

We can also use the contexts in which cultural materials such as pottery or lithics are found to indicate that they were in many cases placed deliberately in the ground (**Illus. 3**), alongside a more casual pattern of discard. For example, at Carrickmines Great at the foot of the Dublin Mountains, an isolated circular pit contained nine perforated serpentine disc-beads and approximately half a Carinated Bowl (Ó Drisceoil 2006). At

Newrath 35, on the route of the N25 Waterford City Bypass, a stone axehead was deposited in the centre of the upper fill of a small circular pit and there were lithics and Carinated Bowl sherds in the lower fill (Hughes et al. 2011). It was argued that the artefacts had been selected for careful, structured deposition. A date of 3695–3523 BC was obtained from a charred emmer wheat grain in the pit.

Our understanding of the 150 years covered in this section has been transformed by development-led archaeology. Various elements of the lifestyle of Early Neolithic communities can now be documented in great detail and there is potential for our understanding of this critical time to be deepened by research. The narrative above suggests a settlement pattern comprising small-scale dispersed social units who were in contact with each other in various ways, not least through larger-scale social gatherings and activities at places like the causewayed enclosure at Donegore Hill (Mallory et al. 2011). Together with the uniformity of Early Neolithic material culture, sites like Donegore Hill hint at a level of social cohesion beyond people's immediate community.

Understanding Neolithisation

This intensification and spread of the evidence for Neolithic activity c. 3750–3600 BC can be paralleled in Britain (Whittle et al. 2011) and it has been argued to reflect a similar boom in activity relating to the success of farming (Stevens & Fuller 2012; Whitehouse et al. 2014). This stands in strong contrast to the somewhat limited evidence for the earliest Neolithic which equally has the potential to throw light on the processes responsible for this major social transformation, particularly in terms of when and how Neolithic things and practices began here. Thus far, there is no incontrovertible evidence for an Irish Neolithic pre-3800 BC and our knowledge of what was happening between 4000–3800 BC remains poor. So we are left to evaluate the two aforementioned models for the inception of the Neolithic during the earliest Neolithic period 3815–3769 BC (Model 3) or the house horizon 3750–3680 BC (Model 2) (Cooney et al. 2011, 663).

Compatible with Model 3 is the robust dating of Poulnabrone indicating that the Neolithic (at least in the Burren) began c. 3800 BC, before the house horizon, thereby invalidating Model 2. Ann Lynch (2014) has argued with some degree of circularity that the evidence from Poulnabrone and Magheraboy appears to make the scenario of a gradual spread of the Neolithic from south-east England less likely. However, this argument does not explain away the issues with the early dates for the Magheraboy causewayed enclosure outlined above and is reliant on the assumption that Neolithic people, domestic animals and crops must have been in the Burren up to a century before Poulnabrone was constructed. Although the earliest dated individuals from this tomb (which undoubtedly represents a Neolithic monument) spent their early lives in the Burren and had a wholly terrestrial diet based on plant foods with only limited consumption of animal protein, it cannot be assumed that these were the descendants of Neolithic farmers. Indeed, recent work has shown that Mesolithic individuals from inland contexts also had a terrestrial diet (Warren 2015a, 5–8; Meiklejohn & Woodman 2012) and while Poulnabrone is just 8 km from the coast, it need not be presumed that Later Mesolithic individuals (in this locale) would have had a marine-based diet. Of course, there is no trace of Later Mesolithic activity (apart from the Fanore More shell midden (M Lynch 2013)) in the surrounding area, but neither is there any evidence for Neolithic activity pre-3800 BC. Furthermore, there is no other incontrovertible evidence for contemporary Neolithic activity on this island. There are other sites which have produced radiocarbon dates with estimated age ranges beginning before 3750 BC (see Schulting 2014; Schulting et al. in press; Meiklejohn & Woodman 2012; Sheridan 2014), but because of the uncertainties associated with the calibration of radiocarbon ages, these may not genuinely reflect Neolithic activity before the Early Neolithic house horizon and the earliest dating of crops.

Despite all this uncertainty about when or how the Neolithic began, what we can say is that the Neolithic (in some form or other) had begun in Ireland by the late 39th century BC. Poulnabrone provides us with evidence for monument use and construction before the earliest known appearance in the archaeological record of cereal cultivation, the rearing of domesticates, axe quarries, large-scale woodland clearance, the deposition of Early Neolithic Carinated Bowls, the use of Early Neolithic houses and court tombs during the 38th century. This indicates that the various different ideas, things and farming technology which might be considered to form a Neolithic package may not

have been part of the earliest Neolithic on this island nor adopted/introduced to Ireland at the same time. Some elements appeared earlier, potentially with various aspects appearing in different parts of Ireland c. 3800 BC before a surge in adoption and high level of convergence across the island 50 years later. This raises the question of what exactly this earliest ‘Poulnabrone Neolithic’ or Mesolithic-Neolithic transition looked like and how can we recognise it within the archaeological record. This must be a priority for future research.

While this discussion revolves around a difference of only 50 years, this has important implications. It suggests that the Neolithic began gradually, not with an abrupt or sudden change and contra Whittle et al. (2011), monument building was early in this process, not a slightly later element conducted by the descendants of the first farming communities after the adoption/introduction of pottery, cereals and new domesticated animals. These novel things, practices and ideas that began to be used in Ireland c. 3800–3700 BC all arrived in Ireland by boats travelling between here and Britain and/or Continental Europe. Debate continues as to how these came to be used in Ireland or Britain and from where exactly (e.g. Sheridan 2004a; 2010; Rowley-Conwy 2004; Garrow & Sturt 2011; Thomas 2013; Pioffet 2014). Clearly, there was a very significant series of changes in social practices during this transition, many of which left a far more visible imprint on the archaeological record than the Mesolithic traditions that they replaced. This must be partly due to the influence of the incoming farmers who almost certainly arrived here (probably from France or Britain), however, the nature of the Irish Early Neolithic suggests that the pre-existing population of Ireland played a key role in the adoption of Neolithic lifeways from beyond these shores and in its transmission across the island. This is supported by recent aDNA (ancient DNA) analysis of a Neolithic individual from Ballynahatty, Co. Down, dating from the end of the fourth millennium BC. This revealed a combination of genomes of a type commonly seen in Early and Middle Neolithic Germany and France associated with migrating Near Eastern agriculturists, as well as an elevated ‘western hunter-gatherer’ component compared to other European regions (Cassidy et al. 2016, 369). This suggests interactions between earlier Neolithic and Mesolithic populations, though given that this is based on just one individual who may or may not have resided on this island for any considerable length of time, we must be careful not to make too much of this data.

Nevertheless, both the Irish and British Early Neolithic evidence shows significant similarities but also key differences to the continental comparanda (e.g. Hensey 2015, 7–9, 24–6). This suggests that there has been a certain level of adaptation from the very beginning, presumably to enable these novelties to better fit within pre-existing traditions. It is also worth highlighting that the particular range of Early Neolithic practices and material culture found in Ireland cannot be traced back to any single region in Britain or the continent (see Thomas 2004; Pioffet 2014; Anderson-Whymark & Garrow 2015). Whatever was happening at this time was complex in a way that defies simplistic explanations, but would almost certainly have involved repeated interactions between Neolithic and Mesolithic people at multiple locations within and beyond this island (Anderson-Whymark et al. 2015). There is increasing recognition that a network of coastal and maritime contacts is likely to have underpinned contact between areas of Ireland, Britain and north-west Europe in the late Mesolithic and early Neolithic (ibid.; Garrow & Sturt 2011; Warren 2015b). This is supported by the evidence of the bones for a domesticated cow from Ferriter's Cove dating to before 4000 BC (Woodman et al. 1999; Tresset 2003) and from Kilgreany Cave pre-dating 3820 BC (Meiklejohn & Woodman 2012), which provide a tantalising glimpse of early interactions. Pioffet (2014) on the basis of a stylistic and technological analysis of Irish and British pottery has argued that there were distinct pathways of contact that differentiate an eastern and a western zone of Early Neolithic interactions. This western zone (comprising west Britain and probably also Ireland) seems to have had strong links with Brittany and Lower Normandy c. 3800 BC. This makes the concept of a number of ongoing points of contact between France and Ireland or Britain and stages of Neolithisation as proposed by Sheridan (e.g. 2010) more likely, though robust evidence to indicate that many of these occurred in Ireland before 3800 BC is largely lacking.

The Middle Neolithic conundrum

While development-led archaeology has clearly transformed our understandings of the Early Neolithic, its impact on our established or traditional understanding of the Middle Neolithic is much harder to gauge. Whitehouse et al. (2014) in their major review of Neolithic agriculture suggested that the end of the Early Neolithic (Early Neolithic II) and the first phase of the Middle Neolithic (Middle Neolithic I, 3600–3400 BC) saw

major changes in the environmental and archaeological records and that these changes continue into the second phase of the Middle Neolithic (Middle Neolithic II, 3400–3100 BC). They commented that ‘the period c. 3600–3000 BC was one of considerable environmental, landscape, settlement and economic change’ (ibid., 20). Thus, in reviewing our current understanding of the Middle Neolithic, it seems appropriate to consider this phase of the Irish Neolithic as a unit (Middle Neolithic I and II).

The process that Whitehouse and colleagues see behind these major changes is a ‘boom’, brought about by the establishment of farming in the early Neolithic, followed by a ‘bust’ with associated population decrease. This is based on the decreasing evidence for Middle Neolithic settlement activity from development-led archaeological projects and specifically sites where cereals were recorded. This leads them to conclude that ‘there is a marked lull in settlement activity . . . from around 3400 BC to just after 3000 BC when the archaeological record is almost completely dominated by burials of the developed passage tomb tradition’ (ibid., 20, fig. 12). Combining these particular aspects of the archaeological record including the decreased evidence for cereal production with that for re-forestation, worsening climatic conditions and the wider north-west European picture of changes at this time, they suggest that in Ireland communities had to adjust their agricultural practices and lifestyle in the light of climatic uncertainties and potential difficulties in crop production (McLaughlin et al. 2016, 144; Whitehouse et al. 2014, 13, 20, figs 12 and 20). On an initial reading, Smyth’s (2014, 81) view of the settlement evidence might seem equally stark indicating that the nature of settlement and domestic architecture is difficult to identify and interpret after 3500 BC.

So we are left with a conundrum; in grappling with the context for the emergence of the developed Irish passage tomb tradition of the Middle Neolithic (while recognising the diversity of interpretive stance on this issue (see discussion in Cooney 2000, 112–9), it seems difficult to reconcile the scale of, for example, the three mega-passage tombs in Brú na Bóinne, the clustering of passage tombs in major complexes and the complexity of the architecture and practices at the sites with the picture of settlement decrease (and associated population decline at this time). It seems difficult to square this evidence with the ‘boom and bust’ model. To take one example the small passage tomb at Tara, Co. Meath, dating to the period c. 3300–3000 BC (Bayliss & O’Sullivan

2013) produced the remains of over 200 people (Kuijt & Quinn 2013) and there are strong indications that this represents the particular treatment of selected individuals over several generations, rather than all the members of the living population who were connected with the construction and use of the tomb. So can we resolve this conundrum? In the context of the discussion here, the approach taken is to review the additional archaeological evidence that has emerged from development-led archaeology over the last decade or so and to compare that with other evidence for activity in Ireland during the Middle Neolithic and then return to this intriguing issue.

In summary, the number of dated Middle Neolithic sites that have produced evidence for cereal production is over 50% less than from the Early Neolithic (McClatchie 2014, table 2) and the range of wheat and barley types appears to be more restricted, with naked and emmer wheat the most common forms (McClatchie et al. 2016, fig. 7). In particular, very few cereals have been found at sites dating from 3400–3100 BC. McClatchie et al. (2016) and McLaughlin et al. (2016) present more nuanced interpretations of the ‘boom and bust’ scenario. They relate this (to varying degrees) to changes in the practices of people in the past and the activities of archaeologists in the present, thereby recognising the high level of bias created in the archaeological record by the nature of the archaeological features recovered in development-led contexts and the approaches taken to these. However, the question remains whether these factors are being fully considered in terms of understanding the notion of a Middle Neolithic gap.

The paucity of faunal assemblages continues to be a problem in assessing the extent and significance of this component of agricultural activity, but an important site in this context is the enclosure at Kilshane, Co. Meath, found on the route of the N2 road. The enclosure is defined by a ditch measuring 45 m by 34 m which had been dug in a series of segments. In the base of the ditch there were the articulated and disarticulated remains of a minimum of 58 cattle (**Illus. 4**). These deposits varied in different segments and the patterning suggested that they had been placed from both the exterior and the interior of the enclosure. A Middle Neolithic broad-rimmed vessel deliberately placed on top of the bone was associated with a radiocarbon date of 3645–3390 BC (Moore 2007; Finola O’Carroll, pers. comm.). The deliberate placement of the cattle bone might be read as indicating both an increase in the economic importance of cattle compared to the Early Neolithic and, linked to this, an enhancement of the symbolic

role of cattle. Along with the increase in some wild resources seen in the archaeobotanical record (Whitehouse et al. 2014) and the decrease in cereals this could be seen as representing a shift in the subsistence strategy, but this remains somewhat unclear (McClatchie et al. 2016, 315).

In terms of the evidence for settlement, as noted above, this also changes. As Smyth (2014, 83) and Whitehouse et al. (2014, 19) note, a significant amount of settlement activity is represented by pits, post-holes, spreads of occupation material, occasional hearths and areas of burning. Though McLaughlin et al. (2016, 128 & 136) observe that this becomes scarcer c. 3300 BC. In trying to make sense of the more ephemeral evidence for houses, Smyth suggests two trends: (1) the continuity of broadly rectangular houses into the earlier Middle Neolithic (3640–3400 BC) represents a move away from the rigidity of the Early Neolithic tradition towards more varied forms and (2) the methods of construction and buildings of the later part of the Middle Neolithic (3400–3000 BC) seem to have been stake-built and oval or circular in shape. They appear to have been rebuilt on occasions with the central hearth as a focus (Smyth 2014, 80–1, 83). The best example of the earlier Middle Neolithic style of rectangular house comes from the enclosed settlement at Tullahedy, Co. Tipperary, on the route of the M7 (Cleary & Kelleher 2011) which dates from the cusp of the end of the Early Neolithic and the beginning of the Middle Neolithic (Schulting 2011). Here (**Illus. 5**) within an area at least 100 m by 120 m in extent and partly enclosed by a palisade there was intensive activity indicated by pits, stake-holes and hearths with three structures defined by irregular slot-trenches and post-holes. After use, the houses appear to have been deliberately covered with occupation material rich in artefacts and at the southern end this spread was in turn covered by glacial till. Tellingly, only one of the sites discussed by Smyth in the oval or circular group of Middle Neolithic houses comes from a development-led archaeological context and that is a curving trench with sherds from two Middle Neolithic Impressed Ware broad-rimmed vessels at Newrath 35, Co. Waterford, a site mentioned above. However, the excavators describe this as a ring-ditch (compare Hughes et al. 2011, 131 and Smyth 2014, 81).

The real issue that has to be confronted is that the traces of settlement and subsistence have to be considered within the broader context of a wider diversity of evidence for activity in the Middle Neolithic period. For example, in reviewing the evidence for the

treatment of the dead in this period, the point is made that mortuary practice becomes increasingly varied (Cooney 2014). As Schulting et al. (2012) note, at least some portal and court tombs continued in use. Passage tombs continued to be built and used into the Middle Neolithic, reaching a peak with the construction of developed passage tombs around 3000 BC (Whittle et al. 2011; Bayliss & O’Sullivan 2013; Kador et al. 2015, Hensey et al. 2013, Schulting et al. forthcoming). Linkardstown burials—a monument type with affinities to passage tombs occurring mainly in the central southern area of Ireland—appear to be communal memorials to leading individuals which were constructed and used from before 3600 to 3300 BC (Cooney et al. 2011, 637). There are also Middle Neolithic pits/graves, as at Martinstown, Co. Meath (Hartnett 1951), and Site C, Lough Gur, Co. Limerick (Ó Ríordáin 1954), linked to Linkardstown burials by the similar deposition of decorated bipartite bowls. Indeed, these bowls appear in other contexts such as court and portal tombs (see Sheridan 1995; Cooney 2000) and also with the burials of male adults in the cave at Annagh, Co. Limerick (Ó Floinn 2011), thereby indicating a further link to the Linkardstown tradition. As Dowd (2008; 2015) has shown, the Annagh burials can be put into the wider context of the use of caves for mortuary practices during the period 3600–3400 BC.

All of this Middle Neolithic evidence for the treatment of the dead by the living is very pertinent to the discussion of the extent of activity in this phase of the Neolithic. In tandem it also has to be acknowledged that because of the fragile nature of their archaeological signature most of our understanding of the character of Middle Neolithic settlement has come from research-led excavations, particularly of protected Middle Neolithic surfaces. The best example of this is the 10 Middle Neolithic structures identified at the Knowth complex in County Meath (Eogan & Roche 1997; 51–2; Smyth 2014, 81–5), which represents the places where at least some of the people building passage tombs lived for at least some of their time.

The reality is that the specific character of the archaeological record and the approaches taken to its dating and interpretation are also responsible for creating the perception of a Middle Neolithic gap. As recognised by McClatchie et al. (2016), the Early Neolithic houses provide a highly identifiable focus for detailed analysis and dating, for example in projects along road schemes, such as the M3 and the M1. In contrast, the probability is that there are more Middle Neolithic sites in the archive but fewer of them have been

dated, hence we have fewer Middle Neolithic archaeobotanical remains. As we have seen above, these sites are less tangible and therefore harder to recognise, a characteristic that seems to strongly influence the extent to which they are selected for radiocarbon dating or other specialist analyses (see McLaughlin et al. 2016, 139). This is especially the case, where they occur so characteristically on multi-period sites with more obvious features of 'higher potential'. When data with these fundamental problems (reflective of archaeological choices in the recent past and Neolithic choices in the distant past) is being used as the basis for an interpretation of major changes in Neolithic agriculture and for a population decrease, then there have to be questions asked as to whether we have really advanced our knowledge of the Middle Neolithic or rather are we in danger of engaging in a circular argument, pulling in as part of the rationale a suite of environmental changes when the 'chronological resolution of the material remains insufficiently well-resolved to address this issue' (Whitehouse et al. 2014, 21).

So what was actually going on during the Middle Neolithic period? There was undoubtedly social change. The increased diversity of mortuary practice points to growing regionalization of social patterns. This can be seen for example in the increasing 'style drift' and range of pottery (Sheridan 2010, 95–6), alongside the use of the same ceramic style, as with decorated bipartite bowl, in a range of contexts. It is also indicated by the use of monuments that we separate in archaeological typologies, such as on the Burren where a Linkardstown burial (Poulawack), a portal tomb (Poul nabrone) and a court tomb (Parknabinnia), all with a few kilometres of each other, were being used at the same time (A Lynch 2014). Farming communities were living in landscapes that had been inhabited and organised with agriculture as a focus for several hundred years. The detail and complexity of these patterns of change and continuity are best followed at the regional level, as Smyth (2014, chapter 7) demonstrates in the case of east Leinster. Here she suggests that social attention and symbolism moved from houses to other realms such as the human body or the sacred space enclosed within the kerbs of passage tombs and other monuments during the mid-fourth millennium BC (*ibid.*, 95). Zooming in on part of this region to consider the Neolithic and Bronze Age landscape in the Tara region Grogan (2013, 336–9) suggests that we should see in the location and activities at passage tombs an alliance of powerful communities that exerted social authority through the control of both local and regional

networks of communication. This approach allied to Smyth's seems a productive way to approach the central question of the emergence of the developed passage tomb tradition in the later Middle Neolithic, as well as the extent and nature of associated settlement.

The Late Neolithic—going round in circles

For consistency, the chronological phasing utilised by Whitehouse et al. (2014) is used here, even though 3100 BC was probably the most intense period of activity within the developed passage tomb tradition. While this division between the Middle and Late Neolithic phases seems rather arbitrary, it importantly highlights that the passage tomb tradition continued into the Late Neolithic, though the use of these monuments may have declined post 2900 BC compared to the peak of activity seen before then. As part of the Middle Neolithic development of more insular inter-regional communities, direct links between Ireland and northern Britain (especially the Boyne Valley area and Orkney) intensified during the floruit of passage tomb use and culminated in a partial convergence of Irish and Orcadian passage tomb practices (Sheridan 2004a; 2014; Carlin in press). This interaction saw the sustained incorporation of Orcadian material culture within the Irish passage tomb tradition into the early part of the Late Neolithic (Sheridan 2004b; 2014). This included Grooved Ware, a flat-bottomed, pottery style decorated with passage tomb motifs which originated on the Orkney Islands c. 3200 BC (Brindley 1999; Roche 1995; Schulting et al. 2010; MacSween et al. 2015).

The larger size of some of these pots suggests that at least in some cases, it may have been used in a wider social arena than the household. This ceramic is closely associated with the emergence of distinctive forms of social practice, material culture and monumental architecture which were widely adopted and adapted across Britain and Ireland into the first half of the third millennium BC. The characteristic Irish architectural component comprises subcircular timber-built structures with central four-post settings typified by the well-known examples initially uncovered through research-led excavations at Knowth (Eogan & Roche 1997, 220–1) or Ballynahatty, Co. Down (Hartwell 1998), which have been interpreted as ceremonial timber circles. It may also possibly include embanked earthen enclosures.

Here the focus is on outlining how our understanding of this period has been impacted on by the results of development-led archaeology, particularly those from road schemes. These excavations have significantly increased the quantity and distribution of Late Neolithic sites across the island, while also confirming the known concentration of this activity in the wider Boyne Valley area. Many of these sites have now been discovered in much more varied and complicated contexts outside of obviously ceremonial settings. As will be discussed, this makes their interpretation difficult. It is clear from the literature that our understanding has not advanced sufficiently to take account of these discoveries. In particular, the dating of various developments during this period is much poorer than that of the Early and Middle Neolithic phases. A key cause of this scenario is that the distinctiveness of the Late Neolithic was not recognised until the late 1990s and, significantly, its recognition has continued to be too narrowly based on Grooved Ware (e.g. Whitehouse et al. 2014, 21). Consequentially, insufficient attention has been paid to well-dated activity from this phase such as the deposition of human remains in passage tombs (Schulting et al. forthcoming). Equally problematic is the challenge of trying to understand the connectedness of the domestic and ritual in various practices and structures at this time (Carlin in press).

It is primarily through the (retrospective) identification of Grooved Ware that many of the Late Neolithic features discovered during development-led excavations have been recognised as such. These represent a restricted set of contexts mainly comprising pits, spreads, and timber structures with central four-post settings, all containing very similar deposits of occupational debris. Closely comparable examples are known at Newgrange, Knowth and Ballynahatty. The presence of these related features at both monumental and non-monumental sites makes it difficult to distinguish a purely domestic or ritual component to these deposits. As we will see there are few, if any, recognisable ‘domestic’ buildings associated with Grooved Ware, even though this ceramic was widely used as an everyday pottery throughout Ireland.

Grooved Ware has mostly been recovered from pits, either in isolation or clustered, which in many cases appear to have been specially created to receive cultural deposits and were filled in very soon after being dug. These vary from those containing a single sherd to others containing more ‘formalised’ or special deposits including very large

amounts of pottery as well as other deliberately selected or arranged artefacts such as polished stone axeheads. For example, among a larger cluster of pits at Treanbaun, Co. Galway, on the M6, *petit tranchet* derivative arrowheads were recovered from three different Late Neolithic pits, one of which also contained Grooved Ware (McKeon & O’Sullivan 2014). Pits containing very large quantities of Grooved Ware are known from various road schemes including Rathmullan Sites 7 and 8, Co. Meath, Lowpark, Co. Mayo, and Scart, Co. Kilkenny (Bolger 2011; Nelis 2011; Laidlaw 2009; Gillespie 2010). At the latter site, a single pit contained as many as 935 sherds from seven Grooved Ware vessels and 193 lithics including 19 end-scrapers (**Illus. 6**). It is obvious from the partial and fragmentary condition of the pottery in this pit that after their original breakage, these vessels had been previously curated in larger repositories such as middens (now represented in the archaeological record by spreads). This treatment is highly characteristic of much of the materials found in Late Neolithic contexts across the country. While at least some of these pits are probably the only surviving element of longer term occupations, it is often difficult to conclusively demonstrate that their contents stemmed directly from settlement in these places. Indeed, many of these features were created during formalised versions of everyday activities that made material statements deliberately emphasising ‘domestic’ aspects of life.

This leads us on to perhaps the most architecturally distinctive element of the Late Neolithic, namely the subcircular timber structures with central four-post settings which seem to have been built and used in accordance with a widely shared template. This included a central axis that divided these structures in half from their entrance through to their corresponding back posts. As many as 20 of these have been found during development-led excavations across the island (**Illus. 7**) with examples now known from Mayo, Cork, Carlow, Kildare, Kilkenny and Tyrone (Cotter 2006; Johnston & Carlin forthcoming; Carlin et al. 2015; Laidlaw 2008; Monteith 2008; Dingwall 2010), though mostly they occur in the eastern half of the country, particularly in the Boyne Valley area. These occur at a range of scales, as has been long known from excavations in the vicinity of Newgrange (Sweetman 1985) and Knowth (Eogan and Roche 1997), but most of the recent discoveries occur at the smaller end of the scale (generally less than 7 m in diameter).

One such example of these highly uniform structures was excavated at Lagavoreen, Co. Meath, on the route of the M1 motorway, 7 km east of Knowth (Stafford 2012). It comprised a subcircular ring of post-holes that enclosed a central square setting of four larger post-holes symmetrically orientated with respect to a well-defined south-east-facing entrance. As is typical of these structures, finds were predominantly found within pit-like voids created in the upper part of the post-holes, post-dating their construction and primary use. At this site and elsewhere, this depositional activity mainly occurred during the dismantling of these structures, often after the timbers had rotted or been burnt as part of ritualised acts of abandonment or commemoration. This involved the deliberate placement of occupational debris, akin to that seen in pits. At Lagavoreen, these deposits included sherds of Grooved Ware, large quantities of flint including debitage and scrapers, burnt animal bone and a dolerite axe (ibid.). These deposits were focused on important locations relating to the aforementioned central axis including the four-post setting, the posts to the right hand side, the entrance area and the corresponding back posts, in a manner highly characteristic of these structures. A good example of this spatial patterning is provided by the discovery of the polished stone axe in the front left post-hole of internal four-post-settings at Lagavoreen—a scenario that is replicated exactly at Knowth and Bettystown in County Meath, Scart, Co. Kilkenny, and Balgatheran, Co. Louth, (Eogan & Roche 1997, 105; Stafford 2012; J Eogan 1999; 2005; Monteith 2008; Ó Drisceoil 2009). Burnt fragments of animal bone from three of the post-holes at Lagavoreen produced radiocarbon dates of 2840–2470 BC (SUERC 31931, 4050 ± 30 BP); 2900–2670 BC (SUERC 31930, 4205 ± 30 BP); and 2580–2460 BC (SUERC 31935, 4005 ± 30 BP). These are compatible with ongoing analysis by one of the authors and Jessica Smyth which indicates that these types of structures were mainly used between 2700–2450 BC in Ireland.

As is well illustrated by the excavation of groups of three similar Late Neolithic structures at Ballynacarriga, Co. Cork, Balgatheran and at least four more at Scart, it is often the case that the large four-post element and the accompanying entrance posts have been identified, but some or all of the post-holes forming the outer ring have not (Carlin et al. 2015; Johnston & Carlin forthcoming; Ó Drisceoil 2009; Monteith 2008; Laidlaw 2008). In such instances, it has been suggested that these arrangements of posts formed a distinct stand-alone element of Late Neolithic architecture (e.g. Smyth 2014). However, it seems more likely that the large four-post setting and associated entrance

was originally encircled by a complete ring of smaller posts, of which either no trace has survived or been recognised.

Identifying which (if any) of these various Late Neolithic structures might have been domestic dwellings or ceremonial monuments is difficult. The Late Neolithic remains of architecturally similar putative houses including stone-built versions on the Orkneys and much slighter but comparable wooden structures, such as those at Durrington Walls have been excavated in Britain (Richards 2005, 58–60; Parker Pearson 2007; 2012). In detailed discussion, Smyth (2013; 2014, 88–95) argued that a more ephemeral domestic architecture can be identified in Ireland by the presence of a central rectangular stone-lined hearth like those found in the British examples mentioned above. Potential examples of which included Slieve Breagh, Co. Meath, and the circuit of rectangular hearths in front of the entrance area at Newgrange. There is a growing consensus in Britain that many of the known timber structures actually represented monumentalised versions of people's homes and together with the more ephemeral examples form a spectrum ranging from substantial timber circles to much less tangible constructions, all of which share some of the same basic elements (Bradley 2005, 53–6; Thomas 2007).

However, the uniformity displayed by the architecture, ceremonial deconstruction and the character of deposition associated within the Irish timber structures across widely varying contexts makes any attempt to distinguish between houses or ceremonial structures highly problematic. Indeed, some of these structures may have fulfilled a range of residential and ritual functions and could even have changed from dwellings to monuments over the course of their use-lives (Thomas 2010). All of this illustrates the impossibility of identifying distinct domestic and ritual spheres during this period (e.g. Brück 1999, 325–7; Bradley 2003; 2005; 2007; Carlin & Brück 2012). What does seem clear is that people were drawing partly upon the symbolism of the home in ways that accentuated collective everyday 'domestic' activities. Ritualising the customs of daily life in these ways may have served to construct and emphasise a shared group-identity based around the idea of the household which maintained the cohesion of the local community (see Thomas 2010; Lévi-Strauss 1983).

Potentially, another element of the Late Neolithic monumental repertoire is represented by embanked earthen enclosures or henges, which in the Boyne Valley at least, show a close spatial relationship with passage tombs (Stout 1991; Condit & Simpson 1998; O’Sullivan et al. 2012). Important new information supporting a Late Neolithic date was revealed along the route of the M1 motorway by the excavation at Balregan 1, Co. Louth, of a site which had been placed in a very specific location at the confluence of two rivers (**Illus. 8**). The excavation revealed the eastern side of a large enclosure defined by a bank with an inner and outer ditch. Sealed under the bank were Middle Neolithic features and an assemblage of Impressed Ware including unusually large vessels, while Grooved Ware was recovered from the upper fill of the outer ditch (Ó Donnchadha & Grogan 2010; Grogan & Roche 2010). This represents the only direct association of this Late Neolithic pottery with embanked enclosures in what is the main area of the occurrence of this monument type in Ireland (Grogan 2013, 340) and it has not yet proved possible to support this attribution with radiocarbon dates. Thus, this forms another of the few partly excavated and poorly dated examples of these in Ireland, like that at Tonafortes, Co. Sligo, which produced radiocarbon dates from apparently primary contexts ranging from 2460–1610 BC (Danaher 2007). Embanked or ditched circular enclosures like these seem to have been constructed in various forms throughout later prehistory in Ireland. This includes Middle–Late Bronze Age examples like that at Grange, Co. Limerick (Roche 2004), and probably also Monknewtown, Co. Meath (Sweetman 1976; Roche & Eogan 2001, 135), as well as Iron Age examples like those at Navan Fort, Co. Armagh, Tara and Dun Ailinne, Co. Kildare (Danaher 2007, 55–6; O’Sullivan et al. 2012). This is comparable to the broad currency of similar monuments in Britain which date from the third to first millennia BC (Gibson 2010). Significantly, at both the Irish and British sites, these tend to occur in places with evidence for pre-existing Neolithic activity.

There also appears to be a pattern of continuity from the Middle Neolithic in terms of the evidence for agricultural activity (McClatchie et al. 2014). Unburnt animal bone has rarely been found in Late Neolithic contexts, but fragmentary burnt bone representing species such as cow, pig, and goat/sheep are comparatively well known. The enduring predominance of cattle in Late Neolithic Ireland is indicated by Smyth’s analysis of the lipids in Grooved Ware (Cramp et al. 2014). Development-led excavations confirm that cereal cultivation persists, but the visibility of this also

remains low because of approaches taken in creating the archaeological record for this period.

A notable characteristic of development-led excavations is the persistent absence of definitive evidence for Late Neolithic human bone from any context including timber circles or pits. Many of these features contained cremated fragments that were too small to be positively identified as human remains. This scenario appears to be paralleled in portal and court tombs, where no obviously Late Neolithic material culture has ever been found and the deposition of human bones ceases c. 3100 BC, although Parknabinnia, Co. Clare, represents a notable exception to this (Schulting et al. 2012).

This is an appropriate place to return to a point raised at the start of this section on the continued role of passage tombs into the Late Neolithic: deposits of human bone dating from 3100–2700 BC—which typify passage tomb depositional practice—are known from these monuments (Cooney forthcoming; Carlin in press). This is well illustrated by Knowth Tomb 6, where the sherds of an early style Grooved Ware pot were found at the edge of a deposit containing burnt and unburnt human bone dating from 3090–2910 BC (G Eogan 1984; 312; Eogan & Roche 1999, 211; Schulting et al. forthcoming). Grooved Ware has also been found in varying quantities either inside and/or outside other developed passage tombs at Knowth, Newgrange, Loughcrew Cairn L and Mound of the Hostages in County Meath (Roche 1995; Cleary 1983; Brindley 1999; Roche & Eogan 2001; O’Sullivan 2005). The combined evidence strongly suggests that passage tombs were still in active use in the early part of the Late Neolithic and that it was in this context that we should set the early occurrence of Grooved Ware c. 3100–2800 BC (Carlin in press). This strongly contrasts with the Late Neolithic data set from development-led archaeology where the vast majority of features including timber structures and pits date from later in this period: 2800–2450 BC (Grogan & Roche 2010, 34). By this time, passage tombs appear to have been superseded as ceremonial monuments by circular structures or enclosures, some of which were located close to the older centres of social and spiritual power that first emerged in the Middle Neolithic.

So then, overall narratives for the Late Neolithic are less concrete than for the Early and Middle Neolithic phases, but a clearer picture is emerging which suggests that there

is much more continuity of place and practice between the Middle and Late Neolithic than previously recognised.

The Chalcolithic decline of Neolithic practices

This strong evidence for continuity during the Middle to Late Neolithic raises important questions about how and when this period concluded. Generally, the end of the Neolithic is demarcated by the appearance of an international suite of novel practices and cultural materials that rapidly appeared across much of Western Europe c. 2500 BC. These included Beaker pottery and the production and deposition of early metalwork, a co-occurrence which has resulted in these being mistakenly seen as culturally synonymous. Significantly, the transmission of these innovations to Ireland resulted from a dramatic expansion of inter-regional interactions whereby people on this island, echoing what happened earlier in the Neolithic, once again involved themselves in exchange networks with various groups across Continental Europe. Contacts with Britain were also maintained as illustrated by the prevalence of Irish copper in early British metalwork (Northover et al. 2001, 28; Needham 2004, 235; O'Brien 2004). All this activity included at least some small-scale movement of people given the degree to which metallurgical knowledge would have been embodied, but the way metallurgy was developed and used in Ireland was strongly influenced by Neolithic traditions.

Recently, it has been advocated that this particular phase (c. 2500–2200 BC) which pre-dates the adoption of bronze technology at the start of the Early Bronze Age be termed the Chalcolithic (e.g. O'Brien 2012; Grogan & Roche 2010). However, as we will see, new research has highlighted the ways in which both Beaker pottery and associated objects were adopted into Neolithic contexts (Carlin 2011; 2012; 2013; Carlin & Brück 2012). This provides strong evidence that many pre-existing practices continued until 2200 BC and that the introduction of copper and gold metallurgy was just one of a broader range of ongoing material changes occurring during this time-frame. Thus we have decided to consider the 'Chalcolithic' discoveries from NRA road schemes here as the final phase of the Neolithic to better understand the key social developments at this time.

Most of our Chalcolithic sites have been recognised by virtue of their association with Beaker pottery (although the duration of its use extends beyond the remit of this review to 2100 BC). Prior to the ‘Celtic Tiger’ boom, comparatively few sites with this pottery were known. This has now been significantly altered by the widespread discovery of Beaker pottery from over 150 sites across the island occurring in most of the areas where development-led archaeology was conducted. Importantly, it seems that from an early stage in Ireland, this pottery was extensively used for a wide range of everyday and special purposes that was not restricted to elites (Carlin 2011).

Beakers rapidly replaced and assumed many of the roles that Grooved Ware once fulfilled in similar depositional practices. This is illustrated by the deposition of Beakers into the post-holes of abandoned Late Neolithic timber circles at Paulstown, Co. Kilkenny, and Armalughey, Co. Tyrone in the exact same manner as described above for Grooved Ware (Elliot 2009; Dingwall 2010). Developed passage tombs such as Knowth and Newgrange continued to be important as indicated by the discovery of Beaker pottery (often in association with or in deposits overlying Grooved Ware) outside these monuments. This activity formed part of a longer sequence of ceremonial acts emphasising the exterior of these monuments dating back to their construction (Cooney 2006; Carlin 2012; in press).

As we saw above, the dating of the construction of embanked enclosures in Ireland is very problematic and there is little recent evidence to confirm that any of these were built during the Chalcolithic (Carlin 2012). However, an exponential increase is seen in the evidence for a different form of monument involving the use of hot-stone technology, namely *fulachta fia*. Examples include those excavated in advance of the M4 motorway (Carlin et al. 2008), the Bord Gáis Gas Pipeline to the West (Grogan et al. 2007) and the N4 Sligo Inner Relief Road (Danaher 2007). The construction and use of these open-air communal monuments was the product of group activity that required substantial investments of energy and time. Regardless of whether or not these sites were used for feasting or some other activity, they were almost certainly communal places and may well have had a ceremonial function.

In contrast to the Late Neolithic, we see a resurgence of interest in Earlier Neolithic megalithic structures with the placement of Beaker-associated deposits into portal and court tombs c. 2450 BC (Carlin & Brück 2012; Carlin 2012). Much of this activity seems to have a referential character, potentially representing interactions between the communities of the living and their past ancestors. While this was certainly not exclusively funerary, recent radiocarbon dating has revealed an increased body of evidence for the deposition of human bone within these monuments, such as at Poul nabrone where Beaker sherds were also found (A Lynch 2014). In a further departure from the Late Neolithic, people began building wedge tombs quite suddenly c. 2450 BC in which burnt and unburnt human remains were deposited in association with Beaker pottery (Schulting et al. 2010; Carlin 2012). This can be seen as a reinvention of the megalithic tradition because it occurred after a 500 year-long hiatus in tomb-building and was influenced by the architecture of pre-existing megaliths (Carlin & Brück 2012, 197).

Most of the newly discovered Beakers have been recovered in a highly fragmentary condition in pits or spreads which bear a striking resemblance in almost every regard to those containing Grooved Ware. These are typified by pit clusters containing large quantities of occupational debris or specially selected artefacts that were deliberately deposited. For example, one of several pits at Paulstown (Elliott 2009) contained 172 sherds from at least 23 Beakers, flint debitage, charred hazelnuts and cereal remains, as well as 23 disc-beads representing one of the few instances of personal ornaments occurring with Beaker pottery in any context in Ireland (**Illus. 9?**). As with the Grooved Ware pits, their contents have almost certainly been derived from what are now the poorly preserved remains of much larger heaps of deliberately accumulated occupational debris such as the culturally-rich spreads excavated in the Boyne Valley at Mell, Co. Louth, and Rathmullan 10, Co. Meath, which included numerous sherds from multiple Beakers and polypod bowls (McQuade 2005; Bolger 2012). The spread at Rathmullan also produced one of the very few provenanced examples of an Irish wrist-bracer or bracelet (Bolger 2001; 2012).

Significantly, these contexts provide much new information regarding diet and economy. The sherds that they contain often have carbonised residues and sooting on their interior indicating that these were most probably used for cooking and serving

foodstuffs. Also present are stone tools including querns, scrapers, barbed-and-tanged and hollow-based arrowheads, polished stone axeheads and hammerstones. The discovery of burnt and unburnt animal bone from cattle, pigs, goats and sheep, as well as the charred remains of cereals (especially barley) provides evidence for animal husbandry and cultivation. The wild foods, particularly hazelnuts, as well as fruits found regularly in these deposits provide further evidence for food preparation and consumption. Overall, these show strong continuity with Middle and Late Neolithic agricultural activity, though the visibility of cereals in the record increases slightly (Carlin 2012).

The polypods are also worthy of further comment because these have strong eastern Bell Beaker and Corded Ware affinities and were probably used for the exchange of foods or liquids during social feasting (Hay & Carlin 2014). At least 16 of these bowls have recently been discovered along the east coast including an intact example deposited upright in a pit at Newtownbalregan 2, Co. Louth (Bayley 2008; Grogan & Roche 2010) (**Illus. 9?**). The presence of two such polypods in a monumental context at Newgrange reminds us of the highly similar spreads and pits of Beaker-associated occupational debris found outside the entrances to the passage tombs at Knowth and Newgrange, which seem to reflect large-scale social gatherings that may have had a ceremonial element (Cleary 1983; Eogan & Roche 1997). This epitomises the highly intertwined nature of ritual and domestic activity at this time. The fact that houses from the mid-third millennium BC do not appear to have left a lasting trace and only a few examples such as Graigueshoneen, Co. Waterford, have been identified complicates things further (Johnston et al. 2008). So again, like the Grooved Ware deposits, we find it exceptionally difficult to assess if these deposits are the poorly preserved remains of settlement activity in these locations.

What is clear is that middens seem to have been a resource where people stored and obtained occupational materials for deposition in a range of different settings. This is based on the presence of very similar deposits of Beaker-associated occupational debris within secondary contexts such as Late Neolithic timber circles, Early Neolithic court and portal tombs, as well as in primary contexts at wedge tombs. In all cases, people seem to have been drawing upon the symbols of everyday 'domestic' life to emphasise their shared group-identity and maintain the cohesion of the local community.

As was the case for the Late Neolithic, a recurrent feature of development-led excavations has been the paucity of evidence for Chalcolithic funerary activity. This is unsurprising given that the classic single inhumation rite practiced elsewhere appears to be largely absent from Ireland until the Early Bronze Age. Indeed with the exception of the small number of Beaker-associated inhumations and cremations known from wedge tombs, the mortuary treatments afforded to the vast majority of the population from 3000–2200 BC do not seem to have left a visible archaeological trace.

Highly fragmented burnt bones have been found in many pits such as at Lismullin, Co. Meath (O’Connell 2013), but as was the case there, these are typically too small to be definitely identified as human. In this context, two recent discoveries are noteworthy. At Mell, Co. Louth, the prone inhumation of an adult female was found within the truncated remains of a partly stone-lined subrectangular grave beside a Beaker-associated occupation spread (McQuade 2005). The body was east–west oriented and was accompanied by animal bone and two convex scrapers. This burial, which bears strong resemblances to Beaker burials in northern Britain, was radiocarbon-dated to 2490–2200 BC (Wk-17463; 3894 ± 50 BP). At Treanbaun 3, Co. Galway, the upper part of an inverted Beaker vessel apparently containing the cremated remains of a minimum of one individual of indeterminable age and sex was found in a highly truncated stone-lined pit (McKeon & O’Sullivan 2014, 132). It is very unusual to find an inverted Beaker and quite rare to find this pottery in association with cremated human bone and so this seems to represent an early example of what would subsequently become a common feature of Bronze Age burial practice. However, a recently obtained radiocarbon date of 1886–1667 BC (UBA-29698; 3455 ± 38 BP) from a fragment of this bone (K Cleary 2016), suggests that the Beaker pot may well have been an antique at the time that it was deposited. It is also worth highlighting that this Early Bronze Age date is contemporary with that from a cremation burial in a stratigraphically later position within the same group of features. It seems that there was considerable complexity to the past activities at this site which we may not fully grasp.

The apparent lack of highly formalised burial activity during this phase can be seen as a continuation of the strong emphasis that was placed upon the domestic household in

Late Neolithic ceremonial activity. Both the form of ceremonial practices and their conduct in largely non-funerary settings seems to have persisted from 2700–2200 BC. This may partly explain the strong focus on deposition in natural places. Large numbers of objects current from 2450–2200 BC such as copper axes, halberds, daggers, gold discs and lunulae, as well as stone wrist-bracers and V-perforated buttons have been found in Ireland, they predominantly occur as stray or single finds or in one-type hoards within natural places, particularly bogs. While this patterning can be frustrating in contrast to other European regions, where many of these objects occur together with Beaker pottery and often accompanying burials, it importantly reflects the fact that the people on this island who adopted these cultural innovations consistently chose characteristic ways of depositing these artefacts which were type-, context- and place-specific (Carlin 2012). In many regards, it seems that the treatment of many of these novelties echoed pre-existing traditions such as the custom of predominantly depositing stone axeheads in wet places (Carlin & Brück 2012).

Overall, the discoveries from development-led excavations have revealed that there was a much greater degree of continuity between the Late Neolithic and the Chalcolithic than had been previously recognised. The adoption of new ideas and objects at this time forms part of a longer sequence of gradual and incremental material changes relating to identity formation strategies which fulfilled the distinctive needs of local communities dating back to the start of the Neolithic. Large-scale social changes do not appear to have occurred and there is little convincing evidence for a prestige goods economy or any increase in social stratification. All of this seems to change c. 2200 BC with the introduction of bronze metallurgy which coincided with an apparent decrease in continental exchange and increase in the regionalisation of social practices.

The future

This account focuses on the impact that archaeological investigations conducted on road schemes has had on our understanding of the Neolithic in Ireland and used selective examples from the large number of sites that have been discovered to illustrate key points. The impact has been transformative and while confirming some elements of previous interpretations of the period (Cooney 2000), it has presented the basis for a

new understanding of the period. The position of the Early Neolithic as a time of radical change and establishment of a new agriculturally based way of life has been really clarified. On the other hand, we are left with major questions about long-term social change and development after the ‘house horizon’ and the processes that underpinned the character of the evidence for the Middle and Late stages of the Neolithic and its final phase, the Chalcolithic. The earlier part of the account here has relied on the pulling together and interpretation of evidence for two major research projects (Smyth 2014; Whitehouse et al. 2014; McLoughlin et al. 2016) and as research continues undoubtedly there will be answers provided, as well as new questions raised! For example, there is enormous potential in studies of material culture to understand daily life in the Neolithic and longer term cultural patterns. This is the case particularly when the detailed study of specific elements of the record is combined with an interpretive pulling together of different materials found in association and in understanding the overall assemblage from sites as representing activities of people (see Lemonnier 2012). However, this needs to be combined with a greater emphasis on achieving more fine grained chronologies for sites and practices, especially those dating from 3600–2200 BC.

A theme that we tried to highlight through the different phases of the Neolithic was the occurrence of enclosures. This is to reiterate a point made in an earlier paper (Cooney 2002) that the construction of enclosures, built at different scales, was a feature of Neolithic life in Ireland. But here, we wanted to emphasise that the discovery of enclosures on road schemes, such as Magheraboy, Tullahedy and Balregan, is a reminder that development-led archaeology has not just enriched our understanding of daily life in the Neolithic but also has the potential to reveal monumental structures. In this sense it has not only helped to re-balance our understanding of the megalithic tombs that had dominated our view of this period but also emphasises that these stone monuments are actually only part of a wider Neolithic deployment of monumental structures built from a range of materials.

This relates to another theme that has become apparent through development-led archaeology, namely, the very high degree to which people intermittently returned to the same locales and often conducted the same sort of activities throughout the Neolithic and beyond. The phenomenon of persistent places is no longer restricted to

large-scale monumental sites; instead we see that people seem to have maintained enduring ties to many (at least) locally important places.

And as a final point, taking the Scottish Archaeological Research Framework as one potential model (Sheridan & Brophy 2012), now seems an appropriate time to identify the key research areas and questions that would allow us to most fruitfully address the data gathered through developer-funded and research excavation, identify foci for research and to create a detailed history of the Neolithic and Neolithic society and people, from the first appearance of new lifeways in the Early Neolithic to the appearance of Food Vessels, single inhumations and bronze metallurgy around 2200 BC that marks the end of the Neolithic and the start of the Bronze Age.

Image captions

Illus. 1—Reconstruction drawing of the causewayed enclosure at Magheraboy, Co. Sligo (John Murphy).

Illus. 2—A cluster of three Early Neolithic houses at Monanny, Co. Monaghan (after Walsh 2011).

Illus. 3—The isolated circular pit at Carrickmines Great, Co. Dublin, with perforated serpentine disc beads *in situ* (Coilin Ó Drisceoil).

Illus. 4—The enclosure at Kilshane, Co. Meath, and the articulated and disarticulated remains of cattle from the base of the ditch (Hawkeye and CRDS Ltd)

Illus. 5—Pits, stake-holes, hearths and Middle Neolithic rectangular houses were uncovered under deposits of occupational debris in an area partially enclosed by a palisade at Tullahedy, Co. Tipperary (after Cleary & Kelleher 2011 and Smyth 2014, fig 5.8).

Illus. 6—A pit containing as many as 935 sherds from seven Grooved Ware vessels and 193 lithics including 19 end-scrapers at Scart, Co. Kilkenny, which occurred on a site with extensive evidence for Late Neolithic activity including the remains of at least four structures (from Laidlaw 2009).

Illus. 7—Examples of Irish Late Neolithic timber structures (after Smyth 2014, fig. 5.13).

Illus. 8—The outer ditch of the partially excavated double-ditched enclosure at Balregan 1, Co. Louth, located at the confluence of the Castletown and Kilcurry rivers (Studio Lab).

Illus. 9—The disc bead necklace from Paulstown, Co. Kilkenny, and the pit which contained 23 of these disc beads along with sherds from at least 23 Beakers, charred hazelnuts and cereal remains, as well as flint debitage

If we cannot get suitable photo of the beads , we will go with this instead

Almost complete Beaker polypod bowl found upright in a pit at Newtownbalregan 2, Co. Louth (Eoin Grogan).

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