BEN EDWARDS

FROM MIDDENED POTTERY TO PIT DEPOSIT: A STUDY OF TWO NEOLITHIC SITES IN NORTHUMBERLAND, UK

Summary. *This paper presents the analysis of a highly significant early Neolithic midden from Threefords in the Milfield Basin, Northumberland, UK. The midden, unique in the region for its association with an early Neolithic building, sheds new light on the practice of pottery curation prior to later pit deposition. Using metric and abrasion analyses the effects on potsherds of temporary deposition in a midden are examined, before their potential removal and reburial in one of the region's Neolithic pits. The paper demonstrates statistically that a midden was a potential locale for the curation of potsherds as a valuable resource for later social practices, and that the metric properties of the pottery from the midden match those of the pottery from a major pit site in the immediate vicinity.*

INTRODUCTION

This paper presents an analysis of Carinated Ware sherds recovered from several contexts interpreted as comprising an early Neolithic midden, and a comparison with sherds recovered from a nearby Neolithic pit site. The midden formed part of a larger occupation site at Threefords near the village of Milfield, Northumberland, UK. This is the first of our two sites. The excavation revealed an early Neolithic structure, interpreted as a roofed dwelling, spatially associated with a series of extensive midden deposits. The excavation and interpretation of the dwelling structure is reported elsewhere (Edwards *et al*. 2022), but the midden and large assemblage of Carinated Ware ceramics that it contained has important ramifications for our understanding of Neolithic depositional practices and the use of fragmented ceramics as a social resource. As we will see, a number of earlier studies of the deposition of Neolithic material culture have identified the likelihood that broken ceramics were temporarily stored prior to final meaningful and rule-bound disposal in different contexts, such as those associated with burial, or in pits. The location of this temporary first stage of deposition has only rarely been identified, however. Central to our understanding of how ceramics were curated, re-used and finally deposited during this period is the study of the differential abrasion and fragmentation of the sherds. This paper argues that the midden at Threefords could represent a context for the temporary deposition of potsherds prior to their later re-use and disposal elsewhere. Importantly, this paper also demonstrates that the metric properties of the Threefords potsherds – their abrasion states and fragmentation – are statistically consistent with another corpus of Carinated Ware sherds recovered from the nearby early Neolithic pit site of Thirlings. It should be stressed, however, it is *not* argued that sherds travelled directly between these two sites, merely that the consistent properties of the sherds deposited in the midden, and those in pits, strengthens the argument that a midden, wherever located, could provide a context for temporary storage.

Previous to the excavation of Threefords, in the north-east of England, large quantities of Carinated Ware ceramics had only been recovered in any significant quantity from pit deposits – the depositional end point of their journey. Our second site, nearby at Thirlings, was the most intensively studied pit site of this type, which revealed 228 pits, 22 containing diagnostically early Neolithic Carinated Ware ceramics (Miket *et al*. 2008). A study of these ceramics (Edwards 2016) constructed a pre-depositional biography for the sherds that demonstrated they has been subject to deliberate, i.e. non-random, selection for burial in these pits following a period of temporary deposition. The sherds were then removed from this temporary context and deposited in the Thirlings pits. This earlier study specifically excluded a 'midden' as the location for this temporary deposition. This earlier interpretation by the author was based on a single and, as it transpires, fallacious assumption that middens were a stable context for storage, which would protect sherds from further abrasion or fragmentation. Yet the results from Threefords force us to reconsider this interpretation – sherds did become more degraded the longer they spent in the midden. Thus, with the discovery of the midden at Threefords, we can examine an earlier stage in the life-cycle of broken ceramics – a potential location for their curation, or temporary deposition, only surmised before.

This paper will outline the context of early Neolithic activity in the Milfield Basin of Northumberland and our existing understanding of depositional activity in the area, before proceeding to report the results of an abrasion study of the middened sherds, and the implications for the biography or post-deposition *chaine operatoire* of socially significant ceramics in the early Neolithic. This will involve the re-assessment of previous work by the author at Thirlings, which focused on the biography of Carinated Ware deposited in pits in the region (Edwards 2016), given the important new information from Threefords. Fundamentally, whilst we *cannot* be sure the ceramics temporarily deposited in the midden at Threefords represented the resource of sherds used for final deposition at Thirlings, we can state with some confidence, statistically, that a midden *of this type* could act as a location for the temporary storage of an important and meaningful resource.

THE EARLY NEOLITHIC AT THREEFORDS

The site at Threefords lies within the Milfield Basin of north Northumberland and was characterized by a relatively light structure, probably a house or dwelling, in close proximity to a horizontally spread deposit containing 269 sherds of Carinated Ware ceramics within a matrix of darker, more humic soil. This ceramic-rich deposit was most likely a midden deposit – see below for a critical analysis of the suitability of this term – associated with the use of the dwelling (Fig. 1). The midden comprised two distinct layers of deposited material, perhaps indicating a period of temporary abandonment or seasonal use of the site, both of which contained Carinated Ware and a small number of flints. A series of intercutting pits had been dug into the midden at different points during its use, but appeared to have been rapidly refilled with similar material. The butt-end of a polished stone axehead was recovered from the lower deposit in the midden, and appears to be of Group VI Langdale Tuff. A series of radiocarbon dates on short-life material were taken from the deposits in the midden, though the stratigraphy was complicated by the truncation of the upper layer by ploughing, and the removal of the limits of the deposits by modern service trenches. Despite this,

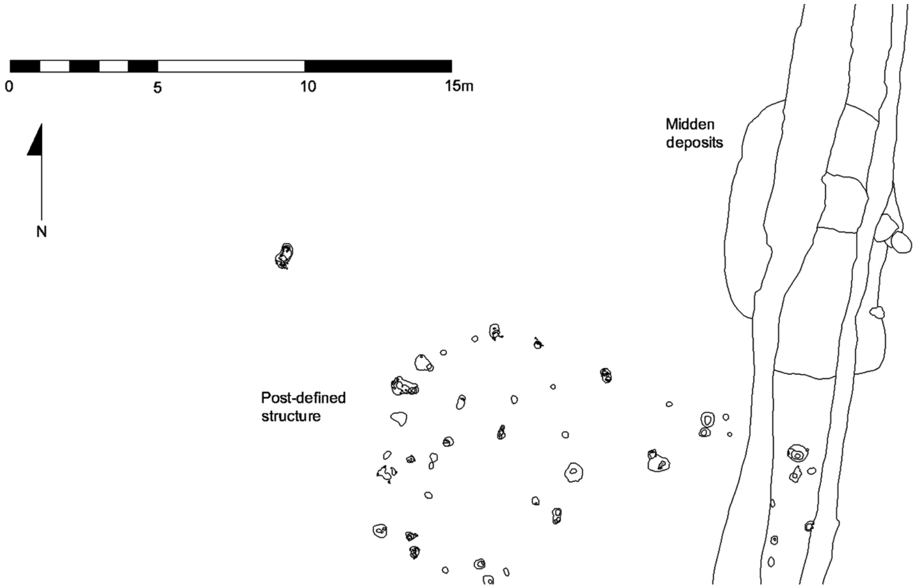

FIGURE 1
The structure and midden at Threefords.

the series of three radiocarbon dates indicate that the midden was most probably used at some point between 3880 and 3650 cal BC (95% confidence).

The structure at Threefords was intriguing and is reported in more detail elsewhere (Edwards *et al*. 2022); however in brief, it measured 15 m by 8 m and was constructed of relatively light posts, around 5–15 cm in diameter, which were often placed together in the same or very closely paired postholes. These posts appear too light to have supported a traditional roof, such as that interpreted for the early Neolithic house at White Horse Stone (Thomas 2013, 298), and are far removed from the monumental structures at Claish and Balbridie (Barclay *et al*. 2002; Ralston 1982, respectively), but ethnographic parallels do indicate that posts of a similar size, placed in a similar manner can be used to produce a lattice-work structure to support a temporary roof of skin or hides. A convincing potential example (but not direct analogy) is provided by Ojibwe structures of Canada (Oliver 1997). Deposits from the post pipes and postholes of the structure provided an overall radiocarbon determination of use between 3910 and 3630 cal BC (95% confidence), from six separate dates from three different contexts, indicating likely contemporaneity with the midden (see Griffiths in Edwards *et al*. 2022, 41 for detailed information). A series of non-structural pits were excavated within the structure, one of which provided a date of 3970–-3710 cal BC (SUERC-30162), whilst the site overall also produced three further examples of pits apparently used for complex Neolithic deposition.

THE MILFIELD BASIN IN THE NEOLTHIC

Whilst the remarkable state of preservation of the midden and associated structure at Threefords is unusual, the local area is very rich in prehistoric archaeology from throughout the

Neolithic and early Bronze Ages. Yet it is for late Neolithic sites that Milfield is most well-known. A series of excavation campaigns from the 1970s to the present have been focused on the elaborate late Neolithic to early Bronze Age henge complex, associated pit alignments and later ring ditches. Anthony Harding excavated three henges at Milfield North, Milfield South and Yeavering (see Fig. 2) and a pit alignment (Harding 1981); Roger Miket investigated the pit alignment at Ewart (Miket 1981), and excavated two ring ditches in close proximity to the henge at Milfield North

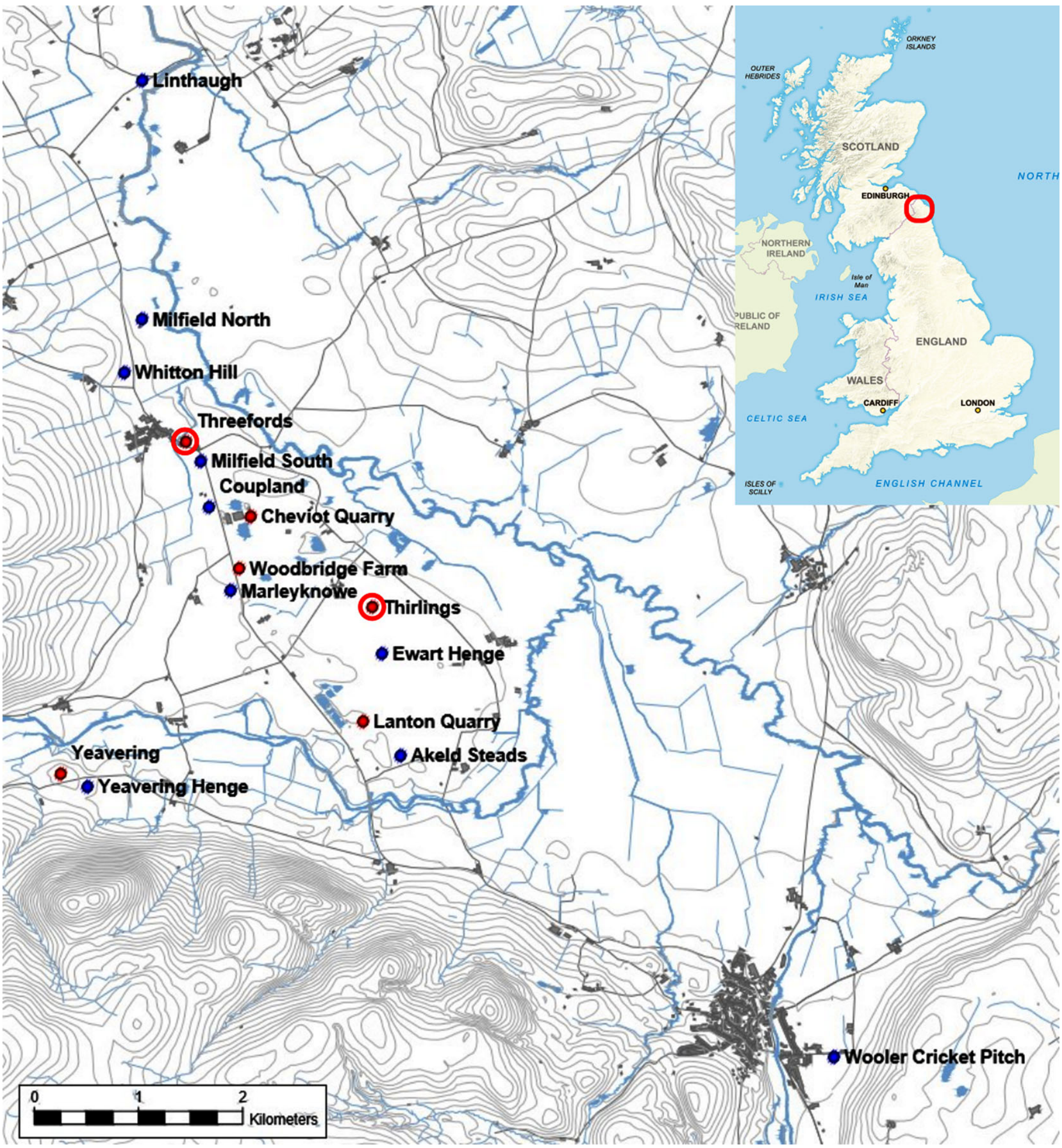

FIGURE 2
Neolithic sites in the Milfield Basin: red – early; blue – late; Threefords and Thirlings highlighted.

(Miket 1985); and Clive Waddington undertook excavation over an entrance to the henge at Coupland (Waddington 1999, 147). Finally, the author is involved in a collaborative project to excavate the most northerly henge at Linthaugh. Despite the excavation of these five henges, the complex still remains only partially understood – the layout of the sites and activity that occurred at them appears to vary widely between monuments, and they only form part of the total of nine known henges in the complex (Harding 1987).

The early Neolithic, associated in this area with Carinated Ware ceramics, is far less well-understood. For many years the only site that had produced any amount of structural or artefactual remains was the extensive pit complex at Thirlings, excavated in the late 1970s (Miket *et al*. 2008). Thirlings comprised 228 pits, 39 of which contained ceramics, that in turn produced 270 sherds of Carinated pottery (Edwards 2016). Extensive analytical work was undertaken by the author on the pits at Thirlings (Edwards 2011) and the ceramics (Edwards 2016), which established statistically observable trends in the selection and complex rule-bound deposition of potsherds, based on the deliberate selection of certain sherd sizes and type for burial, which were over-represented in the assemblage; this will be explored below in the context of the analysis of the Threefords material. There were no structures on the site aside from one small ring of very shallow pits that produced no material suitable for dating.

More recently, pit features at Lanton Quarry produced similarly large numbers of Carinated Bowl pottery (Waddington 2021). The ceramic assemblage from phase 1 of the excavations comprised 565 sherds (Tinsley and Waddington 2009a, 6), whilst phase 2 produced 491 sherds, the majority from a single pit (Tinsley and Waddington 2009b, 3). There were indications of a Neolithic structure at this site (Lotherington 2018); otherwise, the list of pit sites that have produced early Neolithic material with little or no other structural evidence is quite extensive, such as Cheviot Quarry (Johnson and Waddington 2008), Woodbridge Farm (Waddington 2000, 1), Yeavering Palace Site (Hope-Taylor 1977, 345; Ferrell 1990) and the pits predating the henges at Coupland (Waddington 1999, 126) and Yeavering (Harding 1981, 122–7).

Prior to the excavation of Threefords there were two characteristics that defined early Neolithic sites in Milfield, and Northumberland more generally: first, no remains indicating a built structure had ever been found in association with the pits; and second, the context of use of the material culture was always conjectural – temporary deposition or curation prior to burial in the ubiquitous pits was advanced as an explanation (Edwards 2016), but never demonstrated. Threefords provides the opportunity to change this situation.

THE MIDDEN

The structure of the Threefords midden

The deposits defined as the midden at Threefords were highly distinct from others on the site. Most fundamental here was the fact that the layers comprising the midden were the only stratified deposits on the site that existed on top of the natural subsoil, all others were within cut features associated with the built structure or within complex pits. This in itself is remarkable, given the lowland location of the site and its history of intensive arable agriculture. The survival of the deposits appears to have been the result of a series of fortunate circumstances coming together in exactly the right way. They were protected beneath a relict ridge from ridge and furrow agriculture, visible in the trench sections and as an undulation in the truncated natural subsoil; and they appear to have been placed on top of a deflated sandy deposit that filled a fossil ice-wedge cast, a periglacial soil feature that formed within the otherwise homogenous sands and gravels of this part of the Milfield Basin. This is reminiscent of the survival of the middens at Eton Rowing Lake, which were preserved in the hollows of post-glacial river channels (Allen *et al*. 2013, 489). The midden was of course not un-damaged: two service trenches horizontally truncated the deposits to the east; plough furrows were clearly visible truncating the midden to the north, where it was without the protection of relict ridge and furrow; and the upper layer was also vertically truncated by ploughing, though the lower layer appears not to have been. Nevertheless, enough of the deposit survived to provide identification and then analysis of the structure of the midden and its material culture.

The midden was structured as two distinct contexts. An upper layer of wider extent, and a lower layer of smaller extent, focused in the deepest part of the ice-wedge cast. The upper deposit measured 9 m by 5 m whilst the lower measured 3 m by 2 m. A series of pits, perhaps the result of extraction of midden material (see below), were cut into both layers, and thus formed part of a complete stratigraphical sequence (Fig. 3). Exclusively Carinated Ware sherds, 269 in total, were recovered from these deposits, as well as a small number of flints and the butt-end of a Group VI polished stone axe. There was extensive refitting of the ceramics, though sherds representing the entirety of a pot were not recovered, despite the total excavation of the deposits, though this is

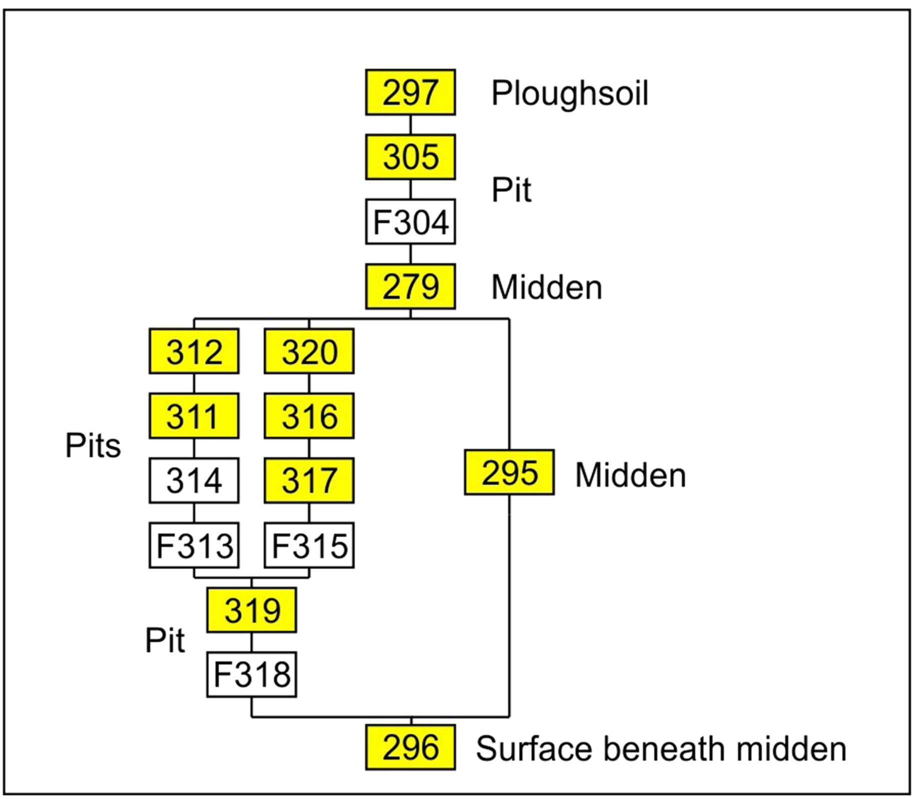

FIGURE 3
Stratigraphical matrix of the midden (shaded contexts produced pottery).

FIGURE 4
Pottery broken *in-situ* in the midden.

perhaps unsurprising given the levels of truncation. Several of the sherds appear to have been broken *in-situ* after they were deposited in the midden (Fig. 4), though this appeared to be the exception rather than the rule.

Defining and identifying the social importance of middens

The over-use of the term 'midden' to describe a depositional context has been criticized in the past by Needham and Spence, who argue that *in-situ* deposits and proof of persistent use are the only way of demonstrating the existence of middening (1997, 80). They make the basic point that the existence of deposited rubbish does not equal the existence of a midden. This is important because there is a social aspect of middening that is essentially ignored when it is seen as an unproblematic means of depositing 'rubbish', or even for storing objects prior to an act of deposition. Where middens have been identified their importance can be very obvious: Potterne, Wiltshire was used for over 500 years in the late Bronze and early Iron ages and comprised a midden containing an enormous 40–50,000 cubic metres of material. The site had seen post-hole activity prior to the midden, in which a huge range of artefacts were deposited, including disarticulated human bone and a gold bracelet, but there was also widespread evidence for stock-keeping directly on the growing mound (Lawson *et al.* 2000). Similarly, the middle to late Bronze Age site at Houseledge West in the Cheviots covered 225 square metres and contained over 2000 artefacts (McOmish 1996, 73). Guttmann also draws attention to the social importance of Mesolithic midden material for the later location of Neolithic activity (2005, 234). Where midden material is identified as a source for material recovered from other contexts, see below, the social importance or 'value' of this material is often highlighted. Pollard argued that the deposition of selected midden material in pits related to the abandonment of temporary settlement, and embodied the identities of the community involved (1999, 89). Thomas noted that cyclical movement through a landscape could be marked by repeated acts of deposition as groups returned to a settlement site (Thomas 1999, 72). In these cases the authors stress the complex sequences of deposition that led to the overall character of the various deposits, and it is clear that we should not regard middens simplistically. Given their complexity and the particular attitudes to rubbish that they represent, it is apparent that the term 'midden' must be critically deployed.

Despite the above, it is quite striking that many researchers have favoured the existence of middens, not because they have been securely identified in the record, but because they are seen as a potential source for material culture later deposited in pits. This was the case with the Coneybury Anomaly, where the 2110 fragments of animal bone seem to have been stored for some time in a pre-depositional context prior to deposition in the large pit. This was evidenced by gnawing on the cattle bones and erosion of the potsherds (Richards 1990, 53). Similarly, at Spong Hill, it appears that depositional behaviour changed between the early and late Neolithic, with the excavator arguing that certain classes of material culture, in this case organic remains, remained in above-ground middens in the latter period, whilst pottery continued to be deposited (Healy 1988, 107). The pits at Firtree Field, Dorset also appear to have contained flintwork that was provisionally discarded before being selected for structured deposition, due to an absence of refitting flakes, with a midden being interpreted as the source for this material (Barrett *et al*. 1991, 77). The deposits at Rowden were also interpreted as being the burial of midden material in a complex manner (Pollard 2001, 323), with this midden being bound into early Neolithic lifeways in the region (Harris 2009, 119), although the midden itself was never identified. Finally, Humphrey Case argued for the presence of re-deposited late Neolithic midden material in the side chambers of West Kennet as a means of de-consecrating the monument (Case 1995, 15).

Of course, *in-situ* deposits have been securely identified as middens in the British prehistoric record. Potterne (above) is a good, if somewhat unusual example. Neolithic examples remain rare but have been identified, particularly in southern Britain. There was middening of early Neolithic deposits, including large quantities of pottery at the Eton Rowing Course (Allen *et al*. 2013, 490). Middens also appear to have been present prior to the construction of Hazelton North and Ascott-under-Wychwood long cairns in the thirty-ninth century cal. BC (Whittle *et al*. 2007, 128); and it would be remiss not to mention the deposits at Skara Brae, Orkney (Childe 1931), subject to very detailed analysis as 'anthropic sediments' (Simpson *et al*. 2006). Similar association between late Neolithic buildings and middens has been identified at Durrington Walls, dated to 2535–2475 cal BC, with the middens in use for up to 55 years (Craig *et al*. 2015, 1096). Distinct from the examples in the previous paragraph, it can be argued that Kilverstone, Norfolk, despite the level of truncation but on the basis of the wealth of its evidence and the quality of its analysis, saw middens on site whilst pits were being used for the deposition of material taken from them (Garrow *et al*. 2005, 152; Garrow 2012, 113).

The Threefords midden

Given that there is a predilection to identify middens on the basis of deposits found in other contexts, usually pits, and that the idea of middening has been problematized (Needham and Spence 1997), it is necessary to justify the identification of the deposits at Threefords as a genuine

TABLE 1
Radiocarbon dates from the midden contexts (Griffiths in Edwards *et al.* 2022, 41), IntCal20 calibration data (Reimer *et al.* 2020)

Laboratory Number	Radiocarbon sample	Context	$\delta^{13}C$ (‰)	Radiocarbon age (BP)	Calibrated date range (95% confidence; BC)
OxA-30724	*Triticum dicoccum* seeds	C296, old ground surface below midden	-25.55	4947±35	3800–3640
OxA-30725	*Ulmus* sp. charcoal	C279, topmost deposit in midden	-24.57	5052±35	3960–3710
OxA-30726	*Ulmus* sp. charcoal	C279, topmost deposit in midden	-24.57	5052±35	3960–3710

midden. In this case, we have two stratified deposits with a succession of shallow pit-digging between and from above, and a limit to the extents horizontally of the deposits. The stratified layers contain a far greater concentration of material culture than the cut features on the site, including ceramics, flints and a fragment of a group VI axehead. The matrix of these deposits was also far richer in organic material than the surrounding subsoil. Analysis of samples taken from the midden indicate that it contained charcoal from oak, hazel, apple/pear, probably used as fuel, whilst the hazel and apple/pear showed evidence of pollarding or coppicing (Kabuku in Edwards *et al*. 2022, 28). Cereal grains and chaff are under-represented in the midden samples, which may indicate a less favourable environment for their preservation, rather than evidence of absence (Kabuku *in* Edwards *et al*. 2022, 30). Taken with the circumstantial evidence of the adjacent Neolithic structure, it appears therefore that we can identify the Threefords deposits as *in-situ* midden material, generated through settlement-related activity on the site.

Crucially, three radiocarbon dates were recovered from the midden. Two from the upper of the two contexts (OxA-30725; OxA-30726; 3960–3710 cal BC; 95% confidence), and one from the ground surface below the midden (OxA-30724; 3800–3640 cal BC; 95% confidence). Given the near contemporaneous distributions of these date ranges, and the potential for mixing of the early Neolithic material by contemporary acts of pit digging into the midden (Fig. 3), in modelling the radiocarbon results, the midden was treated as a single phase of activity (Griffiths in Edwards *et al*. 2022, 44). The result of the model indicated a period of use for the midden between 3880–-3700 cal BC and 3760–3650 cal BC at 95% confidence (Griffiths in Edwards *et al*. 2022, 9). See Table 1 for details of the radiocarbon samples.

ANALYSING THE MIDDEN

The primary purpose of this paper is to analyse the ceramics deposited in the midden in order to tie them into material culture biographies already developed for north Northumberland. This takes the form of abrasion analyses designed to examine the post-depositional history of the pottery. The aim was to determine whether the Threefords midden, or one like it, was the source for ceramics later deposited in the region's pits, most notably those at Thirlings. These pits appear to have contained pottery provisionally discarded elsewhere, which was then collected to be re-used in pit deposits. This analysis also aimed to test a proposition, put forward by this author, that the ceramics from Thirlings *were not* stored in a midden prior to deposition in pits (Edwards 2012). This is a proposition that must be re-examined in light of the evidence from Threefords.

Abrasion analysis as a method

Abrasion analysis is not widely undertaken in British prehistory, but is based on a simple premise: that the present condition of a pottery sherd provides indications as to the processes that created that condition (Schiffer and Skibo 1989, 101). Thus, abrasion analysis aims to quantify the level of erosion suffered by exposed surfaces or edges of sherds that is likely to have occurred post-breakage but before excavation, though does not automatically differentiate between whether this erosion occurred pre or post-*deposition*. It is, however, widely assumed that abrasion will largely cease after complete burial in a stable soil matrix (Schiffer and Skibo 1989, 90). It is argued, therefore, that sherds subject to high levels of post-breakage disturbance (i.e. they are not completely buried in a stable soil matrix) will suffer greater degrees of abrasion and possibly breakage (Bradley and Fulford 1980, 86), though fragmentation is likely to stop when a minimum effective sherd size is reached (Schiffer 1987, 129).

The first major study of pottery abrasion on British deposits was undertaken by Sørensen (1996) in her consideration of the middened pottery deposits at the Bronze Age site of Runnymede Bridge. Previous work by the present author followed the design of Sørensen's study, with the single elaboration that her three-tier scheme was expanded to include four levels of abrasion (Edwards 2011, after Sørensen 1996, 67). They are as follows:

1. None or very little abrasion – very fresh breaks, unpatinated core colour, sharp edges, very rough texture, and extruding grains of temper.
2. Low abrasion – edges maintain sharpness but markedly extruding edges and temper are worn, core colour generally still fresh but texture is slightly smoother.
3. Medium abrasion – points and edges are now worn blunt, temper no longer extrudes, texture of core noticeably smooth, core colour is dull or patinated.
4. High abrasion – sherd is heavily rolled: surfaces have receded from core and core worn smooth, presenting a rounded effect, core is heavily stained and altered.

As something of a vindication of the technique, work by Benjamin Jennings (2015), building on this author's work, deployed this four-tier methodology to good effect studying late Bronze Age Swiss ceramics. It is worth mentioning, however, that this methodology is by necessity qualitative, in that it relies on consistent judgement by the same interpreter. Thus the readings taken by one analyst may not agree with those taken by another. However, it is reasonable to assume that a given analyst will be internally consistent for ceramics of the same fabric. This may go some way to explain why Blanco-González and Chapman posit, in passing, lower abrasion values for the Thirlings material, though they did not elaborate upon the new values (Blanco-González and Chapman 2014, 254).

Previous abrasion studies in the Milfield Basin

The only previous reported abrasion study in Northumberland, was undertaken by the author during the completion of a PhD (Edwards 2009), and later published (Edwards 2011). As already stated, this study was undertaken on the ceramics from the early to middle Neolithic site at Thirlings, which were exclusively recovered from pit deposits. The aim was to construct post-breakage, pre-depositional biographies for the sherds (Edwards 2016). Interesting statistical trends were observed in the abrasion data, which indicated that the fragmentation of the pottery was not related to its abrasion state (*contra* Bradley and Fulford 1980, 86) and that abrasion values were statistically random amongst the assemblage, yet that sherds from the same pot shared similar abrasion values. To summarize the findings, it was argued that sherds had been temporarily deposited in a location that had largely protected them from abrasion and fragmentation via trampling, but not from abrasion by weathering. Sherds were then selected from these temporary deposits to be interred in pits in a series of complex and rule-bound ways. These studies consciously *excluded* middens as the location for these temporary deposits for two reasons: the author believed that less abrasion would be evident if the sherds were stored in a midden; and that no physical evidence of early Neolithic middening had, at that point, ever been excavated in the region. This paper questions these assumptions.

TABLE 2
Quantity of sherds recovered from the analysed contexts

	Number of Sherds Recovered
Upper midden layer (279)	88
Lower midden layer (295)	82
Pit fill (305)	45

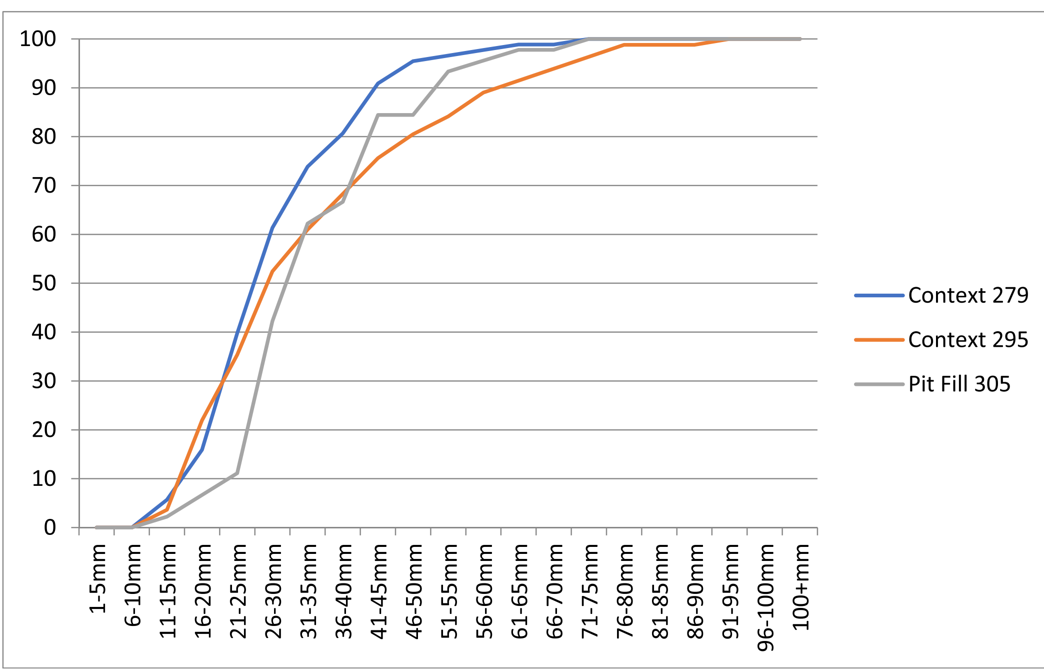

FIGURE 5
Cumulative frequency distribution of the size of sherds from the midden contexts.

Fragmentation analysis

In this and all following analyses, the two main layers in the midden (279 and 295), and the pit fill that yielded a large quantity of pottery (305) are the principal datasets. The basic details of the ceramics from the three contexts is as follows, Table 2.

The first analysis is the fragmentation of the pottery present in the midden. Figure 5 displays the cumulative frequency distribution of the size of the sherds from the three contexts. Size was quantified by the long axis of each sherd, measured in millimetres. The upper layer of the midden (279) has a higher frequency of smaller sherd sizes than the lower layer (295), with the pit fill (305) falling between. This indicates a higher rate of fragmentation for the upper layer of the midden but, at this point, does not allow us to ascertain at what point this fragmentation occurred: pre- or post-deposition.

Abrasion analysis

Abrasion analysis was also undertaken on the sherds recovered from the three contexts, following the methodology described above. Table 3 displays the number of sherds assigned to each abrasion category by context, and Fig. 6 displays the distribution of abrasion values graphically.

In this analysis, the upper layer of the midden (279) has a lower average set of abrasion values than the lower layer (295), with the pit fill (305) once again falling between the two. This indicates that the longer the sherds spend in the midden, as indicated by their depth in the stratigraphy, the more abraded they became (see Fig. 3 for the stratigraphy of the midden overall). Indeed, the number of very low abrasion states in the lower layer (295) is quite remarkable, and the variance from the mean for this context is also relatively low.

Abrasion versus fragmentation

The final analysis of the separate midden deposits is an attempt to ascertain whether the midden, whilst likely to be the context for the abrasion of the sherds, was also the location of their continuing fragmentation. This is key for placing the deposits in their wider regional context of Early Neolithic deposition. In order to undertake this test, a Kendall's *tau-c* test was used to compare two categorical sets of data: the frequency of different sherd lengths versus the abrasion values,

TABLE 3
Frequency of abrasion states by context

	Context		
Abrasion	279	295	305
1	16	3	5
2	19	10	17
3	33	33	13
4	20	36	5
Average	2.65	3.24	2.45
St.Dev.	1.02	0.80	0.86
Variance	0.39	0.25	0.35

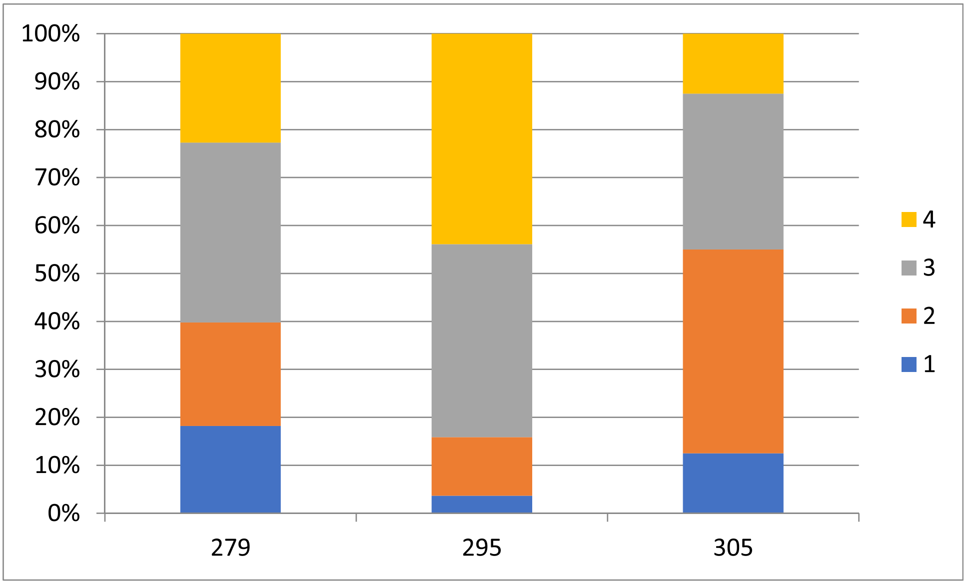

FIGURE 6
Distribution of abrasion values by context.

differentiated by context (Table 4). The *hypothesis* here being that, if the midden was the context for the fragmentation of the sherds, then abrasion levels should show a correlation with decreasing sherds size, i.e. as the sherds get fragmented down to a smaller size, they also become more abraded.

Kendall's Tau (τ) Test of Association

A result near 0 indicates no association between the variables, a result near -1 or 1 indicates association

$$\tau = \frac{2\,k(P - Q)}{n2(k - 1)}$$

n = total frequencies (88 and 82 respectively)
k = number of rows or columns, whichever is smaller (4 rows)
sum of every cell multiplied by the frequencies in every cell below and to the right
Q = sum of every cell multiplied by the frequencies in every cell below and to the left
Context 279
τ = -0.175 – no association
Context 295
τ = -0.217 – no association

In both layers of the midden, there was no association between abrasion levels and sherd size/fragmentation: sherd size does not get smaller as abrasion levels increase. Thus, the midden cannot be the location for both sherd fragmentation and abrasion.

TABLE 4
Frequency tables for Kendall's tau

Context 279							
	Sherd Length						
Abrasion	1-20 mm	21-40 mm	41-60 mm	61-80 mm	81-120 mm	120 mm+	Total
1	0	11	5	0	0	0	**16**
2	2	13	4	0	0	0	**19**
3	8	18	6	1	0	0	**33**
4	4	15	0	1	0	0	**20**
Total	**14**	**57**	**15**	**2**	**0**	**0**	**88**
Context 295							
	Sherd Length						
Abrasion	1-20 mm	21-40 mm	41-60 mm	61-80 mm	81-120 mm	120 mm+	Total
1	1	1	1	0	0	0	**3**
2	1	2	5	1	1	0	**10**
3	8	11	8	6	0	0	**33**
4	8	24	3	1	0	0	**36**
Total	**18**	**38**	**17**	**8**	**1**	**0**	**82**

FIGURE 7
The size distribution of sherds from Thirlings (*n*=270) and Threefords (*n*=269).

Conclusions from the midden analysis

An analysis of the sherd sizes and abrasion levels from the three main pottery producing contexts in the midden draws the following results: 1) the ceramics in the different layers of the midden have different average sizes – those in the upper layer are more fragmented than in the lower; 2) the lower a sherd is down the midden stratigraphy, the more abraded it is likely to be; and 3) the abrasion state of a sherd is not related to is state of fragmentation.

Two conclusions can therefore be drawn regarding the process of middening at Threefords, and the effect this practice had on the preservation of potsherds. First, we must recognize that the *longer* a sherd spent in the midden, as defined by is depth down the stratigraphy, the more abraded it became. This directly contradicts this author's earlier work, where it was assumed, but never tested, that a midden would prevent abrasion (Edwards 2011; 2016). Second, this abrasion did not occur as a result of directly percussive erosion of the sherds, as it appears they were not subject to trampling or similar, given that they do not become more abraded as they get smaller.

Thus, we can argue that the midden at Threefords was a context for the curation of broken pottery, which then had the potential for subsequent removal, as is evidenced by pit digging into the deposits and a lack of complete vessels. Abrasion did occur in the midden, but further damage by trampling was not the cause, as abrasion and sherd size have no direct relationship. Sherds were therefore protected, or curated, to a degree. Weathering certainly did occur, because abrasion is non-random, and increases the longer sherds spent in the midden. A situation could be envisaged where the midden was never a particularly deep deposit, but one that grew up slowly. Sherds could become waterlogged and slowly eroded by the elements, but were not directly walked upon, and were abraded until covered by later deposition.

The case for the active use of the midden for curation and removal can be strengthened by comparison with a similar study undertaken on Carinated Bowl sherds deposited on the ground surface beneath the early Neolithic round barrow at Broomridge, Northumberland, excavated by the Canon Greenwell in the nineteenth century (Greenwell 1877, 410). Here it was argued that a cremation deposit was immediately covered by the mound (Kinnes 1979, 10, 58). In this case the Carinated Bowl sherds remained at a much lower stage of abrasion, whilst also demonstrating a much smaller statistical variance in sherd size (Edwards 2009, 234). So, the presence of the burial mound prevented both abrasion and fragmentation, unlike the midden material from Threefords, which saw active deposition and removal, indicating a degree of exposure over time.

Finally, it must be recognized that sherds could have been subject to an additional phase of curation prior to disposal in the midden, in a context now lost to us, bearing in mind that the midden was the only stratified series of deposits on an otherwise truncated site. This could have influenced the abrasion values of the sherds prior to inclusion, in a manner that cannot be accounted for in these analyses. However, the trends identified in the abrasion and fragmentation of the midden material are statistically robust, even if the cause is open to interpretation. Thus, despite this caveat, midden material still provides a likely origin for ceramics later deposited in the region's pits. This argument is addressed below.

ANALYSING THE MIDDEN IN ITS LANDSCAPE

As noted above, in other studies, it was often argued that middens could have been the pre-depositional context for the temporary storage of material prior to deposition in pits. This was often difficult to securely demonstrate because pits and middens did not exist in the same landscape. In the case under investigation here, we have a situation where a midden has been located at Threefords in close proximity to a very extensive pits site at Thirlings (a mere 2 km away, see Fig. 2). Whilst it is *impossible* to prove that material from the Threefords was transported to the Thirlings for deposition without a secure pottery refit, something beyond the scope of this study, it is yet possible to use statistical analysis to make basic comparisons of the assemblages from the two sites. Again, it must be stressed, this is not an attempt to demonstrate the movement of material between these specific sites, merely to establish whether a local midden similar to Threefords, if not Threefords itself, could be the likely source for the material deposited in the pits at Thirlings. The purpose here is to take advantage of the close proximity and close dates of the two sites in order to make a meaningful comparison between middened material and pit deposits, in a manner that has not before been possible. The fundamental basis for the comparison is sound: the radiocarbon determinations from the early Neolithic elements of Thirlings are comparable; the pottery is all Carinated Ware; the ceramic fabric is similar and likely to come from a local clay source. Furthermore, a similar disconnection between the abrasion and fragmentation of sherds was observed at Thirlings in previous studies (Edwards 2011; 2016). The corpus of Carinated Ware sherds numbers 269 from Threefords, versus 270 from Thirlings.

The most straightforward statistical test to examine the similarity of the ceramic assemblages of Thirlings and Threefords is a comparison of the size distribution of the sherds. This can be achieved with a Kolmogorov-Smirnov 2 sample test, which compares the cumulative frequency distribution of the sherd sizes from the two assemblages. Figure 7 displays these cumulative frequencies as percentages to enable direct comparison.

The Kolmogorov-Smirnov 2 sample (Fig. 7) compares the greatest observed difference between the cumulative frequency percentages and test them against a test statistic to establish whether the two samples are likely to originate from the *same population*.

Kolmogorov-Smirnov Two Sample Test
Max. deviation D is 0.238
Kolmogorov-Smirnov test statistic ks is 0.772
p value is 0.591
As p value is greater than 0.05, accept hypothesis that the two samples come from the same distribution

This test demonstrates that whilst we cannot prove the ceramics from Threefords ended up in the pits at Thirlings, they are similar enough in terms of their size distribution that they come from the same population. Note, that ‘population’ in this sense is a statistical device expressing similarity between samples, not a direct physical or spatial relationship. This indicates that it is very likely that the sherds in pits at Thirlings *were provisionally discarded in a midden* similar to, if not actually, the midden at Threefords. So, if the midden at Threefords was not the actual source, a middened deposit of pottery elsewhere probably was.

DISCUSSION

Previous work has often argued that pottery deposited in Neolithic pits could have been provisionally discarded elsewhere prior to arrival at its final resting place. Following the discovery and analysis of the midden at Threefords, it seems likely that the early Neolithic pottery of the Milfield Basin was curated in midden deposits close to dwellings, prior to its rule-bound deposition in pits in the same landscape. This runs counter to the author's previous assertions (Edwards 2009), which were based on assumptions about the dynamics of midden deposition, rather than an actual analysis of an *in-situ* midden deposit.

At Threefords, we have excavated and analysed an early Neolithic midden deposit in association with a dwelling structure – an extremely rare circumstance in any region of the UK, but particularly so in an area of intensive arable agriculture. This analysis has demonstrated two crucial points: first, that middened pottery appears to become more abraded the longer it spends in a midden, and second, that the metrics of the sherds indicate they were treated in the same manner as pottery discovered in early Neolithic pit deposits in the region.

A full biography of potsherds can now be built for the early Neolithic of the Milfield Basin, building upon the author's previous work (Edwards 2016). Carinated Ware pottery was used in a classically 'domestic' context, i.e. as part of activities associated with a potential dwelling, before being broken, probably during the course of this use. Broken potsherds were picked up and deposited in a midden in close association with these dwellings. However, rather than classifying this material merely as rubbish, the middened pottery held the potential for re-use later. Pit-digging on the midden indicates that material was removed at certain times, and thus appears to have been taken off-site. Sherds recovered in this way were transported to one of the many locales for pit deposition in the area, such as the site at Thirlings, where they were deposited in complex and rule-bound ways, often based on the deliberate selection of sherds for deposition based on their size (Edwards 2011). This is yet another example of the fallacy of separating the 'ritual' from the 'domestic'. Whilst it has long been assumed that the material culture recovered from Neolithic pits was provisionally discarded elsewhere prior to deposition, it is rare and very significant that such a context has been located.

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Department of History, Politics and Philosophy
Manchester Metropolitan University
Oxford Road
Manchester M15 6LL
UK
E-mail: b.edwards@mmu.ac.uk

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