What rivers did: a study of if and how rivers shaped later prehistoric lives in Britain and beyond

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Countering the passive representation of rivers in many previous accounts of later prehistory – as static vessels for spectacular deposits, highways for transport and communication, and backdrops for settlement and farming – this paper asks if and how rivers actively shaped prehistoric lives. Rivers have long been hailed as conduits for prehistoric materials and ideas. However, positive archaeological correlates of the processes involved are notoriously difficult to identify and have rarely been scrutinised in detail. Using the example of Late Bronze and Early Iron Age pottery in the East of England (1150 to 350 BC), we examine in detail how prehistoric pottery making traditions cohered around river valleys over an extended time period and were thus, to a certain extent, generated by rivers. Drawing on wider evidence for the flow of people and things in this region we build a broader multi-dimensional account of how people, objects, and practices moved in a period of diverse lifeways in which the makeup of human mobility is not well understood. In doing so, we hope to tether abstract arguments about the active role of rivers and other non-human elements in shaping past lives, and to approach the often missing 'middle ground' – small-scale movements at local and regional scales – in existing archaeological discussions about mobility.

Key words: rivers, pottery, Bronze Age, Iron Age, Britain, mobility, landscape, non-human agency

INTRODUCTION

River histories have long been a focus of archaeological and wider scholarly fascination in Western Europe (eg, Bradley 1998). In Britain, antiquarian interest in ancient rivers was sparked by spectacular dredging finds of Bronze and Iron Age human remains and metalwork – swords, shields, cauldrons, and so on – from the Thames (eg, Cuming 1857; 1858). Over the last 30 years, the focus of developer-funded archaeology on riverside gravel terraces has allowed archaeologists to develop a much richer understanding of deep-time river valley development and occupation. These developer-funded investigations, together with river-

specific research projects and Local Authority-led syntheses have produced important archaeological narratives for the Great Ouse (Dawson 2000), the Severn (Bell *et al.* 2000), the Witham (Catney & Start 2001), the Humber (Van der Noort 2004), the Trent (Knight & Howard 2004), the Welland (French & Pryor 2005) the Thames (Lambrick *et al.* 2009), and so on. Interpretatively, beyond wide acceptance that river valleys provided ideal settings for ancient settlement and farming, researchers have discussed the role of rivers as foci for ritual deposits of human remains and metal items (eg, Gordon and Bradley 1988; Bradley 1998; Pryor *et al*. 2001; Fontijn 2002; 2020), as conduits for transport, trade and communication (eg, Needham & Burgess 1980; Sherratt 1996; Vyner 2007; Haughey 2013; Kristiansen & Suchowska-Ducke 2015); and as cornerstones in the emergence of Bronze Age social elites (Yates 2007; Kristiansen & Suchowska-Ducke 2015; Vankilde 2016).

In recent years, further extraordinary discoveries, detailed re-evaluations and scientific analyses of known riverine deposits, and shifting interpretative directions, have revealed new aspects of and posed new questions for ancient rivers. The excavation of the Bronze Age pile-dwelling settlement at Must Farm, and of Bronze and Iron Age settlements on riverine islands at Over, both in Cambridgeshire (Evans *et al.* 2016; Knight *et al*. 2019; in press; Evans & Pollard forthcoming) cast new light on prehistoric human-river engagements – not only were river valleys common settings for prehistoric settlement, in certain contexts people chose to inhabit islands within rivers and even raised settlement platforms directly above rivers in later prehistory (see also Cromarty *et al*. 2006). The recovery of nine log boats, with radiocarbon dates ranging from 1755 to 515 cal BC from the palaeochannel upstream of the Must Farm pile-dwelling, gave novel insight into the potential abundance of Bronze and Iron Age river traffic (Robinson et al 2015, table 3.7)(Figure 1). Detailed geoarchaeology surveys have dramatically improved our understanding of the enduring yet often highly dynamic character of ancient rivers (eg, Boreham in Evans 2016; Geary *et al.* 2016; Brown *et al.* 2018; 2019). Re-evaluations of key sets of river finds – human skulls from the river Thames (Arthur 2022), Roman pottery and metalwork from a major crossing point, Piercebridge, on the River Tees (Eckardt &Walton 2021) – have foregrounded the significant intensity and longevity of river deposits in some settings, and have refined understandings of the character (tempo and makeup) of the objects and bodies involved.

Of key interest here are new interpretative questions posed for rivers in the wake of recent material and mobility ‘turns’ across the social sciences, including in archaeology (eg, White

1996, Gell 1998; Rose 2000; Cresswell 2006; 2011; Ingold 2007; 2011; Bennett 2010; Leary 2014; Harris 2016; Aldred 2021; RiverOfLife *et al*. 2021). Archaeological accounts inspired by this broad set of ideas have eschewed previous tendencies to investigate what happened at or along (passive) ancient rivers, or to query the role of rivers as vessels for deposits of human remains and objects and as abstract conduits for communication and exchange. Instead, these recent studies have emphasised rivers' vibrant role in shaping human practices and archaeological landscapes, have considered how rivers and other non-human and human entities – woodlands, pottery fabrics, trades people, boat design, and so on – emerged in relation to one another over extended time periods (eg, Edgeworth 2011), and have reminded us of the importance of looking beyond ethnocentric framings of human-landscape relations in seeking to interpret rivers in the distant past. Aldred's recent account of the archaeology of movement, also called for a shift from current tendencies to identify the 'fact of mobility' – to summarise evidence showing that people and things moved in the past, sometimes over considerable distances – to exploring *how* people and things moved (2021, following Cresswell 2011, 551). This includes both the routes taken (not just the start and end points of journeys), and the character of the movements involved.

This emerging body of work provides an important platform for future archaeological investigations of rivers. The analysis presented here builds on existing studies in this vein in two key ways.

First, without doubt, the most eloquent multi-stranded archaeological account of deep-time human-river relations is Edgeworth's (2011) *Fluid Pasts: An archaeology of flow*. While there is much to applaud in this work, Edgeworth understandably illustrated his arguments mainly with examples from medieval and post-medieval archaeology – his main area of expertise, and also a period for which there is both relevant archaeological evidence and supporting documentary material, allowing him to develop a richer and more interpretatively persuasive account. In setting out a practical and interpretative agenda for investigating an *Archaeology of Movement*, Aldred (2021) similarly tethered his account with post-medieval examples. For this reason, there are few, if any, convincing and empirically grounded studies that examine directly how rivers operated in earlier periods of the past.

Second, recent archaeological mobility studies have helpfully summarised existing evidence for riverine transport (boats) and landing places in Britain and beyond (Haughey 2013;

Dunkley 2014; Bell 2020). Bell also highlights the complexities involved in identifying riverine movement: rivers are mutable routeways, direct evidence for river movement is rare (2020, 204). However, these studies have encountered difficulties in approaching what might be described as mobility's 'middle ground', particularly when it comes to rivers (see Gibson *et al.* 2021 for a concerted attempt to address this issue in mobility studies more widely). Evidence for the role of rivers in moving people and things, and thus in shaping human practice, is principally presented at two irreconcilable scales. On the one hand, finds of boats, landing places, and river crossings offer tangible site-specific understandings of past river craft, and the kinds of wooden structures people built for accessing and crossing rivers (see Dunkley 2014; Bell 2020 Chapters 6 and 9). This evidence also hints at the possibility that people were moving boats overland between river channels (see Dunkley 2014 for a discussion of whether or not the transom on one of the log boats from Must Farm, Cambridgeshire is evidence for portage). On the other hand, rivers are viewed abstractly as being implicated in the overall distribution/movement of 'exotic' materials like gold, amber and bronze (eg, Beck & Shennan 1991; Needham 2006; see also Bell 2020, 210–14), and objects like Neolithic stone axeheads (eg, Haughey 2013); the logical assumption being that if exotic (eg, Continental) materials and objects reached inland locations in Britain, they must have been transported by river. As Hannam *et al.* observed, mobilities must be understood in tandem with moorings (2006, 3; see also Mlekuž 2021).

This paper presents a novel study of relationships between Late Bronze and Early Iron Age people, pottery practices and rivers in three major valleys that drain into the Wash Basin in the east of England – the Nene, the Great Ouse, and the Cam (Figure 2). Based on a regional assemblage of over 110,000 sherds (1177 kg) from 59 excavated sites, we elicit how coherent patterns in pottery-making traditions emerged within separate river valleys over an extended period from 1150 to 350 BC and consider the extent to which this patterning provides evidence that rivers actively shaped human practices. Throughout the paper we define rivers inclusively, acknowledging the reality that in most cases it is difficult to disentangle archaeologically direct movement along rivers from that along their wider floodplains. In discussing our findings, we build a broad multi-dimensional account of *how* people, objects, and practices moved – drawing in wider evidence from communal gathering places (hillforts) and terrestrial routeways – in a period and region for which the character of human, animal and material mobility is still poorly understood. Overall, our study attends to ongoing archaeological interest in exploring the co-production of human and non-human entities, and

in emphasising *how* archaeological entities come into being rather than *what* they are (Gosden & Malafouris 2015). It responds to recent calls within archaeology to develop a multi-stranded toolkit for studying ancient routeways (Bell 2020, 4; Bell & Leary 2020, 1352), to consider the interconnection of different kinds of routeway (Bell & Leary 2020, 1356) and of different forces (architectures, topographies, the need to get from place to place, etc.) that potentially shape human practice (White 1996; Aldred 2021, 65), and to shift analytical attention from acknowledging the 'fact of mobility' to addressing more evocatively *how* people, things and ideas moved (Aldred 2021). It also addresses an important gap in current archaeological mobility studies by approaching a set of evidence – prehistoric pottery – that is particularly well suited to exploring the character of small-scale – local and regional – movement; a mode of movement which is 'mostly ignored' (Bell & Leary 2020, 1349; see Gibson *et al.* 2021 for another recent attempt to address this lacunae).

RIVER SETTINGS: AN INTRODUCTION TO THE LATER PREHISTORIC RIVERS OF THE WASH BASIN

The palaeohydrology, broad character and archaeology of the river systems that drain into the Wash have been recounted many times already and are not repeated in detail here (see Brown & Keough 1992; Robinson 1992; Brown *et al.* 1994; Macklin 1999; Dawson 2000; Langford & Briant 2004; Brown & Allen 2008; Meadows *et al.* 2008; Boreham & Rolfe 2009; Paul *et al*. 2015; Evans *et al.* 2016; O'Brien *et al.* 2016; Evans 2022; Evans & Pollard forthcoming for the Nene and Great Ouse (including the Cam/Rhee); see French *et al.* 1992, 2005 for the Welland, Lincolnshire and Geary *et al*. 2016 for Suffolk rivers, respectively). Basic physical attributes of our case study rivers are given in Table 1 and summarised briefly below.

The Nene and Great Ouse rise in and flow north-eastwards from the boulder clay-blanketed limestone uplands of Northamptonshire; the Cam rises on Essex's chalk downlands. Having left the higher ground, these rivers cut through a complex geological mix of clays and mudstone overlain by glacial drift deposits, mostly sand and gravel. A combination of human and climatic forces led to the silting up (and slowing down) of all three rivers from the Middle Bronze Age onwards (from c. 1500 BC). However, flooding and alluviation had limited impact in these valleys until well into the Roman period (Robinson 1992, 200). The Great Ouse leaves the uplands at a much earlier stage in its course than the Nene, lending it

an altogether different, lowland, character (Harding & Healy 2007, 268). At a broad level, both the Nene and the Great Ouse are described as lacking in gradient and energy, particularly in their lower reaches (Brown *et al.* 1994; Macklin 1999, 522–7; Boreham & Rolfe 2009). The valley floodplains are broad (up to 2 km wide) in places, narrow elsewhere. The lower reaches of all three rivers were transformed in later prehistory by rising sea levels, an escalating groundwater table and by a series of marine incursions in the Fenland Basin that led to a succession of shifting wetland ecologies (Hall & Coles 1994; Waller 1994). The heavily managed current forms of the Cam, Great Ouse and Nene – a result of canalisation, drainage, and so on – obscures their very different nature and flow in prehistory. Detailed paleochannel investigations in the Nene and Great Ouse Valleys (eg, Meadows & Brown 1996–7; Pollard *et al*. 1996; Roseoff 2000; Last 2005; Paul *et al.* 2015; Evans *et al.* 2016; Evans & Tabor 2019) indicate that in prehistory, these river channels were meandering, braided and intermittently active – occasionally, even 'fast flowing and turbulent' (Roseoff 2000): 'such channels would have formed a network, some always wet, but many others only seasonally active … threading across the floodplain' (Meadows *et al.* 2008, 154). In this context, interchannel islands and bankside levees became a particular focus for prehistoric activity (Harding & Healy 2007; Evans *et al.* 2016; Evans & Pollard forthcoming).

All three of our case study rivers are rich in later prehistoric archaeology from the Neolithic period onwards, albeit that their archaeologies are unevenly known, the Great Ouse having been most intensively investigated (Harding and Healy 2007, 269). For the Late Bronze and Early Iron Ages, pit alignments – running for up to 3 km and interpreted diversely as routes of communication and as symbolic statements – are known across the region but are a particular feature of the Nene Valley, for instance at Wollaston, Northamptonshire (Meadows *et al.* 2008, 67, fig. 2.4.2). Hilltop enclosures are focused instead along the northern edge of a broad chalk ridge that runs to the south and east of our study area, and in the lower reaches of the Cam Valley. Log boats from the Must Farm palaeochannel – a later Bronze Age distributary close to the mouth of the Nene (Robinson *et al.* 2015) – and from Peterborough (Fell 1951), further upstream on the Nene, are testament to river journeying in this period. As Harding and Healy point out for the Neolithic and Early Bronze Age, 'such travel would have involved encounters with the river's occupants as well as with the forces embodied in its earthworks, in its trees or in the river itself' (2007, 285). The unique Late Bronze Age pile-dwelling at Must Farm gives rare and rich insight into the character of riparian domestic life at the mouth of the Nene where it drained into what is now known as the Flag Fen Basin

(Knight *et al.* in press). More broadly, largescale excavations across the region have revealed previously elusive Late Bronze and Early Iron Age open settlement remains in diverse landscape settings (see Brudenell 2018 for a recent summary). Evidence for Late Bronze and Early Iron Age field systems is lacking, as is the case across much of southern Britain. In contrast with other major rivers in Britain, notably the Thames and the Witham, river deposits of Late Bronze and Early Iron Age metalwork and human remains are not a defining feature of the Nene, the Great Ouse and the Cam valleys (Malim 2000, 86; Meadows *et al.* 2008, 80). Complete swords of this date are found in channels within wetland areas – where these channels' identity as rivers may not even have been recognised – and in wetland basins where these rivers meet the fen (Yates and Bradley 2010). Upstream of this, however, examples of river deposits are few and far between – key exceptions include an assemblage of swords, currency bars and spearheads from the Nene at Orton Meadows, near Peterborough (Stead 1984; Mackreth 2020) and occasional dredging finds from the Cam, including a socketed spearhead from Chesterton, Cambridgeshire. Rather, in this region, the fen edge and causeways crossing the fen appear to have formed the main focus for Bronze and Iron Age watery deposits, for instance at Bradley Fen, Cambridgeshire (Knight *et al.* 2020; see also Pryor *et al.* 2001; Yates and Bradley 2010).

The Late Bronze and Early Iron Age ceramics that form the centre of our analysis are a major element of this regional evidence base that has only recently been revisited and received much-needed analytical attention following the full impact of developer funded archaeology (Brudenell 2012). Brudenell's fresh synthesis, the particular properties of pots themselves – their makeup of distinctive ingredients potentially from multiple geographical locations – and the authors' common interest in elucidating past mobilities and relationships between people, practice and landscape (in particular rivers), provided a unique opportunity for this collaborative cross-sector research. We see our analysis very much as an exposition of the potential to approach empirically the active role of rivers and to characterise mobility in later prehistory, rather than as any kind of end point. We fully appreciate that other aspects of the evidence base (eg, burial practices or boundary making processes) and other analytical techniques (eg, ceramic petrography) can fruitfully be mobilised in future in augmenting our account.

RIVERS, POTS AND PRACTICE

REGIONAL VARIABILITY

Pottery of the Late Bronze Age (c. 1150–800 BC) and Early Iron Age (c. 800–350 BC) in eastern England falls within the broader umbrella of the post Deverel-Rimbury (PDR) ceramic tradition, as defined by John Barrett (1980). The ceramics of this tradition are essentially split into jars, bowls and cups according to their relative dimensions, and can be further sub-divided into coarsewares and finewares based on the nature of their fabrics (the grade and density of inclusions) and methods of surface treatment (burnished or un-burnished). It is these vessel categories, or *Classes*, with their differing visual and tactile qualities, that mark PDR ceramics as distinct from the urn-based traditions of the Early to Middle Bronze Age and from the slack-shouldered, jar-dominated assemblages of the later Iron Age (Brudenell 2012).

Behind this generalised vessel class scheme are variations in a series of formal and decorative attributes on pots. Some of these change in patterned ways over time (Barrett 1980; Needham 1996; Brudenell 2012), providing a useful guide to the periodisation of Late Bronze Age and Early Iron Age ceramics (Figure 3). Aspects of vessel shape and decoration are normally highlighted in these studies (Plainwares versus Decorated wares) and have tended to form a focus when exploring facets of temporal and geographic variation. The broad consensus is that variability increases at the end of the Late Bronze Age, with pottery traditions becoming more regionalised after 800 BC when a series of geographically restricted Early Iron Age ‘style-zones’ become recognisable, largely on the basis of a few distinctive decorated fineware bowl forms (Cunliffe 2005, 94–103). Whilst the definition, spatial exclusivity, and meaning of these groupings remains contentious (Collis 1977; Brudenell 2012), comparable patterns for the Late Bronze Age are largely absent. The investigation of ceramic variability has, however, been narrowly defined, privileging decoration and form over attributes such as fabric, or aspects such as a fashioning technique and pyrotechnology. The latter have been particularly neglected, revealing some of the underlying biases in conventional recording practices in British later prehistoric pottery studies, which are still predominately geared towards disclosing date and cultural affiliation, instead more holistic chaînes opératoire approaches to ceramic tradition. More surprising, however, is that fabrics seldom feature in these discussions. Indeed, with few exceptions (eg, Woodward 2002) fabric recipes have rarely been used explicitly as a lens for exploring intra-regional variation in this period,

despite the wealth of data now amassed through development-led archaeology in last 30 years.

Recognising that fabric has been underutilised, the analysis that follows focuses exclusively on this attribute, using evidence generated primarily via developer-funded excavations – the context in which the vast majority of archaeological ceramic assemblages in Britain are now produced, recorded, studied and reported upon. In eastern England, this information derives from conventional macroscopic descriptions of fabrics and their raw material inclusions. Lacking localised, highly distinctive geologies, is it not a region that has attracted sustained, research-driven programmes of petrography or other scientific approaches to fabric characterisation and raw material sourcing, unlike south-west England, for example, where a long tradition of such work exits (eg, Peacock 1968; 1969; 1989; Quinnell 1987; 2001; Harrad 2004). While further scientific analysis of this kind would certainly be very interesting, it is beyond the scope of the collaborative cross-sector research represented here. The macroscopic data at hand, still has significant analytical value when approached on its own terms and merits.

At a national scale, such fabric information has been marshalled to produce a series of important overviews concerning the wider organisation of pottery production in later prehistory, identifying broad regional differences through time (Morris 1994; 1996; Hamilton 2002; Morris & Woodward 2003). At the opposite end of the analytical spectrum, fabrics in individual assemblages are routinely described in considerable detail, facilitating discussions around raw material availability and selection preference on a local, site-by-site level. Trends at this scale are occasionally tied to a consideration of wider fabric patterns, but these are commonly framed in terms of what is characteristic in a particular county or larger present-day regional entity, for example, East Anglia or the East Midlands (eg, Sealey 1996, 47; Knight 2002, 137; Jackson 2010, 148; Brudenell 2011, 12; Chapman 2020, 137). We gain some sense of intra-regional variation when we read across such discussions, though an in-depth appreciation of the patterns between these micro and macro geographic scales is often missing, making it difficult to track how local production was situated within broader traditions of making pots and the scales at which these practices resolved themselves.

River valleys provide an alternative, and arguably more appropriate, analytical and geographic frame for examining issues of intra-regional variation in ceramic traditions. This

is particularly so for questions surrounding fabrics, since river courses themselves had a major influence on the exposure, deposition and accessibility of the ingredients required by potters: clays and tempers. Such raw materials were potentially widely available in the region, with their sources ultimately linked to geology. As alluded to already, to the north and west, this is characterised by bedrock strata of the Jurassic period, including various shelly limestones along the Nene Valley, together with extensive areas of clay between the Nene and the interfluves of the Great Ouse and Cam. These clays of the Oxford, Ampthill, and Kimmeridge Formations, each including facies rich in fossil shell-debris, are the likely source of much of the region's prehistoric shelly wares (eg, Williams 1984; Hill & Horne 2003; Hill & Braddock 2006). Blanketed by various drift deposits, the fossiliferous clays surface along the course of the Nene, Ouse and their tributaries, and along the major in-fen islands, principally the Isle of Ely, together with areas northwest of Cambridge. All the regions' river valleys are otherwise flanked by river terrace gravels, which were a potential source of flint temper and sand for potting, in addition to alluvial clays that may have been exploited. Further east, Jurassic clays give way to an earlier Cretaceous bedrock strata comprising Gault Clay and greensand, which outcrop largely on the western side of the Cam and formed a source of some sandy clays with glauconitic inclusions (Hill & Horne 2003). The region's chalk belt lies to the east of this, yielding fresh flint that could be burnt, crushed and added to potting clays.

Compared to the interfluves, the river valleys are therefore characterised by relatively diverse surface outcrops, each one of which could have provided potters with the ingredients needed to produce wares in a range of different fabrics. Given the river valley focused distribution of settlement in this period, it is understandable that site-level studies of raw material availability (whether by macroscopic or petrological means) tend to conclude that all the ingredients for potting were potentially obtainable in the immediate landscape, ie, within c. 7–10 km (Morris 1994, 372) (Figure 4; see below for a more detailed consideration of the location of potential fossil shell sources). This consistency has demonstrated support for a general model of inferred local production in this period in eastern England and elsewhere (*ibid*, 384) but does not extend the understanding of pattern and practice much further. To do this we are required to examine if and how fabrics vary within and between wider valley contexts, and to consider the extent to which preferences in fabric recipe – defined here very simply as the proportion of different raw materials employed in manufacturing – coalesce in relation to the river corridors.

THE DATASET

59 sites (16 sites from the Nene Valley; 22 from the Great Ouse, and 21 from the Cam) were identified from a search of published literature and unpublished 'grey reports' – the latter primarily available through the Archaeology Data Service (ADS). This is thought to represent a fraction of the total number of sites that have yielded late second and earlier first millennium BC ceramics (Morris & Champion 2001), particularly from excavations in the last two decades (Figure 5). However, material of this date is not always (and cannot always be) identified, adequately separated, nor independently quantified as *either* Late Bronze Age *or* Early Iron Age. In certain areas, difficulties in distinction, commonly because assemblages are small or fragmented, lack sufficient diagnostic sherds or obvious fabric changes, mean that material is often grouped and analysed together as 'Late Bronze Age/Early Iron Age' under the PDR category. Even in sizable groups, distinctions can be subtle and may depend upon the appearance of certain vessel forms (commonly fineware bowls), and/or the type, location on the vessel, and frequency of decorative treatments.

A degree of lumping is therefore understandable, but it is worth stating that there remains an overreliance on 'Late Bronze Age/Early Iron Age' as a category, sometimes with little justification or use of available radiocarbon dates. The reasons for this inertia are complex, though they include a continued dependency on reviews now over 30 years old (eg, Knight 1984; Sealey 1996; Bryant 1997; 2002), some devised before the realignment of metalwork and ceramic chronologies around the turn of this millennium (Needham *et al*. 1997; Needham 2007). The combined result is that fewer assemblages are split into the Late Bronze Age or Early Iron Age than might otherwise have been expected given the quantity of material now recovered. These issues are more acute in western parts of the region, reflected in the fact that sites from the Cam and from the lower reaches of the Ouse and Nene, bordering the Fens, are better represented in this study. Attempts were made, however, to place as many groups as possible in one of the two period brackets (Figure 6), sometimes using data from selected features that were phased more accurately, or by utilising relevant radiocarbon dates from the reports.

Another limiting issue is that fabrics have not always been quantified in specialist analyses. Although a concern with the systematic description of fabrics dates back more than half a century (Woodward 2008a, 293; 2008b, 81), it is rare for reports and publications prior to the 1990s to contain detailed quantification of fabrics by period, meaning that most data derives from assemblages excavated or reanalysed in the last three decades. Since the 1990s, fabric reporting has become routine practice, with minimum standards now enshrined in recording guidelines (PCRG 2010). Indeed, it is arguably the only pottery attribute that has seen widespread quantification, even if there remains a large degree in variation in how fabrics are ultimately split and described by different practitioners. These issues aside, the data set assembled for interrogation in the study is vast (112,649 sherds weighing 1,177kg), This the first analysis of its kind to draw-out patterns using coarse-grained fabric data from this region, and from the wealth of material generated from developer-funded archaeology. As such, it represents a substantial amount of work in its own right and provides a vital basis for future more fine-grained scientific analysis.

FABRIC CALCULATIONS

For purposes of this study fabrics have been simplified, with quantification focusing exclusively on the frequency representation of pottery with raw material components of shell, crushed burnt flint, grog and quartz sand (Figure 7). These principal ingredients, some of which are naturally occurring in the clays exploited (shell and sand, though both may also be intentionally added), are found in assemblages across eastern England and are often mixed in individual recipes.

Here, except for sand, each material component has been grouped and quantified independently, whether or not it was classed as the primary ingredient in a particular fabric type. For example, fabrics listed as containing shell, shell-and-sand, grog-and-shell etc, have all been grouped as shelly wares and their frequency calculated, where possible using sherd weights. The process has been repeated for flint and grog, meaning, in the example above, sherds with a combination of grog-and-shell are quantified twice; one in the shelly ware category and one in the grog category. This means that the sum calculation for each assemblage may exceed 100%, but the broad representation of each ingredient can be compared across assemblages both within and between sites from the Nene, Ouse and Cam.

Sandy wares were approached slightly differently since sand was a component of the clay matrix in so many recipes. It was therefore only quantified where sand was the sole ingredient. In addition, fabrics containing both shell and burnt flint were quantified separately, as this combination of ingredients was notably rare.

RIVER PATTERNS

THE RIVER NENE

Shelly wares are ubiquitous in both the Late Bronze and Early Iron Ages in the Nene Valley (Chapman 2020, 137). They dominate all assemblages, accounting for over 90% of pottery in 11 of the 16 study sites (Figure 8). In only one instance does the frequency fall below 75%, and this is in a small Late Bronze Age group from Sandy Lane, Northampton (Figure 2, no. 1), where figures may have been skewed by a few heavier crocks. The shell probably derives from Jurassic limestones and fossiliferous clays; surface outcrops of which were accessible within 5 km of each site (Figures 9 and 10a).

The non-shell component of these assemblages comprises sandy wares, or those with added inclusions of grog or crushed burnt flint. The production of sandy wares – normally identified as quartz – may have involved the use of alluvial clays along the Nene and its tributaries. Sand might otherwise have been added from various river terrace or glaciofluvial deposits, or in some instances, might have derived from outcrops of the Jurassic Kellaways Sand Member on the east side of the Nene between Peterborough and Wellingborough. Exact sources have not been defined, but sandy wares are present in low frequencies, typically under 5%, in three quarters of the Nene assemblages. The low-level use of grog was similarly widespread, recorded in 14 of the 16 assemblages from this valley, mostly in the 1–10% frequency range. Its highest representation is at Must Farm (15%; Figure 2, no. 2), where the grog derived from ground-up and recycled shelly ware vessels; the flat/finished outer surfaces of crushed-up shell-rich sherds being macroscopically visible in some of the coarseware pots.

Wares tempered with crushed burnt flint are scarce in the Nene Valley, though they form a minor component, typically less than 3%, of nine of the Nene assemblages. The source material would have been readily available in the form of gravels from river terrace deposits that flank the Nene between Peterborough and Northampton, as well as glaciofluvial deposits

further west. Burnt flint, however, was clearly not an ingredient favoured by potters in this catchment. Wares combining burnt flint and shell are also extremely rare, being present in very low frequencies in only three of the Nene assemblages. Must Farm is again unusual for having a relatively high frequency of burnt flint tempered pottery (31%), with 9% of vessels displaying a combination of burnt flint and shell. Importantly, contemporary vessels made using these different recipes at Must Farm are very similar to one another in terms of the form, size, building technique, and overall 'style' of pots manufactured – these vessels are interpreted as the products of just four to six individuals at the site (Brudenell in press). The material properties of the recipes did not therefore determine what could be achieved by potters during forming and firing, suggesting there was no technological reason for, or practical advantage of using one recipe over another, regardless of what type of pot was being made. Instead, fabric recipes appear to have been a matter of preference or convention, with patterns from Must Farm broadly aligned with those in the Nene Valley as a whole, despite this measure of variability.

THE RIVER OUSE

Pottery assemblages from sites in the Great Ouse Valley display fabrics that differ markedly in character to those along the Nene (Figure 8). Whereas wares dominated by shell typify all pottery groups in the latter, regardless of date, in the Great Ouse fabric recipes change significantly in their composition and frequency representation over time. In the Late Bronze Age, wares made with the addition of crushed burnt flint are the norm, accounting for over 85% of pottery in eight of the nine dated assemblages from the catchment. In a further reversal of trends, shelly wares tend to constitute less than 10% of material, with the only outlier being from Witchford, Ely (25%; Figure 2, no. 3), a fen island context where river valley association becomes somewhat blurred.

These trends are significant, since all but one site (Fairfield Park, Stotfold; Figure 2, no. 4) in the Great Ouse Valley are within 3 km of a potential surface source of shelly clay (Figure 10b). The simple distribution and availability of this raw material did not therefore determine its selection by potters, with Late Bronze Age communities favouring non-shelly wares with the addition of burnt flint. As noted above, there is no obvious 'technological advantage' to the use of this recipe over that with shell. However, the two differ in texture and feel, with

flint tempered coarsewares having rougher, more abrasive surface finishes compared to their shelly counterparts. Different tactile aesthetics may therefore be at play in the two valleys, which may go some way to explaining why burnt flint was rarely mixed with shell in either setting, or indeed the Cam Valley (see below). In fact, in the Great Ouse, there are only two instances of this combination in the Late Bronze Age, neither exceeding a 5% representation.

With regards the occurrence of grog and sand, the Nene and Great Ouse show similar patterns of consistent low-level use. Higher frequencies of grog are present at High Barns Road (92%; Figure 2, no. 5), and Rhee Lakeside South (92%; Figure 2, no. 6) where, in both instances, the grog was mixed with burnt flint. This is in keeping with much of the grog-tempered pottery from the Cam and Great Ouse Valley's, where grog is largely found in combination with burnt flint and is rarely the sole inclusion. Assemblages dated to the Early Iron Age from the Great Ouse show very different fabric patterns, again highlighting the importance of recipe preference over raw material availability (Figure 8). The use of burnt flint declines significantly in relation to that of sandy wares, shelly wares, and occasionally those with grog. Calcined flint is found in just ten of the 16 Early Iron Age Great Ouse assemblages, in frequencies of less than 10% in six of these sites. It is dominant at only two Middle Great Ouse settlements, at Eynesbury (Figure 2, no. 7) and Margetts Farm (Figure 2, no. 8). Instead, it is now the shelly wares that are most widespread in the catchment, with shell being the prominent fabric in half of the period assemblages. Sandy wares are equally widespread, though they lead the frequency tallies in only four groups.

In general, there is little sense of geographic patterning to the use of different fabrics recipes along the Great Ouse in the Early Iron Age. In most instances, potters favoured the use of either shelly wares or sandy wares, though the balance of ingredients, especially when accounting for grog and burnt flint, varies considerably on a site-by-site basis. This is a major shift from the Late Bronze Age where potters used non-shelly clays tempered with burnt flint to make the vast majority of vessels, regardless of site location within the catchment.

THE RIVER CAM

Mirroring patterns in the Great Ouse, burnt flint tempered wares dominate Late Bronze Age assemblages from sites along the Cam and its tributaries; flint gravels being abundant in the

terrace deposits beside these waterways. Frequencies are consistently high, with a range of 85–99% of flint gritted wares across the eight Late Bronze Age groups in this valley (Figure 8). Shelly wares are also widespread, being present in seven of the assemblages, but in low frequencies typically under 10%. This may be in part because fossiliferous Jurassic clays outcrop in more restricted parts of the valley, with only around half the study sites (10 of 21) being within 10 km of a potential source (Figure 10c). Nevertheless, the broader trends are remarkably similar to those from the Great Ouse catchment and stand in stark contrast to the patterns from the Nene. Sand and grog were also used in the Cam during the Late Bronze Age, though both are minor fabrics. Their presence is slightly more sporadic than in the Great Ouse and Nene, but where represented, the wares occur in similarly low frequencies on a site-by-site basis. An outlier to the trend is Clay Farm (Figure 2, no. 9), where half the pottery in this small assemblage (55%) contains grog alongside burnt flint.

Fabric patterns in the Early Iron Age change, and importantly, differ to those of both the Nene and Great Ouse (Figure 8). Though the use of burnt flint declines in relation to that of sand and shelly wares in this period, it remains the principal inclusion in the Cam. It is present in all 18 of the dated study assemblages and is dominant in 15. Shelly wares are also present in all the groups, and sandy wares in all but one (Rickett Field, Figure 2, no. 10). The relative proportion of these ingredients varies, however, but sand is the more common. This is perhaps owing to the presence of the greensand belt on the western side of the Cam. Indeed, sand is the principal fabric in the two assemblages from Trumpington (both at 52%; Figure 2, no. 11), and is ranked second after burnt flint in half of the groups. By comparison, shell is the principal inclusion in only one assemblage from Northstowe (Figure 2, no. 12), located near an outcrop of Jurassic clay (a potential shell source), and it is ranked second in only seven of the 18 assemblages. Once again, the mixing of shell and flint in the same recipe is rare, occurring in only a third of Cam assemblages, mainly in frequencies of under 1%. The use of grog also continues at a low level: present in just under half the groups, in small frequencies.

Detail aside, patterns in the Early Iron Age are more complex than those of the preceding period in the Cam Valley. Burnt flint remained the preferred temper in general, but diversity in fabric begins to follow that of the local geology more closely, suggesting that the distribution and availability of raw materials played a greater role in selection than before. Interestingly, this increased localisation of fabric preference occurred at the point where there

emerged new valley-wide connections in the ways pots were being shaped and decorated on sites along the Cam. From c. 600 BC, distinctive tripartite bowls with short shoulders and widely flared profiles become commonplace, often with foot-ring or pedestal bases, together with finewares adorned with grooved, incised, or scratched chevrons on or above the shoulder. The production of these 'styles' of vessel, akin to those described by Cunliffe in his *Chinnor-Wandlebury group* (2005, 101–2), became a new expression of the commonalities and conventions held by potters along the Cam, whilst those previously shared through fabric preference began to fragment.

DISCUSSION

This detailed examination of excavated pottery assemblages from the Nene, Great Ouse and Cam river catchments shows clearly that pottery making practices – primarily the makeup of fabrics or 'pottery recipes', but also to a certain extent surface finishes – were coherent within but not across major river valleys in this region for the duration of our 800-year study period from 1150 to 350 BC. Fossil shell tempered fabrics were preferred in the Nene Valley and burnt flint was the main tempering medium for pots in the Cam Valley, throughout this period. By contrast along the Great Ouse Valley, there was a clear change in practice over time. Pots were primarily made using burnt flint tempered fabrics in the Late Bronze Age (from 1150–800 BC) but with sandy and fossil shell tempered wares after 800 BC. There are, of course, exceptions to this patterning – some, almost certainly, resulting from pots and people moving between river valleys. Additionally, and understandably, distinctions are blurred in assemblages from upland settlements located in river valley interfluves (eg, at Striplands Farm, Longstanton (Evans & Patten 2011)). Overall, however, the patterning is remarkably strong. With one possible exception (the Early Iron Age in the Cam Valley), the pottery recipe preferences of Late Bronze and Early Iron Age communities within the three valleys examined here cannot be explained straightforwardly according to how easy it was to access the different clays and tempering materials afforded by nearby geologies. This point is underlined by the fact that the chosen pottery recipe changed over time within the Great Ouse and Cam Valleys, while it remained more-or-less consistent in the Nene.

On this basis, we contend, ideas about the 'right way to act' (Fontijn 2020, 26–8, 78–9) when it came to making pottery must have emerged primarily amongst communities of people

living within the same river valley, rather than being shared over wider areas that transcended river valleys. If we accept this argument, rivers, and the movement and relationships they enabled, can be understood as key players in the generation of Late Bronze and Iron Age pottery traditions in this region: rivers shaped 'communities of practice' (Wenger 1998). River waters exposed and gave people access to the ingredients they used in their pottery recipes; the wider basins carved by rivers guided peoples' journeys and interactions to an extent that this 'flow' (Mlekuž 2021, 154) became materialised in pottery making practices (and almost certainly also in other realms of life).

It is interesting to situate these findings in relation to previous discussions about the role of rivers and, more specifically, movement along river valleys in eastern England. In a nuanced discussion of Neolithic and Early Bronze Age archaeology beyond the major excavated landscape at Raunds, Northamptonshire, Harding and Healy emphasised the coherent character of monument complexes within but not across the Welland, Nene and Great Ouse valleys, leading them to argue that at that time, rivers would have operated as arteries of communication 'uniting the nested territories of communities who made up larger peoples and providing the routes by which they gathered' (2007, 285). Since Harding and Healy made this statement in contextualising the evidence from one specific excavated landscape, they did not explore the empirical details behind their argument. Synthesising over 20 years of excavation at Baston and Langtoft Quarries on the Welland, Lincolnshire, Brittain (pers. comm.) similarly argues for the emergence of valley-specific identities in the Welland, Nene and Great Ouse in the Middle Bronze Age. Brittain's claim is based on a detailed comparison of the makeup of Early and Middle Bronze Age pottery assemblages by type in each valley, which reveals a significantly higher volume of Middle Bronze Age Deverel-Rimbury ceramics in excavated assemblages from the Welland Valley relative to those from the Nene and Great Ouse Valleys: for some reason, people deposited (and perhaps also used) pottery more frequently in the Middle Bronze Age in the Welland Valley. One caveat with Brittain's analysis is that it focuses entirely on material from fen edge sites – the tidal reaches of these rivers – rather than being representative of valley length assemblages. This raises once again, the important question of how and where prehistoric people identified rivers as separate entities in relation to other watery bodies.

Mills (2005, 2006) by contrast, developed a nuanced account of the shifting character of human movements along the full extent of the Nene, Great Ouse and Welland Valleys from

the Mesolithic through to the Middle Bronze Age drawing on wider ideas about mobility in archaeology and beyond (eg, Ingold 2000; Creswell 2001). She observed an overall shift from highly mobile communities in the Early Neolithic when long distance journeying along river valleys punctuated by trips to prominently positioned gathering places like causewayed enclosures was habitual, to more spatially tethered communities in the Middle Bronze Age, when journeying was more purposeful (it related to specific tasks) and primarily involved smaller scale movements to and from settled locations. Interestingly, Mills also argued that the archaeological signatures of each river valley merged over this period as other routes of movement (up and down valley sides and across the uplands) came to the fore.

Our own study adds vital empirical grounding to these and other abstract claims that rivers were the primary axis of movement over much of later prehistory in this region (see also Yates 2007; Evans *et al*. 2016; Evans & Pollard forthcoming). Importantly, it does so for a period – the Late Bronze and Early Iron Ages – in which this argument has not previously been made, and for which levels of mobility are still surprisingly poorly understood. Linking into Mills' (2005, 2006) account of the character of mobility in the Middle Bronze Age, our study suggests that even if long distance journeying along river valleys did take more of a back seat from the Middle Bronze Age onwards, the cumulative effects of shorter, purposive journeys by locally tethered communities in the Late Bronze and Iron Ages still left an archaeological trace at a valley-length scale – people did not need to travel the entire length of the valley or to gather in larger groups at communal monuments in order to develop common – valley tethered – ideas about the best way to do things.

Following Harding and Healy (2007, 285), we are certainly not suggesting that river valleys were the only arteries of movement or social forces involved in shaping of practices like pottery making in our study period and area (see also Brudenell 2012). The relatively open character of landscapes by this time (Scaife 2001; 2005; in press; Meadows *et al.* 2008, 65; Evans *et al*. 2016), and the occurrence of Late Bronze and Early Iron Age occupation sites well beyond the main river valleys underline this point. However, archaeological evidence for alternative routeways in this period is elusive. Contra Fox's arguments (1923), long distance paths like the Icknield and Jurassic Ways that frame our study area are now generally understood to be Roman or later in origin (Bell 2020, Chapter 8). Although it is certainly possible that some of the droveways that structured movements around Middle Bronze Age landscapes were still active or were even extended in the Late Bronze and Iron Ages, this has

left no physical trace. The Iron Age pit alignments that criss-cross this region could have shaped how and where people and animals moved (Meadows *et al.* 2008, 79), but their relatively short lengths (up to 3 km) and the absence of substantial material assemblages from most pit alignments makes this difficult to verify. Communal architectures like the hilltop enclosures that emerged in this region from the Late Bronze Age created new places for people to move to and between and may well have operated as centres for different sets of people to swap ideas about various practices. Interestingly, however, hilltop enclosures are sparse beyond the chalk ridge that skirts the southern edge of our study area and the lower reaches of the river Cam. Additionally, Brudenell's detailed comparison of the makeup of ceramic assemblages from open and enclosed settlements (including hillforts and ringworks) in this region identified differences in the overall volume of assemblages at these different site types but not in the forms, fabrics and decorative attributes represented. We cannot assume, therefore, that hilltop enclosures and other gathering places were hotspots for ceramic creativity or, necessarily, a direct force in shaping the development of ceramic practices (2012, Chapter 7). In summary, routes of movement beyond river valleys and forms of social interaction beyond river valleys almost certainly did shape the emergence of Late Bronze and Early Iron Age ceramic traditions in this region. Thus far, however, these other potential agents are somewhat intangible archaeologically.

Overall, this paper has given a much firmer empirical footing to widely held ideas that rivers were central to later prehistoric human mobility, and that non-human entities played an active role in shaping past practices. Pottery fabrics allowed us to elicit how rivers played a dominant role in shaping movement, communication and the emergence of common practices in later prehistory. Meanwhile, recent analytical interest in rivers, non-human agency and mobility allowed us to approach a substantial ceramic evidence set in a different way. The creative potential and geological specificities of Late Bronze and Early Iron Age pottery recipes gave us an opportunity to approach the previously overlooked 'middle ground' of mobility discussions: small-scale – local and regional – movement (Bell and Leary 2020, 1349; Gibson 2021) and to consider *how* people, pots and ideas (predominantly) moved. This is especially interesting for a period in Britain for which we are still not entirely sure how mobile (or not) peoples' lives were (Bruck 2019; Knight *et al.* in press). We hope to have demonstrated the value of treating landscape features like rivers in archaeological terms rather than according to their current technical definitions – the River Cam created a very different Late Bronze and Early Iron Age archaeological signature to the River Great Ouse,

of which it is now seen to be technically part, and appears to have operated as a separate entity in later prehistory. Our own research and other recent studies (eg, Hommel *et al.* 2017, Heitz & Stapfer 2021; Johnson 2021) make a strong case for including detailed considerations of pottery fabrics in multi-stranded toolkits for investigating mobility (Bell 2020, 4; Bell & Leary 2020, 1352). Finally, like Hommel *et al.* (2017), we have showcased the capacity of a detailed regional study of an understated evidence set (pottery fabrics) to shed important light on interpretative issues – mobility and the role of non-human entities in past practices – which are relevant across archaeology and well beyond.

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What rivers did: a study of if and how rivers shaped later prehistoric lives in Britain and beyond

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FIGURE CAPTIONS

Figure 1. Early Iron Age log boat (Boat 1, 775–515 cal BC) from the Must Farm palaeochannel, Cambridgeshire (Image: CAU).

Figure 2. Study area showing the sites of the 59 Late Bronze and Early Iron Age pottery assemblages analysed. Numbers refer to sites mentioned in the text. 1. Sandy Lane, Northampton (Garland *et al.* 2019); 2. Must Farm, Whittlesey (Knight *et al.* in press); 3. Field End, Witchford (Blackbourn 2018); 4. Fairfield Park, Stotfold (Webley *et al.* 2007); 5. High Barns Road, Great Barford (Timby & Allen 2007); 6. Rhee Lakeside South, Earith (Evans *et al.* 2013); 7. Eynesbury (Ellis & Allen 2004); 8. Margetts Farm, Buckden (Ingham *et al.* 2016); 9. Clay Farm, Cambridge (Phillips & Mortimer 2012); 10, Rickett Field, Great Abington (Armour 2006); 11. Trumpington Meadows and Trumpington Park & Ride (Evans *et al.* 2018); 12. Northstowe (Collins 2016; 2017); Wash extent (after Sturt *et al.* 2013).

Figure 3. PDR ceramics from the East of England (after Brudenell 2012).

Figure 4. Distance to surface deposits/sources of (a) clay and (b) sand from all sites considered in this study (see Figure 8 for outcrops of shelly clays).

Figure 5. PDR assemblages analysed in this study vs PDR assemblages logged in the Later Prehistoric Pottery Gazetteer (Earl *et al.* 2002).

Figure 6. Patterning of predominantly shell, burnt flint, sand and grog tempered pottery in (a) the Late Bronze Age and (b) the Early Iron Age.

Figure 7. The macro and microscopic identification of common inclusions in PDR ceramics from the study area. All examples depicted are from Must Farm (thin sections images from Daniel Brown and Patrick Quin, in Brudenell forthcoming).

Figure 8. Main surface outcrops of shell-rich Jurassic limestones and clays in the study region.

Figure 9. Distribution of distance of the nearest potential geological source of shell in a) Nene; b) Ouse; c) Cam.

Figure 10. Box plots of the frequency range of fabrics by river valley and period.

TABLE CAPTION

Table 1. Basic physical attributes of case study rivers.

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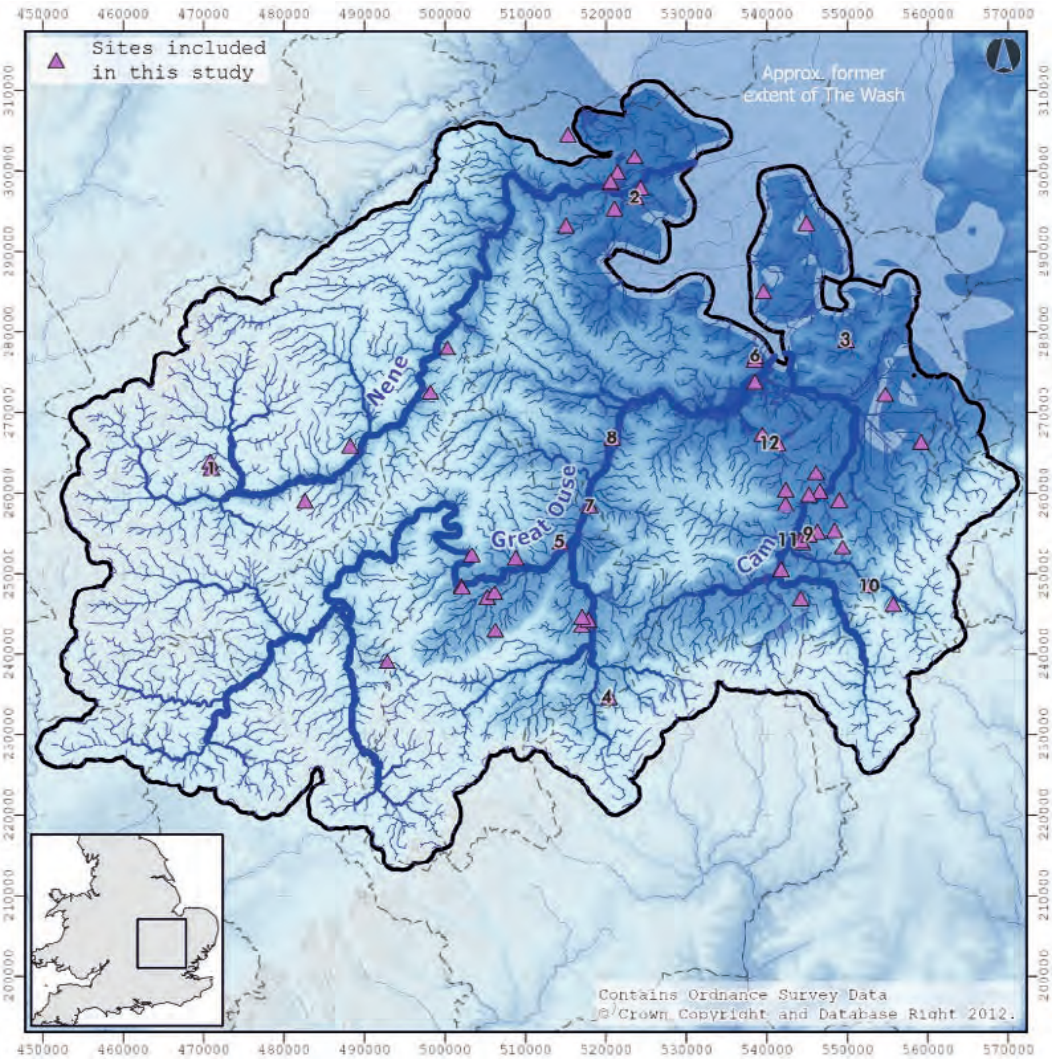
SUPPLEMENTARY MATERIAL


Sites included in this study
Approx. former extent of The Wash
Nene
Great Ouse
Cam
1
2
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Contains Ordnance Survey Data
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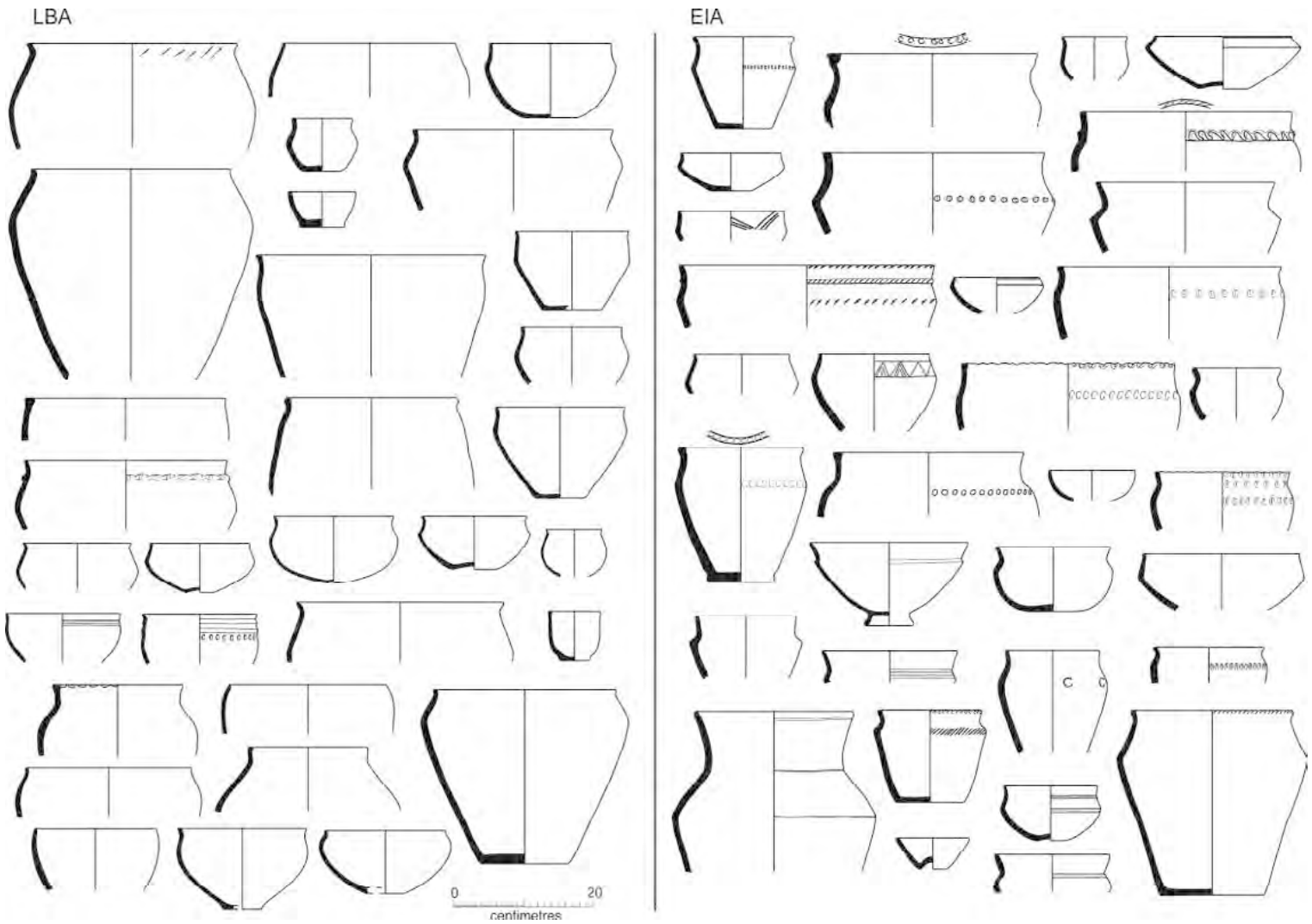
LBA
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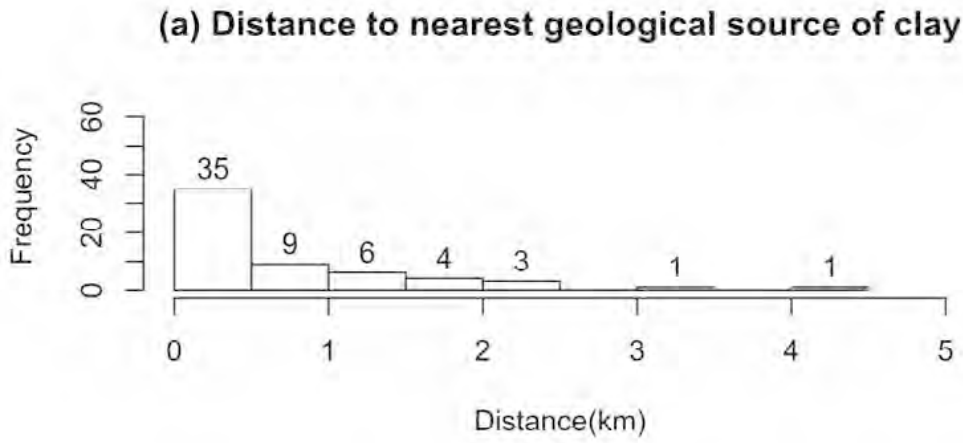
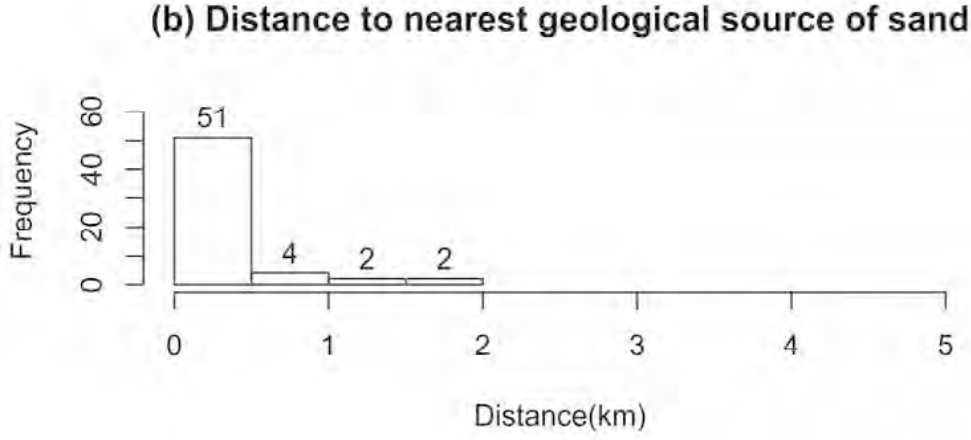
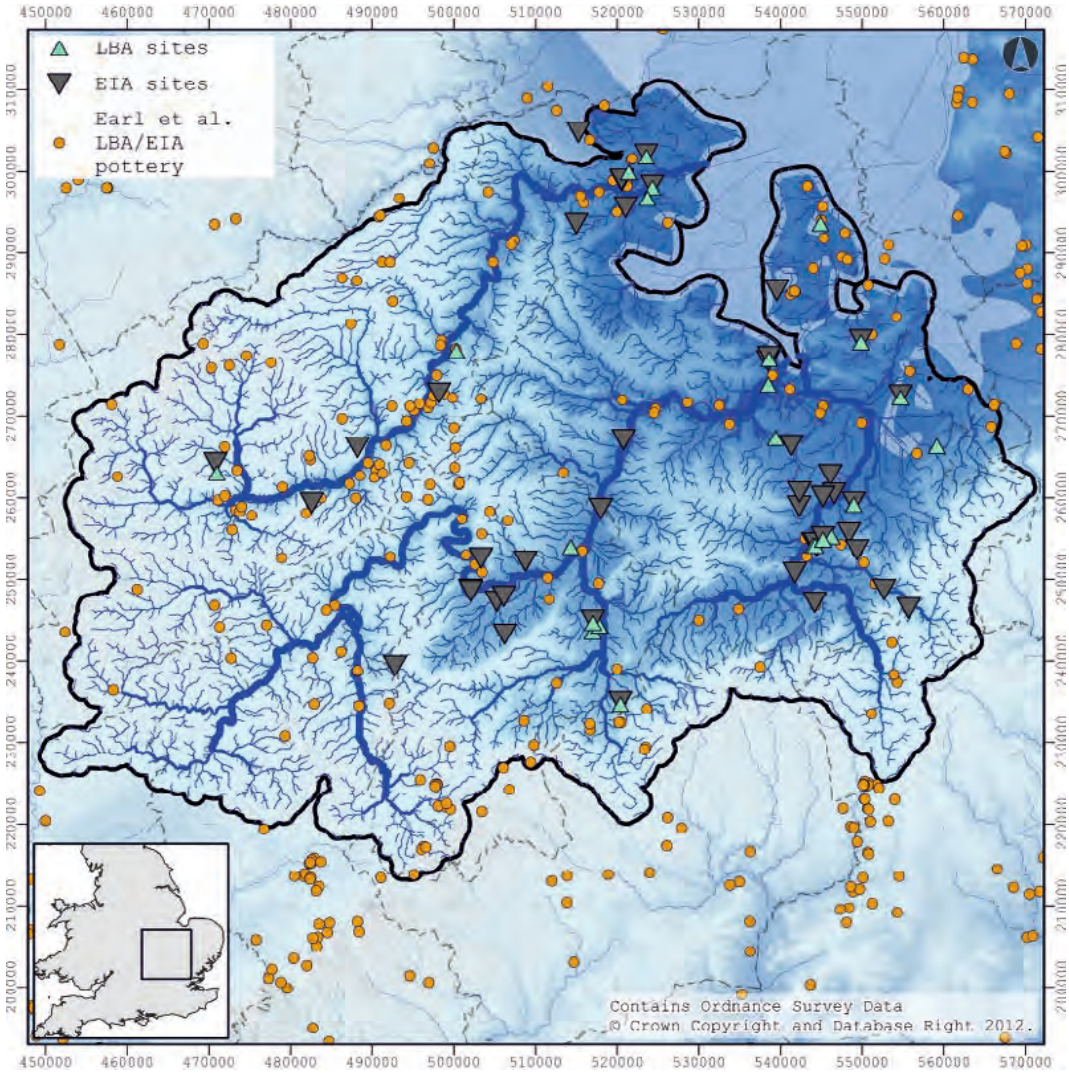

(a) Distance to nearest geological source of clay
Frequency
0
20
40
60
35
9
6
4
3
1
1
0
1
2
3
4
5
Distance(km)


(b) Distance to nearest geological source of sand
Frequency
0
20
40
60
51
4
2
2
0
1
2
3
4
5
Distance(km)


LBA sites
EIA sites
Earl et al. LBA/EIA pottery
Contains Ordnance Survey Data
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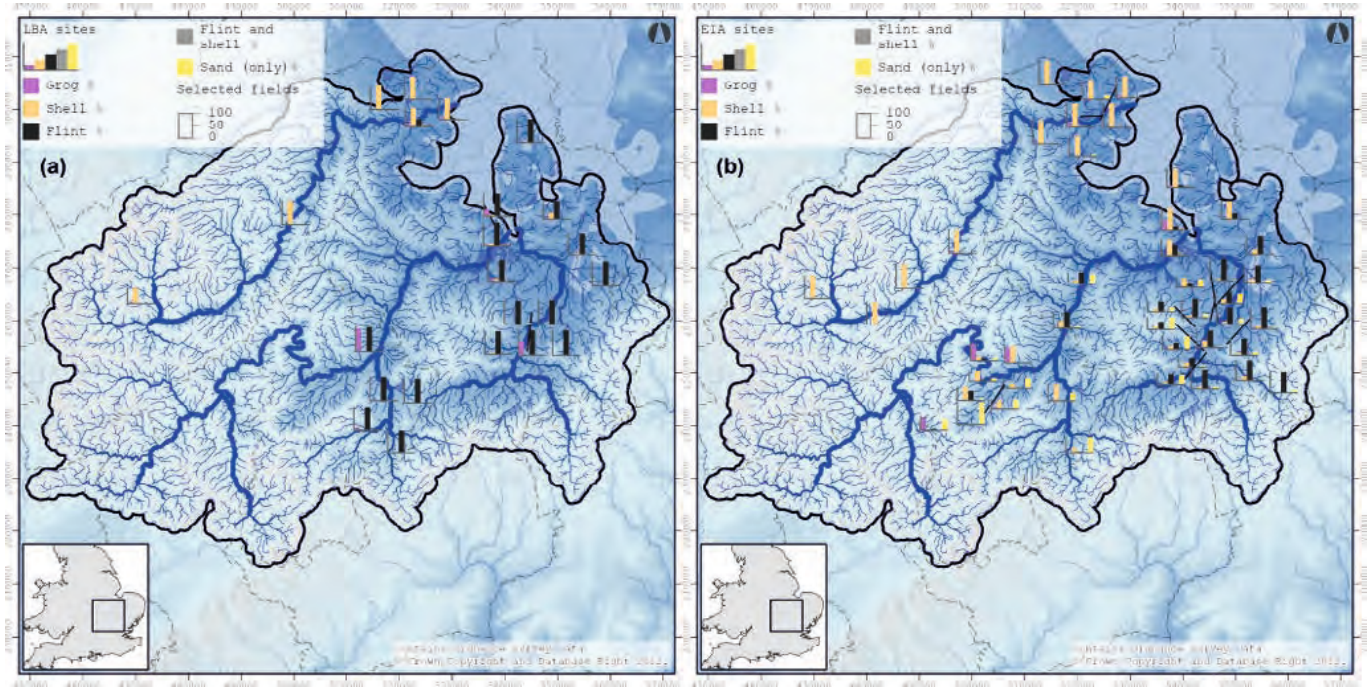

LBA sites
Grog
Shell
Flint
Flint and shell
Sand (only)
Selected fields
100
50
0
(a)
EIA sites
Grog
Shell
Flint
Flint and shell
Sand (only)
Selected fields
100
50
0
(b)

MACRO

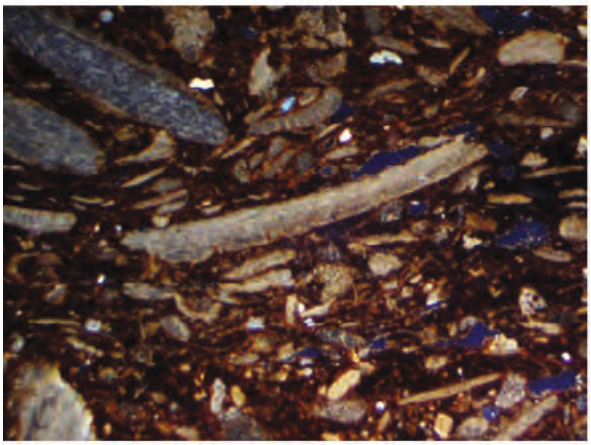
Shell

Flint

Sand

0 1cm

MICRO



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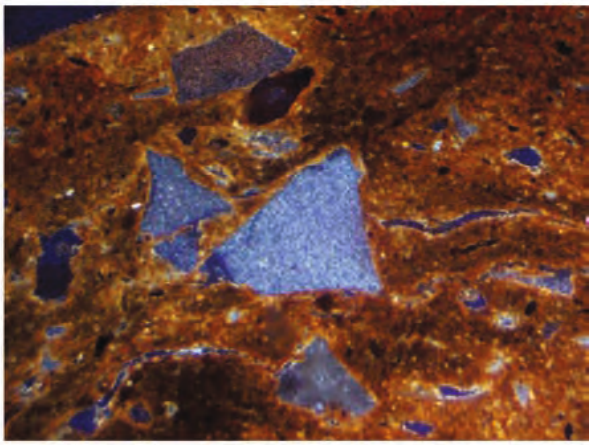
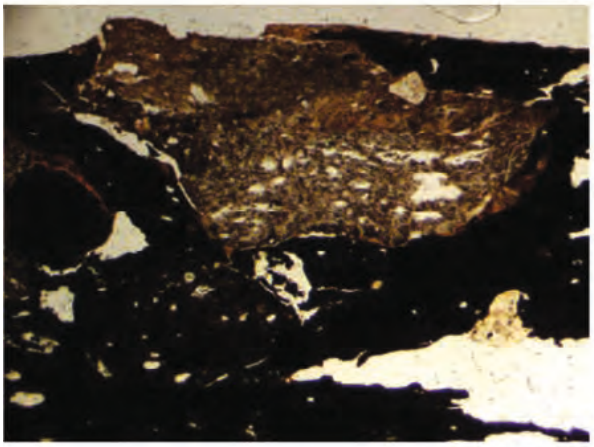
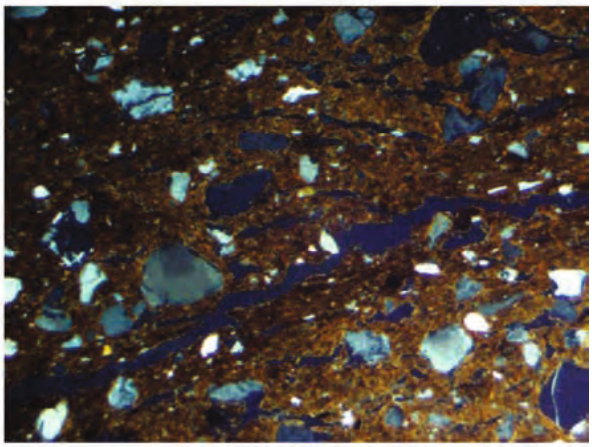


Flint

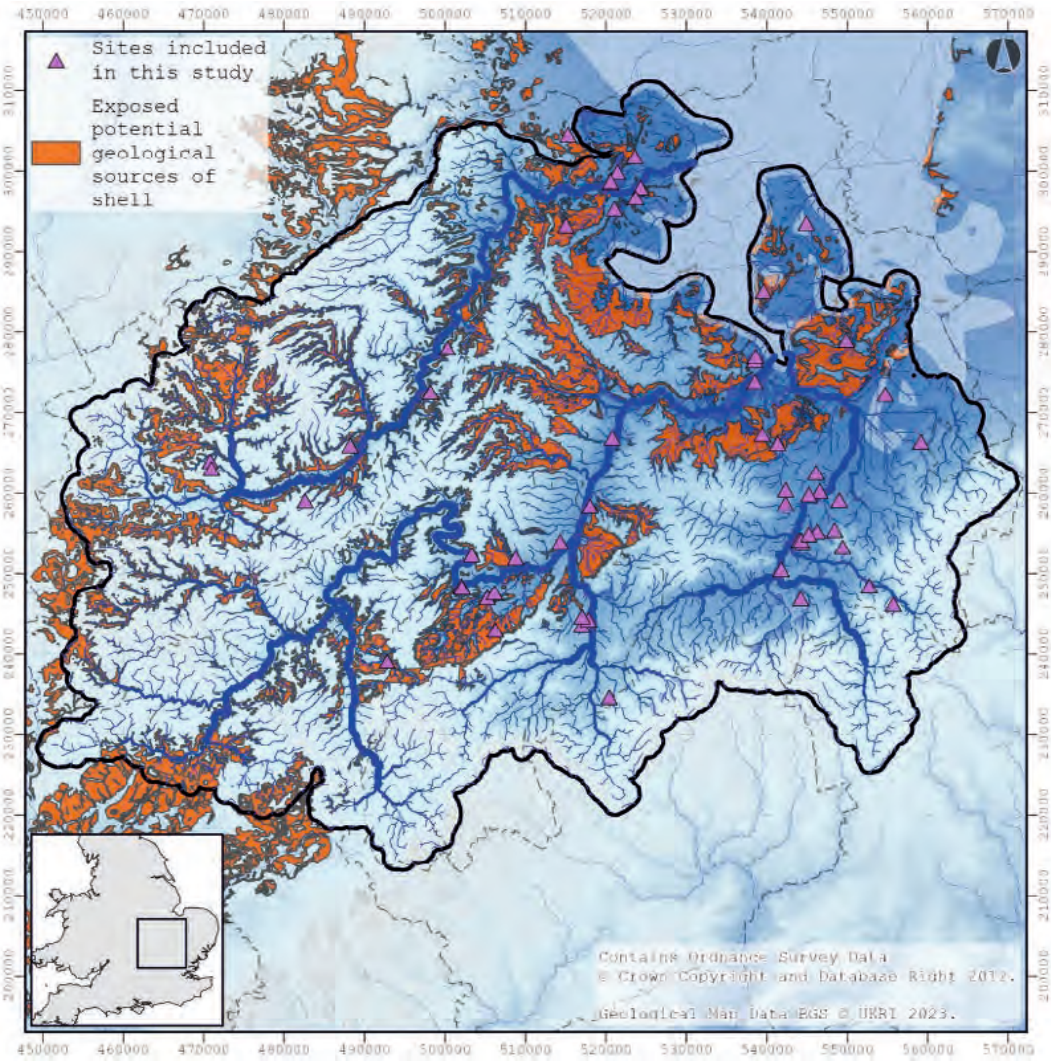


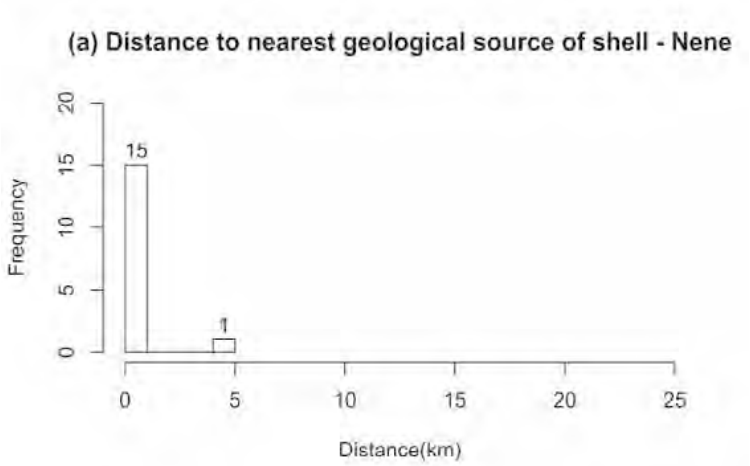
Grog

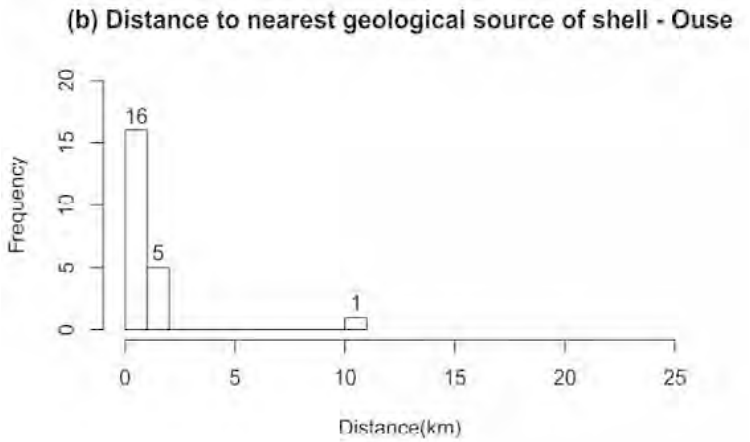


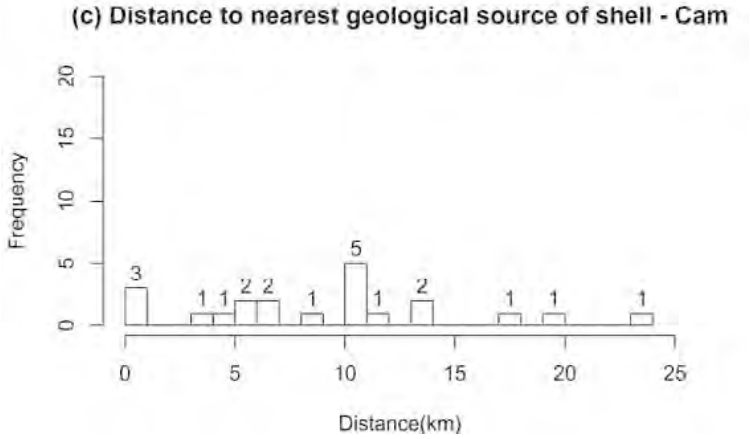
Sand

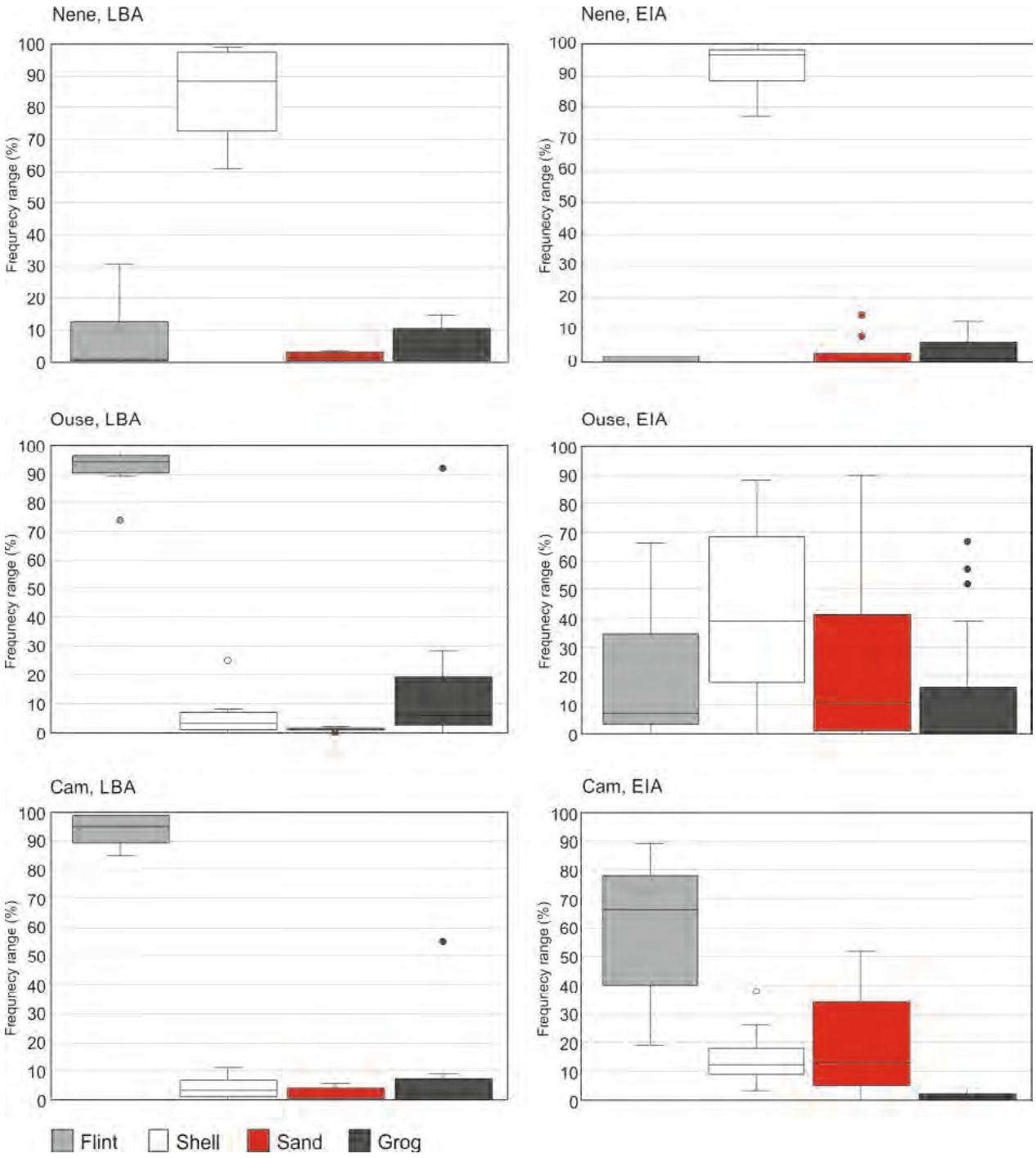
0 1mm


Sites included in this study
Exposed potential geological sources of shell
Contains Ordnance Survey Data
© Crown Copyright and Database Right 2012.
Geological Map Data BGS © UKRI 2023.


(a) Distance to nearest geological source of shell - Nene
Frequency
0
5
10
15
20
15
1
0
5
10
15
20
25
Distance(km)


(b) Distance to nearest geological source of shell - Ouse
Frequency
0
5
10
15
20
16
5
1
0
5
10
15
20
25
Distance(km)


(c) Distance to nearest geological source of shell - Cam
Frequency
0
5
10
15
20
3
1
1
2
2
1
5
1
2
1
1
1
0
5
10
15
20
25
Distance(km)


Nene, LBA
Nene, EIA
Ouse, LBA
Ouse, EIA
Cam, LBA
Cam, EIA
Frequrecy range (%)
Frequnecy range (%)
Flint
Shell
Sand
Grog