ARCHAEOLOGIA

AN EARLY BRONZE AGE CEMETERY AT WINDMILL FIELDS, INGLEBY BARWICK, TEESSIDE, NORTH YORKSHIRE

Blaise Vyner and Richard Annis

with contributions by Sue Anderson, Alex Bayliss, Tom Booth, Christopher Bronk Ramsey, Jacqui Huntley, Jennifer Jones, Peter Marshall, Gerry McCormac, Peter Rowe, Alison Sheridan and Penelope Walton Rogers†

AN EARLY BRONZE AGE CEMETERY AT WINDMILL FIELDS, INGLEBY BARWICK, TEESSIDE, NORTH YORKSHIRE

Being volume 113 of ARCHAEOLOGIA

First published in Great Britain 2024
by
The Society of Antiquaries of London
Burlington House
Piccadilly
London W1J 0BE

www.sal.org.uk

Cover image: Aerial view of Ingleby Barwick, showing the site location
(Image copyright: Google Earth ©2024 CNES/Airbus, Maxar Technologies)

The Society of Antiquaries gratefully acknowledges the financial support of Historic England in the publication of this work.

ISBN: 978-0-85431-308-2
ISSN: 2051-3186

British Library Cataloguing in Publication Data
A CIP catalogue record for this book is available from the British Library.

Edited by Tess Millar and Catrina Appleby FSA
Typeset and laid out by Lesley Collett

CONTENTS

List of figures

List of tables

AN EARLY BRONZE AGE CEMETERY AT WINDMILL FIELDS, INGLEBY BARWICK, TEESSIDE, NORTH YORKSHIRE

Blaise Vyner FSA and Richard Annis FSA, with contributions by Sue Anderson FSA, Alex Bayliss FSA, Tom Booth FSA, Christopher Bronk Ramsey FSA, Jacqui Huntley, Jennifer Jones, Peter Marshall, Gerry McCormac, Peter Rowe, Alison Sheridan FSA and Penelope Walton Rogers FSA†

Blaise Vyner blaise.vyner@outlook.com

Richard Annis rgannis34@gmail.com

Abstract

In 1996, a rescue excavation was carried out by Tees Archaeology after the discovery of human bones during building work. The excavated Early Bronze Age cemetery is unusual for the range of mortuary treatment in evidence and for the quantity and variety of the grave goods in one particular grave, Burial 5. Here the body of a young to middle-aged woman was associated with a pair of bronze armlets, a set of at least 45 tubular beads of sheet bronze (quite possibly a necklace), at least 25 V-bored 'buttons' (mostly of jet) that may have been sewn onto a garment of some kind, and a probable bracelet of at least 88 tiny disc beads made of jet. Two small fragments of a probable copper awl, several pieces of ochre, a flint scraper and two flakes, and traces of a possible organic bag or pouch, were also found in her grave, and it appears that her body had been wrapped (or else covered) in a piece of cattle hide. Another grave, dated later in the Early Bronze Age, contained the crouched body of a man accompanied by a fine stone macehead that had been placed near his feet. Funerary treatment in the cemetery took two forms: crouched inhumation, with at least one of the bodies (Skeleton 2 from Burial 1) mummified, and the selective deposition of individual bones. DNA analysis shows that three of the individuals are likely to be descendants of migrants while a fourth is likely to be descended from the local Neolithic population. The cemetery appears to have formed part of a complex of Chalcolithic and Early Bronze Age funerary features around the confluence of the lower River Tees and its estuarine tributary, the River Leven.

Keywords: Early Bronze Age; cemetery; bronze; jet; mummification; North Yorkshire; Britain

INTRODUCTION

by Blaise Vyner and Richard Annis

The site at Windmill Fields, Ingleby Barwick, Teesside (NZ 44751255), was discovered by chance during building work at the end of November 1996, when contractors cutting a new road towards the top of the slope of the Leven valley found a number of bones. An initial examination of the area by Tees Archaeology led to the discovery of two crouched burials, both of which had been badly disturbed by the mechanical excavator. Further investigation around these findspots revealed other features and a rescue excavation was mounted with funding from Historic England and the assistance of Bryant Homes. In total, an irregular area 29m by 11.5m was excavated between November and December 1996 (Tees Archaeology HER 3536). The circumstances of discovery dictated that some damage had been caused to the remains and not all of them were recorded as completely as would have been desired.

Ingleby Barwick is a topographically interesting area whose name finds more resonances on and around Teesside than its former very limited population would suggest. Since 1968 the area has been under the jurisdiction of local authorities which spanned the Tees, first Teesside County Borough, then Cleveland County Council and more recently the unitary authority of Stockton District, but it was formerly the northernmost part of the North Riding of Yorkshire, hard up against the south bank of the River Tees on a stretch where the loops of the slow-flowing river are particularly marked. On the north bank of the Tees lies County Durham and the historic market town of Stockton-on-Tees (Fig 1). The area is one of variably good quality agricultural land and has been subject to arable agriculture since at least the pre-Roman Iron Age. Until very recently the area retained its agricultural identity, with a very small population and traversed only by a sparse network of minor roads and tracks. Ingleby Barwick was slightly touched by industry in the 19th century, when whinstone was quarried from the Cleveland Dyke for use as road setts (Young and Bird 1822, 171–7). The hard rock allowed the lowermost reliable crossing point of the Tees. In the medieval period most of the area was owned by the Turners of Kirkleatham, and by the end of the 17th century it was known as Ingleby Barwick (Perley 1995, 15). The Barwick element of the place name is the same as that in Berwick-Upon-Tweed, and was pronounced similarly until house builders, sales teams and purchasers found that pronunciation to be a problem.

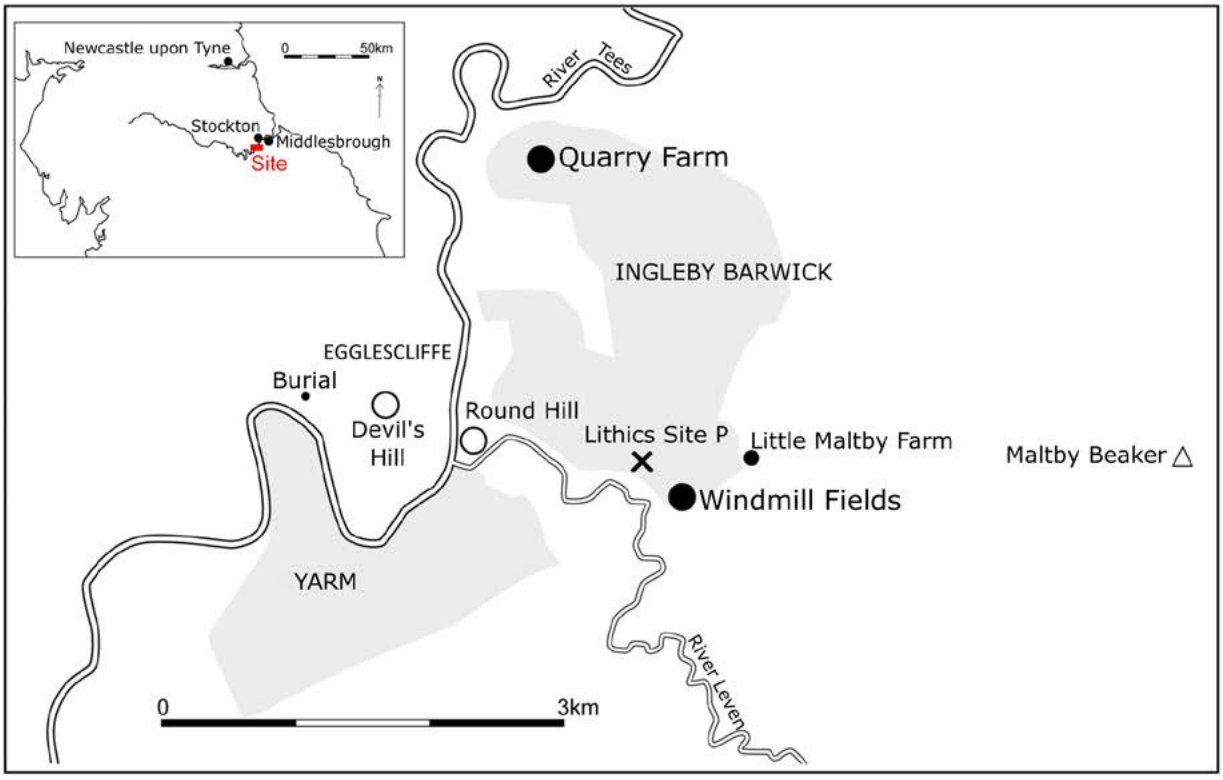


Figure 1. Site location

In 1969, at a time when little evidence of archaeological activity had been identified, the area was purchased for housing. Soon afterwards, in 1970, local amateur archaeologist Don Spratt recorded from the air an extensive cropmark field system at Quarry Farm, at the heart of Ingleby Barwick (Heslop 1984, 23). Planning permission for housing was granted on appeal by Stockton Borough Council in 1978 (Tees Archaeology 1998, 2–3). From then on, before the days of PPG16, and with an uncooperative owner of the housing option, the archaeology of Ingleby Barwick was a ticking bomb. In 1979 Cleveland County Archaeology Section gained access for evaluation excavations of the cropmarks at Quarry Farm, which confirmed the presence of an agricultural settlement of later pre-Roman Iron Age and Romano-British date (Heslop 1984, 33–34). House construction began in the 1980s in areas where no archaeology was known, and reached the Windmill Fields area by the mid-1990s (**Fig 2**). In 1996 house construction revealed the Early Bronze Age burials detailed here (Manby *et al* 2003, 92). In the late 1990s areas near Quarry Farm, 3km north-west of Windmill Fields, were reached and further excavation was undertaken, revealing limited Neolithic and Early Bronze Age evidence in addition to a Roman villa (Willis and Carne 2013, 3–6). Given the scale of the Ingleby Barwick development – during the late 1980s and earlier 1990s it was known as the largest housing development in Europe – it would be unwise to assume that all the archaeology present in the area has been discovered, and still more unwise to consider that it has been adequately examined.

Ingleby Barwick lies on land that is generally only between 20m and 30m above sea level. Geologically the area is dominated by a thick layer of boulder clay, which has been laid down on Triassic sandstones. A couple of diminutive post-glacial lake deposits lie at the west side of Ingleby Barwick, and a small band of glacial sands and gravels exists on the banks of the Leven; it is on this restricted area of better-drained soils that the finds described here were made. These glacially sorted materials appear as a regular series of narrow parallel stripes, each composed of a different deposit, varying from almost pure sands and fine clean gravels to dense sandy pink clays. The bands run roughly north-west–south-east across the site and in section are recognisable as layers running down towards the River Leven. The area is typical of the lower ground of the Tees valley, where intensive agriculture and modern development limit earthwork survival. The 1996 excavation recovered evidence for former ridge-and-furrow here, while the general absence of cropmarks indicative of earlier sites suggests that settlement remained limited until the middle pre-Roman Iron Age (Still and Vyner 1986, 16–17).

Figure 2. Aerial view of the site from the south-west (courtesy of Cleveland Police)

THE EXCAVATION

by Richard Annis

Excavation suggested the presence of five graves and two deposits of partial and disarticulated skeletal fragments (Mortuary Deposits 1 and 2), of which Mortuary Deposit 1 was housed within a probable wooden chamber (Fig 3). Post-excavation analysis revealed that the winter conditions, combined with the damaged nature of the site and the varied treatment accorded the skeletal remains, masked a more complex reality. It would appear that the remains represent a minimum of sixteen people, mostly seen as complete or near-complete skeletons, but some evidenced by only a few bones. The excavated burials are presented in the light of evidence from a number of specialist analyses and are summarised in Table 1. The remains lay in the path of a cutting for an access road and in the area adjoining to the south-east. The first two burials examined (Burial 1 and Burial 2) had been heavily damaged by machining, while Mortuary Deposit 1 had also been significantly reduced by construction works. The location in general had been the subject of intensive agriculture beginning probably in the pre-Roman Iron Age (Heslop 1984, 33–4), with consequent plough damage and movement of material being noted.

Mortuary Deposit 1

An oval pit (26) 2.7m long and 1.0m wide had been truncated by as much as 0.5m by building work and clearance. The remaining deposits had a maximum depth of 0.38m. The long axis of the pit was aligned north-east–south-west and it contained traces of a timber chamber in which were found the disarticulated remains of five individuals (Fig 4).

The pit contained a rectangular area (08), approximately 1m wide and 2m long, with two dark stains on its north-western side which appeared to be the remains of planking (Fig 5). The lowermost of these (14) was

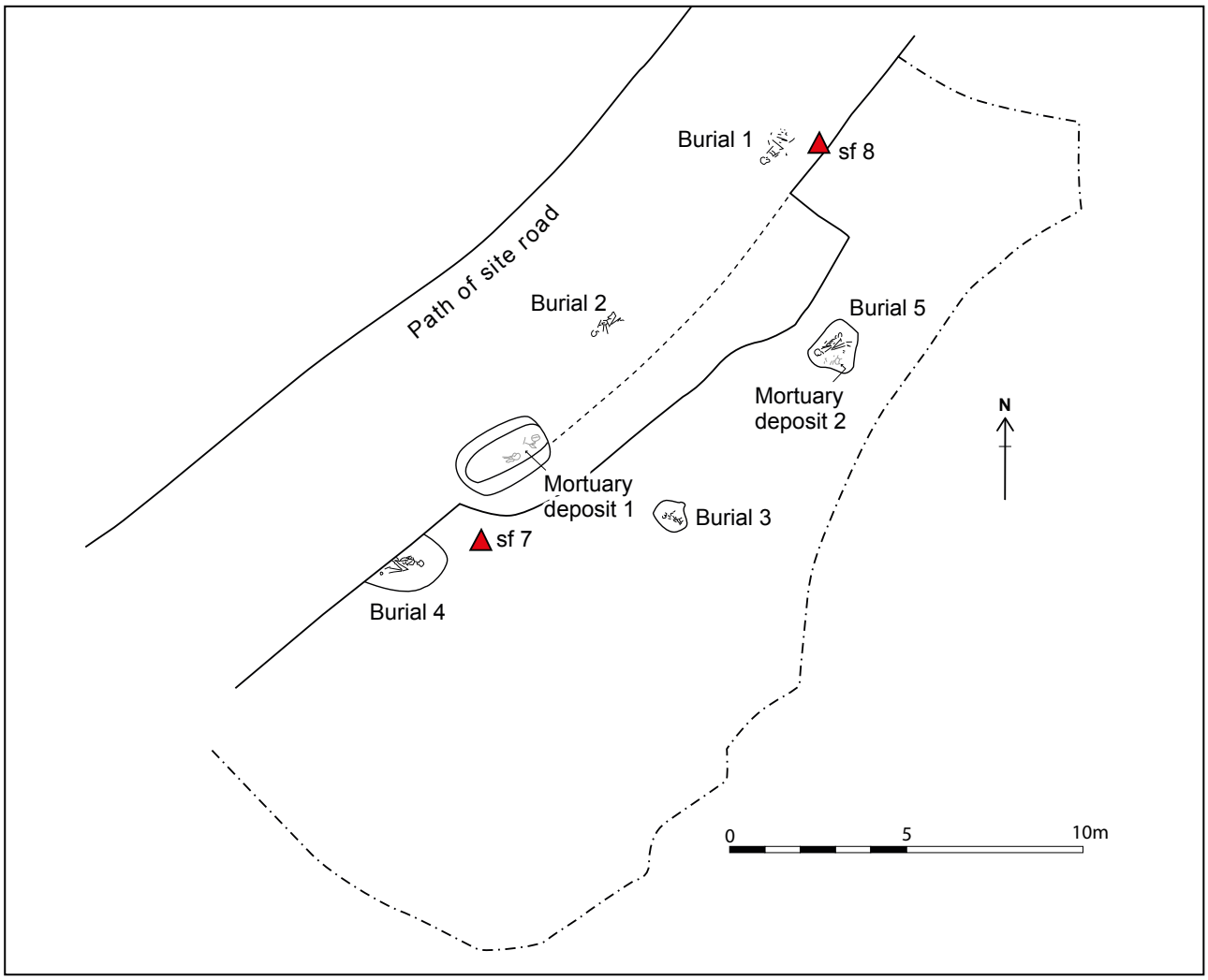


Figure 3. Plan of excavated area showing the graves, timber structure and small find (sf) locations

Table 1 Concordance and summary of the Ingleby Barwick burial deposits

Label	Excavated as	Burial type	Treatment	Sex (* indicates confirmed by DNA)	Age	Accompanied by	Human remains analysis
Burial 1	Skeleton 2 *Burial 2*	crouched inhumation	mummified	male*	adult, young to middle-aged	Beaker/s (found 0.3 m from grave but assumed to have been a grave good)	^{14}C (OxA-8651), DNA (I1767), histomorphology
Burial 2	Skeleton 1 *Burial 1*	crouched inhumation		female	adult, middle-aged	–	^{14}C (OxA-8650)
Burial 3	Skeleton 7 *Burial 6*	crouched inhumation		female*	adult, old	haematite lump	^{14}C (OxA-8729), DNA (I1765)
Burial 4	Skeleton 5 *Burial 3*	crouched inhumation		male	adult, middle-aged	macehead haematite lump Beaker sherd from topsoil to E of grave, and assumed to have come from the grave	^{14}C (UB-4173), histomorphology
Burial 5	Skeleton 6 *Burial 4*	crouched inhumation		female	adult, young to middle-aged	2 bronze armlets 45+ sheet-bronze tubular beads 2 fragments copper alloy(?) wire or rod at least 25 jet (and jet-like) 'buttons' at least 88 jet tiny disc beads 1 chalk(?) disc bead 1 jet fusiform bead 8 ochre fragments 1 flint scraper and 2 flakes possible organic pouch cattle hide	^{14}C (UB-4174), histomorphology
Mortuary Deposit 1a	Skeleton 3	disarticulated	in chamber	male*	adult, poss. middle-aged	No grave goods in Mortuary Deposit 1	^{14}C (OxA-8652), DNA (I3028), histomorphology ^{14}C (OxA-8728), DNA (I5382)
Mortuary Deposit 1b	Skeleton 4	disarticulated	in chamber	male*	adult, poss. middle-aged		
Mortuary Deposit 1c	adult skull fragment	disarticulated	in chamber	indeterminate	adult		
Mortuary Deposit 1d	adult skull fragment	disarticulated	in chamber	indeterminate	adult		
Mortuary Deposit 1e	juvenile skull fragments	disarticulated	in chamber	indeterminate	sub-adult, 6–10 years		
Mortuary Deposit 2a	Skeleton 8 (skull fragments)	disarticulated	in pit	male	adult, young (or sub-adult)	No grave goods in Mortuary Deposit 2	
Mortuary Deposit 2b	Skull fragments	disarticulated	in pit	female* (osteologically ID'd as '?male')	adult		^{14}C (BRAMS-1286), DNA (I7635)
Mortuary Deposit 2c	Skull fragments	disarticulated	in pit	?female	adult, middle-aged		^{14}C (BRAMS-1287)
Mortuary Deposit 2d	Skull fragment (petrous temporal)	disarticulated	in pit	indeterminate	indeterminate		
Mortuary deposit 2, misc. bones 2e–g and fragments (5) <2>, (16) <4>, (19) <5> and (22) <6>	See note 1	disarticulated	in pit	see note 1	see note 1		

Note 1 These comprise fragments of at least three sets of teeth – of a young adult, a child aged 10–11 and an adult, aged c. 18–21 (2e); fragments of a R femur and R humerus, probably all from one male aged c. 20–25 (2f); several other long bone fragments, some but not all of which probably belong to the 2f individual (2g); adult basal skull fragments, toe bone (OA distal) and middle cuneiform ((5) <2>); fragments of radius, ?metacarpal, trapezoid bone and finger phalanx ((16) <4>), skull fragments and some lower teeth of an old adult, ?female ((19) <5>); and three unidentified fragments and lower incisor ((22) <6>). While some of these may belong to the individuals identified in Mortuary Deposits 2a–2d, others do not, and the latter are from at least two individuals (namely a child aged 10–11 and an old adult ?female

Figure 4. Mortuary Deposits 1a and 1b

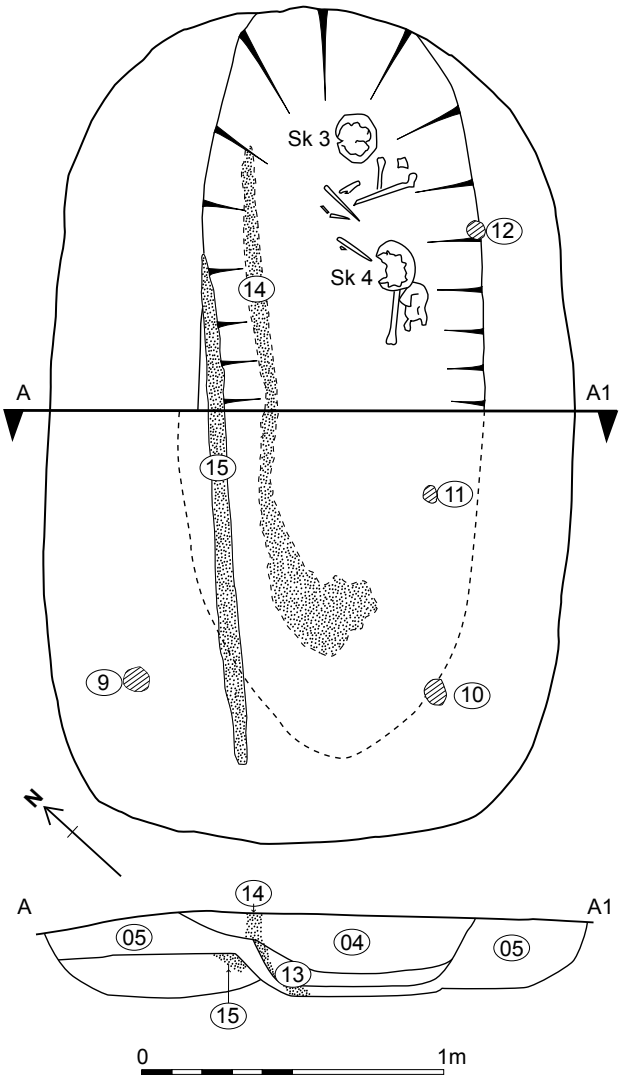


Figure 5. Plan and section of the timber chamber with Mortuary Deposit 1 and Skeletons 3 and 4

1.84m long and 60mm thick; it was up to 0.2m wide at the south-west end, where it lay relatively flat on the bottom of the pit. Higher in the north side was a second stain (15) leaning outwards at a shallow angle from the interior of the feature; this was 1.6m long, 0.14m wide and up to 80mm thick. Its location and angle of 15° probably indicates that the side was two planks high and that stain 15 was the top plank, which had fallen out from the structure when decay set in.

The interpretation of the stains as decayed planks is strengthened by the discovery of four stakeholes in the bottom of the pit (09–12). Stakeholes 10–12 form a line along the east side of the pit. Stakehole 11 is offset to the centre and it may be that a plank or planks were wedged upright, with stakehole 11 inside and stakeholes 10 and 12 the other side of the plank(s). The fourth stakehole, 09, was opposite 10 and these four features together suggest a structure *c* 1m wide, up to 2.7m long and at least 0.38m deep. The stakeholes measured from 70mm to 120mm in diameter. It is presumed that the stakes in 11 and 12 were paired with stakes at the other side of the structure but these were not seen in excavation. There was no indication of end boards and the timber feature may simply have been bounded by the pit edges. In profile, the floor of the pit was slightly deeper along the line of the putative chamber and this may represent a void left by the decay of a wooden floor, staining from which was detected in the overlying layer (13).

Following the building of the chamber a thin layer of clean light brown sandy soil (13) had been deposited and, as noted above, this contained areas of dark staining probably derived from timber flooring. The seemingly initial skeletal deposit, Mortuary Deposit 1a (Skeleton 3), had been placed at the north-eastern end of the chamber towards its centre. It comprised the partial and disarticulated remains of a male, possibly middle-aged. Particularly noticeable was the absence of the lower jaw and any teeth, although the cranial vault was present. This individual is estimated to have died *2290–2120 (77%) or 2100–2035 (18%) cal BC* (OxA-8652, 3785±40 BP). (Note that here, as elsewhere where calibrated date ranges are given in italics, these are the modelled Highest Posterior Density interval values at 95% probability, as given in **Table 7** below.) Following the placement of Mortuary Deposit 1a, a dark red-brown gravelly soil (04) was deposited. This lay around but not underneath the skeletal remains. Mortuary Deposit 1b (Skeleton 4) was then placed on this material and was surrounded and covered by it. The individual – an adult male, possibly middle-aged – is estimated to have died *2270–2255 (1%) or 2210–2015 (93%) or 1995–1980 (1%) cal BC* (OxA-8728, 3725±40 BP). Associated with this deposit were two fragments of other adult skulls (Mortuary Deposits 1c and 1d, both of indeterminate sex), and eight fragments of the skull of a child around 6–10 years old, of indeterminate sex (Mortuary Deposit 1e).

These skeletal remains were all disarticulated (Anderson, below) and analysis of the bone structure of deposit 1a suggests deposition after a process of excarnation (Booth, below). Although scavenging birds might account for the absence of small bones, the lack of some larger bones suggests more complex deposition procedures akin to, but not necessarily descended from, those thought to be associated with some Neolithic cairns a millennium earlier (Whittle 1991, 94–97 and table 15). The only other finds from the Mortuary Deposit 1 area were two pieces of flint: a calcined flake (sf 1), found about 0.4m to the north of Mortuary Deposit 1a, and a small fragment of natural flint gravel (sf 2), found between the two skull fragments 1c and 1d. Neither item can be regarded as a grave good; according to Peter Rowe (below), sf 1 is residual from Mesolithic or Neolithic activity in the area, while the gravel fragment could derive from the natural subsoil or the infill material. It is likely that the fill of the pit (05) was in place by the time the chamber was filled, otherwise there would probably have been leakage of chamber fill (04) into the area outside. If this was the case the pit must have been backfilled either shortly before or just after the first deposition of remains and certainly by the time the second deposition (Mortuary Deposit 1b) had taken place. It was after this that the chamber was filled.

Evidence for timber structures within Early Bronze Age burial mounds is not uncommon, but their incomplete survival, combined with inadequate recording by 19th-century excavators, combines to limit the interpretations that can be made. In his discussion of timber graves and coffin burials in East Yorkshire, Petersen identified inhumations in wood-lined hollows, grave pits with wooden linings and wooden coffins and enclosures (Petersen 1969, 263–66). His discussion was based on Mortimer's somewhat sketchy excavation descriptions. The Ingleby Barwick chamber would appear to belong to Petersen's second group of sites, noted above, the excavation evidence indicating a timber structure 1m wide, up to 2.7m long and at least 0.38m deep. The mixed sandy and gravelly soils of the site would have necessitated a stake-supported structure. It should be noted that even without excavated detail the Ingleby Barwick chamber is most unlikely to have been a tree-trunk coffin: of 46 such coffins whose dimensions are known, only five are over 2.5m in length (Parker Pearson *et al* 2013, table 4.1).

Mortuary Deposit 2

This occupied a small sub-circular pit cut into the south side of the grave pit for Burial 5 and extending slightly deeper than the base of that grave. The fill (27) was the same material as that in the larger grave and the deposit comprised commingled disarticulated bones collected as Mortuary Deposit 2. These proved to comprise the remains of at least five and possibly as many as ten individuals (Table 1 and see Anderson, below). The five clearly identifiable individuals are: a young adult or sub-adult male (Deposit 2a, Skeleton 8) represented by skull fragments; an adult female (according to the DNA results; previously osteologically identified as '?male'), represented by skull fragments (Deposit 2b), estimated to have died *2200–2170 (6%) or 2150–2015 (86%) or 2000–1975 (3%) cal BC* (BRAMS-1286, 3691±28 BP); an adult ?female, represented by skull fragments (Deposit 2c), estimated to have died *2200–2170 (6%) or 2150–2015 (86%) or 2000–1975 (3%) cal BC* (BRAMS-1287, 3691±28 BP); one individual of indeterminate age and sex, represented by a right petrous temporal fragment (2d); and a child, aged *c* 10–11 years, represented by a few teeth (part of 2e). The other remains in Mortuary Deposit 2 include teeth, long bones, further skull fragments and hand bones, but it is impossible to tell whether these belong to the five individuals listed above.

Burial 1

This grave containing a crouched inhumation (IWF96, 02, Skeleton 2) is the most northerly burial of the group. It had been dislodged by mechanical excavation and the remains recovered and placed on the side of the trench, although sufficient fragments remained in the grave for it to be concluded that the body had probably been buried lying on its left side. The grave is orientated NNE–SSW, with the head of the body to the SSW. Examination of the skeletal remains indicates that this was a young to middle-aged individual, probably male (the sex confirmed by DNA analysis), who is estimated to have died *2200–2015 (93%)* or *1995–1980 (2%) cal BC* (OxA-8651, 3705±35 BP). Analysis of the bone indicates that the body had been mummified (Booth, below). A group of eight conjoining sherds from a Beaker vessel (sf 8) and a further small fragment, possibly from a second Beaker, found 0.3m to the east of the burial, are assumed originally to have been associated.

Burial 2

This was the first grave to be recovered; it is orientated north-east–south-west. It had been badly disturbed by machining and most of the bone was recovered from the side of the trench, where it had been placed by the builders. A few ribs and finger bones remained *in situ* and these were sufficient to indicate that the skeleton (IWF96, 03, Skeleton 1) had been articulated and the body had been laid on its right side, with the head at the south-west end of the grave. The identified length of the deposit, 1.2m, indicated that the individual – a middle-aged woman – may have lain in a crouched position. She is estimated to have died *2280–2250 (4%)* or *2235–2030 (91%) cal BC* (OxA-8650, 3755±40 BP). No grave goods were found.

Burial 3

This grave occupied the highest point in the cemetery and the remains had been substantially disturbed by ploughing (Fig 6). The grave had been truncated to the point where only a relatively small area of fill (19) remained. Measuring 1m by 0.9m and 0.15m deep, the grave was orientated ESE–WNW, with the head to the WNW. The only object recovered was a piece of haematite (sf 12), very similar to that found in the grave of Burial 4. The skeleton within the remnant of grave fill (IWF96, 21, Skeleton 7) was in poor condition, identified osteologically as that of an old woman, was crouched on her right side, head pointed to the west. She is estimated to have died *2290–2125 (75%)* or *2100–2035 (20%) cal BC* (OxA-8729, 3780±40 BP). The skull was badly broken, and the jaw and some other bones had been displaced towards the south-east, presumably by ploughing.

Figure 6. Burial 3

Burial 4

An oval grave (18) at the south-westerly end of the excavated area contained a single inhumation (IWF96, Skeleton 5) and a single fill. The grave had been truncated by the road and this had caused slight damage to the burial. At its largest, the grave measured 2.2m by 1.9m and up to 0.15m deep; it was orientated roughly east–west. Some limited truncation had taken place during the mechanical clearance of this area, but most of the loss of depth was probably the result of ploughing. The grave contained the crouched skeleton of a single adult, a middle-aged man, who is estimated to have died *1740–1710 (11%)* or *1695–1600 (76%)* or *1560–1540 (8%) cal BC* (UB-4173, 3364±22 BP). The body had been laid in the grave on its left side, with the head at the east end of the grave. The right side of the pelvis and the right heel had been damaged by the machine-cut for the road. The individual was accompanied by a fine stone macehead (sf 11), which lay beside the feet (Fig 7). The fill (16) comprised a reddish-brown firm gravelly clay, similar to the deposit that filled the rectangular chamber containing Mortuary Deposit 1 adjacent to the north. It contained a rounded lump of reddish haematite (sf 11). A sherd of Beaker pottery (sf 7) found close to the south side of the grave is assumed to have been displaced from the grave by ploughing and is discussed below. The similarity in grave shape, orientation, relative size and fill to the feature containing Mortuary Deposit 1 is notable.

Figure 7 Burial 4 with macehead

Burial 5

A grave orientated north-east–south-west (25), 1.4m long by 1m wide and 0.22m deep, contained Burial 5 (IWF 96, 23; Skeleton 6) (Fig 8). The corpse had been laid in a crouched position on the right side, with the head at the south-west end of the grave, looking south-east. More specifically, the head was turned to the right, the upper torso was not completely turned on its right side, and the arms and legs had been drawn up, with the legs resting on the right side of the body. The bones had been badly crushed by construction traffic and the skull was rather flattened, but with the exception of the lower legs the remains were more-or-less complete. The grave was that of a young to middle-aged woman, estimated to have died *2130–2090 (10%) or 2040–1915 (85%) cal BC* (UB-4174, 3609±24 BP). The fill of the grave comprised a hard red-brown gritty clay with sandy patches (22), similar in appearance to the other grave fills. This grave had been cut by a pit (25), which contained Mortuary Deposit 2.

Figure 8. Burial 5 and Mortuary Deposit 2a

Excavation quickly revealed a large number of small and fragile objects on the torso. It was decided to freeze-lift this portion of the deposit and excavate it in the more controlled conditions of the conservation laboratory (Fig 9; Jones 2001a; 2001b). This description includes both the finds made on site and those recovered by laboratory excavation. The woman had a pair of bronze armlets on her arms; that on the right arm was plain and the one on the left arm was broader and ribbed. Fragments of at least 45 sheet-bronze tubular beads were recovered from the upper chest region (Fig 10, left). In the same area there were at least 25 V-bored 'buttons', 17 of which were complete, with others in fragmentary states (Fig 10, right). These were scattered over the chest area and below the jaw. Most, if not all, are of jet. Around the left clavicle, close to the left wrist, a cluster of tiny disc beads, also seemingly of jet, was found. There were at least 88 beads, plus fragments of an indeterminate additional number (Fig 10, right). Near one of the tubular sheet-bronze beads, pieces of a tiny bead of white stone, perhaps made from chalk, were also found. A single fusiform jet bead was found a little further down the torso, slightly apart from the rest of the jet objects. In addition eight small pieces of ochre were scattered across the torso, and two fragments of what looks to be an awl, presumably of copper alloy, were found when palaeobotanical samples were being processed. A flint scraper and two flint flakes were also present in the grave. The ribbed armlet had traces of mineral-preserved hair from a cattle hide or piece thereof on its outer surface, while small traces of what is almost certainly human hair were found on the plain armlet, as discussed below. It appears likely that the hide (Rogers 1999) had been wrapped around the fully dressed corpse. Evidence for the former presence of a further organic item in the grave comes from an irregularly shaped area of darkened soil around 70mm x 50mm, partly overlying the ribbed armlet (Jones 2001b). This may be the remains of a perished organic bag or pouch, possibly suspended from the neck or attached to the arm.

Figure 9. Block removed for excavation in the conservation laboratory

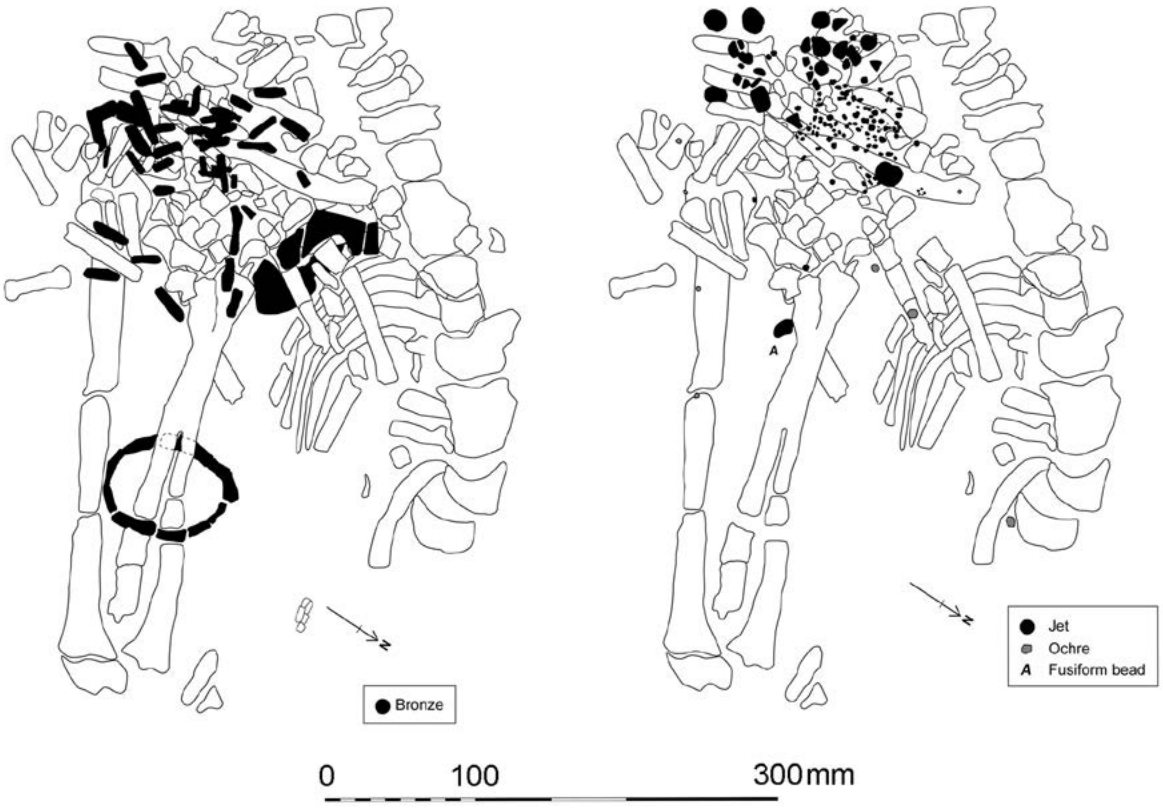


Figure 10. Distribution of bronze and jet items, and ochre. Scale 1:5

THE GRAVE ASSEMBLAGES

by Blaise Vyner and Alison Sheridan,
with contributions by Jennifer Jones, Peter Rowe and Penelope Walton Rogers†

Note: this section covers items that are believed to have been buried with the dead, rather than those (ie, some pieces of flint) that may well have been residual in the grave fill.

Burial 1, young to middle-aged male

Beaker potsherds, sf 8. A group of eight small conjoining sherds from the belly of a Beaker, probably recently broken (Fig 11). These were found at the base of the topsoil some 0.3m east of Burial 1, suggesting an original association dislocated by ploughing, which the excavator points out appears to run in this direction. External surface brown-terracotta, internal surface grey-brown, centre of core dark grey. Fine sandy fabric with occasional mica inclusions. There are a few small angular quartz grits, occasional medium-sized quartz grits and one large quartz fragment visible; occasional small limestone pieces and one medium-sized limestone fragment are also present. These grits may all have been present in the local clay. Wall thickness varies from 6mm to 7mm. The interior surface has been burnished, the exterior less obviously so. Decoration comprises two pairs of impressed segmented lines flanking a narrow zone of impressed cross-hatching, a broad plain zone, and a repeat of the pattern with a further zone of cross-hatching immediately below (Clarke's motif group 3, nos 11 and 14). The horizontal lines have been impressed with a tool of uncertain length that has a slight indentation every 3mm or so – to call it a comb would be to exaggerate. The vessel appears to belong to Clarke's Developed Northern British Group of Beakers (Clarke 1970, 162–75).

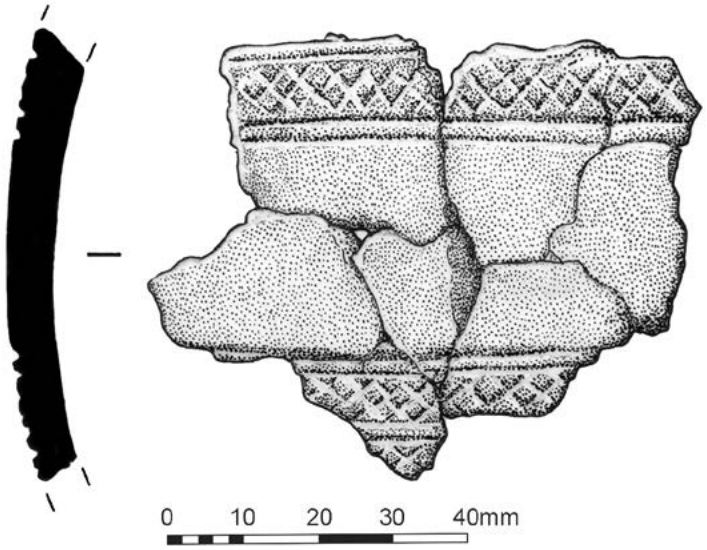


Figure 11. Conjoining Beaker sherds (sf 8) found close to Burial 1

A further small fragment, not necessarily from the same vessel, has an incised horizontal line flanking what may be a series of short, shallow-sloping obliques, as in the upper part of Clarke's motif group 17.

Burial 3, old female

Haematite lump 19, sf 12. Irregularly shaped lump of haematite, weight 35g, maximum dimensions 35mm x 30mm x 25mm. No signs of human modification or wear.

Burial 4, middle-aged male

Stone macehead 16, sf 4. A well-made macehead, oval in outline and probably finished by grinding, maximum dimensions 85mm long, 54mm wide and 34mm thick; the roughly centrally positioned hour-glass perforation averages 31mm in diameter at the outer edge, 20mm at its smallest in the centre (Fig 12). Stone identified by Dr Graham Pearson as diorite. Superficially the rock is similar to some Scottish 'appinites', a very general term used for widely occurring rocks of this type, and the stone could have easily been found in glacial drift or on a beach.

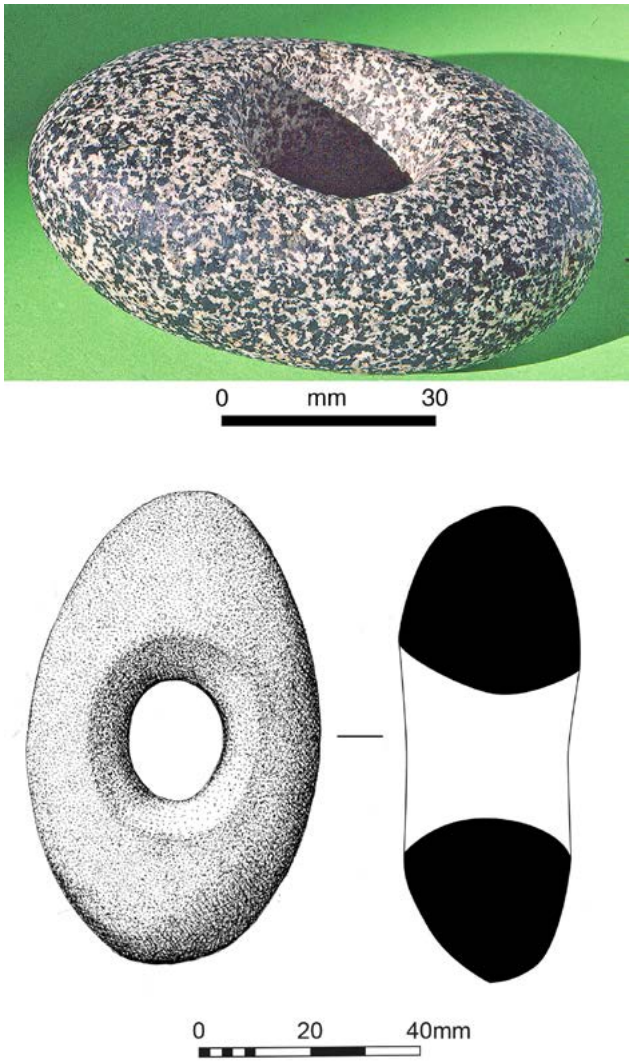


Figure 12. Stone macehead from Burial 4

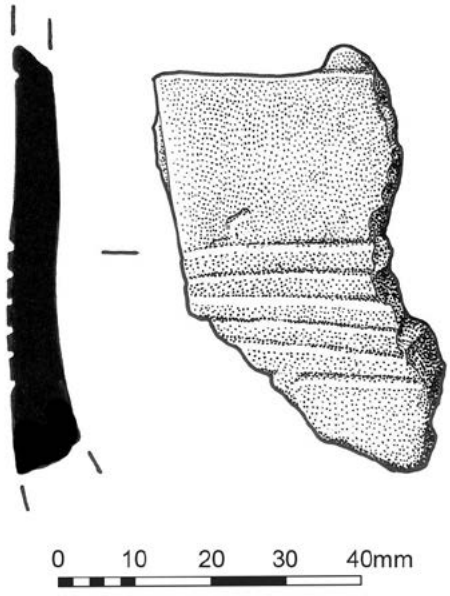


Figure 13. Beaker sherd found close to Burial 4

To judge from the position of the macehead (Fig 7) – found resting on one of its perforated faces – it is likely that it had not been hafted when it was deposited in the grave.

Beaker potsherd, sf 7. Single sherd from the lower belly, just above the base, recovered from the base of the topsoil to the east of Burial 4 and assumed originally to have been associated with the grave, subsequently dislodged by ploughing. External surface buff-brown, interior surface light grey, with a dark grey core. Fine sandy fabric; grits comprise a few small quartz sands and a few angular igneous fragments. Limestone dust is also evident. Wall thickness 6mm at the top, expanding to 10mm at the bottom, where the wall appears to be expanded to meet the base (Fig 13). The wall rises near-vertically from the base, suggesting a roughly cylindrical-shaped vessel, which would belong to the latest Beakers in the British series. Both surfaces have been burnished. Decoration comprises a series of six impressed segmented horizontal lines (Clarke's motif group 3, no. 11), made with a tool similar to that employed to make impressions on the sherd from Burial 1.

Haematite lump, sf 11. Irregularly shaped lump of haematite, weight 45g, maximum dimensions 40mm x 30mm x 25mm. No sign of human modification or wear.

Burial 5, young to middle-aged adult woman

The information presented here is informed mostly by the observations of Jennifer Jones, who excavated a block of material freeze-lifted from the chest area of the skeleton (Jones 2001a; 2001b). Additional comments on the metal and jet items are by Alison Sheridan.

Bronze armlet 1. A plain bar armlet with oval section, complete but in twelve fragments, found on the right arm (Fig 14; see also Fig 9 and Fig 10, left) External diameter 63–80mm, oval section 6mm by 4mm, the terminals butt-jointed. EDXRF surface analysis showed the metal to be bronze with between 10 per cent and 15 per cent tin (although corrosion tends to exaggerate the tin content of bronzes, especially on the surface). Small traces of hairs are present as mineral-preserved organic matter on both the inner and outer surfaces of the armlet. While identification to species on morphological grounds was not possible, one mineralised hair from the interior that was examined at x1000 magnification in a Scanning Electron Microscope was found to be very fine, with a diameter (including corrosion) estimated at 15–20 microns. This is consistent with what might be expected for human female arm hair. (Human head hair ranges between 17 and 181 microns; by comparison, modern cattle hair is over 75 microns thick.) Moreover, the corrosion surface on the interior of one of the fragments shows traces of either

mineral-preserved fungal hyphae or human skin. If the latter, then this and the aforementioned hair would be consistent with the armlet's position on the woman's arm.

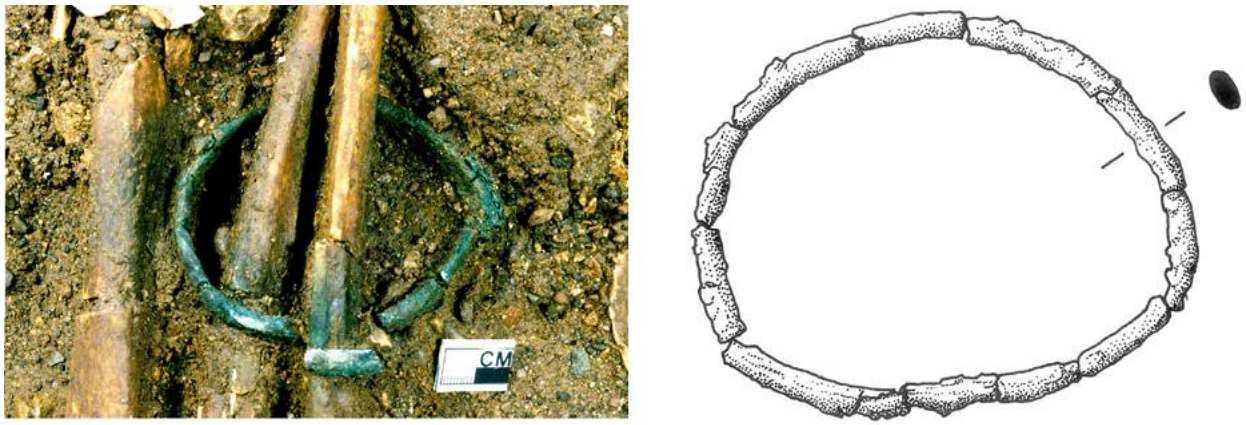


Figure 14. Bronze armlet 1 from Burial 5

Bronze armlet 2. Bronze armlet decorated with five moulded raised ribs, worn on the left arm. Complete, but in six fragments, now conserved (**Fig 15**; see also **Fig 9** and **Fig 10**, left). External diameter 60–74mm. Where best preserved the section is 20mm wide and 4mm thick; the terminals are butt-jointed. Three central raised ribs approximately 4mm wide, separated by grooves around 1mm to 1.5mm wide, flanked by a narrower lower margin 2mm or so wide. EDXRF surface analysis showed that the bronze has tin levels of between 4 per cent and 16 per cent. A part of the armlet retains traces of mineral-preserved cattle hide on its outer face (**Fig 16**); this was identified by microscopy (Rogers 1999). It may therefore be that the poorly preserved hairs on the outside of armlet 1 had also belonged to a cattle hide.

Tubular sheet-bronze beads. Fragments of at least 45 small tubular beads of sheet bronze were recovered from the block of material in the chest area of the skeleton, entangled with the bones of the hands that rested on the chest (**Fig 9**, **Fig 10**, left, **Fig 15**, left). Only one of these metal beads survived complete (**Fig 17**). The complete bead is 36mm long, formed from a rectangle of bronze between 0.3mm and 0.8mm thick, rolled to a diameter of 5.5mm, with the ends of the sheet overlapping slightly. A nick at one end could conceivably have been caused by the pulling of thread inside the bead. The other tubular beads appear to have been of a similar diameter and thickness but may have varied in length; most of them survived as sets of tiny fragments, although an idea of their original form is given by the X-ray image (**Fig 15**, left). The presence of traces of mineralised wood (and in one case, a rod-like fragment) inside many of the beads (**Fig 18**) indicates the use of wood as a stiffener, to help prevent the beads from being crushed – a feature also noted in the tubular sheet-bronze beads from an Early

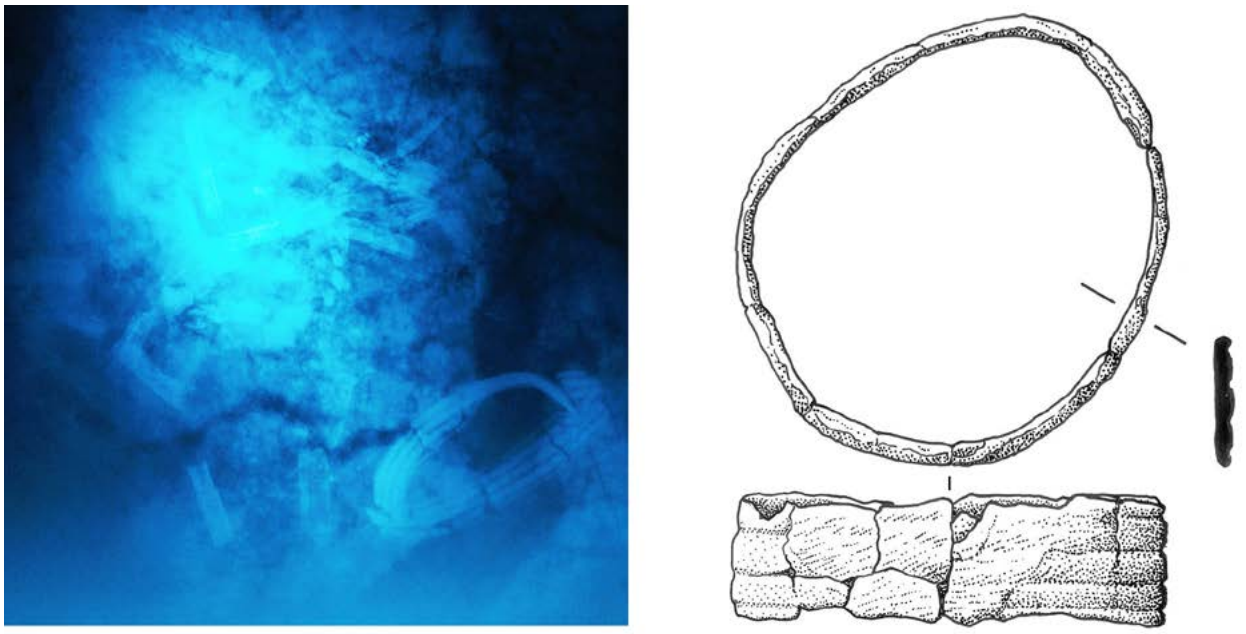


Figure 15. Bronze armlet 2 from Burial 5

Figure 16. Cattle hair on bronze armlet 2

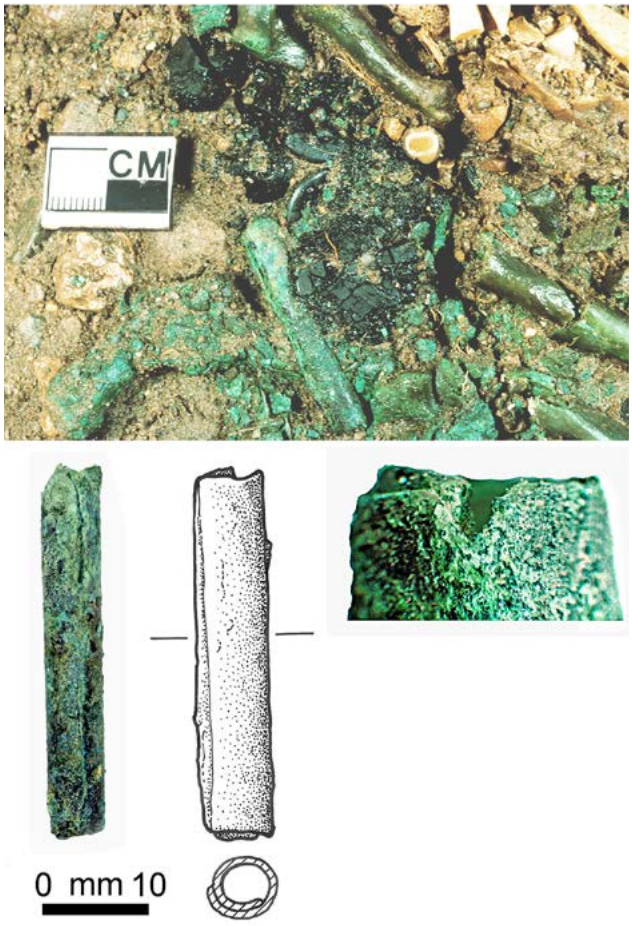


Figure 17. Sheet-bronze tubular bead from Burial 5

Bronze Age hoard found at Migdale in north-east Scotland (Anderson 1901; Clarke *et al* 1985, fig 4.35). The wood species could not be determined beyond its identification as a hardwood, and possibly uniseriate (ie, having a single row of cells making up a ray). Withies would be an ideal material for bead stiffeners.

Unlike some examples from elsewhere, for example at Migdale, there is no sign of any perforation in the sides of the beads – or, at least, none that could be discerned, bearing in mind the poor state of preservation of most of the beads. As discussed below, this has a bearing on interpreting how the beads had been deployed.

All the tubular beads are very corroded, with little or no actual metal remaining. Qualitative energy-dispersive X-ray fluorescence analysis (EDXRF) of the cleaned corrosion surface, undertaken by Jones (2001b), revealed the presence of copper, tin and lead, with the tin content being high, at roughly 15–20 per cent (although note the comment above regarding corrosion exaggerating the tin content in bronze artefacts, especially on the surface). The beads' poor condition precluded the undertaking of metallographic analysis that would have determined whether this was a high-tin bronze or bronze that had been tinned (ie, had a layer of tin fused to its surface). Either way, the beads, when new and polished, might have had a silvery appearance, in contrast to that of the bronze armlets.

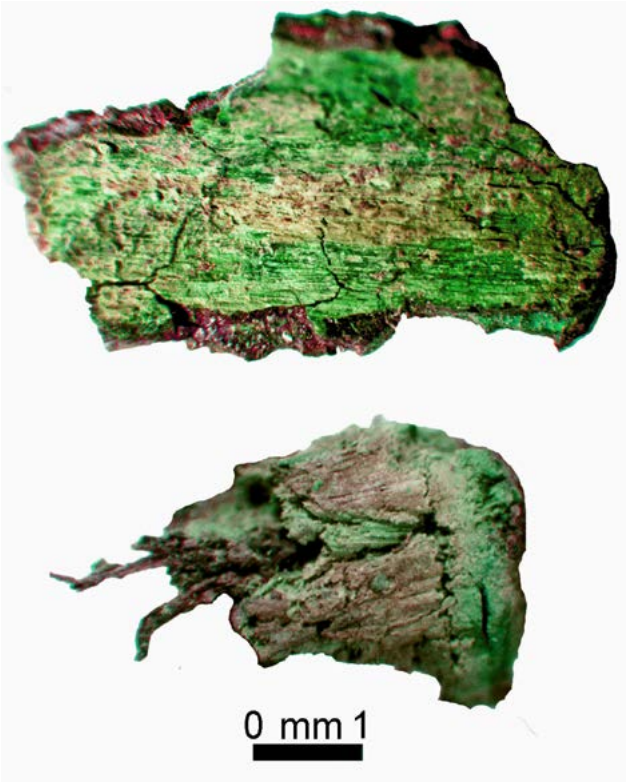


Figure 18. Traces of mineralised wood inside the tubular beads

The beads were clustered mostly in the upper chest area, around and below the clavicles and entangled with, but clearly overlying, the bones of the hands (**Fig 9**, **Fig 10**, left, **Fig 17**). They appear to have been placed separately from, and seemingly above, a group of V-bored 'buttons' of jet and similar-looking material/s (**Fig 9**, **Fig 10**, right, **Fig 17**). Their position relative to the cluster of tiny jet disc beads (which mostly lie to one side of the metal beads and were found at a minimally lower level in the block) suggests that there was no direct relationship between these two sets of ornaments (**Fig 10**, right). The proximity of a tiny stone disc bead (described below) to one of the tubular beads led Jennifer Jones to speculate that it could have been used as a spacer bead in a necklace, to stop the ends of the metal beads grating against each other; and the proximity of a jet fusiform bead to some of the metal beads raises the possibility that it could have been used as a fastener, had the beads been strung as a necklace. The question of how the tubular sheet-bronze beads had been deployed – as a necklace or as ornaments sewn onto a garment – is discussed further below.

V-bored 'buttons' or studs, mostly (or all?) of jet. Remains of at least 25 V-bored 'buttons' – a shorthand term for 'button or stud' – were recovered, of which 17 were largely complete and the rest were fragmentary (**Fig 10**, right; **Fig 19**; **Table 2**). Four were found during the excavation (IWF 96 23 #1–4), while others were discovered during the laboratory excavation of the freeze-lifted block and were allocated letter labels. They were mostly found under the jaw, at the level of the clavicles, with some further down on the chest area, probably moved there post-deposition, through bioturbation and the decay of the body. Most were found upside down, with their flat base uppermost; some others were found on their side (**Fig 20**; see also **Fig 17**, left).

The 'buttons', all relatively small (cf Jelley 1984, 181), range in size, shape, colour and surface finish (Figs 19–21, Table 2 and see Jones 2001b, sections 3 and 6), with the basal diameter ranging between 8.5mm and 17.3mm and the height between 5.2mm and 10.7mm. Some have markedly conical domes with a pointed apex (**Fig 21**.1), while others have a lower, more rounded dome (**Fig 21**.2). Several have angular facets at the junction of the base and the dome (**Fig 21**.3). In most cases, the bases are not truly circular, but minimally oval, and the positioning of the V-bores follows the long axis. The colour and surface finish varies, with some being black and with a high sheen on the dome, others black and matte, others black-brown and matte or with a low sheen, and one black with a low sheen (Jones 2001b, 29).

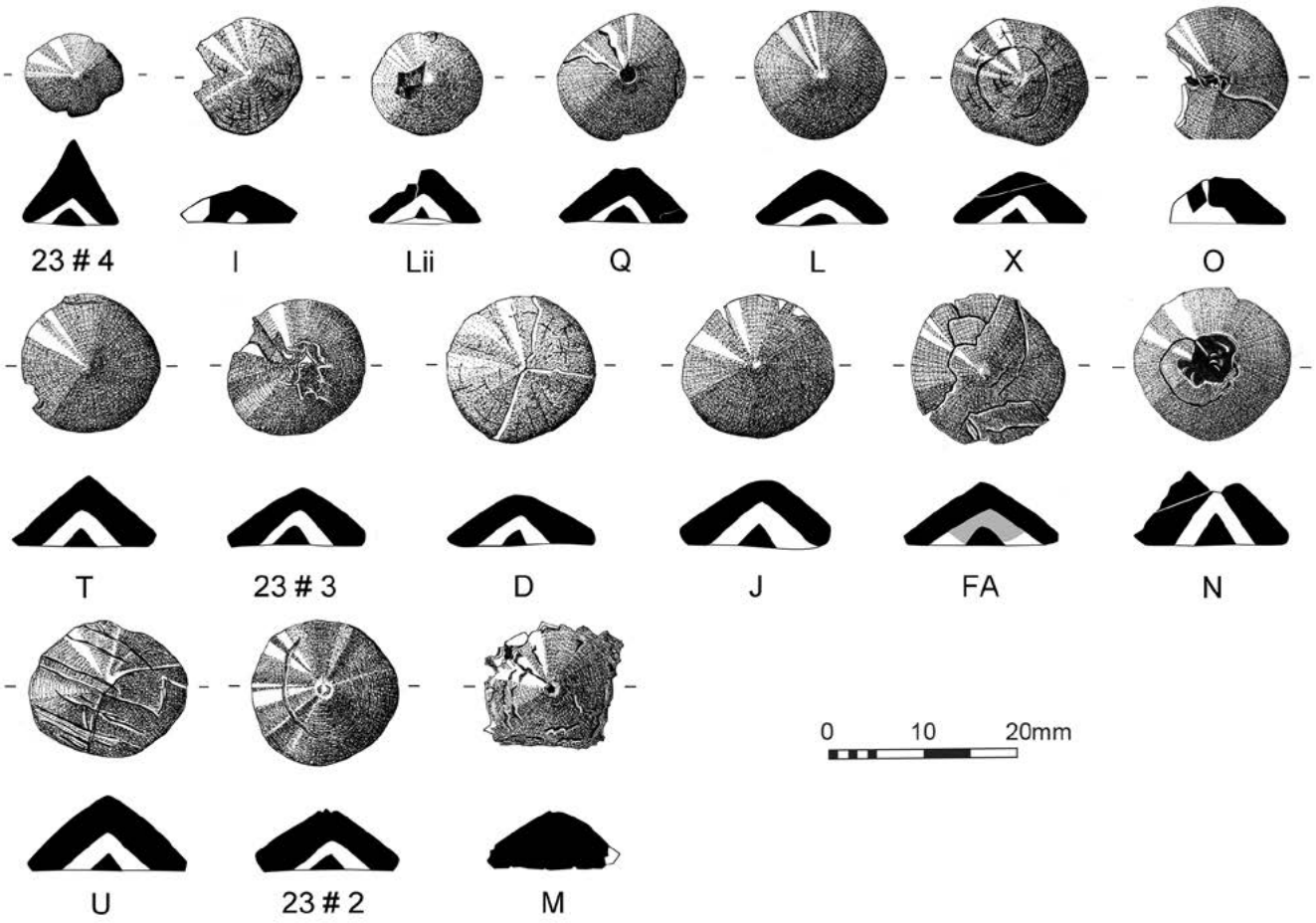


Figure 19. V-bored jet studs or 'buttons'

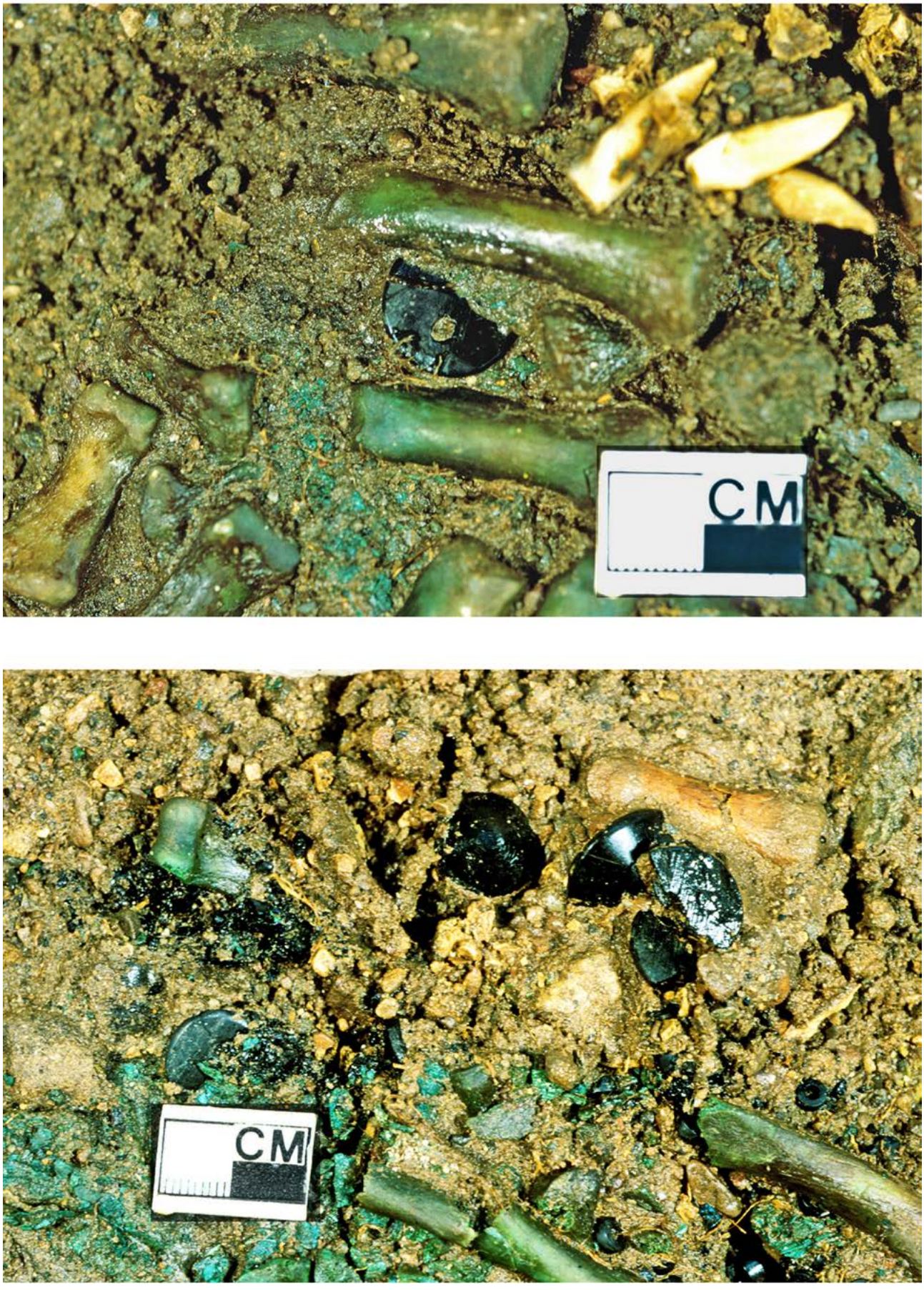


Figure 20. Jet studs or 'buttons', *in situ*

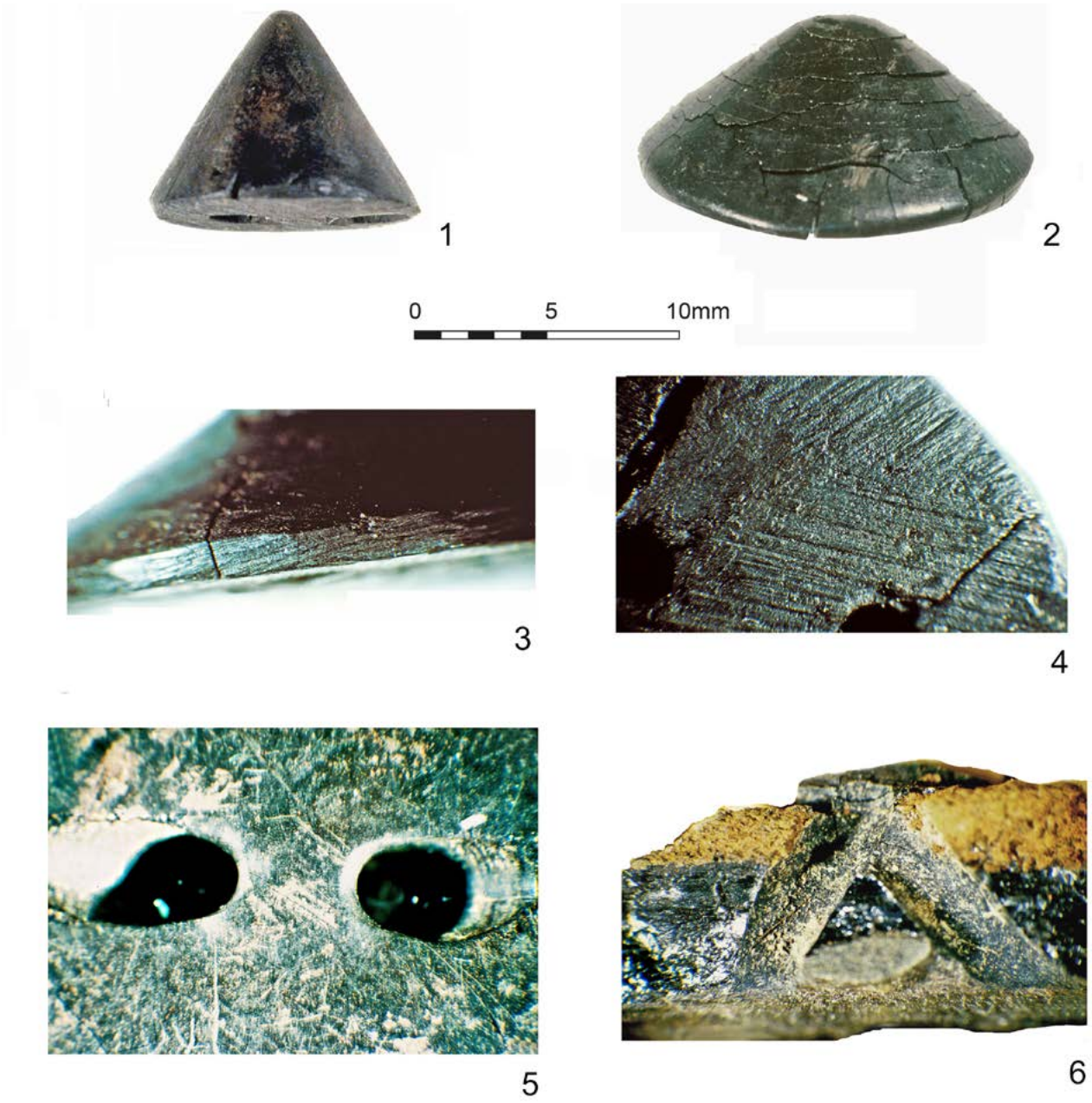


Figure 21. Jet studs or 'buttons', detail

In some cases, traces of manufacture can be seen, including multi-directional grinding striations on the base and facet (Fig 21.3–4) and rilling from the rotation of the drill bit in some of the V-bores (Fig 21.5). The V-bore would have been made prior to the final shaping of the buttons, with a sharp point (possibly of flint) being swivelled first in one direction, then at an angle to that, breaking through at the apex of the 'V', as can be seen in Fig 21.6, where button IWF 96 23 #3 broke during its conservation.

The evidence for wear is fairly minimal, suggesting that the 'buttons' had not been very old when deposited, or else had not been used in such a way as to produce significant wear traces (Figs 20 and 21.4). The manner of their deployment is discussed below.

Analysis of 24 of the 25 'buttons' by Aidan Campbell of Durham University (Table 2), using qualitative EDXRF and working under Jennifer Jones' supervision, concluded that all but four of the buttons are of jet, on the basis of their relatively low iron content, and indeed an identification as jet is strengthened by the fact that several of the buttons cracked in a manner characteristic of jet (Jones 2001b). The remaining four had a relatively high iron content (>500 ppm) and it was thought that at least one of these might be of lignite, but further analysis would be needed to test this, especially since subsequent work on jet characterisation undertaken

Table 2 Dimensions and characteristics of the 25 identifiable V-bored 'buttons'

Label[1]	Diameter (mm)	Height (mm)	Shape	Appearance	Condition[4]	Iron content, ppm, with (standard deviation)	Material (suggested ID)	Comment
23 #1	13.6	5.4	small, low rounded dome	shiny, black	good	–	jet	
23 #2*	17.3[2]	9.42	low dome, tiny chip missing from apex; facet	shiny, black	poor	–	jet	uni-directional striations on base
23 #3*	15.5	5.7	gently conical with variably-shaped facet	matte, brown/ black; iron corrosion products around holes on upper surface, suggesting pyrite inclusions	poor	641 (523)	not jet (?)	striations on facet; base shows traces of wear
23 #4*	8.4	10.7	small but tall, markedly conical	very dull matte, brown/black	good	1139 (661)	not jet	faint striations on upper surface; deeper multi-directional striations on base
D*	15.5	5.5	large, low, rounded dome; partial rounded facet	matte, black	fair	21(9)	probably jet	
G1	[fragmentary]		3 conjoining fragments with facet	one of the 'G' 'buttons' is semi-shiny, black/brown	[poor]	526 (320)	not jet (?)	multi-directional striations on base. (Note : it's unclear which of the 'G' 'buttons' was analysed
G2	[fragmentary]		2 non-conjoining fragments, no facet; 4 other non-conjoining small fragments from G1 or G2					
H	10	[fragmentary]	2 conjoining and 6 non-conjoining fragments of ?small 'button'	shiny, black	[poor]	–	jet	
I*	11–12	5	small, with low rounded dome, facet, fragment of circumference missing	matte, black	fair	–	jet	fine striations on part of facet; base has slightly wavy natural striations
J*	15.6	7	rounded dome, facet	matte, black	fair	201 (109)	jet	uni-directional striations on facet and base
K	[fragmentary]		10 small fragments including 2 conjoining; facet	shiny, black	[poor]	–	jet	striations on facet
L	14	5.6	rounded dome, partial facet	shiny, black	good	–	jet	uni-directional striations on base
Li	[fragment]		one fragment including part of dome	shiny, black	[poor]	–	jet	conchoidal fracture consistent with ID as jet
Lii*	11.9	5.6	small, conical (with part of apex missing), facet	matte, black	fair	-	jet	faint rilling inside one of the boreholes, traces of wear on base
M*	Max 16.5 (would have been larger)	5.9	reassembled from mass of fragments; possibly originally large, with rounded dome; much of circumference missing, giving the 'button' a squarish appearance in plan	matte, black/ brown	poor	1007 (510)	lignite?	faint striations on base
N*	16.3	7.7 (but incomplete)	conical (apex missing), with slight facet	matte, black	poor	246 (66)	jet	multi-directional striations on base

Label[1]	Diameter (mm)	Height (mm)	Shape	Appearance	Condition[4]	Iron content, ppm, with (standard deviation)	Material (suggested ID)	Comment
O*	15	4.9 (but incomplete)	probably conical, apex and part of circumference missing; facet	matte, black/ brown	poor	260 (133)	jet	uni-directional striations on base
P	[fragmentary]		8 non-conjoining fragments	shiny, black	[poor]	–	jet	
Q*	13.7	6.2 (but incomplete)	conical, apex missing, facet	matte, black	fair	136 (37)	jet	multi-directional striations on base ; fine scratches, possibly from use, on dome
T*	15.2	7.5	conical, facet	matte, black; tiny orange/ brown nodules, probably oxidised pyrite inclusions	fair	482 (161)	jet	uni-directional striations on base
U*	16.8	8.2	gently conical dome, almost rectangular in plan; facet	semi-shiny[3], black	fair (but much cracking and some crazing)	–	jet	base shows traces of wear
X*	14.6	5.2	rounded dome, with eccentric 'apex' and partial facet	shiny, black	good	–	jet	base seems polished – could be through wear
FA*	16	7.1	rounded dome, narrow facet	shiny, black	good (despite extensive crazing)	–	jet	faint striations on base
VA	[fragmentary]		9 small and tiny non-conjoining fragments	shiny, black	[poor]	–	jet	
WA	[fragmentary]		15 small and tiny non-conjoining fragments	shiny, black	[poor]	–	jet	

Notes. 1. Labelling: 23 #1–4 were found during the on-site excavation; the others were found during the laboratory excavation of the block. An asterisk indicates that the 'button' is illustrated in Fig. 19.
2. These dimensions do not tally with those on Fig. 19 for this 'button', which are closer to 15.5 x 6.5 mm, but the description matches.
3. It is unclear whether 'semi-shiny' indicates low sheen or partial sheen.
4. Key to descriptions of condition: Poor: much cracking leading to fragmentation and deformity; fair: some cracking leading in some cases to fragmentation but with original form and surface treatment visible; good: complete button with little cracking and retaining some polish. The condition of examples that exist only as fragments is described as [poor]. Note: Information for this table was compiled from reports created by Jennifer Jones in 2001 and by Aidan Campbell in 1999, edited in 2023 by Alison Sheridan

by Mary Davis and others has shown that some jet can contain relatively high iron levels (eg, Davis *et al* 2015). (The amounts of zirconium and of other elements useful in identifying jet were not published in Jones 2001b.) Re-analysis might also reveal whether the material was cannel coal or shale, rather than lignite or jet.

Disc beads, almost certainly of jet. At least 88 tiny disc beads, assumed to be of jet, were found during laboratory investigation of the block-lifted torso fragment. Most were found clustered around the left clavicle, among the bones of the left hand (particularly in the wrist area), with a few scattered further down the chest, moved no doubt by post-depositional bioturbation and the decomposition of the body (**Fig 9**, **Fig 10**, right, Figs 22–23). None was found below the body. Eighty-two of the beads were complete, and a further six lacked part of their circumference; there were also around 70 fragments from an indeterminate number of additional beads. All the beads are black with a shiny outer edge (and, in many cases, shiny flat surfaces: **Fig 23**.1), and are of a compact material assumed to be jet; their small size precluded compositional analysis in 2001, but the shiny conchoidal fracture surfaces noted on one bead (**Fig 23**.2) and the pattern of cracking noted on some beads support the argument that they are indeed of jet. They survived in better condition than many of the buttons. The beads are potentially small enough to have escaped observation during excavation in the field, but the concentration of beads in only one part of the laboratory-excavated block suggests that the assemblage was recovered in its entirety.

Figure 22. Jet disc beads, *in situ*

The beads are circular in plan and parallel-sided to slightly wedge-shaped in profile, with a perforation that is usually central; the outer diameter ranges from 3.2mm to 5mm, and their width from 1.3mm to 3mm. In most cases the perforated surfaces are flat, but some were dished. Jennifer Jones noted that the complete beads fall broadly into three groups (**Fig 23**.3): 'thick-walled', 'thin-walled' and 'tall'. Thick-walled beads are typically 5mm in external diameter, have a perforation 1.75mm in diameter, and the wall (ie, hoop thickness) is 2.5mm to 3mm thick. There are 49 beads of this kind. Thin-walled beads, of which there are 26, are between 4mm and 5mm in external diameter, have a perforation 1.25mm in diameter, and have a hoop 1mm thick. The five 'tall' beads are longer and more tubular, but none exceeds 3mm in width.

Some traces relating to the manufacture of these beads can be discerned. Striations on the perforated surfaces (**Fig 23**.4), initially thought to be saw marks, could alternatively be grinding striations relating to the individual shaping of the beads (Sheridan and Davis 2002, 823; Sheridan 2017). It appears that in most cases, the hole is parallel-sided (**Fig 23**.3); the exception is a thin bead, discussed below (**Fig 23**.5). The initial assumption (Jones 2001b) was that these beads were made by shaping a long, round-sectioned 'pencil' of jet, drilling it, and then sawing off individual beads. According to traditional Whitby jetworker Hal Redvers-Jones, however (reported in Sheridan 2017), alternative techniques, both featuring the individual drilling of the beads, may have been used: either a pencil-shaped roughout was made from a block of jet, then individual beads were sawn off and their flat surfaces trimmed by grinding, or else individual small pebbles of jet were ground into rough shape. Once drilled, the roughout beads would be strung and rolled against abrasive surfaces of increasing fineness to achieve a uniform diameter and round shape. Re-examination of the beads to check for any signs of hourglass-shaped drill-holes (which would indicate individual drilling) is recommended.

As regards wear traces, while one thin bead (**Fig. 23**.5) has a peculiar 'lobed' perforation that at first sight could be taken to indicate heavy thread-wear, it is possible that this bead had been perforated twice, with the position of the drill bit being shifted during the process. The perforation is not parallel-sided.

The location of these beads in the left wrist area suggests that they could have been deployed as a bracelet, thereby complementing the pair of bronze armlets as jewellery for the arms. The combined widths of the disc beads (at least 175mm) are sufficient to make a strand long enough to pass around a woman's wrist. While the distribution of these beads partly overlaps with that of the tubular bronze beads in plan, this is not sufficient to

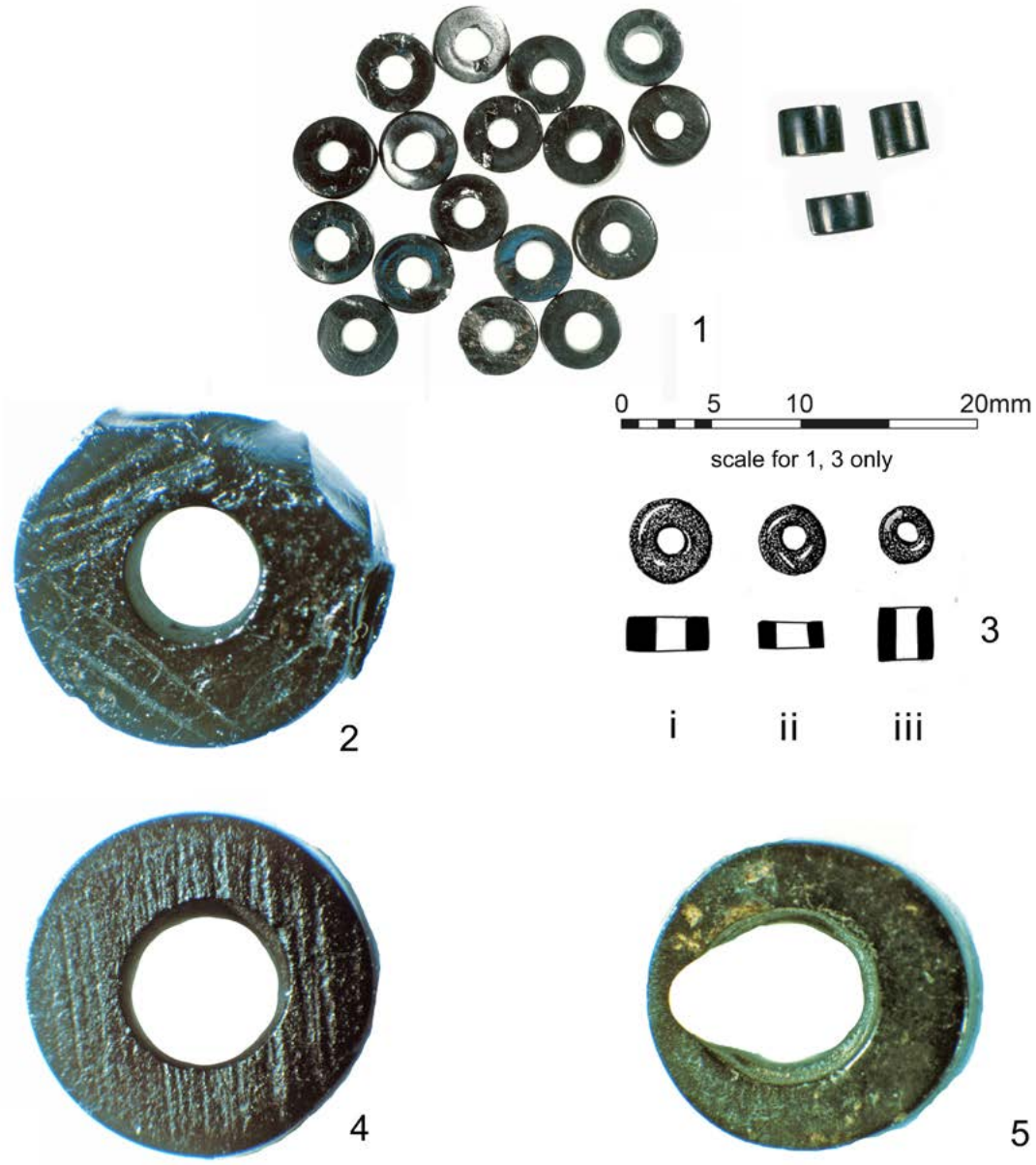


Figure 23. Jet disc beads, detail

argue that the disc beads had been used as separators for, or accompaniments to, the bronze beads; the two sets of beads appear to have belonged to two discrete artefacts.

Jet fusiform bead. Fusiform bead, 16mm long and with a maximum diameter of 9mm; exterior polished to a high sheen (Fig 24). This was found away from the main concentration of jet disc beads, indicating that it had been a separate item. The bead was found in several pieces and the exposed perforation reveals how it was perforated from each end, the boreholes slightly misaligned (Fig 24.3). There is evidence for wear at both ends, with the sloping of one end possibly relating to bead-on-bead wear, and the hollowing of the other end possibly relating to thread-wear – all this implying that the bead had started its life as a component of a jet spacer-plate necklace. Analysis of the bead using EDXRF revealed that it is of jet. The question of how the bead was deployed in the grave is discussed below.

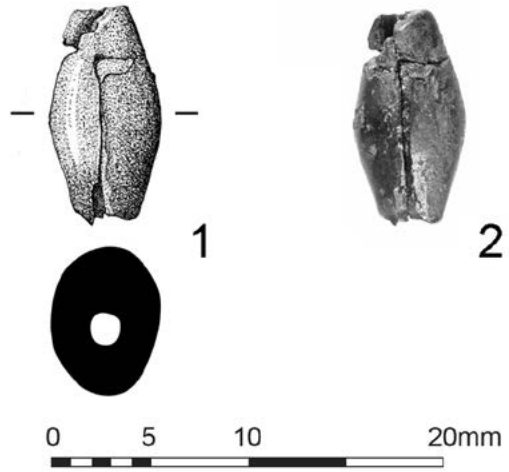
Stone disc bead. Three tiny fragments together make up 70 per cent of the outline of a small disc bead fashioned from a white material, thought to be chalk (Fig 25). One perforated surface is flat, the other dished. Discovered during laboratory excavation of material from the shoulder area of the skeleton, the bead was found close to one of the tubular sheet-bronze beads (Jones 2001b). The bead was *c* 3mm in diameter when complete. It is unclear whether it would have been a spacer bead between two bronze beads, or was deployed in a different way.

Fragments of rod, presumed to be of copper alloy (not illustrated). Two small fragments of metal rod, 10mm and 5mm long respectively, with a section 1.5mm square, were retrieved during sieving of palaeobotanical samples (Huntley 1997), so their exact position within the grave cannot be determined. They have no diagnostic features and their width is consistent – in other words, they do not taper. It is assumed that the metal is copper alloy, but the fragments have not been analysed. The nature of the artefact/s from which they have come is discussed below.

Ochre fragments. Eight fragments of ochre were found scattered over the torso (plotted on **Fig 10**, right). The fragments were not retained.

Flint scraper and flakes. Three flints were recovered from the grave fill. These include a squat flake with flat platform, diffuse bulb and feathered termination, consistent with knapping styles from the later Neolithic onwards. A very small flake of similar raw material was also present. Of greater significance is a scraper based on a robust flake with retouch along both edges and the end. The retouch ranges from semi-abrupt on the dorsal left edge, to invasive on the dorsal right edge and end (**Fig 26**). The item could be described as a horseshoe scraper, and the style of the flake and retouch suggest a Late Neolithic to Early Bronze Age date. The scraper, and possibly the flakes, are likely to have been deliberately deposited grave goods.

Cattle hide and possible bag or pouch. As noted above, these were represented by the slightest of traces. Mineralised hair attached to the exterior of the ribbed armlet (armlet 2) was found to be of cattle (**Fig 16**; Rogers 1999), and it may be that the mineralised hairs found on the outside of armlet 1 were also of cattle, although they were too decayed to be identifiable. The presence of these hairs, and their position, suggests that the corpse may have been wrapped in – or else covered by – a piece of cattle hide, its hair side facing the body. As for the possible bag or pouch, its existence was suggested by an amorphous patch of darkened soil, around 70mm x 50mm, partly overlying the ribbed armlet.



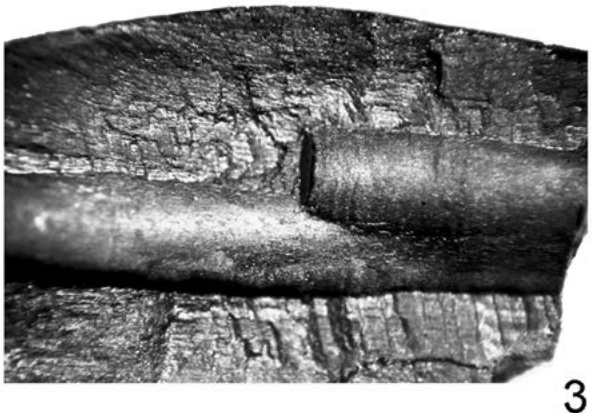


Figure 24. Jet fusiform bead

Figure 25. Chalk disc bead

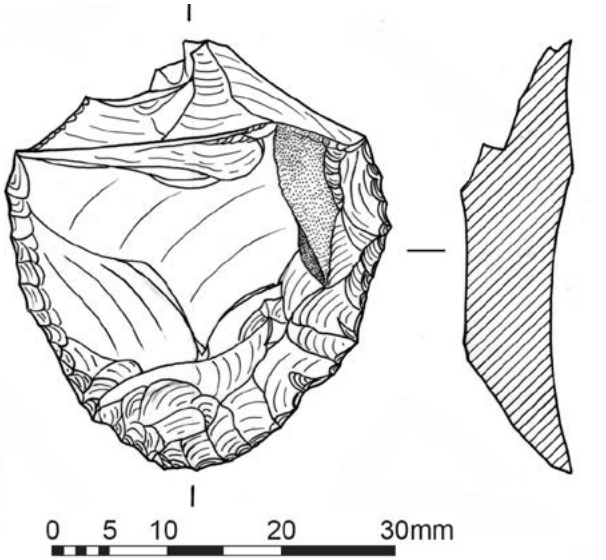


Figure 26. Flint horseshoe scraper

DISCUSSION OF THE GRAVE GOODS

by Blaise Vyner and Alison Sheridan,
with contributions from Jennifer Jones and Peter Rowe

Beaker pottery from the vicinity of Burials 1 and 4

The very small quantity of pottery found in the cemetery may derive from three separate Beaker vessels (of which one or two were found close to Burial 1 [sf 8], and one [sf 7] was found close to Burial 4). The radiocarbon date for Burial 1 accords with the expected date of the type of Beaker represented by the eight conjoining sherds of sf 8, while the date for Burial 4 *–1740–1540 cal BC (95% probability)* – lies outside the generally accepted date range for British Beakers. If the vessel in question had indeed been a grave good in Burial 4, then given its roughly cylindrical shape and simple decorative scheme, it may be that we are dealing with an exceptionally late example of that ceramic tradition, made at a time when Food Vessels had already been the dominant tradition in northern England for several centuries.

Within the region Beaker vessels are usually associated with inhumation burials (Spratt 1993, table 14), and it would be reasonable to assume that the Ingleby Barwick Beakers had originally been inside the graves, as grave goods. It has become clear from examples elsewhere that Beakers were not always deposited complete, and it is possible that the Ingleby Barwick vessels had been deposited in the graves in an incomplete state, as token deposits, although given the amount of plough truncation and disturbance in the area, not to mention the earthmoving operations, this would be difficult to prove. The central grave below a ploughed-out burial mound at Ferrybridge, West Yorkshire, contained a crouched burial (SK26) associated with an incomplete Beaker, and a second crouched burial (SK19) in an adjoining annexe was associated with a Beaker which had the base missing (Wheelhouse 2005, 42–8). The Beaker with SK26 was poorly fired and parts of it may have disintegrated after burial, but it appears that the vessel with SK19 at Ferrybridge was missing its base at the time of deposition (Vyner 2005, 127–30). The Lockington (Leicestershire) Hoard was associated with sherds from two incomplete vessels, not confirmed as Beakers, suggested to have been deposited as heirloom items, the missing parts of the vessels perhaps distributed to other family elements (Woodward 2000, 58–60).

Since the excavation of the Ingleby Barwick cemetery in 1996 there have been further discoveries of Beakers in the vicinity which confirm the importance of the Leven–Tees confluence as an area of Beaker-related activity. Excavations at Quarry Farm, Ingleby Barwick, around 2.5km to the north-west of Windmill Fields, recovered fragments of three Beakers from pit F274, one of them an All Over Cord (AOC) Beaker, the two others AOC-related (Young 2013, 24). At Maltby, 3km to the east, a single Beaker was found during building work (Vyner 2014).

Within the lowlands of the lower Tees valley, and the more extensive area of the Vale of York, Beaker pottery is a rare find, as are Food Vessels. In recent years large-scale excavation has led to the discovery of only small quantities of Beaker pottery in this area: a few isolated sherds are known from Nosterfield and others are from Catterick (Vyner 2003, 31), with additional unpublished finds from Scorton and Marton-le-Moor. Beaker burials are present at West Tanfield (Mayes *et al* 1986) and Ferrybridge (Vyner 2005, 127–30). In the lowlands Food Vessels are even less common, with a recent discovery of three examples from a probable damaged barrow at Sowerby, Thirsk (Vyner 2019a) and a rim sherd from Thorpe Thewles, north of the River Tees (Vyner 2019b) being notable additions to the funerary group from Quernhowe, north-east of Ripon (Waterman 1951). There are further instances of Beaker pottery from burial cairns on the uplands of the North York Moors, 14km and more to the south-east of Ingleby Barwick, including a handled Beaker from Highcliff Nab, Guisborough (Elgee 1930, 70; Clarke 1970, 414, fig 1068), a Beaker from Mount Pleasant, Normanby (Sockett 1971, 35–6, fig 3), and one from Nanny Howe, Kildale (Hayes 1966, fig 2). These vessels tend to be distributed around the periphery of the upland area (Spratt 1993, 84, fig 32). There are no local finds north of the River Tees, apart from a single sherd from Hartlepool Headland (Tees Archaeology HER). The sparse distribution of Food Vessels mirrors the pattern of upland-edge Beaker finds (Spratt 1993, fig 39), as well as that of both earthfast and 'portable' rock art (*ibid*, fig 33). The recent finds do little to dispel the impression that Chalcolithic and Early Bronze Age activity was sparse in the North Yorkshire, Tees valley and Durham lowlands (Hewitt *et al* 2011, 47–8). However, the Ingleby Barwick burials are further evidence to support the notion that Neolithic to Early Bronze Age activity in this region may have been focused on the major rivers, specifically at the location of their lowest fording points (Vyner 2007).

Stone macehead from Burial 4

This macehead falls within Fiona Roe's category of 'mace heads with centrally placed shaftholes' and in her sub-category of those with rounded ends (Roe 1979, 30 and fig 10). Such maceheads are of Early Bronze Age date, and include the spectacular examples from Bush Barrow, Wiltshire (Needham *et al* 2010) and Clandon, Dorset (Needham and Woodward 2008), the former made from a fossil Stromatoporoid and the latter from jet, shale and gold. In their discussion of the Clandon macehead (*ibid*, 22–8), Needham and Woodward reviewed the evidence for Early Bronze Age centrally perforated maceheads in Britain and Ireland and presented a catalogue of nineteen examples from archaeological contexts, together with a distribution map (*ibid*, fig 12). The Ingleby Barwick macehead lies to the north of a cluster of five centrally perforated maceheads in Yorkshire, including an example found in a Collared Urn near Scarborough (*ibid*, 10). The Ingleby Barwick macehead is one of only three centrally perforated maceheads to be associated with a radiocarbon date, and its date of *1740–1540 cal BC* (*95% probability)* (UB-4173, 3364±22 BP) obtained from the associated human remains in Burial 4 is very close to that of 1740–1520 cal BC (GrA-18021, 3355±40 BP) obtained from calcined human bone associated with an example from a cist at Cleughhead, Aberdeenshire (Gammack 1878; Sheridan 2007, 175). Needham and Woodward concluded that the centrally perforated series of maceheads probably emerged around 2000 BC; the Ingleby Barwick and Cleughhead examples indicate that their currency persisted into the third quarter of the second millennium BC.

Haematite lumps from Burials 3 and 4 and ochre fragments from Burial 5

The haematite lumps with Burial 3 and Burial 4 and the ochre fragments associated with Burial 5 may not have been collected simply as unusual items. Regarding the source of the haematite, Ken Sedman reports (pers comm) that although abundant ironstones occur in the Cleveland area, these do not contain significant quantities of haematite. Haematite is known to occur locally, but as very small concentrations filling weathering vughs and other secondary enriched layers; the material found in such situations rarely exceeds more than a few millimetres in thickness. It is also recorded on the coast of north-east Yorkshire in the Scarborough and Whitby areas (https://www.mindat.org/).

Ian Shepherd has drawn attention to the fact that both haematite and ochre had potential use in powdered form for polishing jet, having been used for that purpose on jewellery made in Whitby in the 19th century (Shepherd 1981, 44). As such, these may have been valued materials. Other uses for haematite and ochre are as colourants for the human body or for artefacts, with the former producing a blood-red paint, and ochre producing a range of dark red to yellow colours when ground and mixed with water. Haematite is known to have formed a part of Early Bronze Age fire-making kits; when used to make fire, it is almost exclusively associated with males (Teather and Chamberlain 2016). However, the absence of flint strike-a-lights from Burials 3 and 4, and the fact that the lumps seem unmodified and unworn, militate against the suggestion of their inclusion as fire-making equipment in these instances.

Other finds of haematite and ochre in Early Bronze Age graves suggest that, with their striking colours, these materials could have been accorded symbolic significance and perhaps attributed special powers (eg, to protect the dead or to guarantee immortality), and so could have been used as amulets. A haematite nodule was found in a richly equipped woman's grave at Garton Slack (Area VI, grave 1, burial 1), East Yorkshire (Brewster 1980, 202–6 and figs 89–92; Woodward and Hunter 2015, 265–8) and Mortimer reports the presence of lumps of ochre (or ochreous material) in graves at Garton Slack 153 (associated with a child aged 8–12 years and Garton Slack 40 (adult, possibly male), East Yorkshire (Mortimer 1905, 218, 229; cf lxxiv). Elsewhere, small lumps of ochre were found in a richly equipped, grooved-and-rebated stone cist at Poltalloch in Kilmartin Glen, Argyll and Bute, associated with a spacer-plate necklace mostly of jet (which will have been imported from the Whitby area) and the remains of a young adult, probably female (Craw 1929, 160). Closer to Ingleby Barwick, at Goodmanham (barrow 121, burial 6), East Yorkshire, lumps of a 'yellowish substance', probably ochre, were found near the body (Greenwell and Rolleston 1877, 329–31; Woodward and Hunter 2015, 273, 350). The association with graves that are conventionally (and with justification) referred to as 'high status' confirms the impression that ochre and haematite were indeed valued and significant materials.

Flint scraper and flakes from Burial 5, from the fill of Burial 4, and from elsewhere

The lithic raw material is generally light brown or red-brown flint with a well-reduced cortex where present. It is consistent with beach or glacial pebbles available locally and particularly along the Yorkshire coast. A flint scraper found with Burial 5 and two flakes from the same context may have been deposited intentionally. These have been described above.

Unstratified lithic items comprise three natural pieces of well-rolled gravel, an undiagnostic angular chunk and a squat flake with flat striking platform and pronounced bulb of percussion. This piece is consistent with flint knapping from the later Neolithic onwards when hard hammer knapping became the norm (Butler 2005, 157). From the ploughsoil came the distal end of a blade (sf 3) with a feathered termination typical of Mesolithic or Early Neolithic knapping. Mortuary Deposit 1a (context 06) contained a burnt flake (sf 1). This has a prepared platform, diffuse bulb of percussion and is slightly overshot. Parallel scars on the dorsal face suggest the flake had been detached from a blade core, indicating that the item is a residual Mesolithic or Early Neolithic piece. Mortuary Deposit 1b (07) produced a piece of natural angular flint gravel (sf 2).

Seven flints were recovered from the grave fill of Burial 4. These are largely undiagnostic, consisting of two natural pieces, one burnt fragment, an angular chunk and two small flakes. The flakes are both under 30mm in length with unprepared or flat platforms, diffuse bulbs of percussion and feathered terminations. None of the lithics in this grave fill is conclusively contemporary with the burial.

The metal, jet and stone grave goods and the organic artefacts from Burial 5

Bronze armlets. With its plain oval section and butt-jointed terminals, bronze armlet 1 belongs to Needham's Group 2 series of Early Bronze Age armlets, although it is noticeably slight by comparison with other examples, which are mostly from Scotland (Needham 2000, 29–31, fig 23). The Ingleby Barwick armlet 1 is most similar to an example from Luggacurran, Co. Laois, Ireland (Ó Riordáin and Waddell 1993, 118, no. 301); a fragment of a further similar object was found at Llanelwedd, Powys, Wales (Britnell 2013). Armlet 2 belongs in Needham's Group 3 series of more highly decorated armlets (Needham 2000, 31–35, fig 24). A parallel for the co-occurrence of plain bar armlets and ribbed armlets is offered by the set of six bar armlets, graded in size, plus a pair of ribbed armlets (or possibly anklets), from the Early Bronze Age hoard at Migdale, Sutherland (now in Highland Region: Anderson 1901; Clarke *et al* 1985, 302–3 and figs 4.33–34).

Tubular sheet-bronze beads. The 45+ tubular sheet-bronze beads constitute the largest number of such beads to have been found in a single context in Britain. They are closely comparable to a similarly sized group of around 40 from the aforementioned Migdale hoard (Anderson 1901, 271; Clarke *et al* 1985, 302 and fig 4.35) and, like them, the Ingleby Barwick beads seem to have contained wooden stiffeners to prevent them from being crushed. A fragment of willow stiffener from one of the Migdale beads has been radiocarbon dated to 2280–1770 cal BC (95.4% probability; OxA-4659, 3655±75 BP: Sheridan *et al* 1995, 432), and this is comparable to the date of *2130–1915 cal BC (95% probability)* for the human remains from Burial 5. While the Migdale beads were once thought to have been strung as a spacer-plate necklace (Stevenson 1956), on account of having been associated with a sheet-bronze cover for a spacer-plate, it seems more likely that they had been sewn onto a head dress that also included sheet-bronze conical ornaments, in the style of Bavarian Straubing culture female head-gear (Hundt 1958). The presence of holes on the side of the Migdale beads supports the idea that they had been fixed to some material.

As for how the Ingleby Barwick tubular beads had been deployed, the fact that no sign of any side perforation has been found, even on the intact bead, suggests that they are unlikely to have been sewn onto a garment. Rather, they could have been strung as a necklace, with the thread running alongside the wooden stiffeners, rather than through them – as is evident from the survival of a solid rod of stiffener (**Fig 18**) – and as suggested by the nick at one end of the intact metal bead (**Fig 17**). However, the fact that none of the tubular beads was found *below* the body suggests that, if they had indeed been strung as a necklace, that necklace was not being worn on the body, but had been placed on top of it, as if for display. This echoes the practice in the aforementioned adult woman's grave at Garton Slack (Area VI, grave 1, burial 1), East Yorkshire, where a composite necklace featuring six tubular sheet-bronze beads, 243+ tiny jet disc beads and a boat-shaped jet fastener had been laid out 'in an extended wavy line as if for display' on top of a folded garment, adorned with V-bored 'buttons' of jet and cannel coal or shale, in front of the corpse's chest and face (Brewster 1980, 202–6 and figs 89–92; Woodward and Hunter 2015, 265–8, fig 7.1.3). According to Brewster's account of the Garton Slack necklace, the metal beads lay at the front of the necklace, interspersed with a few of the disc beads that acted as buffers, preventing the ends of the metal beads from grating against each other (Woodward and Hunter 2015, fig 7.1.3). With the Ingleby Barwick tubular beads, the close proximity of the tiny chalk(?) disc bead to one of the metal beads led Jennifer Jones (2001b) to suggest that it might have acted as a buffer, although the same cannot be said of the tiny jet disc beads – or indeed of the V-bored 'buttons'– which, as noted above, have discrete spatial distributions indicating that they belonged to other items in the grave. Had there been other 'buffer' beads in addition to the chalk(?) bead, these could have been of an organic material that did not survive. As noted above, the proximity of the jet fusiform bead to some of the tubular beads suggests that it could conceivably have been used as a fastener for the putative necklace.

Tubular sheet metal beads are rare in Britain, although they are commoner – and generally longer – in continental Europe, with the Bavarian Straubing culture Early Bronze Age examples (Hundt 1958) having already been noted, for example. The Straubing beads are broadly contemporary with the Ingleby Barwick and Migdale examples. As with these Bavarian examples, somewhat later tubular sheet-bronze beads found in Lower Saxony and Denmark have been reconstructed as part of a decorative head dress (Wegner 1996, 97).

The earliest British tubular sheet metal beads date to the Chalcolithic period (25th–22nd century BC) and comprise a gold example from a male's grave at Chilbolton, Hampshire (Russel 1990, 163–4), the skeleton dated to 2570–2300 cal BC at 95.4% probability (OxA-V-2271-35, 3935±32 BP: Parker Pearson *et al* 2019, 49); a set of four, also of gold (and with lateral perforations), from a female's grave at Horton, Berkshire (Needham and Sheridan 2014); and a set of at least five of copper, along with fragments of wooden stiffeners, found associated with fourteen tiny jet disc beads, a Wessex/Middle Rhine (Mid-Carinated) Beaker and unburnt human remains at Beggar's Haven, Sussex (Clarke 1970, 302; Kinnes 1985, A10; Woodward and Hunter 2015, 283–5 and fig 7.1.12); this grave is very likely to be of Chalcolithic date. Early Bronze Age examples that are probably or definitely of bronze include, in addition to the Migdale beads, one or two from a Cordoned Urn at Kilmagadwood, Perth and Kinross, Scotland (Sheridan *et al* 2018); one from a grave at Waterhall Farm, Chippenham, Cambridgeshire (Martin 1976, 10–12); one each from handled cinerary urns at Bere Down and Roke Down, Dorset (Grinsell 1959, 88–9); and the aforementioned six from a composite necklace at Garton Slack. The Garton Slack necklace was associated with an adult female, radiocarbon dated to 2300–2050 cal BC (OxA-V-2279-34, 3781±31 BP: Parker Pearson *et al* 2019, 58).

Fragments of metal rod. Little can be said about these two small fragments of metal (presumed to be of copper alloy), found during the sieving of palaeobotanical samples. The slenderness of their section (1.5mm square) is remarkable, making their identification as to artefact type difficult. Their possible identification as parts of an awl is suggested, although there is no section near any tip which might suggest narrowing, like, for example, the awl from Aldro 113, East Yorkshire (Mortimer 1905, 76 and fig 165). Also, awls tend to be larger than 1.5mm in general section (see Woodward and Hunter 2015, 175–81).

V-bored 'buttons' or studs, mostly (or all?) of jet. As noted above, the results of macro- and microscopic examination and compositional analysis using EDXRF (Table 2 and see Jones 2001b) confirmed that virtually all of these objects are of jet; as for the four examples high in iron (of which one was tentatively identified by Aidan Campbell as being of lignite), re-analysis is recommended to check whether these are of cannel coal, shale or even high-iron jet. The most likely source area for the jet is the coast to the north and south of Whitby in north-east Yorkshire (between Ravenscar and Skinningrove), 32–46km east of Ingleby Barwick, although inland sources of jet at the west end of the North York Moors are also known. As discussed elsewhere (eg, Sheridan 2015), it appears that specialist jetworkers were based around Whitby during the Early Bronze Age, and it is likely that the 'buttons' and beads of this material were made there and acquired through a network of inter-community contacts.

According to Ian Shepherd's typology of V-bored 'buttons' in Britain, the Ingleby Barwick examples all fall within his 'Type 2, Hunmanby' category (with the bevelled examples being type 2(B)), despite the variability in their dome shape (Shepherd 2009, 340, 363). A comparison can be made with the group of 20 V-bored jet 'buttons' that were found, along with a boat-shaped fastener, as a secondary deposit in an Early Neolithic cairn at Street House, Loftus, Cleveland, around 30km to the east of Ingleby Barwick (Jelley 1984). Jelley distinguished three groups among the Street House assemblage (*ibid*, 180–2 and fig 19): large, steep-sided 'buttons' 18–20mm in diameter and 10–12mm high; shallow-sided 'buttons' 18–20mm in diameter and 6–8mm high; and small 'buttons' 14–18mm in diameter and 6–8mm high. Most of the Ingleby Barwick 'buttons' fit into Jelley's category of small 'buttons', with some being even smaller than the lower end of that category; they are thus at the smallest end of the jet 'button' range.

As for how the Ingleby Barwick 'buttons' were deployed, their small size, abundance, and the absence of obvious signs of wear to the boreholes suggest that they had not in fact been used as functioning buttons, or indeed as necklace beads – another use noted by Ian Shepherd (2009) – but instead are most likely to have been sewn onto a garment (or another kind of organic object) as decorative studs, as pointed out by Jelley in discussing the Street House 'buttons' (Jelley 1984, 179–80).

The faceting of the junction between the dome and base on several of the 'buttons' is consistent with such an interpretation, as the facets would have made the edge of the base less sharp and less likely to damage the organic material to which they were attached. The fact that most of the 'buttons' were found upside down, with

their bases uppermost, begs the question of whether we are dealing with a hypothetical garment – possibly even a head dress placed in the hands, or a composite neck ornament such as a studded ribbon – that was deposited on the body with its studded side facing down, or else with a garment such as a tunic, with studs around the front of the neckline, that was worn inside-out by the corpse (with the turning inside-out perhaps symbolising the transformation associated with death). In this respect attention should be drawn once more to the aforementioned adult female grave at Garton Slack (Area VI, grave 1, burial 1, East Yorkshire: Brewster 1980, 202–6 and figs 89–92; Woodward and Hunter 2015, 265–8, fig 7.1.3), where a garment studded with 'buttons' of jet and cannel coal or shale appears to have been deposited in front of the chest and face of the corpse, folded, with the apices of the 'buttons' facing downwards, and with a jet and metal-bead necklace laid out on top of it. To judge from the photographs of the Ingleby Barwick 'buttons' *in situ* (Fig 20; cf Fig 10, right), the artefact to which the 'buttons' were attached is likely to have lain under the hands, and not over them, to judge from the intensity of metal-staining on the hand bones from the metal beads: had the 'buttons' been attached to a garment placed over the body, with the metal necklace on top of it (in an arrangement reminiscent of that seen at Garton Slack), one might arguably have expected less intense staining.

Ian Shepherd's review of V-bored 'buttons' in Britain has provided a comprehensive study of the uses and currency of this artefact type, so only a summary is offered here. Essentially, Shepherd identified a range of uses relating to the different sizes of the 'buttons', ranging from actual use as buttons – to fasten jackets (often as a set of six buttons), cloaks, pouches and 'leggings' – to use as decorative studs and as necklace beads, including necklace fasteners. Their use as buttons tends to be a male attribute, while their use as studs and necklace components has female associations (as at Garton Slack, mentioned above, where the thirteen 'buttons' seem to have been arranged as two vertical lines). As is clear from Shepherd's distribution map (2009, fig 1) – and not surprisingly, given the location of the major source of jet around Whitby – Ingleby Barwick lies within the densest concentration of V-bored 'buttons' in Britain, with all sizes being represented, including the largest (Shepherd's Type 1), which are thought to have fastened cloaks: one such button, measuring 38mm in diameter, was found at the Street House Wossit palisaded enclosure site (Jelley 1988, 194); two, 47 and 48mm in diameter respectively, were found at Rudston, East Yorkshire (Barrow 68 Burial 7: Kinnes and Longworth 1985, 76); and one nearly 60mm in diameter was found at Easington, East Yorkshire (Mackey 2006). 'Buttons' comparable in size to the Ingleby Barwick examples include, as well as the aforementioned Street House set, a set of 20 from Hunmanby (250, burial 3), East Yorkshire, found in a line from the neck to the waist (Greenwell 1890; Kinnes and Longworth 1985, 119 and fig 250; Woodward and Hunter 2015, 164–7 and fig 5.3.3).

The continental origin and currency of V-bored 'buttons' were discussed by Shepherd (2009), with further dates discussed by Woodward and Hunter (2015, chapter 9), and it is clear that the Ingleby Barwick examples fall firmly within the *floruit* period of the 23rd to the 20th century BC, roughly contemporary with those from Garton Slack and Migdale, and possibly slightly earlier than the set from Street House, for which a date of 1930–1625 cal BC (95.4%; BM-2007N, 3470±50 BP) was obtained (Vyner 1988, 199). (Note that the date in question was a re-date to replace a faulty date [Bowman *et al* 1990, 65])

Jet disc beads. As noted above, it seems most likely that the tiny disc beads of jet in Burial 5 had been deployed as a bracelet, meaning that the left arm was adorned with two pieces of jewellery: a bracelet and the ribbed bronze armlet 2.

The origin, uses and distribution of jet and jet-like[1] jewellery made using tiny disc beads of relatively uniform diameter have been discussed fully elsewhere (Sheridan 2015), so will not be rehearsed in detail here. Essentially, a Continental, Bell Beaker origin can be traced, and Chalcolithic examples in Britain include the necklace of 55 such beads of Kimmeridge shale, strung in with a tubular sheet-gold bead, found in the aforementioned male Beaker-associated grave at Chilbolton, Hampshire (Russel 1990; Needham 2012; Sheridan 2015, 341). An example of probable Chalcolithic date from northern England is the necklace of 160 jet beads from Folkton (barrow 245, 'Bording Dale', burial 8), East Yorkshire, which was associated with a sub-adult individual, two All Over Cord Beakers, a bone belt-ring, a flint scraper and two flint flakes (Kinnes and Longworth 1985, 243; Woodward and Hunter 2015, 275–7, fig 7.1.7).

The use of tiny disc beads seems to have increased significantly at the beginning of the Bronze Age, between the 22nd and 19th century BC (when the use of jet in general increased and when Burial 5 was created), and a number of artefacts made using such beads are known from northern England, as well as elsewhere in Britain.

1 The term 'jet-like' is used here to indicate materials, such as lignite and Kimmeridge shale, which resemble jet in their dark colour and general appearance; in their geological formation and composition, however, they are distinct from jet.

Several of these were studied in detail in Woodward and Hunter's project on Early Bronze Age grave goods (2015, chapter 7; see summary tables 7.3.2 and 7.3.3).

The beads have been deployed in various ways, but mostly as necklaces, both single-strand and multi-strand. The single-strand necklaces comprise examples where i) the disc beads were used on their own; ii) the disc beads were strung in with tubular sheet-bronze beads; and iii) the disc beads were strung in with fusiform beads, the latter probably 'recycled' from spacer-plate necklaces. The fasteners associated with these single-strand necklaces vary in shape, perhaps as a way of individualising them. Examples of type (i) single-strand necklaces are Garton Slack barrow 75 (168 disc beads); Garton Slack Area 29, grave 1, burial D (731 disc beads); and Goodmanham barrow 121, burial 6 (124 disc beads), all in East Yorkshire (Woodward and Hunter 2015, 263–5, 268–70, 272–5, figs 7.1.2, 7.1.4 and 7.1.6). A variant featuring disc beads that are graded in size is known from Weaverthorpe barrow 44, burial 2, East Yorkshire (118 disc beads), where diameters ranged from 4.9 to 8.6mm (*ibid*, 270–2 and fig 7.1.5). The composite necklace from Garton Slack Area VI, grave 1, burial 1, East Yorkshire exemplifies type (ii), with its six sheet-bronze tubular beads and 243+ disc beads (*ibid*, 265–8, fig 7.1.3); a further possible example, but from a badly disturbed grave, is known from Waterhall Farm, Chippenham, Cambridgeshire (Martin 1976; Sheridan 2015, 342, 343). An example of a type (iii) disc-and-fusiform necklace is that from Garrowby Wold barrow 64, East Yorkshire, with its two fusiform beads and 204+ disc beads (Woodward and Hunter 2015, 261–3, fig 7.1.1). A variant of the type (iii) necklace, featuring disc beads that are graded in size, is known from Eglingham barrow 200, burial 3, Northumberland (92 disc beads, 4.4–8.7; *ibid*, 281–3 and fig 7.1.11). Several single-strand disc-and-fusiform-bead necklaces are also known from Tayside and Fife in east and east-central Scotland (Sheridan and Davis 2002, fig 8C), including two from a cemetery at Almondbank, Perth and Kinross (Close-Brooks and Shepherd 1997). That from cist VII comprised 37 disc beads, 5–7mm in diameter, plus 15 fusiform beads and a fastener made from a re-used spacer-plate, while that from cist IX comprised 218 disc beads, 4.75–7.75mm in diameter, and 12 fusiform beads; according to the excavator, the disc beads had been arranged, graded in size, to echo the shape of the fusiform beads. Elsewhere in Tayside and Fife, a dozen tiny disc beads, 3.3–3.5mm in diameter, were found at one end of a disc-and-fusiform necklace at Strathairlie, Fife (Largo Field Studies Society 1968, 21–2).

As regards multi-strand necklaces featuring tiny disc beads, these vary in their design. One example from Calais (Callis) Wold barrow 13, East Yorkshire, featured six strands of disc and fusiform beads, strung between two triangular terminal plates, and with two boat-shaped fasteners (Mortimer 1905, 166; Woodward and Hunter 2015, 286–92 and fig 7.2.1); it is uncertain whether a set of ten V-bored 'buttons' in that grave had also been deployed as necklace beads (*ibid*, 286–92, fig 7.2.1; the number of disc beads in that necklace is 573). A variant on that design of necklace was found at Masterton, Fife, on Scotland's east coast: this had five strands, mostly of fusiform beads but with 91 tiny disc beads forming the ends of the strands, plus a boat-shaped fastener (Henshall and Wallace 1963, 147–8 and fig 2; Sheridan and Davis 2002, fig 6). There must have been some kind of organic terminal plates to keep the strands separated. Tiny disc beads were also used in other kinds of spacer-plate necklace, as at Middleton Moor, Derbyshire, where spacer-plates as well as terminal plates were used along with disc and fusiform beads, and possibly also 'buttons', in a necklace that was clearly old, and made up of parts of more than one necklace, when deposited (Woodward and Hunter 2015, 307–13 and fig 7.2.9; note that its current pattern of stringing retains its fanciful 19th-century arrangement). Closer to Ingleby Barwick is a necklace from Pockley barrow 2, North Yorkshire, whose components included a spacer-plate bored to take five strands of beads (*ibid*, 332–6 and fig 7.2.18). There, the spacer-plate, 298+ disc beads, one fusiform bead, two V-bored fasteners, one through-perforated fastener, a rough-out and five V-bored 'buttons' were found on the old land surface below the ploughed-out barrow (Smith 1994, 111).

Examples of tiny disc beads used in other ways are far rarer, with just one other example of deployment as a bracelet known to the authors – from an Early Bronze Age round barrow at Roundway, Wiltshire (Sheridan 2001; cf a bracelet of jet or jet-like fusiform beads from a female skeleton at Southery Fen, Cambridgeshire: Lethbridge *et al* 1932). A unique example of the deployment of tiny disc beads in a belt is known from the cist grave of a female at Culduthel on the outskirts of Inverness, Highland (Low 1929; Parker Pearson *et al* 2019, 169 and fig 4.28). The individual in question has been radiocarbon dated to 2200–1970 cal BC at 95% probability (OxA-V-2166-45, 3697±33 BP, Parker Pearson *et al* 2019, 45). Elsewhere, in Cornwall, tiny disc beads, assumed to be of Kimmeridge shale, had been inserted into the ends of two ribbed biconical faience beads at Boscregan in order to narrow the hole through which the thread (of a presumed necklace) passed (Borlase 1885, 188). The Boscregan beads are likely to post-date the other tiny disc beads described above, probably dating to around the 18th century BC.

Fusiform bead. As noted above, this bead could well have started its life as a component in a jet spacer-plate necklace; its size (16mm x 9mm), shape and pattern of use-wear are all consistent with this interpretation (cf, for example, a recently excavated jet spacer-plate necklace from a grave at Dunragit, Dumfries and Galloway: Sheridan 2021). As for how it had been deployed in the grave, its distance from the jet disc beads (notwithstanding the possibility of some post-depositional movement) is such that it is unlikely to have been associated with them. Instead, its proximity to some of the tubular sheet-bronze beads (**Fig 9**, **Fig 10**, right) raises the distinct possibility that it had been used as a toggle-fastener for the hypothetical necklace of those beads, analogous to the boat-shaped jet toggle from the aforementioned composite bronze-and-jet necklace at Garton Slack (Area VI, grave 1, burial 1), East Yorkshire (Brewster 1980, 202–6 and figs 89–92; Woodward and Hunter 2015, 265–8, fig 7.1.3). Indeed, with the eye of faith it is possible to discern two rough lines of metal beads radiating from the position of the fusiform bead (**Fig 10**, right), as though the necklace had been laid with its fastener resting beside the right radius and ulna.

There have been numerous finds of fusiform jet beads in north-east England, many of them described and discussed in Ann Woodward and John Hunter's volume on Early Bronze Age grave goods (2015). In many instances they have been strung along with tiny disc beads in single- or multi-strand necklaces and, as argued in the Woodward and Hunter volume, in these cases the fusiform beads may well have been 'recycled' from spacer-plate necklaces, like the Ingleby Barwick bead (Sheridan 2015). Examples include the aforementioned single-strand disc-and-fusiform necklace found under a round cairn at Eglingham, Northumberland, whose eight fusiform beads range in length between 19mm and 24mm and in maximum thickness between 7mm and 8mm (Kinnes and Longworth 1985, 103; Woodward and Hunter 2015, 281–3 and fig 7.1.11); and the aforementioned multi-strand disc-and-fusiform necklace from Calais (Callis) Wold barrow 13, East Yorkshire (Mortimer 1905, 166; Woodward and Hunter 2015, 286–92 and fig 7.2.1), whose fusiform beads range in length between 11mm and 24.5mm and in maximum thickness from 5.5mm to 8.5mm.

The putative organic pouch and cattle hide wrapping. Little can be said about the putative organic pouch partly overlying armlet 2 as the evidence for it is so slight, consisting of just an amorphous patch of darkened soil, around 70mm x 50mm. The presence of a pouch would not be out of place in an Early Bronze Age funerary context, however, as several *comparanda* can be cited (albeit from definitely or probably male graves), including the traces of a probable netting bag found in the immediate vicinity of fire-making equipment in a cist at Forteviot, Perth and Kinross (Brophy and Noble 2020). In his discussion of the uses of V-bored 'buttons', Ian Shepherd argued that several had probably been used to fasten pouches, citing examples of their proximity to clusters of fire-making equipment that had probably been contained in pouches, for example at Rudston barrow 68a, East Yorkshire (Shepherd 2009, 347).

As for the evidence for a piece of cattle hide having been used in Burial 5 to wrap or cover the body, its hairy side facing inwards, there are several Early Bronze Age *comparanda* for the inclusion of cattle hide (and other animal hides) in graves. Around a dozen instances of animal hides in Early Bronze Age cists have been noted in Scotland (McAdam 1982, 126–7 and table 4; Arabaolaza 2013; Lelong 2014; Brophy and Noble 2020), and a few further examples are known from England (eg, in the Gristhorpe tree-trunk coffin: Buckley 2013, 174; Sheridan *et al* 2013). A particularly fulsome account of one such find from a grave beneath a round barrow on Parwich Moor, Shuttlestone, Derbyshire, is offered by Bateman:

> the skeleton of a man which had been interred while enveloped in a skin of dark red colour, the hairy surface of which had left many traces both upon the surrounding earth and upon the verdigris or patina coating a bronze axe-shaped celt and dagger deposited with the skeleton. On the former weapon there are also beautifully distinct impressions of fern leaves, handsful of which, in a compressed and half-decayed state, surrounded the bones from head to foot. From these leaves being discernible on one side of the celt only, while the other side presents traces of leather alone, it is certain that the leaves were placed first as a couch for the reception of the corpse with its accompaniments, and after these had been deposited, were then further added in quantity sufficient to protect the body from the earth… Close to the head were one small black bead of jet and a circular flint; in contact with the left upper arm lay a bronze dagger with a very sharp edge, having two rivets for the attachment of the handle, which was of horn, the impression of the grain of that substance being quite distinct around the studs. (Bateman 1861, 40–41)

In most cases the hides are of cattle (and more specifically, ox, in several cases, and probably aurochs in one: McAdam 1982, table 4), although sheepskin was found at Keas Cottage, Spinningdale in northern Scotland (Arabaolaza 2013), and in a prominently located and richly equipped cist at Whitehorse Hill on Dartmoor, Devon, the cremated remains of the deceased were wrapped in the pelt of a brown bear (Jones 2017, 66–7). The hides had been deployed in various ways, although mostly to wrap the body; in the Masterton cist in Fife where

two individuals were buried together, the suspected aurochs' hide had lined the floor of the cist (Henshall and Wallace 1962). It is clear that the inclusion of animal hides in Early Bronze Age graves was one of several ways of signalling the high status of the deceased. Such hides will have been valued possessions in their own right, and in many cases the graves in which they are found also contain rare and precious grave goods (as is the case at Ingleby Barwick). McAdam has also noted (1982, 126) that many of the cists in which hides are found are above average size, and they tend to be sited on prominent natural knolls of sand or gravel.

Overall assessment of the grave goods from Burial 5

The finds assemblage associated with Ingleby Barwick Burial 5 presents a significant addition to the corpus of excavated Early Bronze Age material from the region. The wealth and variety of these grave goods – the bronze armlets, the sheet-bronze tubular bead necklace, the jet disc-bead bracelet, the jet and jet-like 'buttons', the ochre, the flints, the fragments of putative awl, the possible organic pouch and the cattle hide wrapping or cover – arguably distinguish this grave as the most richly equipped of the high-status Early Bronze Age graves in Yorkshire. The occasion of the funeral, with the theatrical placing of the metal necklace on the chest and the wrapping or covering of the corpse with cattle hide, was clearly used as a way of displaying the special status of the woman.

In terms of Stuart Needham's periodisation of the Chalcolithic and Early Bronze Age (as presented, for example, in Woodward and Hunter 2015 – formulated for southern Britain but applicable to the north too), the Ingleby Barwick Burial 5 assemblage and most of the *comparanda* discussed above belong within his Period 2, the earliest part of the Early Bronze Age (2200/2150–1950 BC), following the Beaker 'fission horizon' (Needham 2005). This was a time when Food Vessels were in use, along with late styles of Beaker pottery, and when funerary practices were diversifying. It was also a time when differences in status and wealth were emphatically expressed through funerary practices – not just in the choice of grave goods but also in the form of the grave, and of any covering mound, as the several tree-trunk coffin graves in Yorkshire, including Gristhorpe, make clear (Parker Pearson *et al* 2013, fig 4.1 and appendix 4.1). The use of tree-trunk coffins appears to have been reserved for high-status males (*ibid*, 42–3).

In Yorkshire, as elsewhere in Britain, there was a gender-based Early Bronze Age 'vocabulary of esteem', as expressed through grave goods. Female status started to be signalled regularly, Ingleby Barwick Burial 5 assemblage being an outstanding example of a female suite of objects. For males, this involved the use of (*inter alia*) bronze-bladed or flint daggers (Smith 1994, table 6), V-bored 'buttons', mostly of jet, used as fasteners for cloaks, jackets, pouches and leggings (Shepherd 2009), jet belt rings, and occasionally stone battle-axe-heads (as at Garton Slack barrow 37, burial 6: Clarke *et al* 1985, fig 4.9). For females, the indicators of wealth and high status feature jewellery and dress accessories, principally of jet, with single-strand or spacer-plate necklaces and V-bored 'buttons' (used as decorative studs and perhaps also as necklace components) being the main artefact types. In both male and female high-status Early Bronze Age graves in Yorkshire, the inclusion of a pot is not a common occurrence; in their study, Woodward and Hunter found only three associations between a Food Vessel and a necklace (including at Weaverthorpe barrow 44 and Garton Slack barrow 75), and just one with a V-bored 'button' (at Acklam Wold barrow 123) (Woodward and Hunter 2015, table 11.38; Shepherd 2009, 360).

While several graves in Yorkshire offer *comparanda* for individual elements of the Burial 5 grave good repertoire (as detailed above), the aforementioned adult female grave at Garton Slack Area VI, burial 1, in the Yorkshire Wolds shares more in common as it contained a necklace comprising 243+ tiny disc beads and six sheet-bronze tubular beads, plus a garment adorned with two rows of V-bored 'buttons', almost certainly used as decorative studs (Table 3). As noted above, the garment appears to have been deposited in front of the chest and face, folded, with the apices of the studs pointing downwards, and with the necklace deposited on top of it in a wavy line (Brewster 1980, 205; Woodward and Hunter 2015, 266). The theatricality of this act of deposition echoes that of the deposition of the metal bead necklace on the body at Ingleby Barwick. As is clear from Table 3, the two graves have produced broadly contemporary radiocarbon dates; theoretically they could have been very close in time to each other. Also shown in Table 3 is the assemblage from another broadly contemporary adult female grave at Garton Slack, with its necklace of tiny disc beads. All three graves share roughly the same orientation, with the women buried on their right, facing east or south-east.

Table 3 Ingleby Barwick Burial 5 and comparable dated burial assemblages from East Yorkshire

	Ingleby Barwick Burial 5	**Garton Slack Area VI, Burial 1**	**Garton Slack Area 29, Grave 1, Burial D**
Calibrated radiocarbon date cal BC (95% probability)	*2130–2090 (10%) or 2040–1915 (85%)* UB-4174, 3609±24 BP (Modelled date: Highest Posterior Density interval value)	2300–2050 OxA-V-2279-34, 3781±31 BP	2190–1940 OxA-V-2279-33, 3668±32 BP
Side, head, facing	right, SW, SE	right, S, E	right, S, E
Sex and age	female, adult, young to middle-aged	female, adult, young or middle-aged	female, adult, middle-aged
Bronze	2 armlets 45+ sheet-bronze tubular beads 2 fragments copper alloy(?) wire or rod	6 tubular sheet bronze beads	awl
Jet (and jet-like)	at least 25 V-bored 'buttons' at least 88 tiny disc beads fusiform bead	13 V-bored 'buttons' 243+ tiny disc beads boat-shaped fastener	722+ tiny disc beads triangular fastener
Other	stone (chalk) tiny disc bead 8 ochre fragments 1 flint scraper and 2 flakes possible organic pouch cattle hide		
References	Brewster 1980, 204–6 (= pp 174–7 in the 2010 reprint of the 1980 report); Sheridan 2015, 342–3; this publication	Sheridan 2015, 342–3; Woodward and Hunter 2015, 161–3; Sheridan *et al* 2015, 265–8; Parker Pearson *et al* 2019, 58, 196	Brewster 1980, 581–83; Woodward and Hunter 2015, 268–70 and 469; Parker Pearson *et al* 2019, 58, 196

The extensive cemetery (or cemeteries) at Garton Slack lies around 75km south-east of Ingleby Barwick, and while it is clear that the community to which the Burial 5 woman belonged had close links with the occupants of the Yorkshire Wolds and with the jetworkers in the area around Whitby, it is also clear from the discussion of *comparanda* above that they could well have been connected with communities living further up the North Sea coast, in eastern Scotland. This is evident not only from the shared use of tiny disc beads but also from the similarities with the bronze bangles and tubular sheet-bronze beads (and, to a lesser extent, the V-bored 'buttons') found in the hoard at Migdale, Sutherland (Highland). As noted above, this will have been broadly contemporary with Burial 5 at Ingleby Barwick. There is abundant additional evidence indicating links between Yorkshire and eastern Scotland during the Early Bronze Age, not only in grave assemblages and in the use of jet from the Whitby area (Sheridan and Davis 2002) but also in the use of Yorkshire-style Food Vessels (Simpson 1968). Such connections were not limited to the beginning of the Early Bronze Age: the virtually identical dates in the second quarter of the second millennium for the centrally perforated stone maceheads from Ingleby Barwick Burial 4 and from Cleughhead, Aberdeenshire, discussed above, suggest a persistence of this network of contacts.

THE HUMAN REMAINS

by Sue Anderson

All the human remains from the five single graves and the two mortuary deposits were submitted for analysis; at least fifteen individuals, and possibly as many as twenty, are represented. The assemblage is too small to allow for any statistical analysis of data. Full details of each skeleton and disarticulated bone group are available in the archive.

Method

Measurements were taken using the methods described by Brothwell (1981), together with a few from Bass (1971) and Krogman (1978). Sexing and ageing techniques follow Brothwell (1981) and the Workshop of European Anthropologists (WEA 1980), with the exception of adult tooth wear scoring, which follows Bouts and Pot (1989). All systematically scored non-metric traits are listed in Brothwell (1981), and grades of cribra orbitalia can also be found there.

Comparative material

Groups of comparative material which have been studied as part of this project, in order to contextualise the findings from Ingleby Barwick, are listed in Table 4. Minimum numbers of individuals include inhumations but not cremated human remains.

The closest contemporary material is from East Yorkshire (Brothwell 1960) and the same is true of large groups of earlier and later remains. Neolithic barrow groups with published human bone reports include Kilham long barrow (Dawes 1976), Esh's Barrow (Hicks 1968), and Duggleby Howe (Kinnes *et al* 1983), although generally the information concerning the skeletal remains is heavily abbreviated. A survey of health and disease in Britain carried out in the late 1990s and early 2000s included only 45 sites dating to the entire Bronze Age period, with a total of 291 skeletons from England, Scotland and Ireland (Roberts and Cox 2003, 75), and it appears that very few inhumation burials have been added to this overall total in the intervening years. Instead, new work has involved reassessments of antiquarian finds, many of which are incomplete or represent only single burials. Gamble and Fowler (2013) reassessed the human remains from fourteen Early Bronze Age sites in Tyne and Wear in 2011, but the majority of the sites comprised individual cist burials. Walsh (2013) looked at a number of burials from northern England, with one of the largest groups being Green Howe, North Deighton, North Yorkshire (Wood 1971).

Number of individuals

The remains from the five single graves are of five articulated skeletons, although those in Burials 1 and 2 had been disturbed by machine prior to collection. Two sets of disarticulated, commingled bone were collected (Mortuary Deposits 1 and 2). In total at least fifteen and possibly as many as twenty individuals were identified in the skeletal deposits, namely five from the individual graves, five from Mortuary Deposit 1 and at least five and possibly as many as ten from Mortuary Deposit 2 (Tables 1, 5). Arriving at a reliable estimate of the number of individuals in Mortuary Deposit 2 is impossible, given the fragmentary character of the remains.

Condition

Bone condition was generally recorded as fair or good, although one skeleton was in poor condition. All bones were heavily fragmented and some reconstruction was required to obtain both skull and long bone measurements. This was considered worthwhile due to the rarity of skeletons of this period in the north-east. Most bones had some surface erosion. In some cases this took the form of solution erosion, and this would be consistent with the context for Mortuary Deposit 1, where moisture could have dripped from the roof of the wooden chamber. Evidence for animal gnawing and defleshing was looked for in view of the possibility of excarnation, but the bones were generally too eroded for any positive identification of such phenomena.

Demographic analysis

Criteria used for ageing in this group included tooth attrition, cranial suture closure and degenerative change. Suture closure was advanced in comparison with tooth wear in a number of individuals. Similar disparities were noted at Wetwang Slack and may also have occurred at Cowlam Wold and Amesbury. Sexing was based largely on cranial characteristics since most pelvic bones were very fragmentary. It is noticeable, however, that a number of otherwise female skeletons had slightly masculine skulls, and this has been observed at other sites of contemporary and later date in the north-east of England and Yorkshire (eg, Anderson 1991; Denston 1968). It is

interesting to note that Stead (1991) found the reverse to be the case in East Yorkshire Iron Age groups, ie, that males had particularly gracile skulls.

Based on the minimum number of skulls, five men, five women, three adults of indeterminate sex and one child (aged 6–10) were buried at this site (Table 5); what is likely to be an additional child, *c* 10–11 years old, is represented by teeth in Mortuary Deposit 2. (Note that in the case of Mortuary Deposit 2b, while the original osteological identification was '?male', the DNA results, reported below, indicated the sex as female.) There is no significant difference in the representation of the sexes, as appears to be the case in most Bronze Age groups (Table 4). However, the number of children in this group is very low, with a minimum of one (9.1%) and a maximum of two. The proportion of children to adults varies considerably in groups of this type, but is normally higher. Table 4 shows the percentages of children found in the comparison groups, the lowest of which is 18 per cent with most falling between 25 per cent and 50 per cent. In a large Yorkshire group studied by Brothwell (1960) the children made up about a quarter of the total number of individuals. The small number of children at this site could be accounted for by disturbance and poor preservation.

Table 4 Comparative Chalcolithic–Early Bronze Age Beaker-associated and other Early Bronze Age skeletal groups

Site	Bone analyst	M	F	U	C	% C
Staxton Beacon, N. Yorks	Denston (1968)	3	5	1	3	25
Green Howe, N. Yorks	Walsh (2013)	5	2		5	42
Wetwang Slack, Humberside	Dawes (1979)	1	3		4	50
Cowlam Wold, E. Yorks	Dawes (1984)	3	3		2	25
Octon Wold, Humberside	Mays (1988b)	3	2		7	58
Gazeley, Suffolk	Denston (1973)	1	2	1?	5	55
Risby, Suffolk	Cornwall (1976)	5	1	1	2	22
Barnack, Cambs	Wells (1977)	9	4	1	8	36
Orton Longueville, Cambs	Mays (1988a)	9	6	7	11	33
Chippenham, Cambs	Denston (1977)	3	5		3	27
Frocester, Glos	Fawcett (1938)	10?	5?	8	5	18
Amesbury, Wilts	Powers and Brothwell (1967)	3	1		5	55
Shrewton, Wilts	Wells (1984)	5	3	2	3	23

Key: M – male; F – female; U – unsexed adult; C – child/sub-adult, not including cremated remains

Age could be estimated for eight adults, of which half were middle-aged (Table 5). All but one were probably older than 25 years. If the age ranges are given rough chronological ranges, so that 'young' equals 17–25 years, 'Y–MA' is 25–35 years, and so on, an average age at death can be calculated for the adults in this group of about 37 years. This is higher than the mean ages found at Amesbury (26.3), Chippenham (27.3), Wetwang Slack (31.5), Orton Longueville (35.1) and Octon Wold (33.8), but lower than those from Staxton (39.8) and Gazeley (45.7). Some differences may be due to the methods used to determine age and it is likely that a degree of underestimation has been common in some earlier analyses. However, although some people clearly reached old age in this period, these were in the minority. 'Middle age', if it is defined as between 30 and 50 years of age, would seem to be a reasonable life expectancy once individuals had passed childhood, and this appears to be true of Neolithic and Iron Age groups also.

Metrical and morphological analysis

Measurements were taken from all remains except Mortuary Deposit 2, and stature could be calculated or estimated for five individuals. The males ranged from 167.8cm to 175.2cm and one female stature was estimated at 167.1cm. The male mean of 172.7cm was exactly the same as that estimated for Bronze Age male skeletons from Yorkshire by Brothwell (1960), and for seven men from a round barrow at Barnack. A single male stature could be calculated for Green Howe, North Deighton, burial 7, from the femur length recorded by Walsh (2013, 323), at 171.1cm. Very few female statures were available for comparison, but the means from Staxton (156cm, three females), Wetwang Slack (160cm, three females) and Cowlam Wold (*c* 166cm, one female) are all shorter than the female in this group. The mean stature for 73 Iron Age males from East Yorkshire was 171cm and for 49 females 158cm. Brothwell estimated a mean stature of 167cm for Neolithic men and 169cm for Iron Age men, and suggested that Bronze Age people were generally taller than their precursors and successors.

Five cranial indices were calculated, three male (Skeletons 3, 4 and 5) and two female (Skeletons 1 and 6), ranging from 73.5 to 84.6 with a mean of 80.5. Apart from the lowest index, all were brachycranial or round-

headed. The lowest is dolichocranial, which is less usual but not unknown in a Bronze Age population. Brothwell's study of the Yorkshire Bronze Age showed that the mean cranial index of the Yorkshire men was lower than that of British Bronze Age men in other regions, the latter being close to the mean at Ingleby Barwick. All skulls from this site appeared relatively short and squat from the front, and were different from medieval brachycephalic types, which are generally taller. Unfortunately the few measurements which were taken are not able to reflect this difference. From visual inspection, the skull shapes appear to correspond closely with Dawes' description of the skulls from Wetwang Slack, which had large, broad, low vaults with low foreheads and wide noses (Dawes 1979).

Regional and national studies of Neolithic skulls have shown these to be generally dolichocranial and of average height (eg, Morant 1926; Kinnes *et al* 1983; Deter *et al* 2019), while Chalcolithic and Bronze Age skulls are more frequently brachycranial – Morant quotes a mean of 82.1– and Iron Age skulls are dolichocranial but with a lower height than the Neolithic skulls. This is partially true of the Iron Age people of East Yorkshire, who had narrow skulls (a mean cranial index of 72) which were also relatively high. As discussed elsewhere (by Thomas in Deter *et al* 2019), the appearance of brachycranial individuals in Britain is connected with the arrival of Beaker-using immigrants from the Continent from the 25th century BC onwards.

Table 5 Age and sex of the Ingleby Barwick individuals, based on the evidence from skulls

Burial no.	Skeleton no. (where applicable)	Male	Female	Child	Adult, indeterminate sex
1	2	Y-MA			
2	1		MA		
3	7		Old		
4	5	MA			
5	6		Y-MA		
MD 1a	3	?MA			
MD 1b	4	?MA			
MD 1c					A
MD 1d					A
MD 1e				*c.*6–10 yrs	
MD 2a	8	Young			
MD 2b			A1		
MD 2c			A		
MD 2d					A
Total[2]		5	5	1	3

Key: MD – Mortuary Deposit; Y – young adult; MA – mature/middle-aged adult; A – unaged adult.
Note: 1. While the sex of this individual was identified osteologically as '?male', the results of DNA analysis showed that it is in fact female.
2. In addition to the 14 individuals tabulated here, a probable 15th – a child aged *c.* 10–11 years – is represented by teeth in Mortuary Deposit 2. There may be up to 5 further individuals represented among the commingled bone fragments in Mortuary Deposit 2 – a young adult, and adult *c.* 18–21 years old, a male aged *c.* 20–25, an adult and an old ?female – but it is impossible to be certain that their remains do not belong to any of the MD 2a–2d individuals

Metric and cnemic indices, which indicate the flattening of the femur and tibia shafts respectively, were calculated where possible. Five femora were measured, of which four were platymeric (narrow) and one was eumeric (broad). Two pairs of cnemic indices were measured, and both individuals had broader right than left tibiae, one meso- and platycnemic, and one eury- and mesocnemic. Wetwang Slack produced similar results of narrow femurs but medium-broad tibiae. At Amesbury, two femurs were hyperplatymeric and one was eumeric, and two tibiae were platycnemic and one was eurycnemic. At Frocester, the majority of femurs were platymeric and the majority of tibiae platycnemic. The causes of platymeria and platycnemia are still a matter for debate.

Non-metric traits were scored for the bones present and these are listed in the archive catalogue. A number of rare traits (in comparison with later groups) were recorded, particularly the presence of double facets of the atlas in four out of five individuals for whom the bone was present. Two out of three also had posterior atlas bridging, both examples of which were incomplete on the left side, and this trait is thought to be a good genetic marker (Saunders and Popovich 1978). This, together with the distribution of cranial traits, could suggest a relationship between Burial 2 and Burial 4. Mortuary Deposit 1a and 1b had similar cranial traits, both having a parietal foramen on the right side only and complicated lambdoid suture patterns in which lambdoid wormians may have occurred. One other interesting feature is the presence of large septal apertures of the right humerus in two of the women (Burial 3 and Burial 5), a trait which may be related to robusticity with a slight genetic component (Cavicchi *et al* 1978), and which was also unusually common at the Anglian site of Norton, on the northern side of the River Tees, barely 9km to the north (Marlow 1992). There is some suggestion of epigenetic relationships in this group, but the sample is too small to be certain that these traits are not simply the norm for the population rather than evidence for a family burial site. Unfortunately it has not been possible to compare these results with other sites as most groups are too small to produce meaningful statistics.

The presence of 'squatting facets' is noted as common in several groups of this period. Unfortunately the distal end of the tibia was missing in most skeletons from Ingleby Barwick, and only Burial 4 retained the appropriate area. No squatting facets were present in this individual.

Dental analysis

Partial or full dental remains were present for nine individuals (Skeletons 1, 2, 5, 6, 7, Mortuary Deposit 2e (three sets) and Mortuary Deposit 2, (19 <5>)). If all were complete, the total number of observable positions should be 288, but in this group 137 were missing, leaving 151 positions for study. A total of 130 teeth were present, the remaining positions being thirteen lost post-mortem, two lost ante-mortem, and six unerupted. Three of the latter were the only remaining teeth adult teeth of a child aged *c* 10–11 years and these will not be included in the analysis. This leaves 148 adult positions.

Dental disease was not common in this group. Four carious lesions were found, affecting only two individuals: Burial 4 had a single lesion in the cervical interstitial area of the upper right third molar, and similar areas of both upper third molars of Burial 5 were affected. The latter individual also had a large occlusal lesion in the lower right first molar, which had opened the pulp cavity and produced a periapical abscess. Ante-mortem loss affected two teeth in two individuals, a lower premolar of Burial 2, and a lower first molar of Burial 3. The prevalence of caries was 3.1 per cent and of ante-mortem tooth loss 1.4 per cent. Abscess frequency was more difficult to calculate owing to the general lack of surviving alveolar bone.

In other Bronze Age groups, the presence of dental disease is variable. Some groups, such as Wetwang Slack and Cowlam Wold, appear to have very little. At Staxton there were two examples of abscesses and only one of caries, but one individual had lost several teeth before death. At Octon Wold there was no caries, ante-mortem tooth loss had a frequency of only 0.8 per cent, and abscesses 3.5 per cent. Barnack produced frequencies of 2.3 per cent ante-mortem loss and 0.3 per cent caries. Caries was common at Amesbury, generally in interstitial positions, but there were only two abscesses. Interstitial erosion and caries were present in two individuals from Risby, and there were also a few examples of abscesses and ante-mortem tooth loss. Carious lesions had a 5 per cent prevalence at Orton Longueville, ante-mortem tooth loss was at 10 per cent, and abscesses were at 3.7 per cent. Roberts and Cox's review of individuals from across the country produced a prevalence of 4.8 per cent for caries, 1.9 per cent for abscesses and 5.3 per cent for ante-mortem loss (their figures have been recalculated).

The Bronze Age people of Yorkshire had a prevalence of 4 per cent for caries, 2 per cent for abscesses and 4.5 per cent for tooth loss. Iron Age sites in East Yorkshire had similarly low rates of 2.6 per cent for caries, 0.9 per cent for abscesses and 1.9 per cent for ante-mortem tooth loss. Lack of figures for prevalences at many sites makes direct comparison difficult, but in general it appears that the Ingleby Barwick group was not unusual in having a low occurrence of the three main dental diseases.

Calculus was present in most dentitions and was generally slight or medium in quantity. An overall crude prevalence rate of 37.5 per cent was recorded for 24 datasets from across the country (Roberts and Cox 2003, table 2.29).

Enamel hypoplasia was noted in only two individuals (Burial 1 and Burial 4), both of whom were affected on the canines and premolars at around age 4–5 years, suggesting a short period of malnutrition or illness during childhood. This crude prevalence of 22.2 per cent can be compared with an overall figure of 12.3 per cent for ten British sites *(ibid*, table 2.32).

Pathology

Very little pathology was present in these skeletons. Degenerative disease was seen in three of the older individuals. Burial 2 had osteoarthritis of the right shoulder, the left first rib head and the left sacro-iliac joint of the pelvis, as well as osteophytosis of most rib heads and the left hip joint. Mortuary Deposit 1a had osteoarthritic changes to the seventh cervical vertebral body and slight lipping of most joints. All lumbar vertebral joints and the right knee joint of Burial 3 had osteoarthritis with porosity and eburnation. A condition of uncertain aetiology, hyperostosis frontalis interna, which is also associated with ageing and is relatively common in post-menopausal women, was seen in Burial 2. It produces thickening and irregular new bone growth on the internal surface of the frontal bone of the skull.

Inflammatory changes which may be associated with non-specific infections were seen in the shins of two individuals. Burial 1 had very slight graining of the right fibula, but surface erosion made this identification uncertain. Burial 4 had more definite signs of periostitis on the interosseous surfaces of the left tibia and fibula.

Evidence of physical stress was also seen in three individuals. Burial 5 had Schmorl's nodes on most surviving thoracic vertebrae (T3–10?), a condition associated with stress on the spine which is usually more common in men than women. A disarticulated humerus of a young male in Mortuary Deposit 2 showed evidence of inflam-

matory changes to the deltoid tuberosity, probably the result of a torn muscle. A fragment of extra female skull with Burial 5 (Burial 5a) had porotic cribra orbitalia of the left orbit, suggesting that this individual had suffered from a mild degree of iron deficiency anaemia. Nine other skulls could be scored for this condition in one or both orbits, but none showed any signs of lesions. This crude prevalence rate of 10 per cent is comparable with that from seven datasets presented by Roberts and Cox (2003, table 2.33).

Pathology seen at other sites suggests that slight degenerative changes and stress-related lesions were common in this period, as in any other. Traumatic injuries and trephinations were also seen frequently, but neither appears to have occurred in this group.

Conclusions

The most notable aspect of this group is its homogeneity, a trait which has been recorded in several other small Bronze Age groups. Studies of more widespread groups (eg, Morant 1926; Brothwell 1960; Roberts and Cox 2003) suggest a greater degree of heterogeneity when the larger Bronze Age 'population' is considered. This contrast may be evidence for burial of family or close community burial places, as might be expected. The Ingleby Barwick group showed a number of genetic traits in common between two or three skeletons, but without comparative material from other local groups it is not possible to be certain of family relationships in this group at present. (See also Booth, below, on the results of DNA analysis.)

Life expectancy seems to have been high, although the very small number of children may be anomalous in comparison with the larger proportions at other burial sites. Adults might be expected to reach middle age without any real problems, and at least six individuals died at around or beyond this stage. Average age at death is comparable with other recently analysed groups. There was no real difference in age at death between the sexes, and the sex ratio is normal.

The general physical appearance of these people appears to be normal for the period. Relatively tall individuals with squat, rounded heads form the majority. Even the women show some degree of robustness, particularly in their skulls, indicating a muscular build for the group as a whole.

There is a general lack of pathology, with the exception of a few minor degenerative and stress-related lesions, which are common in most groups of this period and later. Dental disease is also uncommon, and this conforms well with research which suggests that Bronze Age people had the lowest caries rate at any period from the Neolithic to the present day (Brothwell 1959).

HISTOLOGICAL EVIDENCE FOR MUMMIFICATION AND OTHER BODY TREATMENT

by Tom Booth

Four individuals from Ingleby Barwick (Skeleton 2 from Burial 1, Skeleton 5 from Burial 4, Skeleton 6 from Burial 5 and Skeleton 3 from Mortuary Deposit 1a; see **Table 6**) were subjected to quantitative histomorphological assessment in order to find out more about the ways the bodies had been treated.

Table 6 Results of quantitative histomorphological assessment of the human bone thin sections

Specimen	Articulated or disarticulated?	Skeletal element	Slide	Periosteal % remaining	OHI[1]	Internal % remaining	OHI	Endosteal % remaining	OHI
Burial 1 Skeleton 2	Articulated	L femur	1	>85%	4	>95%	5	>95%	5
			2	>85%	4	>85%	4	>95%	5
Burial 4 Skeleton 5	Articulated	L femur	1	<15%	1	<5%	0	<5%	0
			2	<15%	1	<5%	0	<5%	0
Burial 5 Skeleton 6	Articulated	L femur	1	<5%	1	<5%	0	<5%	0
			2	<15%	1	<5%	0	<5%	0
MortuaryDeposit 1a Skeleton 3	Disarticulated	L femur	1	>85%	4	>95%	5	>85%	4
			2	>85%	4	>95%	5	>95%	5

Note: 1. OHI – Oxford Histological Index

Microscopic alteration of internal bone microstructures by micro-organisms, particularly bacteria (bacterial bioerosion), is the primary form of alteration observed in archaeological bones. Anoxic or waterlogged environments inhibit osteolytic bacterial activity, and bones from these sorts of context tend to show little or no bacterial attack (Booth 2016; Kendall *et al* 2018). However, in bones recovered from aerobic environments, there is an association between bacterial attack and early post-mortem treatment. Bones buried as part of intact bodies tend to show high levels of bacterial attack, whereas bones from bodies that were rapidly defleshed through butchery or sub-aerial exposure (excarnation) show low levels of bacterial alteration (Booth 2016; Nielsen-Marsh *et al* 2007; Brönnimann *et al* 2018). This suggests bacterial bioerosion of bone is linked to soft tissue decomposition, although it is still unclear whether this is driven by soil bacteria, putrefactive bacteria or a combination of both (Booth 2016; Brönnimann *et al* 2018; Kendall *et al* 2018).

The bones from Ingleby Barwick were excavated from similar burial contexts – natural gravel and sands that were likely to be pH neutral or slightly acidic. The remains that were sampled for histological analysis were chosen to ensure a full representation of both differential burial rites (ie, articulated versus disarticulated) and temporal phases. Studies have consistently shown that the age of a burial has little direct effect on bone diagenesis (Nielsen-Marsh *et al* 2007). However, any discrepancies between the earlier and later specimens could suggest a change in funerary treatment.

A 10mm by 10mm section was cut from the anterior midshaft of each bone using a coping saw. Thin sections, 50–75μm thick, were produced from the bone cuttings using a Leica 1600 diamond-tipped microtome. The sections were mounted onto slides using Entellan microscopy resin and left to dry in a fume cupboard for 20 minutes. The slides were examined under normal and polarised transmitted light and were quantitatively assessed using the Oxford Histological Index (OHI), which translates the percentage of remaining preserved bone into a grade ranging from 0 (no histological structure remaining) to 5 (indistinguishable from fresh bone) (Hedges *et al* 1995; Millard 2001). The OHI was assessed separately at the periosteal, internal and endosteal surfaces of the thin sections to allow for variation in histological integrity.

Results

The results of the quantitative histomorphological assessment displayed in **Table 6** show a bimodal distribution with the thin sections from Burial 1 and Mortuary Deposit 1a demonstrating very good preservation (OHI=4–5) while the thin sections from Burial 4 and Burial 5 display extremely poor preservation (OHI=0–1) (Hedges *et al* 1995). The advanced degradation observed in Burial 4 and Burial 5 thin sections excluded a thin layer of well-preserved microstructure on the periosteal fringe. The bulk of the diagenetic attack was made up of tunnels that resembled Hackett's budded, linear longitudinal and lamellar micro-foci of destruction (mfd) (Hackett 1981, 250).

Although the Burial 1 and Mortuary Deposit 1a thin sections scored similarly high OHI scores, there were some differences between them in terms of microstructural alterations. The Mortuary Deposit 1a sample demonstrated an abundance of microfissures. Areas of dark brown staining were present in all of the thin sections from Burial 1 and Mortuary Deposit 1a. This staining was usually accompanied by enlarged osteocyte lacunae and canaliculi and was more severe in the latter sample, particularly at the periosteal surface, where it was accompanied by significant collagen loss as evidenced by the complete reduction of birefringence under polarised light (Hackett 1981).

Discussion

The high level of preservation in Burial 1 and Mortuary Deposit 1a thin sections and the lack of diagenetic attack attributable to acidic catastrophic dissolution are consistent features for remains recovered from slightly acidic to pH neutral soils (Smith *et al* 2007). The presence of probable humic brown staining accompanied by collagen loss in some of the Ingleby Barwick samples, but particularly at the periosteal edge of the Mortuary Deposit 1a 3 thin section, suggests there had been some limited minor acidic demineralisation of bone microstructure caused by the acidic burial environment (Hanson and Buikstra 1987). The high levels of bacterial attack observed in the sampled bones from the articulated Burials 4 and 5 were probably the result of 'conventional' intact inhumation soon after death. The absence of bacterial bioerosion from Burial 1 and Mortuary Deposit 1a suggests that these remains were treated in a way which prevented their exposure to bacterial soft tissue decomposition.

The variation observed in bacterial bioerosion in the Ingleby Barwick bones must be attributable to differential taphonomic histories. Their similar burial environments mean that this variation is most likely to be related to variable early post-mortem treatment which affected the way in which the bones were exposed to bacterial soft tissue decomposition. The high levels of bacterial attack observed in the samples from the articulated Burial 4

and Burial 5 were probably the result of 'conventional' intact inhumation soon after death, with the organs intact. The decomposing organs would have provided a consistent source of bacteria, and the articulation of the body would have ensured that microbial access to the bone was not impeded. The excellent microstructural preservation of the bone from the Burial 1 and Mortuary Deposit 1a individuals suggests that these specimens were processed in a way that prevented their exposure to endogenous putrefying bacteria.

An explanation for the prevention of bioerosion in the Mortuary Deposit 1a specimen may be forthcoming in the manner of its deposition. The disarticulated state of the remains suggests that the bones had been excarnated before being placed in the timber chamber or box. Where evidence for anthropogenic defleshing is absent, it can be assumed that disarticulation was achieved either by primary burial or exposure on the ground surface (Redfern 2008; Outram *et al* 2005). It has been demonstrated that remains skeletonised by exposure incur very little bacterial bioerosion to their bone microstructure, especially when compared to inhumed bone (Kontopoulos *et al* 2016; White 2009; White and Booth 2014). Excarnated bodies are rapidly skeletonised by invertebrates, meaning the bones are exposed to lower levels of bacterial soft tissue decomposition (Simmons *et al* 2010). Therefore, the disarticulation and well-preserved microstructure of Mortuary Deposit 1a suggests that bacterial bioerosion was probably prevented by the remains having been excarnated by exposure.

This interpretation may be supported by the high abundance of microfissures observed in the Mortuary Deposit 1a thin section. A common explanation for microfissures is that the bone was subject to rapid wetting and drying cycles, a likely scenario had the remains been exposed on the ground surface (Smith *et al* 2002). Alternatively, abundant microfissures have also been associated with acidic contexts, and the collagen loss at the periosteal surface of the Mortuary Deposit 1a thin sections suggests that these remains were possibly more affected by the burial conditions than the other samples (Fernandez-Jalvo *et al* 2010). The uniform nature of the burial contexts across the Ingleby Barwick site, combined with the dearth of microfissures observed in the other specimens, weakens the argument for an environmental explanation. It is more probable that these specific histological features occurred as a result of surface excarnation. Other explanations for microfissures can similarly be disregarded as most would require variable environmental conditions, evidence for burning or a similar observed abundance of microfissures in all of the sectioned bones (Guarino *et al* 2006; Grupe 1995).

Surface excarnation is not usually argued for at archaeological sites unless there is osteological evidence for carnivore scavenging (Redfern 2008). However, it is possible that the Ingleby Barwick remains could have been protected from carnivores by fencing or by being raised up on platforms.

It is more difficult to deduce the taphonomic event which prevented the bioerosion of bone samples from Burial 1. Parts of this individual were recovered from the spoil heap, and so the extent of their *in situ* articulation is debatable. There is, however, reasonable justification to suggest that these bones were originally part of a fully articulated skeleton (Robin Daniels, pers comm 2008). As discussed above, the bones of an intact body buried in an aerobic environment would be exposed to high levels of bacterial soft tissue decomposition and related bioerosion, yet the Burial 1 microstructure shows no bacterial attack at all (Jans 2008; White and Booth 2014; Booth 2016). Bioerosion can be inhibited by waterlogged or anoxic environments, but there was no evidence for these conditions in any of the graves at Ingleby Barwick (Turner-Walker and Jans 2008; Booth 2016).

It is unlikely that Burial 1 was exposed above ground. The observed lack of bioerosion in the thin section necessitates that the exposure lasted long enough for the soft tissues to be mostly removed by invertebrates. Although this process can reach completion before any major disarticulation occurs, it seems unlikely that the subsequent movement and interment of the partially decomposed corpse could have been achieved without some loss of articulation (Dent *et al* 2004). The high abundance of microfissures observed in the excarnated Mortuary Deposit 1a remains was not present in the Burial 1 thin sections (Smith *et al* 2002).

One possible explanation for the properties of Burial 1 is that the remains were subjected to some other preservative treatment (Booth *et al* 2015). Mummification methods could have included evisceration, but also drying, smoking or treatment with bactericidal agents (Aufderheide 2003).

Evidence for British prehistoric mummification has previously been identified at the Late Bronze Age/Early Iron Age site of Cladh Hallan, South Uist (Parker Pearson *et al* 2005; 2007). Thin-section analysis of the remains from this site also revealed arrested bacterial destruction of the bone microstructure (Parker Pearson *et al* 2005, 541). The bacterial bioerosion recorded within the Cladh Hallan sample was more extensive than that observed in the thin section of Burial 1, but this could reflect a difference in mummification technique. Histomorphological investigations into the naturally mummified 'Ötzi the Iceman' and a Peruvian mummy from Chancay

revealed excellent preservation of both of their respective bone microstructures (Hess *et al* 1998; Weinstein *et al* 1981; Booth *et al* 2015).

The evidence for mummification at Cladh Hallan included post-mortem manipulation and the highly flexed posture of the remains, suggesting some binding of the body (Parker Pearson *et al* 2005; 2007). Because of the state in which the remains were recovered it is difficult to judge whether there is any evidence for the latter two factors at Ingleby Barwick. It is interesting to note that the radiocarbon dating shows that Burial 1, Burial 2 and Burial 3 are more likely to be contemporary with the curated bones in the wooden chamber than with the later articulated Burial 4.

Histological analysis might be regarded as a tenuous foundation on which to base a potentially controversial interpretation of mummification. However, based on current knowledge there is no readily apparent explanation for the high level of microstructural preservation of Burial 1 when compared to the other, badly preserved, articulated remains. Variation in the burial context – the only other factor that could potentially affect bone bioerosion – does not apply here since the articulated remains were all buried in the same kind of grave.

Mummification of the Burial 1 individual raises the possibility that the body was not buried until many years after death and consequently its associated radiocarbon date may not represent the time at which the remains were interred. Although the Burial 2 and Burial 3 remains were not sampled for thin sectioning, their radiocarbon dates and burial style were very similar to those of Burial 1. These specimens might also have been mummified and curated; histological analysis would be required to check whether that is the case. See Marshall *et al*, below, on the radiocarbon dating of the human remains.

Conclusion

The bimodal distribution of OHI scores for the Ingleby Barwick thin sections suggests that Burial 4 and Burial 5 had been subject to extensive bioerosion, which would be expected in articulated intact burials, whereas Burial 1 and Mortuary Deposit 1a underwent processes that prevented bacterial access to the bone (Jans 2008; Nielsen-Marsh *et al* 2007). The disarticulation of Mortuary Deposit 1a suggests that this individual, and by extension the other bones from the timber chamber, had been excarnated by surface exposure. With the caveat that uncertainty persists regarding the *in situ* articulation of the remains, the best explanation for the preserved microstructure of Burial 1 is that this specimen was eviscerated and/or mummified. This proposition raises the possibility that this individual could have been interred at a much later date than that indicated by his radiocarbon date.

ANCIENT DNA

by Tom Booth[2]

Bone samples from four individuals were subject to DNA analysis by the Reich ancient genomics laboratory at the Harvard Medical School. The results were published in Olalde *et al* (2018), which gives a comprehensive account of methods: 50–100mg of bone powder was drilled from the petrous portion of the temporal bone of each skeleton. Bone powder was used to produce DNA extracts and Next Generation Sequencing libraries. Libraries were enriched for human DNA using a 1240k in-solution targeted capture array and subject to genome-wide sequencing (*ibid*).

The individuals in question, their Reich laboratory 'I' code numbers as cited in Olalde *et al* 2018, and their sex as determined from the DNA data, are as follows: Skeleton 2 from Burial 1 (I1767, male), Skeleton 7 from Burial 3 (I1765, sex uncertain), Skeleton 4 from Deposit 1b (I5382, male) and disarticulated adult skull, Mortuary Deposit 2b (incorrectly labelled as 'Skeleton 8' in Olalde *et al* 2018 – see explanation in **Table 7**) (I7635, female). Note that the Mortuary Deposit 2b skull had previously been identified, osteologically, as '?male' and Skeleton 7 as female (Anderson, above).

Olalde *et al* (2018) found that during the Chalcolithic and earliest part of the Early Bronze Age period, between around 2500 BC and 2000 BC, there was a >90 per cent transformation of the genetic ancestry of the inhabitants of Britain. This ancestry shift must have involved migrations of people into Britain from continental Europe. This genetic transformation broadly coincides with the appearance of the 'Beaker phenomenon' in Britain. Early

2 Note: after this report was written, further aDNA analysis was undertaken, for a different project, on Skeleton 3 from Mortuary Deposit 1a. The results are reported on in Patterson *et al* 2022 (Sample I3028). The sex was confirmed as male, but the sample was excluded from further analysis due to mitochondrial contamination.

Bronze Age individuals from the present-day Netherlands are the best fit for the new ancestry of some of the people in Britain at this time, suggesting a predominant genetic influence from around the Rhine valley.

The scale of this genetic transformation in Britain is reflected in the genetics of the people buried at Ingleby Barwick. When confidence intervals are taken into account, all of the genetic ancestries of Mortuary Deposit 1b (Skeleton 4), Burial 3 (Skeleton 7) and Mortuary Deposit 2b (disarticulated adult female skull) are related to Bronze Age populations from continental Europe, with no detectable input from the preceding populations who inhabited Britain through the Neolithic. In addition, Mortuary Deposit 1b belongs to a Y-chromosome haplogroup (paternal lineage) known as R1b. The R1b paternal lineage is absent from Neolithic populations of Britain, but present in 90 per cent of males from Chalcolithic–Early Bronze Age Britain. This indicates that these three individuals represent either first-generation migrants from continental Europe or, more likely, the descendants of communities of migrants who began moving into Britain from *c* 2500 BC, forming enclaves in which they largely had children among themselves, mixing only infrequently with descendants of the Neolithic inhabitants (Booth *et al* 2021).

However, the genetic ancestry of Burial 1 (Skeleton 2) is rather different from that of the other three individuals. While most of his ancestry came from the Bronze Age populations of continental Europe, around a quarter relates to the groups who inhabited Britain during the Neolithic. This is high enough to suggest that one of Burial 1's grandparents may have been entirely descended from the Neolithic population of Britain. Interestingly, Burial 1 also carries a paternal haplogroup that was ubiquitous during the Neolithic, suggesting that his paternal grandfather may have been descended from local Neolithic populations. This result highlights that while there certainly was a large-scale genetic transformation of the population of Britain at this time, the processes involved were not straightforward and involved variable patterns of mixture between incoming and local populations, and their descendants.

All four individuals were subject to analysis to assess their degree of relatedness. The method used picks up close genetic relatives up to third degree (first cousins). Interestingly, none of the four sampled individuals were close genetic relatives of one another. The variability in both their paternal and maternal lineages (mitochondrial haplogroups) suggests that they did not share more distant paternal or maternal descent. In combination with the contrasting ancestry of Burial 1 compared to the other three burials, these results indicate that kinship ties related to biology, either in terms of family relationships or shared ancestry, had little bearing on the decision to inter people at Ingleby Barwick.

RADIOCARBON DATING RESULTS

by Peter Marshall, Alex Bayliss,
Christopher Bronk Ramsey and Gerry McCormac

Nine radiocarbon determinations have been obtained from samples of human bone. Details of the dated samples, radiocarbon ages and associated stable isotopic measurements are provided in **Table 7**. The radiocarbon results are conventional radiocarbon ages (Stuiver and Polach 1977).

Two samples were processed in 1998 by the Queen's University, Belfast, Radiocarbon Research Laboratory, a further five samples measured at the Oxford Radiocarbon Accelerator Unit (ORAU) in 1999, and finally two were dated at the Bristol Radiocarbon Accelerator Mass Spectrometer (BRAMS) in 2017 as part of the Power of Relics Project (Booth and Brück 2020; Brück and Booth 2022). Samples were processed in Belfast according to the methods outlined in Longin (1971), McCormac (1992), McCormac *et al* (1992) and Wilson *et al* (1996) and those measured at ORAU using the methods outlined in Hedges *et al* (2000) and Bronk Ramsey and Hedges (1997). At BRAMS, collagen extraction and purification followed a modified Longin method (Brock *et al* 2010), combustion and graphitisation (Wacker *et al* 2010b), before radiocarbon determination on a MICADAS Accelerator Mass Spectrometer (Synal *et al* 2007) and data reduction (Wacker *et al* 2010a). Given that the stable isotope results (**Table 7**) indicate that the dated individuals consumed a diet predominantly based on terrestrial C3 foods, the radiocarbon results are unlikely to be affected by any significant reservoir effects, so a fully terrestrial calibration curve can be employed. All the samples gave C/N values within the range normally used to indicate good collagen preservation (2.9–3.6: DeNiro 1985).

The chronological modelling described in this section has been undertaken using OxCal 4.4 (Bronk Ramsey 1995; 2009), and the internationally agreed calibration curve for terrestrial samples from the northern

Table 7 Radiocarbon and stable isotope measurements from Ingleby Barwick burials

Laboratory No.	Burial	Sample No. and material	Radiocarbon Age (BP)	$\delta^{13}C_{IRMS}$ (‰)	$\delta^{13}C_{AMS}$ (‰)	$\delta^{15}N_{IRMS}$ (‰)	C/N ratio	*Highest Posterior Density interval (95% probability) cal BC*
OxA-8650	Burial 2	IWF 96/1 Human bone, right humerus	3755±40	−21.1		8.6	3.3	*2280–2250 (4%) or 2235–2030 (91%)*
OxA-8651	Burial 1	IWF 96/2 Human bone, left femur	3705±35	−21.4		10.2	3.4	*2200–2015 (93%) or 1995–1980 (2%)*
OxA-8652	Mortuary Deposit 1a	IWF 96/3 Human bone, right femur	3785±40	−21.4		9.9	3.3	*2290–2120 (77%) or 2100–2035 (18%)*
OxA-8728	Mortuary Deposit 1b	IWF 96/4 Human bone, left femur	3725±40	−21.0		10.4	3.4	*2270–2255 (1%) or 2210–2015 (93%) or 1995–1980 (1%)*
OxA-8729	Burial 3	IWF 96/7 Human bone, right femur	3780±40	−21.4		10.7	3.4	*2290–2125 (75%) or 2100–2035 (20%)*
UB-4173	Burial 4	IWF 96/5 Human bone, left femur	3364±22	−21.4		–	–	*1740–1710 (11%) or 1695–1600 (76%) or 1560–1540 (8%)*
UB-4174	Burial 5	IWF 96/6 Human bone, left and right femur	3609±24	−22.0		–	–	*2130–2090 (10%) or 2040–1915*
BRAMS-1286	Mortuary Deposit 2b[1]	IWF'96-SK8[1] (Petrous 24-8) Human bone, petrous	3691±28		−22.2		3.2	*2200–2170 (6%) or 2150–2015 (86%) or 2000–1975 (3%)*
BRAMS-1287	Mortuary Deposit 2c[2]	IWF'96-SK8[2] (Petrous 24-8) Human bone, petrous	3691±28		−21.5		3.2	*2200–2170 (6%) or 2150–2015 (86%) or 2000–1975 (3%)*

Notes: 1. Referred to in Olalde *et al* 2018, Booth and Brück 2020 and Brück and Booth 2022 as 'Skeleton 8', using a label that was originally applied to most of the remains in Mortuary Deposit 2 before they were separated out into 2a–2d. 2. Referred to in Booth and Brück 2020 and Brück and Booth 2022 as 'Skeleton 8'. Also note: the two dated petrous temporal bones from Mortuary Deposit 2b and 2c are indeed from two different individuals, despite producing identical radiocarbon age results; both are right petrous temporals

hemisphere (IntCal20; Reimer *et al* 2020). The model is defined by the OxCal CQL2 keywords and by the brackets on the left-hand side of Figure 27. In the diagram, calibrated radiocarbon dates are shown in outline and the posterior density estimates produced by the chronological modelling are shown in solid black. The Highest Posterior Density intervals which describe the posterior distributions are given in italics. The five measurements from ORAU (OxA-8650–8652; 8728–8729) on unfurnished Burials 1–3 (Skeletons 2, 1 and 7 respectively) and two individuals from Mortuary Deposit 1 (Skeletons 3 and 4, Mortuary Deposit 1a and 1b), and the two measurements from BRAMS (BRAMS-1286–7) on individuals from Mortuary Deposit 2 (2b and 2c) are statistically consistent at the 5% level (T'=8.0; v=6; T'(5%)=12.6; Ward and Wilson 1978), which might mean that these seven individuals died at exactly the same time (eg, as a result of an infectious epidemic). However, it is possible that if all the individuals died over a relatively short period of time, they could produce such a group of results.

The model shown in **Fig 27** shows good overall agreement (Amodel=112) and suggests that the among Burials 1–3 and 5 and the four individuals from Mortuary Deposits 1a, 1b and 2 the first person died *2305–2125 cal BC (90% probability; FirstDeath*, Fig 27) or *2110–2060 cal BC (5% probability)* and probably *2280–2250 cal BC (14% probability)* or *2235–2150 cal BC (54% probability)*. The last of the individuals is estimated to have died *2110–2095 cal BC (2% probability; LastDeath*, Fig. 27) or *2090–1915 cal BC (93% probability)* and probably *2035–1950 cal BC (68% probability)*. The length of time over which these individuals died is estimated to be *40–345 years (95% probability;* **Fig 28**) and probably over *135–290 years (68% probability)*. The small number of dates available is, however, likely to mean that the estimate tends to suggest that they died over a longer period than was actually the case. Burial 4 (Skeleton 5) is later than the others and the individual is estimated to have been buried during the second quarter of the second millennium cal BC.

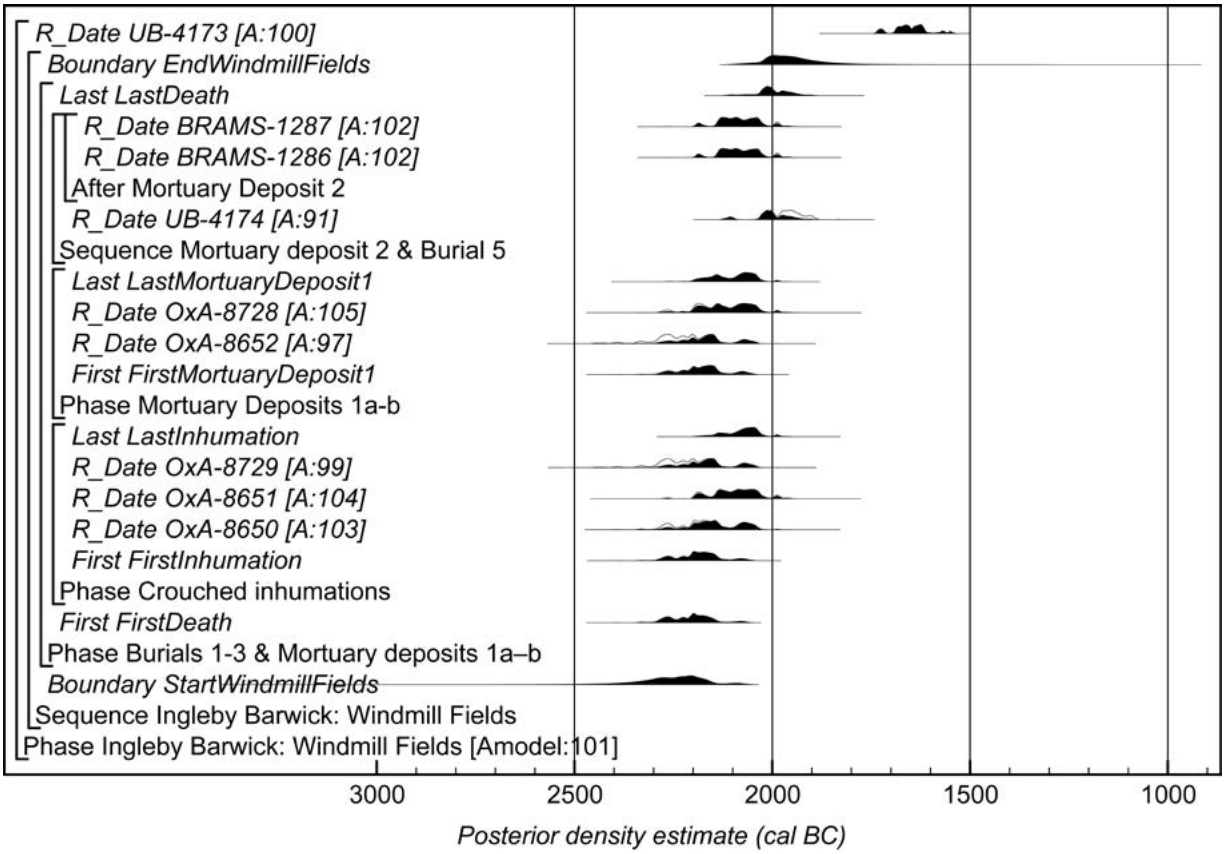


Figure 27. Radiocarbon dates: modelled Highest Posterior Density interval values

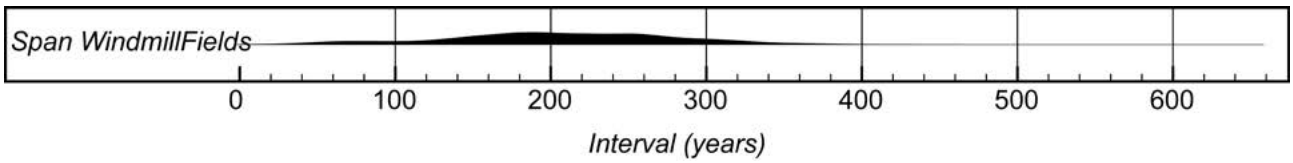


Figure 28. Estimated time-span for death of individuals

OVERALL DISCUSSION

by Blaise Vyner and Richard Annis

The confluence of the Leven and the Tees forms a distinctive topographical location, marked by a substantial mound, Round Hill, which has previously been suggested to have a prehistoric origin (Vyner 2000, 103). The excavated evidence from Ingleby Barwick can be augmented with information on a number of other Neolithic and Early Bronze Age discoveries from the locality, which suggests a focus, perhaps episodic, of prehistoric funerary activity (Fig. 1). The antiquarian information is a limited but at least partly compelling contribution to the excavated evidence. In addition to Round Hill, there is a second mound at Egglescliffe, on the west bank of the Tees, known as Devil's Hill (Dingle 1973, 11). One or other of these mounds may be a Norman motte, but it is unlikely that both are. Also from Egglescliffe is the record of a crouched burial just west of the churchyard, noted in the 19th century, described as similar to those found in the moorland burial mounds (Dingle 1973, 3). At the Roman site at Quarry Farm, Ingleby Barwick, some 2.5km distant from the Windmill Fields burials, excavations retrieved a small lithic assemblage of uncertain date (Scott 2013, 22–3), while a near-complete Neolithic stone axe-head was also discovered (Saville 2013, 23–4).

Also at Quarry Farm, excavations recovered fragments of at least two suggested Peterborough Ware vessels from a pit, although the identification is not supported by the radiocarbon dates. Another pit contained sherds from two All Over Cord Beakers and one comb-decorated Bell Beaker, rare types in the north of England (Young 2013, 24–5). At Little Maltby Farm, 600m south-west of Windmill Fields, recent excavations have uncovered a truncated ring ditch which may be evidence for a former burial mound (Jamie Armstrong, pers comm), a suggestion supported by the presence of former field boundaries which appear to have been focused on an upstanding feature, while an abraded Beaker sherd from nearby tends to suggest a Chalcolithic or Early Bronze Age chronological horizon. Also suggestive of Early Bronze Age activity is a small assemblage of lithic material, potentially not all of the same date, at Site P, Village 3, Ingleby Barwick (Fig 1; Wickham-Jones 1995, 26–9). Finally, as noted above, at Maltby, 2km to the east, a single Beaker was found during building operations (Rowe 2014).

Most of the evidence for the Early Bronze Age from the lower Tees valley comes from the uplands of the North York Moors, the northern escarpment of which, the Cleveland Hills, is prominent on the skyline some 14km to the south-east of Windmill Fields. An outlier of the moors, the Eston Hills, their northern aspect crowned by the rocky outcrop of Eston Nab, would have been an even more obvious landmark to anyone using the River Tees to reach Ingleby Barwick. The Eston Hills have a number of burial mounds of Early Bronze Age date (Vyner 1991), including one at Mount Pleasant which contained a Long-Necked Beaker (Sockett 1971, 35–6) and another in which was found a Collared Urn containing the cremated remains of an adult and a child (Parker 1991). Apart from the burial mounds, direct evidence for early settlement on the Eston Hills is absent, as it is elsewhere on the moors.

The surviving group of deposits in the Early Bronze Age cemetery at Ingleby Barwick demonstrates a mixture of funerary treatments applied to a group of individuals who, with the exception of Skeleton 5 in Burial 4, may have died over a relatively short period (ie, a few generations). As noted above, chronological modelling suggests that the length of time over which these individuals died is estimated to be *40–345 years (95% probability*; Fig 28) and probably over *135–290 years (68% probability),* with the first death dated to *2305–2125 cal BC (90% probability; FirstDeath)* and the last to *2090–1915 cal BC (93% probability,* Fig 27); the small number of dates means that the modelled time-span of the deaths may be an over-estimation.

Of the crouched inhumations it is notable that one, Skeleton 2 (Burial 1), appears to have been the subject of mummification. In addition to variation in the orientation of the graves and treatment and disposition of the bodies (**Table 8**), the graves are variably furnished, suggesting that the occupants of the cemetery were socially differentiated and that the woman buried in Burial 5 was accorded a higher status than the others, as discussed at length above. The grave orientations vary, with those of Burials 1, 2 and 5 providing variations on a north-east–south-west orientation while Burial 3 was orientated ESE–WNW and Burial 4 – the latest dated grave in the cemetery – was orientated east–west. There appears to be a sex-based pattern regarding the side on which the bodies were lain, with females placed wholly or partly on their right (Burials 2, 3 and 5), and males on their left (Burials 1 and 4). This echoes the pattern noted for Beaker-associated graves in East Yorkshire and north-east Scotland as identified by Alexandra Shepherd (née Tuckwell), who found that males (M) were placed on their left (L), their heads to the east (E) with a line of sight to the south (S) – her 'LESM' pattern, and females (F) were laid on their right (R), their heads to the west (W) with a line of sight to the south (S) – her 'RWSF' pattern

Table 8 Excavated evidence for the disposition of the crouched burials

Burial no.	Skeleton no.	Lying on which side?	Grave orientation and position of head (in brackets)	Direction in which head looking	Sex (* indicates confirmed by DNA)	Topography	Relationships	Grave goods
Burial 1	Skeleton 2	probably left	NNE–SSW (SSW)	NW	male*			8 conjoining Beaker sherds, plus fragment possibly from a second Beaker, found 0.3m to the east of the grave, and possibly originally from the grave
Burial 2	Skeleton 1	probably right	roughly NE–SW (roughly SW)	SE	female			none
Burial 3	Skeleton 7	right	ESE–WNW (WNW)	SW	female	highest point		haematite lump
Burial 4	Skeleton 5	left	roughly E–W (E)	S	male			macehead haematite lump Beaker sherd from topsoil to E of grave, and assumed to have come from the grave
Burial 5	Skeleton 6	right	NE–SW (SW)	SE	female		Mortuary Deposit 2 placed within Burial 5 grave pit	2 bronze armlets 45+ sheet-bronze tubular beads 2 fragments copper alloy(?) wire or rod at least 25 jet (and jet-like) 'buttons' at least 88 jet tiny disc beads 1 chalk(?) disc bead 1 jet fusiform bead 8 ochre fragments 1 flint scraper and 2 flakes possible organic pouch cattle hide

(Tuckwell 1975, 113; Shepherd 1989; 2012). This patterning relates to the introduction of continental funerary norms by immigrant users of Beaker pottery from the 25th century BC onwards (Shepherd 2012; see also Parker Pearson *et al* 2019 for regional variations on these norms). The rigidity of the adherence to these norms declined over the course of Beaker use, with Early Bronze Age late-Beaker-associated individuals and those buried with Food Vessels in east Yorkshire showing deviations (Shepherd 2012, 262–3 and fig 17.2). The Ingleby Barwick evidence, with its deviations from the strict 'LESM/WRSF' canon, is consistent with this loosening of norms.

The second tradition of funerary deposition in evidence at Ingleby Barwick is the deposition of incomplete skeletons and skeletal fragments, in which rather more individuals are present, even if partially. Those buried in Mortuary Deposit 1 were placed in a wooden chamber in a pit, while those in Mortuary Deposit 2 were buried in a pit cut into the grave pit for the richly equipped female, Burial 5. In both deposits the treatment accorded the fragmentary remains is not clear, although there has evidently been an element of curation and selection of the remains and, as Booth notes (above), the individual represented by Skeleton 3 (Mortuary Deposit 1a) is very likely to have been laid out on the ground or on a platform for excarnation before his partial remains were gathered up and placed as the initial deposit in the wooden chamber. Indeed, it is quite possible that the surviving remains in both of the mortuary deposits are the end-product of an extended period of re-placement. While the modelled radiocarbon dates suggest that the dated individuals in Mortuary Deposits 1 and 2, like those in Burials 1–3 and 5, could have died within a relatively short time-span, it is most unlikely (not least on stratigraphic grounds) that they all died at the same time. While the evidence from Mortuary Deposit 1 suggests a sequence of placements, the partial remains of four individuals found in Mortuary Deposit 2 seem to have been interred in a single event.

The exposure of corpses and the selective removal of some bones before collective deposition are features of Neolithic mortuary ritual current in the mid-fourth millennium cal BC. While it has been suggested that these traditions resurfaced in the mid-3rd millennium BC (Gibson 2007, 59 and see Gibson 2019), it may be that the diversification of practices that characterises Needham's 'fission horizon' towards the end of the third millennium BC (Needham 2005; 2012) was due to other, or additional, factors. The Ingleby Barwick burials demonstrate that Early Bronze Age mortuary treatment had yet further complexity, probably including mummification (Booth *et al* 2015, 1166; Booth, this report), as well as the deposition of partial skeletons. The Ingleby Barwick depositions (**Table 1**), with others, suggest a range of Early Bronze Age rituals which resulted in archaeological evidence superficially similar to that seen in Neolithic contexts. However, widely differing mortuary rituals might lead to apparently similar archaeological evidence, as Fitzpatrick has noted (2011, 195).

It is possible that, even though the cemetery overall was flat, the individual burial deposits at Ingleby Barwick were marked by mounds, now ploughed away, or were otherwise made visible so that their locations were respected by subsequent burials. Unfortunately, agricultural attrition has removed any evidence for burial markers or potential storage areas or structures. The insertion of Mortuary Deposit 2 completely within the fill of the grave of the richly equipped Burial 5 would seem to constitute a deliberate juxtaposition of human remains, a contrived meeting of kin – socially rather than biologically defined kin, as Booth and Brück have suggested (Booth and Brück 2020; Brück and Booth 2022). As for which act of burial marked the establishment of the cemetery, and how the cemetery evolved spatially, the radiocarbon dating evidence does not offer any clues and there is no 'core and periphery'-type patterning suggestive of primary and subsequent burials. It could be that Mortuary Deposit 1, in its prominent location, constituted the foundational deposit; equally, that role could have been played by the richly equipped Burial 5. All that can be said is that there is some evidence for sequential deposition in Mortuary Deposit 1, and that Mortuary Deposit 2 was inserted after the Burial 5 grave had been backfilled.

The potentially significant location of Ingleby Barwick at the confluence of the Tees and the Leven, near the lowest crossing point of the Tees, has already been discussed. The local topography is also of interest in that Mortuary Deposit 1 in its wooden chamber was sited close to the highest point of the site. This is hardly a marked feature, but there are gentle slopes running away to the north and east, and a slightly more marked gradient towards the Leven valley to the south-west. The evidence of the moorland burial mounds shows that, even with established woodland cover like that which almost certainly existed in the Tees valley at this time, the population was quite capable of selecting the highest points for siting monuments, which may only have become more obviously visible somewhat later. So, for example, Barrow 4D, the earliest and largest barrow in the Burton Howes group above Ingleby Greenhow, was set up when there was significant local woodland cover, but by the time the later small barrow 1A was set up the proportion of tree pollen to non-tree pollen had been reversed (Dimbleby 1962, 61–6). Lasting deforestation took place on the North York Moors at least from the Early Bronze Age (Simmons *et al* 1993, 37–40). In the lowlands of the Tees valley tree clearance may have been delayed in places until the mid- or even late second millennium BC, the woodlands perhaps offering resources which were preferred over agriculture (Fenton-Thomas 1992, 54).

The evidence now known from the confluence of the Tees and Leven is inevitably only a proportion of what once existed, but it is sufficient to suggest that at Ingleby Barwick, around the lowest crossing point of the River Tees and close to the open water of the estuary, was a focus for Early Bronze Age funerary activity. The location of these burials on the lower Tees contrasts with that of the burial mounds on the nearby uplands, which would have been distant from significant expanses of water and reachable only by foot. The people buried at Ingleby Barwick had a much closer relationship with the North Sea, 19km downstream as the crow flies, and some 33km along the meandering river, but easily accessed by boat or canoe. The members of this Early Bronze Age burial group had strong links with coastal Yorkshire and north-east Scotland. The links are particularly visible in Burial 5, with the inclusion of beads and 'buttons' of Whitby jet (Sheridan and Davies 2002, 822 and fig 8), in this instance associated with bronze armlets (Needham 2004, 239–40) and other prestige items (namely the tubular sheet-bronze beads), parallels for which can be seen a long way up the east coast in the Migdale hoard in north-east Scotland. Even more interestingly, the results of DNA sampling indicate that, in common with other analysed Early Bronze Age individuals in Britain (Olalde *et al* 2018), the sampled population was likely to have been descended from Beaker-using migrants who had moved from the Continent several generations earlier.

ACKNOWLEDGEMENTS

Particular acknowledgement is paid to Tees Archaeology Officer, Robin Daniels, for securing the appropriate excavation of the Early Bronze Age cemetery at Ingleby Barwick. Tees Archaeology provided funds to support post-excavation and specialist analysis, which have enabled the project to reach publication. Recording and analysis of the jet and other finds was undertaken by Jennifer Jones, Historic England Scientific Advisor for North-East England. Post-excavation work has been an unexpectedly lengthy process, a benefit of which has been developments in scientific techniques allied with a much expanded range of Early Bronze Age *comparanda*.

The excavation work was carried out on site by Richard Annis, Jeremy Bradley, Robin Daniels and Fiona Macdonald, with assistance from David Bayliss†; laboratory excavation was carried out by Jennifer Jones. The freeze-lifting was carried out by Jennifer Jones and Ticca Ogilvie†. Aidan Campbell, while working on a student placement at the University of Durham Conservation Laboratory, undertook XRF analysis of the iron content of the jet and jet-like objects. Thanks are due to Graham Pearson (Department of Geology, University of Durham) for comment on the petrology of the macehead, to Ken Sedman (formerly at the Dorman Museum, Middlesbrough) for information on haematite and other geology of the area, and to the late Penelope Walton Rogers (Textile Research in Archaeology, York), who provided information on textile remains.

The illustrations were prepared by Peter Hart Allison and Margaret Finch; air photographs were kindly supplied by Cleveland Constabulary's Air Support Unit. Photographs of jet, metal and other small items were produced by Jennifer Jones during laboratory excavation and subsequent consolidation of the finds.

The project was overseen for English Heritage by Henry Owen-John; other English Heritage staff who were at various times responsible for the project were Jan Summerfield, Rob Perrin and Alex Gibson. The authors thank all of these for their assistance and comments.

Richard Annis would like to thank Professor Anthony Harding for a number of helpful conversations about the site. Blaise Vyner offers particular thanks to Trevor Cowie and Alison Sheridan, formerly at National Museums Scotland, for enthusiastic comments and provision of *comparanda*, to Stuart Needham for comments and information on the bronze work, and to Terry Manby for his comments, information and advice on the Early Bronze Age context.

The site archive and finds are held by Tees Archaeology, Sir Wm Gray House, Clarence Road, Hartlepool TS24 8BT.

This report was published with the aid of a grant from Historic England.

BIBLIOGRAPHY

Allen, M J, Gardiner, J and Sheridan, J A 2012. *Is there a British Chalcolithic? People, Place and Polity in the Later 3rd Millennium*, Prehistoric Society Research Paper 4, Oxbow Books, Oxford

Anderson, J 1901. 'Notice of a hoard of bronze implements found at Migdale, on the estate of Skibo, Sutherland', *Proc Soc Antiq Scot,* **35** (1900–01), 266–75

Anderson, S 1991. 'A comparative study of the human skeletal material from late first and early second millennium cemeteries in the North East of England', unpublished Mphil thesis, University of Durham

Arabaolaza, I 2013. *ARO5: Spinning the Yarn: a cist at Keas Cottage, Spinningdale*, Archaeological Reports Online 5, GUARD Archaeology Ltd, Glasgow

Aufderheide, A C 2003. *The Scientific Study of Mummies*, Cambridge University Press, Cambridge

Bass, W 1971. *Human Osteology*, Missouri Archaeological Society, Missouri

Bateman, T 1861. *Ten Years' Digging in Celtic and Saxon Grave Hills in the Counties of Derby, Stafford, and York from 1848 to 1858*, George Allen and Sons, London

Booth, T J 2016. 'An investigation into the relationship between funerary treatment and bacterial bioerosion in European archaeological human bone', *Archaeometry,* 58(3), 484–99

Booth, T J and Brück, J 2020. 'Death is not the end: radiocarbon and histo-taphonomic evidence for curation and excarnation of human remains in Bronze Age Britain', *Antiquity*, 94, 1186–203

Booth, T J, Chamberlain, A T and Parker Pearson, M 2015. 'Mummification in Bronze Age Britain', *Antiquity*, **89**, 1155–73

Booth, T J *et al* 2021. 'Tales from the supplementary information: ancestry change in Chalcolithic–Early Bronze Age Britain was gradual with varied kinship organization', *Cambridge Archaeol J*, **31**(3), 379–400

Borlase, W C 1885. 'Typical specimens of Cornish barrows', *Archaeologia*, 49 (1), 181–98

Bouts, W and Pot, T 1989. 'Computerized recording and analysis of excavated human dental remains', in T J Roberts, F Lee, and J Bintliff (eds), *Burial Archaeology: current research, methods and developments,* 113–28, BAR Brit Ser 211, Oxford

Bowman, S G E, Ambers, J C and Leese, M N 1990. 'Re-evaluation of British Museum radiocarbon dates issued between 1980 and 1984', *Radiocarbon*, 32 (1), 59–79 https://doi.org/10.1017/S0033822200039953

Brewster, T C M 1980. *The Excavation of Garton and Wetwang Slacks*, East Riding Archaeological Research Committee Prehistoric Excavation Reports No. 2, Malton

Britnell, W J 2013. 'Recent work on round barrows in Wales', *Archaeol Cambrensis*, 162, 19–32

Brock, F *et al* 2010. 'Current pretreatment methods for AMS radiocarbon dating at the Oxford Radiocarbon Accelerator Unit (ORAU)', *Radiocarbon*, 52, 103–112

Bronk Ramsey, C 1995. 'Radiocarbon calibration and analysis of stratigraphy: the OxCal program', *Radiocarbon,* 37, 425–30

Bronk Ramsey, C 2009. 'Bayesian analysis of radiocarbon dates', *Radiocarbon*, 51, 337–60

Bronk Ramsey, C and Hedges, R E M 1997 'Hybrid ion sources: radiocarbon measurements from microgram to milligram', *Nuclear Instruments and Methods in Physics Research B: Beam Interactions with Materials and Atoms*, 123, 539–45

Bronk Ramsey, C, Pettitt, P B, Hedges, R E M *et al* 2000. 'Radiocarbon results from the Oxford AMS system: Archaeometry datelist 29', *Archaeometry*, 42, 243–54

Brönnimann, D *et al* 2018. 'Contextualising the dead – combining geoarchaeology and osteo-anthropology in a new multi-focus approach in bone histotaphonomy', *J Archaeol Sci,* **98**, 45–58

Brophy, K and Noble, G 2020. *Prehistoric Forteviot: excavations of a ceremonial complex in eastern Scotland,* CBA Research Report 176, York

Brothwell, D 1959. 'Teeth in earlier human populations', *Proc Nutrition Soc,* **18**, 59–65

Brothwell, D 1960. 'The Bronze Age people of Yorkshire', *Advancement Sci,* **16**, 311–22

Brothwell, D 1981. *Digging up Bones,* British Museum/OUP, London

Brück, J and Booth, T J 2022. 'The power of relics: the curation of human bone in British Bronze Age burials', *Eur J Archaeol*, **25** (4), 1–23 https://doi.org/10.1017/eaa.2022.18

Buckley, M 2013. 'Proteomics analysis of Gristhorpe Man "gelatine" and species identification of the animal hide keratin', in Melton *et al* 2013, 170–4

Butler, C 2005. *Prehistoric Flintwork*, Tempus, Stroud

Cavicchi, S, Russo, E G and Veronesi, E M 1978. 'On relations between olecranal perforation and some humeral and ulnar metric characters on the basis of multivariate analysis', *J Human Evolution,* **7**, 393–9

Clarke, D L 1970. *Beaker Pottery of Great Britain and Ireland,* Cambridge University Press, Cambridge

Clarke, D V, Cowie, T G and Foxon, A 1985. *Symbols of Power at the Time of Stonehenge,* HMSO, Edinburgh

Close-Brooks, J and Shepherd, I A G 1997. 'The finds from Cist VII and Cist IX', in M E C Stewart and G J Barclay, 'Excavations in burial and ceremonial sites of the Bronze Age in Tayside', *Tayside and Fife Archaeol J,* **3**, 28–30

Cornwall, I W 1976. 'Report on the human skeletal material', in F de M and H L Vatcher, 'The excavation of a round barrow near Poor's Heath, Risby, Suffolk', *Proc Prehist Soc*, **42**, 282–8

Craw, J H 1929. 'On a jet necklace from a cist at Poltalloch, Argyll', *Proc Soc Antiq Scot,* **63** (1928–29), 154–89

Davis, M *et al* 2015. 'Appendix V. The study and analysis of jet and jet-like materials: methods and results', in Woodward and Hunter 2015, in the accompanying CD

Dawes, J D 1976. 'Human bones', in T G Manby, Excavation of the Kilham long barrow, East Riding of Yorkshire, *Proc Prehist Soc,* **42**, 111–59

Dawes, J D 1979. 'The human bones', in J S Dent, 'Bronze Age burials from Wetwang Slack', *Yorks Archaeol J*, **51**, 23–39

Dawes, J D 1984. 'Human remains', in P Rahtz and L Watts, *Cowlam Wold Barrows*, 26–9, York University Archaeological Publications, 3, York

DeNiro, M J 1985. 'Postmortem preservation and alteration of *in vivo* bone collagen ratios in relation to palaeodietary reconstruction', *Nature*, **317**, 806–9

Denston, C B 1968. 'The human remains', in I Stead, 'The excavation of Beaker burials at Staxton, East Riding, 1957', *Yorks Archaeol J,* **40**, 129–44

Denston, C B 1973. 'Human bones', in F Petersen, 'The excavation of an Early Bronze Age cemetery at Pin Farm, Gazeley', *Proc Suffolk Inst Archaeol,* **33**, 19–46

Denston, C B 1977. 'Human Bronze Age skeletal remains from Chippenham, Cambridgeshire', 15–21 in E Martin, 'The excavation of two tumuli on Waterhall Farm, Chippenham, Cambridgeshire, 1973', *Proc Cambridge Antiq Soc,* **66**, 1–21

Dent, B B, Forbes, S L and Stuart, B H 2004. 'Review of human decomposition processes in soil', *Environmental Geology,* **45**, 576–85

Deter, C A, Mahoney, P, Johns, S E and Thomas, S 2019. 'Aspects of human osteology and skeletal biology', in Parker Pearson *et al* 2019, 253–91

Dimbleby, G W 1962. *The Development of British Heathlands and their Soils*, Clarendon Press, Oxford

Dingle, A T 1973. *Egglescliffe, a Short Introduction to the Village: edited and with an introduction by Robert Wood,* Patrick Shotton, Middlesbrough

Elgee, F 1930. *Early Man in North-East Yorkshire,* John Bellows, Gloucester

Fawcett, E 1938. 'Report on the human skeletal material', in E M Clifford, 'The Soldier's Grave, Frocester, Gloucestershire', *Proc Prehist Soc,* 4, 217–18

Fenton-Thomas, C 1992. 'Pollen analysis as an aid to the reconstruction of patterns of land-use and settlement in the Tyne-Tees region during the first millennia BC and AD', *Durham Archaeol J* 8, 51–62

Fernández-Jalvo, Y, Andrews, P, Pesquero, D 2010. 'Early bone diagenesis in temperate environments Part I: surface features and histology', *Palaeogeography, Palaeoclimatology, Palaeoecology,* 288, 62–81

Fitzpatrick, A P 2011. 'Bell Beaker mortuary rites in Wessex', in A P Fitzpatrick, *The Amesbury Archer and the Boscombe Bowmen: Bell Beaker burials on Boscombe Down, Amesbury, Wiltshire*, 195–202, Wessex Archaeology Report **27**, Salisbury

Gamble, M and Fowler, C 2013. 'A re-assessment of Early Bronze Age human remains in Tyne and Wear Museums: results and implications for interpreting Early Bronze Age burials from North-East England and beyond', *Archaeologia Aeliana*, 42, 47–80

Gammack, J 1878. 'Notice of a cist recently discovered on the farm of Cleughhead, Glenbervie, containing burnt human bones and a perforated stone hammer', *Proc Soc Antiq Scot*, 12 (1876–78), 609–11

Gibson, A 2007. 'A Beaker veneer? Some evidence from the burial record', in M Larsson and M Parker Pearson (eds), *From Stonehenge to the Baltic: living with cultural diversity in the third millennium BC,* 47–64, BAR Int Ser S511692, Archaeopress, Oxford

Gibson, A 2019. 'The Beaker funerary tradition in Britain in the context of Neolithic and Bronze Age practices', in Parker Pearson *et al* 2019, 201–10

Greenwell, W 1890. 'Recent researches in barrows in Yorkshire, Wiltshire, Berkshire, etc', *Archaeologia*, **52**, 1–72

Greenwell, W and Rolleston, G 1877. *British Barrows*, Clarendon Press, Oxford

Grinsell, L V 1959. *Dorset Barrows*, Dorset Natural History and Archaeological Society, Dorchester

Grupe, G 1995. 'Preservation of collagen in bone from dry, sandy soil', *J Archaeol Sci,* **22**, 193–99

Guarino, F M, Angelini, F, Vollono, C and Orefice, C 2006. 'Bone preservation in human remains from the Terme del Sarno at Pompeii using light microscopy and scanning electron microscopy', *J Archaeol Sci,* **33**, 513–20

Hackett, C J 1981. 'Microscopical focal destruction (tunnels) in exhumed human bones', *Med Sci Law* **21** (4), 243–66

Hanson, D B and Buikstra, J E 1987. 'Histomorphological alteration in buried human bone from the Lower Illinois Valley: Implications for palaeodietary research', *J Archaeol Sci,* **14**, 549–63

Hayes, RH 1966. 'Nanny Howe, Coate Moor, Cleveland', *Yorks Archaeol J,* **41**, 577–81

Hedges, R E M, Millard, A R and Pike, A W G 1995. 'Measurements and relationships of diagenetic alteration of bone from three archaeological sites', *J Archaeol Sci*, **22** (2), 201–9 https://doi.org/10.1006/jasc.1995.0022

Henshall, A S and Wallace, J C 1963. 'A Bronze Age cist burial at Masterton, Pitreavie, Fife', *Proc Soc Antiq Scot,* **96** (1962–63), 145–54

Heslop, D H 1984. 'Initial excavations at Ingleby Barwick, Cleveland', *Durham Archaeol J,* **1**, 23–34

Hess, M W, Klima, G, Pfaller, K *et al* 1998. 'Histological investigations on the Tyrolean ice man', *American J Phys Anth,* **106**, 521–32

Hewitt, R, Brightman, J, Mason, D *et al* 2011. *An Archaeological Assessment of County Durham. The aggregate-producing areas*, Durham County Council and Archaeological Research Services, Durham

Hicks, J D 1968. 'Esh's Barrow', *Yorks Archaeol J*, **42**, 306–13

Hundt, H-J 1958. *Katalog Straubing, 1, Die Funde der Glockenbecher-Kultur und der Straubinger Kultur,* Kallmunz/Of, Lassleben

Huntley, J P 1997. 'Ingleby Barwick, Cleveland: IWF 96: assessment of the environmental samples', unpublished report, Durham Environmental Archaeology Report 15/97

Jans, M M E 2008. 'Microbial bioerosion of bone – a review', in M Wisshak and L Tapanila (eds), *Current Developments in Bioerosion*, 397–413, Springer Verlag, Berlin

Jelley, D 1984. 'The jet buttons', in B E Vyner, 'The excavation of a Neolithic cairn at Street House, Loftus, Cleveland', *Proc Prehist Soc,* **50**, 177–182

Jelley, D 1988. 'The jet button', in B E Vyner, 'The Street House Wossit: the excavation of a late Neolithic and Early Bronze Age palisaded ritual enclosure at Street House, Loftus, Cleveland', *Proc Prehist Soc,* **54**, 194

Jones, A M 2017. *Preserved in the Peat: investigation of a Bronze Age burial on White Horse Hill, Dartmoor, and its wider context*, Oxbow Books, Oxford

Jones, J A 2001a. 'A Bronze Age burial from north-east England: lifting and excavation', in E Williams (ed), *Human Remains: conservation, retrieval and analysis, proceedings of a conference held in Williamsburg, VA, Nov 7–11th 1999*, 33–37, BAR Int Ser 934, Oxford

Jones, J A 2001b 'The freeze-lifting, investigation, conservation and analysis of a burial from Ingleby Barwick', unpublished report, Durham University

Kendall, C, Høier Eriksen, A-M, Kontopoulos, I *et al* 2018. 'Diagenesis of archaeological bone and tooth', *Palaeogeography, Palaeoclimatology, Palaeoecology,* **491**, 21–37

Kinnes, I A 1985. *British Bronze Age Metalwork A7–16: Beaker and Early Bronze Age grave groups,* British Museum, London

Kinnes, I A and Longworth, I H 1985. *Catalogue of the Excavated Prehistoric and Romano-British Material in the Greenwell Collection,* British Museum, London

Kinnes, I A, Schadla-Hall, T, Chadwick, P and Dean, P 1983. 'Duggleby Howe reconsidered', *Archaeol J,* **140**, 83–108

Kontopoulos, I, Nystrom, P and White, L 2016. 'Experimental taphonomy: post-mortem microstructural modifications in Sus scrofa domesticus bone', *Forensic Sci Int*, **266**, 320–28. https://doi.org/10.1016/j.forsciint.2016.06.024

Krogman, W 1978. *The Human Skeleton in Forensic Medicine*, C C Thomas, Springfield, IL

Largo Field Studies Society 1968 'Three Short Cists', *Discovery and Excavation in Scotland*, 21–22

Lelong, O 2014. 'Wrappings of power: a woman's burial in cattle hide at Langwell Farm, Strath Oykel', *Proc Soc Antiq Scot*, **144**, 65–131

Lethbridge, T C, Fowler, G and Sayce, R U 1932. 'A skeleton of the Early Bronze Age found in the Fens', *Proc Prehist Soc East Anglia*, **6** (1929–32), 362–4

Longin, R 1971. 'New method of collagen extraction for radiocarbon dating', *Nature,* **230**, 241–2

Low, A 1929. 'A short cist at Culduthel, Inverness', *Proc Soc Antiq Scot*, **63** (1928–29), 217–24

McAdam, E 1982. 'Comparative background: the cemetery', 120–129 in T Watkins, 'The excavation of an early Bronze Age cemetery at Barns Farm, Dalgety, Fife', *Proc Soc Antiq Scot,* **112**, 48–141

McCormac, F G 1992. 'Liquid scintillation counter characterisation, optimisation and benzene purity correction', *Radiocarbon,* **34**, 37–45

McCormac, F G, Kalin, R M and Long, A 1992. 'Radiocarbon dating beyond 50,000 years by liquid scintillation counting', in J E Noakes, F Shonhofer, and H A Polach (eds), *Liquid Scintillation Spectrometry*, 125–33, Radiocarbon, Tucson, AZ

Mackey, R 2006. 'A tale in three parts concerning a barrow, a long house and a henge (rescue excavations at Easington, East Yorkshire)', *Current Archaeol*, **202**, 526–31

Manby, T G, King, A and Vyner, B E 2003. 'The Neolithic and Bronze Ages: a time of early agriculture', in T G Manby, S Moorhouse and P Ottaway (eds), *The Archaeology of Yorkshire: an assessment at the beginning of the 21st century*, 35–116, Yorkshire Archaeological Society Occasional Paper 3, Leeds

Martin, E A 1976. 'The excavation of two tumuli on Waterhall Farm, Chippenham, Cambridgeshire, 1973', *Proc Cambs Antiq Soc,* **66**, 1–22

Marlow, M 1992. 'The population', in S J Sherlock and M G Welch, *An Anglo-Saxon Cemetery at Norton, Cleveland*, 107–18, CBA Research Report 82, London

Mayes, P, Atherden, M, Manchester, K and Manby, TG 1986. 'A Beaker burial at West Tanfield, North Yorkshire', *Yorks Archaeol J,* **58**, 1–4

Mays, S 1988a. 'The human bones from Orton Longueville, Cambridgeshire', unpublished report, Ancient Monuments Laboratory Rep 98/88, English Heritage, London

Mays, S 1988b. 'The human bone from Octon Wold Round Barrow, Humberside', unpublished report, Ancient Monuments Laboratory Rep 110/88, English Heritage, London

Melton, N D, Montgomery, J and Knüsel, C J (eds) 2013. *Gristhorpe Man: a life and death in the Bronze Age*, Oxbow Books, Oxford

Millard, A 2001. 'The deterioration of bone', in D Brothwell and A M Pollard (eds), *Handbook of Archaeological Sciences*, 637–47, John Wiley & Sons, Chichester

Morant, G 1926. 'A first study of the craniology of England and Scotland from Neolithic to early historic times, with special reference to the Anglo-Saxon skulls in London Museums', *Biometrika,* **18**, 56–93

Mortimer, J R 1905. *Forty Years' Researches in British and Saxon Burial Mounds of East Yorkshire*, A Brown, London

Needham, S 2000. 'Early Bronze Age armlets in Britain', in G Hughes, *The Lockington Gold Hoard: an Early Bronze Age barrow cemetery at Lockington, Leicestershire*, 29–38, Oxbow Books, Oxford

Needham, S 2004. 'Migdale-Marnoch: sunburst of Scottish metallurgy', in I G Shepherd and G J Barclay (eds), *Scotland in Ancient Europe: the Neolithic and Early Bronze Age of Scotland in their European context*, 217–45, Society of Antiquaries of Scotland, Edinburgh

Needham, S 2005. 'Transforming Beaker culture in north-west Europe: processes of fusion and fission', *Proc Prehist Soc*, **71**, 171–217

Needham, S 2012. 'Case and place for the British Chalcolithic', in Allen *et al* 2012, 1–26

Needham, S and Sheridan, J A 2014. 'Chalcolithic and Early Bronze Age goldwork from Britain: new finds and new perspectives', in H Meller, E Pernicka and R Risch (eds), *Metals of Power: early gold and silver. Proceedings of the 6th Archaeological Congress of Central Germany*, 903–941, Tagungen des Landesmuseums Band 11, Landesmuseum **für** Vorgeschichte Halle, Halle

Needham, S, and Woodward, A 2008. 'The Clandon barrow finery: a synopsis of success in an Early Bronze Age world', *Proc Prehist Soc*, **74**, 1–52

Needham, S, Lawson, A and Woodward, A 2010. '"A noble group of barrows": Bush Barrow and the Normanton Down Early Bronze Age cemetery two centuries on', *Antiq J,* **90**, 1–39

Nielsen-Marsh, C M, Smith, C I, Jans, M M E 2007. 'Bone diagenesis in the European Holocene II: taphonomic and environmental considerations', *J Archaeol Sci,* **34**, 1523–31

Olalde, I *et al* 2018. 'The Beaker phenomenon and the genomic transformation of northwest Europe', *Nature,* **555** (7695), 190–96 https:/doi.org/10.1038/nature25738

Ó Riordáin, S P and Waddell, J 1993. *The Funerary Bowls and Vases of the Irish Bronze Age*, Galway University Press, Galway

Outram, A K, Knüsel, C J, Knight, S and Harding, A F 2005. 'Understanding complex fragmented assemblages of human and animal remains: a fully integrated approach', *J Archaeol Sci,* **322**, 1699–710

Parker, S 1991. 'The cremated bone', 33 in B E Vyner, 'Bronze Age activity on the Eston Hills, Cleveland', *Yorks Archaeol J*, **63**, 25–49

Parker Pearson, M *et al* 2005. 'Evidence for mummification in Bronze Age Britain', *Antiquity,* **79**, 529–46

Parker Pearson, M, Chamberlain, A, Collins, M J *et al* 2007. 'Further evidence for mummification in Bronze Age Britain', *Antiquity,* **81**, 312–22

Parker Pearson, M, Sheridan, J A and Needham, S 2013. 'Bronze Age tree-trunk coffin graves in Britain', in Melton *et al* 2013, 29–66

Parker Pearson, M, Needham, S and Sheridan, J A 2019. 'The *Beaker People Project* individuals, their funerary practices and their grave-goods', in Parker Pearson *et al* 2019, 115–210

Parker Pearson, M *et al* (eds) 2019. *The Beaker People: isotopes, mobility and diet in prehistoric Britain*, Prehistoric Society Research Paper 7, Oxbow Books, Oxford

Patterson, N *et al* 2022. 'Large-scale migration into Britain during the Middle to Late Bronze Age', *Nature,* **601**, 588–94

Perley, D 1995. *Ingleby Barwick: the new settlement*, Perley, Ingleby Barwick

Petersen, F 1969. 'Early Bronze Age timber graves and coffin burials on the Yorkshire Wolds', *Yorks Archaeol J*, **42**, 262–7

Powers, R and Brothwell, D 1967. 'Human skeletal material', in P M Christie, 'A barrow cemetery of the second millennium BC in Wiltshire, England', *Proc Prehist Soc,* **33**, 336–66

Redfern, R 2008. 'New evidence for Iron Age secondary burial practice and bone modification from Gussage All Saints and Maiden Castle (Dorset, England)', *Oxford J Archaeol,* **27**, 281–301

Reimer, P J, Austin, W E N, Bard, E *et al* 2020. 'The IntCal20 northern hemisphere radiocarbon age calibration curve (0–55 cal kBP)', *Radiocarbon*, **62**, 725–57

Roberts, C A and Cox, M 2003. *Health and Disease in Britain: from prehistory to the present day*, Sutton Publishing, Stroud

Roe, F E S 1979. 'Typology of stone implements with shaftholes', in T H McClough and W A Cummins (eds), *Stone Axe Studies,* 23–48, CBA Research Report 23, London

Rogers, P W 1999. 'Fibres on a Bronze-Age bangle from Ingleby Barwick, Teesside (IWF 96)', unpublished report, Textile Research in Archaeology, The Anglo-Saxon Laboratory, York

Rowe, P 2014. 'A Bronze Age Beaker vessel from Howl's Nest, Maltby, Stockton-on-Tees', *Durham Archaeol J*, **19**, 1–5

Russel, A D 1990. 'Two Beaker burials from Chilbolton, Hampshire', *Proc Prehist Soc,* **56**, 153–72

Saville, A 2013 'Neolithic polished axehead', in Willis and Carne (eds) 2013, 23–4

Saunders, S and Popovich, F 1978. 'A family study of two skeletal variants: atlas bridging and clinoid bridging', *American J Phys Anth,* **49**, 193–204

Scott, R 2013. 'The lithics', in Willis and Carne (eds) 2013, 22–3

Shepherd, A N 1989. 'A note on the orientation of Beaker burials in North-East Scotland', 79–80 in M K Grieg, C Grieg, A N Shepherd and I A G Shepherd, 'A Beaker cist from Chapelden, Tore of Troup, Aberdour, Banff and Buchan District', *Proc Soc Antiq Scot*, **119**, 73–81

Shepherd, A N 2012. 'Stepping out together: men, women, and their Beakers in time and space', in Allen *et al* 2012, 257–80

Shepherd, I A G 1981. 'Bronze Age jet working in North Britain', *Scot Archaeol Forum*, **11**, 43–51

Shepherd, I A G 2009. 'The V-bored buttons of Great Britain and Ireland', *Proc Prehist Soc*, **75**, 335–69

Sheridan, J A 2001. 'The disc bead bracelet from Roundway', unpublished report for Sarah Semple

Sheridan, J A 2007. 'Dating the Scottish Bronze Age: "There is clearly much that the material can still tell us"', in C Burgess, P Topping and F Lynch (eds), *Beyond Stonehenge: essays on the Bronze Age in honour of Colin Burgess,* 162–85, Oxbow Books, Oxford

Sheridan, J A 2015. 'Discussion of disc bead and spacer plate necklaces of jet and jet-like materials', in Woodward and Hunter 2015, 341–81

Sheridan, J A 2017. 'Towards a methodology for the study of prehistoric jet and jet-like jewellery', in R Shaffrey (ed.), *Written in Stone: papers on the function, form, and provenancing of prehistoric stone objects in memory of Fiona Roe*, 249–74, Highfield Press, St Andrews

Sheridan, J A 2021. 'Appendix 13: Jet spacer-plate necklaces and spacer-plate bracelet from East Challoch Farm', online appendix in W Bailie, *Dunragit – the prehistoric heart of Galloway*, Archaeopress, Oxford. https://www.guard-archaeology.co.uk/DunragitMonographAppendices/Appendix13_Jet.pdf

Sheridan, J A and Davis, M 2002. 'Investigating jet and jet-like artefacts from prehistoric Scotland: the National Museums of Scotland project', *Antiquity*, **76**, 812–25

Sheridan, J A, Hunter, F J and Saville, A 1995. 'Organic artefacts from the collections of the National Museums of Scotland', 423–5 in R E M Hedges, R A Housley, C Bronk Ramsey and G J van Klinken, 'Radiocarbon dates from the Oxford AMS system: Archaeometry datelist 20', *Archaeometry*, **37** (2), 417–30

Sheridan, J A *et al* 2013 'The Gristhorpe coffin and its contents', in Melton *et al* 2013, 148–65

Sheridan, J A, Hall, D, Romera, A *et al* 2018. 'Kilmagadwood Early Bronze Age cemetery: excavation and initial post-excavation research', *Tayside and Fife Archaeol J*, **24**, 1–20

Simmons, I G *et al* 1993. 'Prehistoric environments', in D A Spratt (ed), *Prehistoric and Roman Archaeology of North-East Yorkshire*, 15–50, CBA Research Report 87, London

Simmons, T, Cross, P A, Adlam, R E *et al* 2010. 'The influence of insects on decomposition rate in buried and surface remains', *J Forensic Sci*, **55**, 889–92

Simpson, D D A 1968. 'Food Vessels: associations and chronology', in J M Coles and D D A Simpson (eds), *Studies in Ancient Europe: essays presented to Stuart Piggott,* 205–11, Leicester University Press, Leicester

Smith, C I, Nielsen-March, C M, Jans, M M E *et al* 2002. 'The strange case of Apigliano: early 'fossilisation' of medieval bone in southern Italy', *Archaeometry,* **44**, 405–15

Smith, C I, Nielsen-March, C M, Jans, M M E *et al* 2007. 'Diagenesis in the European Holocene I: patterns and mechanisms', *J Archaeol Sci*, **34**, 1485–93

Smith, M J B 1994. *Excavated Bronze Age Burial Mounds of North-East Yorkshire*, Architectural and Archaeological Society of Durham and Northumberland Research Report 3, Durham

Sockett, E W 1971. 'A Bronze Age Barrow at Mount Pleasant, Normanby, North Riding', *Yorks Archaeol J,* **43**, 33–38

Spratt, D A 1993. *Prehistoric and Roman Archaeology of North-East Yorkshire*. CBA Research Report 87, London

Stead, S 1991. 'The human bones', in I Stead, *Iron Age Cemeteries in East Yorkshire*, 126–39, English Heritage Archaeology Report 22, London

Stevenson, R B K 1956. 'The Migdale hoard bronze necklace', *Proc Soc Antiq Scot*, **89** (1955–56), 456–7

Still, L and Vyner, B E 1986. 'Air photographic evidence for later prehistoric settlement in the Tees valley', *Durham Archaeol J*, **2**, 11–23

Stuiver, M and Polach, H J 1977. 'Reporting of 14C data', *Radiocarbon*, **19**, 355–63

Synal, H-A, Stocker, M and Suter, M 2007 'MICADAS: a new compact radiocarbon AMS system', *Nuclear Instruments and Methods in Physics Research B: Beam Interactions with Materials and Atoms*, **259**, 7–13

Teather, A and Chamberlain, A 2016. 'Dying embers: fire-lighting technology and mortuary practice in Early Bronze Age Britain', *Archaeol J*, **173** (2), 188–205 https://doi.org/10.1080/00665983.2016.1177258

Tees Archaeology1998. *Ingleby Barwick Village 5 and 6: archaeological recommendations*, Hartlepool

Tuckwell, A N 1975 'Patterns of burial orientation in the round barrows of Eastern Yorkshire', *Bull Inst Archaeol*, **12**, 95–123

Turner-Walker, G and Jans, M 2008. 'Reconstructing taphonomic histories using histological analysis', *Palaeogeography, Palaeoclimatology, Palaeoecology,* **266**, 227–35

Vyner, B E 1984. 'The excavation of a Neolithic cairn at Street House, Loftus, Cleveland', *Proc Prehist Soc,* 50, 151–96

Vyner, B E 1988. 'The Street House Wossit: the excavation of a late Neolithic and early Bronze Age palisaded ritual enclosure at Street House, Loftus, Cleveland', *Proc Prehist Soc,* **54**, 173–202

Vyner, B E 1991. 'Bronze Age activity on the Eston Hills, Cleveland', *Yorks Archaeol J,* **145**, 60–98

Vyner, B E 2000. 'Lost horizons: the location of activity in the later Neolithic and early Bronze Age in north-east England', in Harding, J and Johnston, R (eds), *Northern Pasts: Interpretations of the Later Prehistory of Northern England and Southern Scotland*, 101–110, BAR Brit Ser 302, Oxford

Vyner, B E 2003. 'The pottery', in C Moloney, R Holbrey, P Wheelhouse and I Roberts, *Catterick Racecourse, North Yorkshire: the reuse and adaptation of a monument from prehistoric to Anglian times*, 30–35, Archaeological Services (WYAS) Publications 4, Leeds

Vyner, B E 2005. 'Early prehistoric pottery', in I Roberts (ed), *Ferrybridge Henge: the ritual landscape, archaeological investigations at the site of the Holmfield interchange of the A1 motorway*, 127–30, Yorkshire Archaeology 10, West Yorkshire Archaeological Services, Leeds

Vyner, B E 2007 'A great north route in Neolithic and Bronze Age Yorkshire: the evidence of landscape and monuments', *Landscapes*, **8**, 69–84

Vyner, B E 2014. 'The Beaker', 2–4 in P Rowe, 'A Beaker vessel from Howl's Nest, Maltby, Stockton-on-Tees', *Durham Archaeol J*, **19**, 1–5

Vyner, B E 2019a. 'Assessment report on pottery from land at Sowerby, Sowerby Sports Village (OSA18 EX10)', unpublished report, Blaise Vyner Archaeological Consultancy

Vyner, B E 2019b. 'Pottery from evaluation excavations at Durham Road, Thorpe Thewles, Cleveland (DRT18)', unpublished report for West Yorkshire Archaeology, Blaise Vyner Archaeological Consultancy

Wacker, L, Christl, M and Synal, H-A 2010a. 'Bats: A new tool for AMS data reduction', *Nuclear Instruments and Methods in Physics Research B: Beam Interactions with Materials and Atoms*, **268**, 976–9

Wacker, L, Němec, M and Bourquin, J 2010b. 'A revolutionary graphitisation system: fully automated, compact and simple', *Nucl Instrum Methods Phys Res B*, **268**, 931–4.

Walsh, S 2013. 'Identity as process: an archaeological and osteological study of Early Bronze Age burials in Northern England', unpublished PhD thesis, University of Central Lancashire

Ward, G K and Wilson, S R 1978. 'Procedures for comparing and combining radiocarbon age determinations: a critique', *Archaeometry,* **20**, 19–31

Waterman, D M 1951. 'Quernhowe: a Food Vessel barrow in Yorkshire', *Antiq J*, **31**, 1–24

Wegner, G 1996. *Bronzezeit in Niedersachsen*, Isensee, Oldenburg

Weinstein, R S, Simmons, D J and Lovejoy, C O 1981. 'Ancient bone disease in a Peruvian mummy revealed by quantitative skeletal histomorphometry', *American J Phys Anth,* **54**, 321–26

Wells, C 1977. 'The human bones', 216–25 in P Donaldson, 'The excavation of a multiple round barrow at Barnack, Cambridgeshire, 1974–76', *Antiq J,* **57**, 197–231

Wells, C 1984. 'The human skeletal remains', in C Green and S Rollo-Smith, 'The excavation of eighteen round barrows near Shrewton, Wiltshire', *Proc Prehist Soc,* **50**, 255–318 and microfiche

Wheelhouse, P 2005. 'The ritual monuments', in I Roberts (ed) 2005, 21–51

White, L 2009. 'The microbiology of death', unpublished PhD thesis, University of Sheffield

White, L and Booth, T J 2014. 'The origin of bacteria responsible for bioerosion to the interior bone microstructure: results from experimentally-deposited pig carcasses', *Forensic Sci Int*, **239**, 92–102

Whittle, A 1991. 'Wayland's Smithy, Oxfordshire: excavations at the Neolithic tomb in 1962–63 by R J C Atkinson and S Piggott', *Proc Prehist Soc*, **57**, 61–101

Wickham-Jones, C R 1995. 'The lithics', 23–9 in M Adams and P Carne, 'Excavations at Site P, Village 3, Ingleby Barwick, Cleveland', *Durham Archaeol J,* **11**, 19–33

Willis, S and Carne, P (eds) 2013. *A Roman Villa at the Edge of Empire: excavations at Ingleby Barwick, Stockton-on-Tees, 2003–04*, CBA Research Report 170, York

Willis, S and Carne, P 2013. 'Introduction: landscape setting, earlier investigation of the site, and research design', in Willis and Carne (eds) 2013, 1–20

Wilson, J E, McCormac, F G and Hogg, A 1996. 'Small sample high-precision 14C dating: characterization of vials and counter optimization', in G T Cook, D D Harkness, A B McKenzie, B F Miller and E M Scott (eds), *Liquid Scintillation Spectrometry,* 59–65, Radiocarbon, Tucson, AZ

Wood, E S 1971. 'The excavation of a Bronze Age barrow: Green Howe, North Deighton, Yorkshire', *Yorks Archaeol J* **43**, 2–32

Woodward, A 2000. 'The prehistoric pottery', in G Hughes, *The Lockington Gold Hoard: An Early Bronze Age Barrow Cemetery at Lockington, Leicestershire*, 48–60, Oxbow Books, Oxford

Woodward, A and Hunter, J, with D Bukach, S P Needham and J A Sheridan 2015. *Ritual in Early Bronze Age Grave Goods*, Oxbow Books, Oxford

Workshop of European Anthropologists (WEA) 1980. 'Recommendations for age and sex diagnoses of skeletons', *J Human Evolution,* **9**, 517–49

Young, G and Bird, J 1822. *A Geological Survey of the Yorkshire Coast*, Geo Clarke, Whitby

Young, R 2013. 'Early prehistoric pottery', in Willis and Carne (eds) 2013, 24–5