FURTHER EXCAVATION AT FIN COP HILLFORT AND STABLE ISOTOPE ANALYSIS OF THE SKELETONS

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SUMMARY

The main results and discussion of the Fin Cop investigations has been published elsewhere (Waddington 2012). This paper presents the results from a further excavation trench (Trench 9) cut across the southeast corner of the rampart during the summers of 2012 and 2014 by Archaeological Research Services Ltd with the help of local volunteers and, for the 2012 season only, with the assistance of Cranfield University as part of their student fieldwork training. The trench was extended by 2m in a southerly direction during the 2014 season. The excavation followed directly on from the investigations undertaken by Archaeological Research Services Ltd and the Longstone Local History Group during 2009 and 2010. The partial remains of at least 6 human individuals comprising two adults, one perinate and three neonates were identified in the rampart destruction deposit within the fill of the hillfort ditch in Trench 9. Small fragments of animal bone were also found in the hillfort ditch and within the stone wall core comprising remains of cattle, sheep/goat, rabbit/hare and a possible rat. Botanical macrofossils and charred wood were also present, together with a few small pottery fragments and a small assemblage of residual chipped stone tools resulting from Stone Age activity on the site.

Strontium, oxygen, carbon and nitrogen isotope analysis was undertaken on teeth and bone from four adults, a juvenile, two infants and five peri/neonates that were retrieved from the various excavation campaigns. The carbon and nitrogen isotopes of the adults indicate a mixed diet of terrestrial C3 plants and animal protein which is in line with contemporaneous Iron Age populations in Britain. More variation was observed in the sub-adults which may be related to breastfeeding or prenatal stress. Strontium and oxygen isotopes of five of the individuals indicate that only one adult was consistent with origins on the limestone of the White Peak and three individuals were consistent with sedimentary regions within 20 miles. One adult female has an unusually high strontium isotope ratio which is indicative of origins in a granitic terrain.

BACKGROUND

The excavation reported here took place at Fin Cop over a two week period during June 2012 and a one week period in June 2014. The excavations were directed by Archaeological Research Services Ltd (2012 and 2014) and Cranfield University (2012) with the assistance of over 30 local volunteers and fourteen post-graduate students.

As the site and its environs have been described fully in previous publications (e.g. Waddington 2010; 2012), an in-depth description of the site here is unnecessary, save for a brief summary. The site is located on the crest of a steep-sided bluff around the 330m contour with steep scarps off to the north and west, dropping over 170m to the floor of the deeply incised valley known as Monsal Dale (Fig. 1). It commands panoramic views in all directions and other Peak District hillforts at Ball Cross and Burr Tor are visible. The site lies directly on the Carboniferous Limestone bedrock, laid down around 350 million years ago. This has given rise to base-rich fertile soils which have been used for farming from the Neolithic to the present day. Visible remains comprise a discontinuous bank and ditch rampart which define a scarp-edge enclosure, with a short section of a second bank and ditch at the north end of the east-facing section of the circuit forming an area of bivallate defences flanking one side of the entrance (Fig. 2).

Previous excavations documented the deliberate destruction of the fort defences at the same time as the bodies of women, babies and children were unceremoniously dumped into the hillfort ditch immediately after, or during, their death, and the wall destruction debris thrown in on top of them. This is likely to have occurred as a single event towards the end of the middle Iron Age (Waddington 2012).

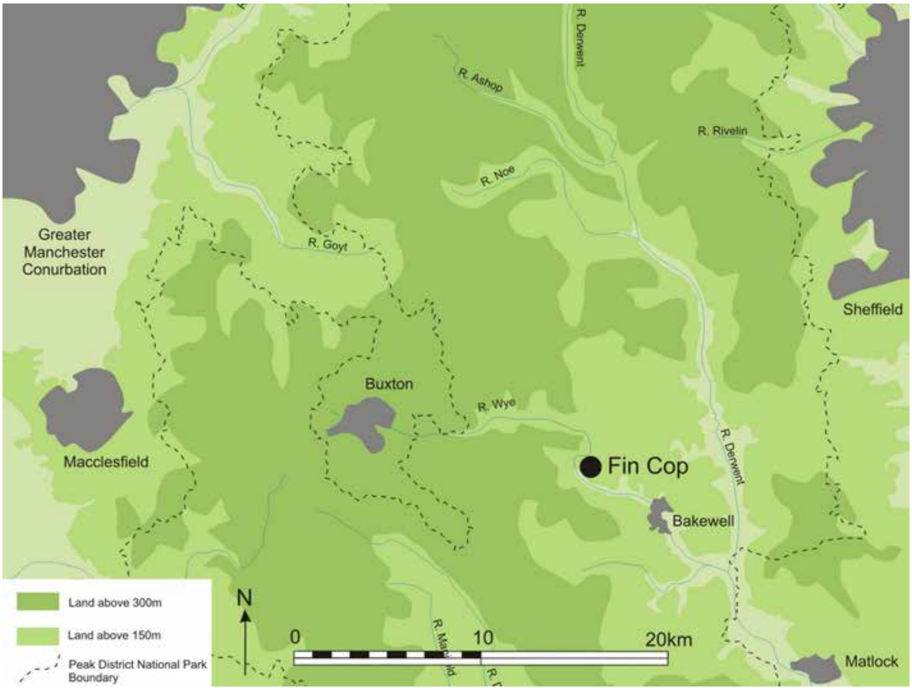


Fig. 1: Site location.

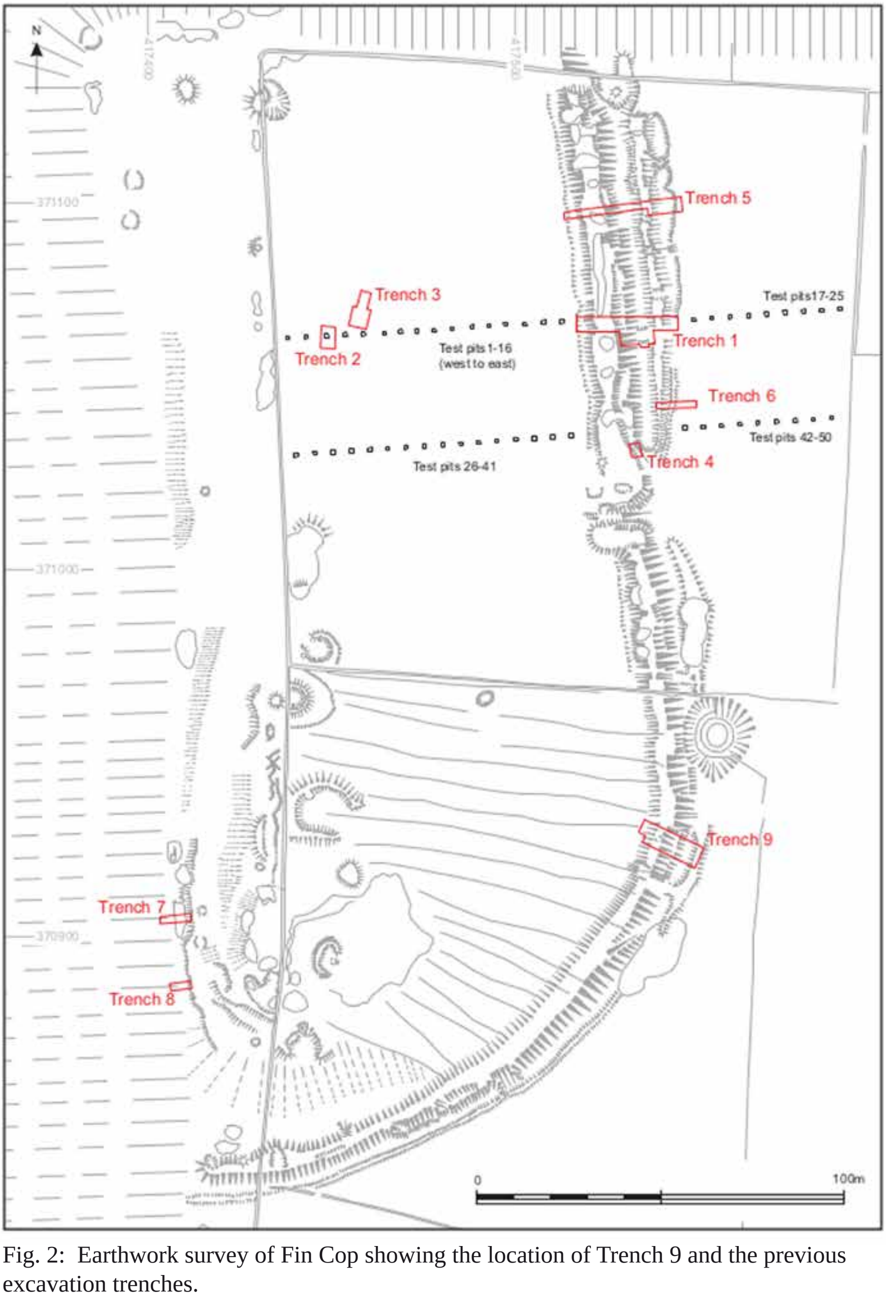


Fig. 2: Earthwork survey of Fin Cop showing the location of Trench 9 and the previous excavation trenches.

One of the outstanding questions leading on from this initial phase of work was whether the deposition of women and children in the fort ditch was a localised phenomenon confined to the eastern sector of the defences or whether bodies had been dumped in the ditch around most of its circuit. In addition, it was not known whether the form of the ramparts was consistent around the fort's circuit or whether it varied in construction; also whether there was any evidence for an earlier phase of defensive works. To address these questions a single excavation trench was cut over the ramparts at the southeast angle of the hillfort, over 100m away from the previous trenches.

EXCAVATION

The excavation comprised a single trench (Trench 9) and its location, together with those from the 1999 and 2000 excavations, can be seen in Figure 2. Trench 9 was laid out in a rectangle perpendicular to the rampart and ditch on the southeast corner of the rampart circuit, in a broadly east-west direction. A trench extension was made in 2014 so that, in total, a 6m width of ditch and rampart was investigated in line with the Scheduled Monument Consent methodology. The combined trench had maximum dimensions of 18m by 7m, including the 1m baulk left between the 2012 and 2014 trenches (Fig. 3).

The trench exposed a rock-cut ditch outside the stone defensive wall which had a vertical face on the inner-side of the ditch (Figs 3 and 4 and Plate 1). The ditch was clearly unfinished with the quarrying face still visible and an area of unexcavated rock still in place towards the southern side of the trench (Fig. 3). The presence of this irregular and jagged slab of rock suggests that separate work gangs were working towards each other as they excavated the ditch. This phenomenon was noted in both of the previous trenches across the ramparts (Trenches 1 and 5, Waddington 2012). Where excavation of the ditch was complete a flat base was evident. Where complete, the ditch base in Trench 9 measured up to 1.25m deep below the pre-rampart ground surface and 4m wide at its top. The ditch contained a thin, discontinuous primary clay lens (008) immediately above the natural bedrock (007) in the northern side of the trench, which is interpreted as the primary ditch silt against the inner face (Fig. 3).

Immediately overlying the primary silt and bedrock base of the ditch was the main ditch fill (003), which was identical to the material found in Trenches 1 and 5 (Waddington 2012). The deposit comprised a rocky fill of angular quarried slabs pitched at different angles with increasing voids with depth. The rock is not naturally shaped but rather quarried material with, in some cases, semi-dressed faces. No tip lines or layering was evident indicating the material was deposited as part of a single event. The pitch of the material shows that most entered the ditch from its inner and higher side where the stone wall was located. The angle at which much of the stone was pitched was such that the stone could not have rolled or slumped into such a position. The facing stones and wall core were mingled throughout the fill with no signs of the anticipated layering if the fort wall had slumped or collapsed. As with Trenches 1 and 2, this fill can be confidently understood as the wall destruction deposit. Voids between the rocks have allowed for fine-grained material to percolate through the stone fill so that the rocky fill now appears as rocks set in a clayey soil matrix, however, the soil has entered the fill of the ditch after the rocks were thrown in.

Above the wall destruction deposit was a subsoil layer (002) comprising an orange-brown (7.5YR 4/4) ferruginous silt that varied between 0.14m and 0.2m thick above the ditch fill and 0.6m in front of the slumped wall face. Above the subsoil was the modern topsoil and turf

Looking west across the 2012 excavation trench with the ditch in the foreground and rampart beyond.

View north across the top of the demolished rampart wall.

Looking west across the 2014 excavation trench with the ditch in the foreground and rampart beyond.

Fig. 3: Trench 9 plan.

layer (001) which varied between 0.2m and 0.26m thick and was dark grey-brown in colour (7.5YR 3/2).

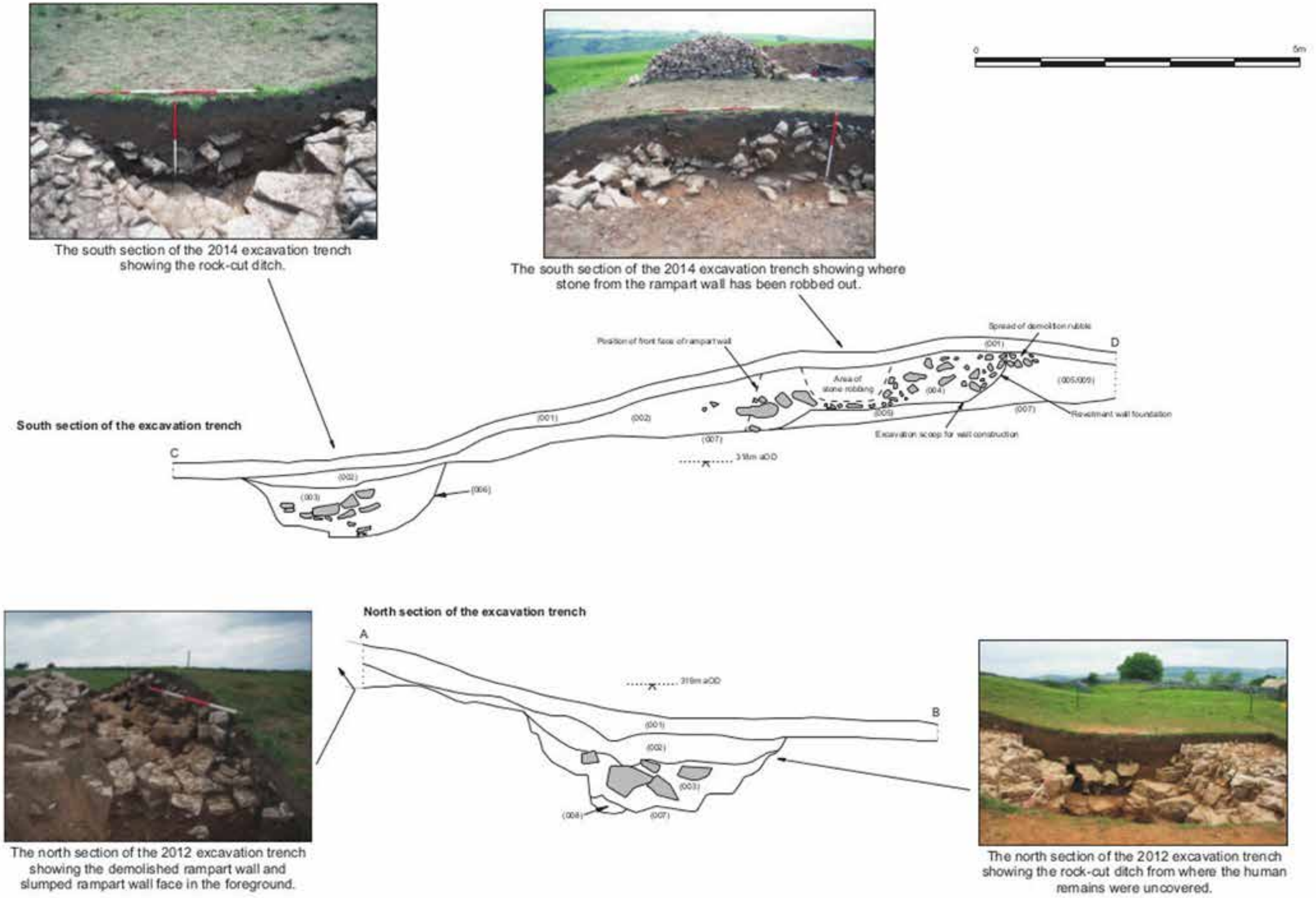
Within the wall destruction deposit (003) skeletal remains of six individuals was recovered. They included two adults, one perinate and three neonates. The articulated adult (Skeleton 11) was recovered from the lower part of the ditch fill just above the bedrock floor in the north side of the trench against the base of the outer edge of the ditch. The individual was not lying flat in the base of the ditch but was at a haphazard angle, partly towards the vertical, indicating that the body had been deposited in the ditch unceremoniously and without any formal attempt at burial. The remains were articulated indicating that the individual had entered the ditch fleshed, however, large parts of the skeleton were missing. This person was found lying on their left-hand side in a sloping position facing south and resting directly against the outer edge of the rock-cut ditch. The attraction of scavenging animals to the smell of rotting flesh within the ditch fill and the removal of various parts of the human bodies within the ditch is considered the primary cause of the incompleteness of some of the Fin Cop skeletons and much of the comingled bone. The other adult was identified by the presence of a single clavicle and the rest of this individual may lie under the northern baulk of the ditch. Bones of the neonates and perinates are all fragmentary and were comingled and in close association with the supine adult (Skeleton 11). Given the presence of a perinate it seems likely that Skeleton 11 belongs to a pregnant women otherwise it is hard to account for the presence of the perinate. Nests and burrows of rodents were found throughout the ditch fill and the presence of these animals, including rat, could also account for the movement, comingling and destruction of small bones; whilst voids between the rocks may have allowed larger bones to fall through once the flesh had decayed, hence the adult clavicle may have dropped into this part of the ditch from the baulk area. Post-depositional animal action and movement of bone through voids could account for the fragmentary survival and position of the bones without having to invoke special depositional practices. Occasional fragments of animal bone were also found in the ditch fill and these probably represent the remains of food consumption and butchery thrown into the ditch prior to, or at the same time as, the rampart destruction material and human bodies.

The stone rampart comprised a faced wall constructed primarily from the limestone won from the rock-cut ditch, but occasional blocks of the local chert were also present. The wall had a clear face of semi-dressed large limestone blocks, although most had slumped so that it appeared as an irregular and uneven face. At the rear, soil had been scooped out to create a level platform on which to build the wall and a rough rear revetment wall composed of large blocks had been built against the rear of the scoop (Fig. 4). The front and rear facing stones were keyed into the body of the rampart, a laid rubble core. The wall measured around 4m wide, consistent with the wall width recorded in Trenches 1 and 2. Animal bone fragments were recovered from the wall core and from the base of the wall where it had been built into the scoop. The wall in this section of the fort perimeter had been located on a natural convex break in slope and, as is typical on many upland hillforts, had been scooped back to provide a flat platform on which to construct the rampart, whilst also taking advantage of the naturally afforded height gain of the break in slope and the greater ease with which this could be enhanced to build a defensive circuit.

The key structural findings from the excavation of Trench 9 are that the form of the wall and ditch remains consistent with the remains encountered in Trenches 1 and 5, indicating that the form of the main rampart around the eastern and southern sides of the enclosure had been constructed to a uniform plan. The wall on both sides of Trench 9 was excavated down

Plate 1: Trench 9 after full excavation of the ditch, looking north-west (Scales = 2m).

Plate 2: Excavation of Skeleton 11 within the ditch fill of Trench 9, looking north (scale = 0.25m). Note how the individual was lying partly vertical and against the outer edge of the ditch where it had been covered by rocks thrown in from the dismantled wall. The body had been deposited during the ditch infilling and wall destruction debris as infill material lies below it and was also found above and around it.



The south section of the 2014 excavation trench showing the rock-cut ditch.

The south section of the 2014 excavation trench showing where stone from the rampart wall has been robbed out.

The north section of the 2012 excavation trench showing the demolished rampart wall and slumped rampart wall face in the foreground.

The north section of the 2012 excavation trench showing the rock-cut ditch from where the human remains were uncovered.

Fig. 4: Trench 9 sections.

to bedrock. No trace of any earlier rampart or structural feature was evident either in plan or section and therefore, in addition to the same findings in Trenches 1 and 5, it is concluded that there was no earlier defensive perimeter occupying the same line as the stone wall defensive circuit. It remains possible that an earlier defensive timberwork could have been constructed on the site, but if there was one it followed a different alignment to the stone wall which defined the middle Iron Age hillfort defences.

PREHISTORIC POTTERY

By Clive Waddington

A total of eight small pieces and three crumbs of prehistoric pottery was recovered from Trench 9, together weighing 57.44g and representing at least seven vessels, although they do not all belong to the same period and extend the range of fabric types present on the site.

Topsoil (001)

A single ceramic sherd [21] was recovered from the topsoil. It is a body sherd with a clear shoulder visible. It has a coarse fabric and is of a different fabric type to any of the other ceramics so far recovered from the various Fin Cop excavations. It contains angular crushed stone inclusions up to 5mm across. It has a rough internal surface and a lightly burnished outer surface and is up to 10mm thick. It has vertical fingernail impressions in a horizontal row running around the pot. The clay used to make the pot has very fine quartz grains within it. Given the fabric, form and decoration of this piece it is thought most likely to be a piece of Neolithic Impressed Ware ceramic or possibly part of an Early Bronze Age Food Vessel.

Ditch fill (003)

Three sherds were recovered from the ditch fill, each being from a different vessel. The best-preserved piece is a small body sherd [16] that appears to have adjoined the flat base of a jar-type vessel. It has carbonised residue adhering to its inner surface that is suitable for radiocarbon dating. It has a dark grey fabric and inner surface and a pale brown and burnished outer surface. It contains crushed quartz inclusions up to 3mm across which erupt occasionally on the outer surface. It averages 8mm thick. There is no decoration visible on the sherd. The form and fabric is consistent with a late prehistoric date and it could therefore be from a pot contemporary with the occupation of the fort.

The other two sherds from this deposit are very small body sherd fragments from vessels of unknown size and shape. One sherd [14] is up to 8mm thick and has an oxidised orange outer surface and dark grey core and inner surface. The other sherd [15] is orange throughout and is made from a coarser fabric that contains angular crushed stone inclusions up to 5mm across. This sherd measures 11mm thick. Although both are likely to be late prehistoric in date little more can be said regarding their stylistic attribution.

Hillfort wall (004)

Two small sherds from different vessels [24 and 25] were recovered from within the stone wall of the hillfort together with three crumbs. One of the crumbs [26] is of the same fabric, and probably from the same vessel, as sherd [25]. The vessel represented by sherds [25 and 26] has a burnished red-orange oxidised outer surface and a dark grey core and inner surface. Sherd [25] has some carbonised residue surviving on its inner surface that could be suitable for radiocarbon dating. The wall of the pot measures 11mm thick and is made from a relatively smooth fabric. Sherd [24] is from a much thinner-walled pot measuring 6mm thick. This sherd also has an orange oxidised outer surface with grey core and inner surface, and is in a relatively smooth fabric. The pitted outer surface suggests that burnt organics may have been used as an opening agent for this pot which have since eroded out. The sherds are not particularly diagnostic although they fit comfortably into a late prehistoric context.

Pre-hillfort soil (005)

Two small sherds of the same fabric, and probably the same vessel, were recovered from the pre-hillfort land surface. They are grey-brown in colour and of a clearly different fabric to the material found in the stratigraphically later wall and ditch fill. It is a relatively coarse fabric and includes angular crushed stone inclusions up to 4.5mm across which erupt on the outer surface. Slight horizontal grooves on the outer surface of sherd [23] could have resulted from being wiped or roughly burnished with grass. In contrast, the inner surface has been burnished smooth implying that liquids may have been held within this vessel. The walls of the pot are quite thin measuring 5-6mm thick. The fabric, despite being coarse, is evenly fired and suggests a well-made pot. It is not diagnostic but its form and fabric would be consistent with an early first millennium cal BC context.

LITHICS

By Clive Waddington

A total of 46 lithics were retrieved from Trench 9, of which 21 came from the unstratified topsoil (001) and 13 from the ditch fill (003), four from the surviving area of stone wall that formed the hillfort rampart (004) and eight from the pre-hillfort soil (005). All the pieces, with the exception of those from stratified deposits, are considered to be residual material resulting from earlier, pre-Iron Age, activity on the site. Nonetheless, this lithic material is unlikely to have come from far away, and is possibly just a few metres or tens of metres from their original position of discard. A catalogue of the lithic assemblage is provided in Table 1. All finds were located according to the context in which they were found and each find was bagged and given a unique find number. Measurements are given for complete pieces only, in accordance with lithic recording conventions (Saville 1980).

Most of the assemblage sits comfortably in a Mesolithic manufacturing tradition (c.10000-4000 cal BC), as evidenced by the concern for blade production, triangular sectioned blades, and the presence of microblades and microcores. There is one utilised squat flake made on high quality nodular flint that stands out from the rest of the assemblage and this is considered more likely to be of Neolithic or Early Bronze Age date.

Thirty one of the 46 pieces (67% of assemblage) recovered from the excavation were flint whilst the other 15 pieces (33% of assemblage) were of local chert, two of which were of high quality dark grey chert, the rest being the very coarse grey chert that occurs naturally on the site. Of those flints that had cortical surfaces surviving on them six had a thick and rough cortex suggesting a glacial provenance for the raw material, whilst five had a thinner and smoother cortex suggesting a primary flint, or nodular, origin. Flint does not occur naturally in the Peak District and therefore the nodular flint is likely to have been imported from a significant distance, the nearest source as the crow flies being the Lincolnshire Wolds, c. 80km distant.

Glacial flint can be found closer to hand, for example in the sands and gravels and tills

SF No.	Context	Material	Colour	Provenance	Type: General	Type: Specific	Core RS	Period	L (mm)	W	T	Notes
17	5	Flint	light grey		flake		sec		13.5	8	2.5	
18	3	Chert	medium grey	nodular	blade		sec		21	9.5	6	Probable chert blade
19	4	Flint	light grey		edge trimmed flake			ter	9.5	20	a	
20	4	Flint			utilised blade		ter				Broken blade patinated a milky white	
28	3	Chert	light grey	nodular	utilised blade		ter					Broken blade appears to be utilised
29	3	Flint	medium grey	glacial	core	multi platform	sec		21	28		Multi platform core lightly patinated
30	3	Flint	light grey		blade		sec					Broken blade segment
31	3	Flint	light grey		utilised blade		ter					Broken utilised blade with triangular section.

SF No.	Context	Material	Colour	Provenance	Type: General	Type: Specific	Core RS	Period	L (mm)	W	T	Notes
32	3	Flint	medium grey		serrated blade		ter	mes	23.5	13	3	An unusually shaped blade that flares at its distal end with fine serration along both long edges on what is a microlith-sized piece. Unusual.
33	3	Flint	light grey	glacial	utilised blade		ter		30.5	13	3	Cortical blade with edge trimming
34	3	Flint	light grey		flake		sec		23	17.5	3	
35	3	Flint	medium grey		blade		sec					Broken bladelet
36	3	Flint	medium grey		utilised blade		ter	mes	24	9.5	2.5	
37	3	Chert	dark grey	nodular	flake		sec					Broken
38	1	Flint	medium grey	nodular	utilised flake		ter	neo?				Broken utilised flake made on nodular flint
39	1	Flint	dark grey	nodular	core	multi platform	sec	mes	19	21		Multi platform microblade core

SF No.	Context	Material	Colour	Provenance	Type: General	Type: Specific	Core RS	Period	L (mm)	W	T	Notes
40	1	Flint			flake		sec		15.5	14	3	Patinated milky white
41	1	Flint	medium grey	nodular	flake		prim		29	18	5.5	Cortical flake unmodified
42	1	Flint	medium grey	glacial	utilised blade		ter	mes?				Broken blade with slight traces of utilisation on both long edges
43	1	Flint	light grey	glacial	blade		sec					Broken
44	1	Flint	medium grey		scraper		ter					Broken and patinated scraper with semi-abrupt retouch
45	1	Flint	light grey		utilised blade	microlithic	ter	mes				Broken utilised microlithic blade segment with triangular section and parallel sides
46	1	Flint		glacial	flake		prim		17	14	3	Patinated cortical flake
47	1	Flint	white		chip		sec					Broken chip
48	1	Chert	light grey	nodular	scraper	end	ter	mes	40	21	13	

SF No.	Context	Material	Colour	Provenance	Type: General	Type: Specific	Core RS	Period	L (mm)	W	T	Notes
49	1	Chert	light grey	nodular	blade		sec		65	27	14	
50	1	Chert	medium grey	nodular	blade		sec					Broken substantial blade segment with triangular section
51	1	Chert	medium grey	nodular	edge trimmed blade		ter	mes	34.5	21	8	
52	1	Chert	medium grey	nodular	edge trimmed flake possible scraper	ter		20	24	5		
53	1	Chert	light grey	nodular	utilised blade	microlithic	ter	mes				Broken
54	1	Chert	medium grey	nodular	blade		ter	mes				Broken blade with hinge fracture on dorsal side and triangular section

SF No.	Context	Material	Colour	Provenance	Type: General	Type: Specific	Core RS	Period	L (mm)	W	T	Notes
55	1	Chert	light grey	nodular	utilised blade		ter	mes	94	26	13	Triangular sectioned long blade with utilisation evident on its two long edges
56	1	Chert	medium grey	nodular	utilised blade		ter	mes				Broken utilised blade segment with triangular section
57	1	Chert	light grey	nodular	utilised blade		ter	mes				Broken utilised blade segment with triangular section
60	4	Flint	medium grey		utilised blade		ter	mes	28.5	8	3	
61	9	Flint	light grey		blade		ter	mes				broken and possibly utilised bladelet, patinated milky white
62	9	Flint	light grey		flake		sec					broken
63	9	Flint	light grey	glacial	blade		sec	mes	19	10.5	3.5	

SF No.	Context	Material	Colour	Provenance	Type: General	Type: Specific	Core RS	Period	L (mm)	W	T	Notes
64	9	Flint	medium grey	glacial	edge-trimmed blade		ter	mes	33	13	3	
66	9	Flint	light brown	nodular	retouched blade	ter	mes	11	13.5	1.5		
67	9	Flint	dark grey	nodular	edge-trimmed blade		ter	mes				broken and lightly patinated
68	9	Chert	dark grey		retouched flake	ter					broken piece but very good quality fine-grained chert	
69	3				retouched blade		ter	mes				heavily burnt and broken piece not able to be certain whether flint or chert
70	4	Chert	medium grey		utilised blade		ter	mes	40	19	6.5	
74	3	Flint	light grey		blade		sec	mes	14.5	10.5	2	
77	1	Flint	light grey		awl		ter		36	32		

Table 1: Trench 9 Lithics Catalogue.

Plate 3: Selected flints from Trench 9 from left to right: burnt and utilised blade, edge-trimmed blade, utilised blade, notched blade and broken utilised blade (scale = 5 cm).

of the Trent Valley 35km to the south, as well as from similar glacial outwash deposits in the river valleys draining the eastern and western flanks of the Peak District massif, which lie slightly closer. Chert can be found on the site and in the immediate vicinity as it occurs naturally within the Carboniferous Limestone on which the site is located. Any flint found on the site has, therefore, to have been imported and this indicates that material was being brought to the site over a considerable distance during the Mesolithic. Although some pieces had patina development all over them prohibiting assessment of colour, of those flints that could be ascribed a colour the main types were light grey (13) and medium grey (10), with only two pieces of dark grey flint. The chert included seven pieces of light grey material, seven pieces of medium grey material and one piece of dark grey, fine-grained, high quality chert. The variation in colour is likely to reflect a variety of different sources, even though there can be much variation in flint colour within a single nodule. Much of the flint was of high purity with few pieces speckled.

The assemblage displays evidence for the use of hard and soft hammer working, with most of the edge-trimming and retouch being unifacial. The manufacturing tradition for Mesolithic material relies on a blade-based technology, that includes slender blades where possible, but also thicker stubby blades when the raw material dictates. The blades typically have a triangular section and production and use of microblades is featured within the assemblage.

Type	*001 Unstratified*	*003 Stone wall ditch fill*	*004 Stone wall*	*005/009 Pre-hillfort soil*	*Total*
Flakes	3	2		2	7
Blades	4	4		2	10
Chip	1				1
Core	1	1			2
Retouched blade		1		1	2
Retouched flake				1	1
Edge-trimmed blade	1			2	3
Edge-trimmed flake	1		1		2
Utilised blade	6	4	3		13
Utilisted flake	1				1
Scrapers	2				2
Serrated blade		1			1
Awl					1
Total	**21**	**13**	**4**	**8**	**46**

Table 2: Summary of lithic types by context.

A range of tool types is present in the assemblage and these are summarised in Table 2. The presence of processing tools, such as various retouched, edge-trimmed and utilised pieces, together with the serrated blade and the scrapers, indicate a wide range of processing activities, which is usually taken as an indicator of settlement sites (Schofield 1991; 1994). The presence of scrapers might imply that hide-working was an important activity. Two cores indicate that tool production also took place on site.

The lithic assemblage recovered from Trench 9 is similar in character to the previous lithic material recovered from the Fin Cop excavations (Waddington 2012). Most of the material that can be dated fits comfortably into a Mesolithic manufacturing tradition thereby testifying to an early phase of human activity on this hilltop. The presence of at least one, and possibly two, later pieces provides further evidence for the Neolithic and/or Early Bronze Age activity that has been identified through the discovery of other lithic and ceramic finds at the site (Waddington 2012). Except for the flint flake from the pre-hillfort soil surface, all the other material is likely to be in a residual post-depositional context and therefore not in its original location of discard. This indicates that construction of the hillfort defences during the Iron Age disturbed pre-existing archaeological remains across the hilltop.

HUMAN REMAINS

By Scott D. Haddow

The skeletal remains of at least six individuals were recovered from Trench 9. Two adults, one perinate and three neonates are represented. Of the six individuals, five are incomplete (<25%) and one is partially complete (25-75%). The skeletal remains of the four subadult individuals were found disarticulated and scattered within the lower fill of the hillfort ditch.

Methods used in the analysis of these human remains are based on the recommendations of Brickley and McKinley (2004) and Buikstra and Ubelaker (1994). The surface condition of the bones are recorded on a graded scale from 0 to 5+, where “0“ indicates excellent bone preservation with no surface erosion or other modifications, and “5+” indicates extremely poor bone preservation with extensive erosion preventing observation of surface morphology (Brickley and McKinley 2004, 16). A skeletal and dental inventory is provided for each individual either within the text for those with few bones present or within Appendix 1 for those where more of the skeleton is present.

For the subadult skeletal remains, age estimation is based on bone measurements (Sheuer *et al*. 2008). Adult age estimation is based on observation of degenerative changes in the pubic symphysis (Brooks and Suchey 1990) and auricular surface (Lovejoy *et al*. 1985) of the ossa coxae. In the absence of the ossa coxae, age estimation is based on observation of occlusal dental wear (Brothwell 1981).

Where possible, sex determination of adult skeletal remains is based on sexually dimorphic features of the ossa coxae such as the greater sciatic notch, subpubic angle, medial ischio-pubic ridge and presence/absence of the ventral arc. Sexually dimorphic features of the cranium and mandible such as the supraorbital ridge and supraorbital margin of the frontal bone, mastoid process of the temporal bone, occipital nuchal crest and the mental eminence of the mandible may also be used to determine sex. Without the bones of the pelvis, cranium and mandible, accurate determination of sex is difficult. While the size and robusticity of skeletal elements may provide a general indication of sex relative to other individuals, this method is not reliable.

Where observable, a description of skeletal and dental pathological lesions is provided. Adult stature estimates based on maximum lengths of long bones are also provided using the regression formulae developed by Trotter (1970).

Skeleton 10

Skeleton 10 is represented solely by a complete (>75%) right clavicle (preservation score = 3). This was the first human bone found in Trench 9 and was recovered at a slightly higher level than subsequently recovered skeletal material. The medial and lateral ends of the clavicle are broken. The bone appears to be of adult size, but a more precise age estimate cannot be provided because the fusion state of the medial epiphysis cannot be observed. Determination of sex cannot be undertaken given the incomplete nature of this individual. There are no pathological lesions observable.

Skeleton 11

Skeleton 11 is a partially complete (25-75%) adult individual found at the base of the rock-cut ditch. The cranium, sacrum, ossa coxae, right and left femora and right tibia and fibula are missing post-mortem, but the rest of the skeleton was found in articulation. The lower left leg and left and right feet were found at a slightly higher level than the torso. The body lay on its left side with both arms flexed at the elbow and hands crossed at the wrist beside the mandible. The head was oriented to the northeast and the lower leg and feet to the southwest. Based on the orientation of the mandible, the head would have been situated face down. Clearly the body was originally deposited with the cranium intact, as several loose maxillary teeth were found in the soil near the mandible. The cranium was likely disturbed at some point after the body had completely skeletonised, as the mandible and all seven cervical vertebrae remained *in situ*. Had the body still been fleshed, it would be very difficult to remove the cranium without disturbing the mandible and taking the atlas and axis (i.e. first and second cervical vertebrae).

Age and sex

All observable epiphyses are fused and, in the absence of the pubic symphysis and auricular surfaces of the ossa coxae, age estimation based on occlusal dental wear places this individual between 25 and 35 years of age. Determination of sex is difficult without the ossa coxae and cranium. The individual appears possibly female based on the morphology of the mandible, including mental eminence, body depth and gonial angle. However, measurement of the maximum diameter of the right humeral head (48.88mm) places it well within the male range. Measurement of the maximum diameter of the head of the radius (22.71mm) provides an indeterminate sex assessment. As such, with the conflicting evidence at hand and without the more reliable bones of the pelvis and cranium to aid sex determination, it is not possible to confidently assign this individual to either sex category.

Pathology

Pathological lesions observable on the bones of this individual include remodelled periosteal bone on the dorsal surfaces of the right 4th and 5th metatarsals with concomitant enlargement of the shafts. This appears to be the result of an infection or fracture that has subsequently healed. A small (<5mm) lytic lesion, possibly osteochondritis dissecans, is observable on the proximal articular surface of the left navicular, as well as on the plantar articular surface of the right talus. A partially healed stress fracture is observable on the pars interarticularis (neural arch) of the 5th lumbar vertebrae. The right side remains ununited, while the left side is partially united and well remodelled. In addition, the body of the 5th lumbar is compressed laterally on the right side. Slight osteophytic lipping is observable on the anterior disk margins of the upper thoracic vertebrae, while Schmorl's nodes are observable on the disk surfaces of the lower thoracic vertebrae as well as the lumbar vertebrae. Degenerative joint disease (DJD) in the form of lipping and porosity of the joint margins is observable on the scaphoid and lunate of the left carpals, as well as the head of the right humerus and distal radius and ulna. Interproximal carious lesions are observable at the cemento-enamel junction of the mandibular left second and third molars. The mandibular left lateral and central incisors and first molar, as well as the mandibular right canine and central and lateral incisors were lost antemortem and the alveoli are partially resorbed. Calculus is present on the lingual surfaces of the mandibular right premolars and first molars, as well as on the buccal and lingual surfaces of the mandibular right second molar. Calculus is also present on the buccal surfaces of the maxillary left premolars and first molar, as well as on the maxillary right second molar.

Stature

Based on the maximum length of the right humerus (29.9cm), a stature estimate of 162.54cm for white males and 158.43cm for white females is provided.

Skeleton 12

Skeleton 12 consists of the incomplete skeletal remains of a pre-term infant (perinate). Based on measurements of the pars petrosa of the temporal bone, the age of this individual is estimated to be between 26-28 weeks in utero. There are no pathological lesions observable.

Skeleton 13

Skeleton 13 consists of the incomplete skeletal remains of a perinate/neonate. Based on the length (12.56mm) of the left pars basilaris of the occipital bone and the left clavicle (42.5mm), this individual is estimated to be between the ages of 38-40 weeks in utero. There are no pathological lesions observable.

Skeleton 14

Skeleton 14 consists of the incomplete skeletal remains of a perinate/neonate. Based on the length of the par petrosa (16.06mm) of the temporal bone, this individual is estimated to be between 40 and 42 weeks of age in utero. There are no pathological lesions observable.

Skeleton 15

Skeleton 15 is represented by a left proximal femur and right distal humerus (preservation score for both = 3). The bones are duplicated in Skeletons 13 and 14 and thus cannot belong to these individuals; they are also too large to belong to Skeleton 12. Estimation of the age of this individual based on long bone lengths cannot be carried out because the bones are incomplete, but they are similar in size and development to Skeletons 13 and 14, thus placing it in the neonate age category. No pathological lesions are observable.

Given the disarticulated and incomplete nature of the subadult skeletal remains, it seems likely that they have been disturbed and moved post-mortem (for example by scavengers and/or rodent action), or perhaps left exposed for some time before being buried completely within the hillfort ditch. Those bones that were recovered are in relatively good condition and it is unlikely that missing elements have degraded resulting from the burial environment. In addition, the recovery strategy employed during excavation was very thorough – the chances of bones being missed are low. As such, the incomplete nature of these subadult remains is probably due to scavenging activities by animals. An alternative, though unlikely, explanation is that these subadult remains represent a form of secondary burial in which bones were only deposited in the enclosure ditch after the bodies had completely decomposed elsewhere, but this is highly unlikely given that some of the subadult bones were found immediately next to the adult (Skeleton 11) at the base of the ditch, and the perinate (Skeleton 12) is likely to have been within/associated with Skeleton 11. Skeletal remains of individuals in secondary burials are rarely complete. There is no skeletal evidence for perimortem trauma on any of the skeletal material from Trench 9, including the adults.

As with the subadults, the incomplete nature of the remains suggests that the bones have been disturbed, and some removed, post-mortem. The burrows and nests of rodents within the ditch fill indicates the likely source of this disturbance and the actions of scavenging animals shortly after burial could account for removal of various parts of the skeletons. The orientation of Skeleton 11 indicates that the body was deposited unceremoniously.

ANIMAL BONE

By Milena Grzybowska

The material consisted of over 198g of animal bone and teeth derived from multiple Iron Age contexts (Table 3). Bones were identified to species or a taxonomic group where possible and any taphonomic traces were recorded. The state of preservation was scored using a four stage system (excellent, good, fair and poor). Age was established based on wear of mandibular dentition (Grant 1982). Sex assessment was attempted based on the presence of morphological traits. The bones were measured following Von den Driesch (1976). A zone recording system was applied (Dobney and Rielly 1988). Identification of butchery marks was attempted and a minimum numbers of individuals (MNI) was estimated. Tabulation of the results is provided in Table 4.

A total assemblage of 155 fragments of animal bone was analysed. The animal bones were generally in a poor state of preservation with occasional complete destruction of the cortex (Table 3). Most of the assemblage was of fairly uniform cream coloration with the exception of a single unstratified leporid tibia that was brown in colour. Fragmentation of the material was high, with most of the bones not exceeding 30mm in size. The majority were also severely weathered and affected by root etching. No butchery marks or pathological conditions were identified and sex estimation was not possible for any of the assemblage.

The assemblage comprised domesticated and wild species. The taxa identified included cattle (Bos taurus), sheep/goat (Ovis aries/Capra hircus), rabbit/hare (Oryctolagus/Lepus sp.) and possible equid/horse (Equus sp.) (Table 4). Among the small mammal remains a possible rat (Rattus sp.) was identified (Table 4). Observation of the mandibular dental wear resulted in identifying three subadults among cattle and one among sheep/goat remains (Table 3).

Fragmentation and erosion of the bone surface did not allow for detailed metrical analysis. One specimen, however, proved informative. Measurements were taken for the 1st phalanx of a cow (Glpe:57.07mm (64.4)/ Bp:27.15mm (40.2)/ Bd:27.30mm (35.6)). When accounting for the observed minimal erosion, these measurements appeared to be considerably smaller than the average dimensions for the corresponding phalanges of modern bulls and oxen (given above in brackets; Bartosiewicz 1993). This is consistent with the smaller size of Iron Age bovids in comparison to post-Norman conquest individuals (Albarella *et al*. 2008).

Domesticates in the assemblage comprised the remains of cattle with the exception of one poorly preserved specimen of sheep/goat and a possible fragment from an equid. Remains of a possible rat were also recognised. The leporid specimen is most likely intrusive, suggested by its differential preservation and the presence of this animal could account for the removal and movement of much of the human skeletal material. Poor representation of small bovids, particularly sheep, is probably due to a small sample size and the poor state of preservation that precluded identification of the large proportion of fragments. The young age of cattle individuals is consistent with the kill-off pattern observed among contemporaneous British assemblages (Albarella *et al*. 2008). Frequent subadult cattle remains may indicate an economy based on meat production, however the small size of this assemblage is not yet sufficient to make such a case and the contribution of cereals and other crops in the economy remains unknown.

Context	***Taxon***	***Element***	***Side***	***Zone >50%***	***Zone <50%***	***Measurements***	***Wgt. (g)***	***Frag. count***	***Age***
3/75/14	cattle	M1/M2 lower	R	crown and root	-	Crown height >36.61mm	17.9	1	pre-h ; accessory column not in wear, roots 3/4 developed, wear stage impossible to establish due to pos-depositional breakages; MWS:8-40 (Grant 1982)
3/75/14	mammal	unid	-	-	-	m:45	7.5	20	-
4/76/14	unid	long bone	-	-	-	m:63	2.4	1	-
3/73/14	unid	unid	-	-	-	m:20	0.7	2	-
4/71/14	mammal	long bone	-	-	-	m:38	2.7	1	-
4/71/14	cattle	1st phalanx anterior	-	1,2,3	-	Glpe:57.07/ Bp:27.15/ Bd:27.30	11.5	1	fused
Unstrat/ 12	rabbit/ hare	tibia	R	5,6,9,10	8	m:76/ max width dist:14.14	4.2	1	fused
8/12	cattle	mandible (&10)	R	-	1	m:35	5.2	3	-
8/12	cattle	dp4 lower (&9)	R	crown and root	-	m:33	6.5	1	wear stage e/f; MWS:4 (Grant 1982)
8/12	cattle	dp3 lower	R	crown and root	-	m:25	1.2	2	worn
8/12	mammal	long bone unid	-	-	shaft	m:33	0.7	1	-
8/12	mammal	unid	-	-	-	m:25	5.7	30	-
3/sk10/12	human*	unid	-	-	-	m:23	2.1	30	-
3/2/12	large ruminant	metacarpus	-	-	5,6,7,8	m:95	27.9	2	-
3/2/12	large mammal/ equid*	Mandibular permanent cheecktooth*	-	-	Crown and root	m:36	10.8	1	heavily worn

Context	***Taxon***	***Element***	***Side***	***Zone >50%***	***Zone <50%***	***Measurements***	***Wgt. (g)***	***Frag. count***	***Age***
3/2/12	mammal	unid	-	-	-	m:26	3.8	6	-
3/4/12	cattle	dp4 lower	L	crown	root	m:28	2.7	1	wear stage k; MWS:13-26 (Grant 1982)
3/4/12	sheep/ goat	P4* upper	-	crown	-	m:18	0.9	1	crown not fully formed, no wear
3/4/12	mammal	unid	-	-	-	m:52	6.3	9	-
3/4/12	mammal	cancellous bone unid	-	-	-	m:36	6.4	1	-
3/4/12	mammal	unid	-	-	-	m:42	2.5	1	-
3/12	mammal	unid	-	-	-	m:10	1	4	-
3/12	small mammal/ rat*	ulna	R	a,b,c,d,e	-	m:11	0.1	1	not fused with radius
9/65/14	mammal	unid	-	-	-	m:55	12.4	1	-
9/65/14	mammal	unid	-	-	-	m:30	1.3	1	-
bulk/3/12	mammal	unid	-	-	-	m:32	10	15	-
bulk/3/12	large mammal	axis	-	-	4	m:65	7	1	-
bulk/3/12	mammal	scapula	-	-	5	m:52	4.3	1	-
8/12	cattle	ilium	L	1	5	m:90	17.2	1	subadult -overall size, fusion unob, articular surface smooth
8/12	mammal	unid	-	-	-	m:66	9	10	-
3/12	mammal	unid	-	-	-	m:30	5	20	-
3/12	mammal	unid	-	-	-	m15	0.1	5	-
3/4/12	small mammal	humerus	L	5,6,7,8	-	m:11	0.1	1	-

Context	*Taphonomy*	*Butchery*	*Pathology*	*Preservation*	*Colour*
3/75/14	D, R, very abraded	-	root extension medially from mesial root associated with a circular lesion at the base of the root	poor	cream
3/75/14	D, very abraded	unob	-	poor	cream
4/76/14	RE	unob	-	poor	cream
3/73/14	very abraded	unob	Unob	poor	cream
4/71/14	rounded	unob	Unob	poor	cream
4/71/14	R, RE, very abraded	-	None	poor	cream
Unstrat/ 12	D, post-dep	-	-	poor	brown
8/12	D	-	-	poor	lbrown
8/12	D	-	-	poor	cream
8/12	D	-	-	poor	cream
8/12	D, abraded	-	-	poor	brown
8/12	D	-	-	poor	lbrown
3/sk10/12	D	-	-	poor	lbrown
3/2/12	D, extremely abraded and rounded	unob	Unob	poor	cream
3/2/12	D, RE	unob	Unob	poor	cream
3/2/12	D, RE, very abraded	unob	Unob	poor	cream
3/4/12	D, very abraded	-	-	poor	cream
3/4/12	D	-	-	fair	cream
3/4/12	D, RE, very rounded, abraded	unob	Unob	poor	cream
3/4/12	D, very abraded, nearly no cortex	unob	Unob	poor	cream
3/4/12	D, R	unob	Unob	poor	lbrown
3/12	D, very abraded	unob	Unob	poor	cream
3/12	D	-	-	fair	cream
9/65/14	R, very abraded	-	-	poor	cream
9/65/14	very abraded	-	-	poor	cream

Context	***Taphonomy***	***Butchery***	***Pathology***	***Preservation***	***Colour***
bulk/3/12	severly weathered	unob	-	poor	cream
bulk/3/12	severly weathered	unob	-	poor	cream
bulk/3/12	severly weathered	unob	-	poor	cream
8/12	D	-	-	poor	cream
8/12	R, D, very abraded	unob	Unob	poor	cream
3/12	D, very abraded	unob	Unob	poor	cream
3/12	D, very abraded	unob	Unob	poor	cream
3/4/12	D	-	-	fair	cream

*Table 3: Tabulated summary of animal bone. * - possible; unob - unobservable; unid - unidentified.*

Context (Finds number)/Year	***Cattle***	***Sheep/goat***	***Equid?***	***Rabbit/Hare***	***Small fauna***
3(2)/12	1	-	1	-	-
3/12	-	-	-	-	1
3(4)/12	1 subadult	1 subadult	-	-	1 (rat?)
3(75)/14	1 subadult	-	-	-	-
4(71)/14	1	-	-	-	-
8/12	1 subadult	-	-	-	-
unstratified	-	-	-	1	-
MNI	3	1	1	1	2

Table 4: Minimum number of individuals (MNI) from animal bone assemblage.

BOTANICAL MACROFOSSILS AND CHARRED WOOD

By Laura Strafford

One environmental bulk sample (3 litres) from the primary ditch silt (008) was submitted for assessment together with 14 individual wood charcoal dating samples. The wood samples came from a variety of features and deposits from Trench 9, including two samples (nos 4 and 5) from the primary ditch silt (008), ten samples (nos 1, 2, 3, 6, 7, 8, 9, 10, 11, 12) from the wall demolition deposit forming the main ditch fill (003), one sample (no. 14) from the subsoil above the ditch (002), and one sample from within the surviving remains of the *in situ* stone wall (004).

The single bulk sample was processed off-site for the recovery of charred plant remains (CPR) using bucket flotation. The flot was collected on a 300μm mesh and the heavy residue was sieved to 1mm. Both were air-dried at room temperature after which the residue was sorted by eye for artefacts and ecofactual remains. The flot was scanned for charred plant remains using a binocular microscope at between x12 and x40 magnification. For the charcoal assessment, all charcoal fragments deemed large enough for identification from each sample were fractured to expose a fresh transverse section (TS) and sorted into groups based on anatomical features under a binocular microscope at magnifications of up to x40. These were fractured to expose tangential (TLS) and radial longitudinal (RS) sections and mounted on to a slide using blu-tack. These were then examined using a binocular microscope at up to x200 magnification. Identification was made according to anatomical characteristics described by Schweingruber (1990). Charcoal identifications were made with reference to on-line and published reference collections/sources.

Environmental sample

The residue from the flot sample yielded only sparse organic material being dominated by sand. Few charcoal fragments were present, but all examples were very fine, measuring less than 1mm in length and therefore unidentifiable. No other CPR was present in the flot and no artefacts were retrieved from the sample. The sample was found to be unsuitable for both species determination and dating.

Wood charcoal samples (Table 6)

As with the environmental sample, the charcoal samples were generally small with few samples being large enough for formal identification. Those samples that could be identified are listed below:

(002) – sample no. 14

Many fragments were too small for identification but four larger fragments were identified as oak (Quercus sp.).

(003) – sample nos. 1, 3, 8 and 9

All the fragments large enough for identification were ring-porous, indicative of either ash (Fraxinus sp.) or oak (Quercus sp.).

(003) – sample no. 11

The transversal section of the largest piece is indicative of gymnosperm (soft wood such as pine, yew or juniper) but the small size of sample makes it impossible to be certain.

(004) – sample no. 13

The transversal sections of three individual fragments are all very ring-porous, and are therefore highly likely to be either oak (Quercus sp.) or ash (Fraxinus sp.).

The lack of identifiable round wood in any of the samples means that the suitability of these charcoal fragments for radiocarbon determination is poor as they may give an 'old wood' effect to any resulting date. Most of the charcoal fragments which were large enough to identify were ring-porous with wide rays indicative of oak (Quercus sp.), however, the small sample sizes meant that a large enough area could not be examined for a definite identification and ash (Fraxinus sp.) may also be a possibility. Although most fragments were unidentifiable, it was possible to determine that the samples were overwhelmingly dominated by dicotyledon wood (hard wood), except for sample 11 (003) which contained at least one fragment of gymnosperm wood (soft wood/conifer). Analyses of charcoal from the previous excavations at Fin Cop showed that oak and yew charcoal were present in the Iron Age deposits, therefore the likelihood is that oak and a little yew charcoal is present in the material recovered from Trench 9.

ISOTOPE ANALYSIS

By Janet Montgomery

Strontium ($^{87}Sr/^{86}Sr$) and oxygen ($\delta^{18}O$) isotope analysis of archaeological humans and animals can provide evidence for childhood residence and summaries of the fundamental principles upon which these techniques are based and how they are applied in archaeological studies can be found in Bentley (2006) and Daux *et al*. (2008), and for Britain particularly in Montgomery (2010) and Evans *et al*. (2012). In brief from these sources, the ability to analyse human and animal remains for this purpose rests on the principle that these elements are ingested from food and water and are incorporated into teeth and bones, and because the isotope ratios of strontium and oxygen in food and water vary geographically, and on the assumption that ancient people sourced the bulk of their diet locally, these differences can be used to draw conclusions about whether individuals were of local or non-local origin. Tooth enamel is commonly used for this purpose because it has been shown to be significantly more resistant to contamination during burial than either tooth dentine or bone. As teeth form in childhood and subsequent change, unlike bone, is negligible, they record residence during the period when the tooth was forming. Dietary strontium ultimately derives from rocks so that human isotope ratios are usually indicative of the geology (solid or drift) of an individual's home region, specifically, where they grew their crops. Oxygen is mainly derived from drinking water, with isotope ratios varying geographically with latitude, altitude and distance from the sea. These data are usually an indicator of the climate and weather patterns prevailing in the home region. For Britain, maps exist of both strontium isotope (Evans *et al*. 2012) and oxygen isotope (Darling *et al*. 2003) geographic environmental variation but the resulting variation on the human scale is still being researched, defined and refined. Nonetheless, by comparing the data obtained with what might be expected for humans living in the region of burial it is possible to say whether the childhood signal appears, in line with current knowledge, to be consistent or inconsistent with the place of burial and thus identify individuals who could not have grown up in the place they were buried.

Carbon and nitrogen stable isotope ratios in skeletal collagen, and carbon isotopes in tooth enamel are widely used in archaeological populations to reconstruct dietary patterns. The fundamental principles and application of this well-established method summarised below can be found in Sealy (2001) and Lee-Thorp (2008) and for Iron Age Britain particularly, in Jay and Richards (2006; 2007) and Jay *et al*. (2013). The carbon and nitrogen of collagen are principally derived from the carbon and nitrogen of ingested protein and whilst they are subject to metabolic fractionation their isotope ratios retain a known trophic level relationship to those of the protein of consumed food. Since the human food chain leads back to plants at the base, the data can also be used to reconstruct an individual's place in the food web at a time and place based on the combination and choice of plants and animal protein in the diet. Carbon ($\delta^{13}C$) and nitrogen ($\delta^{15}N$) isotopes are especially useful to investigate the amount of animal protein that has been consumed (trophic level), whether this is terrestrial, freshwater or marine in origin, and whether plants which use the C_3 or C_4 photosynthetic pathway have been included in the food chain. C_3 plants dominate the food crops of the temperate environments of prehistoric Europe; C_4 plants are rare and predominantly found in warmer environments. Millet, a C_4 crop, was present in the Iron Age on the Continent but it is not until the Roman period that immigrant individuals whose elevated $\delta^{13}C$ values indicate they consumed a C_4-based protein have been found in Britain (Müldner 2013). $\delta^{15}N$ values increase between trophic levels by an estimated 3 to 5‰, for example between plant and herbivore, and from mother to suckling infant, whilst $\delta^{13}C$ values may increase by around 1‰. Another source of elevated $\delta^{13}C$ and $\delta^{15}N$ values in humans is the consumption of marine resources. For a consideration of absolute, rather than relative, human $\delta^{13}C$ and $\delta^{15}N$ values for a specific time and place, however, the herbivore 'baseline' should ideally be established as this varies between different plants and thus food webs due to differing environmental conditions, such as climate, salinity and manuring practices.

The bone collagen extracted for analysis is formed over a long period of time and its $\delta^{13}C$ and $\delta^{15}N$ values represent an average produced during bone growth, turnover and remodelling (Libby *et al*. 1964; Wild *et al*. 2000). The period of life represented by this average value is much longer for adults than it is for infants or growing children and can thus vary from a matter of months for perinates to decades for mature adults: cortical femur can retain values from adolescence even in mature adults whereas ribs may represent only the last two years of life (Cox and Sealy 1997; Hedges *et al*. 2007). Dentine collagen will reflect diet during childhood, as will the carbon isotope ratios of enamel carbonate. However, in contrast to collagen, the $\delta^{13}C$ of enamel carbonate is routed from the whole diet, i.e. including fats and carbohydrates rather than predominantly the protein fraction. Data from both collagen and carbonate combined can therefore shed additional light on the three major nutrient groups and there are established relationships between them (Kellner and Schoeninger 2007). However, because enamel is formed in childhood, if the diet changed between childhood and death it may be problematic to compare carbonate in enamel with collagen in bone as more than one variable will be in play.

A suite of isotope analyses was undertaken on the individuals from Fin Cop to investigate geographical residential origins (strontium and oxygen) and diet (carbon and nitrogen). Carbon and nitrogen isotopes were measured in the bone collagen of twelve individuals (four adults, one adolescent, two infants and four pre-term/neonates). Strontium, carbon and oxygen isotopes were also obtained from the enamel of one tooth from each of five of these individuals (three adults, an adolescent and one infant) providing evidence for residential origins before the age of seven in all cases. Detailed analytical methods are given in Appendix 2 and sample information and results are presented in Table 5. Strontium isotope ratios are given as $^{87}Sr/^{86}Sr$ values and carbon, nitrogen and oxygen isotope ratios are given as $\delta^{13}C$, $\delta^{15}N$ and $\delta^{18}O$ values respectively in the unit ‰ (per mil).

Results

Enamel strontium concentrations obtained from the Fin Cop individuals range from 30 to 107 ppm and are consistent with other archaeological humans excavated in Britain: median = 84 ppm, mean = 105 ± 69 ppm (1SD, n=614) (Evans *et al*. 2012). Although strontium isotope ratios were obtained from only five individuals their range is wide (0.7091-0.7155) considerably exceeding analytical error and only one adult individual (Skeleton 11 – SK11) is consistent with origins on the limestone of the White Peak (Evans *et al*. 2010; Montgomery *et al*. in press). However, it should be stressed that such a value is not unique to the Peak District and is also characteristic of other regions of chalk and limestone, for example the Yorkshire Wolds (Fig. 5). The strontium isotope range for the locality of Fin Cop is confirmed by the two dentine values which have equilibrated with the strontium available in the limestone burial soils which are very close to the local individual SK11 (Fig. 5). The adult SK5, infant SK7, and the adolescent SK8 have higher values ranging from 0.7109 to 0.7121, which could have been obtained in regions of the sedimentary silicate Carboniferous, Permian and Triassic rocks such as the Millstone Grits, Coal Measures and the Bowland Shales that surround the Carboniferous limestone of the White Peak (British Geological Survey 2001; Evans *et al*. 2010). Thus, these three individuals, whilst not originating at Fin Cop, need not have moved more than 5 miles at some time after the age of seven, or in the case of the infant SK7, shortly before death. An alternative interpretation is that they resided at Fin Cop and subsisted on food brought in from these surrounding regions.

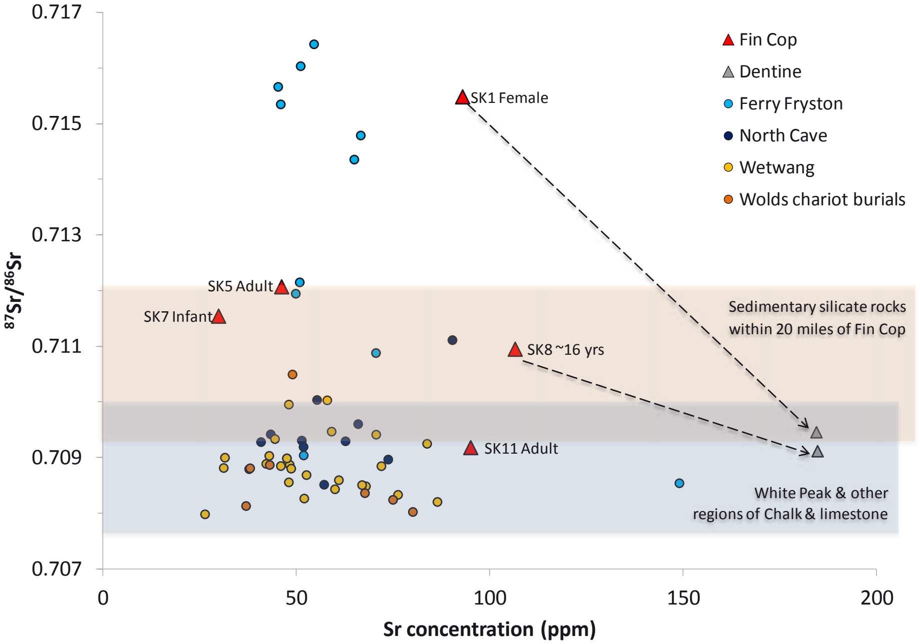


Fig. 5: Strontium isotope and concentration results for five Fin Cop individuals. Enamel/dentine pairs are linked by arrows. Comparative data for other Iron Age individuals excavated in northern England are from Ferry Fryston (Jay *et al*. 2007), North Cave (Montgomery and Jay 2014) and Wetwang (Jay *et al*. 2013). $^{87}Sr/^{86}Sr$ biosphere ranges are estimated from Evans *et al*. (2010), Warham (2012), Jay *et al*. (2013) and Montgomery (unpublished data). 2 sd analytical error is within symbol for $^{87}Sr/^{86}Sr$.

This is not the case, however, for SK1 who has the highest strontium isotope value of 0.7155. Such a value exceeds the maximum value of c. 0.714 believed to be possible for indigenous humans from England (Evans *et al*. 2010; 2012) and whilst there are regions of the Scottish Highlands, Wales, Ireland and continental Europe where such values may be obtained, they are rarely recorded in archaeological humans anywhere in Britain or elsewhere in northern Europe outside Fenno-Scandinavia. When such high human values are found in places other than Fenno-Scandinavia they are almost always deemed to be exotic to the site and indicative of origins in a granitic terrain (Evans *et al*. 2012; Montgomery *et al*. 2014a; Montgomery *et al*. in press; Oelze *et al*. 2012). In Europe, these are primarily found in Spain, Portugal, Brittany, the Central Massif, the Bohemian Massif and the Rhine Graben of southwest Germany (Asch 2005).

Oxygen isotope ratios obtained for the five individuals range from 16.3‰ to 17.6‰ and this range cannot be explained by measurement and calibration uncertainty which is +/- 0.56‰ at 95% CI (Fig. 6). All individuals are below the mean value of 17.7‰ for archaeological humans from Britain (Evans *et al*. 2012). When converted to precipitation values using the equation 6 in Daux *et al*. (2008) they give a $\delta^{18}O$ precipitation range of -8.7‰ to -6.7‰, thus the data suggest the Fin Cop individuals are consistent with origins in central and eastern Britain, eastern Ireland, northern or central Europe. Although oxygen isotopes are

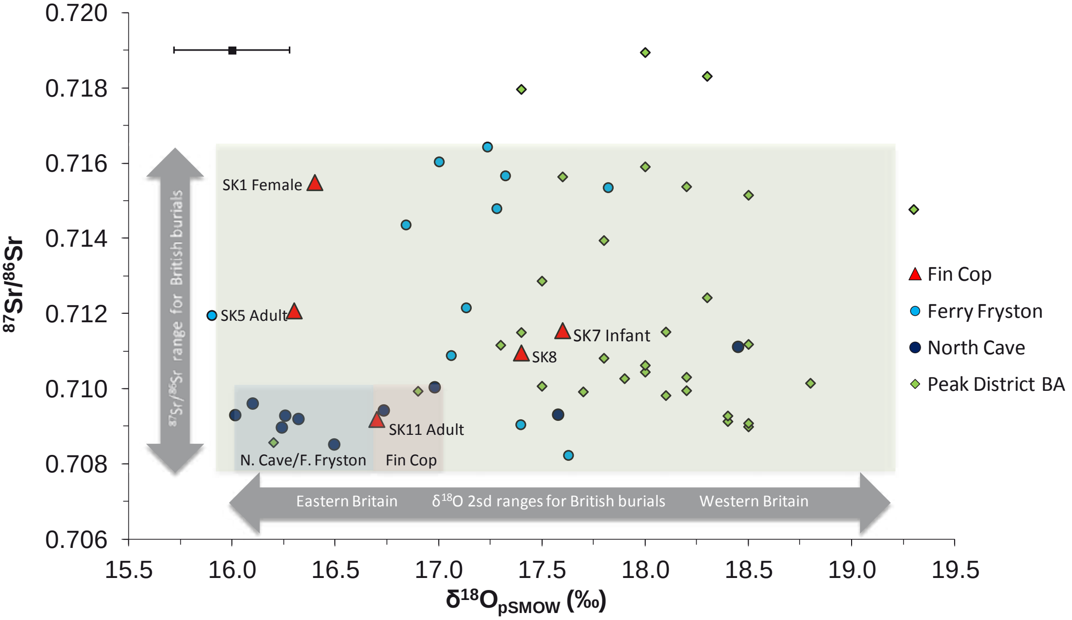


Fig. 6: Strontium and oxygen isotope results for five Fin Cop individuals. $\delta^{18}O$ phosphate values are calculated using the equation of Chenery *et al*. (2012). The $^{87}Sr/^{86}Sr$ range for archaeological burials from Britain and the 2sd $\delta^{18}O$ ranges for burials from eastern and western Britain (Evans *et al*. 2012) are within the green box. The ranges for humans from Fin Cop and North Cave/Ferry Fryston sensu stricto are defined by the red and blue boxes respectively. Comparative data sources: Iron Age individuals from Ferry Fryston (Jay *et al*. 2007) and North Cave (Montgomery and Jay 2014) and for Bronze Age individuals from the Peak District from Pellegrini *et al*. (2016) and Montgomery *et al*. (in press). Analytical error is shown at 1sd for $\delta^{18}O$ and 2sd for $^{87}Sr/^{86}Sr$.

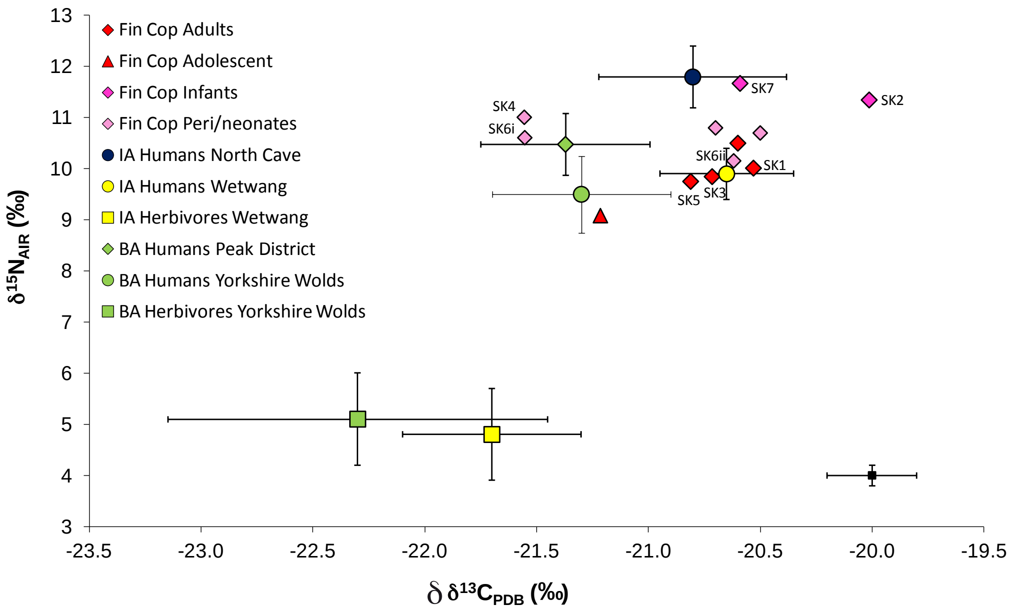


Fig. 7: Carbon and nitrogen isotope data for the Fin Cop individuals. Comparative population bone collagen means +/- 1sd from other limestone sites in northern England are shown for Iron Age individuals from North Cave (Montgomery and Jay 2014), humans and herbivores from Wetwang (Jay *et al.* 2013) and Bronze Age humans and herbivores from the Peak District and the Yorkshire Wolds (Montgomery & Jay 2013; Jay *et al.* in press). Analytical error for the Fin Cop results is shown at 1sd

problematic in their interpretation due to the large uncertainty and hence, scatter, associated with the data, it is perhaps reassuring that the individual with local strontium isotope ratios, SK11, is the only one that also falls within the sensu stricto expected strontium and oxygen isotope range for individuals at Fin Cop (Fig. 6). The highest oxygen isotope ratio of 17.6‰ was obtained from the deciduous molar of the infant SK7 and may be elevated resulting from breastfeeding. If so, this would reduce the δ^{18}O value by c. 1.0 ‰ (Britton *et al.* 2015) shifting it to the left in Fig. 6, reducing the population range to only 1.1‰ (i.e. within measurement uncertainty) and towards SK5 with which it then shares an overall isotopic profile (Fig. 5) that may be consistent with a mother/child relationship, or at least, contemporaneous origins in the same community.

The δ^{13}C values of the Fin Cop adults and children range from -21.6‰ to -20.0‰ in bone collagen and -16.6‰ to -14.6‰ in enamel carbonate. The range for δ^{15}N is 9.1‰ to 11.7‰. This variation cannot simply be explained by analytical uncertainty at 95% CI. Nonetheless, despite the variable geographical origins, the four adults share a very similar δ^{13}C and δ^{15}N dietary profile in collagen and δ^{13}C in enamel which is identical to other Iron Age populations such as at Wetwang in Yorkshire, northern England (Fig. 7), who were believed to be eating a mixed diet of terrestrial C_3 plants and domesticated animal protein with no evidence for the consumption of marine resources or freshwater fish (Jay and Richards 2006; 2007). Whilst regional differences in human δ^{13}C and δ^{15}N values have been observed during the Iron Age in Britain and individual outliers exist, inter-regional differences are small with considerable overlap between populations and appear to be due to geographical variation in the plants at the base of the foodchain rather than a significantly different adult diet (Jay and Richards

2007). The adolescent and infants are much more variable although none lie outwith the observed range for Iron Age populations across Britain (Jay and Richards 2007). The lower $\delta^{13}C$ and $\delta^{15}N$ observed for the adolescent SK8 may indicate this individual consumed a lower proportion of meat when compared to the adults at Fin Cop, or it could be related to geographic variation at the base of the food chain given the strontium and oxygen isotopes indicate this individual came to Fin Cop from elsewhere.

DISCUSSION

By Clive Waddington and Janet Montgomery

The oxygen and strontium isotope data obtained from the five Fin Cop individuals indicates a group with diverse origins but similar adult diets: one adult (SK11) is consistent with origins on the limestone of the White Peak; three, including an adolescent (SK8) and a potential mother (SK5) and child (SK7), are consistent with origins within a 5-20 mile radius of Fin Cop; and the fifth, an adult female (SK1), has a high strontium isotope ratio indicative of origins in a granitic region. In Britain, such regions are primarily found in Cornwall, the Cheviot Hills and Highlands of Scotland, the latter would also be consistent with the low oxygen isotope ratio (Pellegrini *et al*. 2016), however, there are currently few comparative human data with such high values from granitic regions due to poor bone preservation. Several cattle dating to the Roman period with strontium isotope ratios between 0.714 and 0.716 and thus comparable with SK1, have been excavated in Worcester and were suggested to have been driven there from Wales (Montgomery *et al*. 2014b). However, cattle can be grazed in upland regions of granitic rocks and acidic soils that are unsuitable for agriculture: human and animal strontium isotope ratios are controlled primarily by the plants consumed (Montgomery *et al*. 2010) and in humans this is more likely to be grains than grass. Nonetheless, an oxygen isotope value of 16.3‰ is too low to support origins in western Britain (Evans *et al*. 2012) and thus Wales can be ruled out as a likely place of origin for SK1 or indeed SK5.

One of the very few sites where individuals with such anomalously high strontium isotope ratios have been found in Britain is at Ferry Fryston, close to the river Aire in West Yorkshire and on the Magnesian limestone ridge. Here, several Iron Age pit burials and a male buried with a chariot were deemed to be non-local with no place of origin yet identified (Jay *et al*. 2007). These individuals have strontium and oxygen isotopes that, taking analytical uncertainty into account, are identical to SK1 (Figs. 5 and 6) and appear to be inconsistent both with their place of burial and the Chalk of the Yorkshire Wolds (Montgomery *et al*. 2007), where the main cluster of British chariot burials is located. Here, at sites such as Wetwang (Jay *et al*. 2013) and North Cave (Montgomery and Jay 2014), the strontium isotope variation amongst Iron Age populations is far smaller than at Fin Cop or Ferry Fryston, suggesting either a lower incidence of migration to these Yorkshire Wold sites or continental origins in a region of similar geology such as the Chalk of the Champagne region (Fig. 5). A second group of individuals with high strontium isotope ratios are found in the Early Bronze Age barrows of the White Peak (Parker Pearson *et al*. 2016; Montgomery *et al*. in press). Whilst this suggests a common geographical origin, given that two Peak District populations from different periods have apparently unusual strontium isotope ratios, the oxygen isotope ratios of the Bronze Age individuals, when taking analytical and calibration uncertainty into account, appear to suggest an origin in a warmer and/or more southerly clime than SK1 (Fig. 6). Currently though, the residential origins of individuals with strontium isotope ratios above 0.7150 is unclear and whether a place of origin within Britain can be found remains uncertain, nevertheless clusters of high human strontium isotope ratios appears to be an unexplained characteristic of prehistoric populations in this region of northern England (Montgomery *et al*. in press). This may result from accessible river routes via the Humber, Aire, Derwent and Trent and it is possible that the presence of important reserves of metal ores, particularly lead and copper, within the White Peak drew groups of people in to the region at different times.

In the case of the infant SK2, the simplest explanation for the increase in $\delta^{13}C$ and $\delta^{15}N$, compared to the adult migrant female SK1, with whom it was buried, is post-natal breastfeeding rather than stress of either the pregnant mother or fetus in utero, or a stressed or ill newborn (Beaumont *et al*. 2015). A similar mother-infant feeding relationship could be proposed for the infant SK7 and adult female SK5, which were recovered from a comingled context along with perinate SK6ii who has identical values to SK5 consistent with a pre-term infant. The enamel $\delta^{13}C$ is also 0.5‰ higher in SK7 than in SK5 which further supports a mother/child relationship.

This is not the case, however, for the fourth individual in this deposit, perinate SK6i, which has $\delta^{13}C$ ~1‰ lower and $\delta^{15}N$ ~1‰ higher than SK5. There is currently insufficient research on infant stress in utero but it is clear at Fin Cop that breastfeeding cannot be the explanation for the raised $\delta^{15}N$ and lower $\delta^{13}C$ in the pre-term infants such as SK6i and SK4. A study of children in Ireland during the Great Famine in the 19th century demonstrated that a combination of raised $\delta^{15}N$ and lowered $\delta^{13}C$ can indicate severe physiological stress (Beaumont and Montgomery 2016). Alternatively, the larger variation in the infants compared with the adults may document short-term dietary change of the mothers during pregnancy, related to a change in residence (possible given the variable origins of the adults), seasonal food availability, or voluntary or enforced food choices which would not be visible in the long-term average of adult female bone collagen. Although they appear anomalous amongst the other individuals from Fin Cop and other Iron Age individuals from the north of England, these two perinates have $\delta^{13}C$ and $\delta^{15}N$ values within the range of earlier Bronze Age individuals excavated in the Peak District (Jay *et al*. in press). The diachronic increase in $\delta^{13}C$ between Bronze Age and Iron Age humans from the same locality has been demonstrated at several British sites by Jay *et al*. (2012). Whilst the ultimate cause is not currently known, it is also present in domestic herbivores (Fig. 7) and could arise from changing animal management and foddering: for example, grazing livestock under a forest canopy in the Bronze Age but in more open pasture in the Iron Age (Jay *et al*. 2012). An alternative explanation, therefore, for the lower $\delta^{13}C$ values in these perinates is that their mothers were consuming protein sourced from a forested environment during pregnancy.

The presence of numerous Mesolithic chipped stone pieces throughout the excavation deposits testifies to the importance of this hilltop during the Mesolithic. Two observations can be made with respect to this assemblage to add to those made in the previous publication (Waddington 2012). Firstly, most of the material recovered during the 2012/14 excavations was flint rather than chert, indicating that flint material was being imported to the area during the Mesolithic period. Secondly, although some of the assemblage was from residual contexts, much of it was from the pre-hillfort soil layer indicating they were near to their original position of discard, perhaps having only moved a relatively short distance downslope due to post-depositional soil creep. This suggests that *in situ* Mesolithic deposits could survive on the site, particularly in those areas where there are thicker soils overlying the bedrock. The discovery of flint in this locale, in contrast to the large quantities of chipped chert found higher up the slope and further north on the site during the previous investigations, might also imply that there are different phases of Mesolithic activity represented on the hilltop. Although currently only represented by the lithics and the evidence for chert quarrying (Waddington 2012), the importance of Fin Cop as a Mesolithic site should not be under-estimated. Despite subsequent disturbance caused by Neolithic, Bronze Age, Iron Age, medieval and post-medieval activity across the site, there is still relatively undisturbed Mesolithic material to be found where pre-hillfort soil layers survive at depth.

The Iron Age hillfort defences in the southern half of the site have now been shown to be of broadly the same constructional form as those in the northern half of the site. In short, the wall defence comprised a stone-faced front wall with a rougher rear stone revetment and a laid stone fill, together with a rock-cut outer ditch. In the case of Trench 9, it appeared that some soil had also been dumped with the wall core, something not witnessed previously, but this could be to do with the fact that in this part of the perimeter the platform on which the wall had been built had been clearly shaped artificially by scooping into the slope to create a flat base on which to build the wall. This created upcast from the pre-hillfort soil that needed to be disposed of and could explain the soil observed within the wall core in the Trench 9. The hillfort wall averaged around 4m wide, just as it had done in trenches 1 and 5 and, although most of the facing stones in this section had slumped, they could still be seen to have been roughly faced and dressed and typically were the larger blocks encountered.

As with previous trenches cut across the ramparts, Trench 9 provided evidence for an unfinished ditch that appears to have been constructed by work gangs working towards each other. Trench 9 showed the ditch edges, in places, to be jagged and stepped, with blocks left unlifted and the ditch of varying depth with an irregular ‘causeway’ left in place. A quarry line could be seen, when viewed from above, showing how far the work gang had reached. Within the wall destruction deposit forming the ditch fill, the remains of six individuals were recovered, although all were fragmentary. Some remains may have been brought into that part of the ditch by rodents (e.g. the single clavicle testifying to the presence of the adult Skeleton 10), whilst scavengers may have also disturbed and removed body parts from other individuals during the rotting process (e.g. from Skeleton 11). All the human remains were found towards the outer edge of the ditch, consistent with all the skeletal remains found previously, suggesting they had entered the fort ditch by being disposed of from its outer edge. The position of the articulated adult (Skeleton 11) indicated that it had been dumped unceremoniously into the ditch at the same time as the wall destruction material, which is again consistent with previously excavated skeletons from the northern half of the fort’s perimeter.

The presence of six individuals from the 6m of ditch excavated in Trench 9 further supports the estimate of roughly one individual per metre of ditch (Waddington 2012, 224). Given that three trenches have now been cut across the rampart with the furthest two placed 180m apart, it can be concluded that people were disposed of throughout most, if not all, of the fort’s rock-cut ditch. Given that the fort’s ditch extends for approximately 400m a reasonable estimate for the number of individuals within the ditch would be around 400.

Sample	***Age***	***Sex***	***Tooth***	***Tissue***	^{87}***Sr/***^{86}***Sr measured***	***Sr (mg/kg) measured***	***δ***^{13}***C***$_{PDB}$***‰ measured***	***δ***^{15}***N***$_{AIR}$***‰ measured***	***δ***^{13}***C***$_{PDB}$***‰ measured***	***δ***^{18}***O*** $_{SMOW}$***‰ measured***	***δ***^{18}***O*** $_{SMOW}$***‰ calculated****	***δ***^{18}***O*** $_{SMOW}$***‰ calculated*****
SK1	adult	?F	C1	enamel	0.71548	93			-16.3	25.3	16.4	-8.4
				crown dentine	0.70946	185						
				rib			-20.5	10.0				
SK2	neonate			bone fragments			-20.0	11.3				
SK3	20-25 years	F		rib			-20.7	9.8				
SK4	peri/neonate			bone fragments			-21.6	11.0				
SK5	20-30 years	U	P1	enamel	0.71207	46			-15.1	25.2	16.3	-8.6
				rib			-20.8	9.8				
SK6i	peri/neonate			bone fragment			-21.6	10.6				
SK6ii	peri/neonate			bone fragment			-20.6	10.2				
SK7	infant		dm2	enamel	0.71154	30			-14.6	26.4	17.6	-6.7
	c. 2 years			bone fragments			-20.6	11.7				
SK8	15-16 years	?M	C1	enamel	0.71095	107			-16.3	26.2	17.4	-7.0
				crown dentine	0.70911	185						
				rib			-21.2	9.1				
SK11	25-35 years	U	P1	enamel	0.70918	95			-16.6	25.6	16.7	-7.9
				rib			-20.6	10.5				
SK13	peri/neonate			bone fragments			-20.5	10.7				
SK14	peri/neonate			bone fragments			-20.7	10.8				

Table 5: Isotope data for the Fin Cop individuals.

**Phosphate δ^{18}O values were calculated using Chenery et al. (2012). Uncertainty is +/- 0.28 ‰ (1σ)*

***Drinking water δ^{18}O values were calculated using Daux et al. (2008) Eq 6. Measurement uncertainty is +/- 0.5 (1σ)*

	M3	M2	M1	P2	P1	C	I2	I1	I1	I2	C	P1	P2	M1	M2	M3
Maxilla	2	2					2	2				2	2	2		
Mandible	2	2	2	2	2	4	4	4	4	4	2	2	2	4	2	2

Table 6: Skeleton 11 dental inventory. Key: 1=Present, but not in occlusion; 2=Present, development complete, in occlusion; 3=Missing, with no associated alveolar bone; 4= Missing, with alveolus resorbing/ fully resorbed: antemortem loss; 5=Missing, with no alveolar resorption: post-mortem loss; 6=Missing, congenital absence; 7=Present, damage renders measurement impossible but observations are recorded; 8=Present, but unobservable (e.g. deciduous or permanent tooth in crypt); Blank=tooth and alveolus not present.

APPENDIX 2: ANALYTICAL METHODS

Preparation of Tooth Samples

One tooth from each of five individuals (SK1, SK5, SK7, SK8 and SK11) were prepared in the Archaeological Sciences Stable Light Isotope Facility at the University of Bradford. Enamel samples were collected following the methods of Montgomery (2002). To minimise contamination, all tools were cleaned prior to use and between samples. To remove adhering soil and particulates on the tooth surface, all enamel surfaces were abraded with a tungsten carbide dental bur attached to a Marathon 7 micro motor dental drill lubricated with MilliQ water. All surfaces of the enamel samples were removed with a tungsten carbide dental bur to a depth of >100 µm. Any evident cracks as well as cut surfaces were then further abraded with dental burs. Visible cracks were opened and cleaned. All teeth produced sufficient well-preserved enamel for analysis.

The enamel was then sectioned with a flexible diamond dental saw after the sample area had been completely abraded. All adhering dentine and enamel-dentine junction tissue were also removed entirely. A sample of crown dentine, which is not resistant to strontium uptake during burial, was removed from two teeth (SK1 and SK8) to assess labile strontium isotope ratios in the burial soil (Montgomery *et al*., 2007). Enamel samples were divided for each analysis as follows: 10 mg for strontium and 20 mg powder for oxygen and carbon isotopes. The clean enamel and dentine samples were sealed in 1.5 ml plastic capsules and transferred to the clean laboratory.

Oxygen and Carbon Isotope Analysis of Enamel Carbonate

Sample preparation and measurement was undertaken in the Stable Light Isotope Facility at the University of Bradford by Jacqueline Towers and Andrew Gledhill and followed a protocol modified after Sponheimer (1999) for finely powdered enamel, involving initial treatment with 1.7% NaOCl solution (for approximately 30 min.) to remove organic matter. After rinsing with MilliQ water, samples were then treated with 0.1M acetic acid (for < 10 min) to remove any exogenous carbonate. After further rinsing followed by freeze-drying, the samples were weighed in duplicate into septa-capped vials (~1.3 mg for each sample), which were loaded into a Finnigan Gasbench II connected to a Thermo Delta V Advantage continuous flow isotope ratio mass spectrometer (CF-IRMS). The carbonate fraction reacted with phosphoric acid (103%) at 70°C to release CO_2 which was analysed by the mass spectrometer. δ^{18}OVSMOW and δ^{13}CVPDB measurements were normalized using a calibration equation derived from the measured and accepted values of two internal and one international standard (NBS19, OES1, Merck CaCO3).

Skeletal elements	***Preservation***
Mandible	2
7 x cervical vertebrae	3
12 x thoracic vertebrae	3
5 x lumbar vertebrae	3
Complete right clavicle	2
Partial left clavicle	3
Partial left scapula	3
Partial sternal body	3
Fragmented left 1st rib	3
Fragmented left 2nd rib	3
Fragmented right 2nd rib	3
>20 x fragment left ribs (3-12)	3
>20 x fragment right ribs (3-12)	3
2 x fragment left humerus	3
Complete right humerus	3
Partial left radius	3
Partial left ulna	3
2 x fragment right radius	3
Partial right ulna	3
Left scaphoid	3
Left lunate	3
Left trapezium	3
Left trapezoid	3
Left capitate	3
Left 2nd metacarpal	3
Left 4th metacarpal	3
Left 5th metacarpal	3
Right navicular	3
Right lunate	3
Right triquetral	3
Right pisiform	3
Right trapezoid	3
Right capitate	3
Right hamate	3
Right 1st metacarpal	3
Right 2nd metacarpal	3
Right 3rd metacarpal	3
Right 4th metacarpal	3
Right 5th metacarpal	3
Right 1st proximal phalanx	3
5 x unsided proximal phalanges (II-V)	3
5 x unsided intermediate phalanges (II-V)	3
3 x unsided distal phalanges (II-V)	3
Complete left patella	3
2 x fragment left tibia	3
2 x fragment left fibula shaft	3
Left incomplete calcaneus	4
Left talus	3
Left cuboid	3
Left navicular	3
Left 2nd cuneiform	3
Left 3rd cuneiform	3
Left 1st metatarsal	3
Left 2nd metatarsal	3
Left 3rd metatarsal	3
Left 4th metatarsal	3
Left 5th metatarsal	3
Left 1st proximal phalanx	3
Right partial calcaneus	4
Right talus	3
Right cuboid	3
Right navicular	3
Right 1st cuneiform	3
Right 1st metatarsal	3
Right 2nd metatarsal	3
Right 3rd metatarsal	3
Right 4th metatarsal	3
Right 5th metatarsal	3
Right 1st proximal phalanx	3
2 x unsided proximal phalanges (II-V)	3
2 x unsided intermediate phalanges (II-V)	3

Table 7: Skeleton 11 Inventory.

Skeletal elements	***Preservation***
Left pars petrosa (temporal bone)	3
Right pars petrosa (temporal bone)	3
Left proximal ulna	3
Unsided radius shaft	3
Unsided fibula(?) shaft	3
Unidentified long bone shaft	3

Table 8: Skeleton 12 Inventory.

Skeletal elements	***Preservation***
Left mandible	3
Sphenoid body	3
Left pars lateralis (occipital bone)	3
Pars basilaris (occipital bone)	3
Left pars petrosa (temporal bone)	3
>10 unidentified cranial fragments	3
Right first rib	3
>10 unsided rib fragments	3
Left clavicle	3
2 x cervical neural arches	3
Incomplete right humerus shaft	3
Left distal humerus	3
3 x unsided metacarpals	3
Right femur	3
Left femur	3
Left proximal tibia	3
1 x unsided metatarsal	3

Table 9: Skeleton 13 Inventory.

Skeletal elements	***Preservation***
Left mandible	3
2 x fragment of left humerus	3
2 x fragment of left radius	3
Left proximal ulna	3
2 x fragment of right humerus	3
Right ulna	3
Right distal radius	3
2 x fragment of left femur	3
3 x fragment of right femur	3
Left proximal tibia	3
Left and right pars petrosae of temporal bone	3
Pars basilaris of occipital bone	3
Right pars lateralis of occipital bone	3
Distal fibula shaft (unsided)	3
Left scapula	3
Right frontal bone	3
Dentition	Notes
Crown incompletely formed	Crown incompletely formed

Table 10: Skeleton 14 Inventory.

Analytical precision was ± 0.2‰ for δ^{18}OVSMOW (1σ) and ± 0.1‰ for δ^{13}CVPDB (1σ), determined from repeated analyses of an internal enamel laboratory standard (n = 33 over 15 months). The measured mean δ^{18}Ocarbonate were converted to δ^{18}Ophosphate using Chenery *et al*. (2012): $\delta^{18}Op = 1.0322 \times \delta^{18}OC - 9.6849 \pm 0.56‰$ (2σ) and drinking water isotope values (δ^{18}Odw) were calculated using Daux *et al*. (2008) Equation 6: $\delta^{18}Odw = 1.54x\ \delta^{18}Op - 33.72 \pm 1.0‰$ (2σ).

Strontium Isotope Analysis of Enamel and Dentine

Strontium isotope and concentration analysis were carried out in the clean class 100, HEPA©-filtered laboratory at the NERC Isotope Geosciences Laboratory (NIGL), Keyworth, Nottingham by Jane Evans following established laboratory protocols. In the clean laboratory suite at the NIGL, enamel samples were subjected to an acetone wash to remove grease followed by 5 minutes, in MilliQ water, in an ultrasonic bath then rinsed three times. They were placed in MilliQ water on a hotplate at 70ºC for two hours and then dried. Samples were weighed into clean Savillex beakers and spike of ^{84}Sr was added to allow determination of the strontium concentration. The strontium was separated using a standard Dowex cation ion exchange method (Dickin, 1995) and loaded onto rhenium filaments with TaF using a method adapted from Birck (1986). The isotope composition was determined using a Thermo Triton multi-collector mass spectrometer in dynamic collection mode. Accuracy and precision of the machine was monitored using NBS987 international standard and over the period of analysis the machine typically gave $^{87}Sr/^{86}Sr = 0.71025 \pm 0.00001$ (2σ, n = 8). All data were fraction corrected to $^{86}Sr/^{88}Sr$ of 0.1194. Blanks during this period were negligible relative to the sample size and were generally below 150 pg.

Carbon and Nitrogen Isotope Analysis of Bone

Bone collagen was prepared in the Stable Light Isotope Facility at the University of Bradford by Rebecca Nicholls and Andrew Gledhill using the modified Longin method (Brown *et al*., 1988). Bone samples were prepared by cleaning the surfaces by air abrasion and demineralised in 0.5M HCl followed by gelatinisation at pH3 at 70° for 48 hours, and Ezee and ultra-filtered. Freeze-dried collagen samples were combusted in a Thermo Flash EA 1112 and the separated N_2 and CO_2 was introduced to a Delta plus XL via a Conflo III interface. Resulting data are mean values of duplicate samples and laboratory (fish gelatin and bovine liver) and international (IAEA 600, CH6, CH7, N1 and N2) standards were interspersed throughout the run. The analytical error was ± 0.2‰ (1σ) or better for both δ^{13}C and δ^{15}N and all samples met accepted quality control parameters for identifying good quality collagen (van Klinken, 1999).

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