APPENDIX 13: THE WOOD

The excavation at Stainton West produced a large assemblage of waterlogged wood, most of which came from the *Principal palaeochannel*. In total, 3286 pieces of were recorded, of which 198 (6%) had been worked by either humans or beavers, or was unmodified wood that had formed elements of anthropogenic structures within the channel (Table 262). Details of the modified and structural wood have been compiled, which include five wooden artefacts, along with the results of a programme of species identification that focused on both the modified and unmodified wood. This latter analysis considered a 25% sample (812 pieces) of the recorded waterlogged wood, to identify the range of woodland taxa growing nearby, and also any changes in the composition of the ancient woodland over time.

Methodology

M Taylor, M Bamforth, and D Druce

Recording and sampling

Various deposits were encountered, forming identifiable spreads, or structures, associated with those stratigraphic units within the *Principal palaeochannel* dating to the Mesolithic and Neolithic periods. The majority was present in deposits that had a high organic content and accordingly contained high frequencies of wood of various sizes, as well as twigs, leaves, nuts, and smaller plant remains. These deposits had been hand excavated, revealing the form and extent of the organic materials contained within. In general, however, it was the more substantial components of this organic material, representing the more sizable pieces of waterlogged wood, that were revealed and initially retained as *in-situ* features. In consequence, the smaller elements, such as leaves, twigs, and nuts, were removed by the process of excavation, though in some instances they were retained as bulk palaeoenvironmental samples. Once revealed, the *in-situ* spreads of waterlogged wood were photographed, after which plans were produced, which were largely derived from rectified photographs. All of the recorded wood was then inspected and any modified items were removed and recorded on-site using individual *pro-forma* recording sheets. However, any interesting and/or unusual items were retained for further detailed recording by the wood specialist (Maisie Taylor).

In accordance with the advice of the Historic England Regional Scientific Advisor (Sue Stallibrass), an on-site programme of systematic sampling of the unmodified wood was carried out. This involved the random selection of a representative amount of the recorded wood from each bay and context within the *Principal palaeochannel* (*Ch 1*). This wood, along with the vast majority of the worked material, was then subjected to a programme of species identification.

During the broader post-excavation analysis, it became clear during three-dimensional GIS modelling of the surveyed wood that a small proportion initially attributed to the *Earlier Neolithic organic deposit* might have originally derived from deposits associated with the *Mesolithic/Neolithic alluvium* (*Ch 2*). This latter stratigraphic unit was not completely identified during the excavation, but instead was only fully recognised as a distinct entity during the post-excavation assessment. In most cases, the position of this wood, as viewed within the GIS model, is equivocal, and hence, for the purposes of the analysis, it was not reassigned to the *Mesolithic/Neolithic alluvium*, but was quantified as an element of the *Earlier Neolithic organic deposit*. More generally, the full details of the 1515 items of sampled unmodified and worked wood, and also those timbers that were subjected to dendrochronological dating (*Appendix 20*), are contained within the CNDR Finds Database.

Modified and structural wood: assessment and analysis

The methodology adopted towards the assessment and analysis of the altered and structural wood

Wood category	***Mesolithic organic deposit***	***Mesolithic/Neolithic alluvium***	***Earlier Neolithic organic deposit***	***Earlier Neolithic alluvium***	***Later Neolithic organic deposit***	**Retention pond area**	***Total***
Artefact	-	-	4	1	-	-	*5*
Bark	1	-	1	-	-	-	*2*
Debris	7	-	27	-	9	-	*43*
Roundwood	2	-	68	-	8	1	*79*
Timber	5	2	4	-	1	-	*12*
Unworked structural wood	-	-	56	-	1	-	*57*
Total	***15***	***2***	***160***	***1***	***19***	***1***	***198***

Table 262: Modified and structural wood from Stainton West

Condition score	**Museum conservation**	**Technology analysis**	**Woodland management**	**Dendrochronology**	**Species identification**
5 excellent	+	+	+	+	+
4 good	-	+	+	+	+
3 moderate	-	+/-	+	+	+
2 poor	-	+/-	+/-	+/-	+
1 very poor	-	-	-	-	+/-
0 non-viable	-	-	-	-	-

Table 263: Condition scale used to describe the condition of modified waterlogged wood (after Van de Noort et al *1995)*

was in accordance with the then English Heritage guidelines (Brunning and Watson 2010), whilst categorisation and interrogation of this material followed the methodologies developed by Maisie Taylor (1998; 2001). During the initial post-excavation assessment, a selection of the worked wood was re-examined, and the field records were amended as appropriate. All records were then entered into a database. Every effort was made to refit broken or fragmented items; however, due to the nature of the material, the possibility remains that some discrete, yet broken, items may have been processed as their constituent parts, as opposed to as a whole. Metric data were taken using rulers and tapes, and the toolmarks were measured using a profile gauge.

It was often possible to identify oak (*Quercus* sp) by examining morphological traits visible with a hand lens (ring-porous growth rings and large multiseriate medullary rays). However, the modified items that could not be identified with a hand lens (151 in total) were sub-sampled to allow identification to species via optical microscopy (*below*).

The scale developed by the Humber Wetlands Project (Van de Noort *et al* 1995, table 15.1) was used to describe the condition of the worked and structural wood (Table 263). This is based primarily on the clarity of surface data, and material is allocated a score dependent on the types of analyses that can be carried out, given the state of preservation. The condition score reflects the possibility of a given type of analysis, but does not take into account the suitability of the item for a given process. If preservation varies within a discrete item, the section that is best preserved is considered when assigning it a condition score. This normally applies to items that were set vertically in the ground, as these often display relatively better preservation lower down and relatively poorer preservation higher up (*ibid*).

Roundwood was noted as having possible morphological evidence of coppicing when a straight, even stem with a central pith was present. Additional morphological characteristics that may be indicative of coppicing were also noted, such as a curved and/or flared butt or proximal end, or stems with evidence of topping or bolling (*cf* Rackham 1977).

Species identification: assessment and analysis

Just over half of the sampled unmodified wood was selected for species identification, along with 151 pieces of the modified wood (*above*). In addition, the details of the oak (*Quercus* sp) wood lifted for dendrochronological assessment were added to the dataset, and 21 identifications of wood species were made on small roundwood extracted from monolith samples for the purpose of radiocarbon dating (*Appendix 20*). Therefore, species identifications were carried out on 812 samples of wood from the *Principal palaeochannel*. The identifications were made, primarily, to identify the range of woodland taxa growing at the site, and to identify any changes in the composition of the woodland over time. Species identifications were also correlated with wood type (*ie* small roundwood, large limb/trunk wood, or rootwood) to assess the potential of the data for providing information on likely taphonomy. An assessment proved that differences did indeed exist, and that the 812 samples provided an adequate dataset for the study. The selection also provided a reasonable coverage of the wood existing in the channel (Fig 612).

In order to identify the species of the selected wood, a transverse section of each was observed using a Leica MZ6 binocular microscope at up to x40 magnification, to determine its cellular make-up (*ie* ring, semi-ring, or diffuse porous wood). Many of the better-preserved pieces of oak, with their distinct ring-porous growth rings and wide multiseriate medullary rays, could be identified at this stage. However, if the transverse section was not clear, or if the wood was not oak, then small radial and tangential sections were mounted on a slide in water, sealed with a cover slip, and observed under transmitted light using an Olympus BH-2 microscope at up to x400 magnification. Identifications were aided with the use of standard-reference texts (Schweingruber 1978; Hather 2000), and comparison with reference slides held at OA North. The taxonomic level of identification varied according to taxa. Fragments identified as blackthorn-type (*Prunus* sp) include sloe/blackthorn, wild plum, wild cherry, and bird cherry, whilst hawthorn-type (Maloideae) includes hawthorn, whitebeam, apple, and pear. Identification was not possible on the heavily degraded or distorted pieces. Although distinguishing rootwood from roundwood is not always straightforward, the former was considered more likely in those pieces lacking pith and exhibiting a non-uniform growth pattern (the rays forming an almost 'wavy' pattern).

Modified and Structural Wood

M Taylor and M Bamforth

The modified and structural wood was derived from five of the main stratigraphic units contained

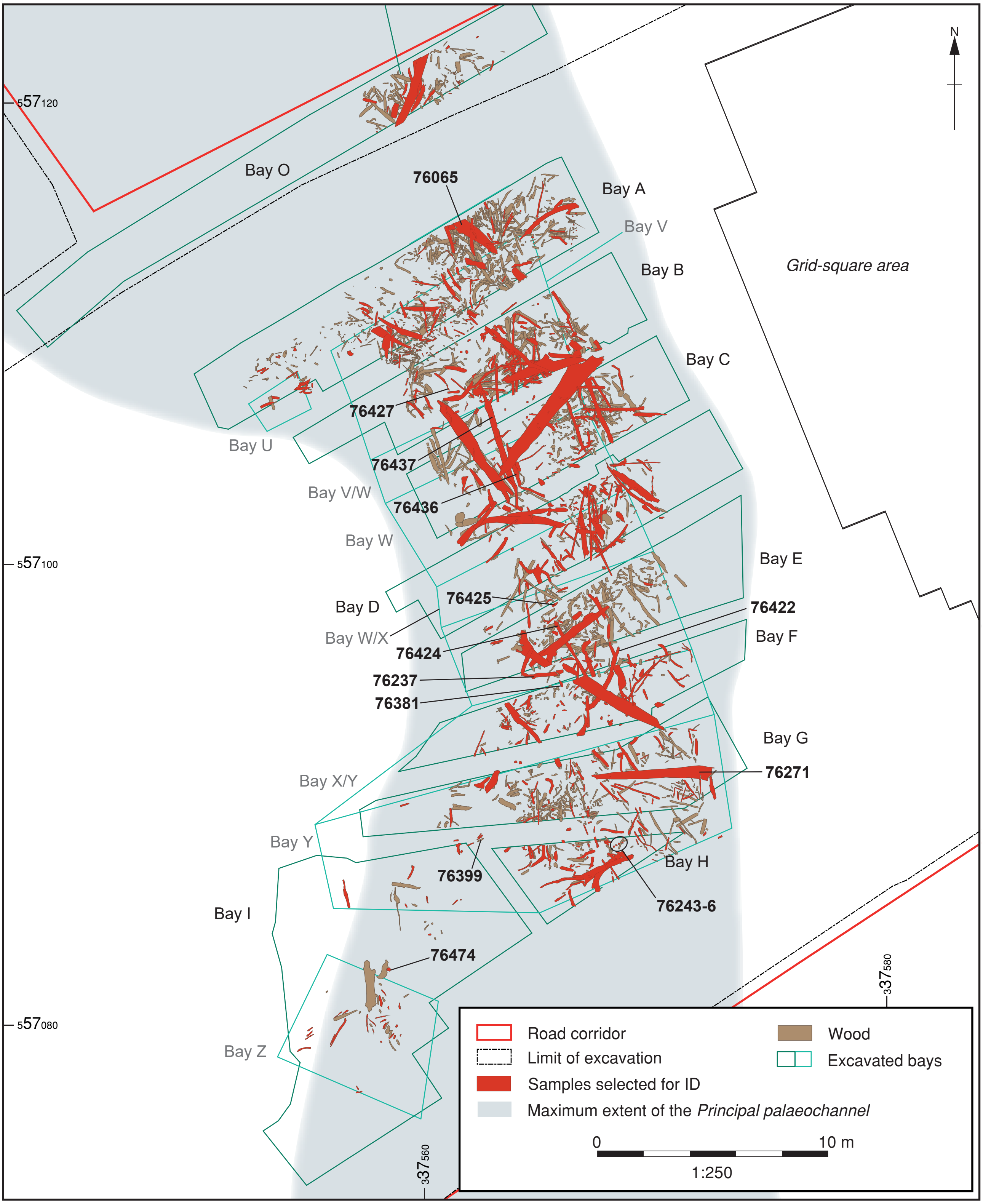

Figure 612: The recorded waterlogged wood from Stainton West

within the *Principal palaeochannel*, whilst a single piece was also recovered from the area of the retention pond for the site (Table 262). Significantly, the assemblage included items both that related to several Neolithic structures and also representing Neolithic wooden artefacts.

Mesolithic organic deposit

A total of 15 items of wood from this stratigraphic unit displayed evidence of modification. The worked items consisted of roundwood, timber, and debris, which ranged in condition from poor to good.

Roundwood

Two items were classed as roundwood (Table 264). Roundwood **76381** was from deposit ***71013***, in Bay X (*Ch 3*; Fig 612); other timber from this deposit has been matched to the site's dendrochronological Cluster 5 (*Appendix 20*). It was identified as alder/hazel (*Alnus*/*Corylus*), was in moderate condition (score 3), measured 345 mm in length, and had a distorted diameter of 48 x 45 mm (Pl 279). It also had a straight, even stem, often associated with material derived from coppice, and had been worked at one end with a distinctive chop and tear. Roundwood **76474** was recovered from Bay W, deposit ***71096*** (*Ch 3*). It was identified as elm (*Ulmus* sp), was in moderate condition (score 3), measured 360 mm in length, and had a distorted diameter of 41 x 56 mm. Although some bark was present, possible tool facets associated with bark removal were apparent. This item was also charred.

Timber

Five worked items from the *Mesolithic organic deposit* were classed as timber, all of oak. Of these, two (**76271** and **76422**) displayed woodworking evidence that suggests possible cultural conversion. Timber **76271** was in Bay Y, within deposit ***71013*** (*Ch 3*), and formed the trunk and partial root bole of an oak tree, measuring 5350 x 430 x 380 mm (Pl 280). Although its upper surface was weathered and worn, possible working was identified on the underside of the timber. This comprised two parallel notches, approximately 210 mm apart, around which was an area of possible tool faceting, perhaps representing hewing (Fig 613). Two possible partial toolmarks were also recorded, measuring 40 x 3 mm and 60 x 4 mm. This timber was sampled for dendrochronological dating, but it could not be matched to the site's dendrochronological clusters, or other reference data (*Appendix 20*). However, an unmodified elm from its parent deposit (***71013***), which appears to have formed an element of a beaver lodge, has produced a date of *4930-4790* cal *BC* (*SUERC-32722*; *Ch 3*; *Appendix 20*), and it is possible that timber **76271** dates to a similar period.

The second timber (**76422**) exhibiting possible woodworking was recovered from Bay X, also from deposit ***71013*** (*Ch 3*). Its tree-ring sequence was matched with dendrochronological Cluster 5, and it was also sampled and subjected to radiocarbon wiggle-matching. This estimated that its final tree-ring formed in *4870-4780* cal *BC* (*ring_90*; *Appendix 20*). This was a Y-shaped oak, possibly the crux of a trunk and side branch (Pl 281). The timber had no bark remaining and was in moderate condition (score 3), whilst the main section of the 'Y' was half split, and the end of its arm was charred. It measured 1232 mm in length and originally had a maximum diameter of 180 mm. Although it had a clearly identifiable split surface, it is unclear if this was the result of cultural or natural activity.

The remaining three modified timbers from the *Mesolithic organic deposit* showed evidence of beaver activity. Timber **76424** was a large oak log with no bark present, and was in moderate condition (score 3). It was found in Bay X, within deposit ***71097***, close to the base of the main channel, and between the beaver lodge and dam (*Ch 3*). It measured 975 mm long, with a distorted diameter of 134 x 196 mm, and a section of it was also notched (Pl 282). Although no tooth marks were visible, the distinctive hemispherical shape of the notch is typical of that created by beavers (*cf* Taylor 2001, 202; Coles 2006, 202, fig 12.5). A sample was subjected to dendrochronological analysis, but its tree-rings could not be matched to the English dendrochronological sequence, or the site's dendrochronological clusters (*Appendix 20*). However, an oak and an elm twig from the same deposit (***71097***) returned a modelled radiocarbon date of *4950-4850* cal *BC* (*SUERC-47195/6*; *Appendix 20*).

The second beaver-modified item (**76436**) was a substantial oak timber, with no bark, in good condition (score 4), measuring 2006 mm long and with a diameter of 235 mm. This had a similar-shaped notch to timber **76424** (*above*), probably created through beaver gnawing, though extensive water wear had erased any fine evidence of tooth marks that may once have been present. This timber was found in Bay W (Fig 612) and was associated with deposit ***71096*** (*Ch 3*). It was also sampled as part of the dendrochronological analysis, though its tree-rings could not be matched with any external reference sequences, or the site's dendrochronological clusters (*Appendix 20*). Another timber from this deposit was, however, matched to the Cluster 1 sequence (*below*).

The last modified oak timber (**76437**), measuring 6048 mm in length, with a maximum diameter of 290 mm, also had a heavily water-worn notch suggestive of beaver activity. As with timber **76436** (*above*), this was found in Bay W and was associated with deposit ***71096***, forming an element of the beaver dam (*Ch 3*). It was sampled for dendrochronological dating and was matched with the Cluster 1 tree-ring sequence, indicating that it dated to the mid-sixth millennium cal BC (*Appendix 20*). Significantly, a section of the timber with less water wear, was in good condition (score 4), where a set of three parallel grooves was recorded (Pl 283); the size of these marks might suggest that they were made by a large predator (possibly a young bear; *Ch 3*).

Debris

Seven items from this stratigraphic unit were identified as debris (Table 264), the material ranging in condition

Category	Bay	Deposit	Item	Species	Coppicing evidence	Condition score	Woodworking and charring	Length (mm)	Breadth (mm)	Thickness (mm)	Diameter long axis (mm)	Diameter short axis (mm)	Dendrochronology/ wiggle-match dating
Roundwood	W	***71096***	76474	Elm (*Ulmus* sp)	No	3	Possible faceting from bark removal; charred along 40% of length	360	-	-	41	56	
	X	***71013***	76381	Alder/hazel (*Alnus/ Corylus*)	Yes	3	Chop and tear at one end	345	-	-	48	45	
Timber	W	***71096***	76436	Oak (*Quercus* sp)	No	4	Possible water-worn 'melon slice' from beaver	2006	-	-	235	235	Undated sequence
			76437	Oak (*Quercus* sp)	No	4	Water-worn notch and three parallel claw marks	2010	-	-	280	280	Matched to Cluster 1
	X	***71013***	76422	Oak (*Quercus* sp)	No	3	Split surface (radial ½); one arm of this Y-shaped timber was charred	1232+	-	-	180	180	Matched to Cluster 5; final ring wiggle-match dated to *4870-4780 cal BC*
		71097	76424	Oak (*Quercus* sp)	Yes	3	'Melon slice' from beaver	975+	-	-	196	134	Undated sequence
	Y	***71013***	76271	Oak (*Quercus* sp)	No	3	Working on one side visible as two parallel notches, tool faceting, and two partial toolmarks	5350	-	-	430	380	Undated sequence
Debris	V	***71097***	76427	Elm (*Ulmus* sp)	No	3	Tangentially split felling debris	342	135	25	-	-	

Table 264: Modified wood from the Mesolithic organic deposit

Category	Bay	Deposit	Item	Species	Coppicing evidence	Condition score	Woodworking and charring	Length (mm)	Breadth (mm)	Thickness (mm)	Diameter long axis (mm)	Diameter short axis (mm)	Dendrochronology/ wiggle-match dating
Debris	X	***71096***	76425	Oak (*Quercus* sp)	No	2	Tangentially split felling debris; end of felled tree or part of stump. Chopped and split off then heavily charred on outside edge	306	298	155	-	-	Undated sequence
	Y	***71014***	76399	Oak (*Quercus* sp)	No	2	Radial oak groove-and-split debris; very faint traces of parallel grooves	263	98	26	-	-	
		71013	74243	Oak (*Quercus* sp)	Yes (possibly base of coppice stool)	4	Tangentially split/torn; bulging lump	540+	310	185	-	-	
			74244	Oak (*Quercus* sp)	No	3	Tangentially split/torn	231+	80	69	-	-	
			74245	Oak (*Quercus* sp)	No	3	Tangentially split/torn; one very flat surface, no obvious striations	198+	123	70	-	-	
			74246	Oak (*Quercus* sp)	No	3	Torn in a bowl shape; very flat surface with striations	210+	164	54	-	-	
Bark	Y	***71013***	75829	Elm (*Ulmus* sp)	No	3	Parallel sided, so probably worked	130	65	35	-	-	

Table 264: Modified wood from the Mesolithic organic deposit *(cont'd)*

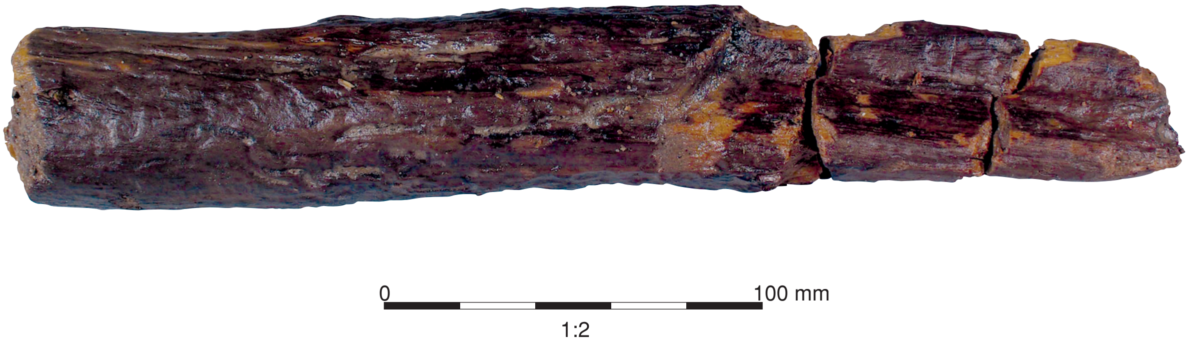

Plate 279: Roundwood ***76381*** *from the* Mesolithic organic deposit

Plate 280: Timber ***76271*** *immediately prior to lifting*

Plate 281: In-situ *timber* ***76422***

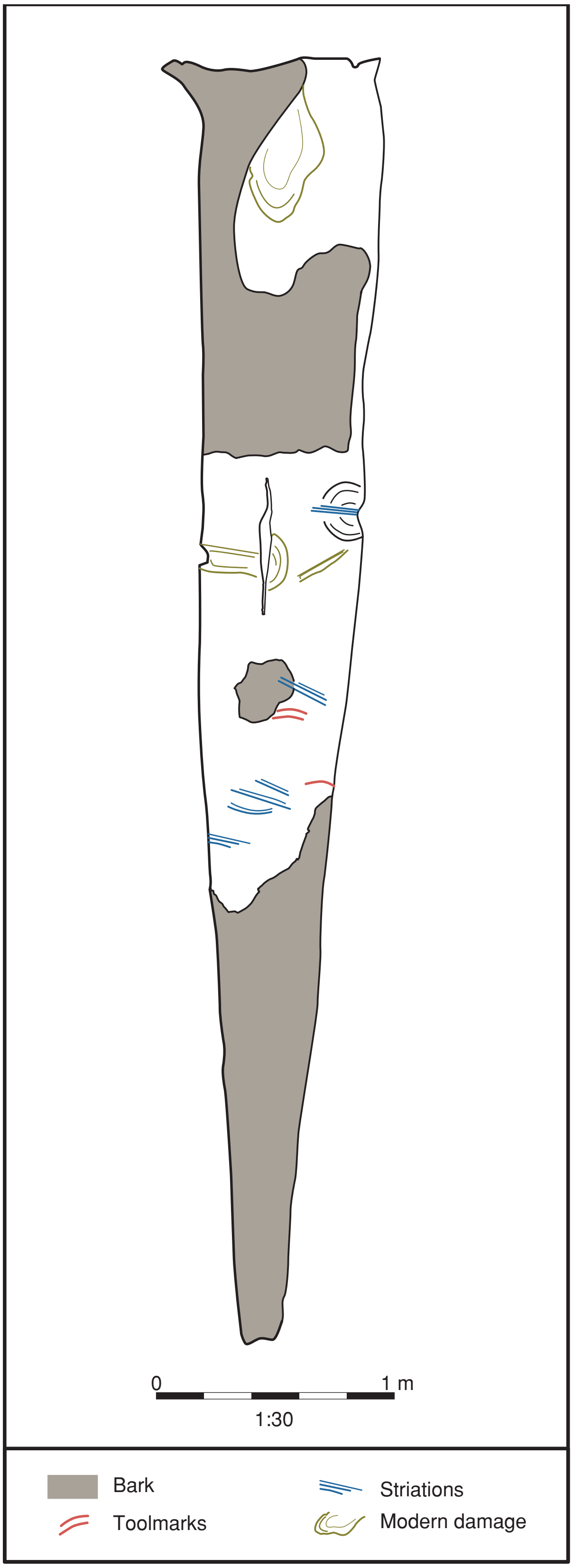

*Figure 613: Timber **76271***

*Plate 282: The notched section of timber **76424** after lifting and cutting*

*Plate 283: Timber **76437** following lifting and cutting, with three potential bear-claw marks*

from poor to good (scores 2-4). Item **76399** was radial oak groove-and-split debris, which had both sapwood and heartwood present. It was found in Bay Y, in deposit ***71014*** within the western channel (*Ch* 3). It was in poor condition (score 2), measuring 263 x 98 x 26 mm. Two parallel grooves ran longitudinally along one face.

Two tangentially split items (**76425** and **76427**) were retrieved, the size and form of which suggested that they might tentatively have been felling debris. Item **76425** was found in Bay X, in deposit ***71096*** (*Ch* 3), which also produced short-lived material that was dated to

Plate 284: Possible charred felling-debris ***76425***

4930-4830 cal *BC* (*SUERC-44777/8*; *Appendix 20*). This potential felling debris was identified as oak, measured 306 x 298 x 155 mm, and had been trimmed and split prior to the outside face being heavily charred (Pl 284). The other item (**76427**) was of elm, measuring 342 x 135 x 25 mm.

A group of four oak pieces (**76243-6**), adjacent to one another, and exhibited a similar and very unusual form of woodworking (Fig 614), were also found in the *Mesolithic organic deposit*. These came from deposit ***71013***, excavated in Bay Y, which contained a piece of elm dated to *4930-4790* cal *BC* (*SUERC-32722*;

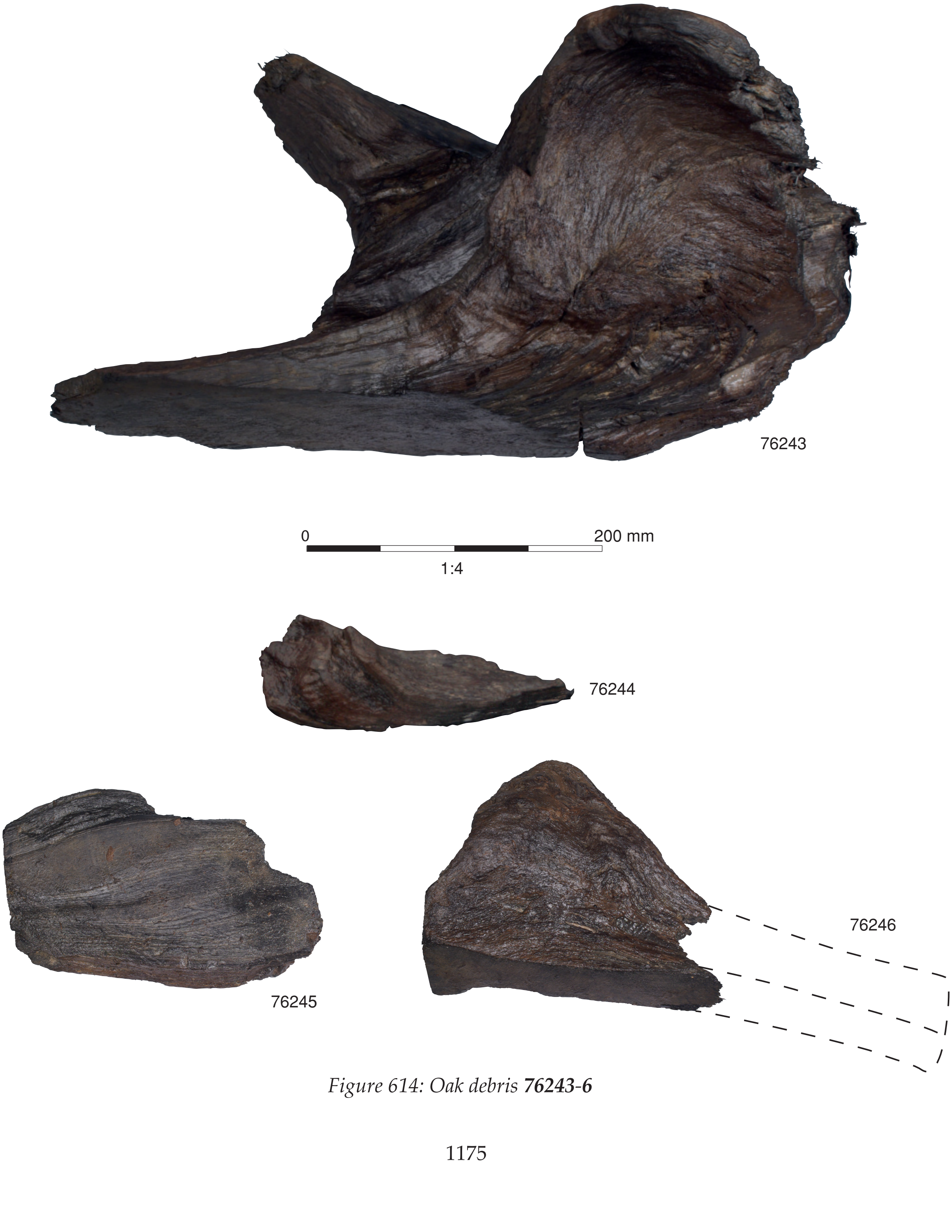

Figure 614: Oak debris ***76243-6***

Plate 285: In-situ *items* ***76244-6***

Appendix 20) forming part of the beaver lodge (*Ch 3*). All had been torn or naturally split, and displayed swirling, irregular grain, suggesting that they came from the base of a coppice stool, or possibly from a burr. It is also possible that three (**76244-6**) may have originally formed a single item that had broken apart (Pl 285). All had one or more flat surfaces, though there were no visible markings to suggest how these had been produced. For instance, the flat surfaces did not have the grain-following patterning seen on split surfaces, nor the scalloping of toolmarks that can be seen when surfaces are produced with an edged tool, such as an axe (Coles and Orme 1978). The items were hand-excavated from a secure context, which rules out the possibility that the flat surfaces were damage caused during the excavation process.

Whatever woodworking process was used to create them, the level of finishing is such that no evidence of the process remained. However, one possibility is that these pieces were burr-wood blanks for the production of wooden bowls or dishes. Burr wood is gnarled, twisted wood at the base of a shrub or tree, which forms as either a natural excrescence or as a result of coppicing to obtain long, straight stems for wattle work (Corkhill 1979, 69). Significantly, these items were comparable to several from the Etton causewayed enclosure, which has been dated to the second half of the fourth millennium BC (Taylor 1998, 151-2; Whittle *et al* 2011, 314-27). In this instance, burr wood appears to have been removed from coppice stools growing in the ditch of the Neolithic causewayed enclosure, which were subsequently shaped, probably by charring and scraping, into bowls and dishes (Taylor 1998, 151-2). As with present-day examples, bowls produced using burr wood would have possessed an attractive swirling grain and were less likely to crack and split.

Bark

One item of bark (**75892**) was recovered from the *Mesolithic organic deposit* (Table 264). This appears to have been derived from the debarking or felling of an elm tree.

Mesolithic/Neolithic alluvium

Timber

Two items (**76065** and **76237**) from the *Mesolithic/ Neolithic alluvium* displayed evidence of possible woodworking, though it is equally possible that this was a product of natural degradation, as opposed to cultural modification. Both were classified as timber (Table 265), were in a moderate condition (score 3), and were oak.

Timber **76065** was a tree trunk in Bay A, which extended into the baulk of the excavation trench (Fig 612), and was associated with a deposit (***70302***) at the base of the *Mesolithic/Neolithic alluvium* (*Ch 2*). The recorded section had its bark intact and measured 2285 mm, with a diameter of 470 mm. One of its ends was tapered (Pl 286) and as such had possibly been trimmed with an axe. However, no clear tool facets remained, and it is also possible that it had naturally degraded into this shape. Two dendrochronological samples matched it with the Cluster 2 tree-ring sequence. Significantly,

Bay	Deposit	Item	Species	Condition score	Woodworking	Length (mm)	Diameter long axis (mm)	Diameter short axis (mm)	Dendrochronology
A	***70302***	76065	Oak (*Quercus* sp)	3	Possibly worked on one end	Not recorded	Not recorded	Not recorded	4144 BC winter death/felling date
E	***70302***	76237	Oak (*Quercus* sp)	3	One end/ possibly all directions to form a 'pencil' point	613+	135	137	4355-10 BC death/ felling date

Table 265: Modified timber from the Mesolithic/Neolithic alluvium

this timber could also be matched with the English prehistoric dendrochronological sequence, indicating that the tree's death/felling date was the winter of 4144 BC (*Appendix 20*).

The other timber (**76237**) was an oak log, slow-grown and originating from a multi-stemmed tree. It was present in Bay E and was also associated with deposit ***70302*** (*Ch 2*), at the base of the *Mesolithic/ Neolithic alluvium*. It had no bark remaining and was in moderate condition. A 613 mm-long section was visible in the excavation trench, with a maximum diameter of 137 mm, its end form suggesting that it may have been trimmed from all directions to a point. However, there were no visible tool facets and, given its condition, it was unclear whether it had been worked, or had naturally degraded into this shape. Dendrochronological analysis again matched this timber with the Cluster 2 tree-ring sequence, and also the English prehistoric dendrochronological sequence. Correlation with this latter sequence indicated that this tree died between 4355 BC and 4310 BC (*Appendix 20*).

Earlier Neolithic organic deposit

In total, 156 items within this *Earlier Neolithic organic deposit* displayed either evidence for woodworking, or was unmodified wood associated with anthropogenic structures. The modified wood included debris, timber debris, timber, and bark, as well as roundwood

Plate 286: In-situ *timber* ***76065***

(Table 262), a large proportion of the latter forming elements of Neolithic structures. Most were elements of the *'Early Neolithic I'* phase (*Ch 8*; *Appendix 20*), though one earlier structure (***75935***; *below*) formed an element of the *'Earliest Early Neolithic activity'* phase (*Ch 8*; *Appendix 20*). In addition, four wooden artefacts were found in this stratigraphic unit, which were probably elements of the *'Early Neolithic I'* phase (*Ch 8*; *Appendix 20*): a trident (Trident 1); a paddle; a carved dowel; and a split-timber object.

Roundwood

Structure 75935

A small group of unmodified roundwood items was found in Bay B, which appeared to form elements an early Neolithic structure (***75935***; Fig 615). This lay

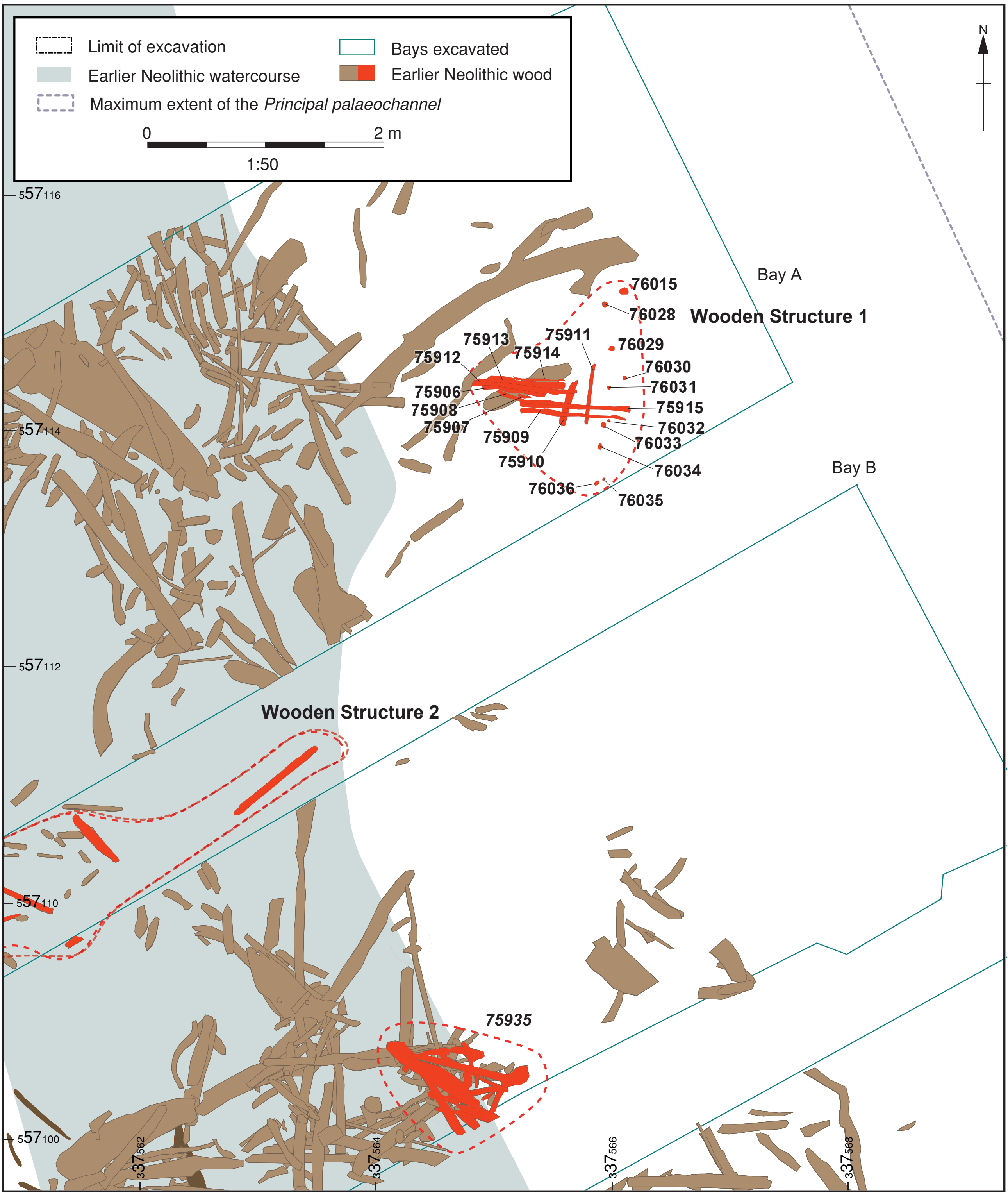

Figure 615: Structure **75935** *and Wooden Structure 1*

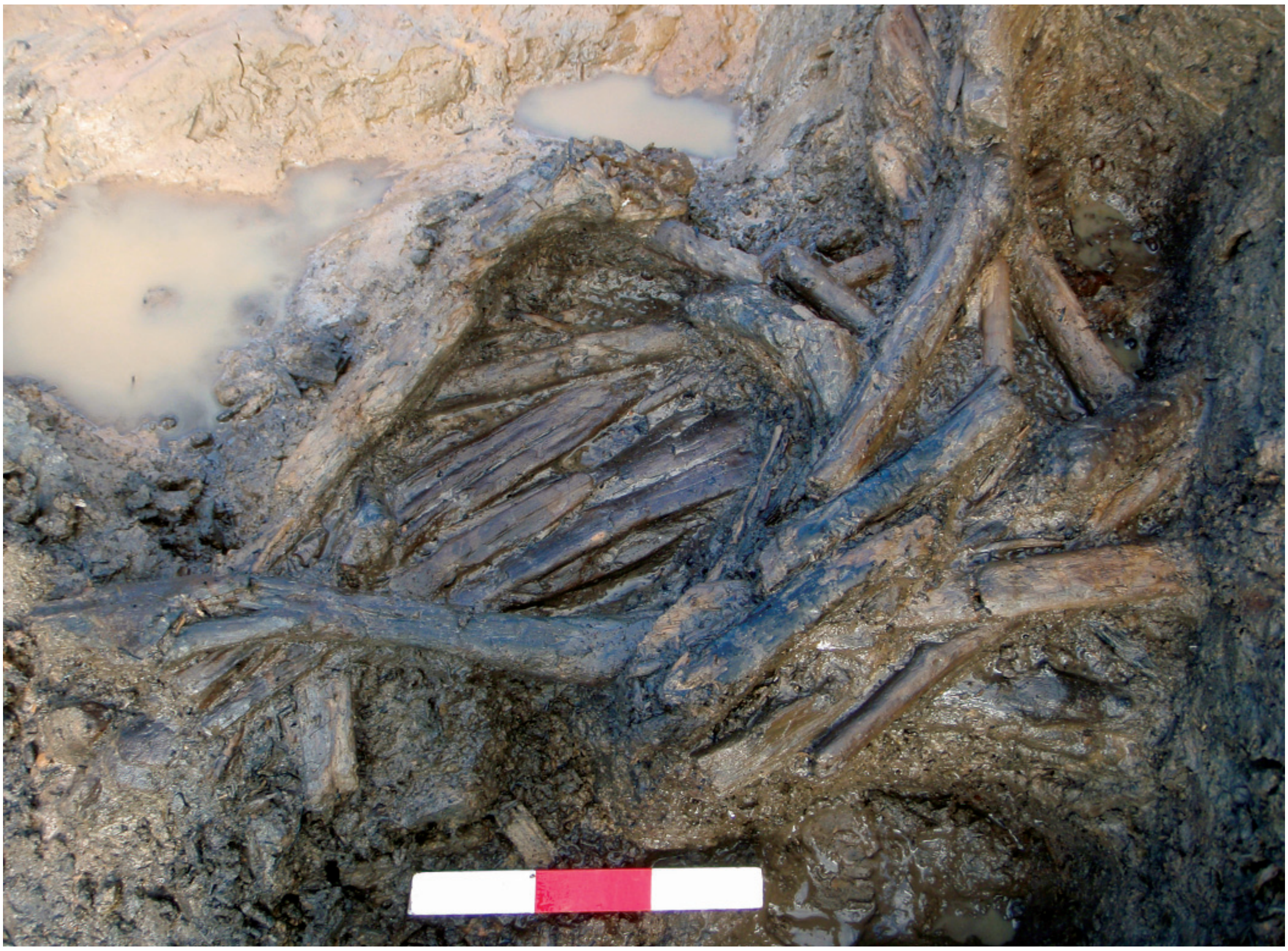

Plate 287: In-situ *timbers forming Neolithic Structure* **75935**

directly below one of the Neolithic tridents (Trident 1) and was composed of 23 pieces of roundwood, set in a tangled V-shaped arrangement (Pl 287; *Ch 8*). This covered an area of 0.5 x 0.5 m and comprised ten pieces of elm, six of hazel, one alder (*Alnus glutinosa*), and one piece of alder/hazel roundwood, with five pieces of roundwood of indeterminate species (Table 266). The roundwood ranged between 95 mm and 940 mm in length, though the majority (18 items) had lengths under 500 mm. The diameters of most (21 items) also fell below 80 mm. A sample from one of the hazel pieces (**76011**) produced a modelled radiocarbon date of *3950-3870* cal *BC* (*SUERC-42027*; *Appendix 20*), suggesting that ***75935*** was the earliest dated Neolithic structure present within the channel (*'Earliest Early Neolithic activity'* phase).

*Wooden Structure 1 (***70264***)*

Another structure (***70264***) was found in Bay A, on the eastern side of the *Principal palaeochannel* (*Ch 8*). It comprised 20 pieces of roundwood, including ten vertical, or near-vertical, driven pieces, acting as supports, and ten horizontal elements (Table 267). Modelling of the radiocarbon dates from the structure indicates that it was first used in *3790-3700* cal *BC* (*'First Wooden Structure 1'*), whilst its last use was in *3750-3660* cal *BC* (*'Last Wooden Structure 1'*; *Appendix 20*).

The roundwood vertical supports (**76015** and **76028-36**) formed a *c* 1.7 m-long line, approximately north-south (Pl 288), six (**76015**, **76028**, **76029**, **76030**, **76031**, and **76034**) exhibiting woodworking, so were classified as stakes. All were identified as hazel (*Corylus* sp) and were in good or moderate condition (scores 3 and 4). Five (**76028**, **76029**, **76030**, **76031**, and **76034**) also had bark present and had straight, even stems, devoid of side branches, but with the central pith present, which indicates that they may have been material from coppice (*cf* Rackham 1977). The lower ends of these stakes showed tool facets where they had been trimmed to a point: two from one direction to form a chisel-type point, and three from two directions to create a wedge-type point. One (**76031**) also had a distinctive chop into the grain, whilst two (**76028** and **76029**) had damage to the worked tips, presumably a product of being driven into the ground. The remaining stake (**76015**) had no morphology suggestive of coppicing, and had been trimmed from two directions, with evidence of a stop mark. The other four (**76032-3** and **76035-6**) vertical roundwood supports differed in that they did not exhibit any evidence for woodworking.

Item	Species and growth rings	Length (mm)	Diameter long axis (mm)	Diameter short axis (mm)
75936	Alder (*Alnus* sp)	248	36	20
75937	Hazel (*Corylus avellana*), 12 years	225	38	28
75938	Hazel (*Corylus avellana*), 13 years	289	75	50
75939	Alder/hazel (*Alnus*/*Corylus*), 25 years	240	107	38
75940	Hazel (*Corylus avellana*), 12 years	95	44	18
75942	Elm (*Ulmus* sp)	580	44	39
75943	Elm (*Ulmus* sp)	205	54	30
75944	Indeterminate	454	68	70
75952	Elm (*Ulmus* sp)	415	26	24
75953	Indeterminate	250	26	15
75954	Elm (*Ulmus* sp)	485	40	40
75955	Hazel (*Corylus avellana*)	404	65	65
75956	*Elm* (*Ulmus* sp)	210	35	75
75957	*Elm* (*Ulmus* sp)	250	35	30
75999	*Elm* (*Ulmus* sp)	400	50	33
76010	Indeterminate	940	60	40
76011*	Hazel (*Corylus avellana*)	365	45	40
76012	Elm (*Ulmus* sp)	748	35	35
76013	Indeterminate	245	68	68
76017	Hazel (*Corylus avellana*)	400	40	40
76018	Indeterminate	600	105	105
76019	Elm (*Ulmus* sp)	250	35	35
76020	*Elm* (*Ulmus* sp)	710	120	120

*Modelled radiocarbon date= *3950-3870 cal BC*

Table 266: Unworked roundwood forming structure **75935** *(Bay B) within the* Earlier Neolithic organic deposit

Although no species could be determined in three, one (**76033**) was identified as alder.

The ten pieces of horizontal roundwood (**75906-15**) lay alongside, and to the west of, the vertical supports, covering an area of 1.25 x 0.4 m (Pl 289). The majority were parallel with each other, on an east/west alignment, whilst two (**75910** and **75911**) were oriented north/south. These latter were beneath the east/west-aligned items and, significantly, were not interwoven with the other pieces, which might have been expected if this material was part of a collapsed wattle panel. Within this group, the lengths were 180-935 mm, whilst their diameters were between 10 mm and 71 mm. Most represented unmodified pieces of roundwood, of indeterminate species, although one, a length of hazel roundwood (**75913**), had been trimmed at one end from one direction; two stop marks were also present on it.

*Wooden Structure 2 (***70467***)*

A second structure was in Bays A/B and B and was formed of 30 pieces of roundwood, which together comprised 12 vertical, or near-vertical, driven stakes, a single unmodified vertical support, and a spread of 17 unworked horizontal roundwood (Fig 616; Table 268). Together, these appeared to have formed elements of a collapsed wattle panel, acting as a barrier or fence, aligned south-west/north-east, and at least 6 m long. Modelled radiocarbon dates from four of the roundwood items estimate that its first use dates to *3780-3700* cal *BC* (*'First Wooden Structure 2'*), whilst the last use was in *3750-3660* cal *BC* (*'Last Wooden Structure 2'*; *Appendix 20*). This suggests that it was contemporary with Wooden Structure 1 (*Appendix 20*), it being quite possible that both were the remains of a single wattle barrier that extended across the width of the channel (*Ch 8*; Fig 615).

Of the associated sharpened stakes, eight were identified as hazel, one as alder/hazel, two as alder, and one as elm, all being in moderate to good condition (scores 3 and 4). Three (**76226**, **76238**, and **76270**) had bark present and all but two (**76270** and **76248**) represent coppice. The lower ends of all the stakes showed tool facets where they had been trimmed to

Item	Species and growth rings	Coppicing evidence	Condition score	Woodworking and damage	Function	Length (mm)	Diameter long axis (mm)	Diameter short axis (mm)
75906	Indeterminate	No	3		?	510	25	15
75907	Indeterminate	No	3		?	180	30	10
75908	Indeterminate	No	3		?	475	35	20
75909	Indeterminate	No	3		?	935	50	25
75910	Indeterminate	No	3		?	405	65	20
75911	Indeterminate	Yes	3		?	250	40	25
75912	Indeterminate	No	3		?	875	30	15
75913*	Hazel (*Corylus avellana*)	Yes	4	Trimmed one end from one direction. Stop marks 25:3, 40:2	?	598	71	40
75914	Indeterminate	No	3		?	540	25	20
75915	Indeterminate	No	3		?	710	50	50
76015	Hazel (*Corylus avellana*)	No	3	Trimmed one end from two directions	Stake	146+	54	48
76028**	Hazel (*Corylus avellana*), five years	Yes	4	Trimmed one end from one direction. Damage to tip; possibly from being driven into clay	Stake	240+	30	26
76029	Hazel (*Corylus avellana*)	Yes	4	Trimmed one end from one direction. Damage to tip; possibly from being driven into clay	Stake	398+	53	46
76030	Hazel (*Corylus avellana*)	Yes	4	Trimmed one end from two directions	Stake	151+	38	36
76031	Hazel (*Corylus avellana*)	Yes	4	Trimmed one end from two directions	Stake	386+	36	35
76032	Indeterminate	No	-		Unworked vertical support	95	40	
76033	Alder (*Alnus glutinosa*)	No	-		Unworked vertical support	100	35	
76034***	Hazel (*Corylus avellana*), eight years	Yes	4	Trimmed one end from two directions	Stake	134+	43	39
76035	Indeterminate	No	-		Unworked vertical support	90+	35	
76036	Indeterminate	No	-		Unworked vertical support	75+	40	

Modelled radiocarbon dates= **3780-3670 cal BC; **3781-3690 cal BC; ***3760-3660 cal BC*

Table 267: Roundwood from Wooden Structure 1, *associated with the* Earlier Neolithic organic deposit

Plate 288: Line of roundwood stakes, associated with Wooden Structure 1

Plate 289: Horizontal roundwood ***75906-15***

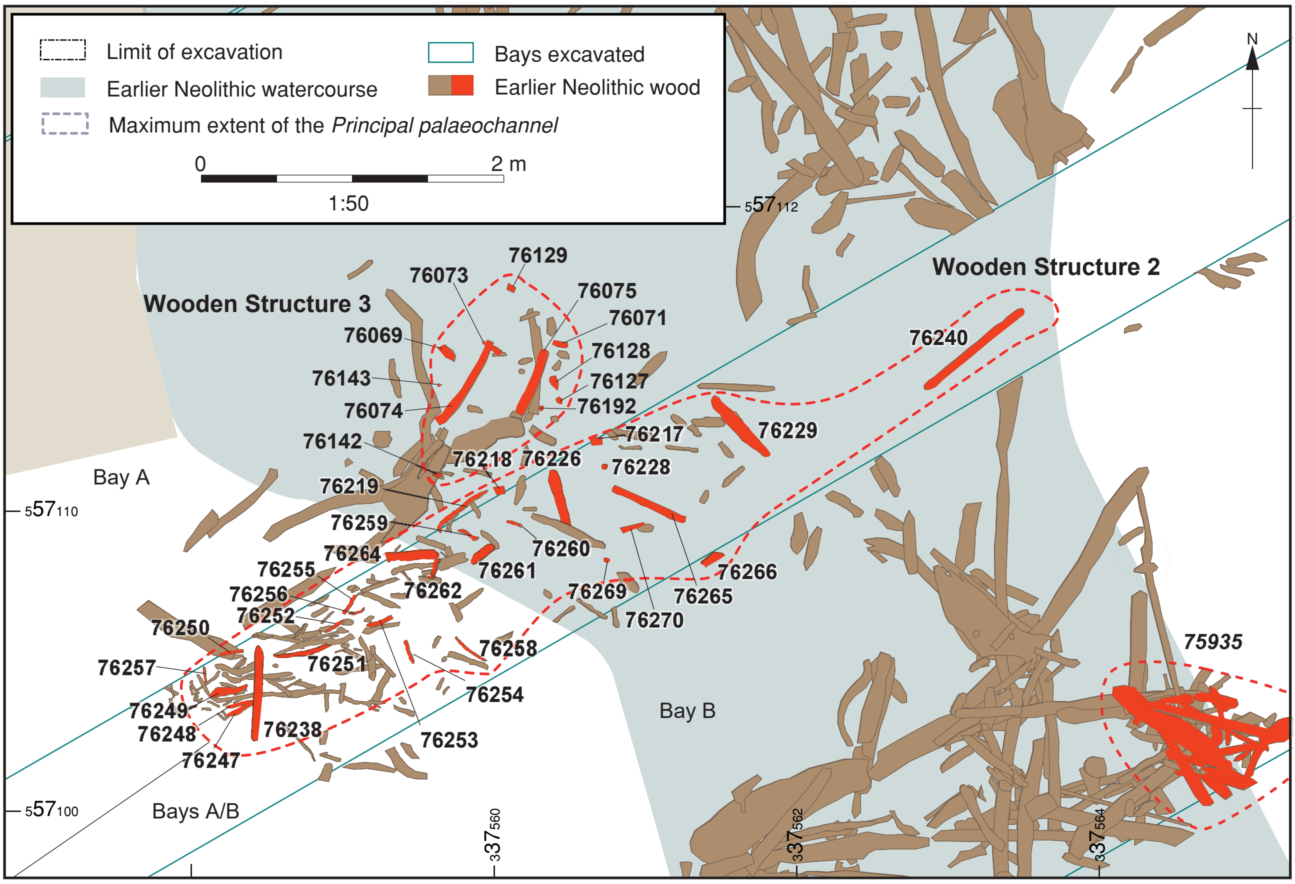

Figure 616: Wooden Structures 2 and 3

Bay	Item	Species and growth rings	Coppicing evidence	Condition score	Woodworking	Function	Length (mm)	Diameter long axis (mm)	Diameter short axis (mm)
A/B	76217	Alder (*Alnus glutinosa*)	Yes	4	Trimmed proximal end from two directions	Stake	455+	45	40
	76218	Indeterminate	No	Not assessed		Unmodified vertical support	231	30	30
	76219	Hazel (*Corylus avellana*)	Yes	4	Trimmed one end from one direction, with chop-and-tear and square-cut tip	Stake	436+	28	28
	76226*	Hazel (*Corylus avellana*)	Yes	3	Trimmed one end, but damaged	Stake	385+	90	65
	76228**	Hazel (*Corylus avellana*), eight years	Yes	4	Trimmed one end from two directions	Stake	418+	26	24
	76229 ***	Elm (*Ulmus* sp)	Yes	3	Trimmed two ends from two directions	Stake	815	65	70
	76238****	Hazel (*Corylus avellana*), eight years	Yes	3	Trimmed one end from two directions	Stake	620+	44	41
	76240	Hazel (*Corylus avellana*)	Yes	3	Trimmed two ends from two directions; partial stop mark	Stake	850	55	55
	76247	Hawthorn-type (Maloideae-type)	Yes	3		Collapsed wattle	150	25	25
	76248	Hazel (*Corylus avellana*)	Yes	3		Collapsed wattle	150	20	20
	76249	Alder (*Alnus glutinosa*)	Yes	3		Collapsed wattle	160	25	25
	76250	*cf* Hazel (*cf Corylus avellana*)	Yes	3		Collapsed wattle	140	25	25
	76251	Hazel (*Corylus avellana*)	Yes	3		Collapsed wattle	260	30	30
	76252	Hazel (*Corylus avellana*)	Yes	3		Collapsed wattle	130	20	20
	76253	Hazel (*Corylus avellana*)	Yes	3		Collapsed wattle	180	30	30
	76254	Elm (*Ulmus* sp)	Yes	3		Collapsed wattle	150	22	22
	76255	Hazel (*Corylus avellana*), four years	Yes	3	Trimmed one end from one direction	Stake	226+	16	16
	76256	Hazel (*Corylus avellana*)	Yes	3		Collapsed wattle	130	20	20
	76257	Alder (*Alnus glutinosa*)	Yes	3		Collapsed wattle	160	20	20
	76258	*cf* Birch (*cf Betula* sp)	Yes	3		Collapsed wattle	260	15	15
	76259	Alder (*Alnus glutinosa*)	Yes	3		Collapsed wattle	135	22	22
	76260	Hazel (*Corylus avellana*)	Yes	3		Collapsed wattle	120	15	15
	76261	Hazel (*Corylus avellana*)	Yes	3		Collapsed wattle	190	40	40

Table 268: Roundwood from Wooden Structure 2, *within the* Earlier Neolithic organic deposit

Bay	Item	Species and growth rings	Coppicing evidence	Condition score	Woodworking	Function	Length (mm)	Diameter long axis (mm)	Diameter short axis (mm)
A/B	76262	Alder (*Alnus glutinosa*)	Yes	3		Collapsed wattle	140	40	40
	76264	Alder (*Alnus glutinosa*)	No	2		Collapsed wattle	362+	85	58
	76265	Hazel (*Corylus avellana*)	Yes	2		Collapsed wattle	495+	44	38
	76269	Alder/hazel (*Alnus/ Corylus*)	Yes	3	Trimmed one end from two directions	Stake	208+	28	28
	76270	Hazel (*Corylus avellana*)	No	3	Trimmed one end from one direction; partial stop mark 30:3	Stake	255+	48	45
	76428	*cf* Alder (*cf Alnus glutinosa*), ten years	No	3	Trimmed one end from two directions	Stake	84+	46	25
B	76266	Hazel (*Corylus avellana*)	Yes	3	Trimmed one end from two directions	Stake	140+	43	38

Modelled radiocarbon dates= **3770-3670 cal BC; **3770-3670 cal BC; ***3780-3690 cal BC; ****3770-3670 cal BC*

Table 268: Roundwood from Wooden Structure 2, *within the* Earlier Neolithic organic deposit *(cont'd)*

Item	Species and growth rings	Coppicing evidence	Condition score	Woodworking and damage	Function	Length (mm)	Diameter long axis (mm)	Diameter short axis (mm)
76073	Indeterminate	Yes	5	Trimmed one end from one direction with scar partially healed	Stake	276	30	30
76127	Hazel (*Corylus avellana*)	Yes	2	Trimmed one end from one direction	Stake	469+	32	29
76128	Alder (*Alnus glutinosa*)	No	3	Trimmed one end from one direction	Stake	95+	28	25
76129	Indeterminate	No	2	Trimmed one end from one direction	Stake	106+	28	27
76143	Hazel (*Corylus avellana*), eight years	No	3	Trimmed one end from two directions	Stake	93+	37	35
76192	Hazel (*Corylus avellana*)	Yes	3	Trimmed one end from three directions; stop mark 28:5	Stake	183+	64	48
76069	Alder (*Alnus glutinosa*), 18 years	No	3	Trimmed one end from two directions to point	?	133+	53	49
76071	Hazel (*Corylus avellana*), ten years	Yes	3	Trimmed one end from one direction	?	139+	39	35
76074	Indeterminate	No	Not assessed	Unmodified roundwood	?	670	40	
76075	Indeterminate	Yes	Not assessed	Long straight bark strip removed vertically, measuring 18 x 230 mm; partially healed. Damage from draw felling or tapping sap?	?	230	57	
76142	Hazel (*Corylus avellana*)	No	2	Trimmed one end from one direction; possibly trimmed or beaver activity	?	49+	26	25

Table 269: Roundwood associated with Wooden Structure 3, *within the* Earlier Neolithic organic deposit

a point. Two of the stakes (**76255** and **76270**) had been trimmed from one direction to form a chisel-type point, one (**76219**) had a distinctive chop-and-tear end with a single blow struck across the grain, whilst eight (**76217**, **76228**, **76229**, **76238**, **76240**, **76269**, **76266**, and **76248**) had been trimmed from two directions to form a wedge-type point. Partial stop marks were present on stakes **76240**, and **76270**. The stakes were varied in length, at 84-850 mm, and in diameter, at 16-90 mm.

The 17 horizontal elements within the wattle panel were in poor or moderate condition (scores 2 or 3), but included a broad spread of species. These comprised hazel (nine items), alder (five), birch (*Betula* sp; one), hawthorn-type (one), and elm (one). No woodworking was recorded from these. The horizontal roundwood varied in length at 120-495 mm, and in diameter at 15-85 mm, only a single item having a diameter greater than 45 mm.

*Wooden Structure 3 (***70340***)*

Another structure (***70340***) within Bay A lay immediately north of Wooden Structure 2 (*above*). Although this was not directly dated, it was probably contemporary with Wooden Structures 1 and 2. It consisted of a cluster of 11 pieces of roundwood, covering an area of 1.3 x 0.85 m, six of which were vertical, or near-vertical, driven stakes (Table 269).

The majority of the stakes had bark present, apart from **76128**, three being of hazel, one of alder, whilst the species of two could not be identified. Three had straight, even stems and, as such, were probably coppice, and the driven ends had all been trimmed from one, two, or three directions. Stop marks were recorded on one (**76192**), while stake **76073** displayed damage to the lower tip, probably sustained when it was driven into the ground. The stakes varied in length from 93 mm to 469 mm, and in diameter at 25-64 mm.

Of the remaining five pieces of roundwood, two were hazel, one was alder, and the species of two were indeterminate. These pieces ranged in length, at 49-670 mm and three had evidence of woodworking at one end. One (**76142**) had been possibly gnawed by a beaver, whilst a strip of bark had been removed from another (**76075**; Pl 290). This had partially healed and may be evidence for draw felling or sap tapping.

Other potential structures

The channel also contained several *in-situ* roundwood stakes that might have related to other structures (Table 270). For instance, in Bay B/C, a linear east/west group of three roundwood stakes (**76221**, **76224**, and **76242**; Fig 617) was present, perhaps part of a structure of some description (*Ch 8*). These had seemingly been set on a 1.4 m-long line, orientated south-west/

Plate 290: In-situ *roundwood* **76075**, *with the area where the bark has been removed, visible as a linear strip*

Bay	Item	Species and growth rings	Coppicing evidence	Condition score	Woodworking	Length (mm)	Diameter long axis (mm)	Diameter short axis (mm)
A	76144	Alder (*Alnus glutinosa*)	No	2	Trimmed one end from two directions	91+	49	39
	76155	Oak (*Quercus* sp)	No	Not assessed	-	500	65	65
	76190	Hazel (*Corylus avellana*)	No	3	Trimmed one end from two directions; stop mark 21:1	115+	34	32
	75959	Indeterminate	Yes	Not assessed	-	170	40	40
B/C	76221	Alder/hazel (*Alnus/ Corylus*)	Yes	4	Trimmed one end from one direction; very clean facet	843	43	34
	76224	Hazel (*Corylus avellana*), 20 years	Yes	4	Trimmed one end from one direction	695+	49	48
	76242	Elm (*Ulmus* sp)	Yes	5	Trimmed proximal end from all directions to a point; one side branch torn away; two stop marks 34:4; partial stop mark 25:6	914+	74	72
G	75829	Hazel (*Corylus avellana*)	Yes	3	Trimmed one end from all directions to broken point	300+	64	55
O	76504	Hazel (*Corylus avellana*), nine years	No	3	Trimmed one end from one direction	106+	26	26
	76506	Hawthorn-type (Maloideae-type)	Yes	2	Possibly trimmed one end from one direction	147+	30	26

Table 270: In situ *roundwood stakes associated with possible structures in the* Earlier Neolithic organic deposit

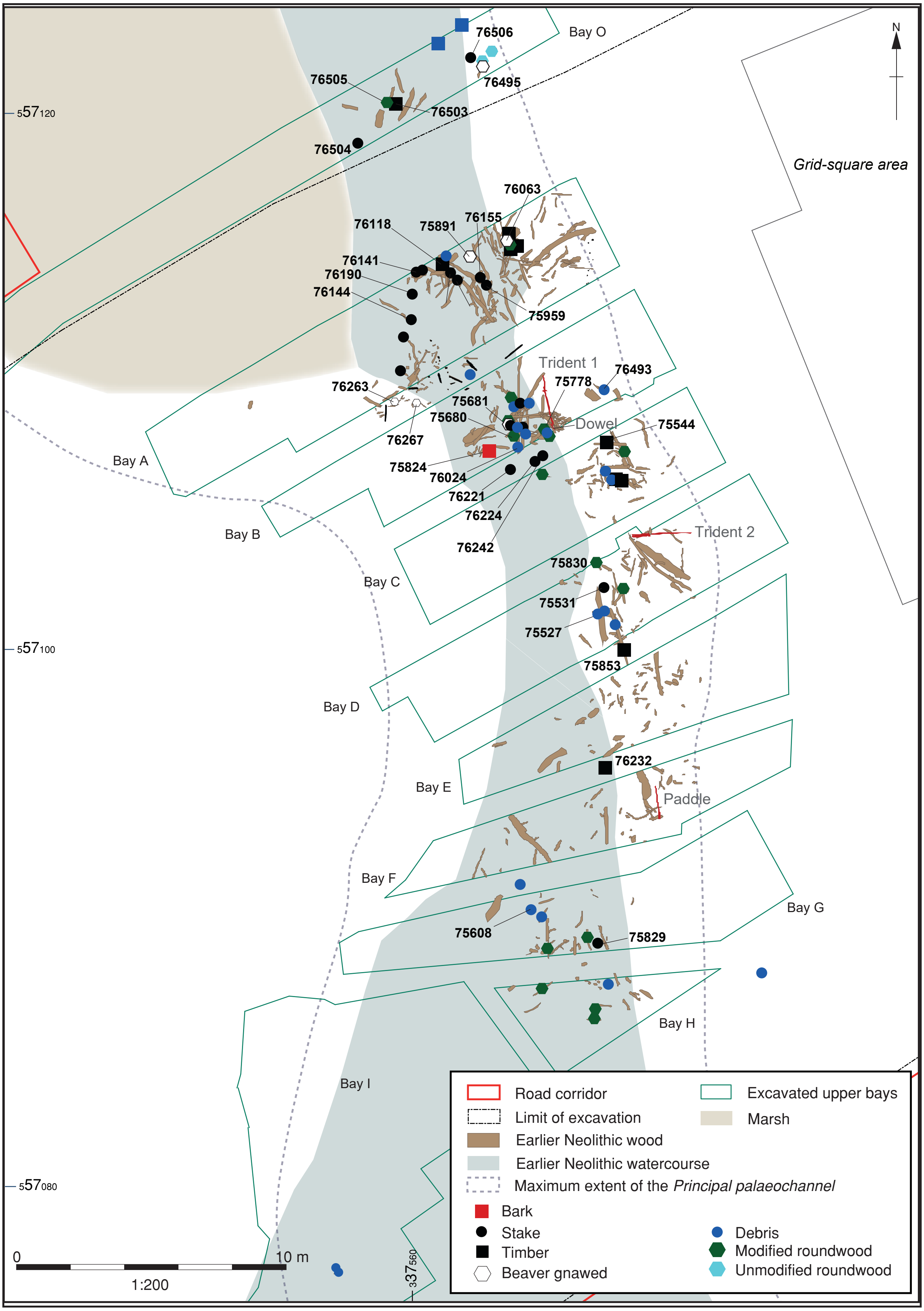

Figure 617: Stakes, roundwood, timber, and debris in the Earlier Neolithic organic deposit

Plate 291: In-situ *stake* ***76242***

north-east. They were in good or excellent condition (scores 4 and 5), and all had bark present. One was of elm (**76242**; Pl 291), another (**76221**) alder/hazel, whilst the third (**76224**) was hazel, and all displayed morphological evidence of possible coppicing, as they possessed straight, even stems. One (**76242**) had been trimmed from all directions to a point, and a side branch had been torn away; it also had two identical complete stop marks and a single partial stop mark on the trimmed end. The remaining pieces (**76221** and **76224**) had been trimmed from one direction, and one displayed damage to the lower tip, which was probably a result of driving the stake into the ground. They were varied in length, at 695-914 mm, and in diameter, at 34-47 mm.

Two *in-situ* stakes were present in Bay A, which did not appear to be associated with any of the other structures in the channel. One (**76144**) was alder, whilst the other (**76190**) was hazel, and both had been trimmed from two directions. A stop mark was also evident on stake **76190**. Similarly, there were two isolated stakes in Bay O. One (**76504**) was a small-diameter roundwood hazel stake, which had been trimmed at one end from one direction, whilst the other (**76506**) was identified as hawthorn-type and, although somewhat degraded, had probably been trimmed from one direction. Finally, in Bay G, there was one further *in-situ* trimmed and coppiced hazel roundwood stake (**75829**), which was probably associated with the *Earlier Neolithic organic deposit* (*Ch 8*). This had been trimmed at one end, in all directions, to form a 'pencil' point.

In addition to the modified stakes, two vertical timbers were identified, which may have been driven. One (**76155**) was an oak roundwood branch, 65 mm in diameter and surviving to 0.5 m long; the other (**75959**) was unworked coppiced wood, 40 mm in diameter and surviving to a length of 170 mm.

Other items

In addition to the roundwood associated with Neolithic structures (*above*), another 32 worked pieces were classified as roundwood (Table 271). It seems possible that a proportion of these originally formed elements of the identified, or indeed other unidentified, timber structures within the channel, representing stakes and other structural elements that had either been naturally displaced or deliberately dismantled (*Ch 8*). These were in various states, ranging between poor and excellent (scores 2-5), and, although a broad range of species was represented (seven in total), just under half (15) were hazel.

Fifteen had morphological traits associated with coppicing, for the most part comprising straight, even stems (*cf* Rackham 1977). Roundwood **76505**, from Bay O, also had a curve and flare at the proximal end, which had been trimmed from one direction (Pl 292).

Fourteen pieces had been trimmed, generally at one end (occasionally identified as the proximal end), from one, two, or three directions, suggesting that they were originally stakes. In addition, one of the roundwood items (**75680**) had a side branch trimmed away, whilst two (**75778** and **75830**) had light faceting along one edge. Of these, **75778** dates to *3790-3680* cal *BC* (*SUERC-42028*; *Appendix 20*). Generally, the tool facets on the trimmed ends were smaller, concave, multiple, and often 'choppy', as is to be expected when a stone axe is used (Coles and Orme 1978; Sands 1997). Partial stop marks were present on one item (**76141**).

Four of the roundwood pieces (**75681**, **75891**, **76263**, and **76267**) also appeared to have been gnawed by a beaver at one end. Following gnawing, one (**75681**) had then been charred while two others (**76063** and **76495**) had been trimmed and then charred.

Timber

Four items from the *Earlier Neolithic organic deposit* were classified as timber (Table 272). Timber **75544** was in Bay C and was a radially split oak, with a sub-rectangular cross-section, which was in good condition (score 4). It was 1225 mm long, with a maximum breadth of 118 mm, and a maximum

Bay	Item	Species	Coppicing evidence	Condition score	Woodworking and charring	Length (mm)	Diameter long axis (mm)	Diameter short axis (mm)
A	75891	Hazel (*Corylus avellana*)	No	2	One end gnawed by beaver	115+	28	24
	76063	Hazel (*Corylus avellana*)	Yes	3	One end trimmed from one direction. Other end possibly trimmed from two directions. After trimming item charred	410	39	38
	76066	Indeterminate	No	2	Trimmed one end from one direction	299	65	54
	76068	*cf* Hazel (*cf Corylus avellana*)	Yes	2	Trimmed one end from possibly two directions	148+	34	28
	76088	Hazel (*Corylus avellana*)	No	3	Trimmed one end from one direction	228+	54	47
	76140	Hazel (*Corylus avellana*)	No	3	Trimmed one end from three directions	290+	36	24
	76141	Hazel (*Corylus avellana*)	Yes	3	Trimmed one end from two directions; partial stop mark 15:6 and possible stop mark 25:4	98+	32	23
	76191	Hazel (*Corylus avellana*)	No	2	Trimmed one end from one direction	107+	38	35
	76193	*cf* Oak (*cf Quercus* sp)	No	3		92+	25	23
A/B	76263	Hazel (*Corylus avellana*)	Yes	3	One end gnawed by beaver	358+	35	25
	76265	Hazel (*Corylus avellana*)	Yes	2		495+	44	38
	76267	Hazel (*Corylus avellana*)	Yes	4	One end gnawed by beaver	178+	44	32
B	75493	Blackthorn (*Prunus spinosa*)	No	3		92+	44	35
	75494	Alder (*Alnus glutinosa*)	Yes	5	Trimmed proximal end from two directions	250+	36	36
	75680	Alder (*Alnus glutinosa*)	No	3	One side branch trimmed from one direction	298+	36	36
	75681	Elm (*Ulmus* sp)	No	3	Beaver-gnawing one end from two directions, prior to charring	278+	58	58
	75683	Hazel (*Corylus avellana*)	No	3	Possibly trimmed one end from two directions	120+	55	55
	75778*	Alder (*Alnus glutinosa*)	Yes	4	Two facets on shaft: 30 x 20 mm and 12 x 12 mm	175	43	38
	76021	Indeterminate	Yes	3		785+	34	28
B/C	76224	Hazel (*Corylus avellana*)	Yes	4	Trimmed one end from one direction	695+	49	48

Table 271: Modified roundwood from the Earlier Neolithic organic deposit

Bay	Item	Species	Coppicing evidence	Condition score	Woodworking and charring	Length (mm)	Diameter long axis (mm)	Diameter short axis (mm)
C	75534	Hawthorn-type (Maloideae-type)	Yes	3	Trimmed one end from one direction	258+	128	99
	75686	*cf* Elm (*cf Ulmus* sp)	No	3		438+	108	78
D	75530	Alder (*Alnus glutinosa*)	No	2		831+	116	70
	75830	Willow/poplar (*Salix/ Populus*)	No	4	Some faceting down one edge	239+	55	50
G	75777	Hazel (*Corylus avellana*)	No	3		413+	65	65
	75827	Hazel (*Corylus avellana*)	Yes	2		755	38	32
H	75832	Elm (*Ulmus* sp)	Yes	3		930	39	37
	75838	Elm (*Ulmus* sp)	No	3		303	48	45
	75893	Oak (*Quercus* sp)	Yes	3	Heavily burnt	345+	75	55
O	76491	Hazel (*Corylus avellana*), nine years	No	3	Trimmed one end from one direction	98+	37	28
	76495	Hazel (*Corylus avellana*)	No	3	One end possibly worked, but subsequently burnt	255+	51	46
	76505	Willow/poplar (*Salix/ Populus*)	Yes	3	Trimmed proximal end from one direction	289+	42	36

*Modelled radiocarbon date= *3790-3660 cal BC*

Table 271: Modified roundwood from the Earlier Neolithic organic deposit *(cont'd)*

Plate 292: Roundwood ***76505***

Bay	Item	Species	Condition score	Woodworking	Length (mm)	Diameter long axis (mm)	Diameter short axis (mm)	Diameter of parent log (mm)	Dendrochronolgy
A	76118	Oak (*Quercus* sp)	3	Radially split; parallel grooves	1215	115	60		Matched to Cluster 3
C	75544	Oak (*Quercus* sp)	4	Radially split (modified). Rectangular cross-section; possibly a plank. Groove in upper surface and shaped across grain	1225	118	80		Undated sequence
D	75527	Oak (*Quercus* sp)	4	Tangentially split. Triangular cross-section	1056+	245	96		Undated sequence
	75853	Oak (*Quercus* sp)	3	Radially split (⅛); split fades at one end	2063	115	30	>230	Undated sequence

Table 272: Timber from the Earlier Neolithic organic deposit

Plate 293: In-situ *timber* ***75527***

thickness of 80 mm. The upper face had two parallel grooves aligned along its length. Although it is likely to be a finished timber, its original function could not be discerned.

Two of the other timbers (**75527** and **75853**) were recovered from Bay D, the first (**75527**) being an irregularly shaped tangentially split oak, formed from sapwood and heartwood. It was in good condition (score 4), but was fragmented, and it might either have been a finished timber or possibly a very large piece of debris (Pl 293). The other timber (**75853**), formed of oak heartwood, was in moderate condition (score 3) and measured 2063 mm long, had a maximum breadth of 115 mm, and a maximum thickness of 30 mm. It was a radial ⅛ split that has been modified tangentially to have a sub-rectangular cross-section, with the split fading out at one end, having been split from a parent log with a diameter greater than 230 mm. This may have been a very large piece of debris, though its length suggests that it was a finished timber (Pl 294).

The final timber (**76118**), in Bay A, was a radially split oak with a sub-rectangular cross-section, formed of fast-grown heartwood, which was in moderate condition (score 3). It was 1215 mm long, with a maximum breadth of 115 mm, and a maximum thickness of 60 mm, with parallel grooves along its axis, on one of the broader faces. Although this was also likely to be a finished timber, its original function could not be discerned. It was matched to dendrochronological Cluster 3 (*Appendix 20*).

Debris

Ten pieces from the *Earlier Neolithic organic deposit* were identified as timber debris, based on their size, form, and types of split, probably being the by-products (offcuts) of shaping large timbers (Table 273). Seven were oak, whilst three were identified as alder, all in moderate to good condition (scores 3 and 4). Five radially aligned pieces of oak debris are likely to be derived from the production of radially aligned timbers, such as the radially converted oak (**76118**; *above*) also present in this stratigraphic unit. One of these pieces (**76503**; Fig 617) was of interest as it displayed the parallel grooves often associated with stone-tool woodworking assemblages (Pl 295). This was also subjected to dendrochronological

*Plate 294: Timber **75853** after lifting*

Bay	Item	Species	Bark/sapwood/ heartwood	Condition score	Split	Woodworking and charring	Length (mm)	Breadth (mm)	Thickness (mm)	Diameter of parent log (mm)
A/B	76268	Oak (*Quercus* sp)	Bark, sapwood, and heartwood	3	Radially (modified)		155+	43	15	
C	75685	Alder (*Alnus glutinosa*)	Heartwood	3	Tangential		271+	83	22	
D	76076	Oak (*Quercus* sp)	Heartwood	4	Radial	Split fades out at one end	571	60	22	>120
F/G	76233	Oak (*Quercus* sp)	Heartwood	4	Radial; ⅛ (modified)		194+	38	28	
H	75741	Alder (*Alnus glutinosa*)	Heartwood	3	Radial	Woodchip; trimmed one end/one direction	154	55	28	
	75894	Oak (*Quercus* sp)	Heartwood	3	Tangential	Rectangular cross-section	237	37	12	
	76234	Oak (*Quercus* sp)	Heartwood	3	Radial; ⅛ (modified)		310+	78	24	
O	76490	Alder (*Alnus glutinosa*)	Sapwood and heartwood	3	Tangential	Charred	123	57	42	
	76494	Oak (*Quercus* sp)	Heartwood	3	Tangential	Partially torn	216	95	35	
	76503*	Oak (*Quercus* sp)	Heartwood	3	Radial	Parallel grooves	706+	124	41	

*Dendrochronology/wiggle-match dating= matched to Cluster 3; final ring wiggle-match dated to *3740-3690 cal BC*

Table 273: Timber debris from the Earlier Neolithic organic deposit

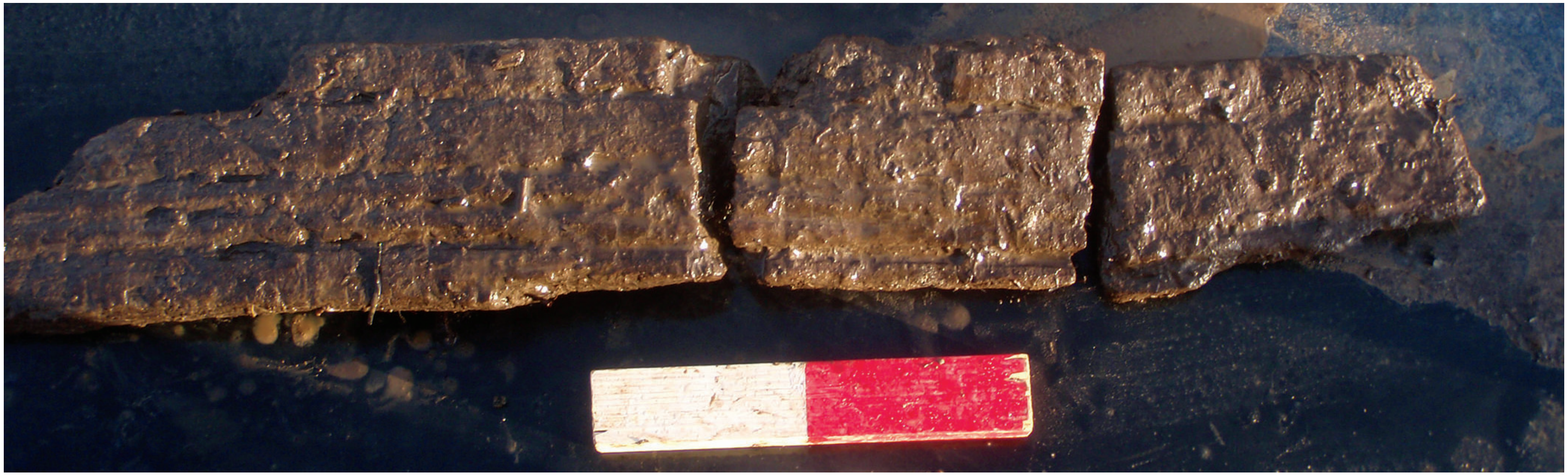

*Plate 295: Timber-debris **76503** after lifting*

Bay	Item	Species	Bark/sapwood/ heartwood	Condition score	Split	Woodworking and damage	Length (mm)	Breadth (mm)	Thickness (mm)
A	76067	Elm (*Ulmus* sp)	Heartwood	3	Tangential	Could be naturally degraded?	265+	210	115
	76087	Indeterminate	Heartwood	3	Tangential	Heavily burnt	282+	55	38
B	75825	Oak (*Quercus* sp)	Bark and sapwood	3	Tangential	Slab; possible felling debris	191+	120	43
	75828	Elm (*Ulmus* sp)	Heartwood	3	Tangential	Possible felling debris	186+	112	20
	75682	Alder/hazel (*Alnus*/*Corylus*)	Heartwood	2	Radial; ½ modified	Could be degraded or possibly split	215+	95	55
	75684	Hazel (*Corylus avellana*)	Sapwood and heartwood	2	Tangential		150+	100	35
	75958	Oak (*Quercus* sp)	Heartwood	3	Radial; ⅛ (modified)		175	45	40
	76024	Oak (*Quercus* sp)	-	4	Radial	Parallel-sided with groove	132	65	37
	76493	Oak (*Quercus* sp)	Sapwood and heartwood	3	Radial	Woodchip	286	36	25
C	75707	Elm (*Ulmus* sp)	Sapwood and heartwood	2	Radial	Possibly split, but general formlessness to structure suggests it could be natural	225	104	85
	76050	Oak (*Quercus* sp)	Heartwood	3	Tangential	Slight tangential grooves; possible felling debris	158	137	25
	76051	Indeterminate	Sapwood	3	Tangential	Possible felling debris	146	95	44
D	75531	Hawthorn-type (Maloideae)	Heartwood	5	Tangential	Woodchip (or stake tip?)	68+	40	17
	75831	Oak (*Quercus* sp)	Heartwood	4	Tangential	Possible notch at broken end (23 x 17 mm); parallel-sided; possible felling debris	114+	85	21
G	75608	Oak (*Quercus* sp)	Sapwood	3	Tangential	Slab/woodchip; roughly parallel-sided	312	75	20
I	76214	Oak (*Quercus* sp)	Heartwood	3	Tangential	Possible felling debris	285+	58	20
	76215	Oak (*Quercus* sp)	Heartwood	2	Tangential	Grooves on one side; possible felling debris	213	122	50

Table 274: Other types of debris from the Earlier Neolithic organic deposit

Plate 296: In-situ *groove-and-split debris* ***76024***

wiggle-match dating (*Appendix 20*) which suggested that its last ring formed in *3740-3690* cal *BC* (*ring_184*). The alder and oak tangentially aligned pieces were likely to have been produced by the shaping of tangentially faced timbers.

In addition to the timber debris, 17 items from this stratigraphic unit represented other types of debris (Table 274). These included an interesting group of seven tangentially split items identified as possible felling debris. There was also a single, radially aligned, parallel-sided item found in Bay B (**76024**; Pl 296), 132 x 65 x 37 mm, with a longitudinal groove on one face. This was of oak and might represent groove-and-split debris.

Three woodchips (**75531**, **76493**, and **75608**) were also within this group. These included a hawthorn-type heartwood, tangentially aligned woodchip (**75531**) from Bay D (Pl 297), measuring 68 x 40 x 17 mm, which had been trimmed at one end, from one direction, and

*Plate 297: Wood chip **75531** after lifting*

may actually have been the tip of a stake. The second, from Bay B, was a radially split oak woodchip (**76493**), whilst the third (**75608**) was recovered from Bay G. This was also oak, though it formed a tangentially aligned 'slab', measuring 312 x 75 x 20 mm, which was probably associated with deliberate bark removal (Pl 298).

Bark

A single piece of oak bark (**75824**) was recovered from this stratigraphic unit in Bay B. This had parallel sides and may have been a product of deliberate bark removal, measuring 204 x 94 x 10 mm.

Earlier Neolithic alluvium

One wooden artefact was associated with the *Earlier Neolithic alluvium* stratigraphic unit. This was a trident (Trident 2; *Ch 8*), from the upper fraction of deposit ***70315***, forming an element of the *'Early Neolithic II'* phase (*Ch 8*; *Appendix 20*).

Later Neolithic organic deposit

In total, 18 items associated with this stratigraphic unit displayed evidence of modification. These have been classified as roundwood, timber, and debris (Table 262). In addition, an unmodified timber might also have originated from this unit, which formed part of a structure (*Ch 10*).

*Plate 298: Timber debris **75608** after lifting*

Roundwood

Three *in-situ* roundwood stakes (**75479**, **75533**, and **76222**; Fig 618) were present in Bays E and E/F (Table 275), which appear to represent elements of a north/south-aligned structure. The stakes were either in good or excellent condition (scores 4 or 5), one being identified as alder/hazel and one as hazel. Stake **75533** had the long, straight, even stem often associated with coppiced material (Pl 299), and the lower ends of all three stakes had been trimmed from

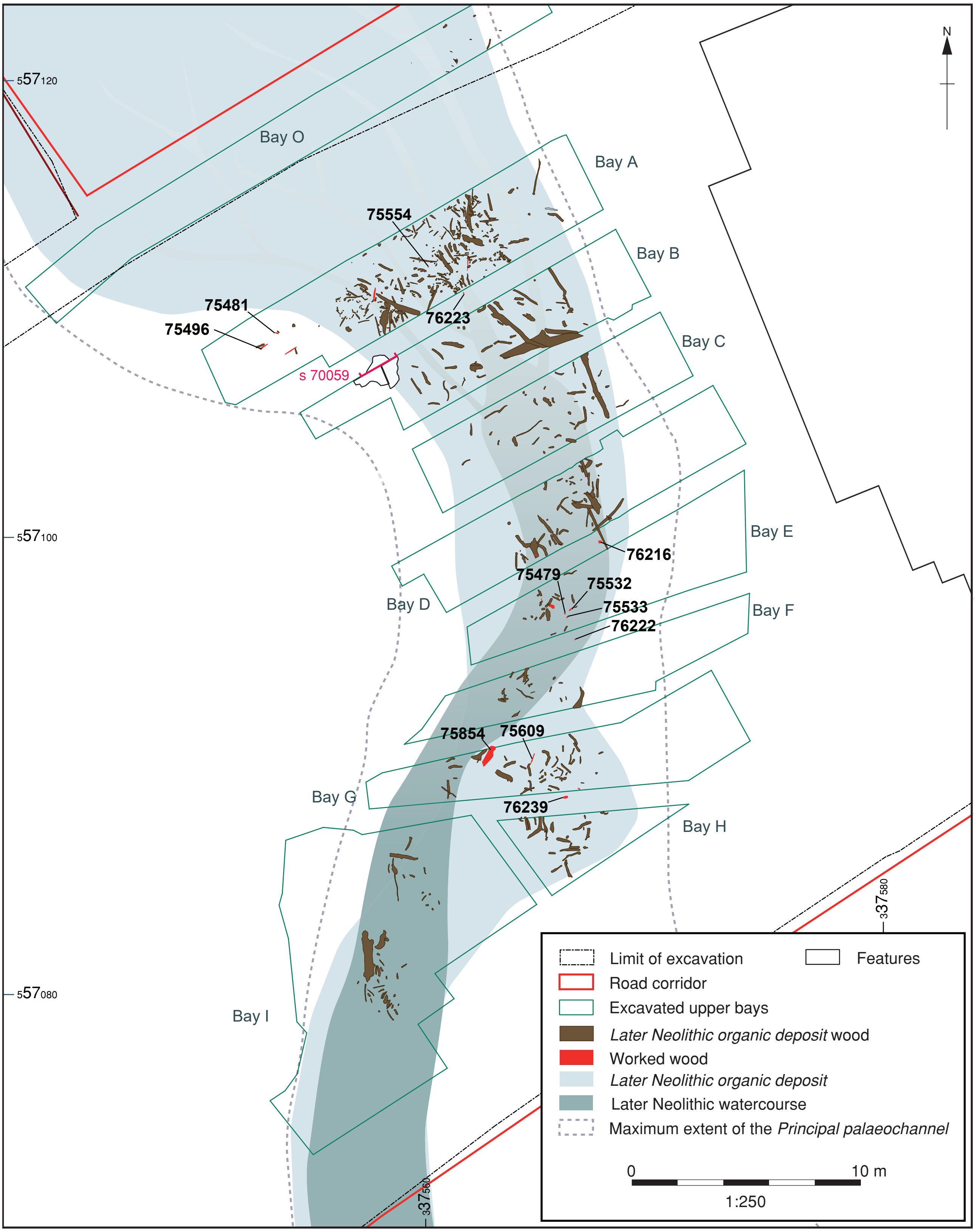

Figure 618: Deposits of wood and worked wood in the Later Neolithic organic deposit

Bay	Item	Species	Coppicing evidence	Condition score	Woodworking and damage	Function	Length (mm)	Diameter long axis (mm)	Diameter short axis (mm)
A	75481	*cf* Hazel (*cf Corylus avellana*)	Yes	4	Trimmed one end from two directions; partial stop mark 23:3. Healed-over side branch	?	251+	78	58
	75495	Hazel (*Corylus avellana*)	No	4	Trimmed one end from two directions	?	192+	41	38
	75497	Alder (*Alnus glutinosa*)	Yes	4	Trimmed proximal end from two directions	?	574+	58	57
D	75591	Alder (*Alnus glutinosa*)	Yes	3		?	263+	36	25
E	75479	Indeterminate	No	4	Trimmed one end from two directions; partial stop mark 47:6 mm	Stake	190+	67	52
	75533	Alder/hazel (*Alnus/ Corylus*)	Yes	5	Trimmed one end from two directions	Stake	222+	50	45
	75886	Indeterminate	Yes	3	Trimmed one end from all directions	?	478+	138	125
E/F	76222	Hazel (*Corylus avellana*)	No	4	Trimmed one end from two directions	Stake	90+	57	32

Table 275: Modified roundwood from the Later Neolithic organic deposit

Plate 299: In-situ *stake* ***75533***

two directions. A partial stop mark was recorded on stake **75479**. They varied in length at 90-222 mm, and 32-67 mm in diameter.

Five other pieces of worked roundwood within the *Later Neolithic organic deposit* might represent displaced elements of later Neolithic structures. These 192-574 mm long, and *c* 25-138 mm in diameter, two being identified as hazel, two as alder, whilst the species of one was indeterminate. Four also had morphological traits indicative of coppicing, and four had trimmed ends suggesting that they might represent displaced stakes. A partial stop mark was recorded on the trimmed end of roundwood **75481**, and this also had a damaged, and subsequently healed, side branch.

Timber

One modified timber (**76239**) was present in Bay G/H that may have originated from the *Later Neolithic organic deposit* (*Ch 10*). This substantial piece only survived in the *Earlier Neolithic organic deposit*, but it had clearly been driven into this stratigraphic unit from a higher level, suggesting that it might have formed an element of a structure of some description. It was an oak trunk, in good condition, 705 mm in length, with a maximum diameter of 175 mm. The proximal end had the form of a classic felling scar, with what appears to be two worked faces meeting at a broken hinge. However, the lack of visible facets precludes its firm interpretation as a felled tree. It was matched with dendrochronological Cluster 4, which dates to the later Neolithic period (*Appendix 20*). Another vertically driven oak timber (**75854**) was also identified in Bay G, which may have formed another element of the putative structure, though this displayed no evidence of working (Pl 300). This was subjected to wiggle-match dating, which estimated that its final ring formed in *2870-2830* cal *BC* (*ring_150*; *Appendix 20*).

*Plate 300: Vertically driven timber **75854***

Debris

Four items of timber debris (Table 276) were found in this stratigraphic unit, all in poor to moderate condition (scores 2 or 3), which represent waste products from the production of alder timbers in the tangential plane, and oak timbers in both the radial and tangential planes. One of the oak pieces (**75496**) had weathered tool facets along an edge where it had been hewn, which is significant, as tool facets are comparatively rare across the timber and timber debris from Stainton West (Pl 301). Although the other three were directly associated with the *Later Neolithic organic deposit*, one of the alder woodchips (**76223**) was recovered from the *Earlier Neolithic organic deposit*. However, a sample from this woodchip returned a radiocarbon date of 3335-3025 cal BC (4464±23 BP; SUERC-42025), suggesting that it was intrusive within this stratigraphic unit, most probably originally derived from the *Later Neolithic organic deposit* (*Appendix 20*). This represented a 'slab' and, as such, may have been associated with bark removal (Taylor 2001).

Apart from the timber debris, five items from this stratigraphic unit represented other types (Table 277).

Bay	Item	Species	Bark/ sapwood/ heartwood	Condition score	Split	Woodworking and charring	Length (mm)	Breadth (mm)	Thickness (mm)	Diameter of parent log (mm)	Radiocarbon date
A	75496	Oak (*Quercus* sp)	Heartwood	3	Tangential	Weathered tool facets along one edge from hewing. Rectangular cross-section	409+	91	32		
	75649	Alder (*Alnus glutinosa*)	Heartwood	2	Tangential	Square cross-section	705	105	47		
A/B	76223	Alder (*Alnus glutinosa*)	Bark and sapwood	2	Tangential	Slab; charred on one side	176	113	49		*3335-3025 cal BC* (4464±23 BP; SUERC-42025)
E	75916	Oak (*Quercus* sp)	Heartwood	3	Radial ⅛	Charred over 75% of surface	303+	68	55	>140	

Table 276: Timber debris originating from the Later Neolithic organic deposit

*Plate 301: Timber debris **75496***

These included, from Bay A, a fragment of tangentially aligned oak, with possible tool marks, and a radially and tangentially aligned oak (**75554**) with a square cross-section. This may represent the 'streamers' that can join split faces when cleaving large timbers (*ibid*). It measured 153 x 43 x 36 mm.

A piece of alder (**76216**) from Bay D/E was tentatively interpreted as felling debris, whilst the remaining material comprised a tangentially aligned oak (**75532**) from Bay E, with a rectangular cross-section, and a tangentially aligned oak slab (**75609**) formed of bark and sapwood, which may have been the product of deliberate bark removal from a larger timber (*ibid*). This slab measured 454 x 53 x 28 mm and was found in Bay G.

Retention Pond

A single piece of undated hazel roundwood was recorded in the area of the retention pond (*Ch 1*), its form suggesting that it was a branch. It was in poor condition (score 2), had been trimmed at one end from one direction, was 68 mm long, and had a distorted diameter of 13 x 18 mm.

Earlier Neolithic Artefacts

Five earlier Neolithic wooden artefacts were found within the *Principal palaeochannel*, coming from the *Earlier Neolithic organic deposit* and the *Earlier Neolithic alluvium*. The artefacts associated with the *Earlier Neolithic organic deposit* comprised a trident, a paddle, a carved dowel, and a large split timber, whilst a second trident was present within the *Earlier Neolithic alluvium* (*Ch 8*).

Tridents

Two wooden forks, or tridents (Tridents 1 and 2), were found in the *Principal palaeochannel*. Trident 1, in Bay B, was associated with deposit ***70308***, which formed part of the *Earlier Neolithic organic deposit* (*'Early Neolithic I'* phase), whilst Trident 2 was present in a stratigraphically later deposit (***70315*** upper fraction), which was an element of the *Earlier Neolithic alluvium* (*'Early Neolithic II'* phase; *Ch 8*). Both objects had been finely carved from oak, and Trident 2 is complete, although broken into two pieces (**75498** and **75499**). In contrast, Trident 1 is incomplete, comprising a single piece (**75482**), though it appears comparable in form to its counterpart. Samples of oak sapwood from both were subjected to radiocarbon assay and these confirmed that Trident 1 was the earlier artefact, dating to *3900-3660* cal *BC* (*SUERC-26379*), and that Trident 2 was later, dating to *3640-3370* cal *BC* (*SUERC-26660*; *Appendix 20*).

Trident 1 (**75482**) appears to have had three tines originally, but has split longitudinally down a medullary ray, detaching two of them, which have not survived (Fig 619). Beyond this, the projecting steps and the handle are virtually intact, although it is likely that the end of the latter is missing. It is shorter than Trident 2, and it ends rather abruptly, with very rough end grain, and does not have a final, slender taper.

Trident 2 (**75498/9**) resembles a flattened, giant culinary fork, with three tines, which are all parallel sided, and parallel to each other (Fig 620). Above the tines, instead of curving smoothly into the handle, there are two projecting wings, or steps, above which the handle begins. This is oval in section at the bottom end, gradually tapering and becoming more rounded. The top end, which is quite slender, is plain, possibly broken or, more likely, worn or damaged by use. The head (**75498**) has also split longitudinally along a medullary ray, detaching one of the outer tines (**75499**).

Bay	Item	Species	Bark/sapwood/ heartwood	Condition score	Split	Woodworking and charring	Length (mm)	Breadth (mm)	Thickness (mm)
A	75021	Oak (*Quercus* sp)	Sapwood and heartwood	3	Tangential	Triangular cross-section. Faceting, possible toolmarks	689+	80	75
	75554	Oak (*Quercus* sp)	Heartwood	4	Radial and tangential	Square cross-section; possible splitting debris	153+	43	36
D/E	76216	Alder (*Alnus glutinosa*)	Heartwood	3	Unknown	Rectangular cross-section; charred at one end; possible felling debris	150+	78	32
E	75532	Oak (*Quercus* sp)	Heartwood	4	Tangential	Rectangular cross-section	225+	34	27
G	75609	Oak (*Quercus* sp)	Bark and sapwood	4	Tangential	Slab; torn off the tree	454	53	28

Table 277: Other types of debris from the Later Neolithic organic deposit

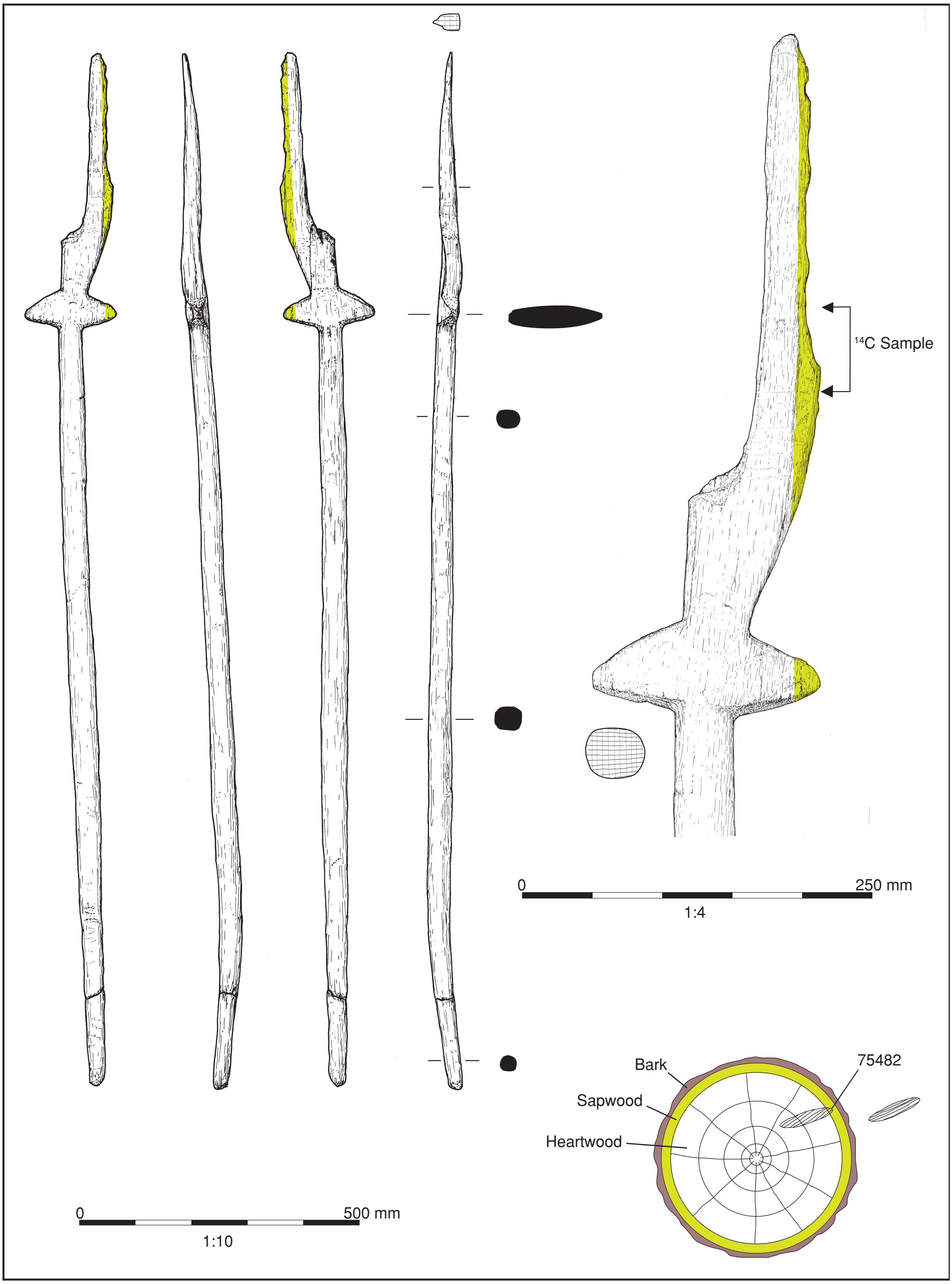

Figure 619: Trident 1

The total length of Trident 2 is 2164 mm. The length from the step to the tip of the prongs is 560 mm, and from the step to the end of the handle 1604 mm. Trident 1 is 1823 mm long, and the length from the

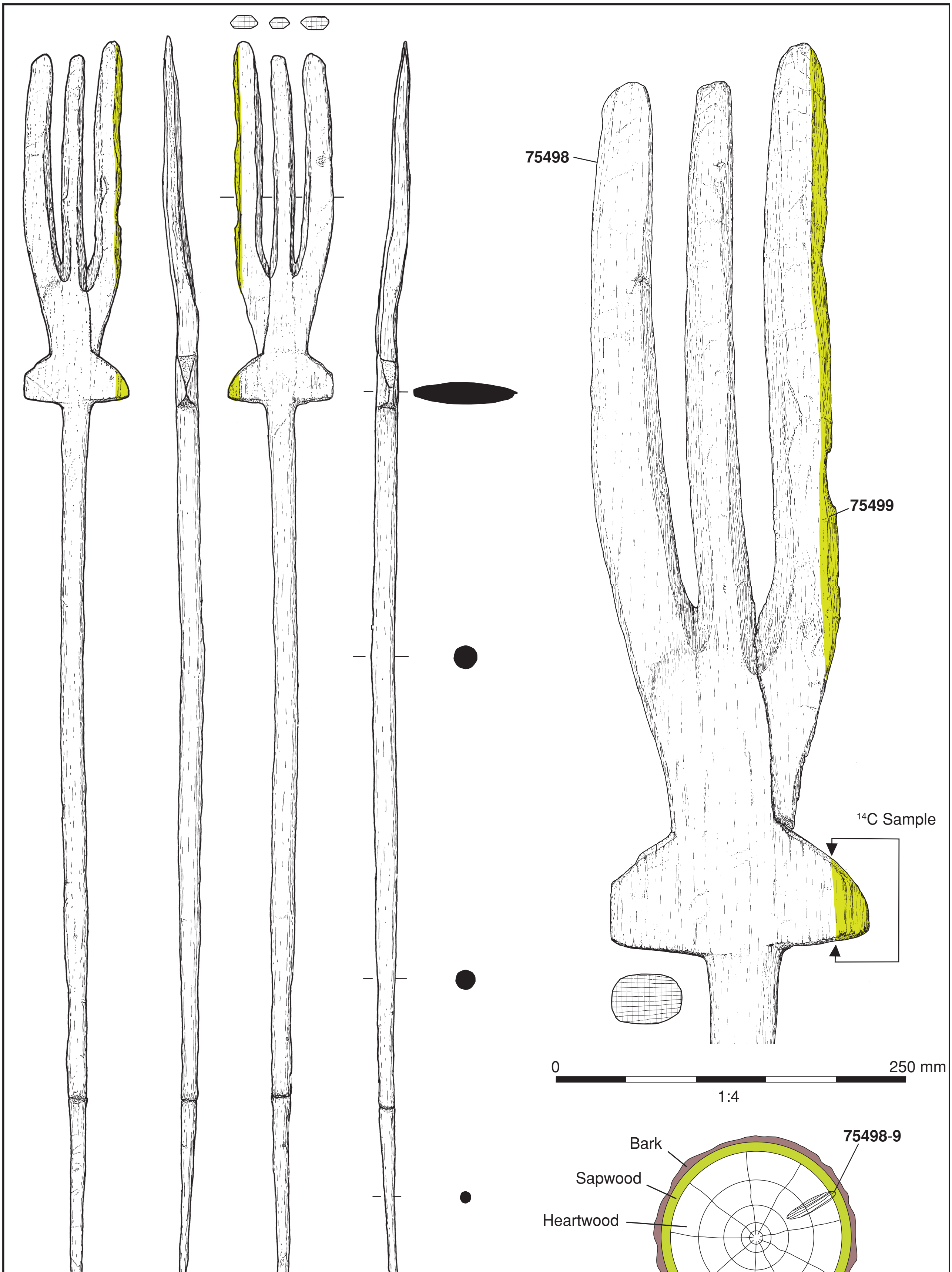

Figure 620: Trident 2

step to the tip of the surviving prong, like Trident 2, is 560 mm. The surviving length of the handle is 1263 mm. The width of the step is 184 mm on Trident 2 and 168 mm on Trident 1.

The tines of both are oval in section, flattening towards the tips. There is a clear 'fin' down the outside of the surviving tine of Trident 1, which is partly broken off. This is sapwood and the chamfered effect could have been caused by differential weathering of the heartwood/sapwood interface. The inside edge of the tines of Trident 2 is also chamfered and this is visible in the front and back view. This is not apparent on the inside edge of the surviving tine of Trident 1, but this could be due to wear or other damage, after the others were broken. The tips of the tines are blunt as well as flattened, but there is no indication of damage or wear, which would suggest that this was how they were originally carved. The step above the tines, at the base of the handle, is approximately as wide as the full width of the tines, and as thick as the thickest part of the fork, giving an indication of the original 'blank', from which the trident was carved.

The handles are carved to a dowel from the top of the step, and, to begin with, they are as thick as the step and quite straight. They are oval in section along their whole length and slightly tapered. Thus, they are between 33 mm and 47 mm in diameter above the tines, but only 20-28 mm at the end. The ends are slightly worn or possibly broken, but there is no evidence for any kind of expanded terminal, or knob.

Both tridents were made in a similar way, being taken from oak logs of similar diameter. The growth rings visible on both show that they came from trees that were quite slow grown. The rings of Trident 1 are the clearest and are 3-4 mm wide, narrowing to 1 mm towards what would have been the outside of the tree. This slowing down in the growth rate is a sign that the tree was in competition for light, water, and nutrients (Hather 2000, 10). This is often interpreted as evidence for coppicing, but the effect may be due to other causes. For example, there may have been acute competition for light, water, and nutrients when a group of juvenile trees were all growing up at the same rate, which can be caused when a parent tree drops a quantity of seed in a relatively small space.

The oak log(s) were at least 400 mm in diameter. These had been split in half, then quarters, and finally down to an eighth, forming a wedge-shaped blank (Taylor 2010, 90-2). The tridents were carved from this blank, quite close to the outside of the tree, demonstrated by the sapwood surviving along the outside edge of the remaining tine of Trident 1, and on the outside edge of one of the outer tines of Trident 2.

Neither trident is completely straight; Trident 2 is slightly curved at the head and Trident 1 near the end of the handle. This shaping follows the grain rather than being carved across it, which implies that they were either originally carved straight, and that the curve is a product of post-depositional factors, or that the original log was curved.

Paddle

What appears to be part of a paddle (**75706**; Fig 621) was recovered from Bay F, in deposit ***70325***, forming part of the *Earlier Neolithic organic deposit* (*Ch 8*). It is made of oak, and carved down from a piece which has been split tangentially out of a log. The handle, or

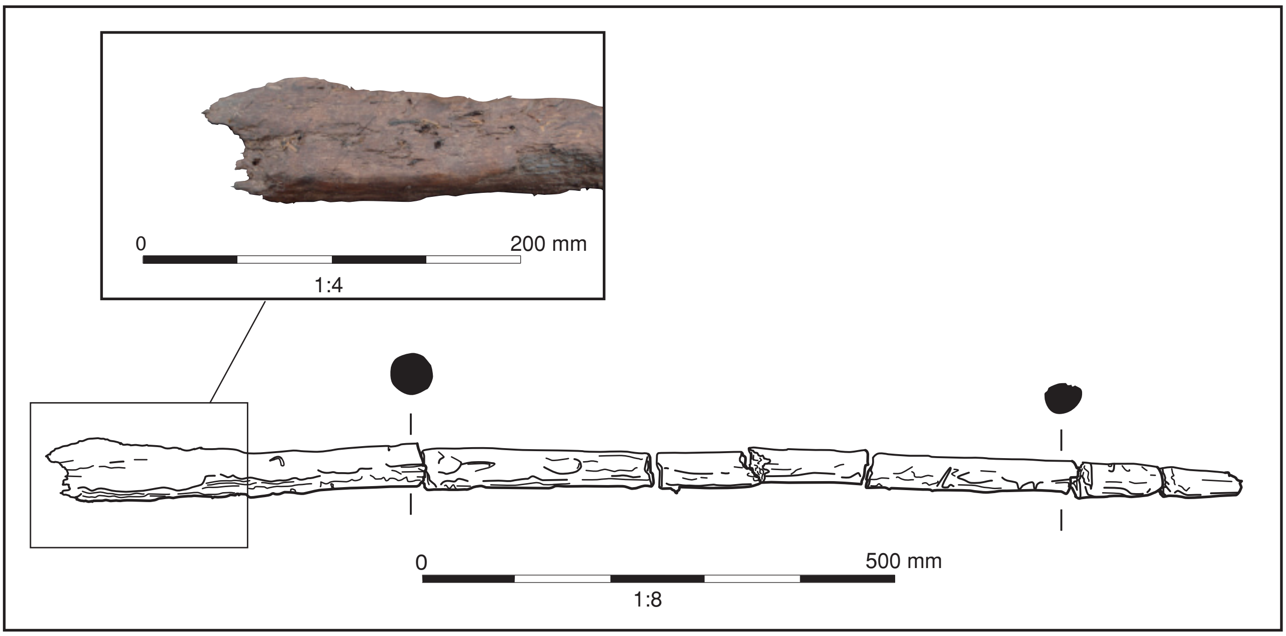

Figure 621: Paddle ***75706***

shaft, is a dowel, which, for the first metre is of similar dimensions to the tridents (*above*). However, it then thickens rapidly and starts to flare out into what was probably a paddle, which had been broken in antiquity. This length is 1285 mm, and the maximum width and thickness of the 'blade' is 69 x 43 mm. Although this was not directly dated, the bulk environmental samples from its immediate vicinity contained plant macrofossils (*Ch 8*) that yielded disparate radiocarbon dates of 3940-3660 cal BC (4990±35 BP; SUERC-32632), 3360-3090 cal BC (4510±30 BP; SUERC-32634), and 3100-2900 cal BC (4384±35 BP; SUERC-44782). Of these, the former (SUERC-32632) may be the more reliable and, based on this, it is estimated that the deposit surrounding the paddle formed in *3920-3660* cal *BC* (*Appendix 20*).

Carved dowel

Artefact **75826** was found in the *Earlier Neolithic organic deposit* (deposit ***70308***) in Bay B. It is a piece of oak, 249 mm long, split radially, and then lightly shaped (Fig 622). One end has been carved to a round dowel, with a diameter of 23 mm, and the other end is triangular in section and measures 13 x 20 mm. The round end is rough and has probably been broken in antiquity. There is a narrow slot across the broken end, which may have been some kind of peg hole, although this could be a natural feature. The oak from which the artefact was fabricated is slow grown and of high quality, with no side branches or blemishes. It is well finished, but slight ridges across the grain are present. The size and shape of the dowel suggests that it may have been a handle or haft for an object of some description.

Split timber

Artefact **76232** was recovered from the *Earlier Neolithic organic deposit* (deposit ***70409***) in Bay E/F. It has been tangentially split out of a larger oak timber, but has little additional shaping, leaving it broadly triangular in section (Pl 302). The surviving length is 423 mm, though the ends are broken, and it is not complete, one end being a modern break. There is no indication of its original function.

Discussion

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The assemblage of modified and structural wood is of particular interest, as it was associated with stratigraphic units dating to the Mesolithic (*Ch 3*) and Neolithic periods (*Chs 8* and *10*). Significantly, it is unusual for wood of this antiquity to survive, and its wide chronological spread provides a rare opportunity to compare material from the same site, gathered under the same sampling strategy. Moreover, given that much of the wood represents the detritus from various forms of woodworking, and possibly coppicing, this provides valuable insights into the raw materials and woodworking techniques that were used by the Mesolithic and Neolithic people of the Solway area.

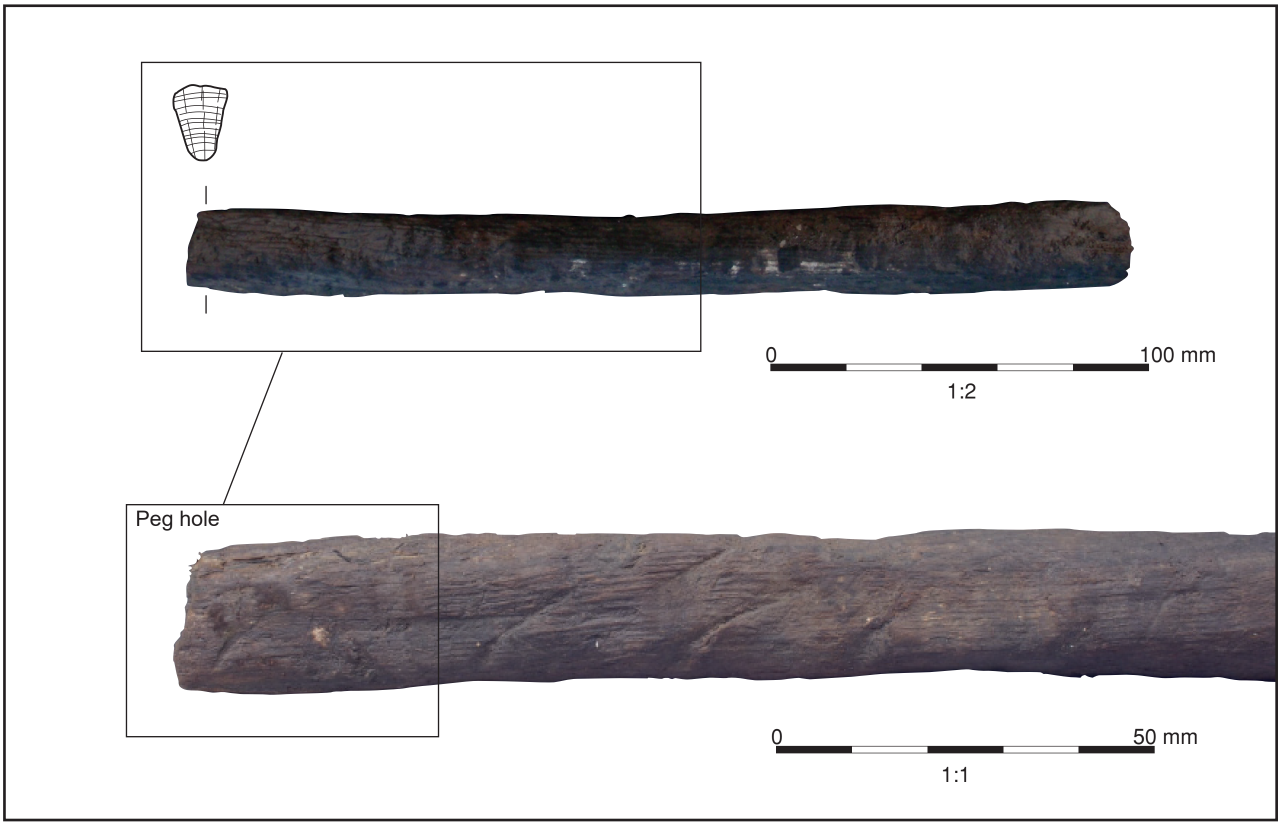

*Figure 622: Carved dowel **75826***

Plate 302: Split-timber **76232**

A proportion of the material was derived from the *Mesolithic organic deposit*, which was the earliest stratigraphic unit encountered within the *Principal palaeochannel*, dating to the mid-sixth- to early fifth millennia BC (*Ch 3*). The modified wood implies that beavers were active in the channel during this period, as three large oak timbers (**76424**, **76436**, and **76437**; *Ch 3*) exhibited evidence of beaver modification, one of which (**76437**) formed part of dendrochronological Cluster 1, dating to the mid-sixth millennium BC (*Appendix 20*). Moreover, the presence of beavers was confirmed by the presence of two concentrations of unworked wood within the channel, associated with this stratigraphic unit, which formed the remains of a potential lodge and dam (*Ch 3*).

In addition to beaver modification, evidence for cultural modification was apparent in this stratigraphic unit in the form of the trunk and bole of a single oak tree (**76271**), which exhibited woodworking in the form of notches, tool facets, and stop marks. A large split-oak timber (**76422**) may have been the result of cultural, or perhaps natural, modification. This was associated with a terminal deposit within the *Mesolithic organic deposit*, its felling/death date being estimated at *4870-4780* cal BC (*ring_90*; *Appendix 20*). Furthermore, the assemblage of debris provided evidence for the working of large oak timbers, in the form of groove-and-split (**76399**), and felling debris (**76425**). There was also a piece of felling debris in elm (**76427**) and a piece of elm bark (**75892**). This latter may have been a further example of felling debris, or could have been produced through the debarking of a tree. The remaining evidence of cultural activity comprised modified roundwood and four enigmatic items of oak debris (**74243-6**), which have been tentatively interpreted as 'blanks' for the production of wooden bowls or dishes.

There was also tentative evidence for culturally modified material from the *Mesolithic/Neolithic alluvium*. This included two oak timbers (**76065** and **76237**), which may have had intentionally worked ends, though this shaping might also have been a product of natural degradation. One of these (**76065**) was felled, or died naturally, in the winter of 4144 BC, whilst the other (**76237**) died, or was felled, between 4355 BC and 4310 BC (*Appendix 20*).

Clear evidence for anthropogenic woodworking and construction was present in the *Earlier Neolithic organic deposit*. This included an enigmatic unmodified structure (*75935*; *Ch 8*), along with stake-defined and collapsed wattle structures (Wooden Structures 1-3; *Ch 8*) and other groups of *in-situ* stakes (Bay A: stakes **76144** and **76190**; Bay B/C: stakes **76221**, **76224**, **76242**; Bay O: stakes **76504** and **76506**; and Bay G: stake **75829**; *Ch 8*), which all probably date to the second half of the fourth millennium BC. In addition, there were quantities of worked roundwood, much of which may have been produced by coppicing, and may represent displaced/dismantled elements of the identified stake-and-wattle structures, or were derived from additional structures which had no surviving *in-situ* remains. The roundwood assemblage also provides firm evidence for the presence of beavers at, or close to, the site during this period.

The other items of modified wood from this stratigraphic unit comprised four large oak timbers (**75444**, **75527**, **75853**, and **76118**; *Ch 8*), of a suitable size and form to have been used as part of structures. In addition, timber debris associated with the production of tangentially and radially aligned oak and alder timbers was present, as well as debris from possible groove-and-split woodworking. Furthermore, the debris from the felling of oak and elm trees was found, as was evidence for the removal of bark from oak timbers, along with oak and hawthorn-type woodchips. These four artefacts provide further evidence for early Neolithic activity at the channel during this period, as does the wooden artefact from the *Earlier Neolithic alluvium*. Moreover, taken as a group, nationally, these items hold great significance, as there are few wooden artefacts that are securely dated to the Neolithic period (*cf* Earwood 1993; Taylor 1998).

Similarly, the *Later Neolithic organic deposit* contained clear evidence for anthropogenic construction and woodworking. For instance, three roundwood stakes in Bays E and E/F relate to a structure, as could the displaced worked-roundwood items, and the vertically driven timbers (**76239** and **75854**; *Ch 10*). In addition, the recorded timber debris relates to production of alder timbers in the tangential plane, and oak timbers in both the radial and tangential planes. The debris also suggests the felling of alder trees, and the debarking, splitting, and working of oak timbers. There was by this time no evidence for the presence of beavers.

Felling and woodworking technology

The modified wood from Stainton West provides evidence for the use of stone axes, the type of felling, and the woodworking that was practised close to the *Principal palaeochannel* during the Late Mesolithic and Neolithic periods.

Stone axes

The evidence for the use of stone axes included many of the tool facets within the assemblage, which displayed the concave cross-section and the short, choppy facets produced by the less acutely angled cutting edge of a stone tool (Coles and Orme 1978; 1984, fig 11; Sands 1997). Similarly, where recorded, stop marks were relatively narrow, as would be expected of stone axes.

The stone axes used to undertake this work were probably hafted in a specific way. Although the direct archaeological evidence for this is scarce (*below*), some indication of hafting has been ascertained through experimentation, specifically those experiments undertaken in Draved Wood by the National Museum of Denmark in the 1950s (Jorgensen 1985). These experiments in tree felling, with replica Neolithic flint axes, are very informative about many aspects of hafting and using stone tools. One of the key principles illustrated by these experiments was the importance of hafting the axehead with the correct angle between its long axis, and the long axis of the haft. Through trial and error, the Danish experimenters found that the best angle of the axe head to haft was between 80°and 90°. The small number of stone axes that have been found in association with their hafts also confirms this hafting angle. For instance, the angle of the axehead to the haft was recorded as being 80° in the examples from Shulishader, Lewis, and Edercloon, Ireland (Sheridan 1992, 200; Lucas 1967, 2, fig 1). Similarly, the axe from Solway Moss, close to Stainton West, is also likely to have been originally hafted at approximately 80° (Evans 1897, 151-2). The only axe studied that does not have an angle of 80° is from Ehenside Tarn, which is hafted at precisely 90° (Darbishire 1874).

Notch-and-split

The Draved Wood experiments also provide some insights into the felling techniques that may have been employed by Neolithic communities (Jorgensen 1985, 13). One of these was a technique termed 'round cutting', where cuts were made all around the trunk until it could eventually be pushed over, snapping it. However, this proved an unsuitable technique for cutting down larger trees, as the direction of fall could not be controlled. In terms of these larger trees, the experiment indicated that the most effective technique was based on notch-and-split, as opposed to the historical 'cut to fall' technique, this having opposing V-shaped notches. When undertaking this, experimenters cut two parallel, horizontal notches or slots, approximately 200 mm apart, and the wood between them was cleaved out. The lower slot was then deepened and more wood was split out. The woodchips generated by this method got smaller as the cutting progressed, but they were all rectangular in shape, with a slight taper in the thickness. Importantly, they run tangentially to the grain and are parallel sided. Similar woodchips were identified at a Neolithic site in Switzerland (*op cit*, figs 35-7), and although they are not illustrated, almost identical woodchips were found in the ditch of a long barrow at Raunds, Northamptonshire. These were later dated to the first half of the fourth millennium BC (Harding and Healy 2007, 307). The Early Mesolithic site of Star Carr in Yorkshire also produced probable notch-and-split woodworking debris (Bamforth *et al* 2018b, 359). In western Germany, a whole tree was found which had been felled by this method, although it is not clear whether this was produced by stone axes (Jorgensen 1985, 33-5).

Significantly, the material from Stainton West provides possible evidence for this form of cleave felling. An oak trunk and bole (**76271**), from the *Mesolithic organic deposit* (*Ch 3*), had two parallel, horizontal notches or

Stratigraphic unit	Bay	Item	Species	Bark/sapwood/ heartwood	Comment	Split	Length (mm)	Breadth (mm)	Thickness (mm)
Mesolithic organic deposit	V	76427	Elm ***(Ulmus** sp)*	Sapwood		Tangential	342	135	25
Earlier Neolithic organic deposit	B	75825	Oak (*Quercus* sp)	Bark and sapwood	Slab	Tangential	191+	120	43
		75828	Elm (*Ulmus* sp)	Heartwood		Tangential	186+	112	20
	C	76050	Oak (*Quercus* sp)	Heartwood	Slight tangential grooves	Tangential	158	137	25
		76051	Indeterminate	Sapwood		Tangential	146	95	44
	D	75831	Oak (*Quercus* sp)	Heartwood	Possible notch at broken end (23 x 17 mm); parallel-sided	Tangential	114+	85	21
	I	76214	Oak (*Quercus* sp)	Heartwood		Tangential	285+	58	20
		76215	Oak (*Quercus* sp)	Heartwood	Grooves on one side	Tangential	213	122	50
Later Neolithic organic deposit	D/E	76216	Alder (*Alnus glutinosa*)	Heartwood	Rectangular cross-section	Unknown	150+	78	32

Table 278: Possible cleave-felling debris

grooves cut across the trunk, approximately 210 mm apart, associated with an area of tool faceting. It seems likely that these notches represent the start of the notch-and-split felling process, which for some reason was not completed. There are also ten items in the assemblage that may be debris resulting from this form of tree felling, based on their conversion, form, size, and general appearance (Table 278).

Chop-and-tear technique

During the experiments at Draved Wood, a chop-and-tear technique was found to be effective for cutting and clearing small stems (20-50 mm). This involved bending the stem, chopping it, allowing it to tear, and then chopping it again in order to sever it (*op cit*, 35-7, fig 41). In an archaeological context, chop-and-tear stems were recovered from the Etton causewayed enclosure, but their significance was not recognised at the time (Taylor 1998, figs 169, 170). The technique, as practised at Etton, was slightly different from that used at Draved, as the Etton method was used for coppicing. In this instance, it appears that a coppiced stem was bent away from the stool and one chop (or a series of chops in the same place) was made at the point where the stem met the stool (the top of the heel). The heel was then encouraged to tear away from the stool (with the foot?) and a second cut was made across the tear, but lower down. This second cut both stopped the tear and severed the stem from the stool. The use of this technique would help to account for the number of pieces of roundwood with the coppice heels still attached in the ditch of the causewayed camp, which would also have been a source of raw material for artefacts (*op cit*, 155-6, figs 140, 171).

The chop-and-tear technique has also been recognised as a feature of Mesolithic woodworking technology. For instance, 24 examples of chop-and-tear have been recorded in the Star Carr modified-wood assemblage (Bamforth *et al* 2018b, 360), including one piece that also showed evidence for beaver gnawing, whilst similar evidence has been noted at the Danish Ertebølle site of Tybrind Vig (Johansen 2013, fig 7).

This chop-and-tear technique was demonstrated by three pieces of small-diameter roundwood within the Stainton West assemblage (Fig 623). Roundwood **76381**, from the *Mesolithic organic deposit* (*Ch 3*), had the

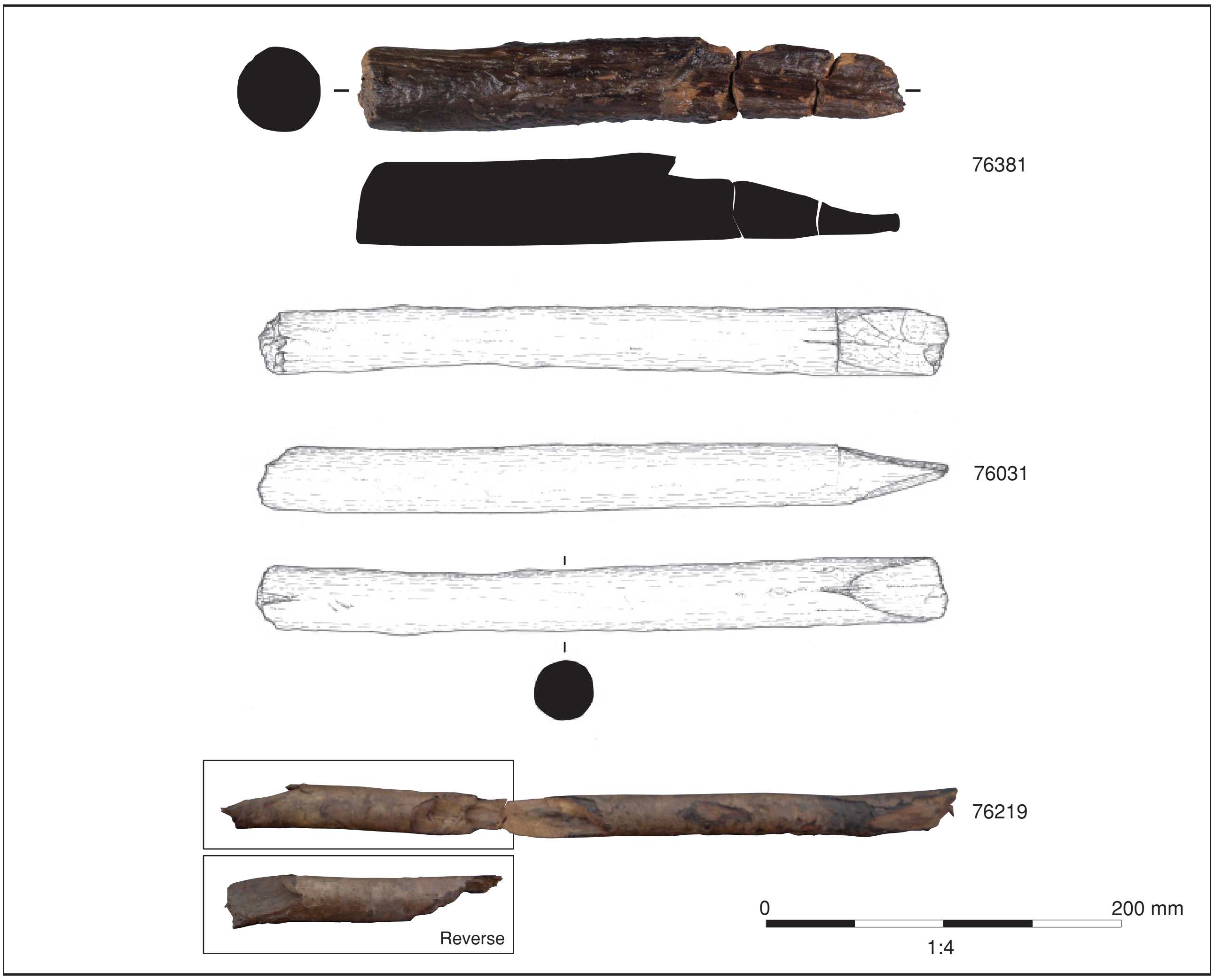

Figure 623: Chop-and-tear worked ends, roundwood ***76031***, ***76219***, *and* ***76831***

straight, even stem often associated with material derived from coppice, and had been worked at one end with a distinctive chop and tear. Stake **76031**, part of Early Neolithic Wooden Structure 1 (*Ch 8*), again had the long, straight stem denoting coppicing, and had a distinctive chop into the grain at the worked end. Finally, stake **76219**, which formed part of Early Neolithic Wooden Structure 2 (*Ch 8*), again had the straight, even stem and also had a distinctive chop-and-tear end, with a single blow struck across the grain.

Groove-and-split technique

During the 1990s, analysis of the wood from Star Carr recorded parallel grooves that had been cut into the wood to facilitate the splitting out of sections of wood in a controlled manner (Mellars and Dark 1998, figs 4.8-11), and similar types of debris have also been identified at Etton Neolithic causewayed enclosure (Taylor 1998) and the Raunds Neolithic long barrow (Taylor and Bradley 2007). This technique would create a similar kind of debris to that produced by Neolithic tree felling, although smaller. Indeed, analysis of the wood from Star Carr has now identified a new kind of woodworking debris (termed groove-and-split debris), a high proportion of which is thin and has been tangentially split off the original wood. Some of these pieces still have bark attached, and a distinctive feature of the debris is that it is parallel sided (Bamforth *et al* 2018b). As most of it appears to be tangentially aligned, it is likely that it was produced by the technique of making grooves and then splitting the wood out between these grooves. This technique has been tested by experimental work, using flint flakes and bone chisels to incise parallel grooves into the surface of split birch timber, after which the section of wood between the grooves was split away with an antler tine and bone chisel (*op cit*, 364-5). It was noted, however, that it was a slow process, and it was also unclear why it would be necessary to split thin pieces away from the surface of the timber (*op cit*, 365).

There were several items from Stainton West that had morphological traits suggesting that they may have been shaped by, or were the debris resulting from, this type of groove-and-split woodworking. Given that this technique has generally been associated with tangentially aligned material, it is of interest that the items from Stainton West were often radially aligned. Two parallel-sided oak pieces appeared to be debris produced by this technique, one being radially aligned debris **76399**, from the *Mesolithic organic deposit* (*Ch 3*), which was formed of sapwood and heartwood. As well as being parallel sided, it also had two parallel grooves longitudinally along one face. The other piece of groove-and-split debris (**76215**) was from the *Earlier Neolithic organic deposit* (*Ch 8*) and was tangentially aligned, parallel-sided, and had a groove along one face.

In addition, there were two large oak timbers (**75544** and **76118**) from the *Earlier Neolithic organic deposit* (*Ch 8*) that each had a pair of parallel grooves along one face. There was also a piece of radial debris (**76024**) from this stratigraphic unit (*Ch 8*), which was likely to be a by-product of groove-and-split working, as it was both parallel-sided and had a single groove along one face. Finally, there was a single piece of oak debris (**76503**), also from the *Earlier Neolithic organic deposit* (*Ch 8*), that again had a pair of parallel grooves along one face, which reflect the groove-and-split technique.

The wooden structures

Several wooden structures, identified within the *Principal palaeochannel*, were composed of small-diameter roundwood stakes, and modified and unmodified roundwood. The earliest of these (***75935***) appeared to be represented by a V-shaped tangle of unmodified roundwood covering an area of some 0.5 m square, which was associated with the *'Earliest Early Neolithic activity'* phase within the channel (*Ch 8*; *Appendix 20*). Given its apparent form, it is possible that it was a collapsed structure.

Several other structures appeared to be broadly contemporary, based on the radiocarbon dating evidence, although they were later in date than structure ***75935*** (*Appendix 20*). While these have been defined as three major structures (Wooden Structures 1-3), it is possible that Wooden Structures 1 and 2 actually formed different elements of a continuous fence or barrier that extended across the whole width of the channel (*Ch 8*), in use between *3820-3700 cal BC* (*'Start Wooden structures'*) and *3750-3650 cal BC* (*'End Wooden structures'*; *Appendix 20*). If this was the case, this feature appears to have comprised upright stakes supporting wattle panels, which would have been woven *in situ*. It is also possible that there was a small projection leading from it into the centre of the channel. This was evidenced by eight pieces of horizontal, east/west-orientated roundwood (**75906-9** and **75912-15**), adjacent to Wooden Structure 1, that might have created a small platform, supported by two perpendicular-set lengths of roundwood (**75910** and **75911**). The cluster of stakes which formed Wooden Structure 3 was also associated with the fence or barrier. This was found immediately north of Wooden Structure 2 and may have formed a rack or setting of some description (*Ch 8*). Other Early Neolithic structures also appear to have existed within the channel, given the discovery of both small groups and isolated roundwood stakes, though these are difficult to interpret (*Ch 8*). It also seems that similar structures were erected in the later Neolithic period, though again these are difficult to interpret (*Ch 10*).

Where it could be ascertained, the six stakes associated with Wooden Structure 1 were identified as hazel, one of its other roundwood elements was also hazel, whilst one of its unmodified uprights was alder. Of the 12 roundwood stakes forming elements of Wooden Structure 2, eight were identified as hazel, one as alder/hazel, two as alder, and one as elm. The wattle-panel elements of this structure were also overwhelmingly composed of hazel and alder roundwood (14 items), although they also contained single examples of birch, elm, and hawthorn-type roundwood, whilst the roundwood components assigned to Wooden Structure 3 were again identified as hazel and alder. Similarly, the majority of the other roundwood stakes within the *Earlier Neolithic organic deposit* and the *Later Neolithic organic deposit* were identified as hazel and alder, although two of the roundwood stakes from the *Earlier Neolithic organic deposit* were hawthorn-type and oak.

The choice of hazel and alder for stakes and uprights is not surprising. Hazel, for instance, which is a deciduous tree or shrub, was traditionally one of the most easily coppiced trees, used for wattle work and a wide range of other uses (Gale and Cutler 2000). It is commonly found as understory in oak or ash (*Fraxinus* sp) woodland (*ibid*), and was probably growing close to Stainton West during the Neolithic period, as evidenced by the more general presence of unmodified hazel wood within the channel, and the frequent presence of plant macrofossils associated with hazel from the *Earlier Neolithic organic deposit* and *Later Neolithic organic deposit* (*Appendix 18*).

Although alder does not split particularly easily, it does survive well in wet conditions. This therefore makes it an ideal choice for use in structures associated with wet/damp environments, notably bank revetments and waterfront piles. Alder is also known to coppice well. It generally grows in damp areas, often close to running water, either in damp woodland mixed with oak, or in marshland mixed with other species to form alder carr (*ibid*). As such, this species was likely to be growing in the immediate vicinity of the site, which is clearly evidenced by the unmodified wood within the channel, as well as by the plant macrofossil (*Appendix 18*) and pollen evidence (*Appendix 17*). Indeed, these indicate that, during the Neolithic period, alder eventually replaced hazel as the dominant tree taxon.

Of the other tree species identified as being used in the Neolithic structures, birch, generally found growing on heathland or in oak woodland, can be coppiced, but generally produces inferior stems, though it has a wide range of uses, whilst hawthorn-type is a hard, easily worked wood (Corkhill 1979). It will tolerate damp soils and is generally found growing on the edges of woodland or clearings (Gale and Cutler 2000). Finally, elm is a hard timber and, although difficult to split, is very durable if kept either completely wet or dry (Usher 1974; Corkhill 1979). It grows in mixed-deciduous woodland and will tolerate damp soils (Gale and Cutler 2000).

It is difficult to arrive at any definitive conclusions about the function of these structures. One suggestion, however, is that some elements may have formed parts of fish weirs. Such weirs took the form of a wattle barrier, often constructed of hazel roundwood, which was erected across a migratory route for fish (Van de Noort 2004; Jecock 2011). As such, they were often erected to target eels, in autumn, or salmon, in spring (Jecock 2011). The most common form possessed a V-shape, the wide end of which was designed to funnel fish towards the point of the 'V', or the eye of the weir, where they could be caught through the use of nets or baskets (Salisbury 1991), the species being fished determining the orientation, either up- or down-stream (Pedersen *et al* 1997). It is likely that, across Europe, such structures were first employed in the Mesolithic period (McQuade and O'Donnell 1997; Lozovski *et al* 2013a), but there is also evidence for static fishing structures in Britain dating to the Neolithic and Bronze Age (*cf* Van de Noort 2001; Jecock 2011; Symonds 2012).

Given the form and chronological dimensions of fish weirs, it is therefore possible that the near-continuous wattle barrier across the channel, represented by Wooden Structures 1 and 2, and perhaps also the earlier V-shaped tangle of wood forming structure ***75935***, represented the remains of Neolithic fish weirs. However, when considering the nature of the channel during this period, the combined palaeoenvironmental evidence suggests that it was a ponded channel that was infilling, and that the flow of water along it was confined to a small stream (*Ch 8*). As such, it may not have been particularly suited to the use of large fish weirs, which were normally placed across larger, fast-flowing, watercourses (Jecock 2011). Given this, an alternative suggestion, based on the concomitant Neolithic artefactual material from the channel, is that the fence/barrier and other structures associated with the *Earlier Neolithic organic deposit*, and perhaps also those putative structures associated with the *Later Neolithic organic deposit*, were designed to divide or define the channel into specific areas, which then acted as 'receptacles' for the intentional deposition of specific cultural items (*Ch 8*).

Possible coppicing

Over half of the worked or potentially structural roundwood examined has morphological traits that may be indicative of coppicing. The taxa of the pieces with such evidence is similar to that of the wider roundwood assemblage, the taxa all being suitable for coppicing and would presumably regenerate if felled (Gale and Cutler 2000). Although some roundwood ring counts were carried out, there is insufficient information to allow a statistical interrogation of the potential evidence for coppicing; however, given the high incidence of straight, even stems, it seems likely that at least some of the roundwood is a product of regrowth. The presence of large volumes of straight hazel rods at Tybrind Vig, used to construct fish weirs, led to a similar suggestion that they may have been derived from coppicing, whilst the Early Mesolithic site of Star Carr also provided plentiful evidence for the selection of long, straight stems, again potentially derived from coppice (Malmros 2013, 386; Bamforth *et al* 2018b, 351). These may have resulted from adventitious harvesting of stems that had regrown from trees felled by people or beavers, or may even have related to deliberate management of woodland resources to produce coppiced rods (Bamforth *et al* 2018b, 351).

The Neolithic tridents

Two of the more remarkable, and rare, artefacts from the excavations were the oak tridents (Tridents 1 and 2) associated with the *'Early Neolithic I'* (Trident 1) and *'Early Neolithic II'* (Trident 2) phases (*Appendix 20*).

Methods of manufacture

Although it is apparent that the woodworkers who made the tridents had a clear understanding of the properties of oak wood, as both objects are so well finished, with generally smoothed surfaces, there are few clues to how precisely they were fabricated. What can be ascertained is that the first stages of manufacture would have been quite straightforward, using woodworking techniques that were already well established.

By examining the grain of the wood and the curve of the growth rings, it is clear that both tridents were worked down from logs, which were much larger than was strictly necessary. Indeed, the oak logs used appear to have had near-identical diameters of 400 mm, which were split in half, then quarters, and finally down to an eighth, forming a wedge-sectioned blank (*cf* Taylor 2010, 90-2). Seasoned oak wedges may have been used to split the logs and the split pieces were probably then squared-up and roughed-out, using an axe. Following this, the tridents were carved from these blanks, quite close to the outside of the tree, as evidenced by the presence of sapwood, sampled for radiocarbon dating from one edge of both tridents; the use of these blanks may have been partly a function of squaring the triangular section that was nearest the centre of the tree, which was trimmed off before work started. Significantly, these woodworking techniques have many similarities with those employed to make the hafts for stone axes, as these were not casually made from roundwood, but were carefully carved from split timber, with the axehead set across the grain (*cf* Taylor 1998, fig 161; Sheridan 1992, 200).

The tines of the tridents are sharply defined and parallel to each other, set approximately 40-50 mm apart. The chamfered edges are cleanly cut, but it is not clear how this was achieved. The very slight traces of faceting suggest that at least some of the finishing was done with an axe, but stone axes are more efficient at hewing than cutting and it seems unlikely that they were used for cutting across the medullary rays to achieve these sharp edges. The angle between the step and the handle of each trident is also sharply cut at an angle of 90°. Virtually nothing is known about other woodworking tools in the Neolithic period. However, it is possible that the wood between the tines was partly split out using small, seasoned-oak wedges, and flint tools were used for finishing. Neither trident is completely straight; Trident 2 is slightly curved at the head and Trident 1 near the end of the handle, the shaping following the grain rather than being carved across it. This could either mean that they were originally carved straight and that the curve is post-depositional, or that the original log was curved.

Although the tridents came from different stratigraphic units and produced different radiocarbon dates, it is noteworthy that they are extremely similar in terms of physical appearance and with regard to the characteristics of the wood from which they are made. Significantly, these artefacts are of quite a complex form and were carved, with enormous skill, in precisely the same way, even down to quite small details, including the alignment in the log, and the slight flattening of the tines. It is therefore difficult to believe that there can have been a very long interval between the fabrication of the two objects.

The quality of preservation of both also suggests that they became waterlogged whilst still in quite good condition; neither had been used enough to cause any kind of polish on the handle, whilst edges and cut surfaces are still sharp and do not appear to have been softened by age or use. The longitudinal splitting down from the tines cannot be used to indicate that the tridents were old; rather than being caused by use, they are more likely to have been caused by the wood drying out, probably during seasoning.

Other tridents from Britain and Ireland

Significantly, several other prehistoric tridents are known from Britain and Ireland, which are closely comparable to those from Stainton West. The British examples were discovered at Ehenside Tarn, Cumbria (Darbishire 1874), whilst in Ireland similar tridents have been found in Co Armagh (Wilde 1857), Co

Wicklow (FitzGerald 1907), Co Sligo (Lucas *et al* 1960), and Co Galway (Lucas 1972).

Two tridents were discovered at Ehenside Tarn in the late nineteenth century, and illustrated in a contemporary engraving (Darbishire 1874, pl IX, figs 4-5). This depicts one as distorted and broken, but it is recorded that the prongs were all originally the same length, and were parallel and 'continued in a straight line' (*op cit*, 289). The second trident is represented by one prong, the blade, and the steps (Fig 624). The deformation of the wood of both artefacts is clearly detailed in the engraving, making it possible to straighten the grain digitally. When this is pulled straight, it can be seen that these tridents were originally closely similar in form to those from Stainton West.

The nineteenth-century engraving indicates that a feature of both of the Ehenside Tarn tridents is a ridge down the whole length of each, close to the centre. The engraving suggests that this ridge is the pith of the original log. If this were the case, this would mean that they were manufactured in a completely different way from the Stainton West tridents, probably from half a smaller log. Fortunately, they survive in the British Museum and were inspected directly. From this, it was quite clear that this central ridge is not the pith and that desiccation has led to a total collapse of the woody structure at a cellular level. When this happens to oak, although the distortion is not particularly great, longitudinally or radially, as a result of the thickness and strength of the medullary rays, the effect on the transverse structure of the wood can be extreme. For instance, the wood between the medullary rays collapses, but the rays themselves have a different structure and consolidate until the wood eventually converts into a kind of *millefeuille*, with its medullary rays stacked like wafers. This also partly explains why the tridents are now virtually flat. The central ridges therefore formed where the wood has been carved across the medullary rays and the grain changes from being radial to tangential. Where there are several large medullary rays close together tangentially, they are more resistant to distortion than the surrounding material, and so a ridge is formed. Therefore, it is now clear that the Ehenside Tarn tridents were originally carved in exactly the same way as those from Stainton West, and the different appearance has probably been caused by the destructive conservation methods employed in the late nineteenth century.

Apart from these, there is also a tantalising allusion to what may have been two more tridents at Ehenside Tarn. These earlier findings, made before Darbishire's site visit, were reported by Rev J W Kenworthy in the Whitehaven Herald in 1870. He mentions 'two paddles…shaped like the foot of a water-fowl, the web of which, once formed of skin, is now decayed… This web-footed shape has in all likelihood been used as an oar' (cited in Darbishire 1874, 274).

Two tridents were also discovered in Armagh during the nineteenth century, described as 'a pair of three-grained forks, or grapes, of gray oak' (Wilde 1857, 205). 'Grained', in this context, means 'forked', whilst 'Gray oak' probably describes the colour of the trident when excavated. For example, bog oak is sometimes paler when first excavated, turning darker as the surface oxidises. Only 'the larger' of the implements was illustrated, but it is clear that it was made in a similar way, and was beginning to split in a similar manner, to the ones from Stainton West. The split runs longitudinally down a medullary ray and would eventually lead to the detachment of one of the tines. One of the steps had already split off in this way.

Another Irish example is a single, seemingly complete, trident, discovered in 1820 in Killalish Bog in Co Wicklow (FitzGerald 1907). Intriguingly, this implement was discovered alongside a 'a skeleton with the remains of a belt, apparently of skin' (*op cit*, 208). In addition, a single trident was discovered at Gorteennaglogh, Co Galway, in 1969, which was donated to the National Museum of Ireland. This again has many similarities to the Stainton West tridents, it being reported that this three-pronged implement is

> Formed of a single piece of wood which broke along the grain where the outer prongs joined the central one. One of the prongs was repaired by using a wooden dowel, the other was secured in its original position by an iron nail. The handle of the fork is circular in cross-section. The prongs are flattened oval in cross-section and taper slightly towards their ends. The central one is a prolongation of the handle, the two outer ones are curved on their outer edges, a shoulder being formed on each by the curve. Above the three prongs, on either side of the handle, there is a trapezoidal foot-rest or treadle, chamfered along its edges (Lucas 1972, 208).

It is not, however, clear from this account if this trident had been repaired immediately following its discovery, or whether the iron nail and dowel were also of some antiquity. However, the close similarities of this object to the Neolithic tridents from Stainton West and Ehenside Tarn, and the presence of an iron nail, may suggest the former. The last known Irish tridents are a pair discovered at Carrowcoller, Co Sligo, in 1958, also donated to the National Museum of Ireland. It is reported that

> The specimens had, unfortunately, dried out somewhat before they reached the Museum so

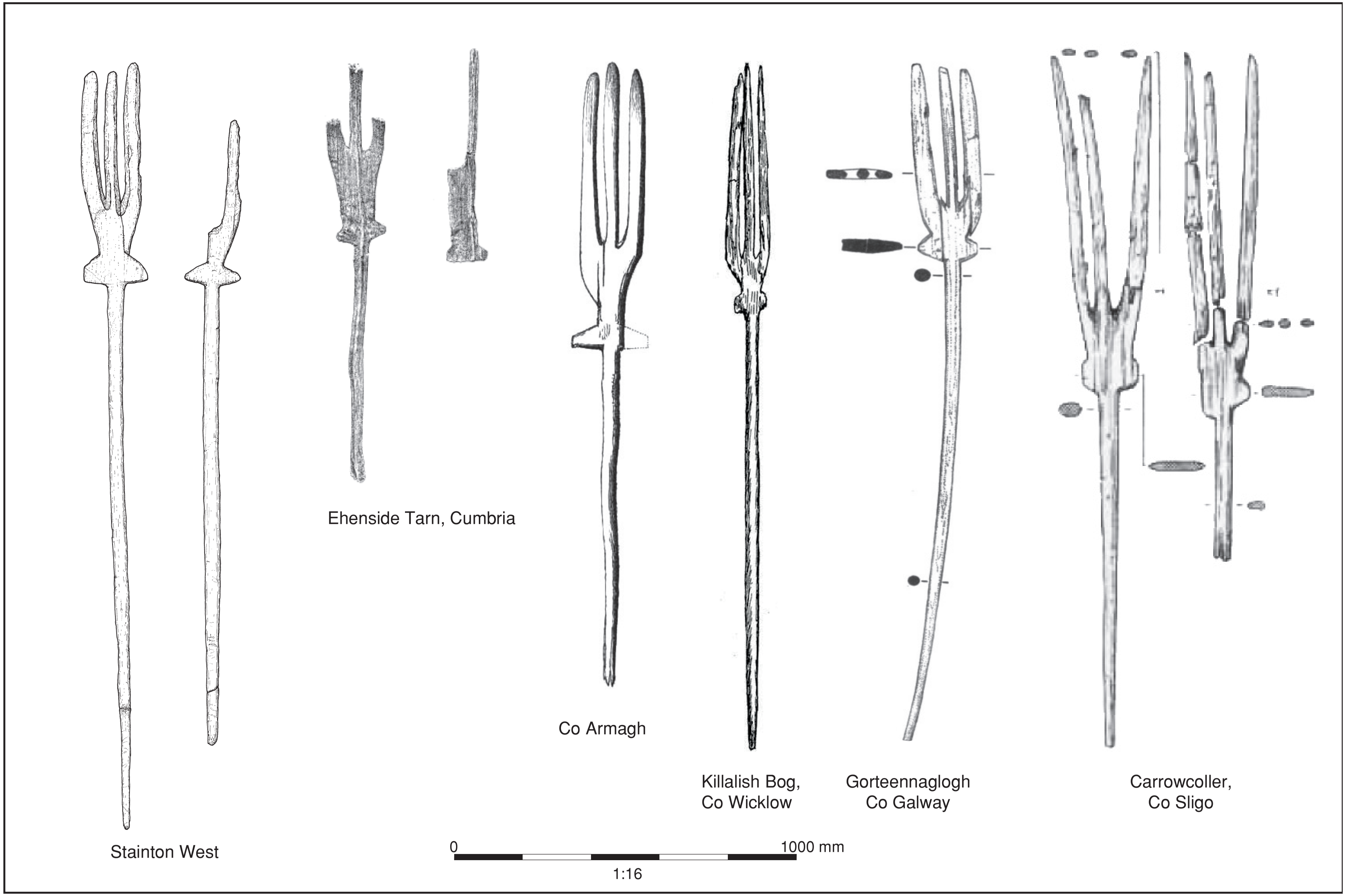

Figure 624: Comparable tridents from Ehenside Tarn, Cumbria, Co Armagh, Co Wicklow, Co Sligo, and Co Galway

> that there is a certain amount of shrinkage and warping. The handle of one fork is missing. Each has been cut from a single piece of oak. The complete specimen consists of a long handle and three tines. A treadle is provided on each side of the handle, one being slightly narrower than the other…The treadle was roughly finished with bevelled edges (Lucas *et al* 1960, 26-7).

Taken as a group, all of the tridents appear to have been manufactured in an identical way and some estimations can be made of their comparative sizes (Table 279), although the comparative size of the artefacts from Ehenside Tarn is difficult to calculate because of the high level of distortion. Even though there is unlikely to have been much shrinkage longitudinally, the total length, the length of the handles, the length of the prongs, and maximum thickness have all been lost through breakage and collapse of the cell structure. The width of the steps would, however, have been somewhere in the region of 152 mm, making these slightly smaller than the other tridents.

Several other observations can be made, which may have some bearing on their function (*below*). For instance, where they are well-enough preserved, the tines have chamfered edges which may be connected to function, although these chamfers would weaken the tines for some uses, such as twisting. The tips of the tines are fairly blunt, apart from those from Carrowcoller, Co Sligo, and all are slightly flattened. The handles on most, apart from the example from Gorteennaglogh, Co Galway, are quite straight and there does not appear to be any evidence for damage or wear caused by lashing or binding on either the handles or tines. The ends of the handles, where they have survived, are all plain, or even slightly tapered. Expanded terminals or knobs on the ends would facilitate functions, which required pressure on the top both downwards and upwards.

Many of the tridents have broken by splitting along the grain. The two complete examples, from Armagh and Stainton West, both show a tendency to split from the gap between two tines down to the step. The partial tridents have also split and broken in a similar way. One of the outer tines on the Gorteennaglogh example has also split in this way, whilst the other outer tine has again split, along with part of the step. These splits coincide with the medullary rays and probably indicate radial shrinkage. This may have happened when the wood seasoned and the grain dried out, but the tendency to split in this way may also have been a weakness when the artefact was in use (*below*). Trident 1 from Stainton West was broken when discovered, the detached tine being underneath the rest of the artefact as if it had snapped in use, giving the impression that the fork was being twisted when it snapped. The tendency to crack or split in this way is partly a result of the way that the tridents were carved (*above*), although the tree species may also have played a part. All the tridents that have been identified

	Total length (mm)	Length of handle (mm)	Length of prongs (mm)	Width of step (mm)	Maximum thickness (mm)
Stainton West Trident 2	2164	1604	560	184	40
Stainton West Trident 1	1823+	1263+	560	168	35
Ehenside Tarn, Cumbria	-	-	-	152	-
Ehenside Tarn, Cumbria	-	-	-	150+	-
Armagh, Ireland	2260+	1092	1168	178+	-
Armagh, Ireland	2184	1600	584	165+	-
Killalish Bog, Co Wicklow, Ireland	2000+*	1025*	630*	100*	-
Gorteennaglogh, Co Galway, Ireland	1950	1390	500	160	45
Carrowcoller, Co Sligo, Ireland	2000	1155	660	155	65
Carrowcoller, Co Sligo, Ireland	1500+	430+	660	150	35

*Approximate measurement

Table 279: Comparative dimensions of the Cumbrian and Irish tridents

to species are oak, a wood valued because of the ease with which it can be split and worked when green, but it will also split radially as it seasons (Edlin 1949). It may also be relevant that oak, and especially oak heartwood, is particularly heavy and inflexible (*ibid*).

Function

The tridents are intriguing, and a range of different functions has been proposed. Wilde (1857), for example, considered the examples from Armagh as 'spades or forks' (Darbishire 1874, 290), whilst it was suggested that the tridents from Ehenside Tarn and Armagh may 'have been eel-spears, the blade or paddle adding strength to the long prongs, preventing them from splitting off' or acted 'as paddles' (*ibid*). Similarly, the trident from Killalish Bog, Co Wicklow, was suggested as having been used for spearing salmon (FitzGerald 1907).

However, an examination of wooden forks of known function tends to highlight the differences between these and the tridents, rather than indicate many similarities. Digging forks, for example, were uncommon until recently because of the difficulty of making the prongs strong enough. Indeed, the nearest traditional digging tool to a modern garden fork is a kind of spade with holes in it (Blandford 1974, fig 33g). In Britain, fish spears were used until recent times; however, whilst they vary depending on the species being fished, they all share certain characteristics, which are not mirrored in the Cumbrian and Irish tridents (*cf* Jenkins 1974). These include tines with reverse-angle barbs to hold the fish, or sharp tines to pierce fish in the shallows. Fish spears also need to be lightweight, with long handles (Stewart 1977, 66).

Traditionally, pitchforks for lifting hay have three, or more usually, two prongs, and although recently they have had iron heads, they were originally modified natural wooden forks, and so, in form at least, they are comparable to the tridents (Blandford 1974). Bakers also used a similar fork for tossing faggots into the fire for the bread oven (*ibid*). However, in both cases these types of fork had to be very lightweight and this probably indicates that the heavy oak tridents from Stainton West were not used for tossing or lifting. Another type of fork was the root pick, or weeding fork, which had a foot-rest and two tines, though these differ from the Stainton West and other Cumbrian and Irish tridents in that the tines were short and the foot-rest was at the rear (*op cit*, 183, fig 34h). These too were fairly lightweight. Coppicers also cut forks for bundling rods and other activities, though these differ from the Stainton West examples in that they were made of roundwood and are usually two-pronged natural forks, with the prongs curved and well apart (Oaks and Mills 2011). It has also been suggested that the tridents from Stainton West might have been 'mash forks' used in the 'mashing in' process, which converted grain into a sweet liquid wort used for brewing beer (*cf* Dineley 2021; in press); again, however, it might well be the case that the tridents were too heavy to be used in such a process.

Of the other forks from archaeological contexts, those that are prehistoric in date also clearly differ from the Cumbrian and Irish tridents. For example, an unusual Bronze Age fork from the Somerset Levels is carved flat on one side from a natural fork (Coles 1978, 114, figs 71-3). It has one tine, which is straight, a continuation of the handle, and a second tine, which is also straight, but at an angle of roughly 40°; it is 1475 mm long, but incomplete, with the handle 45-60 mm in diameter. The tines are flattened and worn, and the construction is quite lightweight. It was found with coppice material, the wood being hazel, which might suggest that it is a coppicer's fork. However, it is very unusual in form and fabrication when compared with known coppicer's forks, and it has been interpreted as a reed fork (*ibid*). Five forks were also recorded from the causewayed enclosure at Etton, all of which are simple roundwood (Taylor 1998, 152, fig 163). These were found associated with coppice material and were considered to be either off-cuts or coppicers' forks.

Given the difference between the traditional forks and those from other archaeological contexts, the function of the wooden tridents from Stainton West remains uncertain. Based on their weight and form, it seems clear that they would have been unsuitable for use as fish or eel spears, pitchforks, or any of the other types of fork considered. Although no satisfactory interpretative function has been established, one possibility is that they were associated with boats or fishing: for instance, the tridents may have been used as mooring poles, with the tines being pressed into soft mud. If this was the case, the steps might have been at a more practical height if they were to be pushed into the riverbank or bed through the pressure of someone's foot. A rope tied between the step and the tines could also have been used for mooring, as well as to pull the trident out of the mud, with the step preventing the rope from slipping up the handle. Alternatively, they could have been used in a similar way for securing fishing nets, as part of a static system of fishing (*cf* Jecock 2011).

Wood Species Identification

D Druce

A programme to identify the species of wood was carried out on 812 samples from the *Principal* *palaeochannel* at Stainton West. Out of these, 171 came from the *Mesolithic organic deposit* (*Ch 3*), 15 from the *Mesolithic/Neolithic alluvium* (*Ch 6*) 344 from the *Earlier Neolithic organic deposit* (*Ch 8*), one from the *Earlier Neolithic alluvium* (*Ch 8*), and 281 from the *Later Neolithic organic deposit* (*Ch 10*). It should be noted that three-dimensional GIS modelling of the surveyed wood, as part of the broader post-excavation analysis process, suggested that a small proportion of that assigned to the *Earlier Neolithic organic deposit* might in fact have been originally from the *Mesolithic/Neolithic alluvium*. However, due to the equivocal position of this material, in terms of quantification, this has not been reassigned, but is instead retained as an element of the *Earlier Neolithic organic deposit*. No wood was recorded in the channel deposits associated with the *Mesolithic alluvium* (*Ch 6*) and the *Chalcolithic alluvium* (*Ch 11*), or from later deposits of alluvium, specifically the *Bronze Age alluvium* and the *Bronze Age/Iron Age alluvium* (*Ch 11*).

Relative abundance of wood taxa

Eight wood species were identified, of which two, birch and willow/poplar (*Salix/Populus*), were found only in the Neolithic organic deposits. The remaining six, alder, hazel, hawthorn-type, blackthorn-type, oak, and elm, were present in all the stratigraphic units, although a clear difference in relative percentages is apparent (*below*).

The *Mesolithic organic deposit* (*5290-5070* cal *BC*; *First Mesolithic organic deposit I'* to *4990-4870* cal *BC*; *'Last Mesolithic organic deposit I'*; *Appendix 20*) was clearly dominated by oak and hazel wood, with abundant elm (Fig 625). Even allowing for much of the alder/hazel wood being alder, the data suggest that this was relatively poorly represented in this stratigraphic unit, and although it had probably colonised the site, it had not become an established component of the local woodland. This is slightly at odds with palaeoenvironmental data suggesting that a major expansion of alder into northern and western Britain took place at about 7000 BP (*c* 5050 BC; Tallantire 1992). Therefore, for whatever reason, the expansion of alder at Stainton West seems to have taken place later (*below*). The moderate percentages of hawthorn and blackthorn-type wood (11% and 4% respectively) suggest some of the woodland bordering the channel was open and scrubby.

The relative percentages of the wood taxa in the *Earlier Neolithic organic deposit* indicate an assemblage slightly dominated by hazel, with almost equal proportions of alder, elm, and oak (Fig 626). A comparison with the data from the *Mesolithic organic deposit* shows that the percentage of hazel stayed broadly the same, though the increase in alder, and to a lesser extent elm, appears to be to the detriment of oak. The relative abundance of scrubby taxa decreased, although the number of indeterminate pieces increased significantly, which

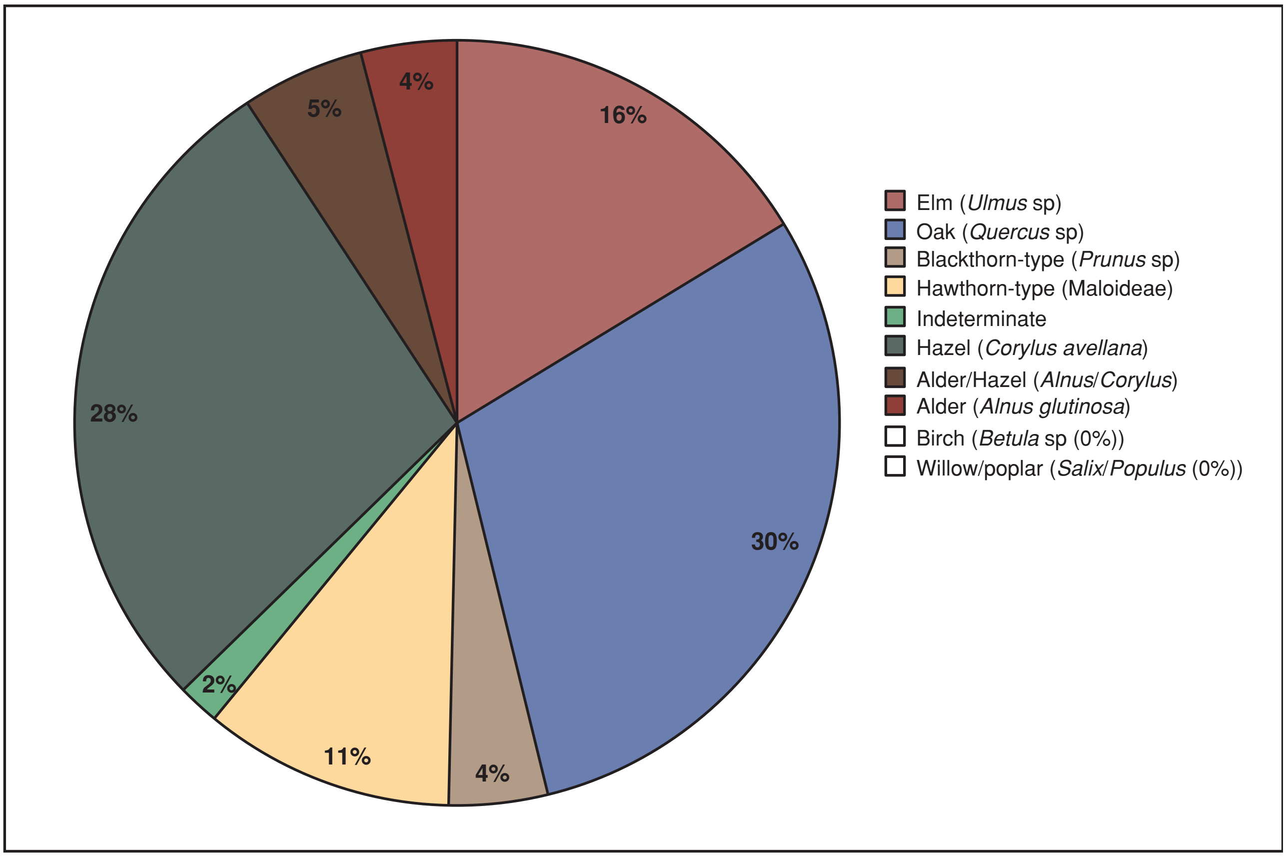

Figure 625: Relative abundance of wood taxa from the Mesolithic organic deposit *(n=171)*

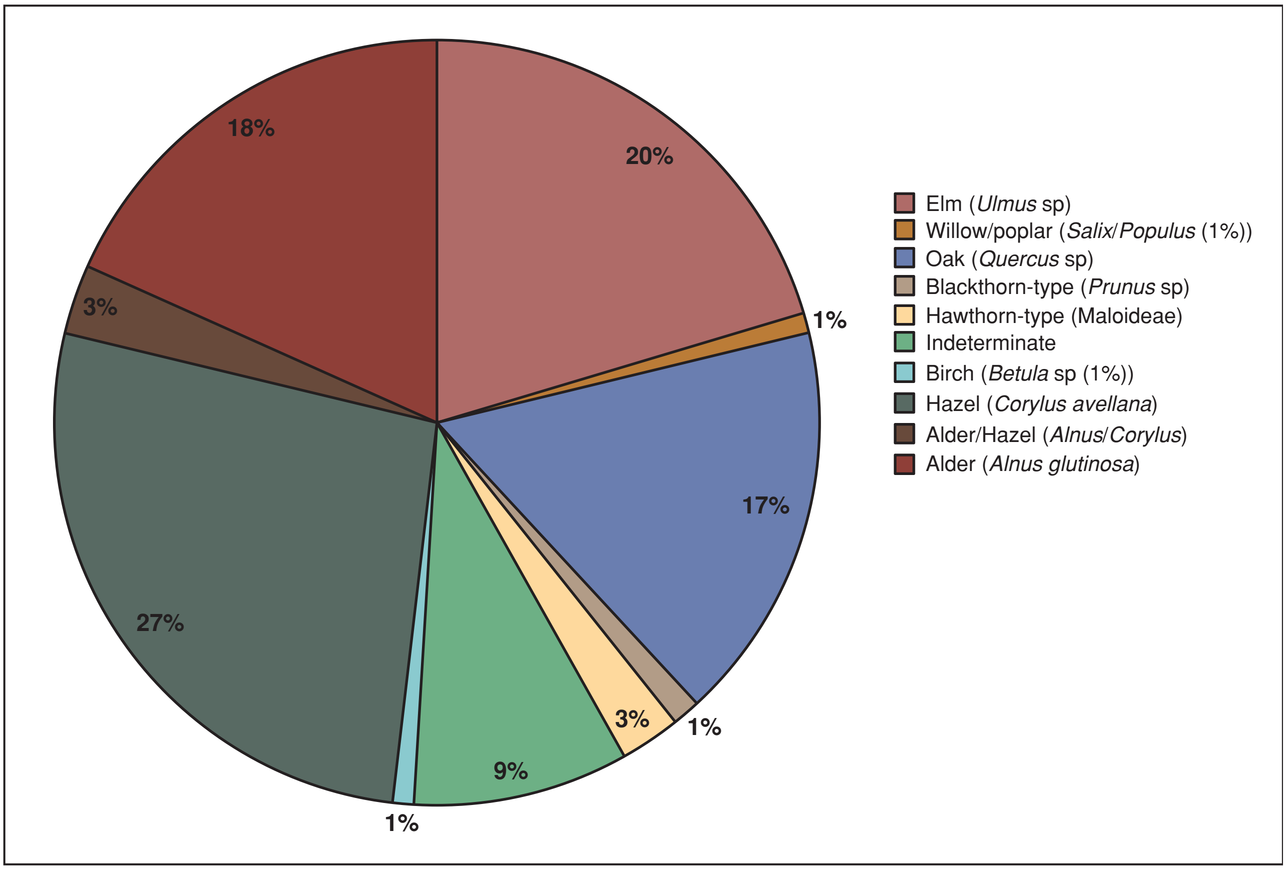

Figure 626: Relative abundance of wood taxa from the Earlier Neolithic organic deposit *(n=344)*

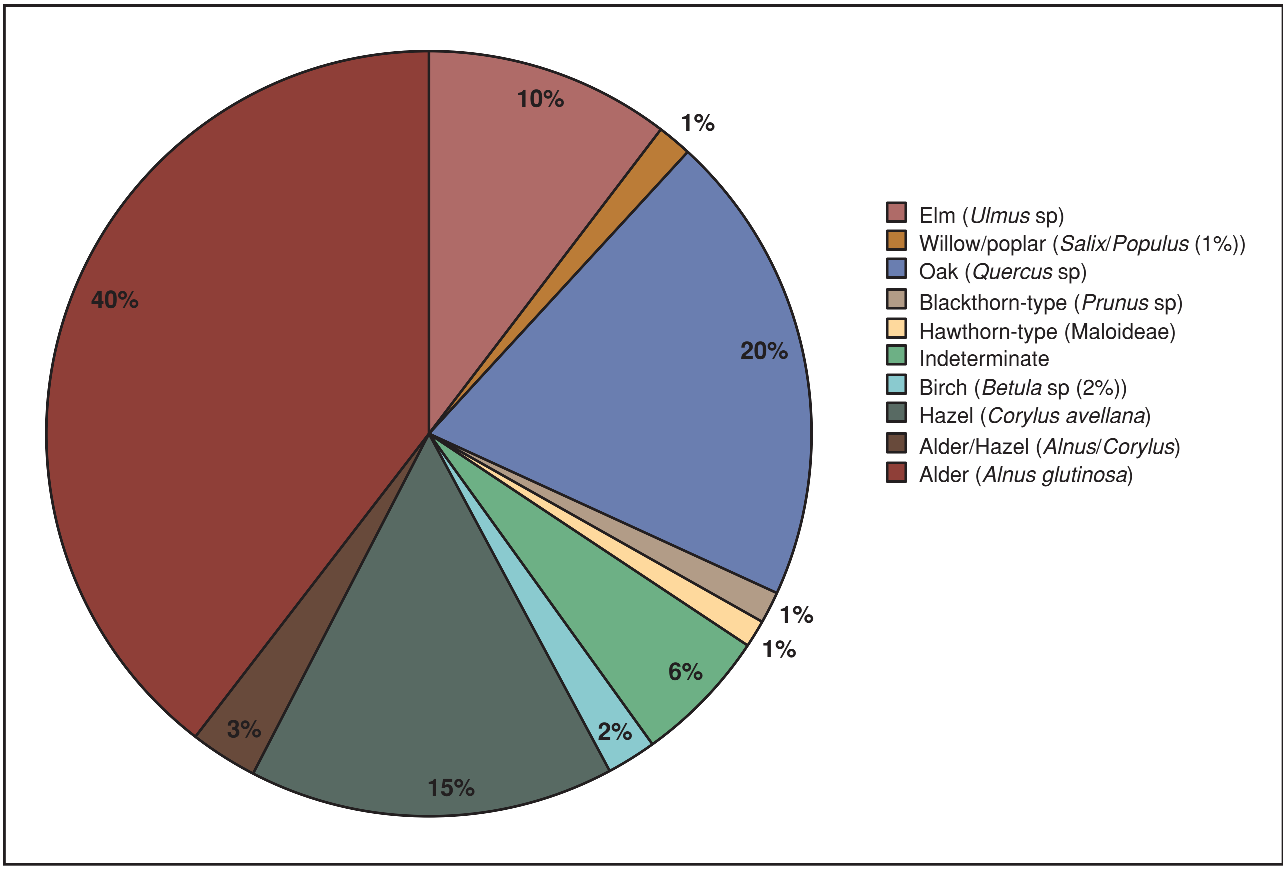

Figure 627: Relative abundance of wood taxa from the Later Neolithic organic deposit *(n=281)*

may have skewed the data slightly. Birch and willow/poplar were recorded for the first time.

The dominant wood type in the *Later Neolithic organic deposit* was clearly alder (Fig 627). Oak was still well represented, although elm and hazel appear to have decreased. Scrubby taxa, alongside birch and willow, were consistent, but at low levels.

Diameter

A comparison of the diameter of the wood from the stratigraphic units demonstrates a correlation between species and wood type (*ie* trunk wood, roundwood, or rootwood). Hazel roundwood dominated the wood in the *Mesolithic organic deposit* (Fig 628). The largest piece possessed a diameter of 150 mm, the majority being less than 100 mm. Oak, however, was represented by both roundwood and larger limbs or trunks, and included five pieces over 400 mm in diameter. The tree-ring data indicate that they ranged in age from 84 to 207 years. Whereas alder and blackthorn-type were represented only by roundwood, larger limbs or trunks of hawthorn-type and elm were also present. Although relatively little rootwood came from this deposit, it is noticeable that it consisted primarily of hazel. No oak rootwood was recovered.

Sixteen pieces of oak wood were recorded in the *Mesolithic/Neolithic alluvium* stratigraphic unit, which were dendrochronologically grouped as Cluster 2 (*Ch 6*). Analysis of the tree-ring sequence indicates that these timbers date to 4466-4144 BC inclusive (*Appendix 20*). This cluster appears to have come from a distinct phase of deposition in the *Principal palaeochannel*, and it is therefore potentially interesting that all are oak. However, the lower deposit associated with these pieces was initially described as being 'wood-free', but the remains of other wood taxa may have existed, such as the three elm twigs extracted from monoliths taken through this stratigraphic unit (*Appendix 20*).

The *Earlier Neolithic organic deposit* was clearly dominated by hazel and alder roundwood, accompanied by the larger limbs, or trunks, of a few oak and elm trees (Fig 629), though, unlike the *Mesolithic organic deposit*, hawthorn-type wood was confined to smaller roundwood. Large trunks were less evident in the *Later Neolithic organic deposit* (Fig 630?), those present including a single oak (**75290**), whose tree-rings indicated that it was 95 years old, and a large alder trunk (**75732**), which, being over 500 mm across, would, by today's standards, be classed as a veteran tree (DEFRA 2007). Rootwood, dominated by alder, was also more common in the *Later Neolithic organic deposit* (*below*), which strongly suggests the development of alder woodland immediately adjacent to the river channel.

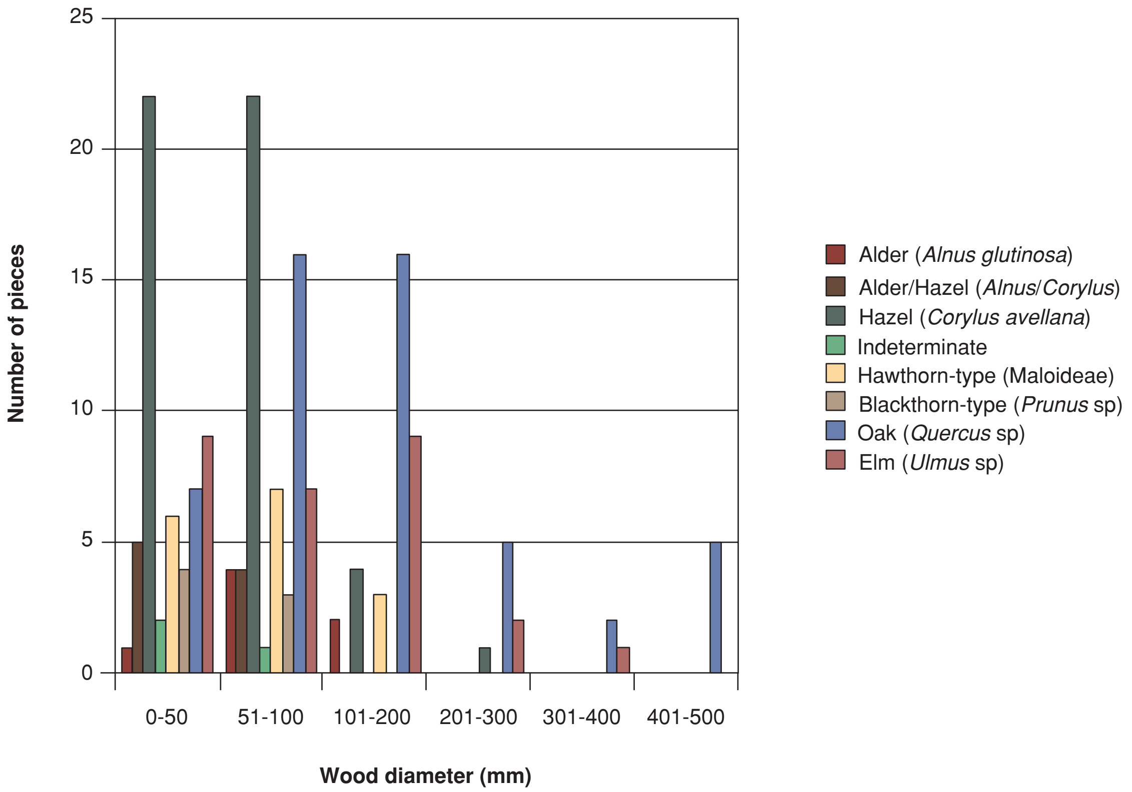

Figure 628: Diameter of the wood from the Mesolithic organic deposit *(n=170)*

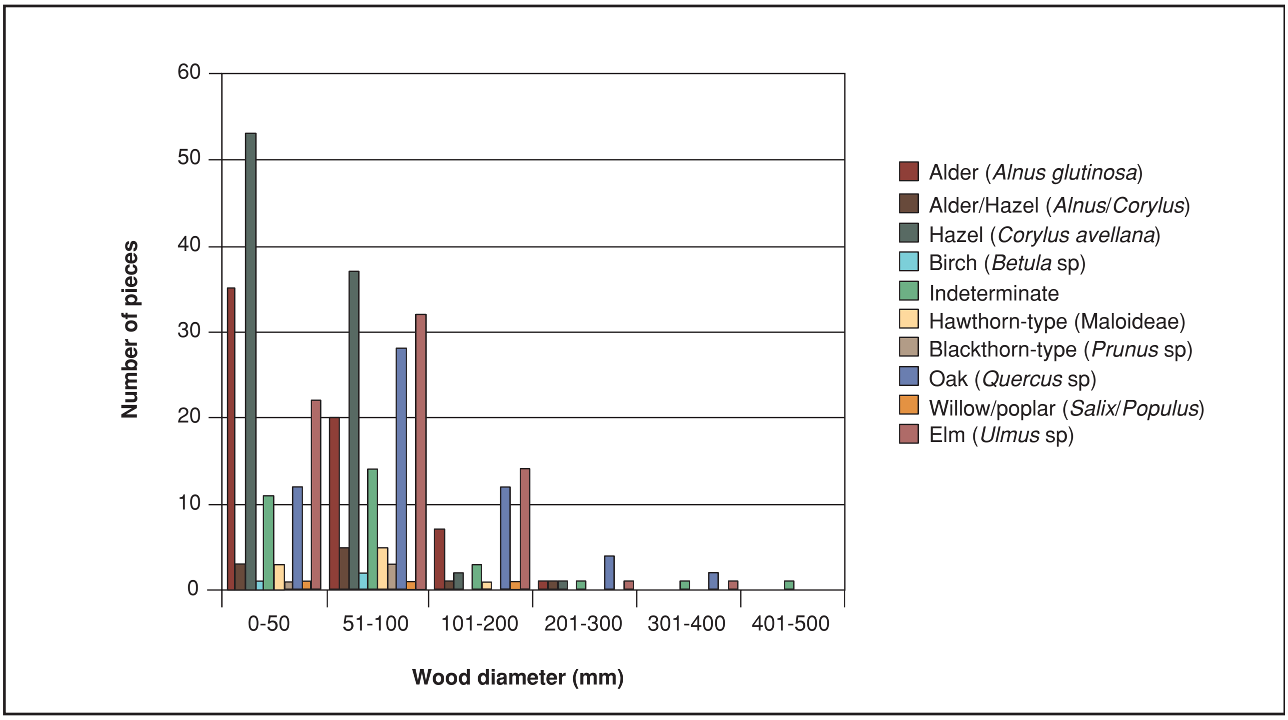

Figure 629: Diameter of the wood from the Earlier Neolithic organic deposit *(n=343)*

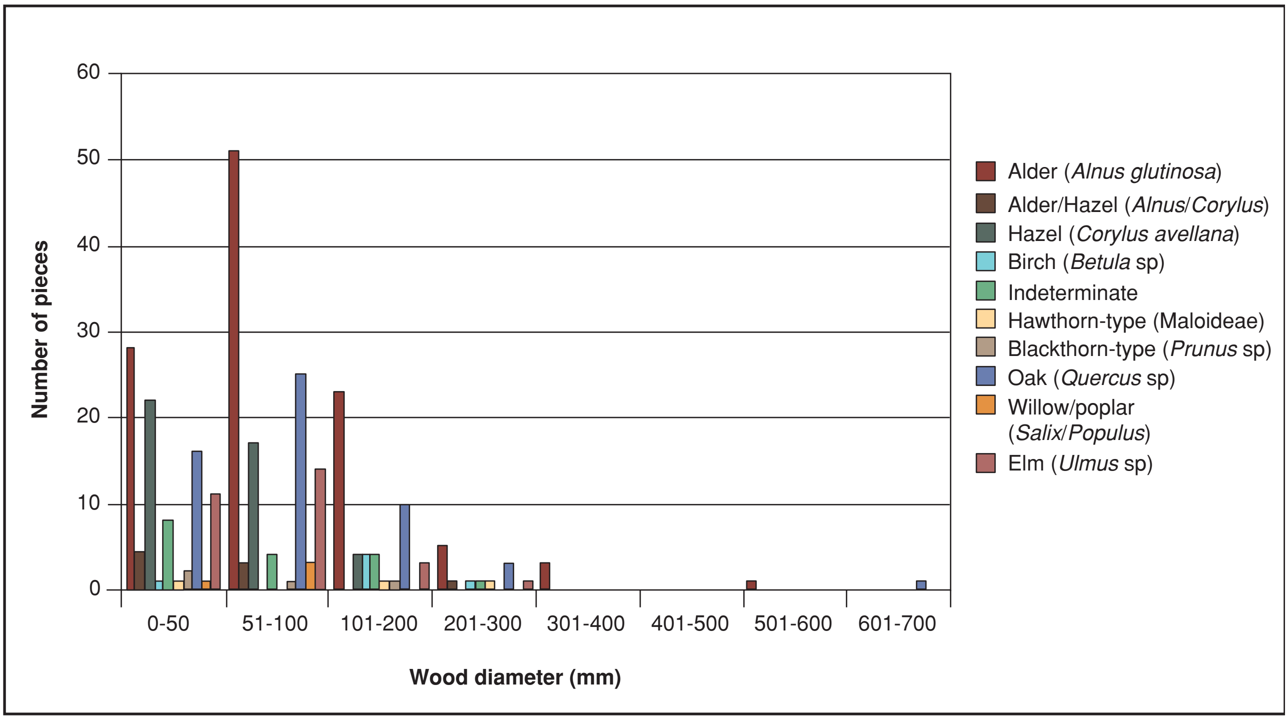

Figure 630: Diameter of the wood from the Later Neolithic organic deposit *(n=280)*

The altered/worked wood

Much of the altered/worked pieces of wood from all the stratigraphic units in the *Principal palaeochannel* appear to consist of oak. This comprised both culturally modified and beaver-gnawed oak in the *Mesolithic organic deposit*, classified as timber, and debris, which included possible oak burr-wood blanks that were intended to be made into bowls. Similarly, worked oak timber was present in the *Mesolithic/Neolithic alluvium*, whist four oak artefacts were recovered from the *Earlier Neolithic organic deposit*, and another oak from the *Earlier Neolithic alluvium*. In addition, a vertically driven oak timber, with a worked end, might have been associated with the *Later Neolithic organic deposit*.

Hazel, in the form of possible coppiced rods, was also extremely abundant in the *Earlier Neolithic organic deposit*, including a collection of roundwood used in the construction of various structures within the *Principal palaeochannel*. Significantly, only a small number of the worked/altered pieces from this stratigraphic unit were identified as alder, which is surprising, given the relatively high percentage of alder wood in this stratigraphic unit (18%). Similarly, elm, which was also relatively abundant throughout the *Principal palaeochannel* deposits (10-20%), does not appear to have been favoured for construction or woodworking, either by humans or beavers.

Burnt/charred wood

Oak appears to comprise the majority of the burnt/charred pieces of wood throughout the *Principal palaeochannel* (that is larger hand-recovered pieces rather than fragments from the bulk samples), and a comparison of its size between stratigraphic units is interesting. For example, although the trunks or large limbs of mature oaks were present in all three of the main units, larger pieces were, primarily, only recovered in a burnt or partially charred state from the *Mesolithic organic deposit* (Fig 631). This layer contained seven pieces of burnt wood, of which four were oak, two elm, and one hawthorn-type. All four of the pieces of oak comprised large limbs or trunks, at least 285 mm in diameter, and at least 84 years in age, the largest (**76426**; *Ch 3*) having a diameter of 495 mm, and being at least 207 years old. Two of these oaks also showed evidence of working (**76422** and **76425**). In contrast, the largest piece of burnt wood (**76047**; *Appendix 20*) to come from the later layers was from the *Earlier Neolithic organic deposit*, and, with a diameter of only 130 mm, was more likely to represent branchwood. Most of the burnt oak wood from the Neolithic deposits consisted of relatively small roundwood/branchwood.

Discussion

Analyses of the waterlogged wood from the *Principal palaeochannel* have identified changes in the composition of the wood over time. Associated with these are patterns in the nature of that deposited in the river channel, which, in turn, may provide an insight into their likely taphonomy. The study of the altered wood (including burnt pieces) indicates a preference for the use and burning of specific wood types.

In summary, hazel branchwood, or possible coppice, up to 100 mm in diameter was the dominant wood

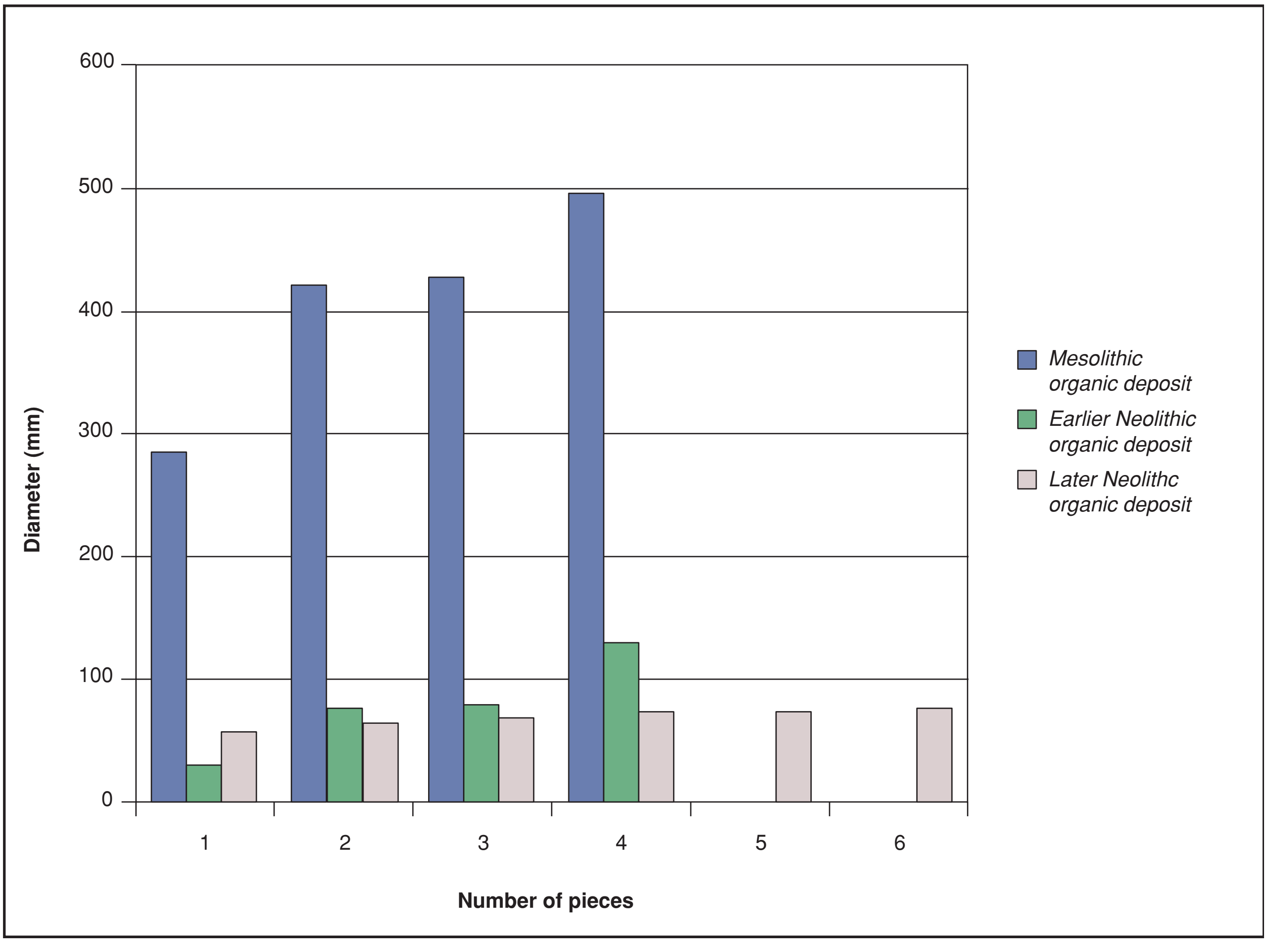

Figure 631: The number and size of burnt oak pieces from the Principal palaeochannel

type in both the *Mesolithic organic deposit* and *Earlier Neolithic organic deposit*. Oak and elm were also well represented in these layers; however, unlike hazel, they existed as both smaller branchwood and probable trunk wood. If it is assumed that these larger limbs/trunks arrived in the river channel from relatively nearby, then the lack of larger limbs/trunks of hazel is intriguing, especially given the dominance of its roundwood and the presence of hazelnuts. One possibility is that there was a genuine absence of large hazel trees close to the channel, as most of the hazel in the area had been coppiced. Alternatively, it is possible that the larger, mature hazel trees were growing close to the channel and were preferentially retained, to supply hazelnuts to the early prehistoric communities of the area.

Alder (dominated by roundwood) was poorly represented in the *Mesolithic organic deposit*, although it significantly increased in both of the Neolithic organic deposits. All three of these stratigraphic units in the *Principal palaeochannel* produced some blackthorn and hawthorn-type wood, which, alongside ash, indicate that much of the woodland adjoining the channel was open and scrubby. This may have been a consequence of its marginal nature (*ie* adjoining a river channel or floodplain); however, there is no doubt that humans and/or animals would have, perhaps opportunistically, played a part in opening up the woodland canopy.

Significantly, most of the larger pieces of burnt/charred wood, some of which showed evidence for working, were from the *Mesolithic organic deposit*. Short of hearths/bonfires being lit in the channel itself, which seems unlikely, this material may represent the remains of felled oak, elm, and hawthorn-type woodland that was growing adjacent to the river channel.

There appears to have been a clear preference for the use of oak and hazel for woodworking and/or construction (be it by humans or beavers). In contrast, alder, which is well-represented in the unworked Neolithic assemblages, does not appear to have been favoured for woodworking activities.

Larger limbs/trunks of trees were less evident in the *Later Neolithic organic deposit*, and, perhaps significantly, this stratigraphic unit produced the only obvious alder trunk recorded. This layer also produced the most rootwood fragments (also dominated by alder), consistent with the general spread of alder woodland at the site during the later periods of infilling of the *Principal palaeochannel*.