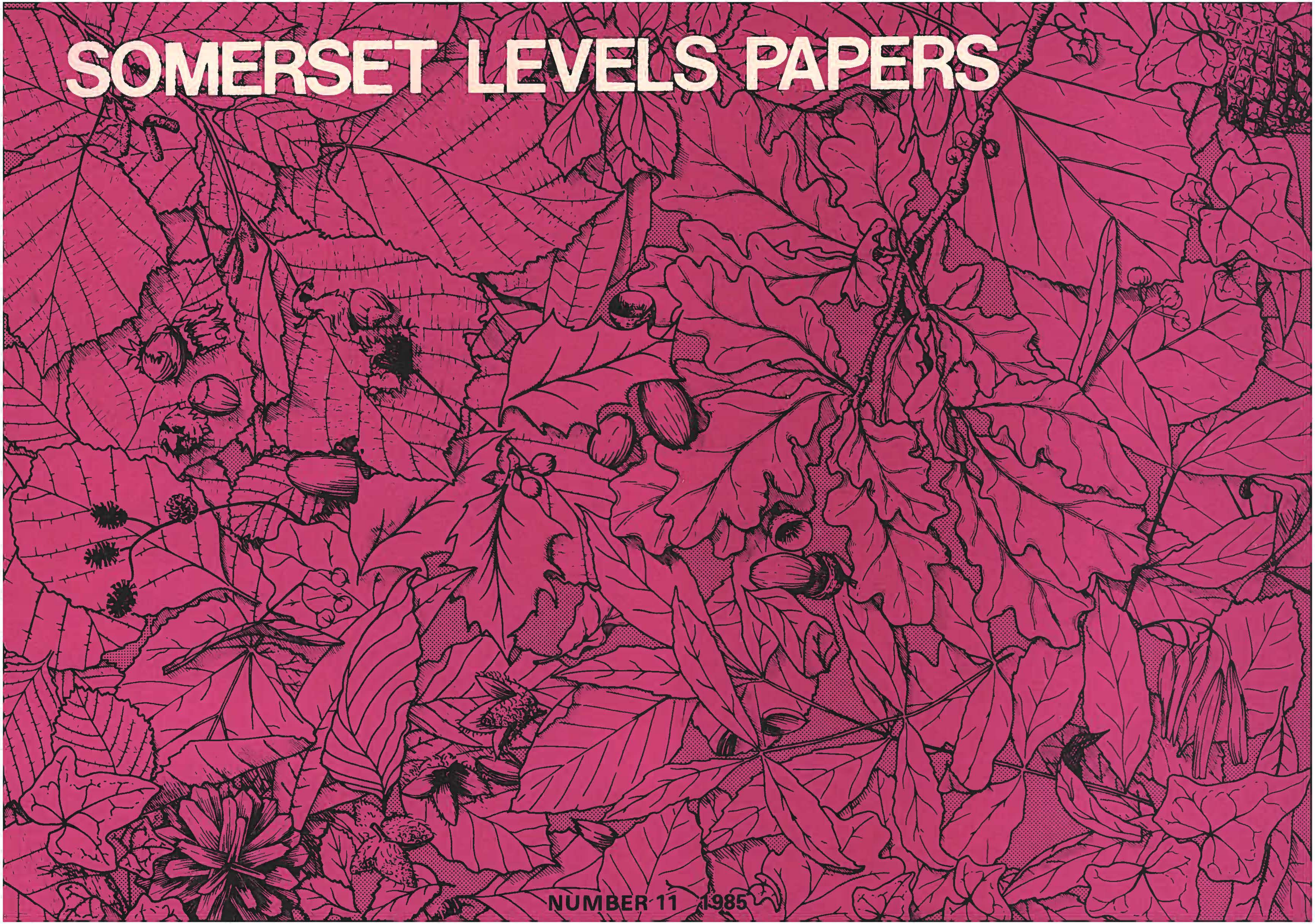
SOMERSET LEVELS PAPERS



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Communications regarding the Somerset Levels Papers to:
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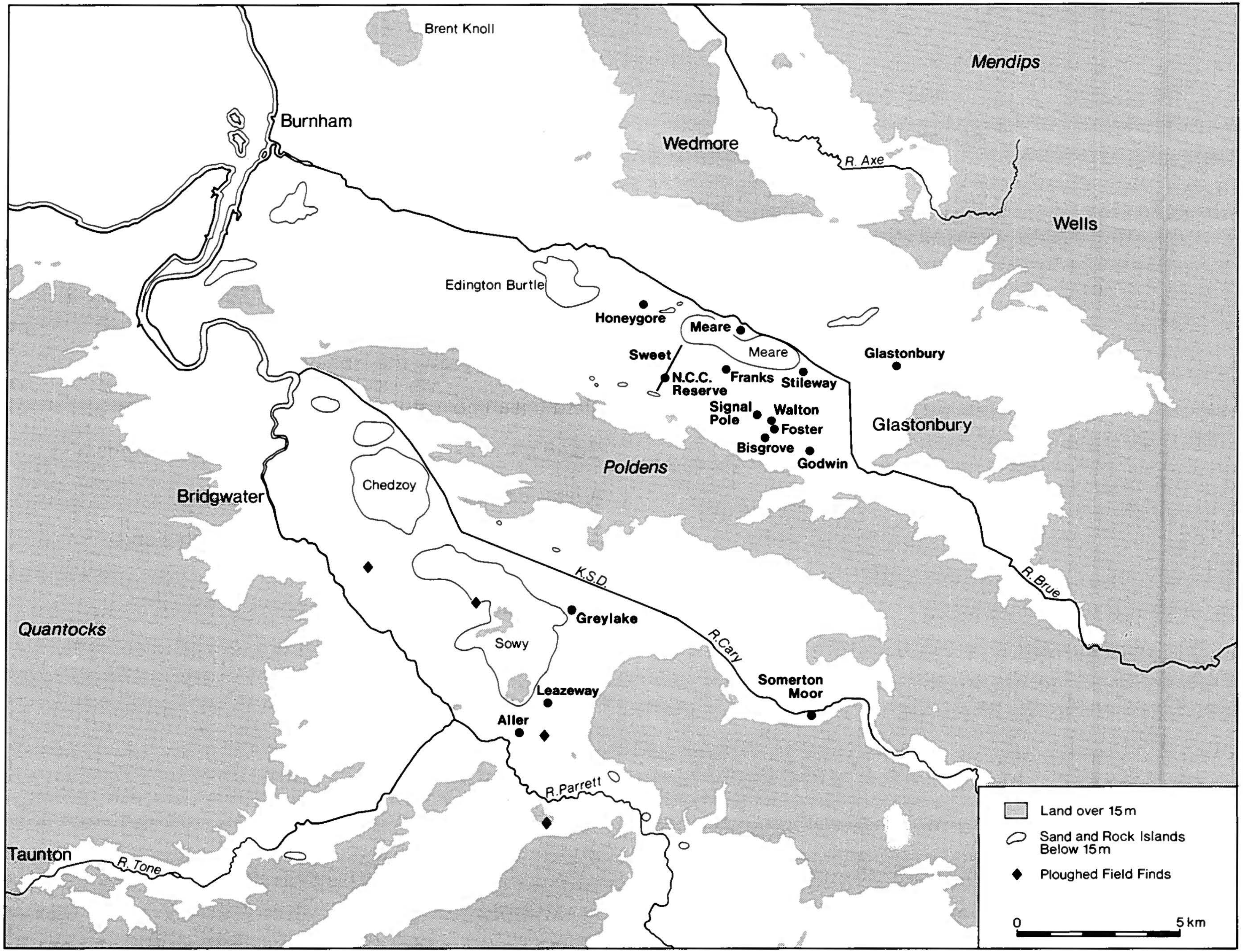


Fig. 1 The Somerset Levels. Sites reported in these *Papers,* and discoveries and work in 1984, are marked.

ARCHAEOLOGY IN THE SOMERSET LEVELS 1984

by J. M. COLES and B. J. ORME

(with a contribution by G. B. O'Hare)

Throughout the year, fieldwork continued in the Brue valley and on Sedgemoor, with particular attention being paid to areas of peat-cutting, new and freshly-cleaned ditches, ploughed fields, and pasture land where drainage has been intensified. Sedgemoor discoveries are outlined below; in the Brue valley many small finds were recorded, and previously unknown wooden structures were found on Meare Heath and on Walton Heath at three sites called Franks, Foster's Walton and Bisgrove (fig. 1). These three structures were excavated prior to peat-digging in the course of the summer. In April, the Project carried out further excavations at Meare, on the western edge of Meare East, on the eastern edge of Meare West and in the area between the two groups of mounds. In September, three small areas were examined at Glastonbury with the permission of the Glastonbury Antiquarian Society. At both sites, it proved possible to locate previously unrecorded excavations, and to retrieve evidence relevant to the interpretation of earlier work. All the excavations were accompanied by a full environmental sampling programme, and in addition the area around Meare was extensively investigated in the early months of the year by the Project's palaeoenvironmentalist A. E. Caseldine, assisted by S. Burn. The Glastonbury investigations were carried out in conjunction with R. A. Housley's research, funded by S.E.R.C., on the environment and the economy of the settlement.

The policy of scheduling selected areas of the Levels, to aid their survival for the future, was continued through the year, and additional parts of the Sweet Track and the Abbot's Way are now protected from peat-cutting in this way; future drainage problems remain. Post-excavation work, largely carried out in Exeter by S. Rouillard, covered many areas including analysis of the pottery from earlier excavations at Meare, and the preparation of the illustrations for the reports published in these *Papers*. Identification of wood samples, and macroscopic and microscopic work on peats and pollen, was undertaken through the year by A. E. Caseldine. Beetle studies were carried out by M. A. Girling of the Ancient Monuments Laboratory, and tree-ring analyses by R. A. Morgan in the Department of Prehistory and Archaeology, University of Sheffield.

Conservation

Conservation of prehistoric wooden artifacts in the Project's laboratory continued through the year. Tanks loaded in February were emptied in September and October, and no real problems were encountered in the PEG processing of Neolithic and Bronze Age wood. An oak plank from the Sweet Track (Turbary site), too long for the Project's tanks, was sent to the Conservation Laboratory, York Archaeological Trust, for treatment by PEG; this operation is financed by the City Museum, Bristol. In the re-organisation of the Project's storage sheds, a quantity of early Neolithic wood held since 1981 was cleaned and re-boxed for future conservation experiments. Several other heavy Neolithic artifacts are still undergoing cold PEG conservation (since 1977) in the Project's laboratory.

Shapwick Heath Nature Reserve

The dry spring and summer of 1984 posed serious problems for the Sweet Track within the Shapwick Heath reserve, due to the drying-out of the peats covering the structure. Although pumps were installed by N.C.C. and the Eclipse Peat Works, bringing water onto the Reserve, parts of the 545m-long stretch of the Sweet Track were subject to desiccation at intervals and in some cases throughout March–September. Table 1 is a representation of the twice-weekly readings of water levels in relation to Track wood, during most of the year. The Project has installed tubes and boxes at intervals along the line of the Track, at various metre-marks from 003m northwards to 545m, and Table 1 demonstrates that the southern 14m at least are now severely desiccated, and (more seriously) a full 150m at the north has been subjected to water levels barely above or in some cases below the wood for much of mid-1984. The Project hopes to investigate the extent of the damage in 1985, and if it seems severe, then perhaps an extremely large excavation and conservation programme will have to be initiated on this scheduled monument.

TABLE 1 Shapwick Heath Nature Reserve. Water Levels 1984

	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
North 545		—	x	•	x	—	—	•
524		—	x	•	x	—	—	•
500		—	x	•	x	—	—	•
452		—	x	•	x	—	—	•
445		—	—	•	x	—	•	•
396		•	—	•	—	•	•	•
381		•	—	•	—	•	•	•
294					•			
256								
239								
192					•			
141								
118								
014			•	x	x	x	x	x
South 003	x	x	x	x	x	x	x	x

Notes: Readings averaged for each month from 8–10 readings taken at stations along track at metre marks 003–545m.
Table 1 is not to scale.
x: water level at or below track wood
—: water level within 5cm of track wood
•: water level within 10cm of track wood
no entry: water level over 10cm above track wood

The Sedgemoor survey 1983–84 (by G. B. O'Hare)

The Project continued its survey of Sedgemoor over the autumn and winter of 1983–84, following the work begun in 1981 and 1982 (Coles and Campbell 1982; Coles and Orme 1983). The work involved walking of ploughed fields on higher ground bordering the moors and on the "islands" within them, and inspection of recently cut or cleaned rhynes (drainage ditches) for wooden structures on the moors themselves. The survey was extended to cover the whole of Sedgemoor, i.e. all peat within the Somerset Levels south of the Polden Hills. A substantial number of farmers were contacted in the course of this work.

A total of forty-seven ploughed fields were walked at 10 metre intervals in an attempt to find surface scatters of flint and pottery indicative of prehistoric settlement. Thirty of these were on "islands" completely surrounded by the peat moors, thirteen on higher ground sloping down onto the moors, and four on the peat itself. Of the former, twenty-five were on Sowy Island around the modern villages of Westonzoyland, Middlezoy and Othery, and the rest on other, smaller islands. Of those ploughed fields on higher ground, six were on the very edge of the Quantock Hills, six on the Stoke St. Gregory "peninsula" and one on Aller Hill at the extreme eastern edge of the area covered.

In most of the 21 fields where finds occurred, these were widely dispersed. However, slight concentrations were found at the following:

ST 38802691 on Oath Hill. Roman, post-Roman and Mediaeval pottery, and two flint flakes.

ST 38542937 on Aller "island". Six flints, including two scrapers. On the peat to the south a further six flints were found.

ST 33853494 Penzoy Farm, Westonzoyland. Eleven flints, six of them definitely worked, one a broad-blade microlith.

ST 36643406 Westonzoyland Airfield. Seven Romano-British sherds. Within 50 metres of a known excavated R.B. cemetery site.

It will be evident from the above that although few fields are ploughed in any one year, nearly half of those that were inspected in 1983–4 yielded material of archaeological interest, suggesting a high level of ancient occupation and use of the land bordering the moors.

Virtually all fields on Sedgemoor are bounded by "rhynes" which serve both as drainage channels and as water fences. These are cleaned out periodically, either by hand or, more usually, machine, revealing the sides more clearly and resulting in the dumping of debris from the ditch along its banks. More rarely, rhynes are completely recut, or new ones are dug. As there is no peat-cutting on Sedgemoor, ditch-cleaning and cutting provide the best opportunities for observing archaeological remains. Most fields can be reached from one of the many droves which cross the moors, and every drove on Sedgemoor was walked at least once to search for ditching activity. Worked timbers were found at four locations. A piece of roundwood with a worked end, two large stakes, and a board with worked end and hole were found along Leazeway Drove on the western side of North Moor, and a possible trackway or platform was found on the eastern side, north-west of the village of Aller. Isolated finds were also made at Somerton Moor and Greylake. The latter find, a large stake, was in the same general area as the brushwood structure excavated there in 1982. In addition, samples were taken from a number of bog oaks for tree-ring study by R. A. Morgan.

The Project acknowledges with thanks financial support from the Historic Buildings and Monuments Commission, from the Universities of Cambridge and Exeter, and from the Maltwood Fund for Archaeological Research in Somerset, administered by the Royal Society of Arts. The tree-ring work is also funded by H.B.M.C. The Eclipse Peat Works (Fisons plc, Horticultural Division) continued to give valued assistance, especially in the provision of office space, and much other local support is gratefully acknowledged. We are pleased to note that both the Museum at the Willows Garden Centre and the reconstruction of the Abbot's Way behind the E. G. Godwin Peat Industries Ltd. continue to attract public interest as well as forming a focus for many field trips and Society visits to the Levels.

Note added in proof

In October 1984, a long stretch of the Meare Heath track was found to be preserved in an area of intensive peat-cutting, from *c*140m north of the South Drain. Wood was revealed earlier in the year, but it was thought to be redeposited pieces of track wood, left behind in the 1930s–1950s peat-cutting operations observed by Bulleid and Godwin. By late summer, when the peat had dried out, it was clear that some wood remained *in situ*. Excavation in early November by S. Loxton and A. Brown revealed a quantity of trackwood, some of it well-protected by peat. In view of the substantial length of track still remaining, Fisons plc agreed to delay peat-cutting until after a full-scale excavation has been carried out, probably in March–April 1985.

An international group organised by D. Grattan (Ottawa) and F. Schweingruber (Zurich) to investigate comparative methods for the treatment of waterlogged wood began its work in late 1984; the Project is participating in this by supplying identical samples of Neolithic wood to various laboratories. Selection from the stored Sweet Track roundwood was made in November 1984, and after recording, samples were sent to conservation laboratories in Canada, Australia, Japan, Denmark, Germany and England; the results of the analyses for degradation and conservation will be important for the development of new methods for the treatment of waterlogged wood.

PREHISTORIC WOODWORKING FROM THE SOMERSET LEVELS: 2. SPECIES SELECTION AND PREHISTORIC WOODLANDS

by B. J. ORME and J. M. COLES
with drawings by S. E. ROUILLARD

This is the second of four papers concerned with prehistoric woodwork from the Levels. The first, Timber, appeared in *Papers* **9** (Orme and Coles 1983); the third, Roundwood, follows this paper, and the fourth, Implements and Composite artifacts, will appear subsequently.

In order to analyse prehistoric man's use of wood, and in particular his selection of species, it is necessary to identify the woods found associated with human activity and then to consider the local natural habitats and likely frequency of the species. It is assumed that wood was not transported any distance—large trunks because of their weight, and roundwood because local supplies were probably abundant. Some artifacts would of course have been transported, notably boats and carts but also tools and weapons. Consideration of the ecology of the species found at a site should therefore give an indication of whether the wood was cut at random in the nearest forest, or whether certain species were picked out, and whether indeed all the species could have been found growing together. The following notes outline the habitats and present or recent uses of species recorded from the Levels. These established, the selection of species at particular sites will be considered, in chronological order. Reference to Table 2 will be found useful throughout.

Many of the tree species native to the British Isles will tolerate unfavourable conditions, to which they are often subject when planted in gardens, but assuming that prehistoric people did not plant trees (although they managed some species), germination was natural and therefore probably in those conditions best suited to the species. Present-day observation of these is not entirely relevant since so many factors have altered, from climate to browsing animals, with loss of some habitats and the appearance of new ones such as motorway banks. For these and other reasons, the behaviour of groups of tree species may be a more reliable guide than that of individuals. Understanding of the probable differences between present-day patterns of tree growth and those of the past has been greatly advanced by the work of Godwin (1956; 2nd edition, 1975 used here) and Rackham (1980), and it is evident that some complex changes in tree ecology may have taken place. Huntley and Birks' pollen maps (1983) trace the broad fluctuations of species across Europe in the Postglacial, but have not proved appropriate to the local scale of investigation undertaken here (see *Carpinus* and *Fagus* below). References to individual sites are not given in the species section of this paper, but in the following section the evidence from the sites is discussed chronologically, from *c*3000 bc to ad 200, as in Table 2.

SPECIES SELECTED

Acer campestre: Maple, Field maple. Maple is known in Britain from the Neolithic onwards; its relatively late expansion cannot have been helped by its resistance to shading and poor colonising ability and one wonders how it came to increase at all, since most species that expanded late can be seen to have been favoured by human activity of one sort or another. It is now found mainly in relatively dryland habitats, though tolerating a range of groundwater conditions, and it is associated with ash and hazel woods (Rackham 1980, 203ff). It can be coppiced. The modern or recent uses of the wood, for bowls, furniture and musical instruments, suggest it would be of greater value for artifacts than structures.

In the Levels, it is identified only from sites later than 2000 bc, and it is never common, except amongst the charcoals identified from Meare Village West. This indicates that species selection for fuel was governed by different factors to selection for structural purposes, and emphasises that identification from structures does not provide a complete guide to contemporary woodland. This aspect will be discussed further below, in relation to Meare Village West.

Alnus glutinosa: Alder. Alder has flourished locally for millennia, preferring not too acid soil where there is movement or seepage of water. It will tolerate sporadic but not prolonged waterlogging, and is often found on the banks of streams and rivers, and also in damp woodland. It responds well to coppicing. Modern and recent uses of the wood include clogs and other carved objects, and scaffolding poles; it has been valued for its durability when permanently waterlogged, e.g. as piles, but it rots quickly if exposed. Rackham comments on alder's "qualities of lightness, straightness and ease of sawing for which we now value conifers" (Rackham 1980, 305). Using an axe and wedges, it is one of the easiest species to fell and to split.

In the Levels it has been identified from sites of all periods, but particularly those after *c*2500 bc; it is often a common or dominant species except where birch is the dominant or, to a lesser degree, hazel. Buried in the peat, the thin bark retains its silvery appearance, although the wood may have the consistency of soft butter. Younger alder will maintain its strength better than older pieces; when partly dried out, as on the Abbot's Way, the alder becomes brittle.

	Acer	*Alnus*	*Betula*	*Carpinus*	*Clematis*	*Corylus*	*Cornus*	*Fagus*	*Fraxinus*	*Frangula*	*Hedera*	*Ilex*	*Malus*	*Myrica gale*	*Pinus*	*Populus*	*Prunus spinosa*	*Prunus avium*	*Quercus*	*Rhamnus*	*Salix*	*Sorbus*	*Taxus*	*Tilia*	*Ulmus*	*Viburnum*		
Sweet		C	R	R?		D	R		C		R	C	R?			O			D		O		R	O	O		Sweet	*c*3000 bc
Bisgrove			D																		R						Bisgrove	
Honeygore			D			C																					Honeygore	
Chilton			D			O																					Chilton	
Walton 83						D			R																		Walton 83	
Baker		D	O			O			O										R		O						Baker	
Bell A			D			C			O																		Bell A	
Bell B			C			C			C														O				Bell B	
Honeybee						D																					Honeybee	
Honeycat			D			O																					Honeycat	
Honeydew			D																								Honeydew	
Jones			D			O			R																		Jones	*c*2500 bc
Burtle Br.			D																								Burtle Br.	
Garvin's		O	D			C			O																		Garvin's	
Walton		O	O	R		D									R				R		O				R		Walton	
Rowland's		R	O			D																					Rowland's	
Blakeway						D		R																			Blakeway	
Signal Pole			D																								Signal Pole	
Abbot's Way		D	O			O			O										R		R				R	R	Abbot's Way	*c*2000 bc
East Moors						D																					East Moors	
Eclipse	R	R				D	R		R										R						R	R?	Eclipse	
Meare Heath		C	O		R	C			R								R		D	R	O	R	R		R	R	Meare Heath	*c*1500 bc
Tinney's		D	O			R			R	R				R					O		O		R			R	Tinney's	
Godwin's		D	O																R		O						Godwin's	
Stileway		D	C			C										O											Stileway	*c*1000 bc
Westhay			D																								Westhay	
Withy Bed	R	C				O			R										O		O	R					Withy Bed	
Viper's	O		D																O								Viper's	
Nidon's			D?																C								Nidon's	
Tollgate						D																					Tollgate	
Platform		R	D																								Platform	
Skinner's	R	C	C			C																					Skinner's	
Shapwick	O	O				C		O	R																	R	Shapwick	*c*500 bc
Meare West	R	C	R			R			R							R	R	R	C		R	R		R			Meare West	
Glastonbury		D	O			O			O				O				O		D		O					O	Glastonbury	
Difford's	R	C	C			O			R					R			R				O						Difford's	bc/ad

TABLE 2 Species of wood identified from structures in the Levels

Note: D, dominant; C, common; O, occasional; R, rare.

Betula, B. pendula and/or *B. pubescens:* Birch. It has not yet proved possible to identify the birch from the Levels to a specific one of the two native trees (e.g. Orme, Caseldine and Morgan 1982). Both could well have been present. Birch, a light-demanding species, flourished early in the Postglacial and has maintained a strong hold locally ever since, being a highly efficient coloniser and favoured by abandoned clearings. *B. pendula* grows best on dry ground, when it may reach 35m; *B. pubescens* will grow in fen wood, on poor and wet soils, and it colonises raised bog, reaching up to 25m (Vedel and Lange 1973, 141–143). One might therefore expect the Levels birch to be *B. pubescens,* both for the fenwood phase and after the development of raised bog from *c*2000 bc; the 2 species will however grow together. Birch can be coppiced, and its wood can be put to many uses; it rots quickly.

Using axes, birch is one of the more awkward trees to fell and process. Nevertheless, it has been identified from more Levels sites than any other species, from the Neolithic onwards; on half of these it is the dominant species, sometimes with hazel also common, but with alder never more than occasional. Exceptions to this dominance are those structures built of planks (Sweet and Meare Heath) or hurdles (numerous) where other species were more suitable. In deeper peats its bark remains shiny and bright, although the wood is soft and rather spongy.

Carpinus betulus: Hornbeam. Hornbeam is another species to have expanded relatively late in the Postglacial and it is now found mostly in the south and east of Britain (Godwin 1975, 264–267). It grows slowly, mainly on acid soils with a medium clay content, and Rackham suggests that it may have replaced lime, (Rackham 1980, 235), a species with similar ecological preferences. Hornbeam will grow on damp soils but prefers continental to maritime conditions. Historically, it has been most valued for fuel, for which it was coppiced. The wood is heavy, tough and hard, difficult to work but durable and it has been used for tool handles, screws, pegs and yokes.

It has been identified from only 2 sites in the Levels, both Neolithic, and its presence is rare on both sites; one of these is the Sweet Track. Nevertheless, it is attested by its wood at a time when the fossil pollen maps of Huntley and Birks (1983, 154–155) would suggest the nearest hornbeam was in south and east Europe, further away than the source of the jade axe. Godwin, however, notes the discrepancy between pollen and macro records (1975, 266) and takes it to be growing in Somerset from the Neolithic.

Clematis vitalba: Old Man's Beard, Travellers' Joy. Travellers' Joy is generally held to be a species of calcicolous or limestone soils, along with privet, wayfaring tree, dogwood and spindle (e.g. Rackham 1980, 215). It grows up other trees and is not itself independent and freestanding. Despite its calcicolous preferences, it is found at present in small patches of woodland in the Levels. It has greater potential value for man as a substitute for string and rope than as wood for structures or artifacts.

It has been identified only from one site in the Levels, the late second millennium Meare Heath Track, where it was associated with a wide range of species, and it probably grew up one of these.

Cornus sanguinea: Dogwood. Dogwood grows as a shrub, up to 4m tall and is found now mostly in southern Britain although it reached south Wales and Ireland relatively early in the Postglacial. Both Rackham and Tansley describe it as a calcicolous shrub, though disagreeing on its association (Tansley 1968, 96) or lack of it (Rackham 1980, 74) with alder buckthorn. Like most shrubs, it grows best on woodland margins or where there is an opening in the canopy. No comment is made on its reaction to wet soils but it would seem to favour drier habitats than the guelder rose. Its wood is described as hard and horny (Vedel and Lange 1973, 192), hence its use for skewers or daggers.

The wood has been identified from two sites in the Levels, Sweet and Eclipse, both of which have a wider than normal range of roundwood species dominated by hazel. It also occurs as charcoal at Meare Village West.

Corylus avellana: Hazel. Hazel tolerates a wide range of conditions from dry to wet (but not waterlogged) and from basic to moderately acid soils. Godwin suggests fresh calcareous soils and oceanic conditions as optimum for hazel growth (1975, 272) and both he and Rackham note the species' ability to grow as a tree as well as the shrub so commonly found today. To flower, it needs light. Although generally associated with oak, as coppice or understorey to oak standards, Rackham stresses its natural associations with ash and maple (1980, 203). It responds well to coppicing, and traditional uses include thatching spars and wattling both of which make use of the fact that hazel can be twisted and bent without snapping. Its wood is soft and easy to split, but remains tough and flexible at pole size. After one or two years' exposure it snaps easily, but if kept dry and stable it retains its strength for many seasons.

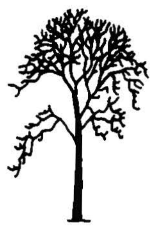
In the Levels, hazel has been found as commonly as birch; it has been identified from 27 of the 36 sites under consideration and was dominant or common at more than half of these, being the sole species identified from three structures (Honeybee, East Moors and Tollgate). Its dominance at 6 of the sites is due to its extensive and almost exclusive use in the manufacture of hurdles, at Walton 83, Honeybee, Walton Heath, Rowland's, East Moors, and Eclipse. These sites range from the early third millennium to *c*1500 bc. It is perhaps less common at the first millennium sites and appears to be absent from structures of this period where birch is dominant, whereas earlier it is common at one or two of the sites where birch is dominant (e.g. Garvin's). Apart from Sweet and Meare Heath it occurs no more than occasionally where alder was used, and vice versa.

In recent years, Morgan has carried out a number of tree-ring analyses of hazel from sites of different ages, and her measurements of stem age and diameter give an indication of rate of growth. For example, the hazel from the Sweet Track, Site TG, had reached a diameter of 20mm within ten years of growth, whereas the hazel used for the Eclipse hurdle rods took up to 15 years to reach the same diameter. Further comments on rates of growth are included below, for the Sweet Track, Baker complex and Eclipse Track (Morgan 1980a, 1984; Coles, Caseldine and Morgan 1982).

A number of stray finds, not included in the table, have also been of hazel (e.g. the Skinner's Wood fork). In the peat, hazel bark remains bright and golden; the wood softens, and dries and splits very rapidly upon exposure.

Fagus sylvatica: Beech. Beech would appear to have been present in S. Britain fairly early in the Postglacial in isolated stands, expanding later as an efficient coloniser of limestone soils regenerating after farming (Godwin 1975, 278). It will grow on a wide range of soils, but not those that are waterlogged, and holly is a relatively common understorey shrub or tree of beech woods. The wood is heavy and hard; opinion differs as to whether it is easy (Vedel and Lange 1973, 149) or difficult (Rackham 1980, 323) to split. Uses, apart from furniture, include beech laths for building, tool handles, and railway sleepers.

In the Levels, it has been identified only from one late Neolithic structure (Blakeway) and from one first millennium structure (Shapwick Heath Track); the scarcity of its use would appear to support Rackham's view (1980, 319) that beech was not a species of the prehistoric southwestern woods. However, the pollen has been identified from later prehistoric deposits at several locations in the Levels (e.g. Meare Heath, Beckett 1978), and Girling's beetle analyses from Stileway (Girling 1982b, and these *Papers*) give indirect evidence for the presence of beech which will be discussed further in relation to under-represented species. As for hornbeam, beech is documented by its wood at an earlier stage than the broad pollen record indicates, for Huntley and Birks place its entry into southeast England as late as 3000 bp (1983, 193).



Fraxinus excelsior: Ash. Ash was possibly widespread in the Atlantic woods, but only common in a few localities until the opening of the forest canopy favoured its expansion. It is a light-demanding species that grows well on chalk or limestone soils. It will flourish on moist soils but not on those that are permanently waterlogged; like alder, but not as frequently, it is found in carr woods and on stream banks and the association with moving water may be relevant. In general, however, it is associated with drier habitats than alder. Rackham places it in a spectrum of ash-maple-hazel woods. Ash can be coppiced. Its wood is hard and elastic, good for shafts and for spears, for carts, agricultural implements and poles in general. It is relatively easy to fell and split using axe and wedge, although not quite as easy as oak.

Ash, like alder, has been identified from just under half the sites in the Levels. It has generally survived well. Planks remain firm and wood-working details are clear. Under dry conditions, ash may rot rapidly. It is normally found only as a minor component (whereas alder is generally common when it occurs). It was used more often and in greater quantities in structures before 1000 bc than in later ones, and in fact was most used in the period up to 2000 bc.

The archaeological evidence indicates the local availability of ash before the forest regeneration of Zone C for it was an important part of the Sweet Track (Caseldine 1984a). It does not seem to have been used in any greater quantity from the later and presumed secondary woods than from those of the earlier Neolithic. It may be, of course, that minor clearing in the Atlantic forest had already favoured the growth of ash, before any structures were built on or across the marsh. Tree-ring studies of Sweet Track ash indicate trees of varying ages up to 150 years old (Morgan 1984).

Stray bits of ash have also been identified. These are not included in the tabulations here.

Frangula alnus: Alder buckthorn. Alder buckthorn grows in marshy or wet places, as does guelder rose, but it will grow on more acid soils than the latter. It may reach 5–6m in height. It will grow in woods given light, and also near lakes and bogs where it may be associated with willow. It is thought to have expanded relatively late in the Postglacial (Godwin 1975, 177).

In the Levels, the wood has been identified only from the Tinney's trackways which were built out over the raised bog on Sharpham Moor. Some charcoal was identified from Meare Village West, and macroscopic remains from the Baker Platform. Its presence in local woodland is therefore indicated in the late third millennium, late second millennium and late first millennium bc.

Ilex aquifolium: Holly. Holly is held by Godwin (1975, 172ff) to have expanded and flourished in southwestern Britain in the later Postglacial, partly being favoured by abandoned agricultural clearings and also responding to Atlantic conditions; in contrast to hornbeam, it dislikes continental conditions and harsh winters. It occurs in many types of woods, including oak and beech; in the former it may be found together with yew. Rackham suggests a preference for oak-woods and acid soils (1980, 345–47). Historically, it has been coppiced and pollarded for leaf fodder for sheep and deer. Its wood is hard and heavy, and does not appear to have had any specific uses other than for carving and turning.

In the Levels, it has been identified only from the Sweet Track, where it was used quite frequently in certain stretches. As with ash, but with less information to go on, the archaeological evidence shows greatest use before the species is thought to have expanded to any great degree.

Malus sylvestris: Apple. Apple has not been a species to inspire much ecological literature; Rackham describes it as a species lacking any evident habitat preference but never common and occurring only singly (Rackham 1980, 355–6). The wood is heavy, hard and strong; it has been used for screws and mallets, and for carving (Vedel and Lange 1973, 166).

In the Levels, there is a probable identification from the Sweet Track (3 pieces), and a possible one from Stileway (too uncertain to be included in Table 2).

Myrica gale: Bog myrtle. This shrubby species grows well in the Levels today, in abandoned peat cuts now reverting to fenwood. It grows best on damp, acid soils and its present distribution shows a northern and coastal tendency. Godwin (1975, 248) suggests restricted distribution in the Atlantic period, and later expansion perhaps due to a preference for cooler climate, or to a sub-Atlantic increase in suitable bog habitats, or both. Its uses are associated with aromatics and alcohol rather than structures or artifacts (Vedel and Lange 1973, 141).

It has been identified from a number of sites in the Levels as an incidental component of local vegetation, together with heather and cottongrass. Two structures have yielded a small quantity of the wood, Tinney's and Difford's, both of which include small amounts of a relatively wide range of shrubby species.

Pinus sylvestris: Scots pine. Scots pine was more widespread in Britain before the Atlantic period than subsequently. From about 5500 bc its distribution appears to have been northern apart from local survival in the Fens. Godwin notes that it is a characteristic species of the transition from fenwood to raised bog, and both he and Rackham refer to the buried stumps found in the Fens (Godwin 1975, 103; Rackham 1980, 99). It does not seem to have survived in similar quantity in the Levels, despite the availablity of apparently suitable habitats. Pine trunks are not found in the Levels peats, and only one identification of the wood has been made, from the later Neolithic Walton Heath trackway. The rare occurrence of pine charcoal from Meare Village West indicates its availability in the late first millennium bc.

Pine wood has many varied uses, including structurally for buildings, railway sleepers, poles, etc. Were it generally available, one would expect prehistoric peoples to have used it, as they did on the continent for piles and platforms.

Populus: Populus tremula and/or *Populus nigra:* Aspen; Black poplar. Aspen, the most likely of the two species to have been present, is a light-demanding tree, apparently uncommon in the Atlantic woods and described by Rackham as "predominantly a tree of seasonally-wet plateau woods" (1980, 341–3), and not found with alder or moving water. Its wood is light and easy to split; it has been used for clogs and for arrowshafts and would, according to Rackham, have had "a special value as one of the few non-coniferous soft-woods", along with alder.

In the Levels, aspen or poplar has been identified from only 3 sites but widely scattered through time. It is difficult to distinguish from willow when identifying the wood; both were definitely used for building the Sweet Track.

Prunus spinosa: Blackthorn, sloe. This small tree grows in southern Britain, in woodland where the canopy has been opened, on woodland margins, in scrub and along streams where it may be found with alder. It does not survive under heavy shade. No particular uses are given for its wood.

In the Levels, it has been identified from 4 of the later prehistoric sites, and in all cases along with a number of other shrubby species. It was identified as a relatively common species among the Meare Village West charcoals.

Prunus avium: Wild cherry. Wild cherry will grow into a tall tree, up to 30m or more high. It grows best in light conditions, on or near woodland margins and on light and well-drained soils. Rackham notes its occurrence in the more acidic ash and hazel woods (1980, 351).

In the Levels, it has been identified only from the recent excavations at Meare Village West, both as wood and as charcoal.

Quercus: Q. robur and/or *Q. petraea:* Pendunculate Oak; Sessile Oak. Oak, once held to be "the natural vegetation of the more favourable soils over most of Great Britain" (Tansley 1968, 86), has recently been demoted in favour of lime for the Atlantic woods (Greig 1982) and its dominance in more recent times diluted by Rackham's observations on the great variability of composition of woodland (Rackham 1980). Oak was flourishing in southwestern Britain as early as 7000 bc (Godwin 1975, 279) and the species may have been *Quercus petraea*. However, Vedel and Lange note that *Q. petraea* favours lighter, more porous soils than *Q. robur* (1973, 150–151) and perhaps locally in the Levels *Q. robur* would have grown on the heavier and wetter soils. In other words, both species may well have been present throughout the period we are concerned with, just as both species of birch were probably available.

Oak's pre-eminent use has been as timber, for buildings and for planking; it is easy to split using wedges and its frequent use in the Levels as timber has already been discussed (Orme and Coles 1983). Split roundwood has traditionally been used for hurdle work for sails, and coppiced oak is not unknown, although the emphasis in the literature is on its use as timber.

In the Levels, it has been identified from one-third of the structures and its dominance at three of these (Sweet, Meare Heath and Glastonbury) is due to its use for timber planking. Several of the sites in question also contain oak roundwood, usually of relatively small diameter. In the peat, oak has responded in different ways, seemingly without logical explanation. Planks from Glastonbury are remarkably fresh and firm; those from Meare Heath tend to be dried-out, slightly cracked, and very hard, with axe-marks well preserved. From the Sweet Track, however, some oak planks may be immaculately preserved, although slightly soft on occasion, but adjacent planks can be completely softened like very soft butter, and working details masked by compression. The variation from Glastonbury to Meare to Sweet may be due to differences in peat types and in times elapsed, but it is possible that the variation found amongst the oak planks in the Sweet Track is due to the use of both species and that their response to burial in waterlogged conditions differed. Oak pegs, whether roundwood or timber, are generally well-preserved, perhaps due to greater depth of immersion in the waterlogged peat. In sectioning the firm planks for tree-ring analysis, the heartwood is often dark and extremely tough, barely capable of being sawn through.

Rhamnus cathartica: Purging buckthorn. Purging buckthorn grows on woodland margins and in scrub, particularly on poor and dry chalk soils (Vedel and Lange 1973, 185–6) although Godwin notes that at Shippea Hill in Cambridgeshire its prehistoric growth was "presumably ... in the fen-woods of the wide valley" (1975, 176) and today in the Levels it grows just off dry land where clay covers peat and the ground is seasonally flooded. It is generally characterised as a shrub but can grow up to 10m tall, and its wood is hard and dense.

In the Levels it has been identified amongst the Meare Heath Track brushwood, along with a number of other shrubby species.

Salix: Willow. There are a number of different species of willow and it has not proved possible to separate them in terms of prehistoric identification. Only general comments will be made on native occurrence, therefore. Tansley (1968) and Rackham agree that willows are not naturally woodland species, though shrubby growth may occur under light woodland cover and Rackham records willow with alderwoods on spring slopes (1980, 101). All willows appear to favour wet conditions and willow may be a pioneer species on wet soils. Use of willow depends on the species concerned, for some grow as shrubs, others as trees, and a species may be particularly suited to some purpose (e.g. cricket bats in recent times). In general, the flexibility of willow shoots has led to coppicing or pollarding to produce the raw materials for baskets, frames, ties, hurdling, etc.

In the Levels, willow has been identified from one-third of the sites in question, i.e. as many sites as oak, but its use is nowhere near as abundant, being only occasional or rare. It has been found at sites of all periods, as split roundwood and as complete stems; perhaps surprisingly, it is only rarely found used as a withy or tie, and its flexible properties do not seem to have been exploited in the way that those of hazel were. Willow tends to be preserved as is hazel and alder, with bark maintained well, and wood softened; upon exposure it is slightly more resistant to drying than is hazel.

Sorbus spp.: Rowan or Whitebeam. It is difficult to separate the wood of rowan and whitebeam when identifying prehistoric remains. Both will be described briefly. Rowan grows up to 13m high, given light, and tolerates a range of soil conditions. Rackham notes its growth on poor and acid soils, in oakwoods or with hornbeam or hazel (1980, 68–69). Whitebeam grows up to 20m high and has a preference for chalk and limestone soils. It is possible, therefore, that the *Sorbus* identified from three sites in the Levels is rowan rather than whitebeam. The sites (Meare Heath, Withy Bed Copse and Meare Village West) have a wide range of species and *Sorbus* is never more than a rare occurrence.

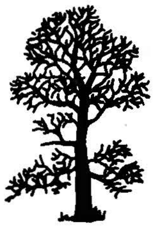
Taxus baccata: Yew. Surveys of modern woodland describe yew as a species of chalk scrub, also occurring singly in beechwood and oakwood (Tansley 1968, 94, 128). Godwin, however, describes its occurrence in the buried forests of the Fens, its growth in the Neolithic in the Levels in fen-carr dominated by alder and birch, and its interglacial association with ash and alder in fenwoods (Godwin 1975, 115ff). Its ancient fenwood habitat therefore seems well documented, and its growth in the Levels is supported by the identification of yew seeds from Sweet and Baker (but, as for hazel, the presence of the fruit does not necessitate the immediately local growth of the tree). Of greater significance is the discovery of a yew stump from Tinney's (Coles and Orme 1980, fig. 57), hardly likely to have been brought in from a long distance. Yew wood has been used for spears and bows and its bark for braiding and weaving.

In the Levels it has been identified from 4 structures, at the earliest (Sweet) as artifact rather than part of the structure, namely the yew pins found beside the trackway. The wood is very tough, and it survives well in the peat; indeed, the discovery of a Neolithic mallet of yew was occasioned by the breakage of a steel-blade on a peat-cutting machine when it bit into the body of the yew mallet. No other wood could have done such welcome (?) damage. Several Neolithic yew bows have also been found.

Tilia: Lime. Lime is the cinderella of native Atlantic woodland, long ignored as anything other than an occasional species, held back by its thermophilous nature, but now brought to the fore by Rackham (1980) and Greig (1982). Rackham argues that it is more tolerant of cold than generally supposed, reaching Britain no later than oak in the Postglacial (1980, 243). It grows on a great range of soils, including poorly-drained ones, and in the past may have been common in fen-margin habitats. Godwin also refers to likely fen-margin growth and suggests it would have favoured fertile mor soils (1975, 163–4).

The potential uses of lime are many. The wood is soft and easy to work, with trunks growing longer than most other species in good conditions, and lime warps little on seasoning. Lime bast has been used for rope and string and the leaves make good fodder. Its decrease after the Atlantic period may therefore have been due to heavy utilisation by people and their domestic animals in climatic conditions which, in Britain, had become marginal for the species.

In the Levels, lime has been identified from the Sweet Track, where it was a major component of the planking of the earliest track line (Post Track) and it also occurs rarely as roundwood. Otherwise it has been identified only from Meare Village West. This suggests that the sub-Atlantic decline postulated for Britain may well have been real and far-reaching locally in the Levels. However, lime appears not to survive well even in waterlogged deposits, and the Sweet and Post Track pieces are often very soft and spongy, able to be torn apart by hands alone. The particular structure of the wood means that it separates when soft rather like wadded paper. This vulnerability to decay must raise some doubts as to its original absence from all the structures built between 3000 and 300 bc.



Ulmus: Elm. Elm's recent and dramatic decline in Britain has led to much speculation about its natural behaviour and the reasons for earlier decline, always contentious, have been argued back and forth at length (e.g. Groenman-van Waateringe 1983; Rowley-Conwy 1982, 205–6; Rackham 1980, 265–66). Rackham notes the lack of literature on woodland elms, and indeed some of the most informative comments are those he quotes from the continental literature, describing elm 'as chiefly a fenwood tree, a constituent of the "hardwood fen" elm-ash woods which together with "softwood fens" of willow and poplar are supposed to be the natural vegetation of flood-plains of great rivers' (1980, 280). Otherwise, elm is held to prefer non-acid, deep and rich soils (Vedel and Lange 1973, 154), to have flourished particularly in south and west Britain (Godwin 1975, 247) and always to be susceptible to rot and disease (Rackham 1980, 257). It should be noted that prehistoric elm has rarely been identified to species, and this has not so far been attempted in the context of the Levels.

Elm wood is tough and heavy when green but soon dries to a much lighter state. Straight-grown elm is easy to split, but twisted and knotty lengths can be surprisingly difficult to cope with. Historically, it has been used for coffins, and also for water pipes and bridge piles—all underground and probably waterlogged uses. It has also been used for wheels, chairs, mallets and longbows, where its high tensile strength at right-angles to the grain is of particular value (Rackham 1980, 267).

In the Levels, elm wood has been identified from 5 sites, scattered across the earlier part of period of peat-growth. It is an occasional species in the Sweet Track, quite common in a few stretches and absent from others and used for planks as well as roundwood. It occurs but rarely in the Walton and Eclipse hurdle trackways, in the Abbot's Way, and in the Meare Heath brushwood. Elm charcoal is an occasional find from Meare Village West, showing the presence of the species towards the end of the prehistoric period.

Viburnum opulus: Guelder rose. Guelder rose grows up to 5m tall, generally on damp rich soils and perhaps associated with alder. It is found in fenwoods and other wet places such as overgrown stream banks. It may grow with alder buckthorn but the latter tolerates more acid soils than guelder rose.

In the Levels it has been identified from 6 structures of the later prehistoric period; at three of these alder is dominant, and it is present in varying quantities in the other three. The prehistoric guelder rose is therefore likely to have been growing in association with alder in neutral or base rich conditions in the later second and first millennia bc.

Missing or under-represented species.

Species not positively identified from any structure in the Levels, but which are recorded from southern Britain during the millennia the peat was forming, are hawthorn, elder, privet, spindle, broom, gorse and juniper. It will be noted that these are all shrubby species, and given the poor representation of some other shrubs (e.g. alder buckthorn) their absence could be simply a matter of non-discovery of the evidence so far. Although many thousands of wood identifications have been carried out from the many structures in the Levels, some pieces of wood (mostly small roundwood) are not taken for identification; to have done so might have added to the list of shrubby species known from the prehistoric period.

Juniper perhaps did not grow locally, the pollen evidence indicating a sparse and northern distribution by the Atlantic period (Godwin 1975, 111–115). Spindle and privet are not securely recorded in Britain until late in prehistory (Godwin 1975, 175, 312). Broom, gorse, elder and hawthorn are attested from the Mesolithic onwards (Godwin 1975, 178, 178, 336, 229), and of these broom is the only species that might not have found a niche in the region. Hawthorn and elder stand out as the two species which probably were present and local growth of elder is confirmed by the identification of seeds from the Baker Platform and from Meare Village West, where elder charcoal was also found. Hawthorn remains less certain, although *Crataegus* type charcoal is common at Meare and one piece of wood from Stileway is recorded as *Crataegus/Malus/Sorbus* type. Both species are likely to have increased in numbers as a result of farming activity and, other things being equal, should have been as likely to be used as blackthorn, guelder rose or viburnum and the other minor shrubby species. These are the two native species which it is now thought to be unlucky to bring indoors, and perhaps some superstition regarding their use has a longer history than one might suppose.

Species which are represented by only one or two identifications amongst the thousands now made from the Levels are beech, hornbeam and pine. All three are held to be continental in their climatic preferences and they may therefore have been scarce in the Levels throughout the period in question, although Girling (1984) has outlined beetle evidence for a more continental Neolithic climate. The absence of pine is only somewhat surprising because of its survival at this time in the Fens, and because its presence is indicated by charcoal at Meare. Possible indirect evidence for beech, to reinforce the Blakeway and Shapwick Heath identifications, comes from the Stileway beetles. Here, Girling (these *Papers*) has identified a forest fauna whose eating habits show a preference for mature, undisturbed trees with abundant dead wood and she has used the preferences of individual species to discuss a possible forest composition where beech rates second only to oak. No beetle was found that lives solely off beech, but the tree is an important host for a number of them, and this study draws attention to the probable underuse by prehistoric man of a species that was available and had many useful properties. In other words, there seems to have been a deliberate avoidance of beech. Pine is also indicated by the Stileway beetle species, though less strongly than beech. Hornbeam is not, nor is there any strong indication of another sort that it was present in the local woodland but underused. The low occurrence of *Malus, Hedera* and *Clematis* is perhaps to be expected; the latter two are creepers rather than shrubs, and the former is held to occur only very sparsely as a wild tree.

Species which are represented by several identifications, but which one might have expected to be more frequently used are elm, holly, lime, maple and poplar. Elm's use in the Sweet Track is at or just before the classic Elm Decline seen in the local pollen record and, with only sparse occurrence thereafter, might be due to a real decline in its numbers in the local woods. The use of lime and holly follows a very similar pattern, i.e. not uncommon in the Sweet Track but very rare or absent thereafter. Both species are held to be thermophilous and may have declined naturally after the Atlantic period. There does not seem to be any particular reason why poplars and maple would not have been used as frequently as, say, willow, and maple is well-represented in the Meare Village West charcoals.

None of these five species can be argued to be exclusively dryland species, growing at a greater distance from the marsh than others and therefore only exploited at times of severe shortage or when the particular qualities of their woods were needed. The pattern of when they were used, and comparison with the habitats and properties of other species represented, simply does not fit such an explanation. Four of the five, elm, lime, holly and poplar, are reasonably well-represented in stretches along the Sweet Track, and perhaps their scarce use thereafter is a reflection of the impoverishment of local woodlands after the first farming onslaught, or, more simply, an indication that the wood of other species was preferred.

SPECIES' USE BY SITE
(for site locations, see fig. 2)

Having seen that every tree and almost every shrub that grew in southern Britain in the later prehistoric period was used at some time or other in the structures from the peat, but some in much greater quantities and more frequently than others, the next stage in our analysis is to consider whether the species used for a particular structure would have grown together or not, and whether they would have grown in the vicinity of the site. From this, deductions may be made about random cutting versus deliberate selection and, where structures have different components (e.g. longitudinals and pegs), about the selection of species for particular functions. Considerations of function relevant to timber will not be repeated here, though the likely habitat of timber trees enters into the question of where the wood for any particular structure was culled. (The radiocarbon-year dates noted for each site are approximate only; for the dating list see Orme 1982a and the Fifth List in these *Papers*.)

The Sweet Track, including Post Track. *c*3200 bc.

Coles, Hibbert and Orme 1973; Coles and Orme 1976a, 1979, 1984.

Over half of the species used at one time or another in the prehistoric structures from the Levels have been identified from the Sweet Track, including all the tree species (as opposed to shrubs) likely to have been present in the local woods of the late fourth millennium bc.

Birch and perhaps willow could have grown in the wet, basic conditions of emerging fenwood, and stumps of naturally-growing birch have been found both above and below the Sweet Track. Alder and poplar could have grown on the margins of the marsh, but perhaps not invariably together if Rackham is correct in associating alder with moving water, which he suggests poplar avoids. Elm, ash and lime include wet conditions in their possible range of habitats, elm and ash in the "hardwood-fen" of river plains (see above) and lime on fen-margins; they would not have grown out in the *Phragmites* and *Cladium* marsh, unlike the occasional birch, but they could well have grown along the "shore-lines" of the dry land. Rackham indicates lime may be a calcifuge (1980, 227).

Oak grows in a very wide range of habitats, including moderately wet conditions. Tree-ring evidence may eliminate some localities for the oak used in 3200 bc, in that some of the trees were just over 400 years old when felled, and had begun to grow *c*3600 bc, more or less when the basal peat was forming in the eastern half of the Levels and the west was still under brackish or salty water. These oaks were therefore probably growing away from the brackish waters and deposits of marine clay, perhaps further upslope than trees which germinated a century or so later.

Hazel, like oak, tolerates a wide range of habitats including relatively wet soils; it will only flower given plenty of light and the abundant hazel nuts found beside the Sweet Track indicate unshaded hazel in the region; it was not just an understorey shrub of the oak or ash woods. The nuts were brought or washed in to the Track, as the hazel was not actually growing in the swamp.

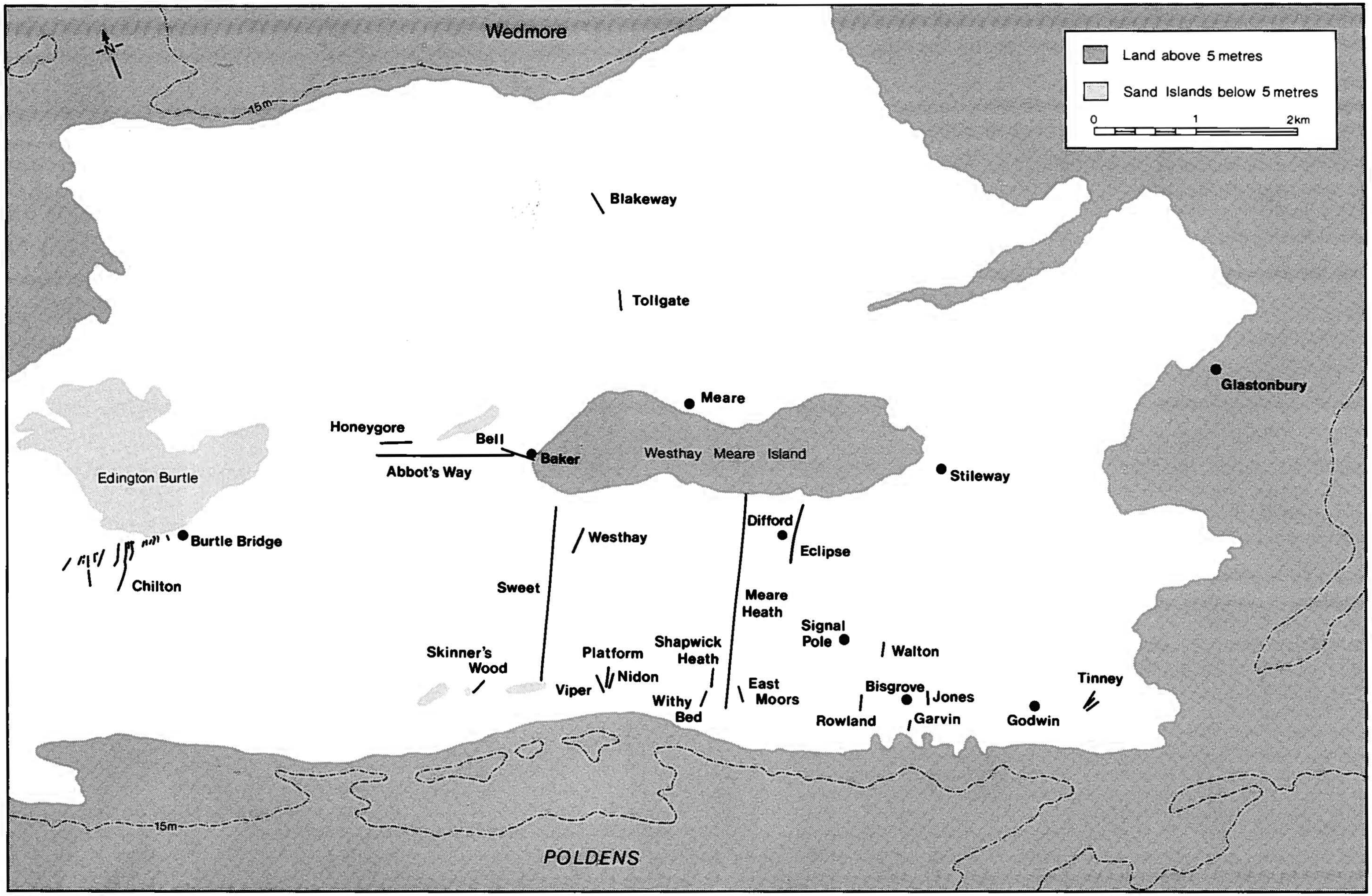


Fig. 2 Sites discussed in the Species Selection and Roundwood papers.

Holly's preference for acid soils might indicate growth on a sandy burtle rather than on the lias of the Poldens or Westhay island; it too will grow in moist conditions. Hornbeam will also grow on acid and damp soils. Godwin emphasises the fen associations of yew, perhaps with alder and birch or with ash and alder. Apple has no strong habitat preferences. Dogwood is by preference a woodland margin species, and calcicolous, so probably not growing near hornbeam or holly but perhaps with hazel, ash or elm.

It will be noted that all of these trees tolerate wet conditions of one sort or another, and a number of them are or were typical of fenwood or fen margins. They do however vary in their preferences for acid or basic soils. Thus, although the majority also grow well on dry land, we need not suppose the track builders went far upslope for their wood. Laterally, they probably ranged onto the sandy Shapwick burtle as well as onto the lower Polden and Westhay slopes; holly and lime may have been more common on and around the base of the burtle, ash, elm and alder along the Westhay and Polden shores. The sheer quantity of wood in the trackway indicates exploitation of woodland beyond the immediate vicinity of the trackway terminals. Both pollen and tree-ring evidence is relevant here, and has been discussed elsewhere (Morgan 1984, Caseldine 1984a).

In the most recent reports on the Sweet Track, some comment was made about the relative proportions of species used at different areas along the Track (Coles and Orme 1984; Morgan 1984). Although the full analysis of this has yet to be undertaken, a brief summary of the evidence readily at hand from 8 major sites allows a few comments to be made concerning available and used species. Table 3 shows the relative abundances of species used in the Sweet Track on the basis of over 2500 identifications.

TABLE 3 Sweet Track species, by major sites from South to North

Site	B	C	D	F	N.R.	QZ	R	SA	TG	WA	Summary
Alnus	C	R	R	C	R		C	R	R	R	C
Betula	R	R		R	R		R	R	O	O	R
Carpinus	O										R
Corylus	C	D	D	D	D	D	D	D	D	C	D
Cornus						R			R		R
Fraxinus	O	C	O	C	O	O	C	R	C	R	C
Hedera				R					R		R
Ilex	C	O	O	C	O	R	O			R	C
Malus			R				R				R
Populus									O	O	O
Quercus	O	D	C	D	C	D	D	D	C	D	D
Salix		R		R			R	O	C	O	O
Taxus				R			R				R
Tilia	O		O	O	C	R	O				O
Ulmus		R	O	R	R	O	C	R	O	R	O

Note: D, dominant; C, common; O, occasional; R, rare.

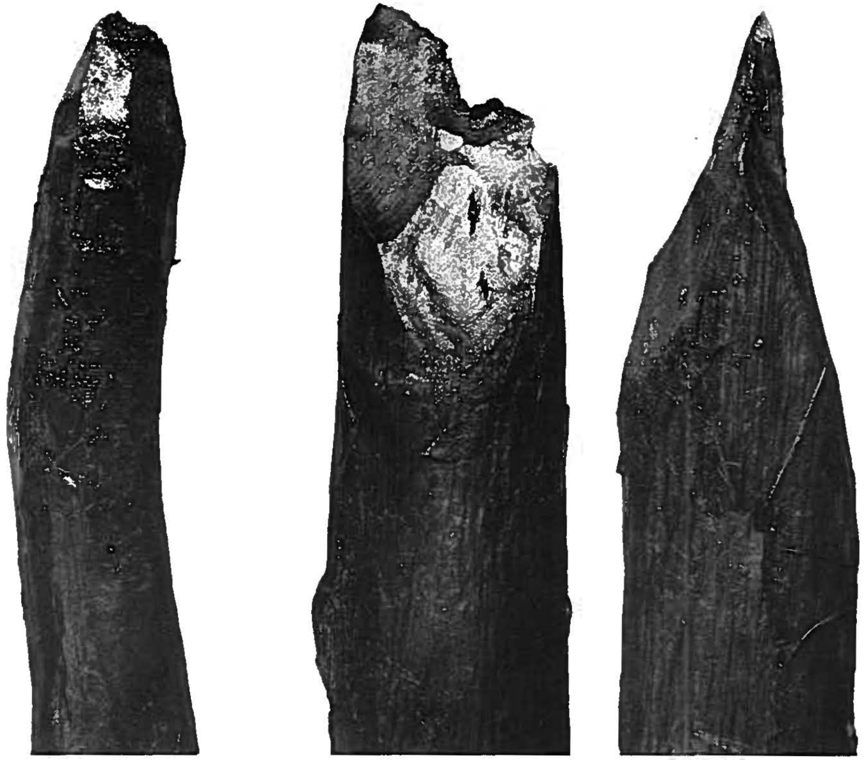


Fig. 3 Sweet Track hazel roundwood used for pegs. Scale ½. Left, SWC483, chopped around the stem. Right, SWC55 (2 views), axed asymmetrically on two sides to form a wedge end with the facets converging at one edge.

Hazel was obviously a readily available source, and was consistently used for, in this case, pegs and some rails along the whole length of the track (fig. 3 and 4). The quantity, perhaps 1200 straight pegs *c*1m long, suggests some form of management system in open woodland. Oak too is a dominant species, used extensively for planks and occasionally for pegs, and Morgan's work has pointed to the possible existence of two stands of oak, an old mature stand to the north yielding planks for *c*1600m of the track, and a younger stand for the south which provided planks for *c*200m of the track.

Another species which was often used in the track was ash (fig. 4), for planking, but its presence is not consistent and several sites yielded no evidence of ash. Alder too is irregularly present, most frequent at Site R but often rare; it was used for pegs and rails. Elm forms a somewhat symmetrical pattern, common at Site R but fading away from this site both to north and south. Holly is another species of irregular appearance in the track, only common in Site F to the south, and rather rare farther northwards. In contrast, willow and poplar may have served

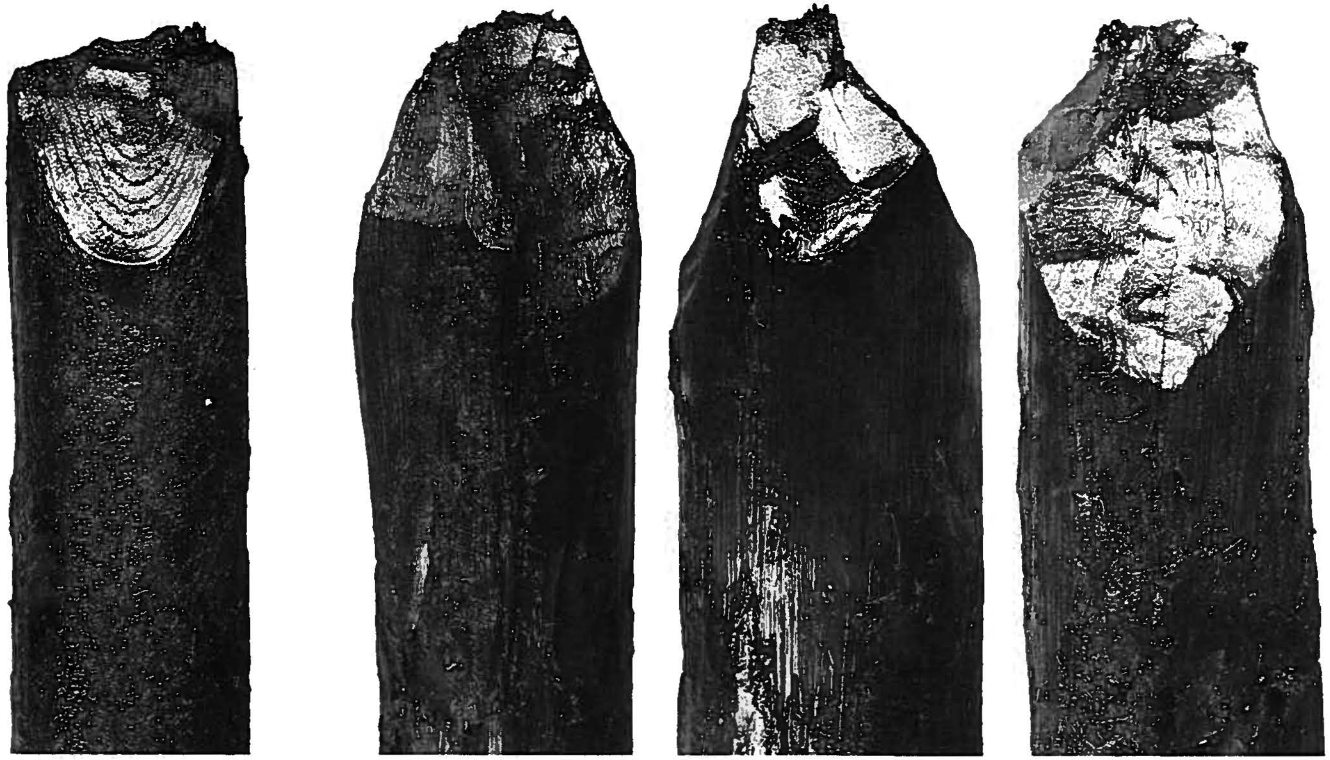
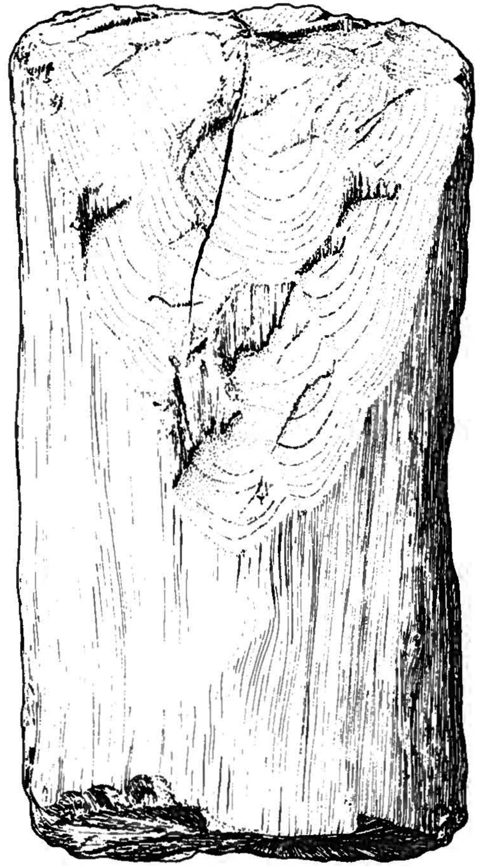



Fig. 4 Sweet Track roundwood. Scale $\frac{1}{2}$. Left, SWC59, ash peg chopped from two sides to form a wedge; growth rings clearly marked. Centre, SWC69 (3 views), pointed end of hazel, chopped from all sides. Right, SWRV15, lime post, axed on two faces with multiple blows to form a wedge end.

here as substitute for holly in the making of pegs, and occasional rails, in the northernmost part of the track. Birch too was present in some quantity in this northern area. Lime was used for planks and some posts (fig. 4) of the Post track, and as this pre-Sweet structure has not been clearly identified north of Site R, the corresponding absence of lime in the north is less significant than would be if the Post Track was present. If the grouped species are considered, a case could perhaps be argued that the source of wood for the southernmost sites was a well-drained woodland, with much ash, holly and dogwood, and little alder and willow. Similarly, the Nature Reserve sites immediately to the north, with ash, holly, lime and elm may have drawn upon a rather dry woodland. The presence of holly and lime, as noted above, may indicate exploitation of woodland growing on the sandy Shapwick burtle, but ash, elm and dogwood indicate exploitation of Polden woods as well for the southern end of the Track. To the north, sandy soils were available only beyond the lias island of Meare and Westhay, and the rarity or absence of holly and lime from the northern sites may indicate that sufficient wood for track building in the north was to be found on the lias island alone. The woods from Site TG, with alder, willow and poplar, show the use of wet as well as dry woodlands and Site WA, the farthest north, is notable in this context for the rarity of ash and preponderance of the wetland species of birch, poplar and willow. Perhaps the Track was built out from the north, starting with trees culled from the interface of marsh and island. Oak as a vital element in the structure of the track was deliberately sought and brought onto all parts of this track. The change from old to young oak trees noted by Morgan occurs further south than the appearance of holly and lime.

The tree-ring analyses, referred to above, help to establish some pattern for the several woodland indicators discussed here. In addition to the change from young to old oak near the southern end of the trackway, Morgan has identified two groupings of hazel with slightly different growth patterns. One of these is found predominantly on southern sites and the other predominantly in the northern stretch with an area of overlap *c*250m long roughly in the centre. The hazel from the south is faster grown than that from the north, and so are the other species such as ash and alder, which are represented throughout the structure. For one reason or another, rapid tree growth was more favoured at the south end of the Sweet Track than two kilometres to the north. The differences may lie in variations in soil conditions, drainage and ground water, management practices and previous onslaughts on the woodland.

The Sweet evidence thus suggests at least two areas of varied woodland, rather than pure stands of a single species, and there were different mixes according to local variation in ground conditions. Species selection overall is clearer for timber than for roundwood with oak, ash and lime the favoured plank species. Any available species appears to have been used for pegs and rails, so perhaps the proportions used in the trackway are a good guide to the proportions in the local down-slope woodland. The only caveat to enter here is the possibility that some species were already being managed to produce poles. The contenders are oak and ash, and perhaps hazel (Rackham 1979, Morgan 1984), and oak tree-ring evidence also points to secondary growth. As oak and hazel are the dominant species in the trackway, we could in fact be seeing the deliberate production of building wood, here used for a track, supplemented by the nearest available wildwood where necessary. That is an interpretation at one extreme of the possibilities; at the other end, the "coppicing" could be a natural effect of felling by man (or beaver? Coles and Orme 1983c), and the heavy use of these two species merely a reflection of their local dominance in the wildwood. Morgan's work on hazel shows age peaks at 7 year intervals, from 4–5 years to 25 years old, and although the full significance of this has yet to be established it does point to a regular interference with the woodland. Whether wild or managed, the local woodlands were culled of sufficient trees to yield *c*3600m of planking, 2000 or more metres of roundwood rails and 6000 pegs 600–2100mm long. It is interesting to note that this did not produce any particular effect on the pollen from a monolith very close to the north end of the Track, which is the one most likely to have reflected felling on the Meare-Westhay island (Caseldine 1984a, 73ff).

In conclusion, we may reiterate the ability of many of the species to grow in wet conditions, and the likelihood that they would *not* all have grown in similar environments, and whilst it seems likely that timber was made from those species easiest to split, no particular intention governed the choice of roundwood. However, experimental work (reported in these *Papers*) has shown alder, ash and hazel to be easier to work with stone axes than willow or birch so perhaps ease of working had some influence on the selection of the roundwood. Finally, if the Post Track was indeed earlier than Sweet, it is interesting to note its greater use of lime and ash, with little oak, perhaps a reflection of the formers' fen-margin colonisation in the century or so before 3200 bc and an indication that the nearest timber trees were used first, followed by the ancient oaks established upslope of the earlier brackish waters.

*Bisgrove's Track. c*2900 bc.
Orme, Caseldine and Morgan 1982.

The short stretch examined of this structure was dominated by birch, with a little willow. It is likely that the builders were making use of the nearest available wood, since both species could have grown as fenwood. Closeness was therefore more important than ease of working.

*The Honeygore Track. c*2800 bc.
Godwin 1960; Coles and Hibbert 1975; Coles, Orme, Caseldine and Morgan, these *Papers.*

The bulk of the wood identified was birch, which could have grown locally, and stumps were found associated with the track. Hazel, also identified, is unlikely to have grown in the wet but could have been culled from the nearby Honeygore burtle. The exploitation of two different localities is therefore indicated, with the suggestion that perhaps fen birch trees were not common enough to supply all the wood needed.

*The Chilton Tracks. c*2800 bc.
Coles, Hibbert and Clements 1970.

As for Honeygore, the builders appear to have used local birch, with a little hazel, which in this case was probably found on the large sandy burtle to the north of the tracks.

*Walton 83. c*2700 bc.
Orme, Coles, Caseldine and Morgan, these *Papers.*

This structure was probably a demolished hurdle, made of hazel rods and sails, with one rod of ash. The hazel is likely to have been coppiced, and grown away from the wetland. The comments on the Walton Heath and Rowland's tracks apply.

*The Baker Complex. c*2800–2300 bc.
Coles, Fleming and Orme 1980.

The question of species selection here is complicated by the incorporation of beaver-felled wood into the structure (see Coles and Orme 1982), which was built just off the edge of Westhay island. The beaver-wood was all willow, no doubt of local growth. Alder, the dominant species, could also have grown in the immediate vicinity along with birch. Ash and oak probably required slightly drier conditions, although both will grow in fenwood, and hazel one would expect to flourish on slightly drier soils still. Alder and ash may be associated with moving water, the lagg stream perhaps, and given the closeness of Westhay island we could place the oak and hazel there. Morgan has compared the growth rates of five species used in the Baker complex (1980a, 25). The willow present had grown very rapidly compared with the ash; the hazel had grown slightly faster than the ash, and birch and alder showed considerable variation, some pieces being nearly as fast-grown as the willow and others as slow as the ash. None of the growth patterns indicate coppicing, although willow has a preponderance of stems 6–11 years old which perhaps relates to earlier beaver activity in the area.

*The Bell Tracks. c*2300–2000 bc.
Coles and Hibbert 1968.

Built of ash, hazel, yew and birch, and associated with the later stages of the Baker platform, the wood for these tracks was probably culled from similar sources to those exploited for the platform. The absence of alder and willow might reflect earlier over-exploitation locally, but since both species regenerate quickly it seems more likely that the trackway builders selected their four species from the local woods, ignoring others. The use of split ash for transverses and the predominance of hazel for pegs and birch for longitudinals does suggest deliberate selection of species for function. Moreover the presence of birch and alder stumps, but no alder wood, indicates that the latter was not wanted in the Bell Tracks, though perhaps used only a few metres away in the Baker platform. The inclusion of a few yew twigs need not extend the woodland exploited beyond the fen margin.

*Honeybee, Honeycat and Honeydew. c*2600–2300 bc.
Coles, Orme, Caseldine and Morgan, these *Papers*.

These three tracks form part of the Honeygore complex, and both Honeycat and Honeydew are exclusively of birch, a tree which was growing locally in the fen woodland of the time. The character of the birch stems, branches and twigs show a random selection of wood with little work expended upon its preparation. The Honeybee hurdle track, however, was made entirely of hazel, coppiced not in the fen wood but on the slopes of the hills or on the sandy burtles to west and east of the site.

*Jones' Track. c*2600–2500 bc.
Orme, Caseldine and Morgan 1982.

This structure was examined at some distance from dry land. It was built largely of birch (e.g. fig. 6), probably locally grown. The inclusion of some hazel and a little ash indicates exploitation of marginal or slope woods as well, and both species showed signs of coppiced growth.

*The Burtle Bridge Track. c*2400–2300 bc.

This substantial track was made entirely of birch, according to unpublished notes (C. F. Clements). As such, it must have drawn extensively upon local fen woodland.

*Garvin's Tracks. c*2500–2300 bc.
Coles and Orme 1977c.

The use of wood here follows a pattern similar to Jones' track and in the same locality but possibly a century or so later. The tracks were made of birch roundwood stems and branches (figs. 5 and 6), with some coppiced hazel. Alder was also included, cut perhaps from the banks of a lagg stream or from woods growing around and below the nearby spring on the Poldens. The spring is close to Garvin's site and some distance from Jones', which had no alder.

From Bisgrove to Garvin's (i.e. early third millennium to *c*2300 bc) birch plays a major part in almost all trackways, and is only relegated to a lesser role in the Baker Platform, the structure closest to dryland with its fringing carr wood, and in the hurdles. This suggests that birch grew across the Levels as fenwood, and other environmental evidence supports this. But was it exclusively a birch fenwood and if not why is there so little use of species such as willow, when birch is the more difficult to fell? Perhaps there was indeed a sea of birch. We should also note the frequent inclusion of hazel, often coppiced, and the absence of alder in many cases; given local conditions, one would expect alder to have been available closer to hand than hazel. No specific function is evident for the hazel in the brushwood tracks and one wonders why bundles were included in so many of the basically birch trackways. The answer probably lies in the presence of coppiced hazel woodland which was used for hurdle-making, and which would have also yielded rods unneeded or unsuitable for hurdles, but entirely suitable for unstructured brushwood tracks. The question of draw-felling (selection for uniform diameter) or clear-felling (total clearance of stool) might be posed here; hurdles seem to have been composed of draw-felled rods, but a clear-felled area would have yielded rods suitable for hurdles (selected pieces) and brushwood bundles (rubbish left over, too big or too small or too short for hurdle-rods). Experiments in cutting hazel rods from a coppiced stool have shown that draw-felling is complicated by the unwanted rods that get in the way, so prehistoric woodsmen may have regularly clear-felled, and therefore always had a number of unneeded rods to hand. We should also note here the possibility that some of the birch was culled from dryland, where it may have flourished as a coloniser of abandoned clearings. The bulk, however, must surely have come from the nearest source, the fenwood.

From the Walton Heath Track to Stileway (*c*2200–1000 bc) birch loses its pre-eminence to hazel or alder, and in the wetland fenwood gave way to raised bog. Further comment on this change follows the relevant site comments.

*Walton Heath and Rowland's Tracks. c*2400–2300 bc.
Coles and Orme 1977a and b.

The Walton Heath and Rowland's tracks are among the oldest hurdle-built trackways from the Levels, and both have hazel as the dominant species. This is coppiced hazel and it would not have grown out on the raised bog where the tracks were built, but on the Poldens or the Meare-Westhay island.

The Walton Heath track has a wider range of other species than Rowland's and their distribution is not entirely random. Alder, birch and willow occur in significant quantities. The birch came mostly from one area near the middle of the 60m examined, and was used largely to supplement the hazel rods in a panel. The alder was also used mostly for rods, in the multi-layered central area of the track just to the north of the birch concentration, and some alder was used here for bundles along with hazel. Willow was likewise used mostly for rods for panels in the same central area. All three species also provided two or three sails and there were two birch pegs.

The incorporation of these species into the hurdles, which have always been held to be prefabricated, suggests that the trees were probably growing in coppice along with the hazel. Their wet affinities do not preclude growth on drier land. The single pieces of oak, elm, hornbeam and pine may have come from the same woods, unless the pine were growing on the raised bog. Clearly the Walton builders had a strong preference for hazel for all functions, but it would seem that their coppice was not pure, and the incorporation of a few other species did not matter. The willow ties on the hurdles would have been available at the bog-edge, in watery conditions. Fewer pieces were identified from Rowland's which had been severely damaged by earlier peat cutting. The great majority were hazel, with some birch most of which was used for pegs, none being woven into the panels. One alder rod was identified from a panel, and a couple of stray pieces were alder (fig. 6). It would appear that a purer stand of hazel was used for the panels for Rowland's than for Walton Heath, with locally-growing birch used when the supply of imported hazel pegs was running short.

*Signal Pole. c*2600 bc.
Orme, Coles, Caseldine and Morgan, these *Papers*.

Signal Pole, a patch of brushwood in the vicinity of Walton and Rowland's, consisted entirely of birch and is likely to have been cut locally. The size of the stems and branches suggest that several large trees were knocked down and chopped or broken up.

*Blakeway. c*2300 bc.
Clapham and Godwin 1948; Godwin 1960.

Blakeway, one of the rare structures found north of Westhay, was made almost entirely of coppiced hazel. One of the two identifications of beech from the prehistoric sites in the Levels came from this structure. As with all the hazel-dominated tracks, the wood was probably culled from drier ground than the immediate vicinity of the structure. Blakeway is the only brushwood track made of hazel, as all others used birch, and coppiced hazel rods of the small diameters noted here would have more normally been used in hurdles. It was Godwin who recorded the coppiced character of the Blakeway hazel and in 1948 drew attention to a Neolithic system of woodland treatment which produced the same effects upon the hazel undergrowth as does coppicing today (Clapham and Godwin 1948). This was some three decades before further discoveries in the Levels of coppiced wood led to general recognition of Neolithic woodland management.

*The Abbot's Way. c*2100–2000 bc.
Coles and Hibbert 1968; Coles and Orme 1976b; Coles 1980.

The Abbot's Way is one of the relatively few structures where alder is the species of wood most frequently used. Given the ubiquity of alder in the pollen records, the ease with which it is felled and split and its durability when waterlogged, one might have expected it to be used in large quantities more often, instead of which it tends to be used in moderate quantities at about half the structures under consideration, all of them dating after 2500 bc apart from the Sweet Track. In the Abbot's Way, where it is abundant, we find quite large alder roundwood, split and used to form a fairly flat corduroy path. Birch, hazel and ash were also included, giving ingredients similar to Garvin's but mixed in different proportions, and a little willow, oak and viburnum were used. Alder, ash and hazel will grow together on damp neutral or basic soils, perhaps with willow and viburnum, but birch does not seem to be naturally associated with them (as observed on seasonally flooded Devon fields and stream banks). The mixture is best explained as a deliberate search for alder, around the edges of the wetlands, the incidental incorporation of associated hazel, ash and willow, and the use of birch growing near the track line whenever needed. If we look at the functions of the different woods in the structure, the pattern of use may become clearer. Alder was used predominantly for transverses of the walkway, whereas most of hazel, birch and ash was used for pegs, few of which were made of alder. Pegs tended to be of a particular species in any one stretch (e.g. birch in one site, Coles and Hibbert 1968), with the clear use of ash (fig. 7) along one edge and hazel along the other in the area examined in 1979 (Coles 1980). Thus despite the relatively wide range of species that occur in the Abbot's Way, a case can be made for the selection of particular species for certain components of the track, and for the exploitation of both immediate trees and those growing outside the area of raised bog, perhaps along the lagg fringing the dry land.

*East Moors. c*1900–1700 bc.
Orme, Sturdy and Morgan 1980.

Heavily damaged, this hurdle structure is rare in being made from one species only, hazel. It and Honeybee are the only hurdle tracks in fact to be purely hazel, although most hurdles are predominantly of this species and show deliberate selection on the part of the makers. Indeed, as the hazel is coppiced, a degree of planning ahead is also indicated. As coppiced hazel is now attested at intervals from *c*2700 bc to at least *c*1500, and probably to *c*200 bc (see below), and as the Sweet Track appears to contain coppiced hazel for pegs (*c*3200 bc), there is a very long period when hazel woodland was being managed; absolute continuity cannot yet be demonstrated.

*The Eclipse Track. c*1700–1500 bc.
Coles, Orme and Hibbert 1975; Coles, Caseldine and Morgan 1982.

A case can be made for the Eclipse Track being the northern end of East Moors (Coles, Caseldine and Morgan 1982), but in terms of wood used it differs, for although the Eclipse panels are woven largely from coppiced hazel, they also include occasional stems from other species. These are maple, alder, dogwood, ash, oak, elm and guelder rose. The range is not dissimilar to that of the less common species found in the Abbot's Way, except that maple appears for the first time, and there is no willow and no birch suggesting little use of raised bog trees. The range contrasts to that from Walton Heath, almost the first of the run of hazel-dominated structures of which Eclipse is the last. Walton Heath has birch, hornbeam, pine and willow which do not appear in the later track, and Eclipse has maple, dogwood, ash and guelder rose (probably), none of which was identified from Walton Heath. On the whole, the Walton Heath incidentals look more like species of the fen than those from Eclipse, reinforcing the suggestion of an entirely dry-land origin for the latter. The Eclipse range of species would be likely to occur on neutral to basic soils, whereas the Walton Heath range includes species that tolerate or prefer acid soils.

Recent tree-ring analyses of the Eclipse hazel (Coles, Caseldine and Morgan 1982) indicate well-grown hazel, though perhaps not flourishing quite as vigorously as that culled for the Sweet Track. Comparison of growth rates for rods and sails shows that faster-grown stems were selected for the latter, i.e. the sails reached up to twice the diameter of the rods in the same number of years. This could be due to clear-felling of a stool followed by selecting out of the fatter stems for sails.

The Meare Heath Track. *c*1300–900 bc.
Coles and Orme 1976c, 1978a.

The structures known as Meare Heath, Tinney's, Stileway and Godwin's fall close together in time and belong to the eastern half of the Brue Valley, either far east and near the Poldens (Tinney's and Godwin's) or associated with Meare island. The Meare Heath Track, like the Sweet Track, links the Meare-Westhay island to the Poldens and both have a plank walkway with associated roundwood. The Meare Heath planks are almost entirely made of split oak whilst the numerous roundwood species brings the total identified from the structure to 13, where Sweet has 15. Most occur only rarely, with occasional willow and birch and rather more alder and hazel. As the track appears to have been built shortly after the raised bog became wetter than usual, it would seem unlikely that any of the trees grew locally. Once again, the laggs around Meare island and the base of the Poldens, and the moist soils immediately above them, are probably sources for the wood for the track. The oak, though of lesser quality than that used in the Sweet Track (Morgan 1982), was not impoverished by modern standards. Many of the less common species are light-demanding shrubs of woodland margin or scrub (e.g. blackthorn) and ash also responds well to light. Possible habitats for the range of species represented are therefore lagg fenwood and slightly drier young secondary woodland, with an area of longer-established secondary woodland for the oak trunks. Godwin's reference to the association of yew with alder and birch fen carr (1975, 115ff), or with alder and ash, supports the case for some fenwood exploitation, given the identification of yew amongst the brushwood.

Godwin's Track. *c*1100 bc.
Coles, Orme, Caseldine and Morgan, these *Papers*.

This brushwood track was made mainly of small alder roundwood, with occasional birch and willow; a few pieces of oak had also been used. The source of the alder is likely to have been the edge of the raised bog, where willow might also have been found. The birch could have been growing near the track line, on the bog, unless it too came from the fringing woodland. The track wood is almost exactly that range exhibited in the Tinney's tracks nearby.

Tinney's Tracks. *c*1100–1000 bc.
Coles, Orme, Hibbert and Jones 1975b; Coles and Orme 1978b, 1980.

The multiple brushwood tracks at Tinney's Ground include oak timber, but for the greater part consist of bundles of alder brushwood mixed with small amounts of several other species (fig. 8). These include a fair amount of birch and willow, suggesting a relatively wet source. Bog myrtle and guelder rose are also likely species of a wet habitat, and ash, alder buckthorn and hazel could be. The incorporation of a yew stump in one trackway suggests this species too could have grown fairly close to the trackways. Yew, bog myrtle and alder buckthorn would prefer more acidic conditions than alder or ash. The oak planks and stakes come from mature trees, probably growing on drier ground than the bulk of the brushwood. Overall, the pattern of exploitation looks similar to that at Meare Heath and Godwin's, though the brushwood for Tinney's may have come from a slightly wetter and more diverse environment than Meare Heath, and of course it was a much more important element of track construction than in the plank-dominated Meare Heath track.

The Stileway complex. *c*1200–900 bc.
Coles and Orme 1978c; Orme, Coles, Caseldine and Morgan, these *Papers*.

The patches of wood at Stileway consisted largely of alder, with birch, and some hazel and poplar. A broken hurdle on the site was possibly coppiced alder, including split sails, and other much heavier wood included split alder and birch stems. One piece is of the apple–rowan–hawthorn group. A local source is indicated, perhaps along the edge of Meare Island which lies immediately to the west.

From the Abbot's Way to the Stileway complex, alder was used extensively and most occurrences of guelder rose are from structures of this period. The association of the two was noted above, and the evidence points to the exploitation of woodland growing in damp conditions very different to the impoverished raised bog that dominated the lowland the trackways were built across. The longer timespan, from the Walton Heath Track to Stileway, sees hazel dominant where alder is not, except for two minor birch structures. Birch is not absent from this period, but used less frequently when it was one of the few and sparse trees growing on raised bog than when it was growing profusely in fen woodland. It is possible that raised bog was colonised by one birch species and fen woodland another, and that the latter was easier to work. This possibility is supported by the switch to hazel and alder as dominants more-or-less when the fen woodland gave way to raised bog. It is also the case, of course, that much less birch was available in the latter phase.

The Westhay Track. *c*850 bc.
Godwin 1960.

This trackway was examined in a short stretch which yielded only birch wood. As such, it is likely to have been built from the nearest trees to hand.

*Withy Bed Copse. c*800–700 bc.
Coles, Orme, Hibbert and Jones 1975a.

A mixture of dumped planks and brushwood, with a scrap of hurdle work, came from a range of species which appears to have excluded birch. Alder, ash and oak were used for planks, and the brushwood also included maple, hazel, rowan/whitebeam and willow. Apart from willow, the preferred habitat of the brushwood would be relatively dry, and maple–ash–hazel woods are one of the associations emphasised by Rackham. All would do well in secondary growth and perhaps such woodland was established on the Polden slopes by the first millennium bc.

*Viper's and Nidon's Tracks. c*600 bc.
Godwin 1960.

Dominated by birch, the Viper's track has the somewhat unexpected inclusion of maple as well as oak. The use of a probable fenwood or raised bog species together with a smaller amount from a single species (maple) normally of drier and more nutrient-rich habitats is similar to the occasional use of hazel in the birch structures of the earlier third millennium bc. The oak planking from both tracks is likely to have a source on the Polden Hills only 200–300m away from the site, and the tracks emanated from this area, possibly from a major structure as yet unexamined.

*Platform Track. c*500 bc.
Coles 1972.

Close to Viper's and Nidon's in space and time, the Platform track was likewise dominated by birch. Some alder was identified, and all the wood could have been cut from fen carr fringing the Poldens immediately to the south.

*Tollgate. c*650 bc.
Godwin 1960.

This track resembles Blakeway in being built of hazel, and running north from Westhay island. The hazel may have grown on the sandy-gravel island immediately north of Westhay, very close to the one recorded exposure of the structure.

*Skinner's Wood. c*650bc.

Little is known as yet about the trackways here but alder, birch and hazel are apparently the main species used in the several structures (C. F. Clements).

*The Shapwick Heath Track. c*250bc.
Godwin 1960.

This brushwood track was made of hazel, like Tollgate, and its source would logically be on the Polden slopes to the south, near Withy Bed Copse.

It will be noted that the first millennium structures show a partial return to the heavy use of birch evident in the earlier third millennium bc. There is little to suggest that the Levels as a whole returned to the fenwood conditions common in the earlier period, but there may be some link either between the flooding episodes evident in the first millennium (Godwin 1960; Beckett 1978; Girling 1982a; and see also discussions in these *Papers*) and local increases in birch, or between the escalation in woodland clearance on dry land indicated by pollen studies, a decline in secondary forest and the use therefore of lagg fen carr to supply the material needed for trackways. Part and parcel of such developments might also be an increase in the availability of dryland birch, flourishing as an early coloniser of untended clearings, if any such existed.

*Meare and Glastonbury. c*200 bc–ad 100.
Bulleid and Gray 1911, 1917, 1948; Gray and Bulleid 1953; Gray 1966; Orme, Coles and Sturdy 1979; Orme, Coles, Caseldine and Bailey 1981; Orme, Coles and Silvester 1983.

The only known prehistoric settlements from the Levels have yielded wood, abundant at Glastonbury and sporadically so at Meare. Unfortunately, few precise identifications were made of the species used when these sites were first excavated, and recent excavations by the Somerset Levels Project have produced little in the way of structural wood. What follows is an attempt to piece together an outline of local woodlands on the basis of all available evidence, namely pollen, macroscopic remains, identification of the few surviving bits of wood, and a beetle, together with Bulleid's occasional reference to species.

The description of Glastonbury (Bulleid and Gray 1911) refers to the species used to make the palisade which surrounded the settlement. Alder was the wood most commonly used, with some oak and birch and a few other species. The substructure of the settlement, with brush and logs, again used mostly alder, with oak, ash, willow and birch occurring "not infrequently". The suitability of alder for structures in the wet was noted above, because of its durability when permanently waterlogged, and we may assume that the builders of Glastonbury knew of this when they made heavy use of the species. At both Glastonbury and Meare, oak was used for what may be termed "house" timbers, namely beams, planking and stakes associated with clay floors (e.g. Bulleid and Gray 1911, 324–326). Recent excavations have also located oak stakes and planks which may have been associated with buildings and other structures. Reliance on oak as the main or sole species for timber, i.e. split wood, is a practice noted for the Meare Heath track, and commonly assumed to be prevalent in the historic period, but not evident when primary woodland was available to the Neolithic builders of the Sweet Track. It was probably a combination of ease of splitting and durability that led to a preference for oak above all other species as a source of building timber.

Many artifacts of wood were recovered from Glastonbury, and some are identified to species. The majority of these are oak, and some are ash, both species relatively easy to identify from surface examination, which we presume was the method used by Bulleid when labelling the artifacts oak, ash or unknown. The ash was used for the same sort of artifacts as the oak, e.g. handles, a wheel hub, a ladder, and for numerous pieces that Bulleid suggested were parts of a loom frame. Oak was used also for stoppers and ladles and a dugout boat. Artifacts unidentified to species included several tubs and part of a second dugout which

TABLE 4 Evidence for wood species from Meare Village West 1979

Species	Charcoal	Wood	Seeds	Pollen	Beetle
Acer campestre	C	P	—	—	—
Alnus	C	C	—	C	—
Betula	O	P	P	C	—
Calluna	R	—	—	—	—
Cornus	R	—	—	—	—
Corylus	C	P	—	C	—
Crataegus type	C	—	—	—	—
Fagus	—	—	—	R	—
Frangula alnus	R	—	—	R	—
Fraxinus	—	P	—	O	—
Hedera	R	—	—	O	—
Pinus silvestris	? R	—	—	R	—
Populus	—	R	—	—	—
Prunus spinosa	C	P	—	—	—
Prunus padus/avium	R	P	—	—	—
Quercus	C	C	—	O	P
Salix	O	P	—	O	—
Salix/Populus	O	—	—	O	—
Sambucus	R	—	P	R	—
Sorbus	—	P	—	R	—
Tilia	—	P	—	R	—
Ulmus	O	—	—	R	—

Note: C, common; O, occasional; R, rare; P, present in unspecified quantity

Bulleid recorded as "not oak" and "quite soft" (1911, 333). Perhaps this was hewn from lime, like the Tybrind Vig canoe (Andersen 1983). As far as deliberate selection of species for function is concerned, we can say that the pieces which came from a loom frame or similar artifact were exclusively made of oak and ash, that many more oak than ash tubs were recovered, and that oak was thought suitable for virtually the whole range of wooden objects recovered, from stopper to dugout.

Evidence for the local woodlands of the later first millennium has come from the recent excavations at Meare. Pollen analyses by Caseldine (Orme, Coles, Caseldine and Bailey 1981) suggest a basic trend of declining tree pollen, with shrub pollen increasing markedly in the third quarter of the millennium and then likewise declining as herbs increase. The preponderance of shrubby species for 200 years or so is reflected in the wide range of wood fragments and charcoals identified from the 1979 excavations. The species and some indication of their occurrence are given in Table 4.

Oak and alder, which were common at Glastonbury, are well represented here by charcoal, wood and pollen, and oak additionally by the beetle for which it is host, *Rhynchaenus quercus* (Girling 1979b). We can therefore be confident that these two species were abundant locally and abundantly exploited. Tree-ring analyses (Morgan 1981) and the longer pollen record indicate clearance and regeneration on Meare island prior to the steady inroad on the forest that would seem to be contemporary with the occupation at Meare. The expansion of shrubby species in the first stages of forest decline, seen in the pollen, seems to have led to their exploitation which perhaps in turn accounts for their decline after a couple of centuries, although expanding cultivation is another factor to consider here. The shrubby species such as elder, dogwood, cherry, purging buckthorn and blackthorn, together with hazel, flourish and flower as forest is broken into a mosaic of woodland and field and their habitat of woodland margin is thereby increased. Therefore the later first millennium may have seen the secondary tree growth on Meare island steadily decreasing, at first broken up in such a way as to encourage shrubs, but with relentless exploitation, coupled with the expansion of fields, leading inevitably to shrinking woodland cover.

Lime is recorded in the woods for the first time since the building of the Sweet Track some three millennia earlier. It seems likely that it was present but not used for track building in the intervening period as the pollen has been identified at other sites. Pine is present as charcoal and as pollen, but rare. Beech is present only as pollen, and guelder rose not at all. Until we have a fuller record from Meare, it would be unwise to speculate further on the significance of this.

The later prehistoric woodlands can therefore be reconstructed to a limited degree, with cross-checks from different categories of evidence. One awaits now a similar reconstruction from a site outside the Levels, to see whether the picture is typical of the lowland Iron Age or whether the wetland environment influenced the growth of the dryland flora and man's exploitation of it.

The Difford's Platform. c ad 200–250.

Coles and Orme 1978.

Difford's is the only Romano-British structure so far discovered and excavated in the peat of the Levels. It consisted of a random dump of wood, akin to Stileway or Withy Bed Copse, that had been cut from trees of a moderately wide range of species. Birch and alder could have grown within a few hundred metres of the base of Meare island, together with willow, and these 3 species make up the bulk of the wood. Maple, ash and hazel in small quantities may all have come from one slope of woodland, with blackthorn growing on its margin. Bog myrtle could have grown in the immediate vicinity or in the alder–birch–willow woods. Withy Bed Copse, to the south of Difford's and several centuries earlier, had a similar small quantity of maple–ash–hazel, indicating perhaps the establishment of this woodland type on both the Poldens and Meare island.

(*continued overleaf*)

SUMMARY OF SITES AND SPECIES

For a majority of sites from the Levels, it would seem that the wood closest to hand was used, except for the hurdle tracks, the two plank walkways of Sweet and Meare Heath and the buildings at Glastonbury. For the greater part of the third millennium, when fenwood flourished over much of the Levels, birch was culled for track building, and neither before nor after was wood available so close to hand once away from dry land. An element of species selection may be evident in the heavy use of birch as opposed to other fenwood species, but given the toughness of birch to fell perhaps this reflects its predominance across the Levels rather than any Neolithic preference for the properties of its wood.

The Baker complex does not fit a fenwood birch structure pattern, and shows a degree of species selection for particular functions as well as the full use of the more varied woodland likely to be found at the interface of fen and island. The use of split alder for the Baker slipway indicates an appreciation of the durability of this wood under water, as well as making use of the ease with which it splits. The Bell Track choices of split ash for transverses and birch brushwood for the body of the walkway are less easy to understand, although ash is another tree that lends itself to splitting.

As fenwood was replaced by raised bog, the low wet ground had few trees growing upon it compared with the preceding centuries, and it was now that the track builders turned to the use of coppiced hazel, generally woven into panels as at the Walton Heath, Eclipse, and other structures. This was an efficient way of making a strong walkway across wet ground whilst minimising the weight to be carried onto the bog.

Amidst the hazel phase, the Abbot's Way stands out with its predominance of split alder logs, and preference for hazel, birch or ash for pegs. The alder would have been easy to fell and split, but heavier to carry out onto the raised bog than hazel panels. There do not seem to be any environmental factors governing the choice of alder, for out in the middle of the raised bog it must have been as scarce as hazel, and we must presume that other, cultural factors were at play. The quantities of split alder logs used were very great.

The Tinney's and Godwin's trackways are the only ones to make heavy use of alder brushwood, although the Stileway complex also has much alder. Given the range of other species used incidentally, this may reflect a local abundance of alder fringing the dryland as much as deliberate selection, although evidence for coppicing at Tinney's and Stileway indicates some human influence on the woodland.

After the later second millennium bc, and more or less from a time when the regional pollen shows a steady increase in woodland clearance, the pattern breaks. Birch reappears as a dominant species, but not consistently so, and its use in the Westhay, Viper's and Platform tracks probably reflects its colonisation of higher and drier raised bog rather than any temporary return to fenwood (as might be postulated in association with flooding episodes). The reason for this is the paucity of associated species found with birch in any structure of the first millennium bc: the picture is very much one of birch and birch alone, as one might expect to find sparsely scattered out on raised bog. To set against this, Withy Bed Copse, Tollgate and Difford's are built of wood carried out from the slopes and margins of drier, richer ground.

The Sweet and Meare Heath tracks cannot be evaluated solely in terms of roundwood species, given that both were primarily plank walkways. The species chosen to make planks are clearly determined both by the growth characteristics of the wood in question and the ease with which it was converted into planks. Oak both grows long straight trunks and splits easily, whereas birch, for example, does neither. Plank species must have been more restricted in their occurrence than roundwood species, and the almost exclusive use of oak for the Meare Heath track and later at Glastonbury and Meare may have been due to the elimination of other suitable timber trees from the local woods as much as to a conscious preference for oak because of its qualities as a plank-maker.

For the planks, however, there is little doubt that careful selection of individual trees was made by the builders of both the Sweet and the Meare Heath track (Orme and Coles 1983). The numerous long and straight-edged oak planks from Sweet, supplemented by ash and lime planks, some from the Post Track, show sources well away from the swamp of *c*3200 bc, and probably represent man's first major impact upon the natural woodlands around the Levels. For Meare Heath in the late second millennium, with a raised bog to contend with, secondary oak woodlands were exploited for the production of surprisingly long and thin planks.

Roundwood in the Meare Heath track was used largely as foundation heaps, and so closeness of source and ease of felling were more important factors than any qualities of the wood in use. Roundwood in the Sweet Track was used for specific components, posts, rails and pegs and there are some indications that certain species, when available, were put to certain functions, but there are no exclusive uses. For example, where poplar was used it was often as a rail making good use of long straight trunks, and left-over pieces served for pegs.

The advantages of dealing with a wetland over a long period of time, here from the early Neolithic to late in the Iron Age, is that trends in woodland use can be discerned through archaeological, environmental and dendrochronological studies. For the Somerset Levels, the record is quite clear, and it demonstrates man's impact upon and management of the native woodlands which provided the major sources of raw materials for many of his activities. Trackways provide only part of the answer to the question of ancient exploitation, but they give us a clear indication of the range and variety of wood available, and a more restricted pointer to the ways by which such wood was worked.

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PREHISTORIC WOODWORKING FROM THE SOMERSET LEVELS: 3. ROUNDWOOD

by J. M. COLES and B. J. ORME
with drawings by S. E. ROUILLARD

This third paper in the series devoted to prehistoric woodworking in the Somerset Levels is closely related to the second paper on species selection and woodlands. Here, however, the examination will be restricted to the evidence for the chopping and shaping of the roundwood chosen from the wide and varied range of trees in and around the reed swamps, fenwoods and raised bogs of the Levels. Although many species were available to prehistoric man, only those major species will be discussed here where the quantities used would suggest that a deliberate effort, and conscious decision, had been made to gather and use specific woods. In some cases, only wood immediately to hand was used although it might not have been the easiest to work, and in other cases, wider areas were exploited to obtain wood capable of performing particular functions; among these, size (both length and diameter) is an obvious control but ease of working into particular shapes was another. In the first of these reports (Orme and Coles 1983) it was made clear that oak and to some extent ash, for timber, was carefully chosen and worked for track planking in both the Neolithic and Bronze Age, and for the Iron Age too, although our evidence here is rather secondary. From the evidence now assembled in the present paper, it seems clear that hazel, birch and alder were three species which for various reasons were often used in the tracks and platforms, and for which we have enough records to allow some quantifiable results to be suggested. Over the past decade of work, it has become clear that very precise and detailed recording is essential, not only for the structures but for their individual components, if synthetic and analytical assessments are to be made; our records in the early years are not, we think, up to the standards we now hope to achieve, and the variation in time spent in actual exposure of structures and that in recording and dismantling widens with each excavation. Even stray, discarded pieces are informative and require full recording (fig. 9). A preliminary assessment of woodlands and woodworking appears in Orme (1982b).

The evidence now available covers 26 species of wood, in age from *c*3200 bc to *c* ad 200, and from over 30 different sites and constructions. The record consists of excavation cards or sheets for individual pieces of wood (numbering in the thousands), drawings and sketches made in the field of many hundreds of pieces, photographs before and after conservation of hundreds of artifacts, and the conserved record of many objects successfully treated in the Project's laboratory. There is also a large series of experiments, described below, using various ancient axes on a variety of the woods most commonly used in the Levels' structures. All this evidence allows us to make some detailed observations about the methods of handling roundwood in the past, and to draw some general conclusions about the way in which the material selected and the tools available affected the results which we find today preserved in the peat.

Inspection of Table 2 in the paper on Species Selection will make clear that throughout the 4000 years for which we have some evidence, six major species of tree were chosen, probably whenever widely available, for use in the making of tracks, platforms and other structures. These woods were *Alnus* (alder), *Betula* (birch), *Corylus* (hazel), *Fraxinus* (ash), *Quercus* (oak), and to a lesser extent *Salix* (willow). The time ranges for the use of each of these, and the other 20 species, are discussed in the paper noted above, but it is perhaps worth mentioning here that the earliest structure, the Sweet Track, introduces alder, and to some extent ash and oak, well before its appearance in other structures; alder is not otherwise known in any structures before *c*2300 bc, ash before *c*2600 bc, and oak before *c*2500 bc. Thereafter, all species remain in use, even if sporadically, until our record closes at *c* ad 200.

Roundwood consists of stems, branches and twigs which have not been split into planks, boards etc. (timber), but which have been used in the round as complete sections, most often with bark still attached. On occasion, bark may be stripped off, and sometimes the tendency of particular species to split led to their use as half-rounds, still with bark attached on the outer surface; this is not real timber which should normally be deliberately shaped, by splitting, axing or adzing into an angular shape especially in cross-section, e.g. planks. Roundwood then is wood with far less working upon it, and the main reasons for treating it are (a) to fell or cut into lengths of a suitable size, (b) to shape one or both ends if either had to perform a particular function; the best example is sharpening of an end for pushing or driving into the ground as post, peg or stake.

Obvious ways to fell or otherwise produce lengths of roundwood are by breaking the wood if it is small enough, to snap-off or pull away the stem from its root or stool using hands and/or foot to aid its detachment, to chop into the stem then break it away, or to chop straight through with a number of blows (fig. 10). Stone axes, bronze axes of various types, and iron blades, were used at appropriate times, and each had a particular technique depending on the nature of the wood being attacked. In the examination of the wood from the prehistoric structures in the Levels, the marks left by the implement can often indicate the character of the tool used, its technique of usage and sometimes we may approach the identity of the tool or its user, where a particular tool leaves its signature on the wood, or where the technique used is more or less idiosyncratic, and seen on several pieces. As yet, however, one cannot put names to such identities.

In order to make some meaningful comparisons, we have attempted to define the descriptive terms carefully while admitting that wood, being a flexible medium, allows infinite variation in the ways by which it may be worked. For roundwood there are seven obvious elements to consider: species of wood, whether green or seasoned, its growth rate, the type of tool, angle of cut, shape of product and character of facets; several of these are self-explanatory and require no detailed comment here, although all will be considered somewhere in this paper. The woods used are listed in Table 2 in these *Papers*, and the experimental work undertaken here and by many others has demonstrated the ease with which

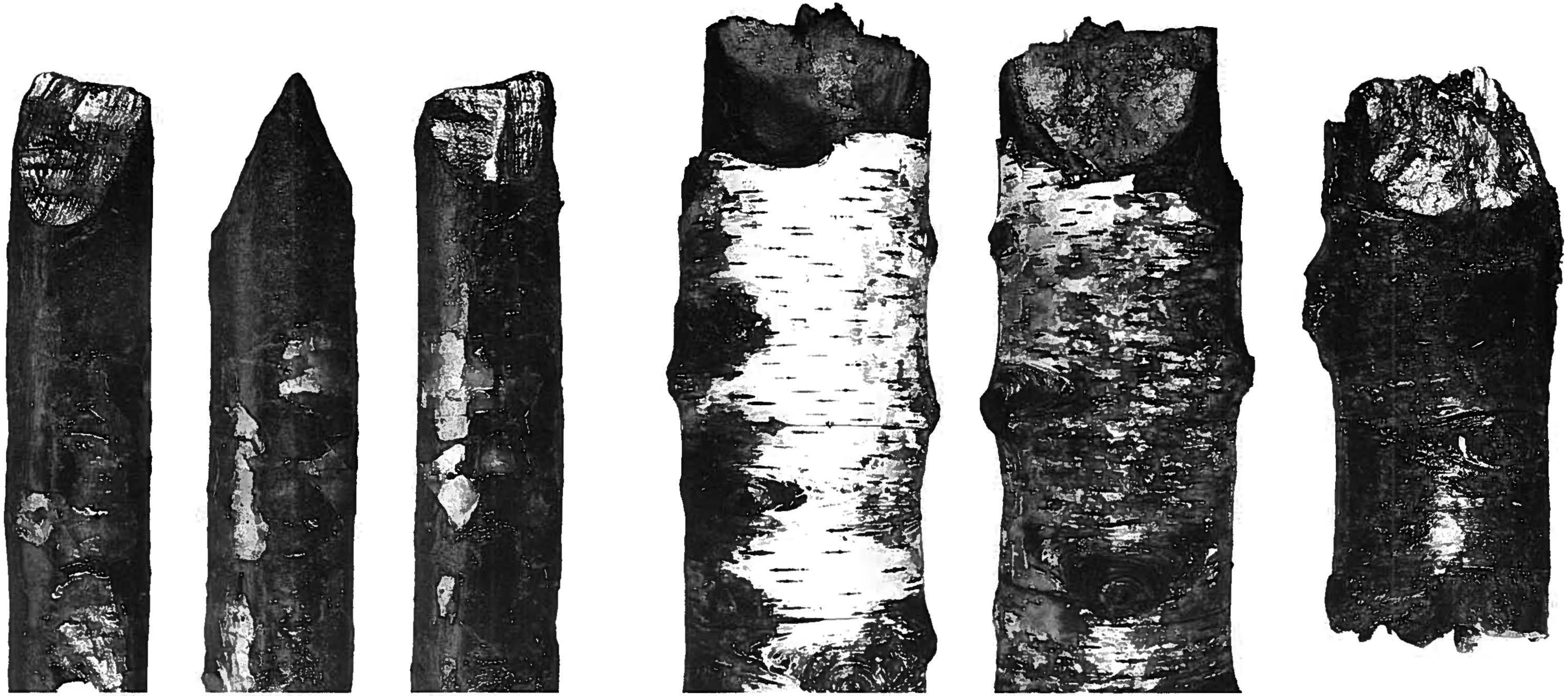


Fig. 5 Garvin's and Jones' tracks birchwood. Scale ½.
Left, GV79.33 (3 views), wedge end with facets forming an asymmetrical end. A rough axe blade is suggested by the ridged and grooved facets. Centre, GV79.22 (2 views), wedge end chopped on a heavy birch stem, with the wood tearing at the end. Right, JN79.12, wedge end roughly chopped on birch stem.

oak, for example, may be worked green, and its difficult nature when seasoned. The growth rate of wood is more complicated, and will not be explored in depth here; fast-grown ash, for example, is tough to work, and slow-grown branch woods may be brittle and hard to control. The axes used upon the wood are also varied, and some of those found in the Levels were noted in Orme and Coles 1983, 22.

The angle of cut has been used as a general guide in the recording of wooden objects. There are several elements involved, as an axe will have in effect two angles, its blade angle (the angle made by the two opposing faces of the axe) and its edge angle (the angle made at the extreme cutting edge through grinding and sharpening). We are not yet at a stage to identify these two features on the wood, and have confined our comment to the angle of the blade as it enters the roundwood. This is recorded in relation to the line of the wood (fig. 11): straight, at right angle to the stem (90°–80°); steep, at 80°–60°; medium, at 60°–40°; shallow, at 40°–20°. A very shallow entry into the stem may produce a slash, removing a long sliver or splinter of wood.

The shape of the product has been generalized for our purposes into five shapes: snapped or torn, chisel-end, wedge-end, pointed, and variant-pointed. These are best demonstrated by illustrations as well as by written descriptions. Many stems or branches were reduced to the desired lengths by breaking, pulling or tearing (fig. 10). Slender pieces are obvious candidates for this simple approach if the wood is not too flexible. Some species tend to tear and shred, such as willow, and alder too, and birch can sometimes be rather tough. *Chisel-ends* (fig. 12; see also fig. 6) were produced by chopping through the stem or branch from one side only, with one or more blows until the roundwood was severed. The blows delivered might be single (fig. 12, ECL2), one upon another (fig. 12, TinA28), or side by side (fig. 8, ML82); the other side of the stem is untouched.

These are generally recorded as 1 + 0, 2 + 0 etc., that is, facets on one side and none on the other. *Wedge-ends* (figs. 13 and 14; see also fig. 5) were produced by chopping on both sides of the stem, to form an intersection of facets, and these may be simple (1 + 1 fig. 14, TinA36) or multiple (1 + 2, 2 + 2, up to 12 + 15 e.g. fig. 13). Larger pieces often required more chops, but in any event our experimental work demonstrates that to produce a sharpened peg or stake with a stone axe may require as many as 50 chops, yet at the conclusion, the piece will bear only 5 or 6 facets, the others having been removed totally. Both chisel- and wedge-ends are wide, more or less the full width of the stem, in contrast to *pointed ends*, where the wood has been sharpened like a pencil, worked all around and carrying multiple facets (fig. 15, 23, 24). Often, however, these are grouped, as the worker chopped on one general place, turned the piece slightly and chopped again, then turned and chopped again; such pieces are recorded as e.g. 2 + 1 + 3, or 3 + 2 + 4. The facets may be on top of one another (e.g. fig. 4) as well as beside one another (e.g. fig. 23, SWD575). A variant point, often seen for hazel sails in hurdles, is produced by two facets, side by side on one half of the stem only, to intersect and form a point (fig. 28). Recorded as 1 + 1 + 0, these ends were made on the sails to allow them to be stuck into the ground during weaving of the rods; they were probably produced by holding the sail nearly vertical, chopping one facet, slightly turning the stem, and chopping the other.

The character of facets will be described for particular woods and sites in the course of this paper but in general one may identify facets that are slightly dished, concave across their width, and produced by stone and some bronze blades, or flat, produced by some bronze and iron blades. This is only a general descriptive distinction, as blade angle and edge angle (noted above) play their parts in the shaping of the facets. Facet junctions, where the blade has not gone straight through the wood but has come out across a previous facet, may be rather ragged, or sharp and clear; this is a reflection of the wood species more than contrast between stone and metal axe, although as a general guide a metal axe tends to make a clearer exit. Facets produced by stone axes tend also to be shorter than those from a bronze axe, but this too reflects not only wood species but also angle of cut; stone-axe users knew what their tools would and would not do, and rarely attempted a shallow angle or slash cut, whereas metal-axe users often over-estimated their ability to successfully cut through a stem in one shallow-angled chop. Where this event occurred, and the blade in effect jammed, its withdrawal often left the imprint of the blade-edge, evenly curved and reproducing the blade-shape. It is also clear that some Bronze Age sites have roundwood with flat wide facets reminiscent of those later sites where wide sharp iron blades, axe or bill-hook, are likely tools. Finally, the character of facets can sometimes point to individual tools, which were damaged and which thus left their imprint in the form of ridges and scratches; where these pieces can be related, the signatures provide a clear guide to contemporaneity and association.

The range of trees available to the builders *c*3200 bc–*c* ad 200 was wide, and among this variety there were a number which were often selected as roundwood for working. The structures made from roundwood include what may be called

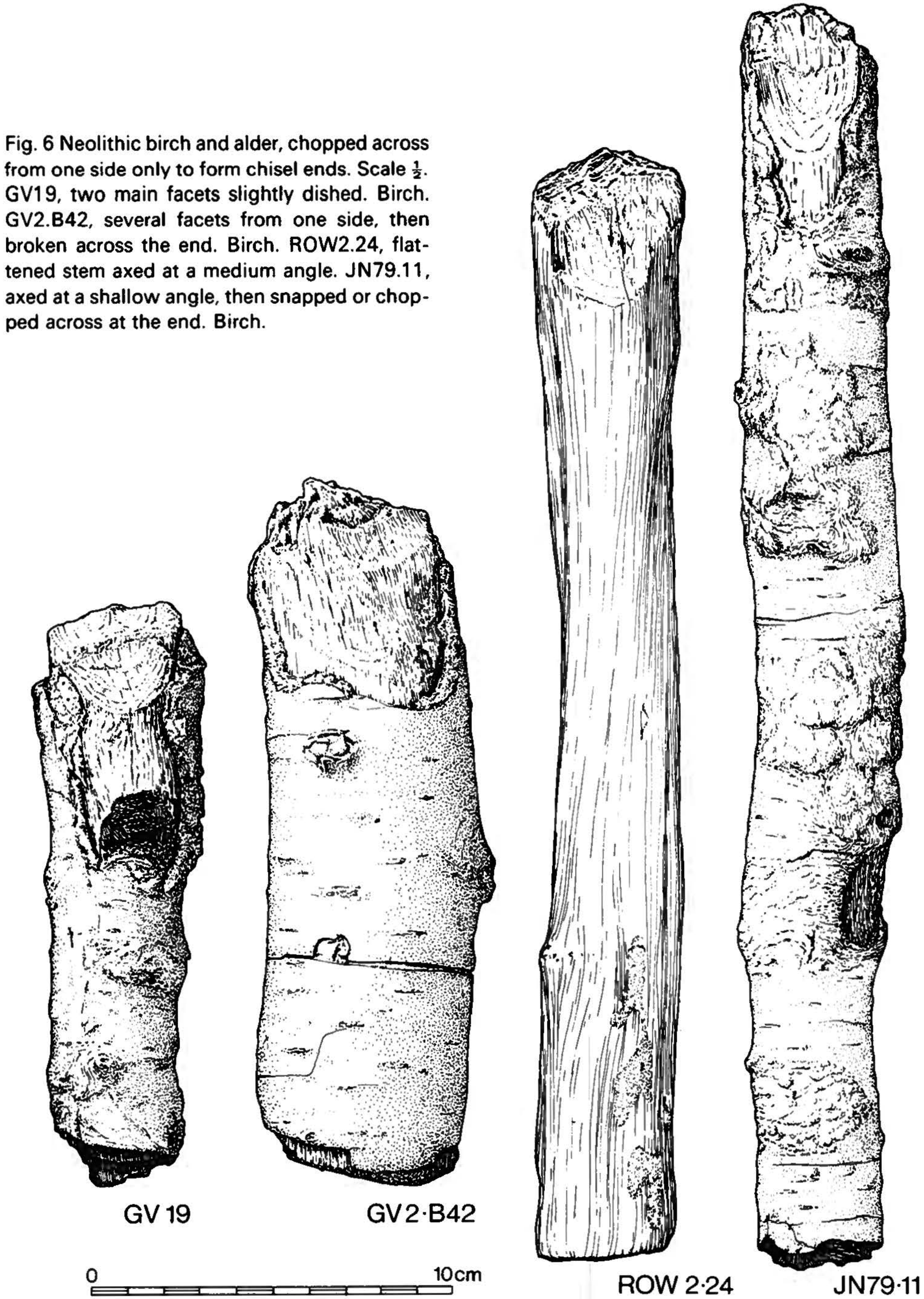


Fig. 6 Neolithic birch and alder, chopped across from one side only to form chisel ends. Scale ½. GV19, two main facets slightly dished. Birch. GV2.B42, several facets from one side, then broken across the end. Birch. ROW2.24, flattened stem axed at a medium angle. JN79.11, axed at a shallow angle, then snapped or chopped across at the end. Birch.

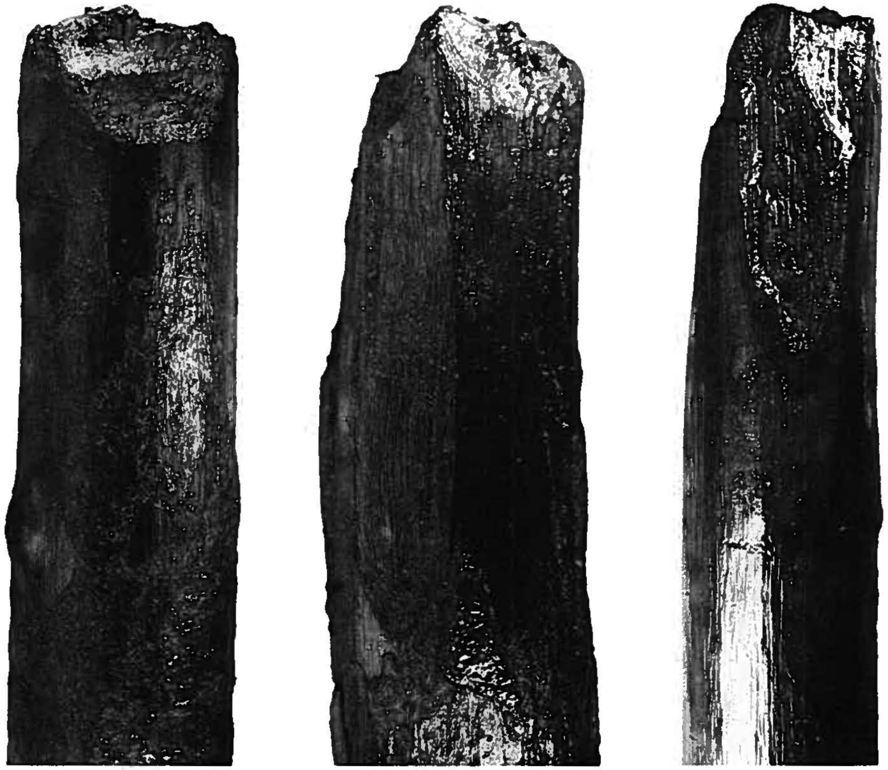


Fig. 7 Abbot's Way ash used for pegs. Scale ½.
Left, AW79.26, wedge end chopped at a medium angle. Centre, AW79.27, pointed end axed at shallow angles with a final chop across the end. Right, AW79.24, wedge end chopped at a shallow angle.

built-tracks (where individual elements were fitted together), brushwood tracks (of bundles and heaps of mostly little-prepared stems and branches), split roundwood tracks (of stems roughly split), platforms (of brushwood, split roundwood and occasional timber), hurdle-tracks (of hazel or alder woven panels), and other variants (e.g. layers of thin brushwood or brash with transverse split stems interspersed). Most of these structures have one element in common, that they had to be somehow fastened to the underlying peats by pegs or stakes driven through or beside the horizontal pieces. As such pegs and stakes were sharpened before driving, and as their lower ends are buried and well-preserved, they give us the best indication of what was achieved; however, the brushwood bundles of the Neolithic and Bronze Age also provide valuable indications of the scale and character of woodworking where less-sharp ends were appropriate to the structure. This is perhaps one important fact to recall in making comparisons through time; pointed roundwood may be the result of felling and separating into usable lengths, or of deliberately sharpening for driving into the ground. Almost any method would do for the former, but not for the latter.

The woods examined in this paper are alder, birch, hazel, ash and willow. As can be seen in Table 5, there is variation in the diameters of the roundwood used, and our paper on Species Selection makes some suggestions about rate of growth. Fast-grown oak, for example, has a different character to that of slow-grown oak, and the knowing woodworker will choose accordingly. In track and platform building, it is unlikely that such a refinement would have been exercised, even if known, for basic roundwood choice, and so in this paper we disregard rate of growth.

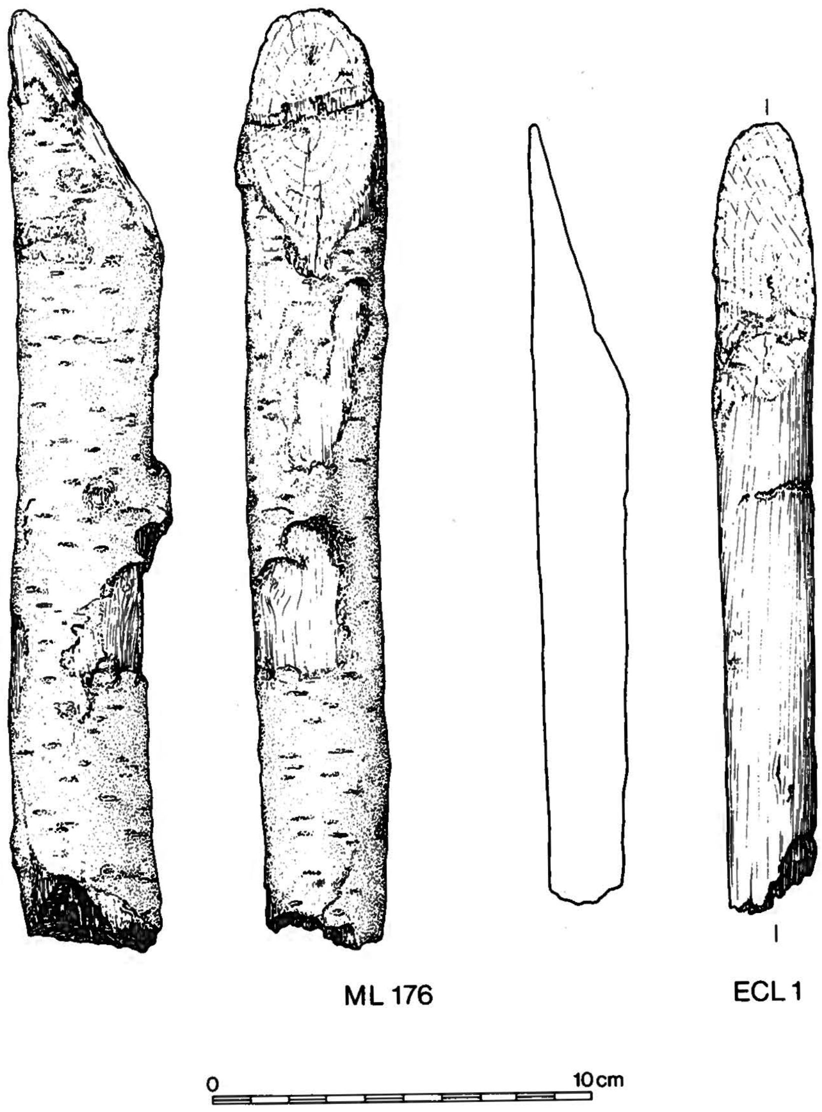
However, the age of the tree and its consequent diameter (even if variable) is a factor, and the felling, handling and working of heavier roundwood will be different from slender trees and branches. The maximum lengths of roundwood encountered in the structures so far examined are 12m rails and 2.5m posts in the Sweet Track, 5m stems in the Baker Platform; this compares with the 3–5m planks of oak, lime and ash from the Sweet Track examined previously (Orme and Coles 1983, 25; Coles and Orme 1984, 16). Even the numerous pegs of the Sweet Track were up to 3m long although most were less than 2m (hazel) or less than 1.5m (willow, holly, oak, ash, elm, dogwood); the holding and turning of these for sharpening would be different from the much more slender and shorter pegs of later structures.

TABLE 5 Diameters (mm) of roundwood by species in selected structures

	Alnus	**Betula**	**Corylus**	**Fraxinus**	**Salix**
Sweet Track	30–40	20–80	30–200	15–85	40–100
Chilton Tracks	—	40–100	—	—	—
Garvin's Tracks	—	5–80	—	—	—
Rowland's–Walton	—	—	10–70	—	—
Bisgrove–Jones	—	5–60	—	—	—
Baker Platform	20–200	15–160	10–150	10–140	15–90
Abbot's Way	30–150	30–60	40–60	—	—
Eclipse Track	—	—	5–45	—	—
Meare Heath	10–50	—	—	—	—
Tinney's Tracks	10–85	—	—	—	—
Difford's Platform	—	15–110	—	—	—

Notes:

Sweet Track:	*Corylus* posts 60–200, pegs often 30–85mm *Salix* pegs often 50–85mm
Garvin's Track:	*Betula* roundwood often 30–50mm
Rowland's–Walton Heath:	*Corylus* rods often 10–25, sails 20–25, pegs 40–70mm
Baker Platform:	*Salix* reflects beaver taste not human
Abbot's Way:	*Alnus* pegs 30–70, horizontals 90–150mm
Eclipse Track:	*Corylus* rods often 10–25, sails 25–40mm
Tinney's Tracks:	*Alnus* roundwood often 25–30, posts 35–85mm
Difford's Platform:	*Betula* roundwood often 15–70mm



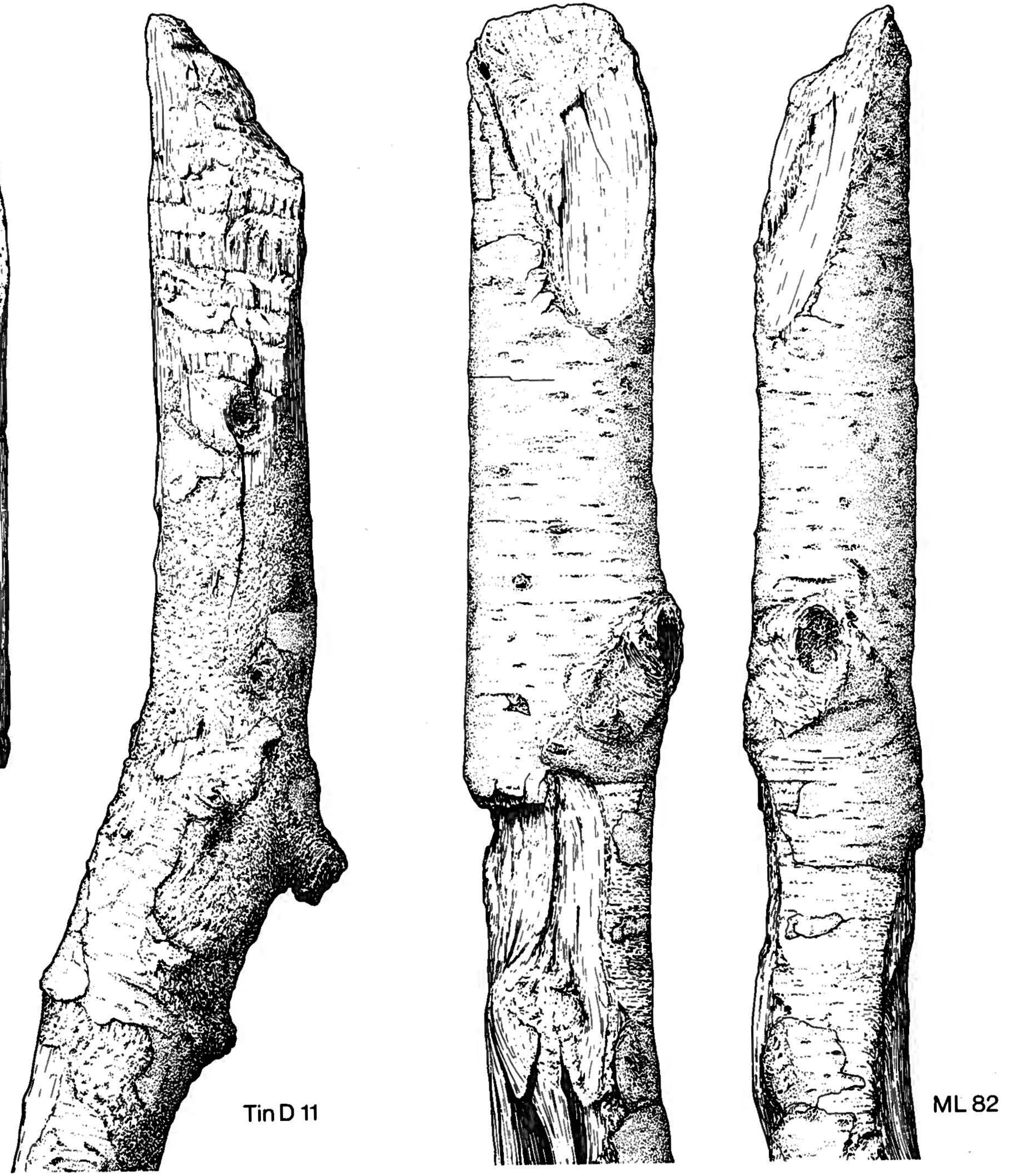


Fig. 8 Bronze Age alder and hazel branches used as pegs, rods and brushwood. Scale ½. These were chopped at shallow angles, the axe blade sometimes leaving clean flat facets (ECL1, ML82), sometimes stepped facets where the blade did not cut through at once (ML176, TinD11).

EXPERIMENTAL WORK ON ROUNDWOOD (figs. 16–22)

A series of experiments has been conducted on a variety of roundwood in order to gain a better understanding of the nature of the woods and the ways by which they could be worked in the Neolithic and Bronze Age. Young roundwood stems of hazel, ash, willow, birch and alder were selected, with 2–4 years of growth rings on all but the alder which was 4–6 years old. The diameters of the roundwood ranged from 11–26mm. Additional wood of older age (9–10 years) and greater diameter (30–55mm) was also available for work. The tools used in the experiments were various bronze and stone axes, with ash hafts 300–400mm long. One stone and one bronze axe had hafts 500mm long. Some of the tools and their weights and hafts are listed in Table 6.

All the axes were sharpened by grinding before use, and this action left various irregularities on the blades, such as small nicks, feather edges, or rough surfaces. During use these were observed and by the end of work, after many hundred blows had been delivered with each tool, almost all of the minor irregularities had been cleaned away or smoothed out. Traces of these signatures on the wood were therefore more readily visible and identifiable when the tools were first in use and much less so after prolonged use. Recent experimental work with greenstone axes shows that, in one case, 16 hours' use required 14 resharpenings, so it is possible that one axe alone could have a series of signatures over time (Olausson 1983); most of our work has been done with bronze axes where such extended use has not been tested. Further comment appears below, and for present purposes we concentrate upon the evidence left on the wood rather than on the tools.

The axes were used primarily to prepare sharpened points on the roundwood, to duplicate those faceted ends seen on Neolithic and Bronze Age pegs and stakes from many structures in the Levels. All axes and types of wood were used for each of the basic experiments, which involved efforts to chop straight through the roundwood at 90°, and at varying angles (20°–80°), either with single blows or to intersect another facet or facets from the other side of the piece. One hundred separate artifacts were made, some of them reworked several times, and the number of axe-blows per piece ranged from a single chop to over 200 (fig. 16). The details of each, with photographs, remain in an archive, and only a summary is given here. Notes on some experimental working of timber, a separate series, have already appeared (Orme and Coles 1983).

TABLE 6 Details of axes

	axe weight (g)	haft length (mm)	total weight (g)	blade width (mm)	blade thickness (mm)	blade angle (°)
flat axe, bronze	700	500	900	120	10	40
palstave, bronze	400	350	600	57	12	25
socketed axe, bronze	100	300	300	40	17	25
stone axe	400	500	1000	60	36	55

Note: blade thickness measured 30mm from edge; blade angle = sharpened angle

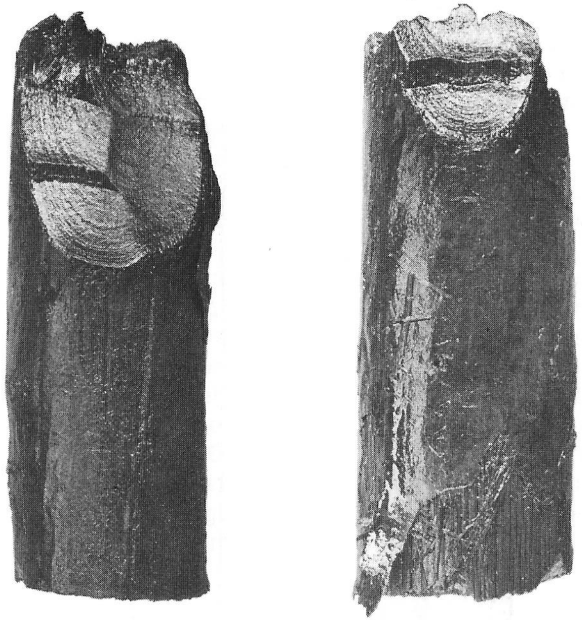


Fig. 9 A stray piece of hazel, SWC137, found beside the Sweet Track. Scale ½. Axed at both ends with a stone axe which left concave (dished) facets, including one which is stepped (raised) above its neighbour; these show the sequence, angle and force of the work. The axe blade was smooth, probably polished, and left no visible signature in the form of ridging and grooving on the facets.

The five species of wood displayed different characteristics in the experiments, just as the Neolithic and Bronze Age examples do.

Hazel, abundant as Sweet Track pegs, and in Neolithic and Bronze Age hurdles, tends to split longitudinally during chopping, and provides medium resistance to the axe-blade; its bark remains intact. The facets created by the axe are clean and sharp, and retain any axe blemish. In creating copies of Bronze Age pegs, such as were encountered at Tinney's Ground, or hurdle rod-ends, as in the Eclipse track, the heavy flat bronze axe proved most suitable, producing a slightly cleaner cut than the palstave, with the lighter socketed axe yielding a more ragged set of facets (fig. 16). The facets, however produced, are slightly dished as if the oblique entry into the wood at 30°–60° causes the blade to be deflected upwards; scoop facets are thereby produced. There is little difference between the flat (thinner) axe and the socketed (fatter) axe in these facets, in contrast to some published accounts. The stone axe was less effective than the bronze axes, penetrating less deeply, and leaving coarser facets, but certain features are clear (fig. 20); the bark-facet junction may be slightly smoothed just as was noted on some roundwood from Garvin's tracks, or nearly sharp as on the Walton Heath hurdle track pegs. The facets produced by a stone axe are generally distinct from

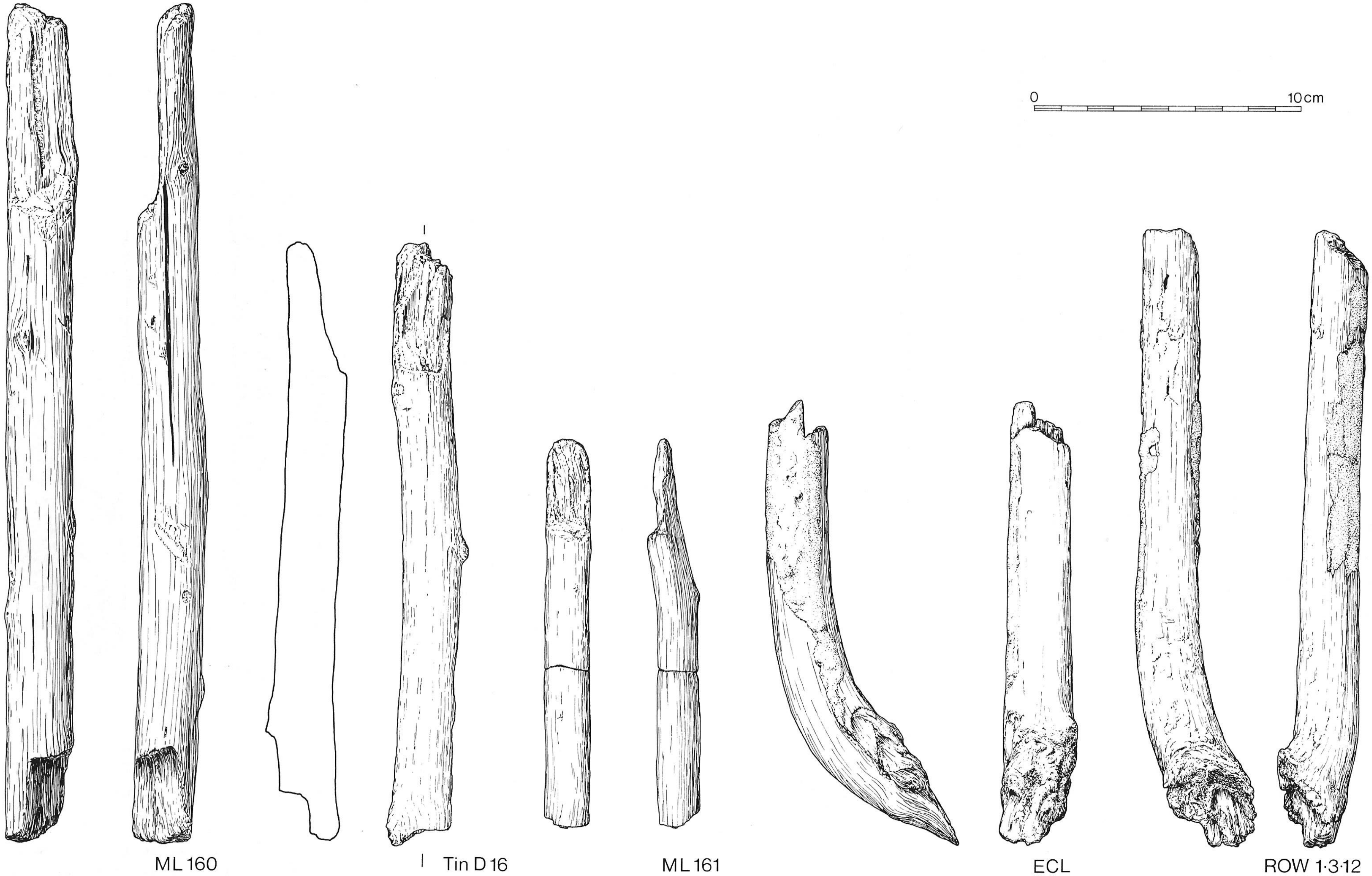


Fig. 10 Chopped and tearing of roundwood. Scale $\frac{1}{2}$.
ML160, each end has been chopped once at a steep angle, then torn away and snapped off. TinD16, a slight chop and tear, but the blurred facet could also have been left by a cow chewing at a slender branch. ML161, a single chop and tear on a 2 or 3 year twig. ECL, a coppiced heel probably chopped before it was pulled from the stool. Hazel. ROW1.3.12, a coppiced heel torn from the stool. Hazel.

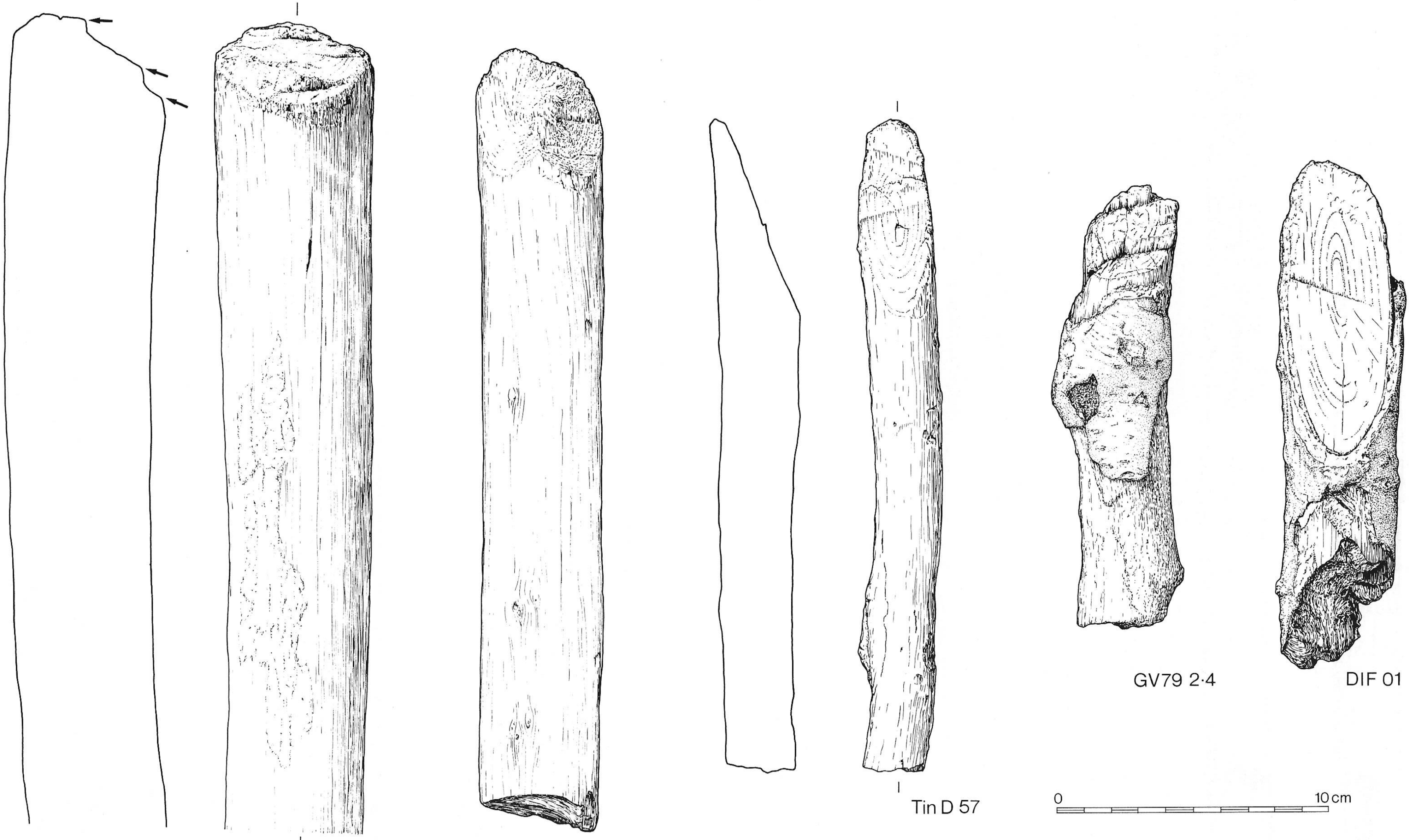


Fig. 11 Angles and facets on roundwood. Scale ½.
SWD94, chopped at a steep angle into the wood leaving a rather blunt end. WAL2.19, chopped at a medium angle with an axe which left dished facets. TinD57, chopped at a shallow angle, with straight ridges between the three facets. GV79.2.4, chopped at a medium angle into the wood, with steps left between the facets. Birch. DIF.01, chopped at a shallow angle with a wide flat blade which cut cleanly through thick bark.

one another, with ridges separating, so that it is possible to identify a set of facets (fig. 22); but in order to reproduce a typical Sweet Track peg of, say, 4 + 2 facets (wedge), it would be necessary to chop at a rate of, say, 12 + 8. Some chops do not completely remove a chip, others are obscured or removed by subsequent chops. If anything was learned by the experiments, it was that the mere counting of facets on prehistoric roundwood does not tell the whole story, and the character of bark, wood, axe and axe-work are all variables. Hazel is a common species in the Levels structures, and its tendency to split longitudinally (fig. 21) is the reason why Bronze Age rods and pegs of hazel often have one or two shallow facets (20°–30°) ending in a long torn strip which forms the fragile tip of the piece. This is not a feature of hazel pegs from the Sweet Track, where the angle of cutting was of medium or steep aspect, rather than shallow. Sail ends of Bronze Age hurdles are often distinctive in their preparation, with two facets side by side closely intersecting on one surface of the sail, the other half of the roundwood left unworked (1 + 1 + 0). The feature is not encountered elsewhere and it would seem that it was produced on the site of hurdle-making by selecting sail-size hazel rods, and smartly chopping them with only a slight turning of the rod to make the point. The best way to do this is if the rod is held at a steep angle to the ground, and chops are made at very slightly different angles on the upper surface.

Alder is another common wood in the Levels and can be chopped cleanly. The bark does not strip or tear but there is a tendency for the roundwood to split. The ease of splitting alder perhaps encouraged its extensive use on the Abbot's Way as half-rounds. The axe facets on obliquely-chopped pieces tended to be slightly dished, and if the blow was shallow at 20°–30°, the piece might split or tear and yet remain held by the bark. Any irregularities on the axe-blade will be signalled on the alder facets and it is an easy wood to work with either bronze or stone axes (fig. 19 and 20).

Birch was commonly used in Neolithic structures and Garvin's and other tracks contain abundant quantities of this species (fig. 5). The wood is rather fibrous and when fresh its sap also creates some resistance to axe-work. The bark is easily smashed and bruised by axe blows, and the wood snaps off readily, leaving a set of steps across a worked face rather than a series of smooth intersecting facets (fig. 17 and 22). The wood will also tear if cut shallowly (20°–30°), but it will not split easily. The result of this is the production of many small chips of birch around the working site, not long slivers but short chunks. Dishing of facets is less evident for birch and the difficulty of working wet-grown birch is reflected not only in the experiments but in the coarse workmanship of the Neolithic birch structures such as Garvin's tracks and the Honeygore complex. We have not distinguished between *Betula pendula* and *Betula pubescens* either for the prehistoric wood or for these experiments, and it is possible that the experimental work was exclusively on one species, which could be tougher than that selected by prehistoric workers.

Willow is a wood not often encountered in bulk in the Levels structures but it has some slight use in all periods, and was used in the northern part of the Sweet Track. The wood is easily crushed by both stone and bronze axes, and it tears into strips, with some splitting (fig. 18). A direct chop into the wood at 90° will severely compress the fibres; chips tend to cling to the parent piece rather than fly off. The tough bark is not very firmly attached to the wood, and peels away in lengths quite easily. Some dishing of facets may survive, but the use of a stone axe in these experiments barely succeeded in creating any facets at all due to the crushing of wood; yet Sweet Track pegs of willow have clearly-marked facets, created probably by a very sharp and rather thin stone axe.

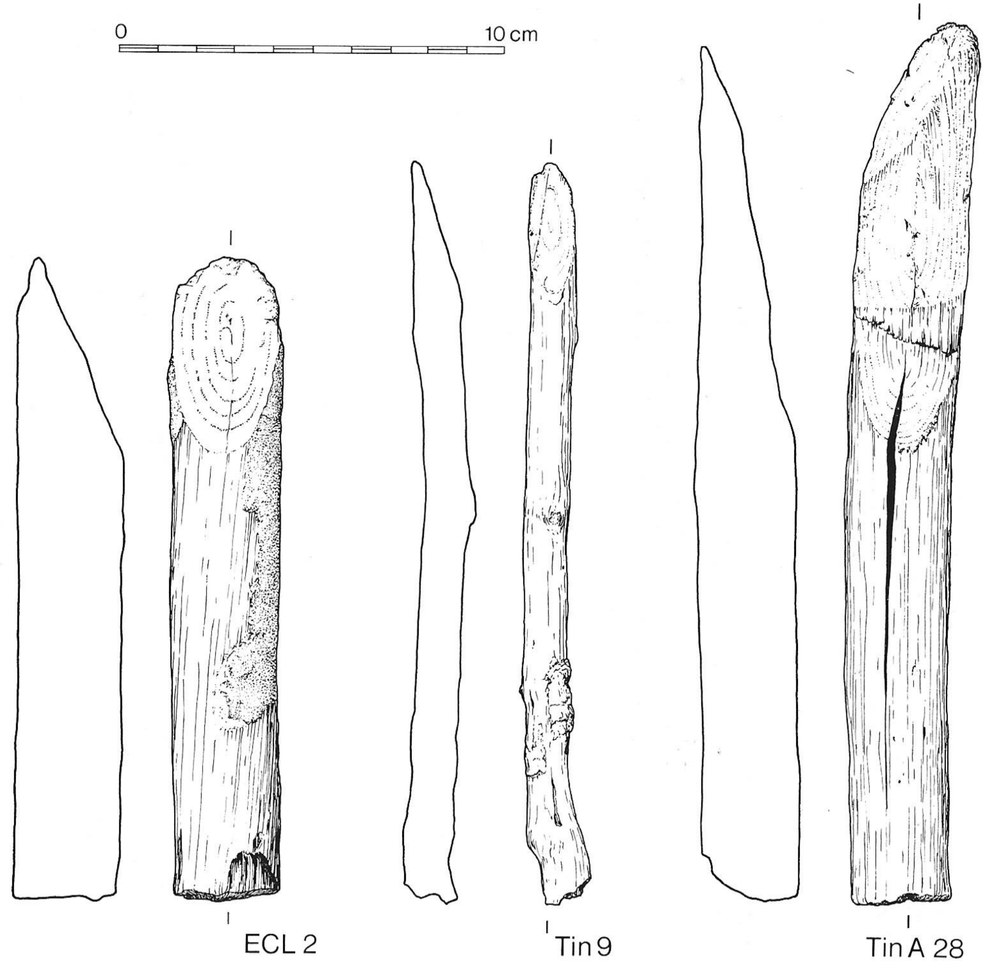
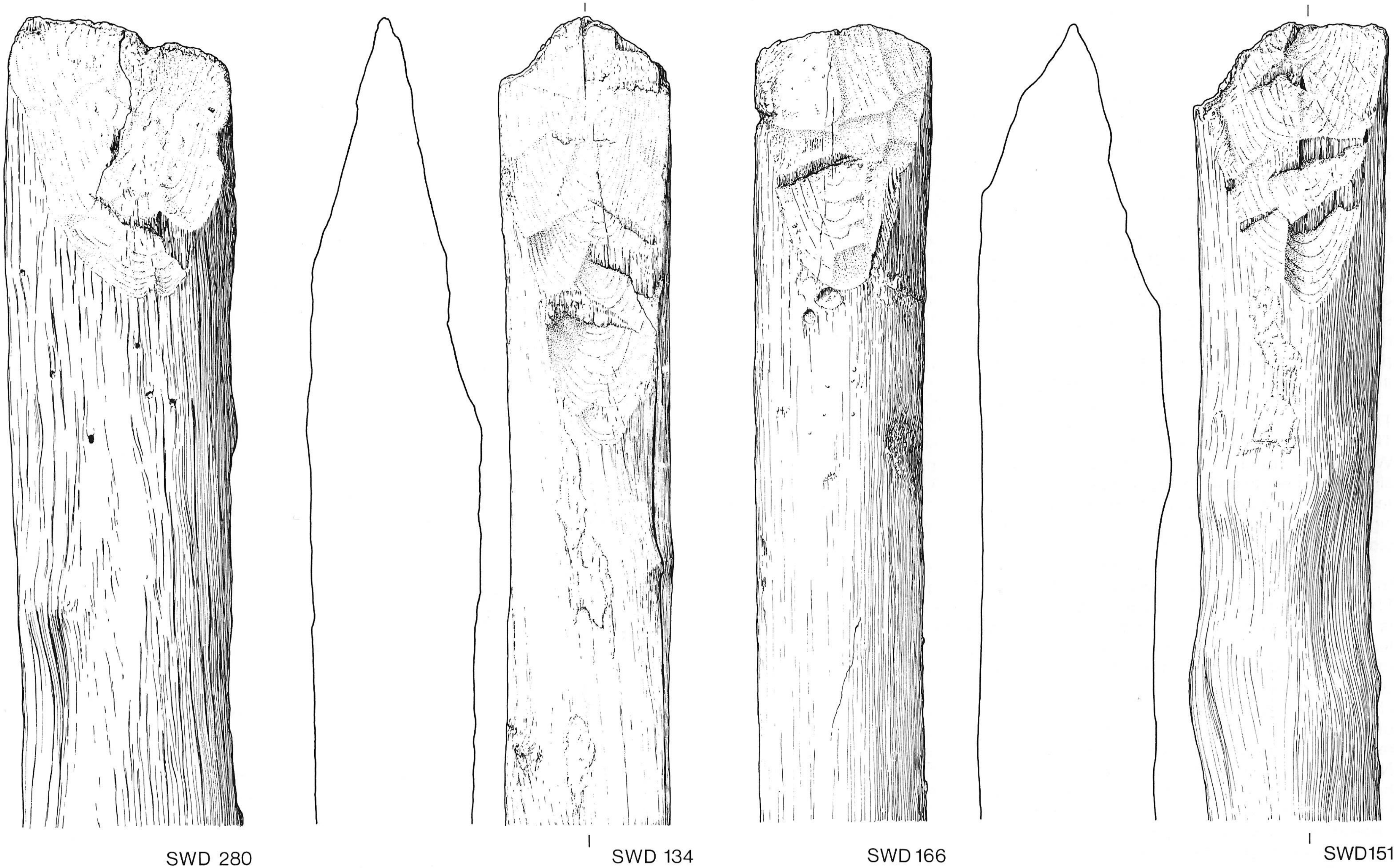


Fig. 12 Chisel ends, Bronze Age. Scale ½.
Pegs, rods and brushwood chopped from one side only, at shallow angles, leaving clean facets. Alder and hazel.

Ash is a finer quality of wood for working with axes, and could be cut cleanly by both bronze and stone blades. There is little or no splitting and facets are clean and easily produced (fig. 18 and 19). Dishing of facets tends to be marked for



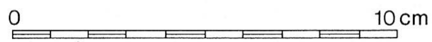
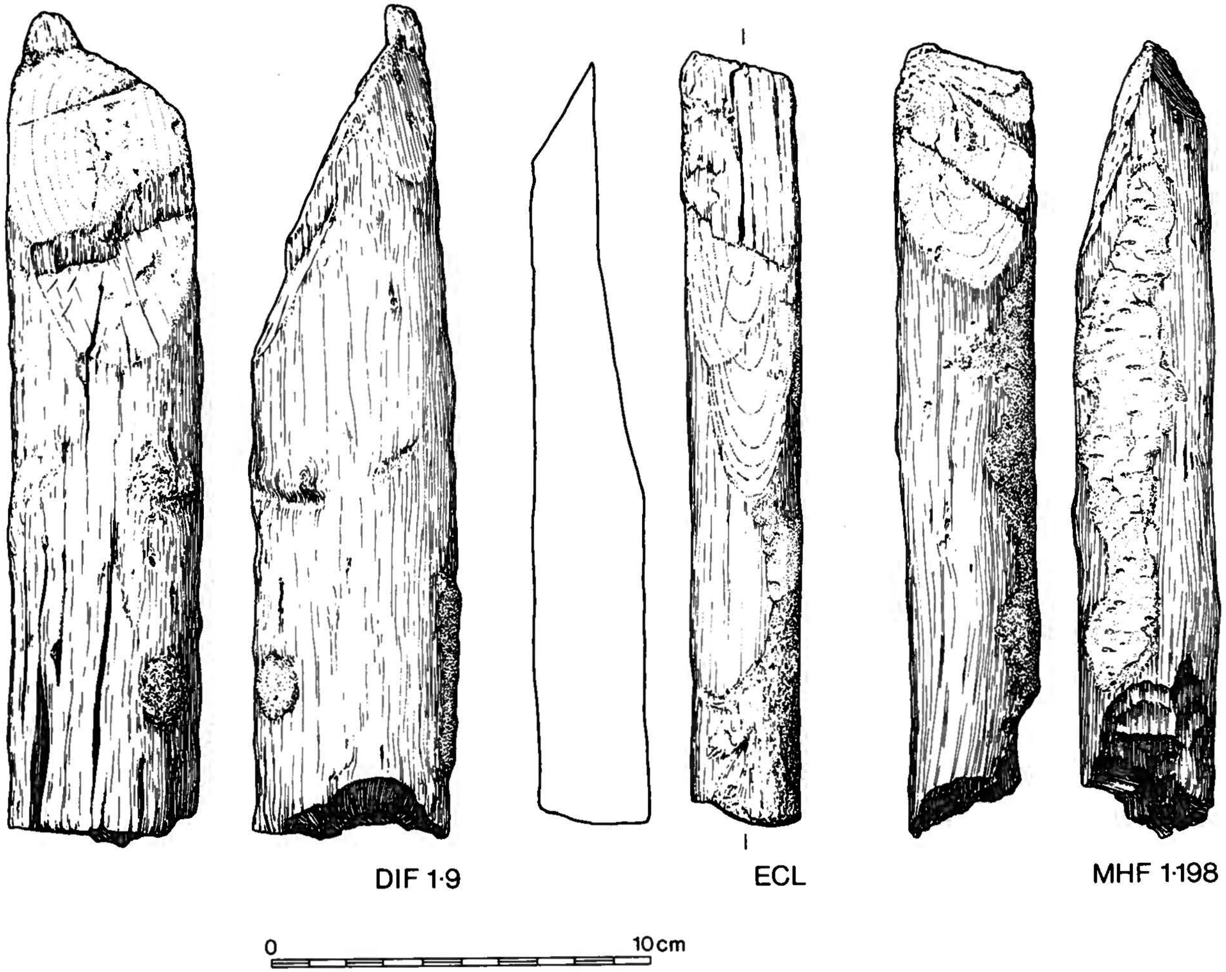


Fig. 13 Wedge ends, Neolithic. Sweet Track. Scale ½.
These pegs have been chopped from two faces to make wedge ends. The axework was at medium angles, with one face longer than the other. SWD151 and 280, hazel; SWD166, holly; SWD134 unidentified.



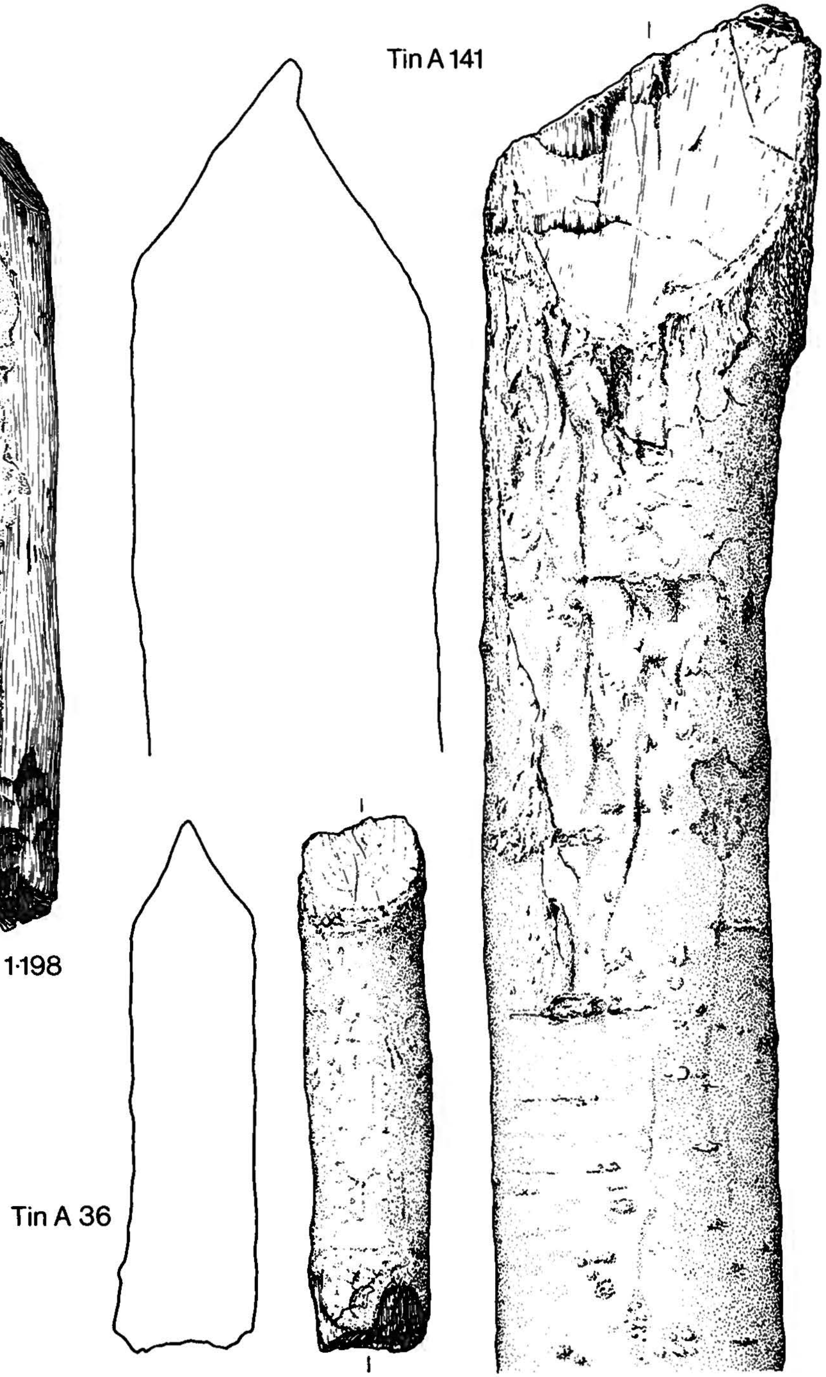


Fig. 14 Wedge ends, Bronze Age and later. Scale ½.
DIF1.9, a heavy piece chopped into an asymmetrical wedge end with a wide flat axe or blade, with two stepped facets on one face and a short facet on the other. ECL, an asymmetric wedge end formed by a single facet on one (undrawn) side, and two shallow-angled facets and a tear on the other. MHF1.198, asymmetric wedge end with flat facet stepped on one face. Alder. TinA36, a single wedge end formed by the intersection of only two facets. TinA141, chopped from two sides, with stepped flat facets. The undrawn side has five facets.

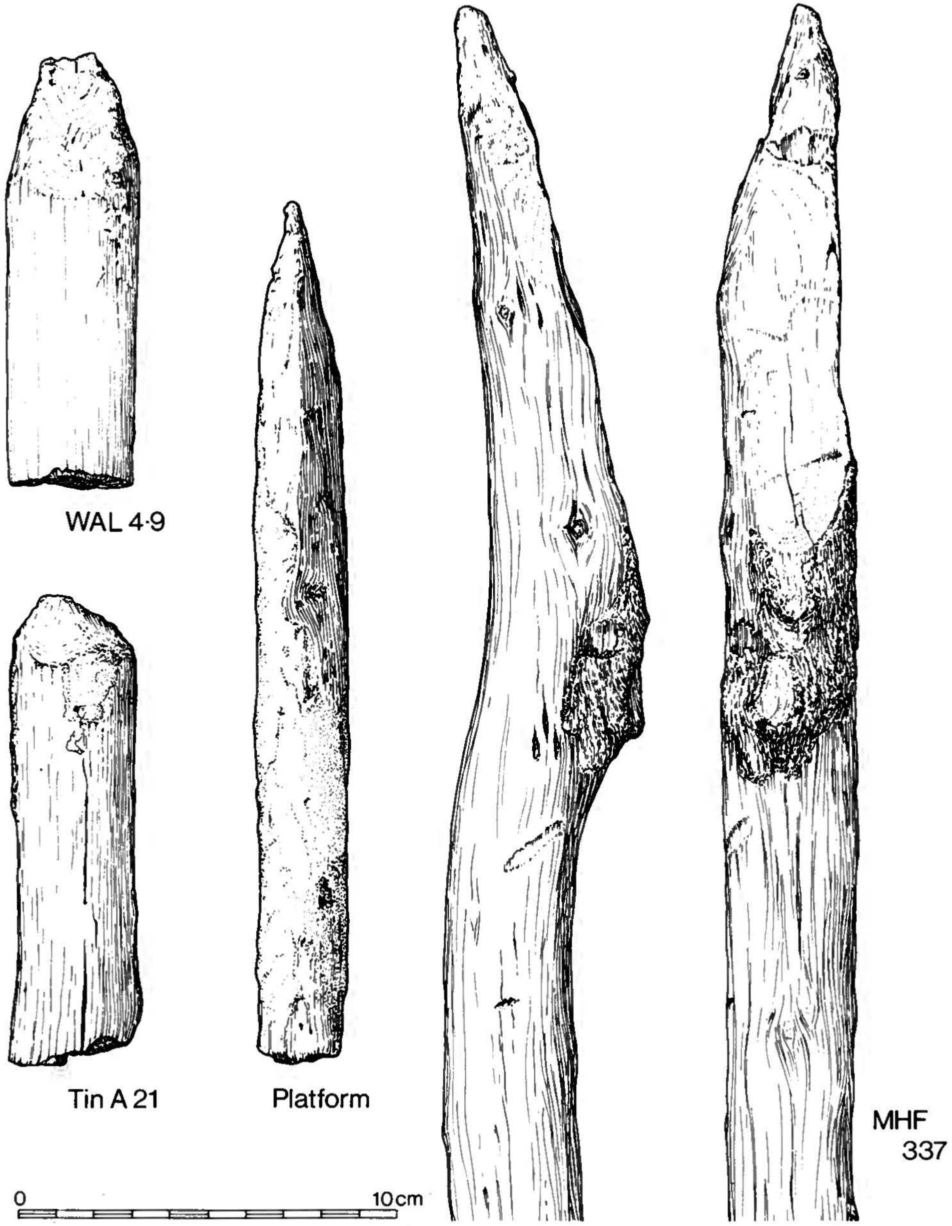


Fig. 15 Pointed ends, Neolithic and Bronze Age. Scale ½.
WAL4.9 and TinA21, chopped on four separate faces, leaving slightly dished facets on the Neolithic piece (WAL), and more steeply-angled facets on the Bronze Age piece. PLAT, a narrow rod with long very shallow facets. MHF3.37, chopped only around half of the piece, to form a slender slanting point.

bronze axes, and not for stone axes; the latter could crush the wood if applied too steeply (70°–90°). Bark may strip off, unlike hazel or alder, and axe-blade damage should be signalled on the facets. This wood probably demonstrates more than any other the increased efficiency of metal axes over stone axes, yet the abundance of ash handles for the Neolithic shows that the wood was identified, popular and successfully worked.

The experiments in themselves are in no way a complete set of observations about these woods and axes. The work was designed to gain an understanding of Somerset Levels species and the ways by which they might have been worked and therefore selected for various purposes. Already the Project has built up a body of experience about wood technology so that newly-discovered structures can often be identified for general positioning in the sequence of sites on the basis of pure wood technology. This is of minor importance, but it does demonstrate that distinctions exist and can be identified. What is more important is that certain woods possessed particular features and characteristics, and that prehistoric woodsmen were aware of them and consistently used them advantageously. That this was so should be no surprise but it is nonetheless satisfying to be able to demonstrate it.

ROUNDWOOD WORKING BY SITES

*Sweet Track. c*3200 bc. Fig. 3, 4, 13, 23, 24.
Coles, Hibbert and Orme 1973; Coles and Orme 1976a, 1979, 1984.

An estimated 6000 pegs and 400 rails of roundwood were required for this structure, with hazel commonly used for pegs in particular (see Coles and Orme 1984 for details of 10 recently-excavated sites along this structure). Willow, holly, poplar, alder, ash and oak were also used for pegs, and large hazel stems for posts. The working of all of these into pegs or posts for driving deep into the marsh was carried out with stone axes which left clear traces on hundreds of artifacts. The angle of chopping was almost invariably steep-to-medium, as a shallow angle with a rather thick stone axe will generally succeed only in bouncing the axe off the stem due to its fatness. Where a shallow angle was used successfully, a thin stone axe is indicated, and one that is sharp. A solution adopted by the Sweet Track builders was to chop a wedge-end (see below) with medium-to-steep angles, then in order to reduce the overall thickness of the peg just above the wedge-end, short shallow facets were created, removing the upper parts of the first set of facets on each side of the stem. The result was a peg with an end thin enough for driving, with a minimum number of axe blows. Pegs of species other than willow or poplar were commonly prepared as wedge-ends, with far fewer chisel-ends, and even fewer pointed ends. Because most of the stems were over 40mm diameter, a number of chops were required, and a sample of pegs of hazel from the Turbary site (Site TG) may illustrate the variety and proportions. Of 70 hazel pegs, 50 were wedge-ends, 12 chisel-ends, 8 pointed. Of the wedge-ends, the simplest is 1 + 1 facets, of which there were 5 examples, and the list extends to a multi-faceted wedge-end with 13 + 13. It will be remembered that many facets are removed during the work, so 13 + 13 may indicate up to 40 + 40 blows

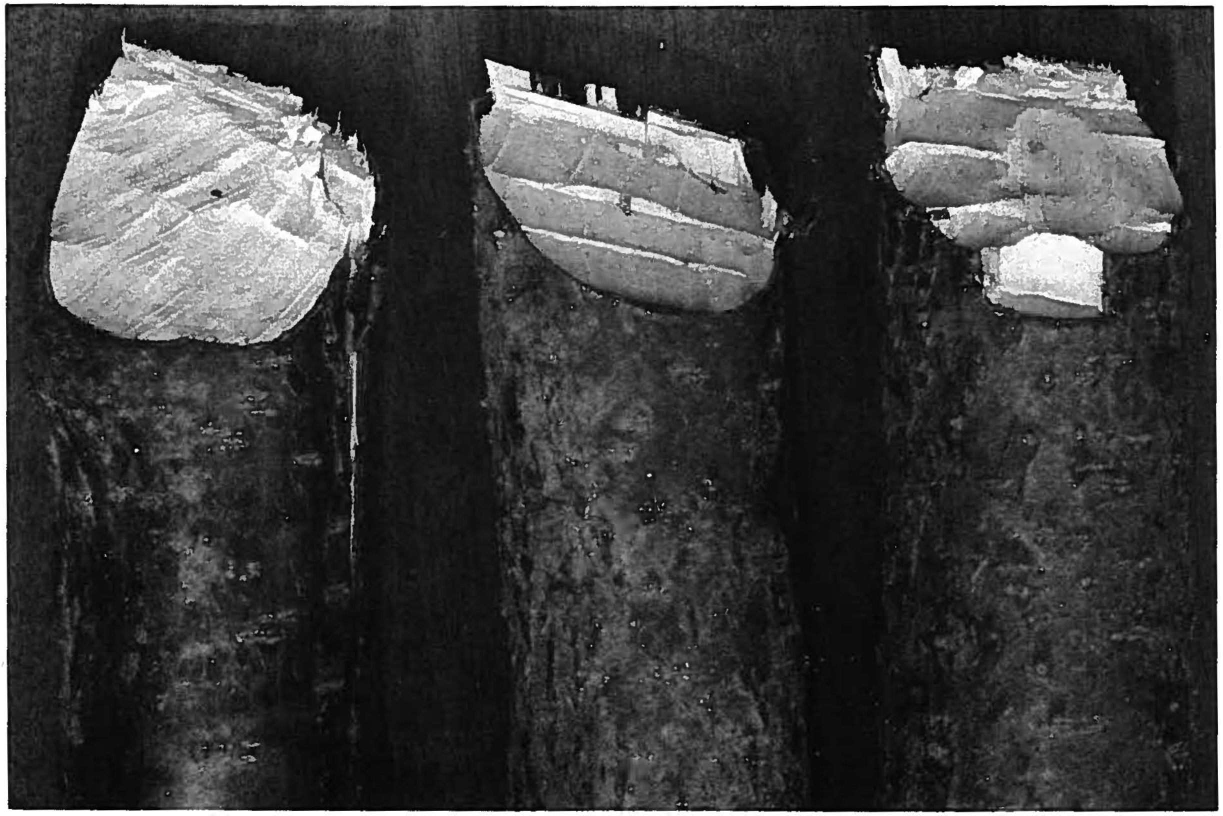


Fig. 16 Hazel rod chopped at medium angles with (left) a flat bronze axe, (centre) a palstave, and (right) a socketed axe. The flat axe left rather indistinct facets, and 51 blows were delivered on this face. The palstave left 3 clear facets from 57 chops. The socketed axe was light in weight and to produce this set of 7 facets took 207 chops. Diameter of the hazel rod 37–39mm, age 10 years. Scale 1/1.

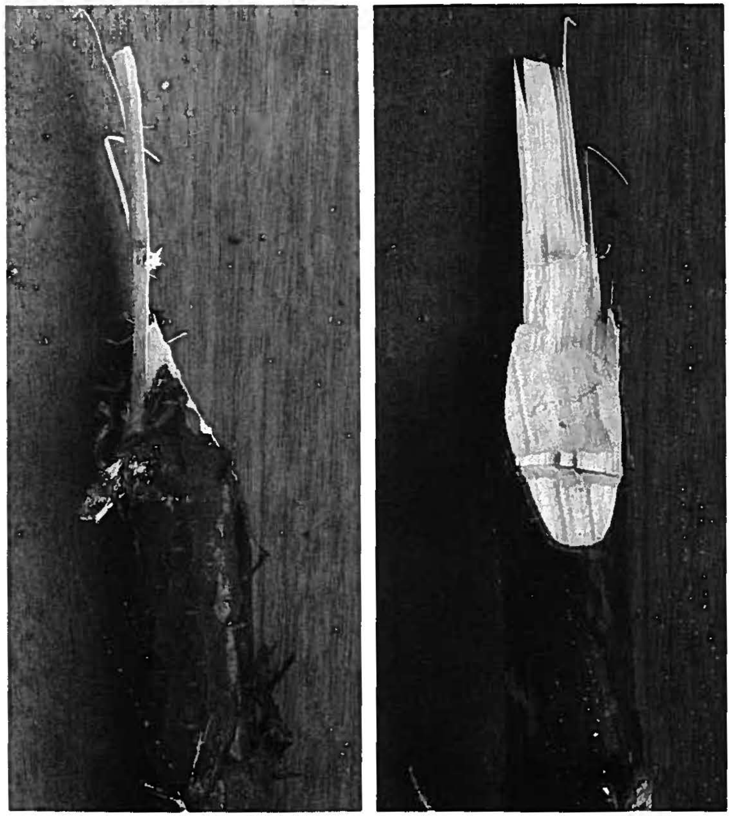


Fig. 17 Birch rod chopped at a shallow angle with a socketed axe. The birch bark has shredded, and the wood split as the blow created a long torn end below the stepped and ridged facets. Although there are two visible facets, 22 blows were delivered. Diameter 17mm, age 4 years. Scale 1/1.

or more, if the axe is blunt, the wood hard, the axeman tired or inexperienced. In some cases, wedge-ends were produced by double sets of facets on each side of the stem, i.e. there were 4 lines of axing, 2 on each side; this is unlike the facets forming a pointed peg, where there may be 3 or 4 lines of facets evenly spread around the circumference of the stem to form a sharp point rather than a wedge. The chisel-ends from the sample had been produced by steep-angled chopping, leaving 2 to 5 facets on the one face. The pointed pegs had as many as 7 + 5 + 4 facets, and the preferred method was to chop at medium-to-shallow angles to leave a rather thick triangular or sometimes square-sectioned point with blunt tip. It is not entirely certain how much of this work was done on site, as opposed to the woodland where the hazel (in this case) grew, but at certain positions along the track, paired pegs occur which by tree-ring analysis are probably from the same stem and which therefore might be suspected of being prepared on site. At the South Drain site (site SA in Coles and Orme 1984, and Morgan 1984, 53) two sets of such paired pegs were noted, but their working into wedge-ends ready for driving does not seem uniform. The problem is that hazel stems capable of yielding 1m poles of 60–70mm diameter would probably be long enough for several pegs, and in the separation, presumably one wedge-end would be prepared, leaving the adjacent end of the stem in a less-fit state for driving, and thus needing more work. The results might not therefore be closely comparable, and for the pegs in question from site SA there are noticeable differences in their wedge-ends. However, among the hazel pegs from this site and from others along the Sweet Track, closely comparable axed ends can be identified, which might be considered the work of one person. There is much scope for further work on this aspect.

The Sweet Track also contained hazel posts up to 3m long, and 70–130mm

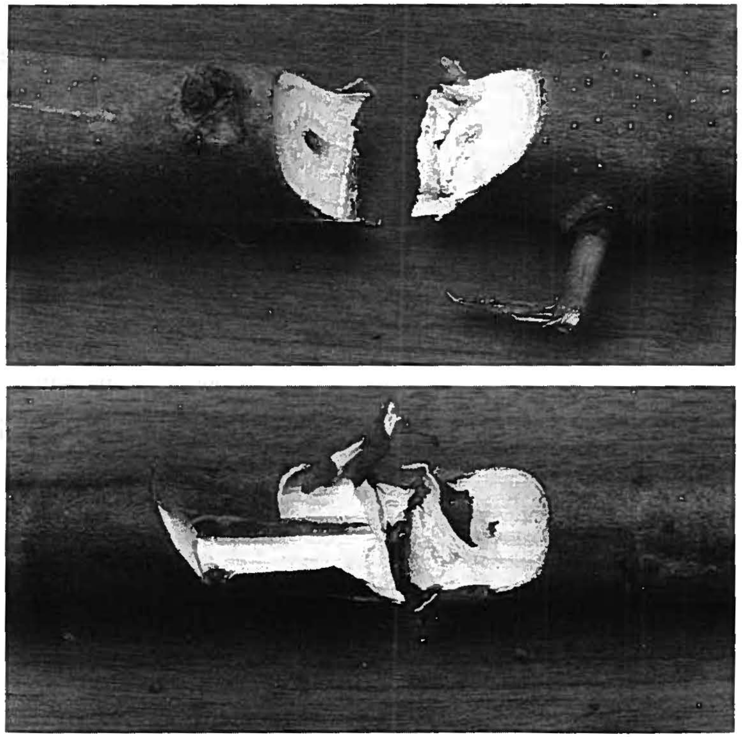


Fig. 18 Upper, Ash branch chopped by palstave at medium angles. Diameter 22mm, age 3 years. Lower, Willow branch chopped by palstave. Note splitting and compression of fibrous willow, partly due to a mis-hit on the left piece. Diameter 19mm, age 2–3 years. Scale $\frac{1}{1}$.

Fig. 19 From the left: Alder branch chopped with a palstave into a point, with stepped facets. Diameter 34mm, age 9–10 years. Alder branch chopped with a palstave into a wedge end, leaving a stepped facet on this face as well as slender striations across the face of the facets. Diameter 34 × 30mm, age 9–10 years. Ash branch chopped at a shallow angle by palstave, leaving torn intersection between the facets; a total of 23 blows were delivered. Diameter 26mm, age 3 years. Ash branch chopped at a medium angle by flat bronze axe, which left its signature as ridges across the facet. Diameter 24mm, age 3 years. Scale $\frac{1}{1}$.

diameter; these were extensively worked at medium angles into wedge, chisel and pointed ends, using the technique of medium–shallow sequence of angles to create blunt points and permit the very thick posts to be driven. Even so, the fresh posts almost always bent and often broke when the points hit the clay beneath the peat. One ash stem clearly shows the facets made in the preparation of a heavy pointed post, and its top, axed very steeply, shows no sign of driving with mallet or hammer; it was probably pulled down into the marsh by platform and rope.

Of other woods used in this track for pegs, most were treated in the same way as hazel, but oak and willow-poplar were handled differently. Oak was often split into timber (called board pegs), but willow and poplar being woods which split easily (and accidentally ?) were often quartered or otherwise reduced before sharpening of the tip took place. Of 33 examples from the Turbary site (26 willow, 7 poplar), 23 were split (3 reduced to $\frac{1}{2}$ stems, 6 to $\frac{1}{3}$ stems, 12 to $\frac{1}{4}$ stems, and 2 to $\frac{1}{6}$ stems). Some of these split pieces (6) could be used directly as thin pegs without facetting, but most were worked into sharpened pegs. Here however, the tendency of willow and poplar to split along the grain persuaded the axeman to slash points very shallowly, rather than at medium or steep angles. Only 6 wedge-ends were made, 5 chisel-ends, and the rest (16) were pointed, by multiple facets or by only 1 or 2 shallow slashes to create a tapering point.

There is a contrast, between both the willow-poplar pegs and the hazel pegs, and the many roundwood rails used in the track. These long rails, of diameters up to 200mm, and sometimes split into halves, were never required to be driven, and the workmanship on their ends is as simple as possible. Most are roughly pointed, probably just as felled, but there are a few with wedge-ends, and very rarely a chisel-end. Occasionally, a rail was perforated at one end, probably for drawing it into position. In general, the rails show an economy in preparation which the peg-ends do not, because although some pegs could be driven successfully with relatively little sharpening, many others were elaborately sharpened, as if there was some satisfaction in the working of fine long straight stems from coppiced hazel and other managed trees in the woodlands around the swamp.

Bisgrove, Jones, Chilton, Garvin and Honeygore tracks. c2900–2500 bc. Fig. 5, 6, 11, 25.

Orme, Caseldine and Morgan 1982; Coles, Hibbert and Clements 1970; Coles and Orme 1977c; Coles and Hibbert 1975; Coles, Orme, Caseldine and Morgan, these *Papers*.

These third millennium tracks were made of birch brushwood, sometimes with other species, but all were rather simple in structure, consisting of armloads or bundles of birch stems and branches dumped along the proposed line of passage. From the age ranges and varied diameters of the birch, it is clear that entire trees were being taken and separated into usable lengths of about 1m. The felling of birch of 60–90mm diameter with stone axes, as shown by chopped stem-ends in all the tracks as well as birch stumps in the Honeygore track, was accomplished by chopping from only one side of the tree, it then being pushed over and broken from the stump. The stems and thicker branches were then separated into lengths by chopping at medium to steep angles, the heavier pieces turned to make wedge-ends, the lighter pieces chopped through as chisel-ends. Wedge-ends often carry 2 + 2, 3 + 2 or other more or less equal combinations to make symmetrical wedge-ends, but in the Garvin's tracks there are some asymmetrical ends formed by e.g. 6 + 1 facets. The Bisgrove birch was often pointed rather than worked into wedge-ends, but the Jones track wood is more like that from Garvin's. Many smaller pieces in all the structures were chopped once, rather steeply, and then snapped or torn off, and twigs and very slender branches were merely broken into pieces. Pegs in the Honeygore and Garvin's tracks were often treated in the same way as the bundled wood, with just enough of a wedged or pointed end to allow the rather short pegs to be driven into the peat with a hefty mallet, one of which has survived. These birch-built structures are basic, minimum preparation and minimum construction, but they do show the effectiveness of stone axes on birch, which is rather a dense clogging wood to work. It is probable that very heavy birch trees were left alone.

Baker Platform and Bell Tracks. c2800–2300 bc.

Coles, Fleming and Orme 1980; Coles and Hibbert 1968.

These structures at the west end of the Westhay island were made of alder and willow, with added hazel, birch and ash. All but the willow yielded roundwood of widely varying diameters (10–200mm) and it is probable that whole trees were being taken and separated. A majority of the pieces were chopped around into lengths pointed at one or both ends, particularly the heavier stems. In the lower Bell track, several stumps of birch and alder remained, one of alder *in situ*, with facets from the stone axe; this species can be easily chopped through so long as the axe does not jam through being too fat. In the Baker platform, a detached willow stump demonstrates more clearly the method of handling a tree of only 100mm diameter. The stem was chopped almost half through from one side, then bent back, and axed straight through from the same notch, the stump thus bearing scars at two different inclines (Coles, Fleming and Orme 1980, fig. 11). As the bark of this tree was not torn away, the felling must have been cleanly completed with a rather sharp axe. The contrast in the handling

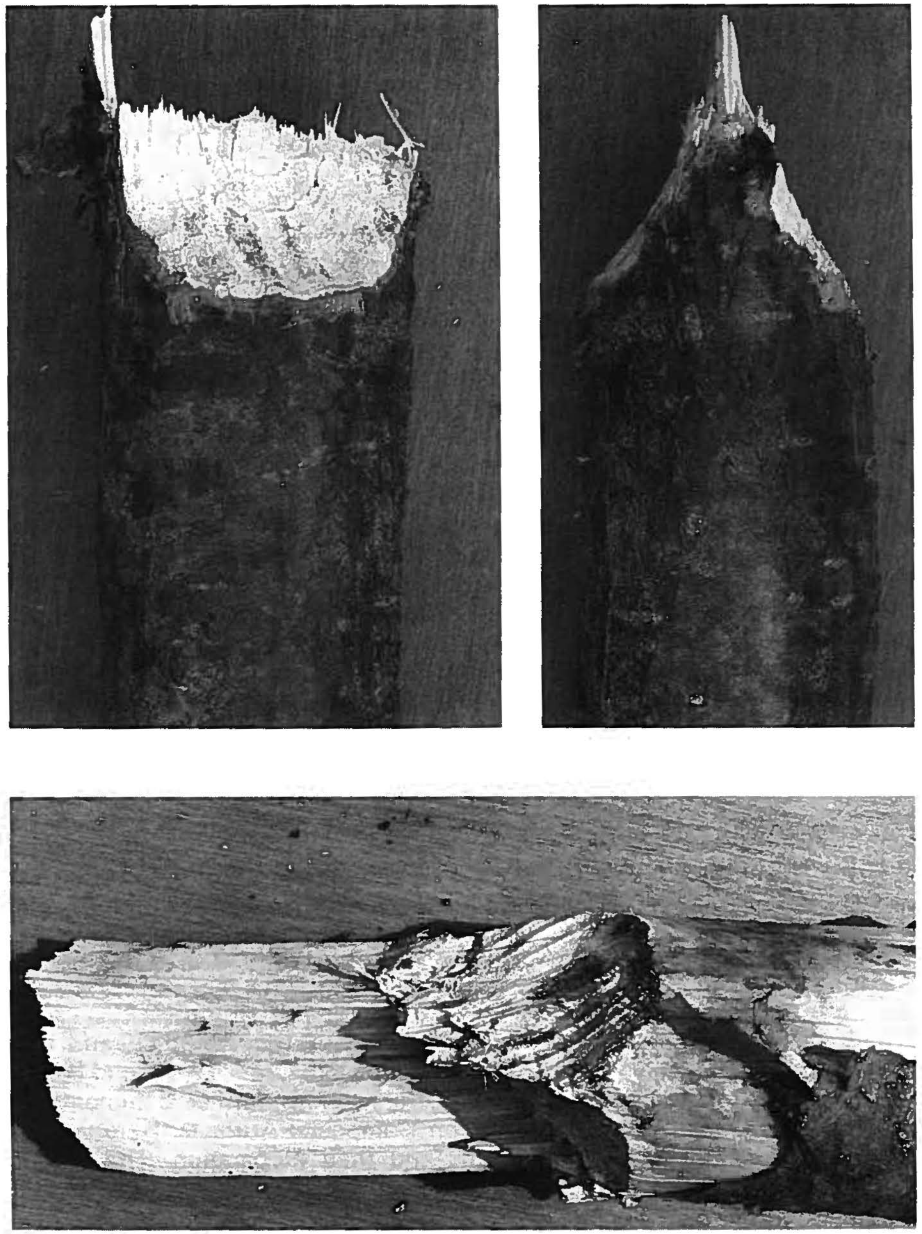


Fig. 20 Lower, Alder branch chopped with a stone axe, leaving two rough and ridged facets, damaged bark, and a long tear where the wood split. Diameter 36mm. Upper, Two views of a hazel branch chopped into a wedge end by stone axe. The facets are indistinct, and the tip ragged, although a total of 35 chops were delivered into the two faces. Diameter 36mm. Scale $\frac{1}{1}$.

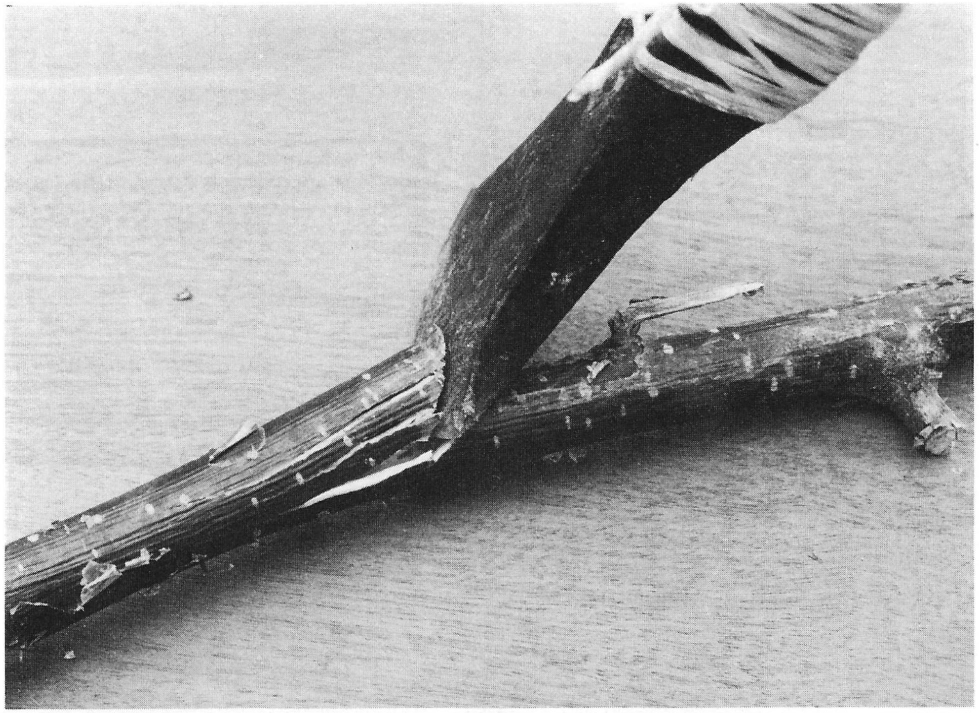


Fig. 21 Detail of a palstave cutting into a hazel rod at a medium angle. Note the triple splitting of the wood below the facet. Diameter 15mm, age 3 years.

of this species and that of yew (noted below in the Tinney's tracks) is very marked. Some of the willow roundwood was not chopped by man, but chewed by beaver (Coles and Orme 1982).

*Rowland's and Walton Heath hurdle tracks. c*2400–2300 bc. Fig. 6, 10, 11, 15, 26.

Coles and Orme 1977a and b.

These tracks were formed by the laying of many hazel hurdles, and their construction has previously been described (Coles and Orme 1977a and b) and investigated by experiment (Coles and Darrah 1977); further comment will appear in the fourth paper in this series on Composite Artifacts. Here we will consider only the individual components and their preparation. The hurdles contained thousands of slender rods of 10–25mm diameter from coppiced hazel, several hundred sails of 20–25mm diameter, also coppiced, and hundreds of pegs of 30–70mm diameter, probably also from coppice woodlands. Lengths ranged up to 1m for sails and pegs, up to 2.7m for rods. Many of the slender rods had been broken from the stools by pulling and stamping, so that torn ends were common; the upper thinner rod ends were snapped or chopped cleanly across, at medium to steep angles. Other rods and sails could be separated from the stools by pulling down and chopping through with a stone axe. A sample of rods from Rowland's track contained 20 rods snapped cleanly off, 15 rods with the coppice heel remaining, and only 10 with chopped facets, mostly single chisel-ends (1 + 0). Sails were treated in the same way but here most of the heels were trimmed off for ease in weaving the rods, and the hazel was axed through at medium to steep angles to make chisel-ends, occasionally simple wedge-ends (1 + 1, 2 + 1). Thicker sails, and pegs, were axed into wedge-ends at steep angles with multiple facets (up to 3 + 3 for 60mm pegs). One of the pegs from Walton Heath carries facets with wide scratches, showing the use of a very ragged stone axe; more information about such signatures on axes is available from the bronze axes used on the Tinney's tracks (see below).

*The Abbot's Way. c*2100–2000 bc. Fig. 7.

Coles and Hibbert 1968; Coles and Orme 1976b; Coles 1980.

This heavy track consists of split alder transverses, supplemented by alder, birch, hazel and ash roundwood, with pegs of the same species. Little preparation is evident in the horizontal roundwood pieces, with ends broken or chopped through at steep to medium angles in the preparation of lengths of 70–150cm. The pegs, 30–60mm diameter, were prepared for driving by chopping chisel-ends or wedge-ends at steep to medium angles. Of a small sample of hazel and ash pegs, half were chisel, half were wedge, generally with a minimum of facets (1 + 0 up to 5 + 0 for chisel-ends, 1 + 1 and 2 + 1 for wedge-ends). There is one recorded instance where a finely-sharpened peg was somehow driven, with difficulty, into the peat, as the builder (or his mate ?) put it in upside down (Coles and Hibbert 1968). In previous examinations of this track, other pegs formed from forked branches, driven in upside-down, were encountered here and there. The impression is of a rather rapid preparation and indeed construction of this track, which ran for 2500m across a raised bog; the amount of alder and other roundwood, some of it roughly split, for the horizontals was over 30000 pieces, with an additional 3300 long pegs and *c*12000 short stakes or pegs.

*Eclipse and East Moors tracks. c*1900–1500 bc. Fig. 8, 10, 12, 14, 27.

Coles, Orme and Hibbert 1975; Coles, Caseldine and Morgan 1982; Orme, Sturdy and Morgan 1980.

These two tracks, which may eventually be found to represent the northern and southern ends of only one long track, were made of hurdles from coppiced hazel. The rods range in diameter 4–40mm, with a majority 10–25mm, and the sails 24–47mm, majority 30–40mm. Their uniformity in size, but variable ages, suggest draw-felling in coppiced woodland. Over half of a sample of 230 rods from one part of the Eclipse track had been broken by hand or foot, without axing. Of the rest, most had been cut cleanly across at shallow angles, or slashed at a very shallow angle, in their division into the desired lengths of *c*2m. The facets left by the tool are sharp and smooth, not as dished as those on the earlier Walton Heath and Rowland's hazel rods, and in experimental work with flat bronze axes the same effects could be reproduced. Most chisel-ends have only one facet, some having 2–3 facets in a line. The sails were generally chopped at their thicker ends, chisel-ended (1 + 0 to 3 + 0), or wedge-ended (1 + 1), or variant pointed

Fig. 22 Left, Hazel branch chopped with a stone axe into a pointed end. The facets are clear but appear slightly smoothed, as those from Neolithic sites such as Walton Heath where the heavy poles in particular resemble these experimental pieces. Diameter 37mm. Centre, Birch branch chopped with a stone axe; 32 blows were delivered. Note the ragged facets and crushed bark, features often seen on Neolithic birch from e.g. the Honeygore and Garvin's tracks. Diameter 49mm. Right, Birch tree felled with a flat bronze axe. Note the clean and distinct facets produced by the metal blades, and the centre 'pipe' left as the tree fell; c.f. the Bronze Age stump from Tinney's track. Diameter 73mm, age 6 years. Scale $\frac{1}{1}$.

(1 + 1 + 0); this last is typical of sail ends, where the sail is pointed for sticking into the ground during hurdle-making. In the Eclipse track, these sail ends were not trimmed off after weaving, and one of them had been worked with a bronze axe with a nick in the blade which left a ridge on the facets; only one sail had this effect, which suggests that the axeman concerned had done little work for this structure as we have examined it. Our work has exposed only 25m of the track, out of at least 250m and possibly 2500m if it runs all the way between Meare and the Poldens. If the latter, then over 1000 hurdles were needed, with 40 rods and 6 sails per hurdle.

Meare Heath track. c1300–900 bc. Fig. 8, 10, 12, 14, 15.
Coles and Orme 1976c, 1978a.

Most of the essential elements in this structure were of timber, but dumps of predominantly alder, birch and hazel roundwood occurred here and there, and a few short pegs were of branch wood rather than split oak. Most of the small roundwood (20–30mm diameter) was snapped to length, or axed across at medium to steep angles to make chisel-ends; larger pieces were often chopped into wedge-ends. The alder roundwood could be slashed shallowly to make long thin points but little time was expended on roundwood in comparison to the careful timber work (Orme and Coles 1983, figs. 21–24). In comparison with the estimated 180 oak trees, with boles of at least 10m, needed for the planks and other timber of the track, only a few small stands of alder, birch and hazel would have been felled for the roundwood dumps.

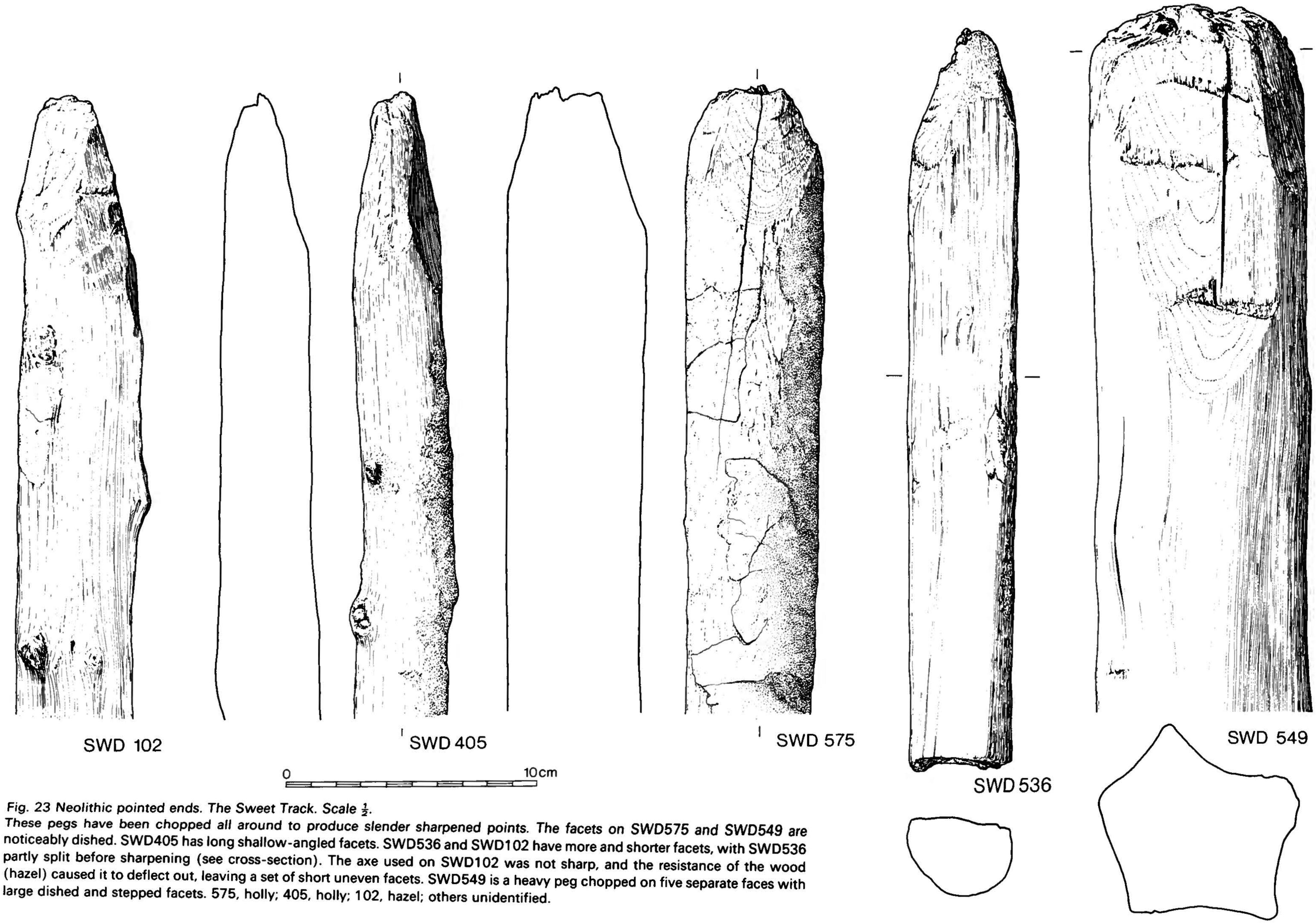
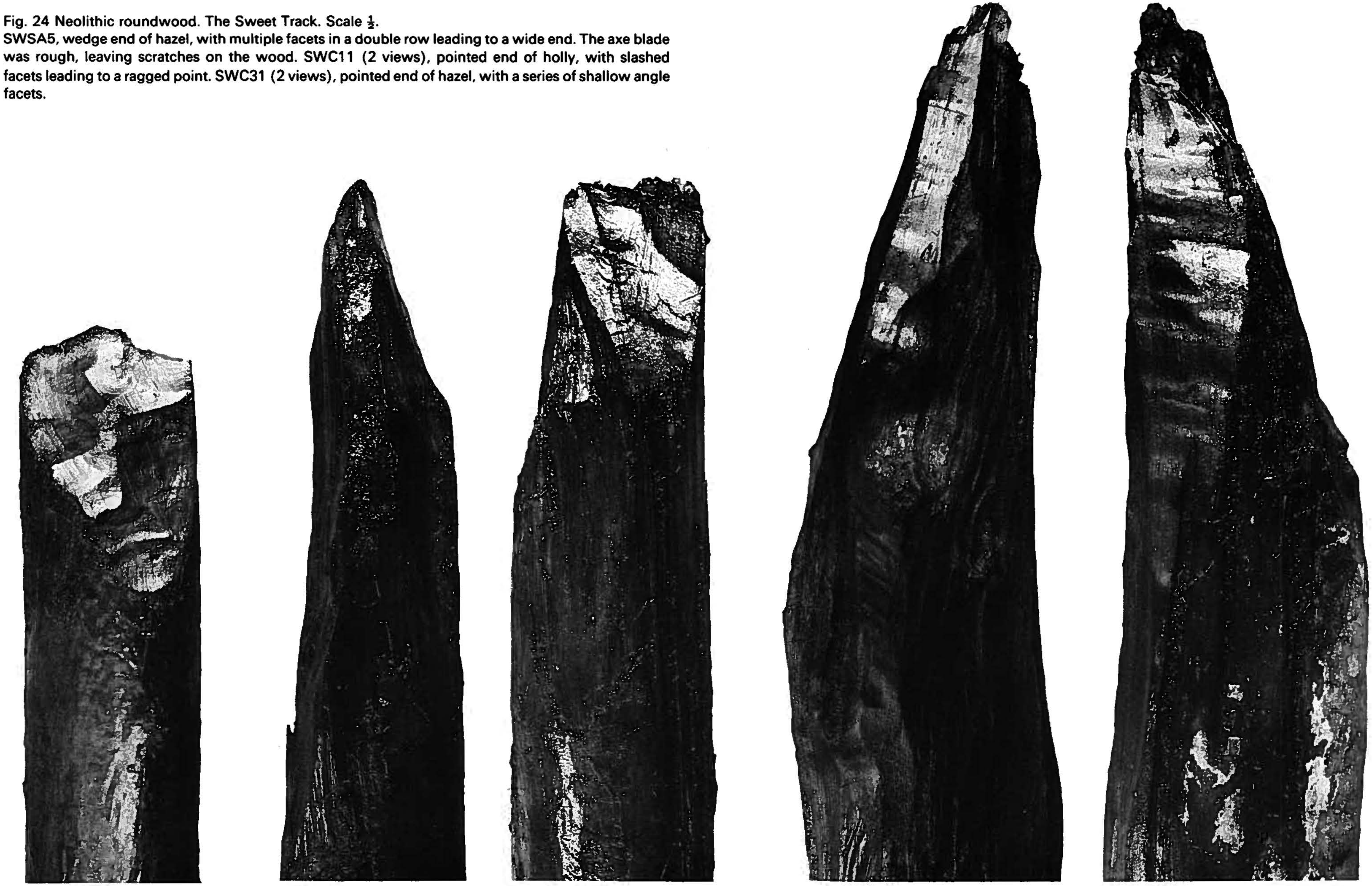


Fig. 23 Neolithic pointed ends. The Sweet Track. Scale ½.

These pegs have been chopped all around to produce slender sharpened points. The facets on SWD575 and SWD549 are noticeably dished. SWD405 has long shallow-angled facets. SWD536 and SWD102 have more and shorter facets, with SWD536 partly split before sharpening (see cross-section). The axe used on SWD102 was not sharp, and the resistance of the wood (hazel) caused it to deflect out, leaving a set of short uneven facets. SWD549 is a heavy peg chopped on five separate faces with large dished and stepped facets. 575, holly; 405, holly; 102, hazel; others unidentified.

Fig. 24 Neolithic roundwood. The Sweet Track. Scale ½.
SWSA5, wedge end of hazel, with multiple facets in a double row leading to a wide end. The axe blade was rough, leaving scratches on the wood. SWC11 (2 views), pointed end of holly, with slashed facets leading to a ragged point. SWC31 (2 views), pointed end of hazel, with a series of shallow angle facets.



*Tinney's tracks and Godwin's track. c*1100–1000 bc. Fig. 8, 10, 11, 12, 14, 15, 28, 29, 51.

Coles, Orme, Hibbert and Jones 1975b; Coles and Orme 1978b, 1980; Coles, Orme, Caseldine and Morgan, these *Papers*.

The variety of woods used in the dozens of tracks, small patches and probable platforms in Tinney's Ground is dominated by alder, with occasional birch and willow roundwood as well as oak timber. Most of the roundwood was used in short lengths in brushwood bundles, and the alder, birch and willow ranged in diameter 15–60mm; here and there larger pieces were used, clearly the tree stems from which all the branches came for the bundles, and these stems were 70–90mm diameter. Some were used as posts.

Taking several sample areas as a guide to preparation of wood for the tracks, it appears that a pattern of seven techniques can be seen. Small roundwood 10–30mm diameter, making up a large proportion of the brushwood, was mostly broken during branch separation, and many snaps and tears are recorded. Small pieces 15–35mm diameter with chopped ends are also abundantly represented (perhaps about $\frac{1}{3}$ as many as the snapped pieces); these were invariably chisel-ends, cleanly cut in one blow at a shallow angle, as if the branch was slashed along its length at intervals of 20–60cm as appropriate. Slightly larger pieces, 25–50mm diameter, were also cut through from one side only, making chisel-ends, but here there were often 2 facets, one above the other (2 + 0), where the shallow angle did not permit the first chop to cut cleanly through. Often the lower facet is long, over 100mm long, and slightly more angled towards a medium angle than the first facet. This is a logical approach and occurred quite naturally during experimental work.

Alder roundwood, in the range 35–60mm diameter, was sometimes separated in a different way, by chopping at medium to shallow angles, from two sides to make wedge-ends, generally 1 + 1; these are not at all common in the samples examined. Nor are those roundwood pieces of even larger diameter, up to 70mm, which were prepared in two ways, either by chisel-end with 3 or more facets in a line, or by wedge-end with opposing sets of facets (2 + 2, or 3 + 2) also generally in lines rather than side-by-side. Even where this approach was used, angles were still shallow, or medium to shallow.

There are some exceptions to this pattern, but steep angles are rare, and pointed ends are not often encountered, presumably being replaced by shallow-angle facets. Large roundwood stems or branches were often pointed, however, by sets of facets such as 5 + 10 + 4, or 4 long facets from 4 sides, or occasionally wedge- or chisel-ended by extensive axework.

The facets in most of the roundwood from Tinney's are sharp, with clear ridging between facets, and often the earlier blow has been levered up and out, detaching a sliver or chunk of wood, and the subsequent blow has landed partway up the step left by the earlier blow; thus a set of stepped facets occurs, and the common method of trying to sever the roundwood in one shallow-angled blow has led to sets of 2, 3 or even 4 stepped-facets in a line down the stem. Where the axe-blade has stopped, and its edge-line not thereafter removed, its evenly curved line is apparent, thus identifying the axe. Slight dishing of the facets suggests blades of moderate thickness and rather wide edge-angle, but whether palstave or flanged axe, or even socketed axe, is not clear from our experimental work and the Tinney's observations.

The worked roundwood from Godwin's track, a recently-discovered structure only 500m from Tinney's Ground, is in general comparable to that of the Tinney's material. Many of the alder brushwood pieces were simple breaks or snaps, but a few had chisel-ends produced at a medium to steep angle, generally with one facet but occasionally with two or three in a line.

Among the hundreds, in fact thousands, of worked roundwood pieces from Tinney's tracks, there are a small number which carry facets with sets of scratches and ridges imposed upon the smoothed wood. These represent the marks left by particular axes, axes which for one reason or another had been damaged before use. Each imperfect axe will have its own signature, and it should be possible to relate specific tools to the wood, if the archaeological record was complete enough. At the moment, it is not, but nonetheless we can point to particular pieces of roundwood which were chopped by different axes, and some which were worked by the same axe.

From the track known as Tinney's A, there are four pieces of roundwood which were worked by the same axe (fig. 29). Each has a chisel-end of two facets (with a slight third facet on TinA22). Each was worked in the same direction, i.e. from left to right down to the tip. Each has a thick ridge, from a gap in the axe blade, with a pair of slight ridges to the right where the axe blade had a couple of very slight areas of damage. On one of the pieces of wood (Tin A22), one of the facets has the two slight ridges to the left of the thicker ridge; this facet was the first to be formed, and clearly shows that the piece was held away from the axeman, vertically, and backhanded down; then the piece was turned more obliquely to the ground and axed in a forehand way to complete the second facet (which truncated the first) and finish the point by a final swipe at the tip which just picked up the two slight ridges of the axe blade. On the other hand (literally) this axe could have been wielded left-handed for the first blow then transferred to the right for the final two, an unlikely event one thinks. (This is assuming that the typical axeman of the later Bronze Age was normally right-handed. There is no evidence either way.) Nonetheless, it is this kind of evidence which brings the actual workmanship closer to us today, and its implications for linking areas of activity are clear.

There are other signatures on the wood from the Tinney's tracks, including a possible 9 pieces with a single ridge in the facets, and various others with paired ridges widely-spaced, or closely-spaced pairs with adjacent scratches, and others too. These at the very least show that more than ten different bronze blades were in use on the alder, birch and hazel roundwood for these structures. One probable pairing links two tracks, Tinney's A and Tinney's D, because roundwood from each carries pairs of slight ridges widely spaced; in the event, tree-ring studies have shown that oak pieces in both tracks are exactly contemporary (Morgan 1980). Of course, identical signatures need not mean exact contemporaneity as we do not know how long a bronze axe might have retained its signature, but as we think that the construction of these tracks was a very rapid process, it is

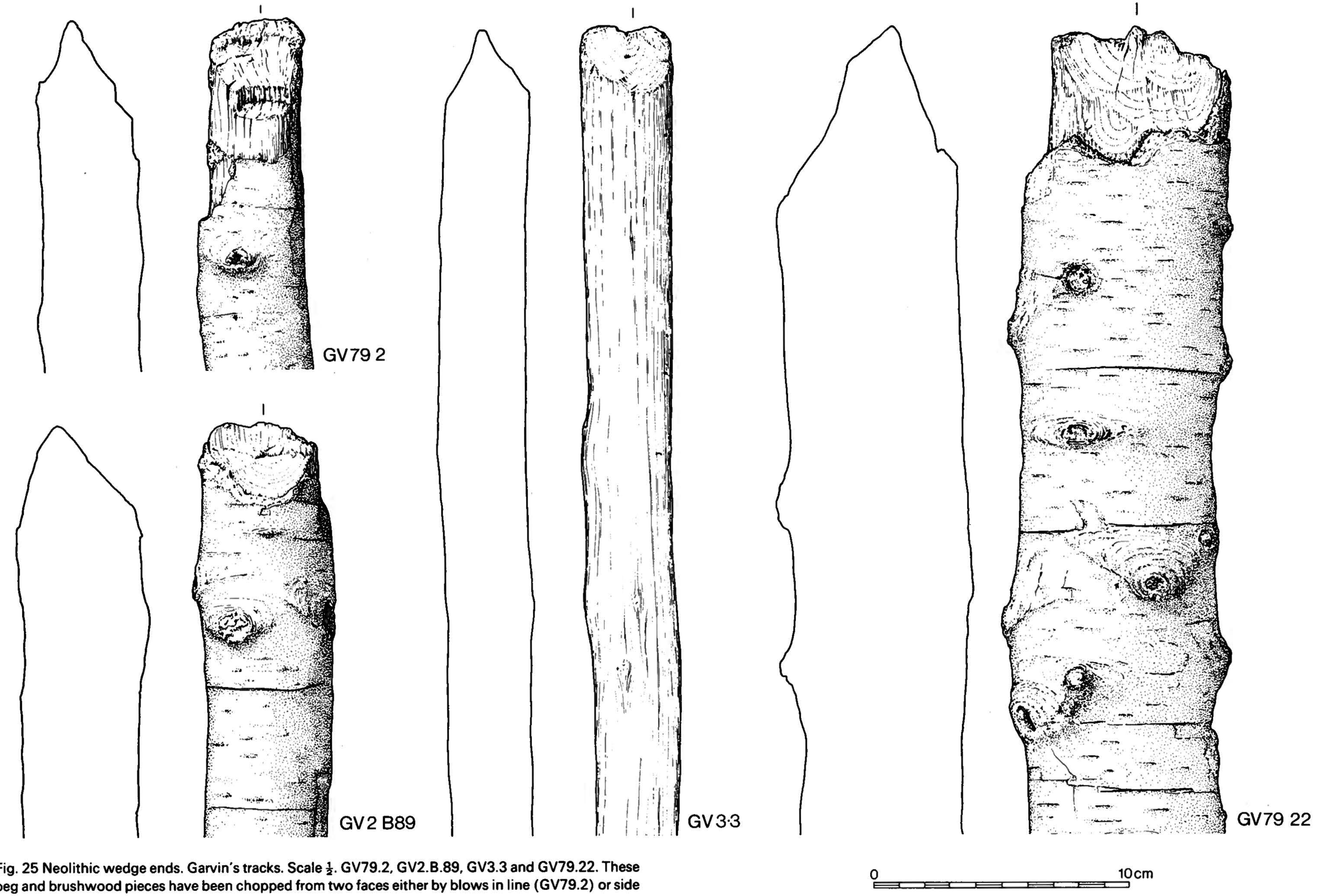


Fig. 25 Neolithic wedge ends. Garvin's tracks. Scale ½. GV79.2, GV2.B.89, GV3.3 and GV79.22. These peg and brushwood pieces have been chopped from two faces either by blows in line (GV79.2) or side by side (GV3.3). Most of the facets are dished, bark broken and ridges blurred. Birch.

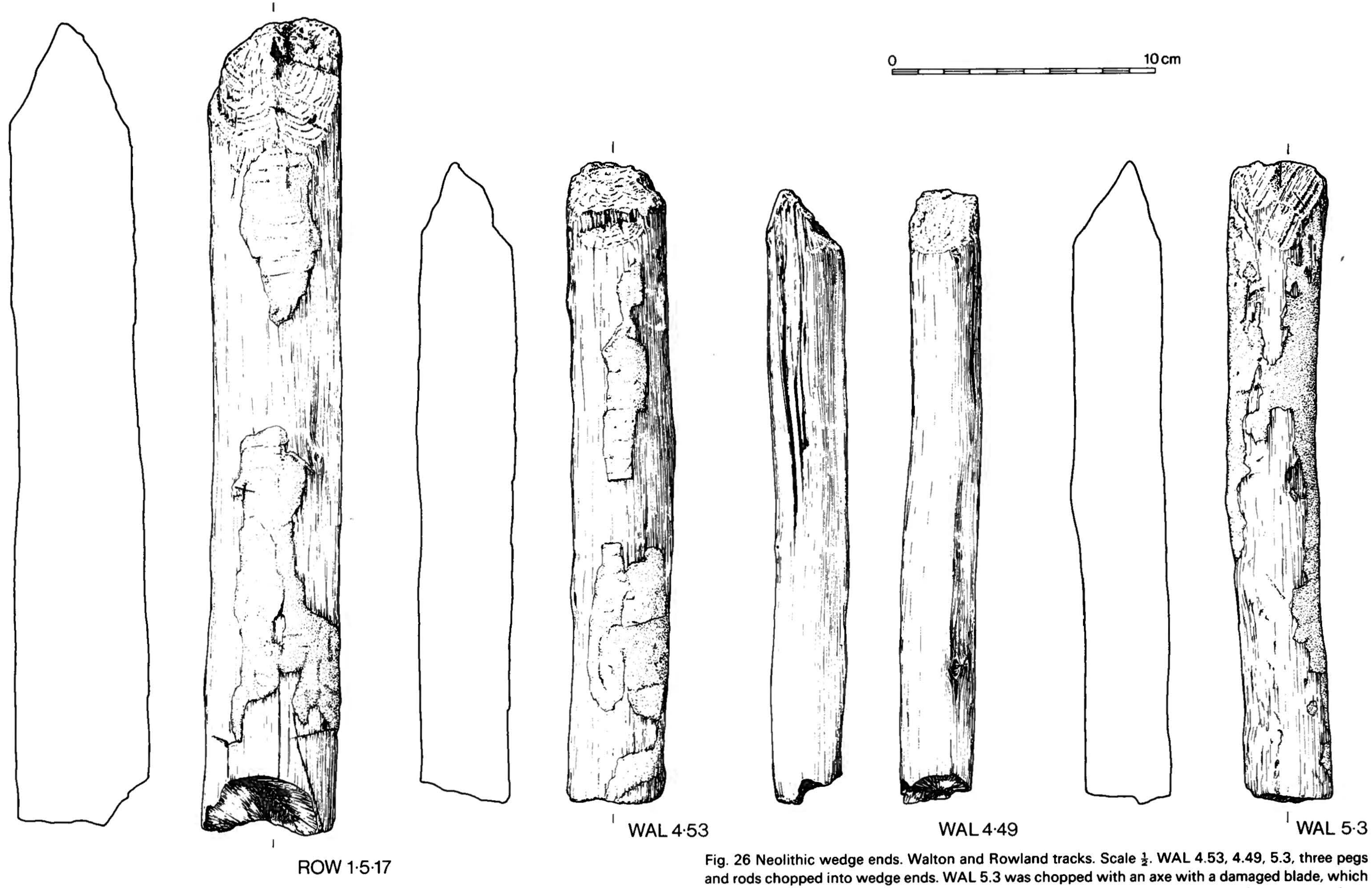


Fig. 26 Neolithic wedge ends. Walton and Rowland tracks. Scale ½. WAL 4.53, 4.49, 5.3, three pegs and rods chopped into wedge ends. WAL 5.3 was chopped with an axe with a damaged blade, which left ridges on the facets. ROW 1.5.17, a heavy peg chopped by two sets of dished facets on one face, and one set on the other (undrawn) face.

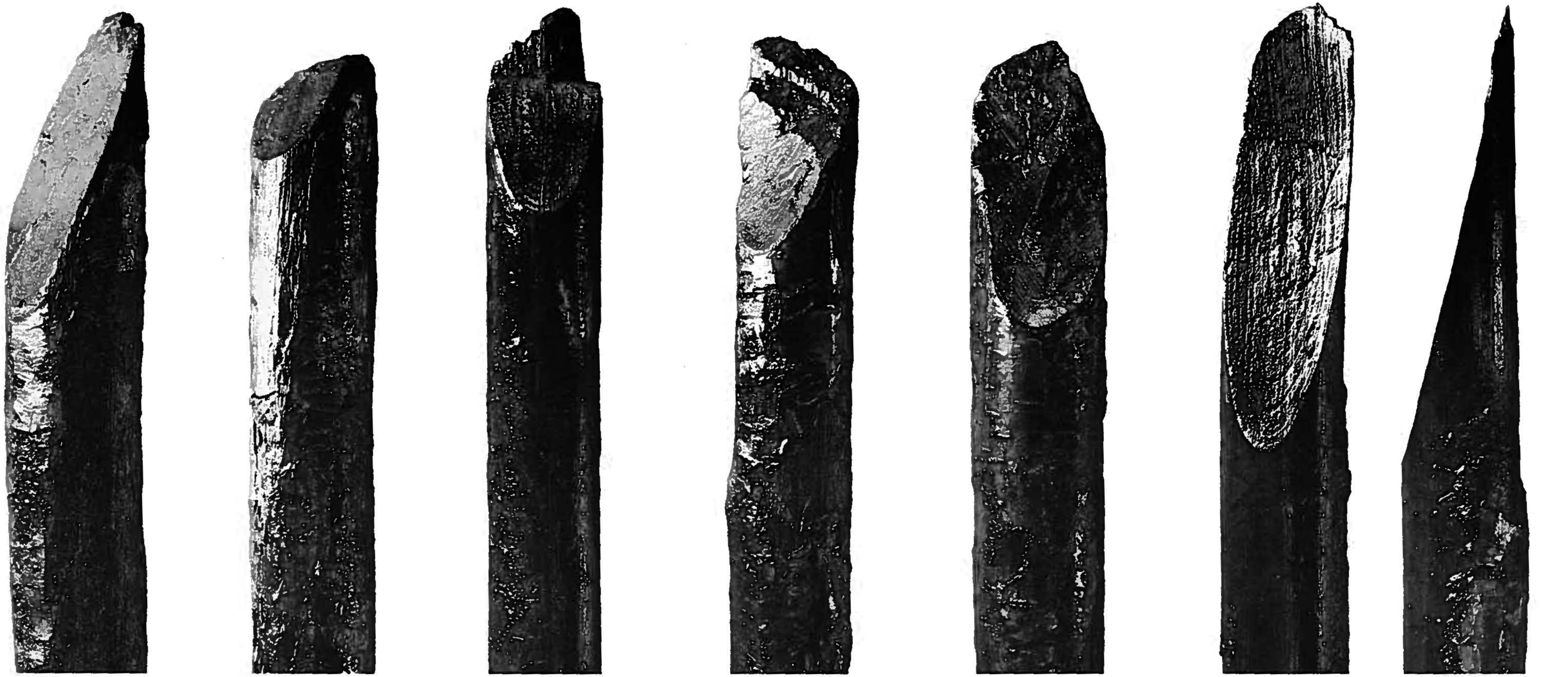


Fig. 27 Bronze Age roundwood. The Eclipse track. Scale ½. From the left: 80.7, chisel end cut at shallow angle with a sharp flat blade. 80.9, short chisel end cut at medium angle. 80.11, chisel end cut at shallow angle, the rod not completely cut through with one blow, whereupon the half-detached end was snapped off. 80.13, chisel end cut at shallow and medium angles across the line of the rod length, with stepped facet at end. 80.14, chisel end with slightly dished facets cut across rod length, the metal blade leaving striations on the facets. 80.16 (2 views), chisel end cut at shallow angle by one axe blow, the blade cutting deeply into the rod, followed at once by a slightly inclined push forward to free it and thus complete the detachment. Note striations left by the blade. Hazel.

unlikely that these signatures represent only one or several axes repeatedly sharpened during use, each re-sharpening producing a new signature. It would seem more likely that a number of axes were in use at the same time.

One final piece of evidence from Tinney's comes from the base of one of the substantial tracks. This is a yew stump uprooted after its trunk had been chopped away (Coles and Orme 1980, fig. 57). the tree was *c*150mm diameter and it had been felled with a sharp narrow-bladed axe from two sides, with over 25 facets preserved on one side and fewer on the other, leading into the centre of the tree which when it fell, left a small splinter protruding from the stump. The axe was swung almost straight into the tree, to detach chips already loosened by chopping down from above, making a notch which steadily ate into the heart of the tree. Once the centre was reached, the axeman moved to the other side to carry out the same action until the tree was cut almost entirely through. Yew is a tough wood to axe, and the yield of wood from the trunk and branches did not reach the bog but was used elsewhere, probably for more important objects than mere brushwood bundles. The stump, however, was chopped and dug out of its ground and carted into the bog for the foundation of a track.

*Stileway, Platform and Skinner's Wood structures. c*1200–500 bc. Fig. 15, 62.
Coles and Orme 1978c; Orme, Coles, Caseldine and Morgan, these *Papers;* Coles 1972.

Of the numerous structures of the later second and earlier first millennium bc, three may serve as samples of the woodworking of the period. The roundwood from the various platforms and dumps at Stileway is predominantly alder, with birch and hazel as well. A few of the heavier pieces had been axed at their ends, and one or two had notches chopped into the stem proper (fig. 61); these show

Fig. 28 Bronze Age roundwood. Tinney's tracks. Scale ½.
From the left: D83, D57, D5, chisel ends cut at shallow angles with consecutive chops down the rods. D82, D83A, D3, asymmetrical chisel ends, cut across the line of the rod. D13, D11, chisel ends produced by multiple chops down the line of the rod; stepped facets on D11. Alder.

the use of two different kinds of axes, one which left flat facets, and one which left more dished facets (fig. 62). The normal angle of chopping on these larger pieces, of 100–150mm diameters, was medium to shallow, and many of the ends have been chopped from two sides; some may represent the upper facets of stems as they were felled, but it seems more likely from our experimental work, that most are the result of separation of felled roundwood into suitable lengths for the structures. Smaller pieces of alder, birch and hazel were slashed to narrow points, or had one or two facets on chisel-ends, and variant points (1 + 1 + 0) were occasionally found. As the Stileway sites mostly represent unstructured dumps, they are not likely to have contained carefully-prepared wood, although separation into lengths of 0.5–1.0m was clearly efficient and simple. The use of an axe producing flat facets is perhaps the most interesting feature of the Stileway roundwood.

The Platform structure on Shapwick Heath consisted of a narrow track with several circular platforms attached. These were made of bundles of birch roundwood, 20–40mm diameter, set within arcs of stakes and pegs (Coles 1972). Many of the pegs were sharpened to points, and facets were almost always flat and at shallow angles. The stakes were also made of birch, but here the roundwood had been slashed at very shallow angles along the whole 150–250mm length, before the point was sharpened by axing short facets at steep to medium angles. Some of these stakes were of oak, and are more properly called timber work, but the flatness of the facets is again a feature on most of the wood from these structures.

The Skinner's Wood tracks and other structures are not yet published, but a few heavy pieces were recovered by one of us in 1970 and subsequently conserved. Roundwood pegs of 1m length and diameters of 50–110mm were axed to wedge-ends (1 + 1 and 2 + 2), or pointed with multiple facets, mostly with a blade leaving flat facets, although other pieces of wood from the site were distinctly shaped by a blade leaving dished facets (Coles and Orme 1978c, fig. 72).

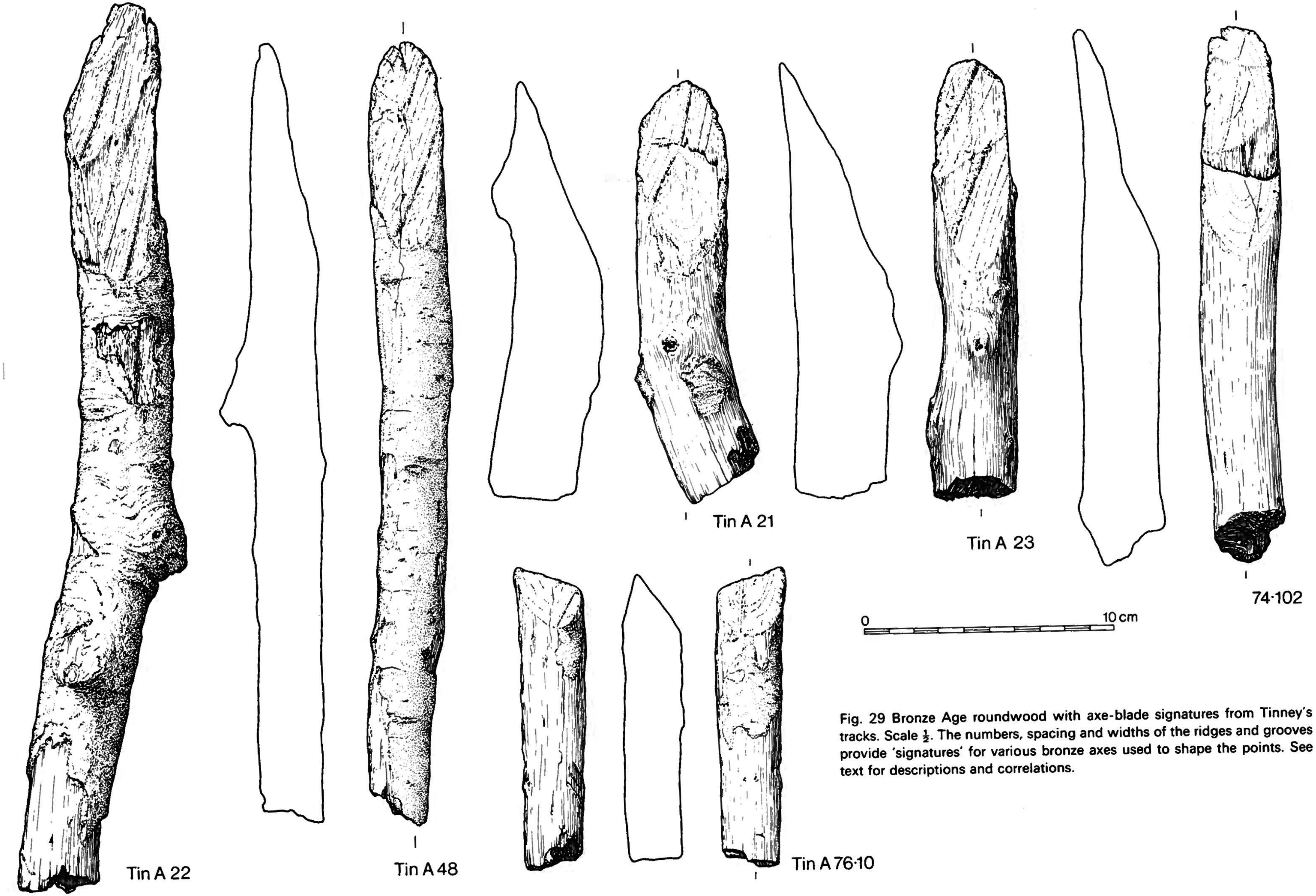


Fig. 29 Bronze Age roundwood with axe-blade signatures from Tinney's tracks. Scale ½. The numbers, spacing and widths of the ridges and grooves provide 'signatures' for various bronze axes used to shape the points. See text for descriptions and correlations.

*Glastonbury and Meare settlements. c*200 bc–ad 100

Bulleid and Gray 1911, 1917, 1948; Gray and Bulleid 1953; Gray 1966; Orme, Coles and Sturdy 1979; Orme, Coles, Caseldine and Bailey 1981; Orme, Coles and Silvester 1983.

The three Iron Age occupation sites of Glastonbury, Meare West and Meare East contained vast quantities of wood, forming palisades, substructuring and house foundations at Glastonbury, and a less well-defined series of usages at the Meare sites. Many worked timbers and artifacts of oak, alder and ash were recovered; timber has been described (Orme and Coles 1983) and artifacts will be discussed subsequently. Here we are concerned only with roundwood, and its working. Because the excavations at Glastonbury and Meare West were completed many years ago, and little was able to be conserved, we must rely upon the careful observations made by A. Bulleid. As has been noted in the paper on Species Selection, Bulleid was able to identify oak and ash in the field, and could suggest the use of the shiny-barked alder–hazel–birch roundwoods, but he was not in a position to carry out further identifications, nor did he spend much time in print on the handling of the common roundwood pieces used in the palisade, substructures and flooring of the settlement at Glastonbury; he was concerned more with the artifacts, the identifiable features of houses such as hearths and doors, and the multiple stakes, posts and timbers forming elements in the organisation of the settlement.

From the information given, the palisade at the Glastonbury Iron Age site was made of alder trunks, still with bark on, as well as some birch and oak trees, of 1.5–4m length and 75–225mm diameter, which had wedge-ends or pointed ends roughly axed; some of these are almost certainly the unprepared ends of trees freshly felled and others may be lengths separated specifically for the palisade. The heavy substructure of the settlement covered an area of *c*10000 sq.m. and consisted of logs and brushwood as well as peat, stone and clay, forming a dense mat 0.3–1m thick over the whole area; alder again was the most common wood, with birch, ash, oak and willow, and these must represent cleared stands of woodland with stems, branches and twigs all chopped into sizes suitable for dumping on the site. From the descriptions provided, it would seem that much of the heavier material, as well as the palisade poles, was axed by sharp blades, leaving flattened facets, and the smaller branches and twigs were cleaved off with billhooks or similar flat implements. Billhooks and axes of iron were found at the Iron Age sites, and although few experiments have been carried out yet, these tools seem the most likely to have produced the flat abrupt facets seen on a few wooden pieces, and described by Bulleid. One further element for roundwood treatment at Glastonbury and at Meare West is the hurdling from several locations; probably of alder or hazel coppiced wood, the sails were oak, cleft rather than left in the round as on all the earlier (Neolithic and Bronze Age) hurdles known from the Levels except for the Stileway alder hurdle (Orme, Coles, Caseldine and Morgan, these *Papers*). The billhook or iron knife would have been a suitable tool for this, although once the split is started, a wooden wedge can complete the work. It is unfortunate that we have so little distinct and quantifiable information from these sites, although for its time the Glastonbury work in particular is recorded extremely well.

Difford's platform. c ad 200–250. Fig. 11, 14.

Coles and Orme 1978c.

The dumped birch and alder at the side of a presumed pool or sluggish stream displays a considerable amount of working by axes or other blades. A wide range of different sizes of roundwood was used, probably representing entire trees felled and separated for brushwood heaps. Almost all of the birch was chopped, and much of the alder, but small alder pieces were sometimes broken and twigs pulled off the branches or stems. Most of the pieces were cut with a heavy flat, sharp blade, and even roundwood of 70mm diameter could on occasion be truncated by a single chop at a steep angle. Where the angle was shallow, slashed ends of up to 300mm could be produced, mostly by 2 or 3 facets. A majority of the birch and alder was in the range 15–70mm diameter, and of a sample of about 50 pieces half had chisel-ends with only one facet, with the other half also with chisel-ends created by 2 or 3 facets in line; only rarely were there clear traces of more than 3 chops, and the facets are uniformly flat. A very sharp billhook would account for most of the work, with a heavier axe for the thicker stems. Most of these latter were chopped into wedge-ends, again with flat facets, and most of these ends are of the simple variety (1 + 1 up to 3 + 1). A few rather heavy pieces had been axed through in an unusual way; from one side, 4 or 5 facets made a cut through the piece, and these intersected near the end with a single facet on the side of the faceted face, thus pointing the piece rather than creating a wedge-end. Very heavy birch stems up to 110mm diameter had been extensively axed at steep angles either to form faceted chisel-ends or wedge-ends. The Difford's structure (if it can be termed this) is remarkable for the large amount of chopped wood; at other dump-sites, and brushwood tracks and platforms, much of the smaller roundwood had been broken by hand, or pulled from the parent stem. Perhaps the availability of heavy iron blades, especially the billhook, at Difford's would have made it easier to hack through almost all sizes of roundwood rather than spend time in bare hand work. The converse may also be suggested, that in earlier sites such as third millennium Honeygore, Signal Pole, Baker Platform, and second millennium Tinney's, Godwin's and Stileway, it was as easy to break small branches as to chop at them with rather thicker blades than a billhook-type. It would seem that the possession of thin and strong iron blades made a difference even to the basic separation and preparation of roundwood for the simple structures as are represented in the Levels from the early third millennium bc. Experimental work with stone, bronze and iron blades fully supports this observation.

The study of roundwood from prehistoric sites is not often as actively pursued as is that for timber, where planks can provide much information. Nonetheless, roundwood in quantity can often yield data fundamental to a greater understanding of the tools used as well as the products of woodworking.

Acknowledgements. We are grateful to Richard Darrah for valuable comments on the subject of ancient woodworking. This paper is published with the aid of a grant from the University of Exeter Research Fund.

A NEOLITHIC JIGSAW: THE HONEYGORE COMPLEX

by J. M. COLES, B. J. ORME, A. E. CASELDINE and R. A. MORGAN

One of the recurring features of archaeological fieldwork in the Somerset Levels is that continued surveillance of the peat-cuttings in areas of known prehistoric structures often reveals new evidence which had not previously been available or noted. The Honeygore complex (fig. 30) is an example of this. In the peat-fields west of the E. J. Godwin factory, brushwood tracks were first noted by H. Godwin in 1947, and several small excavations were carried out by Godwin in 1948 and 1959 (Godwin 1960). These established the presence and nature of two brushwood tracks, called Honeygore and Honeycat (the former went towards Honeygar or Honeygore farm on a Burtle Bed, and the latter was a made-up name combining Honey and Catcott Burtle, a village to the west from whence the trackways might have been built). Godwin carried out work at the Honeygore site which established that this track lay within the fenwood stage of the vegetational succession as it was then understood. Both tracks lay on west–east alignments which seemed to link the major dry islands of Burtle to the west and Westhay to the east, although it was not known if the tracks actually ran the entire distance of *c*3000m.

In 1967, fieldwork by J. M. Coles noted a brushwood track *c*300m to the east of Godwin's Honeygore track, and subsequent excavations confirmed the closely comparable character of this structure to that of Godwin's Honeygore. An intensive programme was mounted in the original peat-fields, and both Honeygore and Honeycat were traced across parts of two adjoining fields, showing that the two tracks did not run in parallel but converged from the west, nearing one

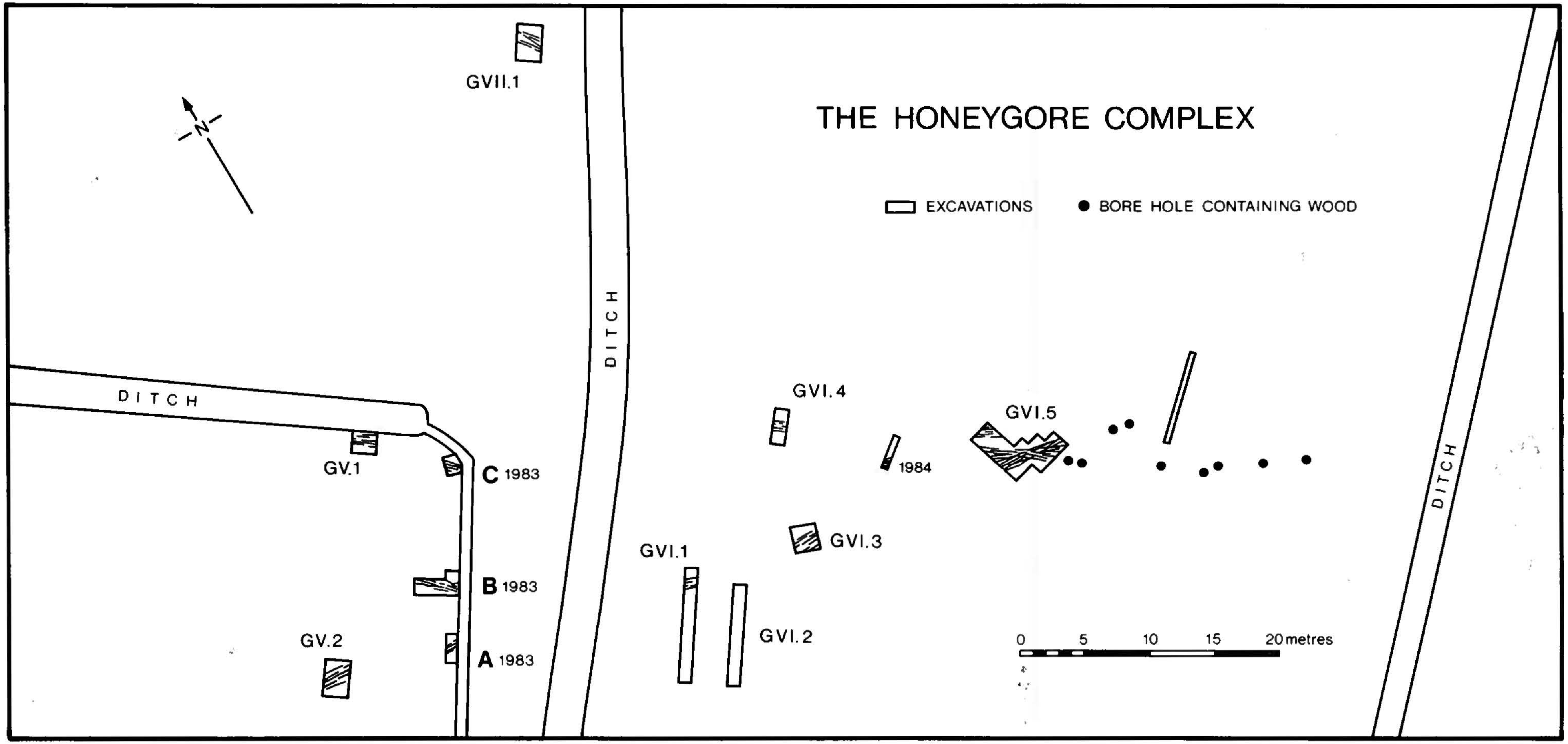


Fig. 30 Map of the Honeygore complex of Neolithic tracks on the Westhay Level, as discovered over the past 15 years.

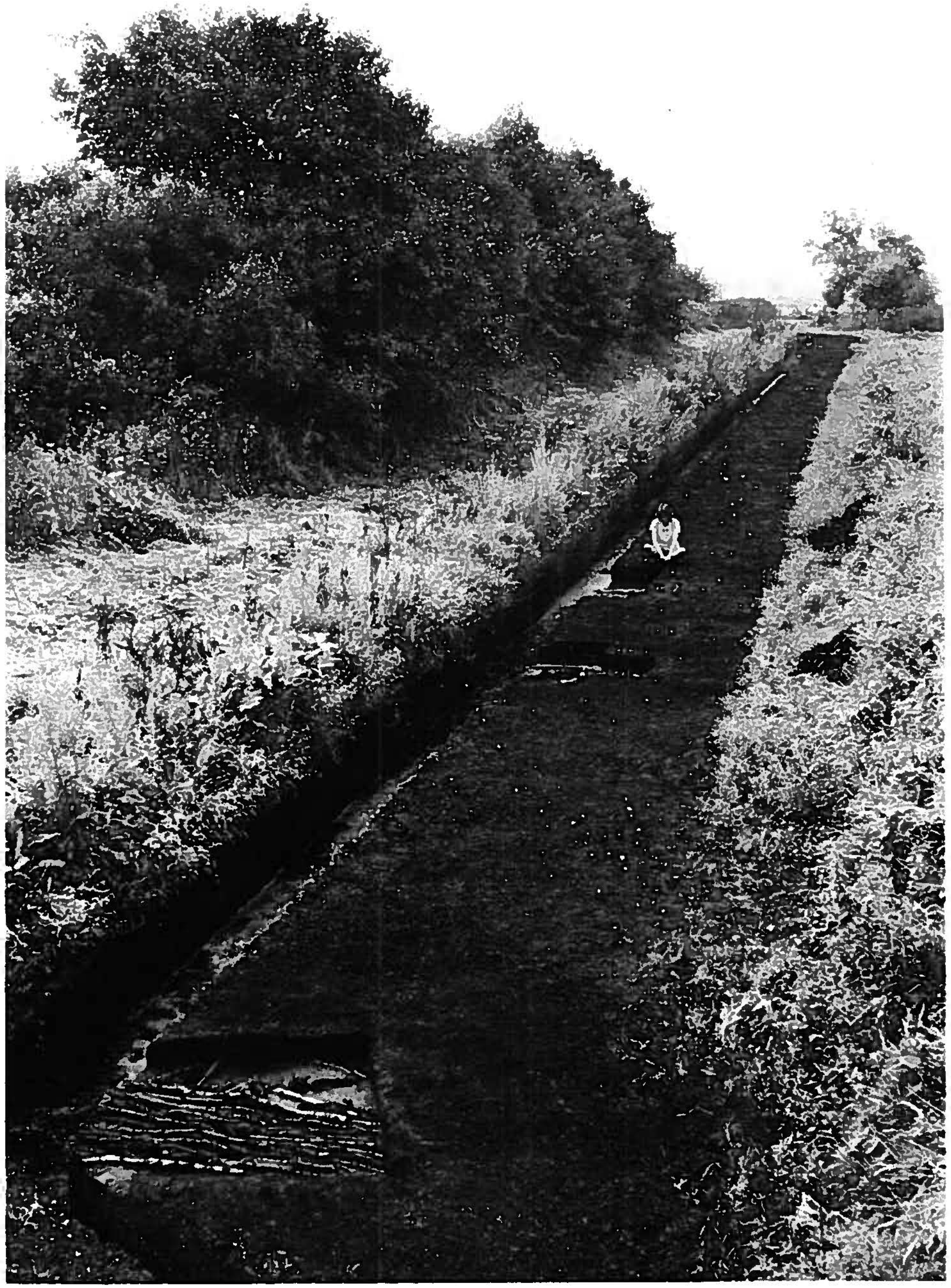


Fig. 31 The Honeygore sites 1983. In foreground, the Honeycat track; middle, Honeybee hurdles; by the figure, the Honeygore track.

another at a point in field GV1, where a major excavation was carried out in 1970 (Coles and Hibbert 1975).

Peat-cutting in these fields was halted after 1969 and the fields lay dormant until extraction was revived in 1983 with rotovation to the west of the excavated areas; the field where the overlap occurred had already been rotovated and it has now developed a fine expanse of wet moss and cotton grass along with a young fenwood of birch and alder. In the course of new drainage, a narrow ditch was cut across the line of the Honeygore and Honeycat tracks, and inspection of the ditch by fieldworkers revealed not two but three exposures of wood. In the examination of these, the third structure was only tentatively identified as a definite track, thus perhaps adding one more feature to the remarkable record of Neolithic trackways in this area of the Levels. Previously, this structure was suspected to have existed through the odd find or record of wood in sections, but it had never been conclusively identified. It already had a name, Honeybee, from the unwelcome presence of a set of hives encountered in the 1969 search. The new sites are centred at ST41604281. In August 1983, the three structures were examined in small excavations carried out by the Project's field team of D. Bedford, A. Wickenden and S. Loxton; the work was completed in less than a week, partly because the dry weather necessitated speed. The three sites (fig. 31) were exposed back from the ditch face for 1–2m, and kept shallow in order to prevent damage to the ditch itself; the structures lay near the top of the peat so the entire sites could be cleared of all wood. Samples were taken for tree-ring studies by R. A. Morgan and the results are included with the site descriptions that follow. The environmental evidence from the three sites is then discussed by A. E. Caseldine, followed by a brief outline of the present state of interpretation of the Honeygore complex.

Description of the 1983 structures

Honeygore

This site, called A on the field plan (fig. 30), consisted of a small exposure of the heaviest brushwood track in the complex. As this structure has been examined in several places already, only a small confirmatory excavation was carried out (fig. 31 and 32). The track consisted of a bundle of birch stems and branches dumped onto the bog surface to form a longitudinal brushwood track about one metre wide. Most of the roundwood still retained bark, but some had become detached as the wood softened and was somewhat flattened by foot traffic. In the exposure, 4 larger stems and numerous smaller pieces made up the single thickness of track. All of the 28 pieces sampled for wood identification were *Betula* (birch). The diameters of the major pieces ranged from 20–80mm, and their ages varied from 6 to *c*36 years (see the tree-ring report). Twigs, broken bark, leaves and general wood debris (brash) lay around and beneath the stems and branches, but did not form a distinct layer such as has been seen elsewhere. There were no pegs within the track, although pegs were a regular feature on other exposures of Honeygore (Coles and Hibbert 1975, fig. 5). Because such a small length of track was examined, it was not possible to measure the individual pieces for length. Chopped or broken ends of some pieces, however, lay within the site,

SITE A *HONEYGORE*

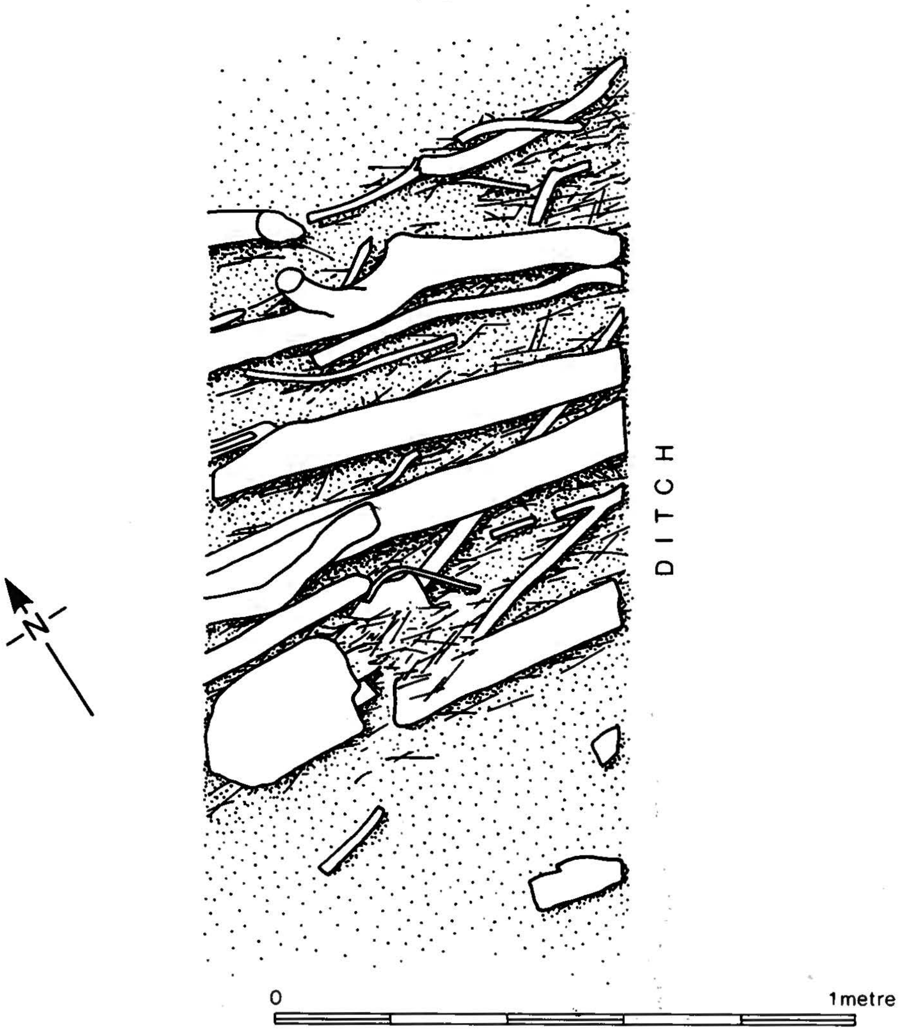


Fig. 32 Plan of the Honeygore track (HgA) 1983.

and demonstrated the rather rough treatment given to the birch in cutting into suitable lengths. Smaller diameter branches were snapped or torn from the stems, but heavier pieces were chopped through with several axe-blows. It would seem that small trees were felled, branches trimmed off, and trunks then axed around to provide suitable lengths. A typical chopped end would have 3 facets on one face, 4 on another, and then the stem would be completely severed by breaking; in most cases, the stems were not chopped through from one side only, but the stem was turned for an attack at another side. Birch when fresh is quite tough and may clog a stone axe (see comments elsewhere in these *Papers*), so any sizeable tree is more easily divided by axing from several places.

The stems and branches consisted entirely of birch, a wood in which the rings are not easy to distinguish; they are often vague and very narrow, though occasionally clear enough for ring-width measurement. It is not clearly understood why the annual growth should be so variable in nature. Most of the 23 samples examined for tree-ring studies were complete roundwood, though two were split in half and two so decayed that their transverse surface could not be studied. Only 15 were exactly or roughly aged.

Diameters ranged from 9 to 102mm, averaging 38mm, and the age (so far as it could be determined) from 6 to about 36 years. The range is wide, and there is no suggestion of any selection for size; all available material was made use of (fig. 33). At least 5 stems were probably cut in winter.

The excavations of 1983 have thus confirmed the existence and character of the Honeygore track which in this area is now known from 5 small excavations and several borings (fig. 30); its sites here are GV.2—A 1983—GV1.1—GV1.3—GV1.5, and in 1979 it was noted *c*90m to the west of GV.2. The track is now mostly destroyed in field GV, and much is also gone farther east. Its total length as

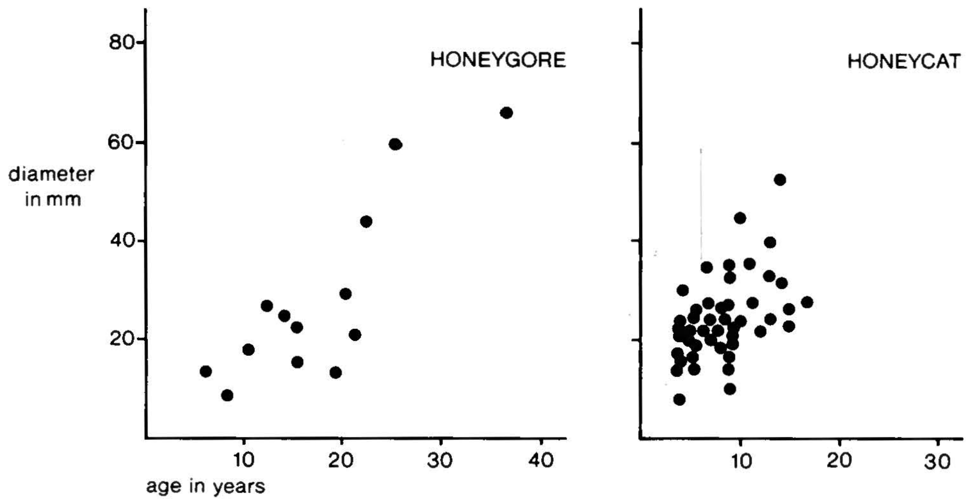


Fig. 33 The age and size distribution of the birch stems from the Honeygore track (left) and the Honeycat track (right).

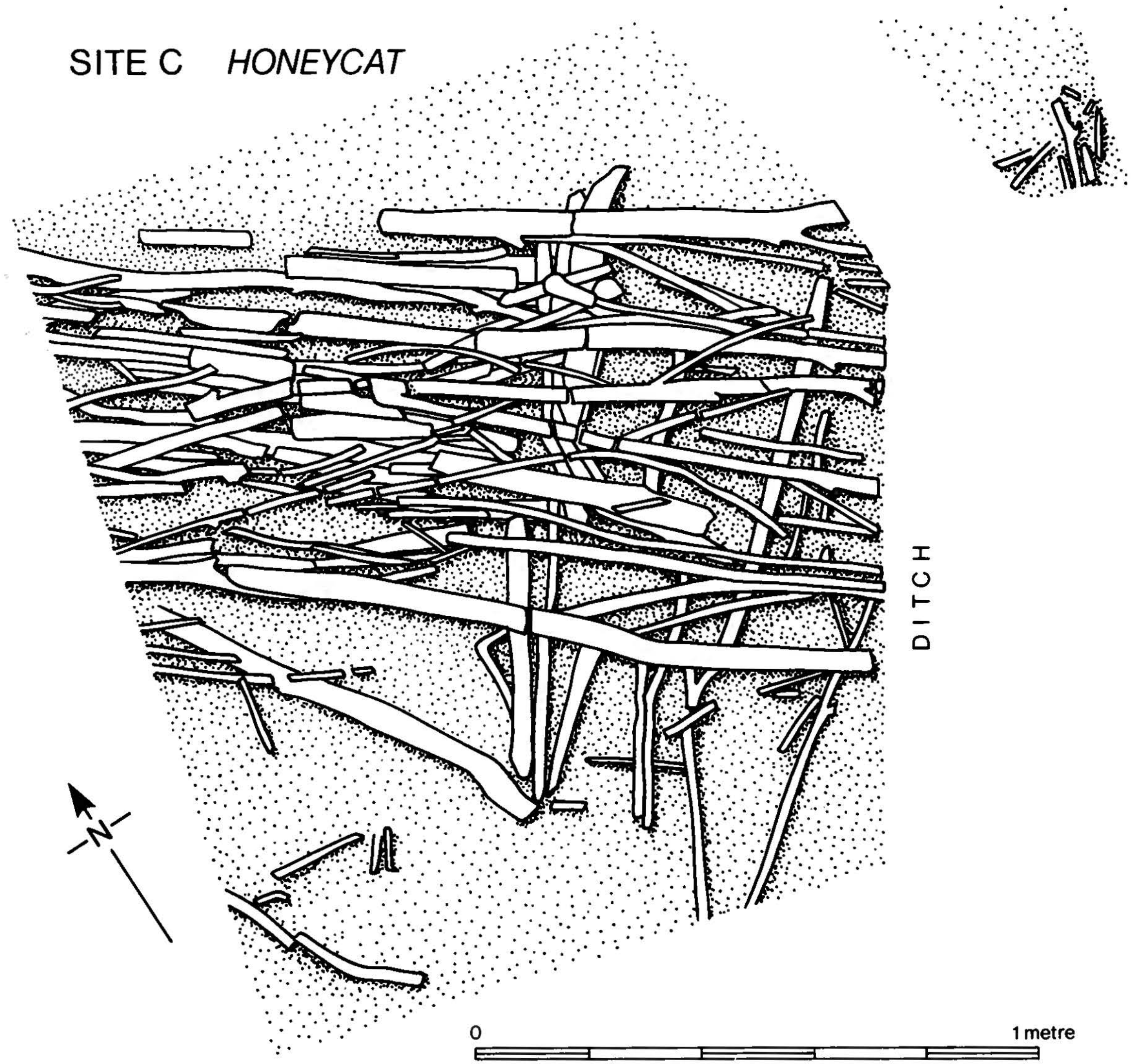


Fig. 34 Plan of the Honeycat track (HgC) 1983.

Fig. 35 Honeybee hurdles. Dismantled hurdle A in foreground. Beyond, the stray birch branch with white bark, and hurdles B and C, with backfilled peat surface by the metre scale.

traced is 600m and it is the longest brushwood track so far recorded with certainty in the Levels. Its alignment indicates a destination to the west at Catcott Burtle, and to the east at Westhay where the brushwood track called Bell A (Coles and Hibbert 1968) may conceivably be related. If so, Honeygore would be as much as 3000m long, and represent over 30000m of birch roundwood.

Honeycat

This site, called C on the field plan (fig. 30), lay at the northern end of the drainage ditch and contained a typical exposure of the light brushwood Honeycat track, as seen previously in 3 exposures. The track (fig. 34) was made of a series of brushwood heaps or bundles, dumped on the bog surface. The structure consisted of many roundwood branches, again all of *Betula*, laid to form a path 70cm wide. Heavier pieces of birch lay on the sides of the track, as well as within the body. There were numerous smaller branches upon and beside the heavier pieces, and beneath the bundle were 8 pieces laid transversely, probably in a deliberate attempt to keep the bundle from sinking under the weight of traffic. Most of the pieces of wood in the exposure had bark intact. The surface of the track was not flattened, suggesting that traffic was sparse, the bog was soft, and that the period of use was short. Of the 57 samples taken for identification, all were birch. The diameters of the pieces varied from 9–50mm with many between 20–25mm, and their age varied from 4–17 years. There were quantities of brash around the track, and as almost all pieces still retained bark, the brash must represent the trimmings of branches, and twigs and leaves knocked off during dumping or traffic; it is unlikely that the brash is deliberate dumping of material. No pegs were noted in the exposure, nor were any recorded in the earlier excavation (Coles and Hibbert 1975, fig. 8). Because only a short length of track was excavated, few complete birch pieces could be recovered; the longest seen was 1200mm, and there were several at 700–800mm. The birch pieces had been axed mostly from two sides, with 1–3 facets intersecting with one facet to form a wedge-like end; some pieces had only one axe facet, the pieces then snapped off. Others had been chopped straight across, but a majority had simply been broken without the use of an axe. Being rather slender, most could have been handled this way if the tree was not too sappy.

For tree-ring studies, 56 samples were examined. The range in diameter extended from 8 to 53mm, averaging 24.4mm; most of the stems lie between 10 and 35mm with a definite peak at 20–25mm (fig. 36) indicating that stems of a certain size were more desirable than in the Honeygore track. The age ranged from 4 to 17 years (where it could be determined), with an average of 8 years. The age too is much more consistent than in the Honeygore track (fig. 33). Several stems had a double pith or an off-centre pith, indicating an origin in forking and branching pieces. Eleven stems suggested winter cutting.

The properties of birch are not ideal in terms of strength and durability, and its use in Honeygore and Honeycat to the exclusion of all other wood species suggests that a pure stand of birch grew nearby and it was unnecessary to go further afield to collect bundles of wood to build the tracks. There can be no definite explanation of the marked differences in the age/size range of the birch

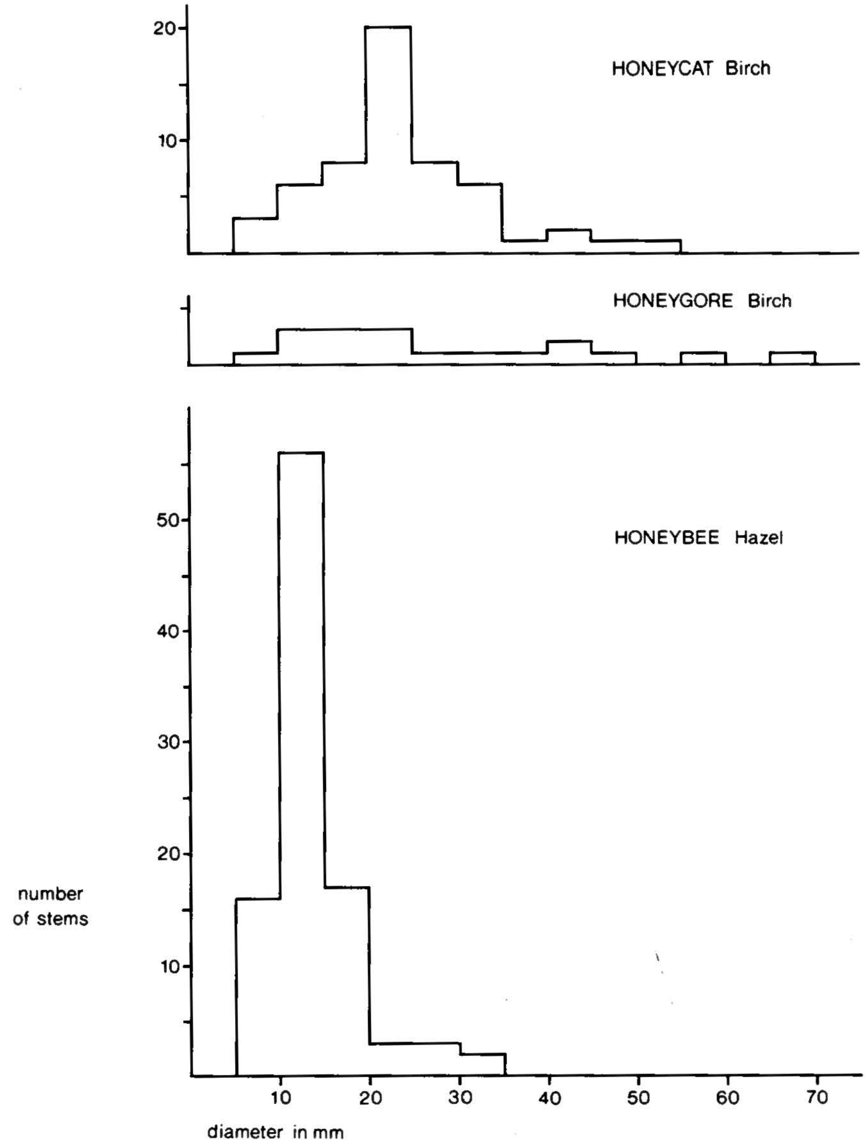


Fig. 36 Range in size of the Honeygore and Honeycat birch stems (above) and the Honeybee hazel stems (below).

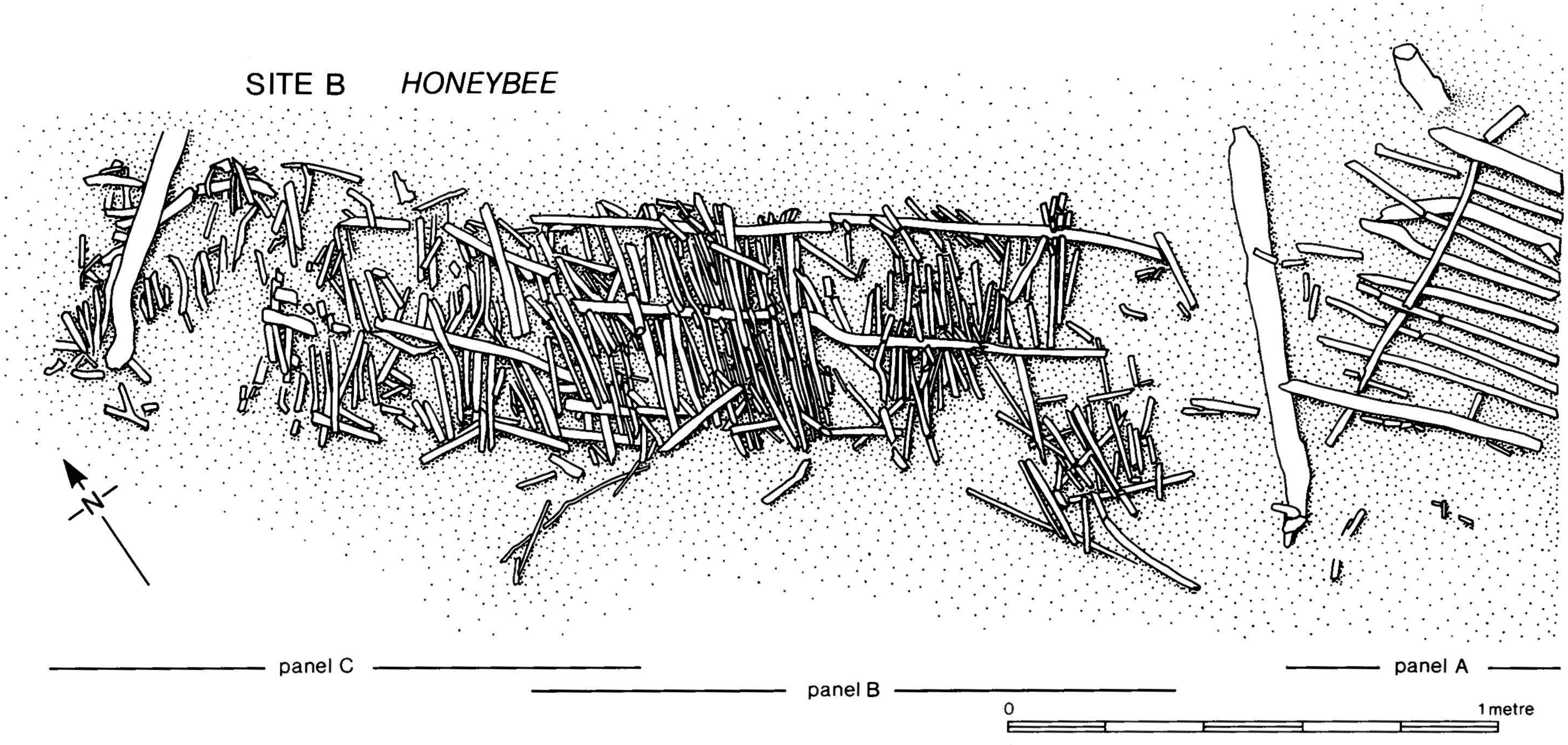


Fig. 37 Plan of the Honeybee hurdles (HgB) 1983.

stems in the two trackways; different builders or different woodlands could cause the variations, or the Honeycat birch may have come from a wood previously cut over.

The track as excavated thus confirms observations made previously at GV.1, GV1.4 and GV1.5 (fig. 30). In 1984 a small exploratory trench between GV1.4 and GV1.5 confirmed its alignment. Honeycat is interpreted for the moment as a short track which approached the heavier Honeygore at GV1.5, thereby perhaps using the pre-existing route eastwards; Honeycat was perhaps never more than a short stretch of track on an awkward wet bog requiring a short structure in isolation.

Honeybee

This structure is identified here for the first time; it has been suspected to exist from previous observations but its existence is now certain, and its character unusual in this complex. Although only examined at one site, B in 1983, it is clearly a structure made at least in part of woven hurdles (fig. 35), and it therefore extends the presence of hurdle-making in the Levels back another few generations beyond the Walton Heath and Rowland's hurdle tracks (Coles and Orme 1977a and b).

The site lay between Honeygore and Honeycat, and was only 5m from the former. The area excavated (fig. 37) was extended over 3m, in order to recover as much evidence as possible, particularly once the hurdles were identified; to the west, previous peat-cutting had destroyed the structure so only one complete hurdle had survived. Present were three hurdles, an incomplete hurdle (A) truncated by the drainage ditch to the east, a complete hurdle (B) separated from A by 30cm (with a transverse birch stem lying between), and a damaged hurdle (C) beneath B in part and destroyed to the west.

Hurdle A consisted of 10 rods and only one sail, with a peculiar and unconvincing weave; the sail lay under the 2 outside rods and over all the inner rods, not a normal weave at all. The "hurdle" nature is thus open to question. The rods were widely spaced (40–60mm apart), with a width overall of 600mm. A possible tie of hazel was noted at the south-west corner. The sail was 680mm long, 19mm diameter with traces of a coppiced heel. The diameters of the rods were: 35, 20, 30, 18, 25, 18, 19, 20, 19, 39mm. All had bark intact and were straight-grown hazel without side shoots, giving a clear impression of coppicing. The ends of the rods had been chopped once and then snapped off if the axe-blow had not cut through.

Hurdle C was also incomplete, and lay 30mm below the west end of Hurdle B. Its details are sparse due to heavy damage but it consisted of about 50 rods woven evenly, alternately Over and Under the sails. All the pieces were hazel. No ties were noted. The rods were woven unevenly by diameter, in that some thicker ends lay with thinner ends.

Hurdle B was the only complete hurdle on the site, and as much detail as possible was recorded. The extremely hot weather caused some damage to the thin rods and sails during recording, although watering was carried out whenever possible. The hurdle was 1300mm long and 500mm wide, and woven in a rather unusual way in that the sails extended the length of the panel and the rods across the panel, so that the three sails were longer than the rods. The upright panel, if rods were held horizontally as usual, would have been 1300mm tall and only 500mm wide; this is in contrast to the other Neolithic hurdles from e.g. Walton Heath where some panels were over 2500mm wide and 1400mm tall (Coles and Orme 1977a). The Honeybee hurdle had only three sails, spaced 150–210mm apart; the damage to the hurdle, with its south-eastern corner dislodged and breakage across the central sail, had spread the sails apart in places. It is possible that the original hurdle had been of Walton size, and, after its original use, had been cut up to make one or several narrow pieces for the track; we are not able at this stage to pursue this idea further. The diameters of the hazel sails were 18–24mm, 18–20mm and 15–19mm, with the narrow ends not uniform, i.e. not all at one end of the panel. There were at least 53 rods, with possibly 7 more so broken that their position over or under the central sail was indistinct. The rods were woven evenly over the sails, alternately Over and Under; although damage had removed parts of some of the rods, where a well-preserved section could be recorded, the weave was regular Over-Under-Over-Under; no doubles were noted. The rods were 5–20mm diameter, straight grown mostly 2–4 year old hazel with bark, no side twigs, and although no clear coppice heels were noted, there can be little doubt of the source of the straight rods in coppiced hazel. Most of the chopped and thicker ends lay at the northern end of the panel, with thinner snapped ends at the south. The chopped ends of the rods generally had a single facet, suggesting the slender rod was severed at one blow, but the sails and a few rods had 2 facets cut before the roundwood was snapped off. One piece had 2 + 3 facets, forming a wedge-end.

As noted above, all the pieces identified from the hurdles A, B and C were *Corylus* (hazel), with only one recorded birch piece which lay as a transverse between hurdles A and B. This piece was 850mm long, 55–70mm diameter, with one roughly-pointed end.

The 97 hazel stems sampled for tree-ring studies were all under 35mm in diameter; almost all lie between 5 and 20mm, averaging 14.2mm (fig. 36). The age too is very consistent, with the majority being 2–4 years old (fig. 38), extending up to 18 years.

The hurdles were considered individually in their separate parts of rods and sails; the sails are more variable in age and size than the rods, though not much larger (fig. 39; Table 7). The rods of hurdle A are very large and variable, especially compared to hurdles B and C (fig. 39), and since this is suspected not to be a hurdle in the usual sense, the rods may be uncharacteristic. The wide scatter may then be confirmation that A is not a hurdle, but perhaps a bundle of stems intended for use as sails. The rods of hurdles B and C are very consistent in the 2–4 year range and averaging about 12mm in diameter; they are the crop from coppiced stools growing on higher ground in the area.

TABLE 7 Sizes and ages of the rods and sails in the Honeybee hazel hurdle

	Age Average	Range	Diameter Average	Range	Number of stems
SAILS	6.2	4–11	18.4	13–27	9
RODS Hurdle A	8	3–18	23.3	16–35	10
Hurdle B	3.5	2–10	12.8	6–20	63
Hurdle C	3.1	2–4	11.7	8–15	15

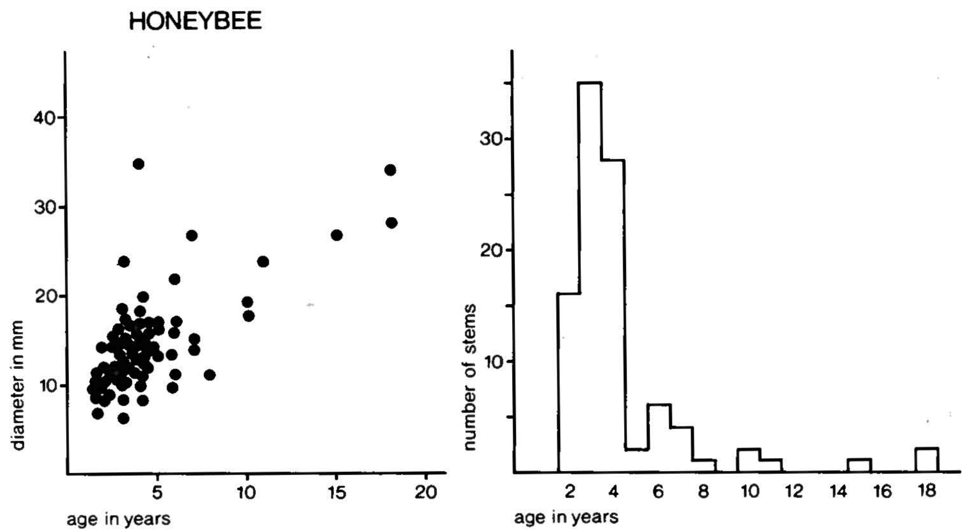


Fig. 38 Left, scatter diagram showing the age and size distribution of the Honeybee hazel. Right, the age range of the hazel stems.

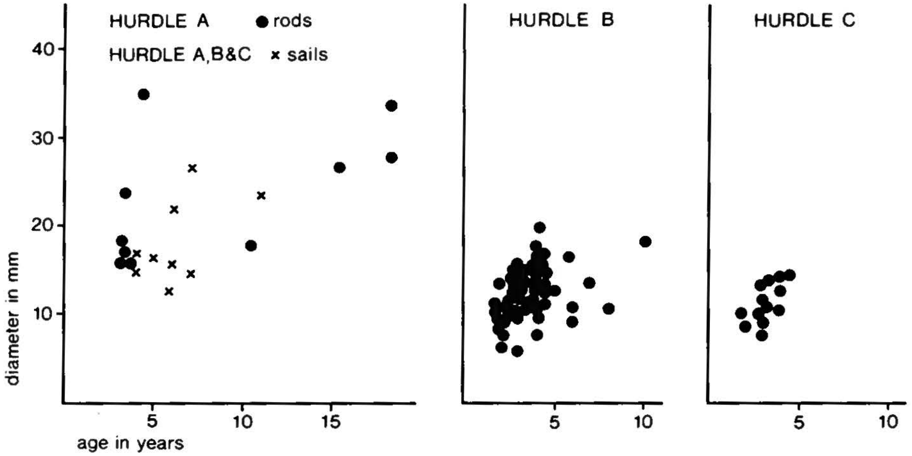


Fig. 39 Range in age and size of the hazel sails and the rods from each hurdle of the Honeybee track.

About 33% of the stems suggest winter cutting in their wide outermost growth rings. However some also had narrow outermost rings and may have been cut in summer. A total of 22 have narrow innermost rings usually followed by a wide second ring; this Rackham (1977) suggests is the result of previous summer cutting, so there may be evidence of haphazard cutting when stems were required rather than regular cycles of coppicing.

The hazel data can be compared to figures from other hurdle tracks which have been examined; the Honeybee hazel proved to be the smallest and youngest of all the 5 sites (Table 8). Other rods were usually cut from stems of 5–8 years growth and 16–18mm in diameter, while the sails were 8–11 years old on average and often over 20mm in diameter. Thus the Honeybee hurdles are unusual in being woven of much finer rods which may suggest they had been made with some other purpose in mind.

TABLE 8 Comparative figures of the age and size of hazel stems used in hurdle-built trackways in the Levels

Site	Rods Average age	Average diameter	No. of stems	Sails Average age	Average diameter	No. of stems
HONEYBEE	3.9	13.8	88	6.2	18.4	9
WALTON '83[1]	6.2	18.6	21	9.3	14.3	3
ROWLAND'S[2]	5	16	67	8.7	24	28
EAST MOORS[3]	6.2	17.9	48	7.9	19.9	7
ECLIPSE[4]	8	16.9	110	11.1	31.3	17

Notes: [1]these *Papers* [2]Morgan 1977a [3]Orme, Sturdy & Morgan 1980 [4]Coles, Caseldine & Morgan 1982

TABLE 9 Radiocarbon dates from the Honeygore Complex

Honeygore	Q-431		2800±130 bc
	Q-999		2807±60 bc
	LU-297		2810±65 bc
	Q-909		2823±80 bc
	Q-1028		2830±50 bc
	HAR-5721	A 1983	2660±100 bc
	Q-1027		2792±50 bc
Honeycat	HAR-653		2490±70 bc
	Q-427		2376±130 bc
	Q-429		2265±130 bc
	Q-320		2115±130 bc
	HAR-5724	C 1983	2610±80 bc
	HAR-652		2420±80 bc
Honeydew	HAR-651		2510±90 bc
Honeybee	HAR-5723	Hurdle B 1983	2550±70 bc
	HAR-5727	(peat) B 1983	2350±70 bc
	HAR-5722	Hurdle A 1983	2660±100 bc

Discussion

Honeybee has not been certainly identified at other positions within the Honeygore complex area. Radiocarbon dates, as noted in Table 9, point to its mid-third millennium bc age, but do not separate it in time from the Honeycat or Honeydew tracks (Honeydew is known only from one exposure 33m to the north of Honeycat, fig. 30). The levels of the three 1983 tracks are broadly similar, with Honeygore 2.31–2.35m OD, Honeybee 2.25–2.31m OD, Honeycat 2.28–2.36m OD. Relative chronology is discussed further in relation to the environmental evidence.

As a check on the current state of radiocarbon dating of the Honeygore complex, we list here all the dates so far obtained with our current views on grouping of dates. Note that the recent dates for Honeybee consist of a youngwood date somewhat older than a date from the peat immediately underneath the structure; this is a consistent if unexplained problem for the Levels, in that peat dates are younger than their demonstrably contemporary wooden structures (Orme 1982a).

Palaeobotanical investigations

During the excavations, peat monoliths were taken through the trackways at each site (fig. 30, 31) to allow comparison of the local environmental conditions by analysis of the macrofossil plant remains. The monoliths at Honeygore and Honeycat were taken at the excavated sites, but the monolith at Honeybee was taken on the other side of the ditch, i.e. from the east section of the ditch. This was necessary because the whole of the track available was excavated on the west side of the ditch. The west end of the track was terminated by an old peat cut. It was also hoped that a greater depth of undisturbed peat above the track would be recovered in the drove section on the eastern side of the ditch. However, it was discovered that former peat cutting had extended down to virtually the same level on the east side as on the west side of the ditch. Honeybee was located approximately 5m to the north of Honeygore and 16m to the south of Honeycat. The peat stratigraphies at the three sites were as follows:

Honeygore

0–0.07m	Dark brown, humified *Sphagnum-Eriophorum-Calluna* peat.
0.07–0.16m	Less humified *Eriophorum* and laminated *Sphagnum* with occasional monocot and Ericaceous remains.
0.16–0.24m	Brash and wood of track with abundant *Homalothecium nitens*. Monocot remains present.
0.24–0.32m	Slightly woody peat with monocot remains and *Menyanthes trifoliata* seeds.
0.32–0.40m	Fen peat with abundant remains of *Meesia* sp.
0.40–0.43m	*Phragmites* fen peat.

Honeybee

0–0.06m	Humified *Sphagnum-Eriophorum* peat with abundant *Calluna*.
0.06–0.12m	Less humified *Sphagnum-Eriophorum* peat with occasional *Calluna* and monocot remains.
0.12–0.22m	Brash and wood of track with some *Homalothecium nitens* moss, monocot, *Eriophorum* and Ericaceous remains.
0.22–0.34m	Woody peat with monocot, including *Phragmites*.
0.34–0.40m	Fen peat with *Phragmites, Menyanthes* and between 0.34–0.37m frequent moss remains of *Drepanocladus* sp.

Honeycat

0–0.12m	Humified, laminated *Sphagnum* peat with abundant Ericaceous remains and frequent *Eriophorum*.
0.12–0.17m	Brash and wood of track with *Sphagnum* moss and monocot present.
0.17–0.22m	*Sphagnum* peat with *Phragmites, Eriophorum* and other monocot remains. *Menyanthes* seeds present.
0.22–0.26m	Slightly woody peat with occasional Ericaceous remains, *Phragmites, Eriophorum*, and monocot.
0.26–0.34m	Moss peat with abundant *Meesia* sp.
0.34–0.39m	Fen peat with monocot remains, *Menyanthes* seeds and *Drepanocladus* moss.

Contiguous samples were taken from the monoliths at 5cm intervals and the results of the macrofossil analyses are given in fig. 40.

The basic vegetation succession of fen followed by fenwood and then raised bog is similar at all three sites, although some local variation is apparent. Below track level fruits of *Typha* (reedmace, bulrush), *Phragmites communis* (reed) and *Carex* (sedge), and seeds of *Menyanthes trifoliata* (bog bean) indicate fen conditions with standing water. Fen mosses, in particular *Calliergon giganteum, Meesia longiseta* and *Meesia tristicha*, are frequent and suggest some nutrient enrichment of the fen. *Meesia longiseta* is now extinct in Britain and is only rarely found in the fossil state (Caseldine 1984a). Another fen moss, *Homalothecium nitens*, is present at and below track level. This moss tolerates a wider range of environments than the *Meesia* spp. which prefer base-rich fen. The same bryophyte succession of *Meesia* spp. followed by *Homalothecium nitens* was recorded at Sweet TW (Caseldine 1984a), and in both areas suggests a trend towards more acid conditions. Macro remains of *Betula* (birch) at and below track level are probably derived from locally growing fen woodland and from the wood of the trackways. The change to an acid raised bog environment at and above track level is indicated by the presence of *Eriophorum vaginatum* (cotton grass), *Calluna vulgaris* (heather), *Empetrum nigrum* (crowberry) and *Vaccinium* (cowberry, bilberry, cranberry). *Aulacomnium palustre* and *Sphagnum* mosses are present, and these species frequently grow on raised bog but will also tolerate a variety of bog conditions.

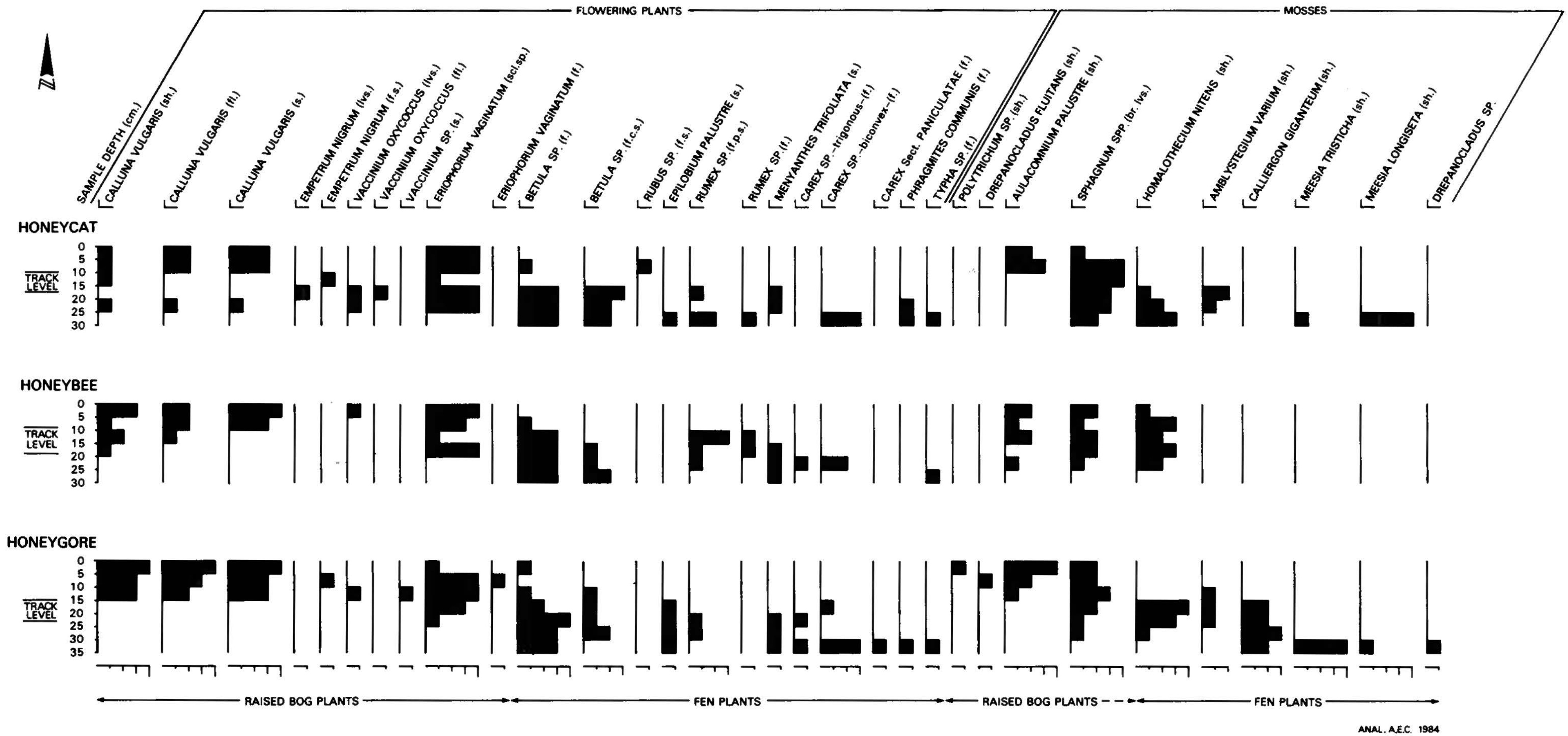
The results of the macrofossil analysis from the Honeygore site are in general agreement with those obtained by Hibbert (Coles and Hibbert 1975). However he suggested that a layer of *Homalothecium* (*Camptothecium*) *nitens* moss above the trackway might have been deliberately placed there. At the present Honeygore site *Homalothecium nitens* moss is abundant at track level and gradually decreases downwards. The moss is also present at various levels at the other two sites, but occurs at approximately the same point in the vegetation succession at all three sites. Hence the presence of *Homalothecium nitens* at track level at Honeygore appears to be natural rather than deliberate placing by man.

The macrofossil records from Honeygore and Honeycat are also consistent with the peat stratigraphies described by Godwin (1960). At both Honeygore sites Ericaceous and *Eriophorum* remains lie directly above the track, whilst at the Honeycat sites *Sphagnum* peat occurs above and below track level.

Apart from providing information about the local environment, it was hoped that analysis of the plant remains from the three sites would indicate the relative ages of the tracks and provide independent evidence to compare with the radiocarbon evidence (Table 9). Godwin (1960) obtained dates of 4326±130 bp and 4065±130 bp for wood from Honeycat and 4750±130 bp for wood from Honeygore, and similar dates were obtained by Coles and Hibbert (1975) for the two tracks. However, radiocarbon dates for wood samples taken during the recent excavations are 4610±90 bp for Honeygore, and 4560±80 bp for Honeycat, making the tracks more or less contemporary.

There are two possible interpretations of the palaeobotanical evidence from Honeygore and Honeycat. At Honeycat *Sphagnum* is abundant at track level, whilst at Honeygore *Sphagnum* is more frequent just above the track and *Homalothecium nitens* is the dominant moss at track level. The latter is frequent in the samples below track level at Honeycat. Equally *Eriophorum vaginatum* is more plentiful at and below the track at Honeycat than at Honeygore. *Empetrum nigrum* is present at track level at Honeycat and above the track at Honeygore. There is some evidence of *Calluna* to a greater depth, i.e. to below the track, in the monolith from Honeycat, but a marked rise in *Calluna* remains occurs at both sites immediately above the track. A number of other species, including *Menyanthes* and *Rumex* (docks, sorrels), are present at similar levels in relation to the tracks at both sites. However, in terms of the vegetation succession recorded at each site, the evidence suggests that the development of raised bog is greater at Honeycat at track level than at Honeygore, where it does not really begin to develop until

THE HONEYGORE COMPLEX



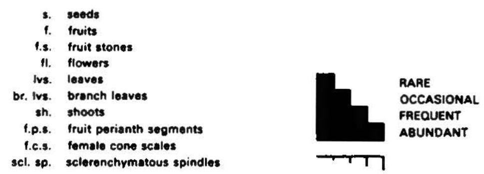


Fig. 40 A three-dimensional macrofossil diagram from the Honeygore complex 1983.

after the track was constructed, and therefore that Honeycat is later than Honeygore. This interpretation is in agreement with the radiocarbon evidence and with tree-ring indications that the Honeycat stems came from a previously cut woodland. The palaeobotanical evidence also suggests that the time interval between construction of the tracks was probably not very great and that the most recently obtained radiocarbon dates are a truer reflection of the actual ages of the tracks. An alternative interpretation of the plant macrofossil evidence is that the initiation of raised bog began earlier at Honeycat than at Honeygore, and therefore that the trackways are contemporary or even that Honeycat is slightly older than Honeygore. At the present time this second interpretation is in disagreement with the earlier radiocarbon dates obtained but increases in likelihood if the 1983 dates are accepted as being more accurate.

The radiocarbon dates from the recently discovered track Honeybee are similar to the 1983 dates for Honeygore and Honeycat, suggesting broad contemporaneity. But if the previous dates for Honeygore and Honeycat are accepted, then Honeybee is younger than Honeygore and older than Honeycat. The palaeobotanical evidence from Honeybee has certain features in common with Honeygore and others in common with Honeycat. *Sphagnum* and *Homalothecium nitens* mosses both occur at track level while *Sphagnum* dominates at Honeycat and *Homalothecium nitens* at Honeygore. *Eriophorum* is quite frequent at and below track levels as at Honeycat. *Eriophorum* is absent from below the track at Honeygore, although present at track level. Ericaceous remains occur at track level at Honeycat and Honeybee but are not present at Honeygore. Hence on the evidence of the plant macrofossil remains, if the change to raised bog was synchronous throughout the area then Honeybee is interpreted as being later in date than Honeygore and possibly marginally earlier than Honeycat. Alternatively, if the development of raised bog was diachronous across the area then it is likely that all three tracks are contemporary.

Certainly on the basis of the stratigraphic evidence the trackways would appear to have been constructed over a relatively short period of time. This suggests considerable human activity in the Westhay-Burtle area, and confirmation of this is provided by the pollen evidence from Honeygore (Coles and Hibbert 1975) which shows that the track was constructed during the first major clearance episode in the Levels.

Conclusion

Through fieldwork and excavation we now know of the existence of at least four prehistoric tracks in the Honeygore area. The earliest by radiocarbon is the Honeygore track, seen at numerous sites over at least 600m. Honeycat has also been identified at several sites over a distance of about 80m. Single exposures of Honeybee and Honeydew are known. All lie at approximately the same level OD, although their position in the peat stratigraphy is not as uniform, as is noted by Caseldine in this report. At one site GV1.5 two of the tracks were close together, Honeygore and Honeycat. To the east of the area under review we have managed to trace only one track, the Honeygore, and from H. Godwin's records it would appear that he saw and dated exposures of both Honeygore and Honeycat very near to our 1983 sites. The rarity and impermanence of substantial marker points in the landscape of the Levels may well have a part to play in our uncertainty about the positions of dated trackway wood found over 25 years ago, and our first report on this complex succeeded in placing the intersection of Honeygore and Honeycat too far to the west in the fields drawn on the map (Coles and Hibbert 1975, fig. 2). The alignments and relationships are not affected. The final (?) elucidation of the complex is likely to lie only with further fortuitous or planned exposures of the tracks.

Fig. 41 Signal Pole 1981. Photo of the scatter of birch stems and branches, lying at varying angles and levels, truncated by the peat head. Scale one metre.

THIRD MILLENNIUM STRUCTURES ON WALTON HEATH

by B. J. ORME, J. M. COLES, A. E. CASELDINE and R. A. MORGAN

Signal Pole

The field known locally as Signal Pole (due to its proximity to the former railway line, and Ashcott Station) lies at the north of Walton Heath and Ashcott Heath, and thus north of the Walton and Rowland's hurdle tracks. This general area has yielded considerable evidence for later third millennium bc activity, and field workers have been aware of its potential for further discoveries. In late 1981, the Project archaeologist K. R. Campbell recorded a heavy concentration of wood low down in one of the machine-cut heads in Signal Pole, and in July 1982 this was examined by a small team of 5 under the supervision of S. Thomsett. The field belongs to the E. J. Godwin peat company who as usual gave instant permission for the work, although the site required a rather deeper excavation than is normally requested by the Project. The site (fig. 41), at ST 45243951, was laid out along the head for 4.2m, and cut back 0.8m, a normal machine width.

The peat at this level in Signal Pole is of typical raised bog character, with abundant cotton grass which created problems in excavation. The OD level of the structure revealed by the work is 1.61–1.91m, with much of the wood at or near 1.80m. The plan (fig. 42) shows the extent of the wood excavated and clearly represents a structure without identifiable distinct elements, such as a track or platform might have, and also a site severely truncated by machine-cutting. Although the site appears to have extended sufficiently to west and east, and to have thus included the full size of the structure in these directions, there can be no such assurance for the other directions to south and north. Cut away in part to the north, the southern extent is not known although in subsequent peat-cutting very little wood was observed. Thus our understanding of Signal Pole is very poorly based on the evidence that was originally present.

The structure as it survived consisted of about 20 heavy pieces of birch stems and branches, over 30mm diameter and in length 400–900mm, dumped into a wet patch of the bog along with many more smaller pieces of birch, 10–30mm diameter and up to 500mm long, to which there accumulated twigs, bark and other small debris. The dump was tilted downwards to the north at 15–25° from the horizontal, as if it had been placed on the edge of a hollow or pool. The orientation of the wood was not uniform in plan, with pieces lying obliquely and at right angles to one another. All the pieces sampled and identified were birch, and the stems and branches were irregular with twists, twigs and knots, showing their origin in a normal fen woodland where individual trees respond unevenly to location and nutrients. All of the pieces of roundwood had bark still attached, and most had been roughly broken from the tree with little care or preparation. Three of the larger pieces had axe-marks at one end (fig. 43), probably the result of felling: one had a chisel-end (with one strong facet right across the face), the other two had wedge-ends (with multiple facets on two faces). No pegs were observed, nor would they have made much sense in the absence of any sign of deliberate alignments and positions of pieces of wood.

The Signal Pole birch stems were very difficult to age by counting the growth

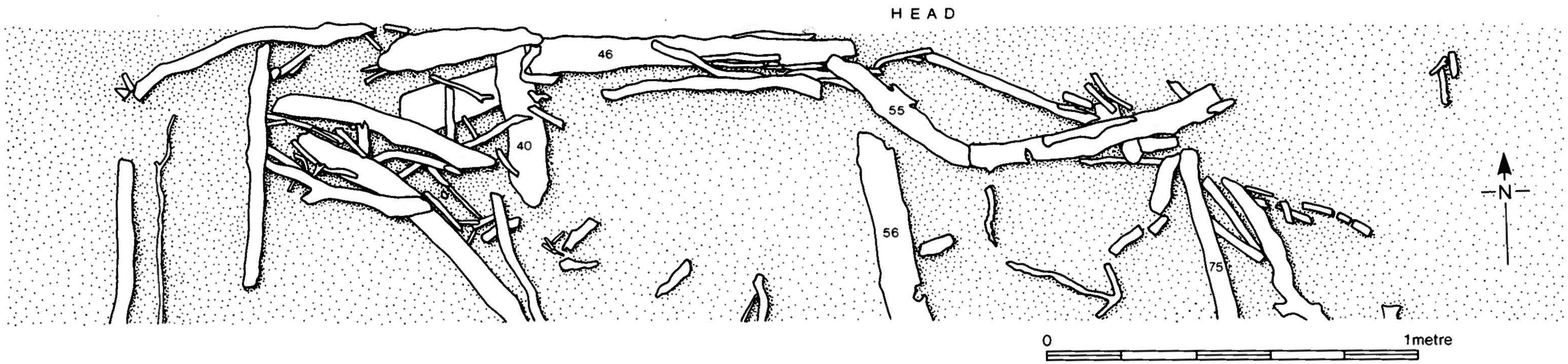


Fig. 42 Signal Pole. Plan of the birchwood scatter.

rings, since many do not have distinct boundaries or the rings are extremely narrow. Out of the 23 samples, 7 could not be aged, 9 were given approximate ages and 7 had quite clear growth rings. The roundwood was aged between 10 and 40 years, the majority being 20–30 years old. Measuring the diameter too was not straightforward as many had been compressed to an oval cross-section, so an average is given to the two dimensions; size varied greatly between 19 and 100mm, with the majority 20–60mm (fig. 46).

Many of the stems have an off-centre pith which suggests they may have been branchwood. Some have double piths (one even has four) showing their origin just below a forking stem. Many are knotty and distorted, others are very narrow-ringed or slow-grown. No ring-width measurement was possible.

The quality of the material suggests the collection of natural birch trunks and branches, without any selection for size; whatever was locally available was collected or felled and thrown down in this concentration. One interesting point is the complete absence of any other wood species; either birch was being selected in preference to other woods or only pure stands of birch grew nearby.

The structure bears some resemblance, by the miscellaneous and seemingly fortuitous alignments of bits of wood, their inclination as if down a shallow slope, and their rough-and-ready preparation, to a structure at Difford's Ground excavated in 1976 (Coles and Orme 1978c). This was interpreted as a pool-edge construction, perhaps consolidating the ground as a form of platform or helping to delimit and protect a pool. This structure was probably oval in shape, 10 x 7m, although it is also possible that the wood, seen in two heads separated by a destroyed area 5m across, was only on the sides of a narrow pool, or even a sluggish stream. The date of the Difford's structure is indicated by two radiocarbon dates *c* ad 230.

At Signal Pole, the structure was of much smaller extent, only 3.25m west–east, and possibly less north–south. In the bottom of the peat-cut, beside the western end of the site, were found a few birch branches, perhaps remnants of

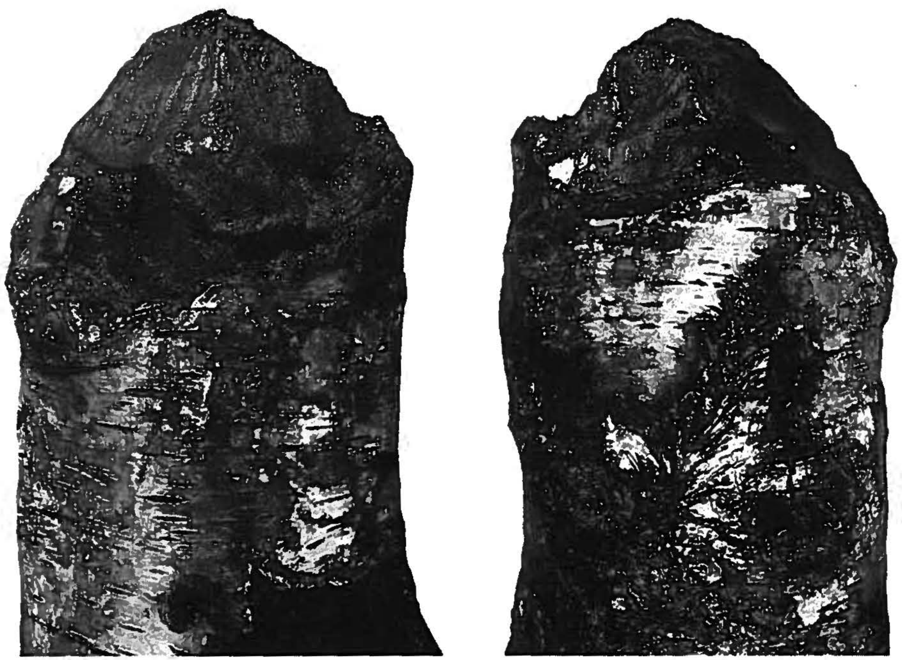


Fig. 43 Signal Pole. Chopped end of birch (2 views) with rough facets forming point. Scale ½.

low-lying parts of the sloped assemblage of wood, but the abundance of chopped pieces in the peat mumps show that part of the structure was certainly at or near the same level as that on the excavated site, and was chopped through by machine. Nothing was seen before 1981, so perhaps the north–south extent of the structure was only 1–1.5m; it would thus be 3.25×1.5m maximum, and barely more than a "patch" such as has been recorded elsewhere in the Levels at e.g. Stileway (see report in these *Papers*). The date of the Signal Pole structure is indicated by one radiocarbon date of young birchwood from the site, 2630±70 bc (HAR-4739). This is broadly in line with the later third millennium bc dates from other structures in this area of the Levels, the Walton Heath, Rowland's, Garvin's, Jones' and Bisgrove tracks, as well as simple finds of stone tools and stray pieces of wood (see summary map in Orme, Caseldine and Morgan 1982), and the remains of an earlier third millennium hurdle-like artifact which is described below.

The local environment

In order to determine the local environmental conditions at Signal Pole, the peat stratigraphy at the site was recorded and samples for plant macrofossil analysis were taken from under the pieces of wood making up the structure. The gross stratigraphy at the site was as follows:

0–0.06/7m	Humified peat with *Eriophorum vaginatum* stem bases and Ericaceous remains.
0.06/7–0.11/13m	Unhumified, strongly laminated *Sphagnum* peat with *Aulacomnium palustre* and rhizomes of *Scheuchzeria palustris*.
0.11/13–0.20m	Dark brown humified peat with Ericaceous remains and *Eriophorum vaginatum*. Stones of *Empetrum nigrum* abundant.
0.20–0.25m	Laminated band of fresh *Sphagnum* peat with *Scheuchzeria* and *Aulacomnium palustre*.
0.25–0.30m	Fresh *Eriophorum vaginatum* peat.
0.30–0.45m	Humified *Sphagnum-Calluna-Eriophorum* peat.
0.45–0.61m	Less humified *Sphagnum* peat. Occasional Ericaceous remains and *Eriophorum*. Wood of structure present.
0.61–0.66m	Fresh *Sphagnum* peat. Wood of structure present.
0.66–0.71m	Fen peat with *Scorpidium scorpioides*, and *Phragmites* rhizomes.
0.71–1.34m	Fen peat with abundant *Cladium mariscus* rhizomes and occasional *Phragmites*. Wood remains below 1.25m.
1.34–2.07m	*Phragmites* peat with wood down to 1.72m. *Alnus* present at 1.40m, 1.41–1.43m and 1.43–1.47m. *Menyanthes* present *c*1.82m.
2.07m	Soft grey clay.

Plant macrofossil samples were taken from amongst the wood of the structure as follows:

Sample SP40A—from under SP40 and above SP46.
SP55A—from under SP55.
SP56A—from under SP56.
SP56B—from under SP56A.
SP75A—from under SP75.

The plant remains identified in these samples are given in Table 10.

TABLE 10 Macroscopic plant remains from Signal Pole

	SP40A	SP55A	SP56A	SP56B	SP75A
Sphagnum spp. (leaves and shoots)	A	A	A	A	F
Aulacomnium palustre (Hedw.) Schwaegr. (leaves and shoots)	—	R	R	R	Oc
Drepanocladus fluitans (Hedw.) Warnst. (leaves and shoots)	R	—	R	R	R
Mnium hornum Hedw. (leaves and shoots)	—	—	—	—	R
Calluna vulgaris (L.) Hull (shoots)	Oc	Oc	F	F	R
Calluna vulgaris (L.) Hull (flowers)	R	Oc	F	Oc	R
Calluna vulgaris (L.) Hull (seeds)	Oc	Oc	F	F	R
Erica tetralix L. (seeds)	—	R	R	—	—
Vaccinium oxycoccus L. (leaves)	—	—	R	—	—
Eriophorum vaginatum L. (scleren. spindles)	A	Oc	A	A	A
Eriophorum vaginatum L. (fruits)	—	R	—	—	—
Rhynchospora alba (L.) Vahl (fruits)	Oc	Oc	Oc	R	Oc
Juncus L. sp. (seeds)	—	R	R	R	—
Betula L. sp. (fruits)	R	R	R	—	R
Lychnis flos-cuculi L. (seeds)	R	—	—	—	—
Carex L. sp.—trigonous (fruits)	R	—	—	—	—
Cladium mariscus (L.) Pohl (fruits)	—	R	R	R	—
Chara sp. (oosporangia)	R	—	—	—	R

Note: A, abundant; F, frequent; Oc, occasional; R, rare.

The plant remains preserved in the peat at the base of the stratigraphy indicate that *Phragmites communis* (reed) swamp developed after the marine transgression during which the grey clay had been deposited. As plant material accumulated in the form of peat and the water level became shallower, the reed swamp was replaced by *Cladium* fen. The *Cladium* fen community was then succeeded by a raised bog community as continued peat growth became dependent on a high rainfall rather than a high ground water level. It was during this period that the structure at Signal Pole was made. Analysis of the samples from the site has enabled a more precise reconstruction of the local environment than could have been achieved by only examining the gross stratigraphy. *Sphagnum* moss leaves and *Eriophorum vaginatum* (cotton grass) sclerenchymatous spindles are abundant in most of the samples, and shoots, flowers and seeds of *Calluna vulgaris* (heather) are present in all the samples. All these plants are characteristic of acid raised bog. The ovate leaves of *Vaccinium oxycoccus* (cranberry), another typical oxylophyte, also occur in SP56A. *Erica tetralix* (cross-leaved heath) and in particular *Rhynchospora alba* (white beak sedge) remains indicate the wet nature of the bog at the site. *Erica tetralix* tends to tolerate wetter conditions than *Calluna* with which it is commonly associated, and *Rhynchospora alba* occurs either at or below water level in pools on raised bog. The remnants of a fen community are suggested by the presence of *Cladium mariscus* (saw-toothed sedge) fruits and *Chara* (stonewort) oosporangia in the samples. Both these plants are frequently found in calcareous fen habitats. *Lychnis flos-cuculi* (ragged robin), another fen species, is also present.

The birch wood of the structure had the general appearance of fenwood. The occurrence of *Betula* fruits is rare in the samples from the site, and the fruits may have been brought in with the wood. However, it is probable that the wood was from a relatively local source. A date of 4580±70 bp (HAR-4739) has been obtained for wood from Signal Pole and this date and the stratigraphic position of the structure are in agreement with the radiocarbon and stratigraphic evidence from the nearby site of Walton (see below).

Finally, the upper and more recent levels of the raised bog peat at Signal Pole contained distinct bands of paler, less humified peat consisting of *Sphagnum* and *Aulacomnium palustre* mosses and rhizomes of *Scheuchzeria palustris*. The latter is found in wet *Sphagnum* bog, usually in pools, and is now very rare in Britain. These bands of fresh peat suggest a higher ground water table, and similar "flooding horizons" have been recorded at other sites in the Levels (Clapham and Godwin 1948, Beckett and Hibbert 1979). *Cladium mariscus* and other fen plants occur in the flooding horizons at certain sites, for example Decoy Pool Wood (Clapham and Godwin 1948) and Meare Heath (Beckett 1978, Beckett and Hibbert 1979), where the raised bog surface has been flooded by base-rich water. At Signal Pole the species represented in the peat indicate a continuation of acid conditions although very much wetter, suggesting a high water table but not actual flooding. Comparable results were obtained by Clapham and Godwin (1948) at Willis's Piece. Trackways and structures of late Bronze Age date have frequently been found in association with flooding horizons, and the relationship of these trackways to the flooding horizons and the cause of the flooding is discussed in the Godwin's track report (these *Papers*). It should be noted, however, that at Signal Pole the structure is dated well before the Bronze Age.

Walton 1983

In September 1983, fieldwork on Walton Heath identified an area where several long poles lay truncated by peat-cutting. These were investigated and proved to be nothing more than naturally-deposited tree stems in a reed swamp; the record of this small excavation remains in the Project files. During the work, however, peat-cutting was underway in an adjacent field on Walton II, where the Neolithic hurdles had been discovered and excavated in 1975 (Coles and Orme 1977a). This field contained not only the hurdle track but also numerous isolated patches of prehistoric woodwork, including poles, withy ties, pegs and fragments of hurdles. They represented flooded-in material from distintegrated structures, small areas of bog which were "bridged" by single hurdles, and possibly a selection of poles used for markers or as rafting poles during periods of flooding. Most of these were reported in the 1977 paper.

In 1983, A. Foster informed the Project fieldworkers that his machine had cut through another structure on Walton II (ST 45533935), about 200m from the original hurdle track. Further heads to north and south of the exposure were also cut, and observed, but no trace of any ancient wood was visible. A one-day excavation, by three people, was undertaken to investigate the discovery, and its result can be seen in fig. 44. The site exposed was only 1.5×1.5m but this was

Fig. 44 Walton Heath 1983. A dismantled hurdle of the third millennium bc, with multiple hazel rods lying over two broken sails. Scale one metre.

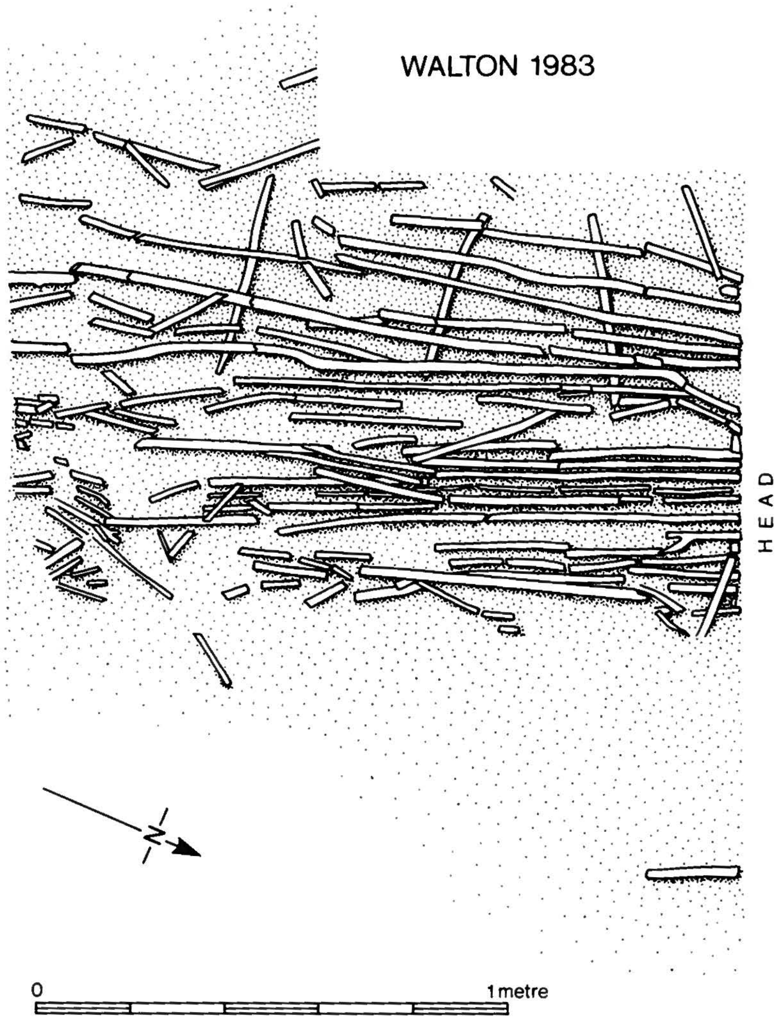


Fig. 45 Walton Heath 1983. Plan of the hurdle.

sufficient to gain an impression of the structure which at first glance represents a hurdle, with longitudinal rods and transverse sails. However, the transverses are not woven into the rods, and lie beneath all the rods, so this is not a true panel. The structure consists of at least three transverses laid 40 and 35cm apart, and under a uniform parallel set of about 20 rods, which together form a wooden surface 100cm wide and at least 150cm long (fig. 45). All of the rods are hazel, except for one rod of ash, and the transverses are of hazel.

The hazel was aged by counting the rings, and the diameters were measured; the size ranged from 11 to 25mm, with an average of 18.8mm, and the age ranged from 2 to about 16 years, averaging 6.6 years. There is a very significant peak in stems aged 4 years, which must almost certainly be the result of some form of coppice management to produce the long straight rods needed by the hurdle-makers (fig. 47). Fig. 48 shows that while the ages of the stems varied considerably, the diameter is quite uniform. The three sails showed little significant difference in size from the rods.

Twenty of the 24 hazel stems had a wide outer ring and were probably cut in winter. Another feature found on 10 stems was a very narrow innermost ring followed by a wide second ring; this may suggest summer cutting in the previous cycle, and was noted in earlier studies of Walton Heath wood (Rackham 1977, 67). The ash was 12–13 years old and 19–20mm in diameter; it had very narrow rings and the cutting season could not be determined.

Lengths of the rods were difficult to ascertain due to extensive breakage of the pieces, but the maximum seen was *c*1200mm. Several pieces seem to have been topped with continued growth from a slight curve (fig. 45); this is a feature noted previously on the Walton hurdles (Rackham 1977).

The components of the hurdle are overall comparable with those recorded from the nearby Rowland's track (Morgan 1977a); not many rods and sails were sampled from the 1975 excavations on Walton Heath for comparison. Table 8 (earlier in these *Papers*) compares the age and size of hazel rods from several hurdle tracks; this hurdle has the highest average diameter.

An isolated patch of rods and transverses from Walton was identified in the 1975–76 seasons, but was more clearly a woven hurdle (Coles and Orme 1977a, fig. 8); this hurdle was dated by radiocarbon to 2380±90 bc and 2300±90 bc, with the major hurdle track dated 2210±100 bc, 2310±80 bc, and 2470±90 bc (Orme 1982a for full list and discussion). The 1983 structure has one radiocarbon date: 2730±70 bc (HAR-5726); this is the earliest structure from Walton Heath, and if it is a disintegrated hurdle with sails pulled out, then it is probably the earliest-known hurdle surviving from the Levels and from Britain. However, in the absence of any evidence for ties, such as were numerous in the Walton hurdles, it is more appropriate to consider the 1983 structure as perhaps a bunch of hurdle components either brought in unwoven to the marsh or carried in as a flimsy panel and collapsed onto the bog. It may also be compared with Blakeway (Godwin 1960). In any event, it adds another element to the evidence for Neolithic activity on Walton Heath, clearly an area of some importance in the third millennium bc.

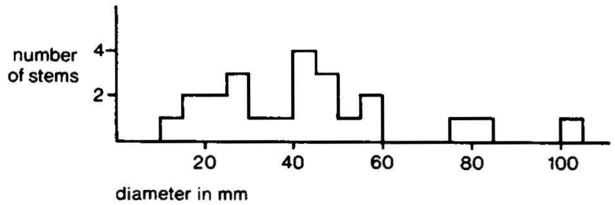


Fig. 46 Range in size of the birch stems from Signal Pole.

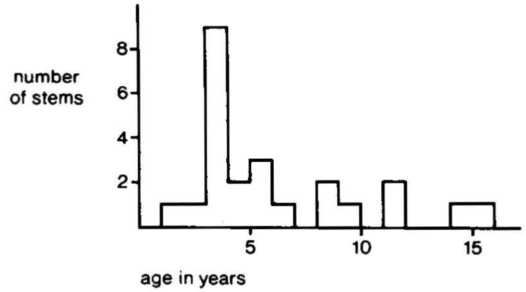


Fig. 47 Range in age of the hazel stems from the Walton Heath 1983 hurdle.

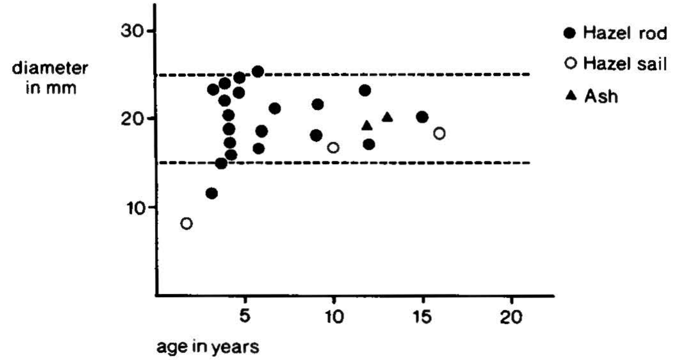


Fig. 48 Age and size relationship of the Walton Heath 1983 hazel stems.

The local environment

The structure lay at a lower level in the peat than the hurdle trackway previously known. The gross stratigraphy recorded at the site is described below.

0–0.08m	Humified *Sphagnum-Eriophorum-Calluna* peat.
0.08–0.15m	Less humified *Sphagnum-Eriophorum* peat.
0.15–0.23m	Fresh *Sphagnum* peat.
0.23–0.28m	Fen peat with abundant *Campylium stellatum* and *Scorpidium scorpioides* moss and *Cladium mariscus* rhizomes. Track timbers at *c*0.25m.
0.28–0.71m	*Cladium* fen peat.
Below 0.71m	Not sampled.

Samples for plant macrofossil analysis were taken directly above and at track level, and a monolith was taken immediately adjacent to the structure. The samples analysed were as follows:

Sample WAL1 —from immediately above the structure
WAL3 —from track level
WAL4M—from 0.15–0.20m in the monolith
WAL5M—from 0.20–0.25m in the monolith and approximately at track level
WAL6M—from 0.25–0.30m in the monolith

The general vegetation succession of base-rich fen followed by acid raised bog that took place in the Walton area is evident from the gross stratigraphy. However, a more detailed reconstruction of the local environment can be made from the analysis of macroscopic plant remains. The plant taxa identified in the samples are given in Table 11.

The plant macrofossils in sample WAL6M indicate the vegetation growing in the area just before the structure was built. *Cladium mariscus* (saw-toothed sedge) fruits are frequent, suggesting base-rich shallow fen as *Cladium* is a calcicole (lime-loving) and also prefers a water depth of less than 40cm. These conditions are confirmed by the presence of *Potamogeton coloratus* (fen pond-weed), which is found especially in calcareous pools in fen peat, and *Carex elata* (tufted sedge), which also occurs in eutrophic mires.

Macroscopic plant remains in WAL3 and WAL5M reflect the local environmental conditions when the hazel rods were laid down. By this time virtually a carpet of fen mosses had developed. Leaves and shoots of *Calliergon giganteum, Scorpidium scorpioides,* and *Campylium stellatum* are abundant in the samples. *Cladium* is still present and various other plant taxa, namely *Lychnis flos-cuculi* (ragged robin) and *Carex* (sedge), which are indicative of a fen environment are also represented. However the appearance of fruits of *Rhynchospora alba* (white beak sedge) in both WAL3 and WAL5M suggests a change to more acid conditions as *Rhynchospora alba* is a species typically found growing in shallow water at the margin of pools in raised bog (see discussion of Godwin's track, these *Papers*). *Sphagnum* moss is also more frequent. There is little evidence for a fenwood stage in the hydroseral succession at Walton, as is frequently recorded elsewhere in the Levels at this time, as no wood is present in the stratigraphy and *Betula* (birch) fruits are rare. This is in agreement with the evidence for fen woodland from other sites in the Walton area where, at the most, the peat is only moderately woody, suggesting fairly open fen woodland (Beckett 1977, Hibbert 1977, Orme, Caseldine and Morgan 1982).

The abundance of *Sphagnum* leaves in samples WAL1 and WAL4M indicates the establishment of a *Sphagnum* moss peat immediately above the trackway. The fresh, well preserved leaves suggest wet conditions and that the track was overwhelmed by rapid peat growth. A similar vegetation sequence

TABLE 11 Macroscopic plant remains from Walton 83

	WAL1	WAL3	WAL4M	WAL5M	WAL6M
Sphagnum spp. (leaves and shoots)	A	Oc	A	F	R
Aulacomnium palustre (Hedw.) Schwaegr. (leaves and shoots)	—	—	Oc	—	—
Campylium stellatum (Hedw.) J. Lange & C. Jens (leaves and shoots)	—	A	—	A	—
Drepanocladus sp. (leaves and shoots)	—	—	—	—	F
Calliergon giganteum (Schimp.) Kindb. (leaves and shoots)	—	A	—	R	R
Scorpidium scorpioides (Hedw.) Limpr. (leaves and shoots)	—	A	—	F	Oc
Rhizomnium punctatum (Hedw.) Kop. (shoots)	—	R	—	—	—
Eriophorum vaginatum L. (fruits)	R	—	Oc	—	—
Eriophorum vaginatum L. (scleren. spindles)	—	—	Oc	—	—
Rhynchospora alba (L.) Vahl (fruits)	R	Oc	—	R	—
Carex Sect. *Paniculatae* Carey (fruits)	—	R	—	—	—
Carex elata All. (fruits)	—	—	—	—	R
Cladium mariscus (L.) Pohl (fruits)	—	Oc	—	R	F
Potamogeton coloratus Hornem. (fruits)	—	—	—	—	R
Hydrocotyle vulgaris L. (fruits)	R	—	—	—	—
Lychnis flos-cuculi L. (seeds)	—	R	—	—	—
Rumex L. sp. (fr. per. segs.)	—	R	—	—	—
Betula L. sp. (fruits)	—	R	—	—	—
Juncus L. sp. (seeds)	—	R	—	R	R
Sagina cf. *nodosa* (L.) Fenzel (seeds)	—	R	—	—	—

Note: A, abundant; F, frequent; Oc, occasional; R, rare.

occurred at the Jones site (Orme, Caseldine and Morgan 1982) and at Garvin's (Beckett 1977). Fruits of *Hydrocotyle vulgaris* (marsh pennywort) and *Rhynchospora alba* provide further evidence for the wet nature of the environment and for a trend towards oligotrophic conditions. The latter is confirmed by the absence of *Cladium* remains and the presence of *Eriophorum vaginatum* (cotton grass) fruits in WAL1 and WAL4M. *Eriophorum* is characteristic of raised bog and *Eriophorum vaginatum* sclerenchymatous spindles (highly resistant fusiform structures only found in the leaf bases of this species), and leaves of the moss *Aulacomnium palustre*, a moss which commonly grows on raised bog but will tolerate a fairly wide range of bog conditions, also occur in WAL4M. The establishment of drier raised bog is indicated by the fibrous leaf bases of *Eriophorum* and Ericaceous remains higher in the stratigraphy.

The Walton Heath hurdle track which lay in the raised bog peat around 30cm above the transition from fen deposits, was dated to between 4420±90 bp (HAR-1471) and 4160±100 bp (HAR-1220). The stratigraphic evidence suggests that the Walton 1983 structure is older than the Walton hurdle, and this is confirmed by a radiocarbon date of 4680±70 bp (HAR-5726) obtained for wood from the structure. The radiocarbon date and stratigraphic evidence from Walton 1983 are consistent with those from the structure at Signal Pole, the adjacent field to the west, indicating perhaps a more than passing interest in the area.

Fig. 49 Godwin's track. General view of the upper levels of the brushwood track, looking south-west, showing the track line, which runs from just left of the scale off to the right, and a spread of brushwood (foreground). Sharpham peninsula lies in the left distance.

GODWIN'S TRACK: A BRONZE AGE STRUCTURE AT SHARPHAM

by J. M. COLES, B. J. ORME, A. E. CASELDINE and R. A. MORGAN

During field walking in the Sharpham area in late May 1982, one of the Project's archaeologists A. Wickenden discovered worked wood in one of the 18 machine-cut heads (trench faces) in a field known locally as Old Rhyne Ground, but called in recent years Big Godwins. The field belongs to the E. J. Godwin peat company and was being cut by S. Durston; it had not previously been cut, according to local informants, apart from three cuts in 1981, and a fourth in 1982, all at the same level. The peat in this area is still very deep, about 3.5m in this field, and it consists of raised bog in the upper parts at least. After the initial discovery of wood in one of the heads, further search revealed traces of wood in the mumps, and in 5 other heads farther east and north. The alignment suggested a trackway running from south-west to the north-east. Within 350m to the south-west, the dry land of Sharpham lies with its terminal area for the Tinney's tracks, and in this general area the newly-discovered track may well originate. It seems logical to name it the Godwin track, after Mr E. J. Godwin (for long a supporter of archaeology in the Levels) and after Sir Harry Godwin (whose work in the Levels established the nature of prehistoric activity).

In early July 1982 the Project carried out a small excavation on the site of the first exposure (ST46543831), with the permission of the peat company, and under the supervision of A. Wickenden the entire process was completed in 5 days with a team of 5–9 persons. In order not to disturb the peat-cutting operations, the site was laid out over about 5 x 2m, running slightly obliquely to the head; the depth excavated was kept to only 40cm at most, so that further machine-cutting would not be handicapped. In the event, the entire structure lay well within this self-imposed limit. Conditions were dry and warm, and the South Drain was used to supply water for spraying the track wood as it emerged. After 2 days' work the structure (fig. 49) was ready for photography, planning by sketch and photo-mosaic, recording and sampling. The upper levels were removed, and lower levels exposed and treated in similar fashion, before the numerous small vertical pegs were finally lifted intact. There is no question in the Project's mind that a short intensive excavation is essential for such structures, particularly now that most of these are already partly dried-out by drainage of upper peat levels. In order to facilitate the excavation, a sampling strategy was adopted in which areas within the structure were selected for the collection of wood pieces for identification and tree-ring analysis, with other areas unsampled. Over 150 samples were taken for identification, in 8 major blocks of 15–25 pieces each, with a few individual pieces taken from elsewhere; numerous pieces were also collected for conservation. Peat samples were taken for environmental analyses.

The track as seen in this excavation is comparable in many ways to the brushwood tracks at Tinney's Ground only 500m to the east of the site. Godwin's track consists of a series of bundles of alder, birch and willow branches and twigs dumped onto the raised bog with moss, cotton grass and other plants colonising the soft and wet surface. The horizontal wood was prevented from immediate lateral movement by sticking and knocking short pegs through the bundles. In the short length of track seen, it was difficult to identify bundle ends, as much of the material was broken into short lengths. At the southern end of the site, truncated by the angled head end, only a few scatters of wood had survived, and from the plan (fig. 50) it is clear that here the body of the track was totally destroyed, and only a few strays remained on the original surface. Rather unusually, of 6 pieces taken for identification from the extreme southern end, all were oak, the only identified oak from the entire site except for one longer piece lying 80cm away and truncated by the head.

The main body of the track as preserved for excavation is best considered in two parts. The southern section consisted of a dense *c*20cm thick bundle of alder (with a very few pieces of birch and willow) dumped to form a path 50cm wide. The wood used was short, rarely over 400mm long, and of varying diameters, 10–30mm. Almost all pieces were roundwood, with bark, and few had been prepared for the track by elaborate axing; most ends were simple breaks or snaps, although several had a couple of facets cut from one side and a few had one clean facet where a sharp axe had severed the branch at one blow (fig. 51). Many of the larger pieces had twigs and shoots still attached, or torn off, and there was nothing here to indicate any form of coppicing or careful selection. The bundled and dumped wood was held loosely in place by short pegs of alder, 20mm diameter and 100–400mm long, pushed or driven into the bog. Some of these pegs were bent, as if in driving with a mallet they had been forced into the ground at such a rate that, the wood being green, they had bent under pressure. Their ends were not prepared in any way differently from those of the horizontal pieces and doubtless they were merely picked from the bundles and used as pegs as and when it was felt necessary.

Farther to the north, the track seemed to divide into two branches, one running a normal course, the other diverging towards the east. The excavation site was extended to follow the latter but it appeared that what was exposed was merely a bundle of rather larger pieces of alder and birch slightly dislodged to the east. The plan gives a rather positive impression of deliberate divergence, but the extension was generally a single layer of wood rather than a multiple deposit of 2–6 pieces thick such as was found along the main line of the track. The track in the northern part of the site was much wider than that to the south. Its western edge was neat and straight, and from this to the eastern edge was about 100cm. However, again taking the thickness of the structure as a guide, it would seem that the major part of the track here was about 60cm wide, with a scatter of pieces to the east giving the impression of a wider structure. The wood used in this northern part was mostly alder, with a few pieces of birch, and willow only found at the bottom of the structure. It is possible that the willow, locally growing, was knocked down first and dumped along the line to await the bundles of alder branches and the occasional birch piece. These willow stems and branches were generally longer than the upper alder and birch pieces. A number of the latter had been obtained by axing, but most had been simply broken from the tree. Throughout the dense spread of the track there were many pegs, 15–25mm

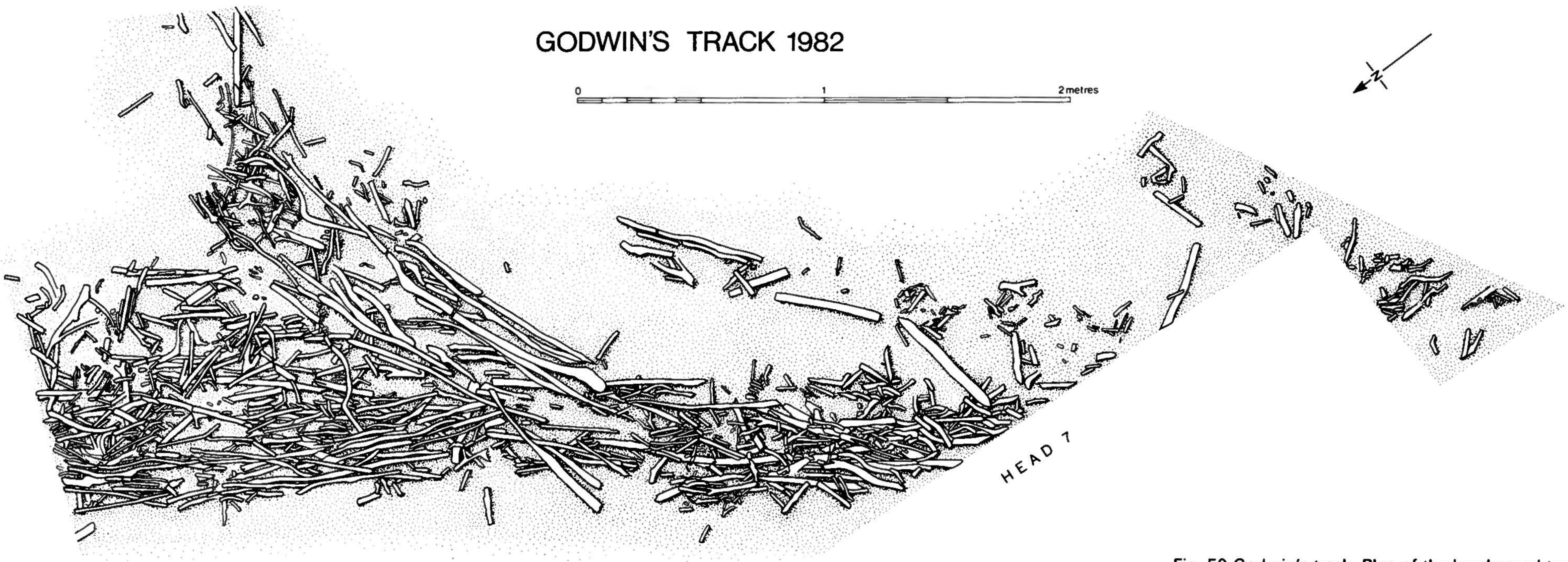


Fig. 50 Godwin's track. Plan of the brushwood track.

diameter, 100–400mm long, pushed or driven into the bog and projecting only a few cm above the brushwood horizontals. These pegs, as those in the southern part, lay at angles of 30–90° from the horizontal; of 40 measured, 12 were vertical or near-vertical (70–90°).

Table 12 provides some indication of the woods used in the track. The wood of the northern part of the track was slightly more slender than that of the southern part, ranging in diameter 10–30mm, and in length 100–600mm with an occasional longer piece. Twigs and forked pieces, bends and knots show the absence of any controlled growth process except perhaps for some of the alder (see below), and it would seem that any tree locally available was felled for use in the track. The wood is generally no more than ten years old, showing the relative immaturity of the trees selected. It would seem that young trees were felled, and totally broken up into the small stems, branches and twigs in the bundles. That the bundles were likely to be armloads may be indicated by the spread of wood at the bottom of the structure, dispersed across the ground rather than firmly indented into the soft surface which might happen if a tied rounded bundle was placed in position; in any event, if the variable lengths of the pieces found are representative of their original lengths, the use of the word bundle is probably misleading, and loads or armfuls or heaps is a better description. Thus bundle ends would not really be clearly identifiable.

TABLE 12 Wood species in Godwin's Track

	Alnus	Betula	Salix	Quercus
Southern part	16	2	5	0
Southern part, low	13	0	3	0
Northern part	54	6	0	0
Northern part, low	30	0	4	0
Extreme Southern end	0	0	0	6
Eastern spread	7	3	2	0

Tree-ring studies

Being fairly scattered and fragmentary, the track was sampled for tree-ring analysis in small areas labelled A to M. These sampling areas covered the spread of brushwood evenly; from some areas, a sample was taken from each suitably preserved piece regardless of size, from others only an isolated large piece was sampled. In this way, it was hoped to obtain a representative view of the range and distribution of wood species, and their size and age. Pegs were not separately

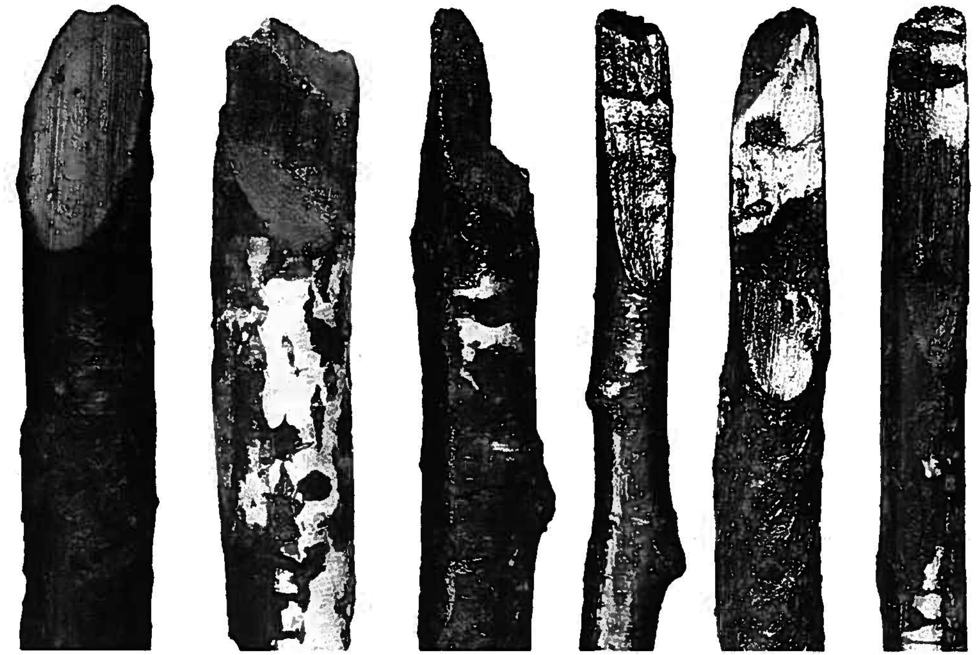


Fig. 51 Godwin's track. Chopped ends of the brushwood and pegs. Most have been cut at shallow angles, with one or two blows of a metal axe, leaving flattened facets occasionally smoothed. Scale ½.

recorded. A total of 154 samples were examined.

Measuring the diameter was generally not difficult except where decay had removed the outer surface, but only about 60% of the stems could be aged; alder and birch are both difficult species in which to distinguish the ring boundaries. Looking at the stems as a whole, the diameters are variable between 6 and 40mm (fig. 52), though largely in the 10–20mm range and with a peak at 14–16mm. This peak is the result of a concentration of alder stems 15mm in diameter. Alder also has a peak in age at 4–5 years (fig. 53, though this diagram only includes about 60% of the 123 alder stems examined), corresponding to the 15mm diameter peak. A concentration of these uniform rods lay in the widely spread central area of the track (groups B/C), and almost certainly represents the crop from a stool which has been cut over before; they were probably harvested and laid down in a bundle.

When we consider the individual areas of the track which were sampled, it appears that the species were randomly mixed horizontally, with the exception of oak which is concentrated at the south end of the excavation. The oak stems were largely 4–5 years old, and 5 out of the 6 were cut in winter.

The brushwood deposit was thick and in two layers; 9 sampling groups came from the upper layers and 4 groups from the lower layers. Willow was more abundant in the lower layers while birch was evenly spread among the alder. Comparisons were made of the stem diameters between three upper layer groups

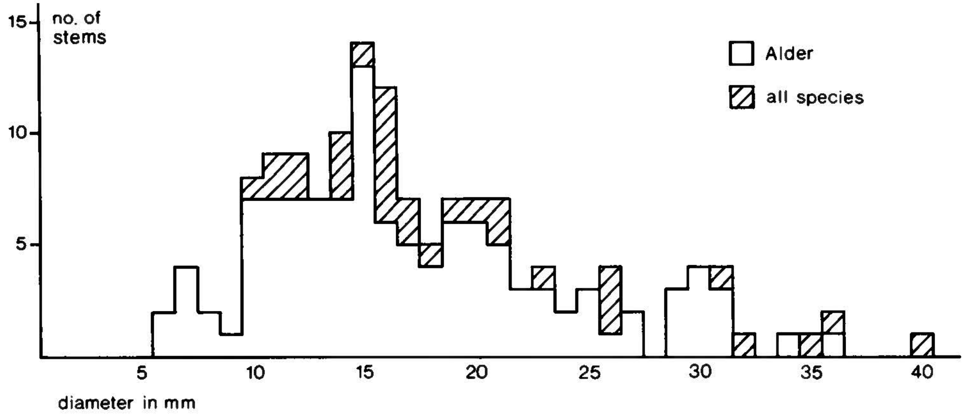


Fig. 52 The range of stem diameters in the Godwin's track.

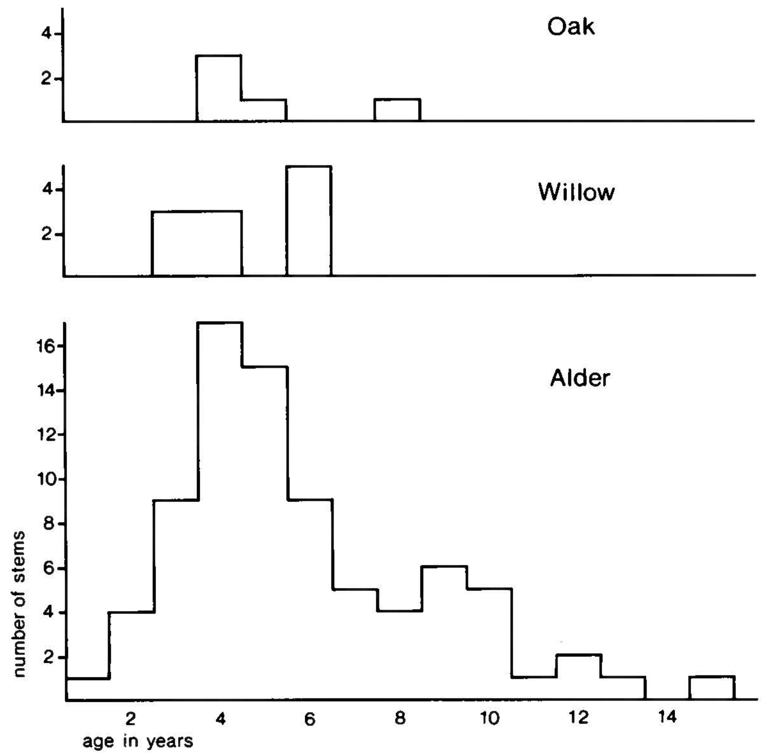


Fig. 53 The range of stem ages in the Godwin's track.

(A/B/F) and three lower layer groups (J/L/M) which were adjacent or beneath them. Each group consisted of 15–25 stems from across the entire width of the brushwood bundle. Groups A and B, upper layers in the north, are all of alder, while group F to the south contains some birch and willow; the stems are mostly below 20mm in diameter, averaging 15.9mm (fig. 54). Their associated lower layer groups contain more willow and are more substantial, averaging 18.7mm, suggesting that the heavier material was laid first as a firmer base for the track.

The Godwin's alder can be compared to alder stems of similar date from the series of parallel tracks in Tinney's Ground not far away to the east (Coles and Orme 1980). The alder from Tinney's A tended to average 7–8 years old and 27mm in diameter, while that from Tinney's D was largely under 6 years old and about 21mm in diameter (Morgan 1980b). By contrast, the Godwin's alder averages 5.9 years in age, roughly in between the two Tinney's Ground assemblages, and 17.3mm in diameter which is considerably smaller. Alder would no doubt have been growing quite close by, along the wetter edges of the Poldens just to the south-west. The much smaller size, and thus slower growth, of the Godwin's alder suggests that the wood came from an area of less favourable growth than the Tinney's wood, perhaps on the higher and drier ground. Willow and birch grow in similar conditions, whereas the small patch of oak must certainly have come from the higher ground.

The Godwin's track was thus constructed of bundles of locally available wood, some of natural origin and some which had been cut over before, 4 or 5 years previously.

Palaeobotanical investigations

The construction of a trackway is largely in response to the prevailing environmental conditions, and therefore a detailed examination of the peat deposits at the site was undertaken. Apart from a short pollen diagram by Hibbert (Coles, Orme, Hibbert and Jones 1975b) and the analysis of macroscopic plant remains by Beckett (Coles and Orme 1978b) from Tinney's Ground, no other detailed palaeobotanical work has been carried out in this part of the Levels. Unfortunately, although the depth of peat at Godwin's was considerably greater than exists in much of the peat-cutting area, only a shallow thickness of undisturbed peat overlay the track, thereby preventing the reconstruction of later environmental events in the area. However, it has proved possible to ascertain the vegetation changes taking place before, during and immediately after the trackway was in use, and to correlate these changes with the general environmental sequence evident at other sites in the Levels.

A vertical peat monolith was taken through the track at the northern end of the site. Contiguous samples for the analysis of macroscopic plant remains were taken at 5cm intervals from the monolith. Samples G1 (0–5cm), G2 (5–10cm) and G3 (10–15cm) were all taken from above the trackway. Samples G4 (15–20cm) and G5 (20–25cm) included the track. Sample G6 (25–30cm) included the base of the track and the peat directly underneath. Samples G7 (30–35cm) and G8 (35–40cm) were taken from the peat below the track. The results of the plant macrofossil analyses are given in fig. 55.

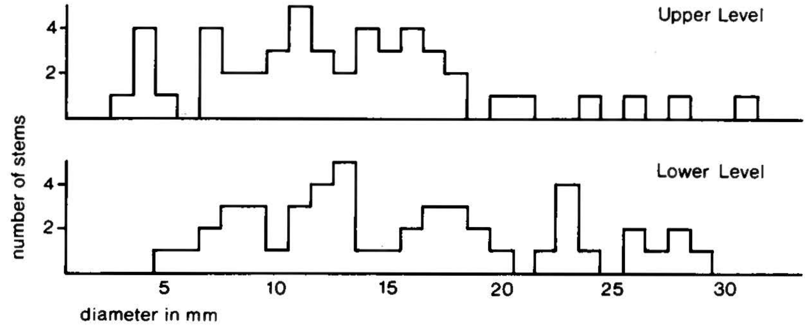


Fig. 54 Comparison of the stem diameters of alder in the upper and lower brushwood of the Godwin's track.

In the lowest sample, G8, *Calluna vulgaris* (ling, heather) and *Eriophorum vaginatum* (cotton grass, hare's tail) remains are abundant. *Sphagnum* and *Aulacomnium palustre* mosses are also present. All these plants are typical of a raised bog environment, which is dependent on high rainfall rather than high ground water levels, as in a fen, to sustain it. In the sample immediately above, G7, *Calluna* and *Eriophorum* again dominate the macrofossil assemblage, but seeds of *Erica tetralix* (cross-leaved heath) also occur. *Erica tetralix* is frequently found in association with *Calluna* but it will tolerate wetter conditions than the latter. Hence the appearance of *Erica tetralix* leaves and seeds in the peat stratigraphy suggests a trend towards wetter conditions, which is confirmed by the macrofossil plant remains in the samples above. In G6, which was taken at a level which included the lowest pieces of wood of the track, as well as the species already mentioned, *Rhynchospora alba* (white beak sedge) is recorded. *Rhynchospora alba* is a characteristic invader of the muddy margins or shallow water at the edge of pools in ombrogenous bogs, and Godwin (1975, 1981) refers to it often occurring in the aquatic *Sphagnum* peat of the flooding horizons of the Levels. *Rhynchospora alba* and *Erica tetralix* increase in frequency in sample G5 which is at track level. Seeds of *Juncus bufonius* (toad rush), a rush which occurs on mud at the edge of ponds, are also numerous. This is a cosmopolitan species which occupies a number of habitats, including land disturbed by man. Hence its presence at Godwin's may be as much a result of disturbance of the vegetation cover by man's activities as by "natural" environmental factors. *Calluna* remains decline significantly in this sample as well, indicating wetter conditions and possibly the effect of trampling by human feet.

Further evidence for a wetter local environment when the trackway was in use is provided by the plant taxa recorded in sample G4. In particular in this sample, fruits of *Hydrocotyle vulgaris* (marsh pennywort, white rot) are frequent, while seeds, shoots and flowers of *Calluna* are rare. Godwin (1975) refers to *Hydrocotyle* being eutrophic and, like *Rhynchospora alba*, occurring in the flooding horizons in the peats of the Levels. However, it is a plant which will

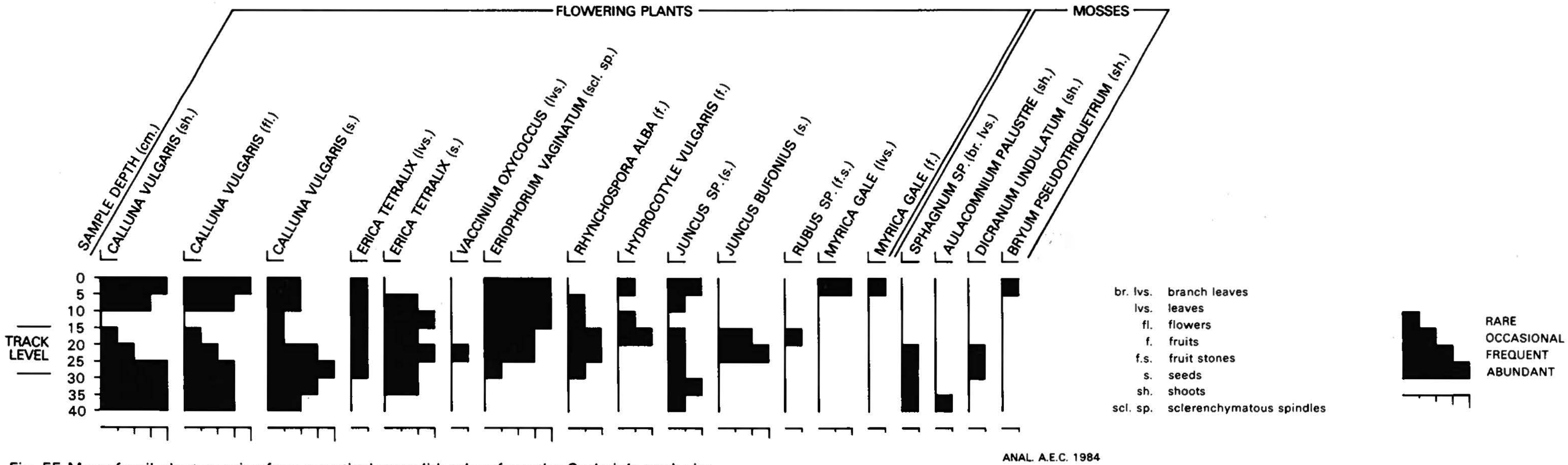


Fig. 55 Macrofossil plant remains from a vertical monolith taken from the Godwin's track site.

survive in a range of habitats from bogs to fens and marshes, and tolerate a nutrient status from oligotrophic to eutrophic and of high to low alkalinity (Haslam, Sinker and Wolseley 1975).

The sample immediately above track level contains abundant *Erica tetralix* seeds, indicating a continuation of wet conditions, but fruits of *Hydrocotyle vulgaris* and *Rhynchospora alba* decrease in frequency. In the final two samples, G1 and G2, an increase in *Calluna* remains may suggest slightly drier conditions, but the presence of *Myrica gale* (bog myrtle) macrofossils, *Hydrocotyle* fruits, monocotyledon remains and secondary penetration of the peat by *Cladium mariscus* (saw-toothed sedge) rhizomes implies a change to wetter and base-rich conditions. *Myrica* is found in a variety of habitats which include bogs, wet heaths and fens, but it tends to avoid extremes of both oligotrophy and eutrophy. Macrofossil remains of *Myrica* have mainly been found in the upper peats of the Levels, and *Myrica* wood was identified from the trackway at Tinney's C (Coles and Orme 1978b). High Coryloid, *Corylus/Myrica*, pollen values usually correspond with the presence of macro remains as, for example, at Decoy Pool Wood (Clapham and Godwin 1948) and Tinney's (Coles, Orme, Hibbert and Jones 1975b, Coles and Orme 1978b). The occurrence of *Myrica* in association with *Cladium* characterises the flooding horizons at a number of sites in the Levels, and it is clear that the presence of *Myrica* and *Cladium* in the top sample at Godwin's reflects the beginning of the first flooding horizon as recorded at other sites. This will be discussed in more detail below.

Godwin's track is in many ways comparable to the brushwood bundle tracks discovered at Tinney's Ground 500m to the east, and a radiocarbon date of 3060±70 bp (HAR-5086) has been obtained for wood from Godwin's in comparison to dates between 2920±60 bp and 3040±70 bp at Tinney's. Hence the tracks from the two sites are thought to be broadly contemporary and the palaeobotanical evidence would tend to support this view. The macrofossil results obtained by Beckett (Coles and Orme 1978b) from Tinney's Ground indicate the local environment when the tracks were constructed. As at Godwin's, *Erica tetralix* seeds are frequent and *Rhynchospora alba* fruits are present in samples from the base of Tinney's A, indicating the track was built across wet raised bog. The sample from under Tinney's B lacks these two species and it is suggested that the track was built over slightly drier ground than Tinney's A. The results therefore indicate very similar conditions at Tinney's to those at Godwin's, although possibly marginally drier at the former. Samples from above the trackways were not analysed by Beckett but during an earlier excavation Hibbert (Coles, Orme, Hibbert and Jones 1975b) described the peat stratigraphy and analysed pollen from the site. The track was recorded as lying 6cm below a change in the peat stratigraphy from well humified *Calluna-Sphagnum* peat to *Cladium*-monocot peat. Although the track lay below the major stratigraphic change, less humified *Sphagnum* peat was noted at track level, suggesting a wetter bog surface at that time. Beckett (Coles and Orme 1978b) also found abundant *Sphagnum* at track level. The environmental sequence therefore, of relatively dry raised bog followed by wetter conditions when the tracks were built and finally a major change to flooded *Cladium* fen, appears to be basically the same throughout the Sharpham area.

Flooding horizons. The presence of two flooding horizons in the upper raised bog peats of the Levels was first noted by Godwin (1948), and since then has been recorded at many sites (Godwin 1981, Beckett and Hibbert 1978, Caseldine 1984b and see Signal Pole in these *Papers*). The flooding horizons are represented in various ways depending on the degree of influence of the ground water at the particular site. Hence at some sites *Cladium* is present in the stratigraphy whilst at others, for example the Abbot's Way (Beckett and Hibbert 1976, 1978), because of the height of the raised bog surface above the water table, the wetter conditions are marked by a change to less humified *Sphagnum* peat. However in the stratigraphy at Decoy Pool Wood (Clapham and Godwin 1948) the influence of base-rich water is evident, as the flooding horizon is characterised by *Cladium* and *Myrica gale* remains. A peak in *Hydrocotyle* pollen occurs in the diagram from Decoy Pool Wood in the aquatic *Sphagnum* peat level below the *Cladium-Hypnum* peat, and this vegetation sequence is in agreement with that found in the macrofossil analysis at Godwin's.

The beginning of the first flooding horizon has been dated to 2624±45 bp (SRR-914) at Meare Heath (Beckett 1978, Beckett and Hibbert 1979), but the cause of this major environmental change from acid raised bog to calcareous fen remains uncertain. Alterations in climate may have been involved (Godwin 1948, 1960), but it is also probable that changes in sea level played a part (Hibbert 1980). It has been suggested that the scale of change involved in creating an environment dependent on a high ground water table rather than high rainfall must have necessitated a substantial alteration in the drainage pattern. Such a change would have been brought about by a rising sea level. Recently, radiocarbon dates have been obtained for the peat immediately above and below the "Romano-British" clay in the Godney area (pers. comm. R. Housley). The lower date is 2860±50 bp (Q-2458) and the upper date is 2550±50 bp (Q-2459). The lower date is somewhat earlier than the date from Meare Heath for the beginning of the first flooding horizon, but this variation can be accounted for by a number of factors. The radiocarbon sample from Meare Heath was taken at 85–87cm, slightly above the stratigraphic change to *Cladium* peat, which occurred at 90cm (Beckett and Hibbert 1979). Hence the flooding of the bog surface probably began earlier than indicated by the Meare Heath date. The depth of sample dated from beneath the estuarine clay was 6cm rather than 2cm as at Meare Heath, and therefore deposition of the clay probably began slightly later than indicated by the Godney date. Also, apart from the problem of the comparability of radiocarbon dates (Orme 1982a), the date of any response to changing drainage conditions brought about by a change in sea level will vary through space, time and in degree, depending on the proximity of the site to the origin of the change. Hence it is likely that the date of the response to a change in sea level, namely flooding of the raised bog surface, would be slightly later at Meare Heath, approximately 5km from the marine incursion at Godney. However, the beginning of a trend towards wetter conditions at Godwin's is evident before the major stratigraphic change occurs, and the same may be seen at Stileway (these *Papers*). The apparent discontinuity between the radiocarbon dates for the late Bronze Age tracks and structures and the beginning of the first flooding horizon will be discussed in more detail elsewhere. However, it seems likely that the flooding horizon discussed here and probably the construction of the late Bronze Age trackways are related to changes in sea level, although probably a number of other variables are involved, including climate and forest clearance.

Discussion

From the excavation site in Head 7 in Godwin's field, the track appears to run at 35° (north-east) across the bog. Search of the other heads revealed comparable wood in Head 8 (20m from the site), and in Heads 12 and 13 (120 and 130m from the site, at ST 46613845) from which point the heads would not have cut through the track. Nothing was seen in Heads 9–11, which should have contained the track. However, as the structure lay only a few cm below the top of the heads where it was seen, any undulation in the surface of the bog upon which the track lay might well have resulted in its loss in the unridding of the field prior to machine-cutting, i.e. the track may have been even nearer the surface in the area of Heads 9–11, and been stripped off. Alternatively, the track may have been only built where the bog was becoming particularly wet, and raised parts might have still been dry enough not to require a built structure for foot traffic. The only way to decide which of these possibilities is the more likely is to excavate from Head 7 (the site) north-eastwards through Heads 8 (a sighting of probable track) and 9–11 until Heads 12 and 13 are encountered (with track wood); this seems a task of rather low priority and the Project continues to rely upon its field workers to observe the heads and record the track exposures over time as the field is cut away.

The track in Godwin's is at the moment an isolated and solitary structure, running from the high ground of Sharpham, a part of the Polden Hills ridge. From this part of the Hills, only 350m to the east, there emanate the multiple brushwood tracks of Tinney's Ground, recorded over a number of years by the Project as the field in question was systematically cut. From their alignment, it would appear that the eastern promontory of Sharpham Park is the likely starting-point for these tracks, and that here there should be a later Bronze Age settlement. The dates for the Tinney's tracks are of the order of 970±60 bc–1090±70 bc, and a single date for Godwin's track is 1110±70 bc (HAR-5086). This suggests that the structures are broadly contemporary, a view supported by the palaeobotanical evidence. The discovery of Godwin's track thus strengthens the belief that this part of the Levels was an area where the dryland Poldens, the wetlands, and the river Brue all combined to offer the Sharpham settlement ample opportunities for successful exploitation of a varied landscape.

A LATER BRONZE AGE COMPLEX AT STILEWAY

by B. J. ORME, J. M. COLES, A. E. CASELDINE and R. A. MORGAN

In 1978 an account was published of wooden structures found to the east of Stileway, at the eastern end of the Meare-Westhay island (Coles and Orme 1978c, 91–93). The account was based largely on observations made in 1975 and 1976, and described a probable route leading out from the island across raised bog, with dumps of wood to consolidate wet patches on the path and to make small platforms at a little distance to either side, rather like the Platform track on Shapwick Heath (Coles 1972). A radiocarbon date of 1100±70 bc (HAR-1221) placed the activity at the end of the second millennium bc.

Since the 1975–76 observations, the area has been cut over many times for peat extraction, and prehistoric worked wood was revealed on several occasions and recorded for the Project archive (fig. 57). In 1983 a large expanse of wood was observed in one of the heads, and excavated by the field workers. This excavation will be described now, followed by a consideration of all the evidence which has accumulated over the last few years. The 1983 discovery was made by A. Wickenden at ST46474076 and the excavation largely carried out by A. Wickenden and D. Bedford with occasional assistance from other Project staff. The work was done in July 1983, during some of the hottest weather of the century in Somerset, under conditions far from ideal for wood or workers. Various episodes were recorded by the Central Office of Information, in the course of filming for a programme about man and landscape. Permission to excavate was given by the owner of the field, Basil Loxton, and the Project is grateful to him for the many times he has allowed access for fieldwalking, surveying and excavation.

The 1983 site was laid out along a peat head where wood was visible in section and in the mumps, which had recently been cut and set out along the top of the head. The site was 5.6m long and 1m wide. Excavation, using normal procedures as far as the heat allowed, soon revealed a layer of wood near the surface which was not visible in section, followed at a lower level by those pieces which had been partly cut away by the peat machine.

The top layer of wood (fig. 56) was much damaged, but clearly consisted originally of woven hurdlework. The maximum preserved length was 2.5m and maximum width 1.2m, and it is probable that this was a single large hurdle. Eight sails were recorded; they were of alder roundwood, two being split stems, and their diameters ranged from 13 to 38mm. They were spaced at intervals of 20–35cm. The rods were also of alder roundwood, apart from a single piece of hazel; they were 7–26mm in diameter, and possibly up to 2.5m long although none was preserved to that length, and most were broken into short pieces, tending particularly to snap where they crossed the transverses. Damage, both in antiquity and perhaps recently from the passage of heavy machinery, was too extensive to be sure of details of the hurdle weave, but it appeared that single rods passed regularly over and under the transverses, and at least 23 were used.

The hurdle was sampled for tree-ring studies, and each of the 23 rods and 8 sails was examined. Their average ages and diameters are given in Table 13.

Fig. 56 Stileway 1983. Upper level of the Late Bronze Age structure, with damaged hurdlework.

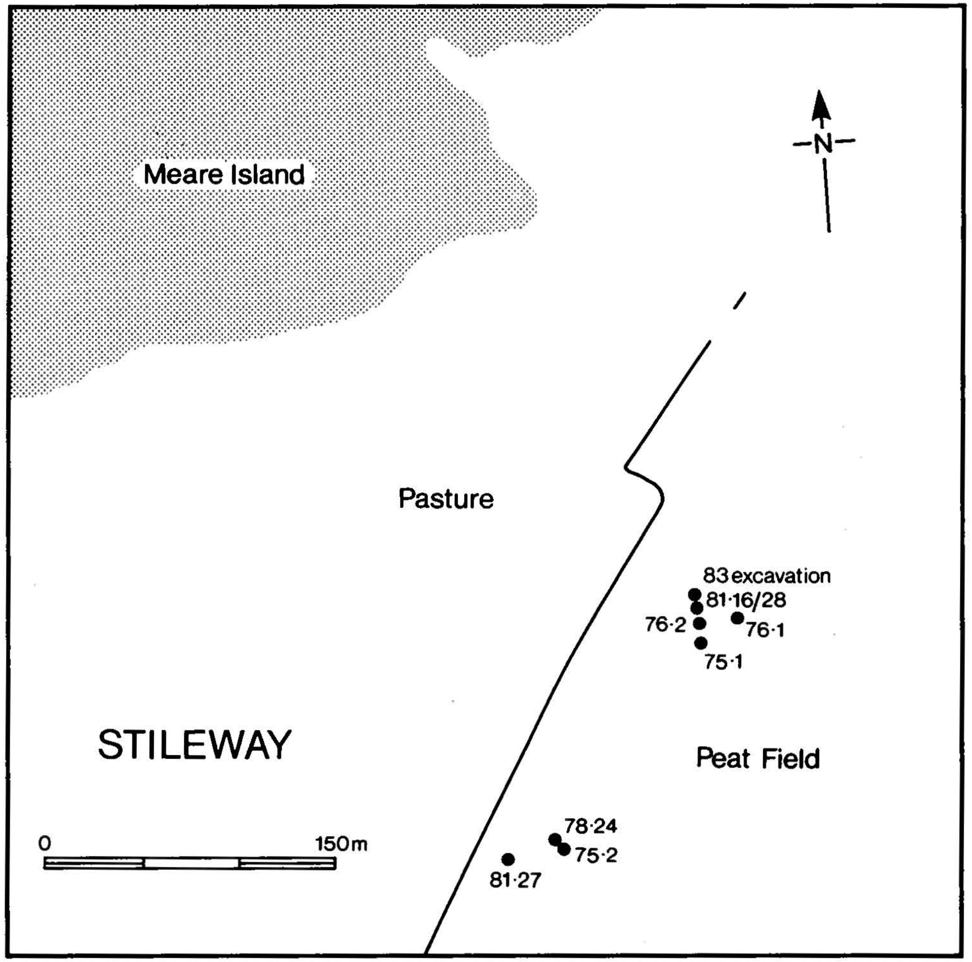


Fig. 57 Map of the Stileway area, east of Meare island, showing discoveries made in recent years.

TABLE 13 Details of the age and size of the Stileway alder stems

	Age Average	Range	Diameter Average	Range	No. of stems
Rods	4.3	2–8	14.6	7–26	23
Sails	6.4	5–9	21.6	13–38	8

As fig. 58 shows, the rods are almost exclusively 10–20mm in diameter, while the sails vary between 13 and 38mm. The average age is based on only 20 out of the total 31 stems; the rods are mostly 3–5 years old and the sails 5–7 years old. This alder almost certainly came from coppiced stools which could provide the long straight rods for hurdle-making; rods were usually hazel, and the choice of alder is interesting.

It should be noted that no trace of this hurdling was visible prior to excavation and that it would all have been cut away when the peat machine next passed by. It is highly likely that nothing would have been known of it but for the discovery of the larger wood below and the decision to excavate that. It serves as a reminder that many slight structures and artifacts must have been lost over the years, even when there has been regular monitoring of peat-cutting operations. However, single hurdles have occasionally been observed and recorded as at Withy Bed Copse (Coles, Orme, Hibbert and Jones 1975a, fig. 18), Difford's (Coles and Orme 1978c, 97–98), and Walton and Honeygore (these *Papers*). In all cases, the hurdles were found near or directly associated with other wood. The Stileway example, if a single hurdle, is relatively large.

The heavier wood below the hurdle (fig. 59) was separated from it by a minimum of 4cm peat and often more, and whereas the hurdle lay horizontal the lower timbers were sometimes oblique, dipping to the east, i.e. towards the section. Most were truncated by the 1983 peat cut, but as they were not observed in the 1982 cutting it can be assumed that they ended within the peat cut out in 1983, i.e. no more than 0.8m further to the east. The wood occurred in three heaps or dumps of split alder trunks with alder, hazel and birch roundwood. The southern heap contained a heavy piece of split alder, 190mm wide and axed to a sharp point at its western end (fig. 60) and a complete trunk with its lower, southern end cut to a wedge point. This piece was kept for conservation and therefore not identified. Two further heavy pieces had been largely cut away by the peat-machine. Both were alder, one a complete stem and one split. One slight alder stem was recovered, together with several short pieces of hazel and birch and a piece identified as apple, rowan or hawthorn. The central heap contained three heavy timbers, all split trunks and two identified as alder. Tree-ring patterns

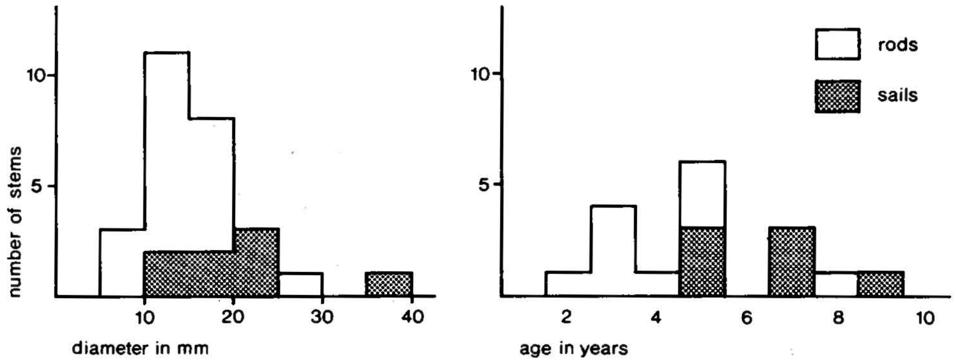


Fig. 58 Size and age range of the alder sails and rods of the Stileway 1983 hurdle.

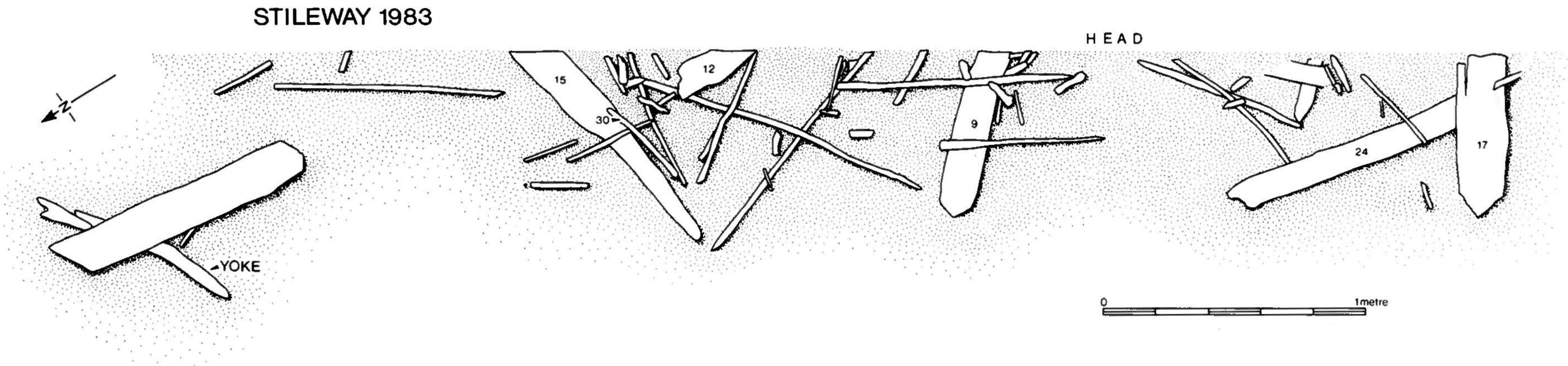


Fig. 59 Plan of the lower wood at Stileway 1983.

indicate that one of these may have had a common origin with the split alder piece in the southern heap. The third was lifted complete for conservation, being axed to a sharp point at its western end, with a notch cut 210mm from this end. The identified smaller pieces in the central group were predominantly hazel, long straight stems 20–30mm in diameter and usually cut or torn at one end. One of these dipped to the north and had 7 or 8 pressure bends as if it had originally carried some weight, whereas others lay horizontal. Five small pieces of birch were identified.

The northern heap scarcely merits the term, consisting of one heavy roundwood stem with a pointed end (not identified), a few scraps and one other worked piece. The latter is perhaps the most interesting piece of worked wood yet recovered from Stileway. It appears to have been driven as a peg under the heavy stem, and had two pressure bends. On lifting, the bent sections were eased apart and cleaned of peat, revealing two neat holes. Straightened and reassembled, the piece has the appearance of a yoke. The original dimensions were approximately 875mm long, up to 90mm wide and 60mm thick, with holes cut 245mm from either end. The size of the holes is uncertain, due to distortion of their sides under pressure but they may be estimated at 40–50mm square on the surfaces, and countersunk, narrowing to about 20mm for the effective hole. The surfaces of the wood were split, and retained slight axe marks, and the complete piece was probably slightly curved. A small sample was removed, and identified as alder. The working on this piece bore no relation to its use in the heap of wood, and it was probably discarded from some other function. As a single piece, it could have been used as a carrying yoke, for example to suspend water pots by a rope from the holes. Alternatively, it could have been part of a composite artifact, with the holes designed to space other components, e.g. an animal yoke, rake, rack or part of a sleeper beam for a wattle wall.

Most pieces of wood from the site bore axe marks, other than the stems used for the hurdle. The facets were often well-preserved, and had been made by a sharp blade which left relatively flat and clean surfaces (fig. 61). Wedge points were found on several of the heavier pieces of alder and slighter stems were slashed across. No holes were cut, other than in the "yoke", but notches were made in one alder timber from the site and in at least one of the pieces recovered from the mumps. About 80 fragments were recovered and recorded from the mumps, and all well-preserved working details were photographed, although few pieces emerged from the peat machine in a state fit for conservation.

Tree-ring samples were examined from 16 of the lower stems. Five out of the 7 alder stems had been split into halves or quarters, from trees up to 35 years old and about 150mm in diameter. Their flatter surfaces would give a more stable and safe walking surface. The ring-widths of two large pieces (15 and 17) were measured, and their similar patterns of growth suggested a common origin. Four

Fig. 60 Detail of the scattered timber and brushwood split stems at the southern end of the lower level, Stileway 1983.

TABLE 14 Macroscopic plant remains from Stileway

	STL34	STL61	STL62	STL63	STL83
Sphagnum spp. (leaves and shoots)	A	F	Oc	R	Oc
Aulacomnium palustre (Hedw.) Schwaegr. (leaves and shoots)	R	—	F	F	A
Dicranum undulatum Brid. (leaves and shoots)	Oc	F	—	A	Oc
Pohlia nutans (Hedw.) Lindb. (leaves and shoots)	R	R	R	—	R
Calluna vulgaris (L.) Hull (shoots)	R	A	F	R	A
Calluna vulgaris (L.) Hull (flowers)	Oc	F	—	Oc	F
Calluna vulgaris (L.) Hull (seeds)	F	F	F	R	F
Erica tetralix L. (leaves)	—	R	—	—	—
Eriophorum vaginatum L. (fruits)	—	—	—	—	R
Eriophorum vaginatum L. (scleren. spindles)	F	F	F	—	F
Rhynchospora alba (L.) Vahl (fruits)	—	Oc	—	—	R
Eleocharis palustris (L.) Roemer & Schultes (fruits)	—	R	—	—	—
Juncus acutiflorus Ehrh. ex Hoffm. (seeds)	—	R	—	—	R
Betula L. sp. (fruits)	—	R	—	—	R
Hydrocotyle vulgaris L. (fruits)	—	R	—	—	—
Rumex L. sp. (fruits)	—	R	—	—	—
Rumex L. sp. (fr. per. segs.)	—	Oc	—	—	—
Urtica dioica L. (fruits)	—	R	—	—	—

Note: A, abundant; F, frequent; Oc, occasional; R, rare.

of the split trunks had a very narrow outermost ring and may have been summer cut.

The 5 hazel stems were 16–30mm in diameter and 5–13 years old; two were possibly summer cut. The 4 birch stems include three of 23–30mm in diameter and one very large trunk about 100mm in diameter split into a radial plank across the pith. Despite the size difference, they were all about 14–17 years old.

Thus despite the lack of any recognisable structure in the heavier wood beneath the hurdle, and the range in size and species, the larger trees had evidently undergone a certain amount of preparation prior to their use; this may suggest they had performed some other function before being dumped to provide dry footing.

The local environment

During the excavation in 1983, samples were taken for the analysis of macroscopic plant remains. All the samples were taken from peat adjacent to or below the heavier wood found beneath the hurdle. No samples were taken at the hurdle level as the peat was disturbed. The provenance of the samples is given below.

Sample STL34—from under STL30 and adjacent to STL15 in the central heap of wood
STL61—from under STL17 in the southern heap of wood
STL62—from between STL17 and STL24 in the southern heap of wood
STL63—from under STL9 in the central heap of wood
STL83—from under STL12 in the central heap of wood

The samples were allowed to soak in a 5% solution of sodium hydroxide and then washed through a stack of sieves of mesh sizes 1mm, 500µm, 300µm and 150µm. The residues were then sorted and the plant remains identified by reference to published identification keys and by comparison with type material. The results are given in Table 14.

All the samples contain species indicative of a raised bog environment. *Calluna vulgaris* (heather) remains are present in each sample, whilst *Eriophorum vaginatum* (cotton grass) sclerenchymatous spindles are frequent in every sample apart from STL63. The moss taxa recorded, *Sphagnum, Aulacomnium palustre* and *Dicranum undulatum*, are also typical of acid raised bog. The latter species, *Dicranum undulatum*, is becoming increasingly rare as a result of man's destruction of its mire habitat, and the species is now extinct in southern England (Dickson 1973). *Erica tetralix* (cross-leaved heath) and *Juncus acutiflorus* (sharp-flowered rush), both species found in wet heath communities, are also represented in samples from the site. Evidence for a wetter area and possibly a pool, and hence the need for the structure at Stileway to cross it, is provided by the abundance of *Sphagnum cuspidatum* moss in STL34 and fruits of *Rhynchospora alba* (white beak sedge) in STL61 and STL83. *Rhynchospora alba* is frequently found growing at the edge of pools on raised bog. Also the presence of *Hydrocotyle vulgaris* (marsh pennywort) and *Eleocharis palustris* (common spike-rush) in STL61 further suggests the existence of a pool. Macrofossil remains of *Urtica dioica* (stinging nettle) and *Rumex* (docks and sorrels) may reflect either the wetter conditions at the site or disturbance caused by man's activities.

Fig. 61 Stileway 1983. Chopped ends of brushwood with medium to shallow angled facets, and slender points cut by flat-bladed axe. Scale ½.

Discussion

The excavated wood is characterised by its many axe marks, but lacks any structure to the heaps, which are probably no more than armloads of unwanted wood carried out to fill up wet patches on a path across the raised bog. Such an interpretation is consonant with the accumulating evidence from the area. Fig. 57 shows all the observations made over the last decade, with one probable route that includes the 1983 site, and a scatter of isolated pieces of timber to the south which does not as yet form a coherent pattern. One radiocarbon date was obtained from the recent excavation, 1260±80 bc (HAR-5710). The sample came from immediately below the hurdle, and the result covers a slightly earlier but overlapping timespan to 1100±70 bc (HAR-1221), a sample from Site 1975.1 which lies on the probable route, and consisted of a dump of birch and alder wood with a few pieces of hazel and poplar. Site 1976.2 contained two layers of alder and hazel roundwood, the lower bundle possibly placed at right angles to the route as was the hurdle in the 1983 site. Find 1981.16, a field observation without excavation, revealed alder roundwood with a few split pieces and some faceted ends. A radiocarbon date from here, 860±90 bc (HAR-4477), overlaps with HAR-1221 but not with HAR-5710. Find 1981.28 was similar to 1981.16 and included a split trunk. The five locations are spread over *c*30m. The levels given in Table 15 indicate a gentle rise to the south, typical of routes leading up onto a domed raised bog.

TABLE 15 Stileway levels OD

1975.1	2.84–2.94m
1976.2	2.63–2.74m
1981.16	2.32–2.55m
1983	2.18–2.55m
1983 hurdle	2.58–2.60m

Environmental data from Stileway shows that the route was in use at a time when raised bog dominated the low land in the vicinity, and beetle studies indicate that forest grew on the edge of the island (Girling, these *Papers*). The macrofossil plant remains from the 1983 site, the pattern of short stretches of trackway, and the levels (Table 15) for the individual sites, suggest a gentle rise to the south over a sloping bog surface on which pools and hummocks have become aligned with their long axes parallel to the contours. The latter is possibly related to a high water table (Ratcliffe and Walker 1958), and the wet conditions at Stileway, although local, may also reflect the beginning of a trend towards wetter conditions throughout the Levels (see discussion of the evidence from the Godwin's trackway in these *Papers*).

A continuous built track is not indicated so much as a path over raised bog that needed consolidation in a number of wet patches. This interpretation is supported by the absence of any structure to the groups of wood, and the occasional blank area where the peat has been cut away but no wood was observed. In this respect the evidence from Stileway is similar to that from Withy Bed Copse, a route of the first millennium bc (Coles, Orme, Hibbert and Jones 1975a). The spread of the radiocarbon dates, coupled with the evidence for two distinct layers at the 1983 site, suggests that the route could have been in use over a long period, and occasionally refurbished.

AN 'OLD-FOREST' BEETLE FAUNA FROM A NEOLITHIC AND BRONZE AGE PEAT DEPOSIT AT STILEWAY

by M. A. GIRLING

In 1979, woody peats were exposed down to clay in a freshly-cut drainage ditch in a field neighbouring the Stileway excavations. After the stratigraphy was recorded from a freshly cleaned peat face, samples of about 2kg were collected vertically at 5cm intervals to produce a column of 18 samples for insect analysis. A radiocarbon assessment was carried out on the lowest sample to yield sufficient twigs, and a date of 4470±70 years bp, 2520±70 bc (HAR-1465) was obtained from small twigs from sample 13, 30cm above the clay base. The upper part of the peats may be tentatively correlated with those containing the Bronze Age structures, indicating that the peats at the site developed over a period of at least 1500 years, and that the insects preserved in them were likely to reflect local environmental conditions over the same length of time. The Stileway samples were taken closer to dryland than is normally the case with samples associated with the trackways in the Levels, and it was thought that the beetles and other insects would reflect the vegetation on the island as well as that around it.

Species list

Insect remains were extracted from the peat samples by the paraffin flotation technique (Coope and Osborne 1968); samples were gently disaggregated in warm running water and washed into 300 micron sieves. The retained fraction was drained, mixed with paraffin and the addition of cold water produced a flotant containing most of the insect remains and other light organic material. The flotant was washed in detergent then alcohol, and sorted microscopically. The remains, predominantly of Coleoptera, were identified by direct comparison with collections at the British Museum of Natural History and are now stored at the Ancient Monuments Laboratory.

Fifteen of the eighteen samples contained insect remains. The 2 basal samples collected at the uneven clay/peat interface were unproductive and the highest sample from disturbed peat at the top of the section yielded only a few indeterminate scraps of cuticle. The species list is given in Table 16 at the end of this paper. As there is little faunal variation throughout the sequence, the numbers given represent the totals for all samples and the minor variations are detailed later.

The nomenclature for Coleoptera follows Pope's 1977 revision of Kloet and Hincks. Species no longer found in Britain are preceded by an asterisk.

Environmental reconstruction

By examining habitat requirements for every beetle species from each sample and assessing their importance, reconstructions can be made of the dominant ecological and climatic factors influencing the depositional area. Where serial samples are taken through a deposit, information can be gained about the stability of that environment, which in this instance appears to have changed little throughout the period studied. At Stileway about 30 of the 80 recorded species are dependent upon trees or associated with forest habitats. Those of the remaining fauna which have well defined habitat demands and which, therefore, may be used as environmental indicator species, provide evidence about the local substratum, aquatic conditions and ground vegetation.

Aquatic element. All the Carabidae from Stileway are inhabitants of damp, shaded soils and are typically found in boggy or pond edge sites. One typical forest species *Bembidion harpaloides* is often taken in woodland soils or found hibernating under bark. Numbers of Dytiscidae and Hydrophilidae indicate the availability of aquatic and water-side habitats, and whilst several of them are found in small dykes and pools, *Colymbetes fuscus* demands some vegetation-free expanses of water. In the central peat bog areas, the aquatic faunas of the raised bog deposits are dominated by acid pool species such as *Hydroporus melanarius* Sturm and *H. obscurus* Sturm (as recorded at the Abbot's Way), whereas in areas adjacent to the limestone islands the supply of minerals in the ground water appears to maintain eutrophic conditions. Most of the Stileway water beetles favour this type of habitat, with typical eutrophic fen and detritus pond species including *Hygrotus decoratus* and *Hydrochus carinatus*. Those species from the Stileway peats, such as *Hydroporus gyllenhali*, which tend to favour more acidic conditions might have found suitable habitats in woodland pools where the accumulation of dead leaves had reduced the pH.

Two species of weevil which live on water plants have been recorded. *Eubrychius velutus* feeds and develops on various aquatic and sub-aquatic plants, principally *Potomogeton, Hippuris* and *Myriophyllum* species (Fowler 1891). *Tanysphyrus lemnae* feeds on duckweed and like the preceding species is found in stagnant or slowly flowing water.

Large numbers of inhabitants of decaying vegetation, including *Hydraenidae, Staphylinidae* and *Scirtidae,* signify the importance of this biotope at the site. One of the commoner species, *Corylophus cassidoides* is often associated with accumulations of dead reeds. The presence throughout the samples of *Thryogenes scirrhosis* which feeds on *Sparganium*, indicates that reeds formed part of the water-side vegetation. Most of the other specifically named phytophages are tree feeders (see below), perhaps indicating that ground vegetation was limited to pond edges and elsewhere was shaded out by dense canopy.

Woodland element. In terms of species, a major faunal element is that associated with woodland. This group is represented by beetles which feed on living trees, those which live in dead wood, species of tree moulds and fungi, and predators. There are records of 6 Scolytidae, all bark beetles which attack deciduous trees. *Acrantes vittatus* is usually found under the bark of elm, and the host trees for *Hylurgops palliatus, Xyloterus* (=*Trypodendron*) *domesticus* and *Xyleborus dispar* include oak, elm, ash and beech. The latter is also known from holly and fruit trees (Joy 1932, Chararas 1962). Both *Hylesinus* species are found in ash, and other trees (Fowler 1891, Reitter 1916).

Two weevils which feed on trees and especially shrubs of willow are present

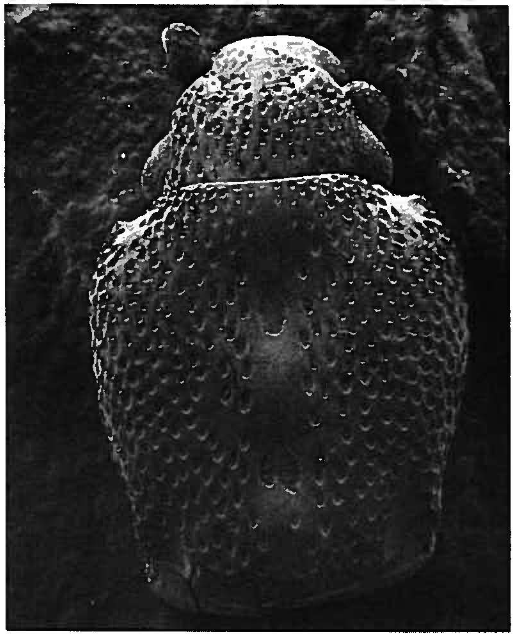


Fig. 62 Left, *Bothrideres contractus* (×30). Right, Antennal club of *B. contractus* (×400). Photos A.M.L.

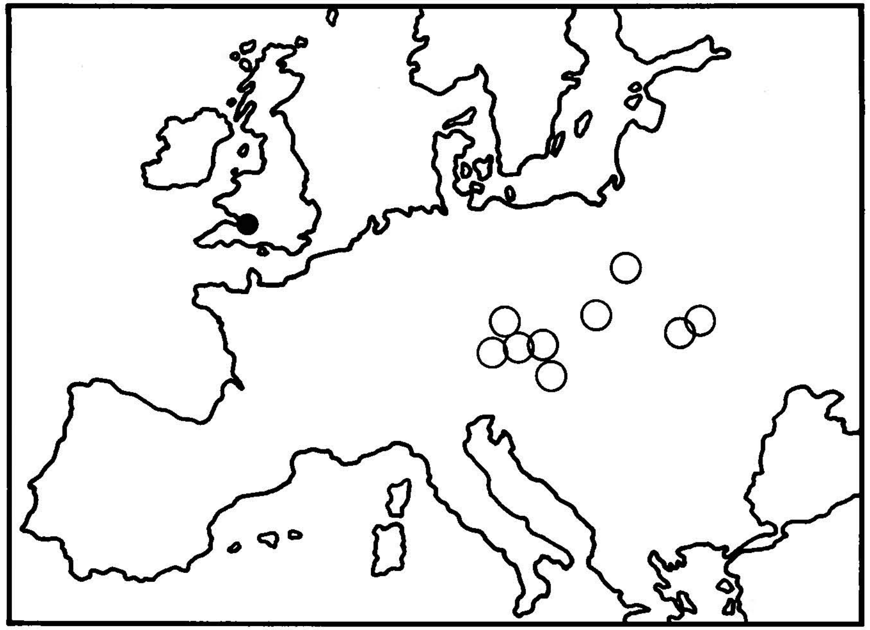


Fig. 63 Present distribution (open circles) of *Eremotes punctulatus* Boh. Fossil record shown as closed circle.

in the fauna: *Curculio salicivoris*, found in *Salix* leaves and *Dorytomus salicinus* which Reitter records from willow thickets on river banks. A single example was present of *Curculio nucum*, the nut-weevil, which lives on trees and shrubs of hazel. *Acalles ptinoides* has been collected from deciduous stands, especially of oak, as well as from fir trees, but the species is also known from *Calluna* twigs, and the four individuals recovered from the samples are not necessarily part of the forest fauna. The remaining wood-dependent weevils are all members of the cossoninae sub-family which are found in dead or decayed parts of various deciduous trees. *Eremotes punctulatus* and *Cossonus parallelopipedus* are additionally known from decaying coniferous stumps (Folwaczney 1977).

Other species which develop in decaying wood include *Silvanus unidentatus, Denticollis linearis* (identified from Stileway on both larval and adult remains), and *Melasis buprestoides.* The latter species is today found mainly in dry beech, for instance by Palm (1959) from sun-dried beech attacked by heart rot, but it also lives in birch and other deciduous trees. Dead dry wood is favoured by several of the Anobiidae including *Grynobius planus* and *Hemicoelus* (=*Anobium*) *fulvicornis*. The other member of this family, *Gastrallus immarginatus* has been recorded by Donisthorpe (1939) from Windsor Forest (as *G. laevigatus* Oliv. see Allen 1954a) on cut elm logs and field maple. One further forest habitat, perhaps exploited by *Scaphisoma boletia*, is tree fungus, although this species is also known in boleti away from woodlands.

The Stileway peats yielded several predator species, which live on these wood borers and which favour deciduous trees although records from conifers are known. The colydiid *Pycnomerus terebrans* is found in willow, beech, poplar and especially oak (Horion 1961), sometimes in the company of the ant *Lasius brunneus* (Lat.). Buysson (1912) regards the species as strongly myrmecophilous (living in ant-nests), a factor disputed by Freude, Harde and Lohse (1967) and Dajoz (1977). A further colydiid, *Bothrideres contractus* (fig. 62), like the preceding species no longer occurs in this country; it lives mainly in oak and beech where it is found in the galleries of Anobiidae, Scolytidae, Cerambycidae including *Leiopus nebulosus*, and even of other predators (Reitter 1911, Dajoz 1977). The presence in the deposit of several species upon which it is known to prey is note-worthy. The third representative of this family, *Bitoma crenata*, is stated by Reitter (1911) to feed upon bark beetles, and Palm (1959) has recorded it in their galleries, but the species is also found in fungal mats under bark (personal communication R. D. Pope). Four examples were recorded of the melyrid *Aplocnemus nigricornis* a beetle recorded in the galleries of other wood-boring insects, especially in beech.

Completing the overall pattern of dominance of the fauna by forest insects, it is of interest to note that *Aphodius zenkeri*, the only dung beetle species recorded from the site, is considered by Landin (1963) to be stenotopic in woodland where it lives in the dung of sheep, pig and deer. British records for this beetle include those of Knole Park, in deer dung (Britton 1956).

Notes on the host trees for the forest fauna

An impression can be gained of the composition of the local forest by examining the host tree requirements of the wood obligate element of the Stileway fauna. Figure 64 is a simple numerical assessment of host trees, in which a single host of any beetle has been awarded 3 points, 2 or more named hosts awarded 2 points and occasional records of attacked trees given one point. Trees in bold type are host specific to at least one beetle, as in the case of oak for *Rhynchaenus quercus*, the oak leaf miner, and these trees were certainly present in the vicinity.

Two important points emerge. It is very likely that in this marshy, fen-edge location, alder was an important woodland species and the identification of wood from the nearby structures proves its presence in the Bronze Age (see Table 2 earlier in these *Papers* for identifications from other structures). Unlike the majority of deciduous trees, alder does not support a large beetle population although its wood is susceptible, particularly when dry, to attacks by common wood borers such as *A.punctatum*. Studies of fossil beetle assemblages do not, therefore, provide a reliable guide to the presence or absence of alder, a factor noted in other sites where alder pollen values are high but wood obligate beetles are absent or present only in low numbers (Musson, Smith and Girling 1977, and unpublished data). Secondly, beech emerges as an important potential host, which is intriguing in view of the uncertain status of this tree in prehistoric Britain. No beetles specific to this tree have been recorded in the deposit and there is therefore no evidence that the tree grew in the depositional area, but beech is readily attacked by numbers of beetles from the Stileway list. The tree undoubtedly arrived in Britain before the formation of the English Channel, about 7500 years ago, but for the next 5000 years its sparse pollen record is confined to the south coast (Pennington 1974, Godwin 1962, Rackham 1980). It is however known from sparse macroscopic remains from the Levels (Orme and Coles, these *Papers*), and whilst alternative host trees such as willow and oak might have provided habitats for those Stileway beetles which also live on beech, the surrounding limestone uplands in the area could have provided suitable conditions for the establishment of the species. The Stileway beetles therefore tend to support the wood evidence for the local presence of beech.

Ecological stability and the archaeological significance of the Stileway record

Marshy deciduous woodland has been inferred for the whole of the depositional sequence at Stileway, the only faunal variation being a slightly higher proportion of aquatic species in the lower layers, replaced by greater percentage of forest insects in the middle and upper layers. This might reflect a fall in the local water level, allowing woodland on the higher ground to encroach upon a formerly wetter area (but note comments elsewhere in these *Papers* on the local water table). The conditions within the wooded area, however, appear to have remained stable.

The extensive network of trackways linking the islands and higher ground of the Somerset Levels during the Neolithic and Bronze Age argues for significant land use of the dryland areas by early man. The excellent preservation of archaeological and palaeoecological remains in the waterlogged peats does not

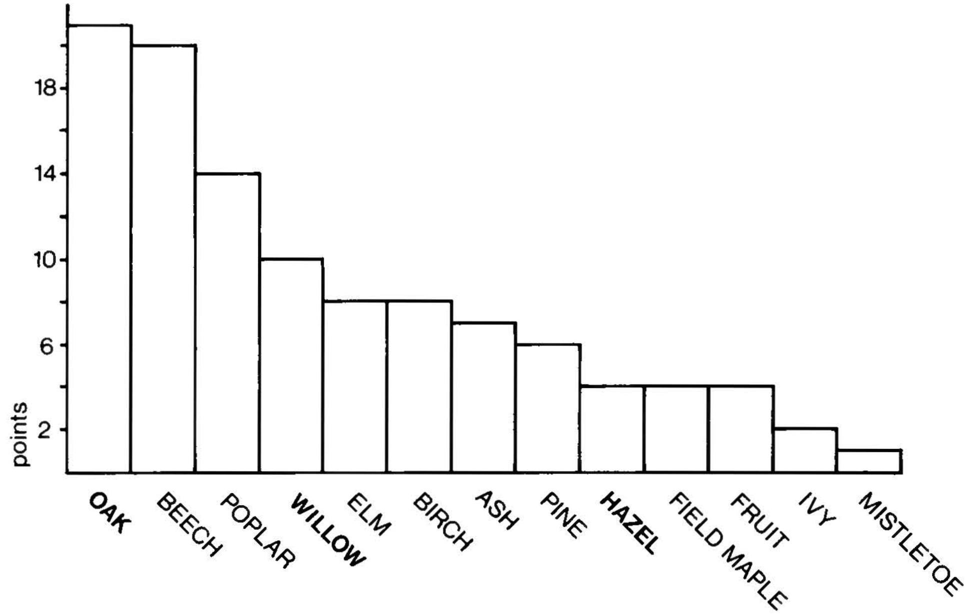


Fig. 64 Host tree species. Obligate hosts are indicated by bold type. See text for full explanation.

extend to the drier soils of the higher ground, and so far no direct evidence has been found in these areas of related settlements. Changes in the pollen frequencies from successive peat layers do, however, provide evidence of forest clearance and farming (Beckett and Hibbert 1978, 1979). Also, the inclusion in the trackways of coppiced wood implies woodland management on dryland from an early date (Rackham 1977, 1979). The existence at Stileway of mature forest well into the Bronze Age indicates that at least this eastern end of the island remained undisturbed by man, and the inferred abundance of dead wood and lack of ground vegetation suggest that felling, coppicing and even the gathering of firewood were not carried out widely, if at all. Were this the case, the source of the coppiced alder for the Stileway hurdle cannot have been the immediate dryland edge. One possible explanation for avoidance of the area might have been its marshy nature, hindering movement through the dense woodland and rendering the land unsuitable for the agricultural techniques used by prehistoric man. The slender evidence of large mammals suggested by *Aphodius zenkeri* might indicate an alternative land use. In an area where wildfowl probably provided a major quarry, the hunting of deer or wild boar in the dwindling forest areas might have provided a welcome additional food source.

Extinctions and range contractions

The most striking examples of range contractions in the British beetle fauna are those which have resulted in the disappearance of species from this country, and a number of such extinctions have been documented from studies of fossil assemblages of insects. At Stileway, 3 of the 4 such extinctions are obligate forest species. *Bothrideres contractus* (fig. 62) today occurs throughout Europe from Southern Scandinavia and France to Greece and Siberia. Its disjunct east-west distribution in Germany has prompted Freude, Harde and Lohse (1967) to apply Palm's term *Urwaldrelikt* to the species. This colydiid has previously been recorded in Britain from an interglacial deposit at Austerfield (Gaunt, Coope, Osborne and Franks 1972). Another of these *Urwaldtier* is *Pycnomerus terebrans*. Other post-glacial records of this species from Minsterly near Church Stretton, Salop (Osborne 1972) and Hampstead Heath, London (Girling and Greig 1977; Girling 1982b) indicate that the species once occurred widely in Britain and there is also an interglacial record from Lincolnshire (Girling 1974). Today it occurs sporadically from mid-France to Greece, its scattered distribution reflecting the few areas of surviving mature forest. The third Stileway species with no match in the present British fauna is *Eremotes punctulatus*. Today the genus is represented in this country by a single species, *ater* (L.) whose fossil history in Worldsend, Salop (Osborne 1972), Thorne Moor (Buckland 1979), Hampstead Heath (Girling and Greig 1977) and Somerset (Girling 1979b) denotes a much wider range than its present Sherwood Forest and Scottish strongholds. Its status is discussed elsewhere by Buckland (1977). Two further *Eremotes* species, *strangulatus* Perris and *elongatus* Gyll., have been recorded by Osborne at Worldsend and now the discovery of *E.punctulatus* at Stileway prompts the suggestion that the 2 remaining temperate European species, *sculpturatus* Watl. and *reflexus* Bohem. may eventually be recorded in British post-glacial deposits. The present European distribution of *E. punctulatus* is indicated in fig. 63.

The remaining Stileway species which is no longer found in Britain, the large batrisine pselaphid *Batrisus formicarius*, whilst not strictly wood-dependent is nevertheless a typical woodland insect. Its usual habitat is rotten, deciduous stumps where it is often found in the company of *L. brunneus* or other ant species. The largest European pselaphid, it measures 3.1–3.5mm, and the species is widely spread on the continent, reaching the northern French coast (Freude, Harde and Lohse 1974).

Two other members of the fauna whose rarity in Britain today merits attention are *Gastrallus immarginatus*, now known from Windsor but with a wider fossil history and *Hylis olexai*. The latter species was first placed on the British list by Allen (1954b) who captured specimens from dead beech at Otford, west Kent and noted a previous capture by Linberg at Box Hill in 1951. Allen suggested that the species had survived in Britain from earlier times, possibly in the beech and yew forests of chalk regions, although in a later paper (1956) he drew attention to the expansion of the species in Belgium and the possibility that the British records had resulted from importations from that country. The Stileway record indicates that the species was indeed a member of the old forest fauna, but studies of more recent deposits are needed to determine whether *H. olexai* was present in Britain during the later post-glacial.

The range contractions and extinctions must be assessed in relation to known changes in the British fauna. Over 20 species now extinct in this country have been recorded from post-glacial deposits and 2 mechanisms have been proposed to explain their disappearance; climatic change and forest clearance, (Osborne 1964, 1976). The major influence at Stileway appears to be forest clearance as large scale range contractions are displayed by the woodland beetles. These are inhabitants of mature forest which are susceptible to disturbance, particularly the removal of dead trees, as well as the total removal of their forest habitat. This anthropogenic effect can also be observed to a lesser extent in some of the water beetle ranges. *Hygrotus decoratus, Hydroporus scalesianus* and *Hydrochus carinatus* have east and south-eastern ranges in England today, reflecting the present rarity of fen land, a formerly more widespread land type which has been destroyed by drainage, reed gathering and peat cutting. The closest match in England today for the fens which have existed in the prehistoric Somerset Levels is undoubtedly Wicken Fen in Cambridgeshire, as is attested by the similarity in Coleoptera records for the Fen (Cooper, Perkins and Tottenham 1928) and the fossil assemblages from the Levels. A further consideration of old forest faunas is given in Girling 1982b.

Possible climatic changes resulting in range reduction are masked at the site by changes which can clearly be attributed to man's far-reaching effect on the landscape. Most of the Stileway species however occur in south England today and there is no evidence for conditions cooler than present. The extinctions from the Levels' sites of a number of beetles which are not woodland obligates have included *Oodes gracilis* Villa, *Chlaenius sulcicollis* (Payk). and *Airaphilus elongatus* Gyll. Elsewhere, these have been proposed as indicators of a warmer climate than at present, prevailing at least during the early Neolithic (Girling 1984), a suggestion which finds no opposition from the predominantly southern British character of the Stileway fauna.

Acknowledgements. I wish to thank Mr P. M. Hammond for useful comments on this manuscript and Mr R. D. Pope for access to the Coleoptera collections at the British Museum (Natural History).

TABLE 16 Stileway species list

INSECTA	Total
HEMIPTERA	29
COLEOPTERA	
Carabidae	
Carabus sp.	1
Dyschirius globosus (Herbst)	9
Trechus micros (Herbst)	1
Bembidion harpaloides Ser.	2
B.guttula (F.)	3
Bembidion spp.	2
Pterostichus diligens (Sturm)	3
P.minor (Gyll.)	17
Pterostichus sp.	1
Agonum obscurum (Herbst)	2
Agonum sp.	1
Badister bipustulatus (F.) or *peltatus* (Panz.)	2
Dromius sp.	4
Haliplidae	
Haliplus sp.	1
Dytiscidae	
Laccophilus minutus (L.)	1
Hygrotus decoratus (Gyll.)	3
Hygrotus inaequalis (F.)	1
Hydroporus gyllenhali Schiodte	1
H.scalesianus Steph.	27
Hydroporus spp.	4
Graptodytes granularis (L.)	1
Agabus bipustulatus (L.)	1
Agabus spp.	4
Ilybius ater (Deg.)	?1
I.quadriguttatus (Lac. & Bois.)	7
Rhantus grapii (Gyll.)	1
Colymbetes fuscus (L.)	3
Gyrinidae	
Gyrinus sp.	2
Hydrophilidae	
Hydrochus carinatus Germ.	5
Coelostoma orbiculare (F.)	1
Cercyon spp.	40
Hydrobius fuscipes (L.)	7
Anacaena globosus (Payk.)	20
Enochrus spp.	21
Chaetarthria seminulum (Herbst)	1

INSECTA	Total
Hydraenidae	
Ochthebius minimus (F.) } *Ochthebius* spp. }	15
Hydraena palustris Er.	22
H.testacea Curt.	23
Hydraena sp.	7
Limnebius sp.	1
Ptiliidae	
Gen et spp. indet.	8
Leiodidae	
Leiodes sp.	1
Silphidae	
Silpha atrata L.	6
Scydmaenidae	
Cephennium gallicum Gangl.	2
Euconnus sp.	1
Scaphidiidae	
Scaphisoma boleti (Panz.)	1
Staphylinidae	
Olophrum piceum (Gyll.)	4
Lesteva punctata Er.	3
Lesteva sp.	6
Carpelimus or Thinobius spp.	4
Anotylus rugosus (F.)	4
Anotylus sp.	2
Stenus spp.	28
Euaesthetus ruficapillus Bois. & Lac.	4
Lathrobium brunnipes (F.)	9
Lathrobium spp.	10
Medon apicalis (Kraatz)	1
Astenus immaculatus (Steph.)	5
Erichsonius cinerascens (Grav.)	2
Staphylinus erythropterus (L.)	3
Quedius sp.	1
Tachyporinae *indet.*	1
Drusilla canaliculata (F.)	7
Aleocharinae *indet.*	22

INSECTA	Total
Pselaphidae	
Bibloplectus sp.	4
**Batrisus formicarius* Aubé	1
Bryaxis puncticollis (Denny) } *Bryaxis* sp. }	51
Brachygluta sp.	5
Pselaphus heisei (Herbst)	3
Lucanidae	
Sinodendron cylindricum (L.)	3
Scarabaeidae	
Aphodius zenkeri Germ.	3
Dascillidae	
Dascillus cervinus (L.)	1
Scirtidae	
Microcara testacea (L.)	5
Gen. et spp. indet.	297
Elateridae	
Athous sp. (including larvae)	4
Denticollis linearis (L.) (including larvae)	5
Eucnemidae	
Melasis buprestoides (L.)	2
Hylis olexai (Palm)	1
Cantharidae	
Rhagonycha lutea (Müll)	1
Anobiidae	
Grynobius planus (F.)	2
Gastrallus immarginatus (Mull.)	1
Hemicoelus fulvicornis (Sturm)	1
Anobium punctatum (Deg.)	1
Dorcatoma serra Panz.	1
Melyridae	
Aplocnemus nigricornis (F.)	4
Silvanidae	
Silvanus unidentatus (Ol.)	1
Psammoecus bipunctatus (F.)	13
Cerylonidae	
Cerylon sp.	1

INSECTA	Total
Corylophidae	
Corylophus cassidoides (Marsh.)	23
Lathridiidae	
Corticarina sp.	2
Colydiidae	
Bitoma crenata (F.)	1
**Pycnomerus terebrans* 01.	1
**Bothrideres contractus*	2
Mordellidae	
Mordellistena sp.	1
Cerambycidae	
Leiopus nebulosus (L.)	1
Chrysomelidae	
Donacia sp.	2
Plateumaris sp.	2
Cryptocephalus sp.	1
Altica sp.	1
Curculionidae	
Tanysphyrus lemnae (Payk.)	5
Cossonus parallelepipedus (Herbst)	1
**Eremotes punctulatus* Bohem.	1
Rhyncolus lignarius (Marsh.)	1
Acalles ptinoides (Marsh.)	4
Dorytomus salicinus (Gyll.)	3
Thryogenes scirrhosus (Gyll.)	14
Coeliodes sp.	1
Ceuthorhynchus sp.	1
Eubrychius velutus (Beck)	1
Curculio nucum (L.)	1
C.salicivorus (Payk.)	3
Rhynchaenus quercus (L.)	5
Rhynchaenus sp.	1
Scolytidae	
Hylesinus crenatus (F.)	1
H.oleiperda (F.)	1
Hylurgops palliatus (Gyll.)	1
Xyletorus domesticus (L.)	1
Xyleborus dispar (F.)	1
Acrantes vittatus	1
DIPTERA	26
HYMENOPTERA	2

RADIOCARBON DATES: FIFTH LIST

compiled by J. M. COLES and B. J. ORME

(earlier lists in *Papers* 1, 3, 5 and 8; summary of all previous dates in *Papers* 8)

Dates from wood and peat associated with structures and artifacts

HAR-4541	Westhay shoreline at Sweet Track terminal; stray wood *Papers* 7	5780±100bp	3830bc
HAR-5726	Walton Heath; wood from 1983 hurdle *Papers* 11	4680±70bp	2730bc
HAR-5721	Honeygore complex, Site A 1983; wood from Honeygore track	4610±90bp	2660bc
HAR-5722	Honeygore complex, Site B 1983; wood from Honeybee track, hurdle A	4610±90bp	2660bc
HAR-5723	Honeygore complex, Site B 1983; wood from Honeybee track, hurdle B	4500±70bp	2550bc
HAR-5727	Honeygore complex, Site B 1983; peat from immediately below hurdle B, Honeybee track	4300±70bp	2350bc
HAR-5724	Honeygore complex, Site C 1983; wood from Honeycat track *Papers* 11	4560±80bp	2610bc
HAR-4739	Signal Pole, Walton Heath; brushwood from structure *Papers* 11	4580±70bp	2630bc
HAR-5054	Flint core from Meare Heath	3810±70bp	1860bc
HAR-4868	Eclipse track; peat from immediately below hurdles and above HAR-4867 *Papers* 8	3230±70bp	1280bc
HAR-5710	Stileway; wood from structure 1983	3210±80bp	1260bc
HAR-4477	Stileway; wood from structure 1981 *Papers* 11	2810±90bp	860bc
HAR-5086	Godwin's track; wood from structure *Papers* 11	3060±70bp	1110bc
HAR-5001	Meare Village East; lower mound 19, charcoal layer	1740±60bp	ad210
HAR-5002	Meare Village East; upper mound 19, charred layer below lower hearth	2090±70bp	140bc
HAR-5000	Meare Village East; upper mound 19, charred layer below upper hearth *Papers* 9	2080±60bp	130bc

King's Sedgemoor sites

HAR-4375	Chedzoy tracks; wood from structure	4690±90bp	2740bc
HAR-4374	Chedzoy tracks; wood from second structure *Papers* 8	4510±80bp	2560bc
HAR-4998	Henley Bridge; wood from structure *Papers* 9	3020±60bp	1070bc
CAR-566	Greylake; wood from structure *Papers* 9	2740±65bp	790bc

Dates from peat/clay interface

HAR-4865	Eclipse track site; interface between lower marine clay and freshwater peat *Papers* 8	5440±70bp	3490bc
HAR-4999	West Edington; interface between lower marine clay and freshwater peat	5420±70bp	3470bc
HAR-5354	Sutton Hams; interface between lower marine clay and freshwater peat *Papers* 9	5020±80bp	3070bc

Dates from peat monoliths (from base to top)

	Sweet Track, site TW		
HAR-5296	Pollen zone A/B boundary	4790±80bp	2840bc
HAR-5295	Pollen zone B/C boundary	4510±70bp	2560bc
HAR-5294	Pollen zone C/D boundary	4180±70bp	2230bc
HAR-5293	Top of monolith *Papers* 10	3660±80bp	1710bc
	Eclipse Track, 1980 site		
HAR-4865	Peat/clay interface (also listed above)	5440±70bp	3490bc
HAR-4866	Pollen zone A/B boundary	4780±70bp	2830bc
HAR-4544	Pollen zone B/C boundary	4640±70bp	2690bc
HAR-4543	Pollen zone C/D boundary	4230±80bp	2280bc
HAR-4867	Near or at pollen zone D/E boundary	3840±60bp	1890bc
HAR-4542	Pollen zone E/F boundary	3990±100bp	2040bc
HAR-4868	Peat from immediately below hurdles *Papers* 8	3230±70bp	1280bc

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