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WOOD AS AN ARCHAEOLOGICAL RESOURCE: THE SEVERN ESTUARY EVIDENCE

By Richard Brunning

Wood is one of the most important and overlooked of archaeological materials. The Severn estuary region is fortunate in having a larger quantity of archaeological wood – both excavated and still in situ *– than any other rural area of the UK. The evidence it contains can be analysed in many ways and provides a view of past societies which is more intense and more meaningful than that derived from 'normal' dry archaeology. The challenge which faces present day archaeologists is to develop strategies to overcome the forces which threaten the survival of this important resource.*

Wood as an archaeological resource

Wood has been the most important and ubiquitous raw material used by humans until the 19th century. It was the most widely used building material for all types of structures from prehistoric trackways to medieval palaces and was vital for the boats, ships and wagons that moved goods and people (Coles 1988, 2001). Archaeologists inundated with large quantities of pottery or flint, tend to forget that organic objects formed up to 95% of past material culture (Coles 2001). The small but essential items needed for everyday living such as buckets, barrels, bungs, baskets, benches, bowls, beakers and boxes all required wood for their manufacture.

Woodland was also an important source of food for wild and domestic animals and for humans. Perhaps most importantly, wood was the main fuel for cooking, heating and industrial activity.

The reason why most archaeologists lose sight of the importance of wood to human existence is because of the vagaries of its survival in the archaeological record. It is usually only preserved in extremely wet or extremely dry conditions. Fortunately the Severn estuary region encompasses some extensive areas of Holocene wetlands that have produced more waterlogged prehistoric sites than anywhere else in the country (Coles *et al.* 1978). If archaeologists can gain the most complete understanding of past societies where the most complete evidence survives, then the Severn estuary region should be of the greatest importance to prehistoric research in the UK. The Barlands Farm and Magor Pill boats and the sewn boat planks from Caldicot and Goldcliff are similarly finds of national or international importance to maritime archaeology.

Woodland and its utilisation

Archaeological wood can provide a useful compliment to pollen analysis as direct evidence for the composition of the arboreal landscape. This finds its best visual expression in the submerged forests of the Severn estuary coasts and the fen woodland and bog oaks of the inland peats of the Somerset moors (Figure 1; Bell *et al.* 2000, Brunning *et al.* 1996). These sites allow us to analyse the species and spatial distribution within prehistoric woodlands. Because long tree trunks sometimes survive it is possible to compare tree-ring data concerning growth rates with the morphological character of the tree itself. There is little reason to think that early prehistoric forests bore much resemblance to the woodland that exist in the UK today. Therefore direct evidence for the character of such forests should be recognised as an important source of information for developing our understanding of the prehistoric landscape. Tree-ring data from this source can provide evidence for significant changes in climate and sea level which must have had a major impact on contemporary human society (e.g. Baillie 1999 and Pedersen *et al.* 1997).

Wooden structures provide evidence for the nature of their woodland sources, as can be seen in the case of the Neolithic Sweet Track in the Brue valley of Somerset (Figure 2). The species used

Figure 1: A Large bog oak trunk being sampled for dendrochronological dating near Athelney, Somerset, one of over eighty recovered from a single field. Copyright: Somerset County Council.

illustrate the diversity of the locally available trees including hazel, alder, oak, elm, ash, holly, lime, birch, yew, poplar, willow and dogwood (Orme and Coles 1985). Some indication of how these woodlands had been altered by human communities, even at this early stage in the Neolithic, can be seen in the morphology and age of the wood utilised. Long straight stems of hazel were abundant in the track, suggesting that large areas of hazel coppice were available (see comments on coppicing below).

In the northern and central sections of the trackway the oak planks used were derived from a mature primary forest with trees over one metre in diameter and 400 years in age. These trees had been felled on an island at the northern end of the trackway. The southern end was connected to a larger area of high ground and the oak planks used in that section of the track were smaller and younger, suggesting a period of woodland clearance over 100 years earlier (Hillam *et al.*1990). The trackway can therefore be linked to a phase of clearance in the island wood, probably by the same community which had previously created a temporary opening up of woodland on the mainland. Such snapshots of human activity are vital for our understanding of early prehistoric adaptation of the natural environ-ment, as can be seen to better effect in the more extensive evidence from the Bodensee (see Maier and Vogt this volume).

By building up information from different periods it will become possible to identify significant changes in the nature of woodland over time and from one area to another. These can then be compared to evidence for the utilisation of the landscape provided by pollen, seeds, grain, animal bone and soil morphology. If oak, the main species used for structural purposes, is considered, some significant differences are immediately apparent between the Sweet Track oaks described above and those used as piles in the Late Bronze Age structure at Harter's Hill in Somerset (Brunning 1998). The latter were only 40-80 years old and the main trunks were only two metres in length before they branched into two or three. By contrast some of the oaks used in the Iron Age building 6 at Goldcliff were over 1.7 m in diameter and up to 250 years old. These differences may be related to differing sources of the trees, such as woods, wood pasture or hedges, or a result of varying pressures of supply and demand on the woodland resource, for example. A massive change in the woodland resource occurred over the last 300 years with the domination of the timber

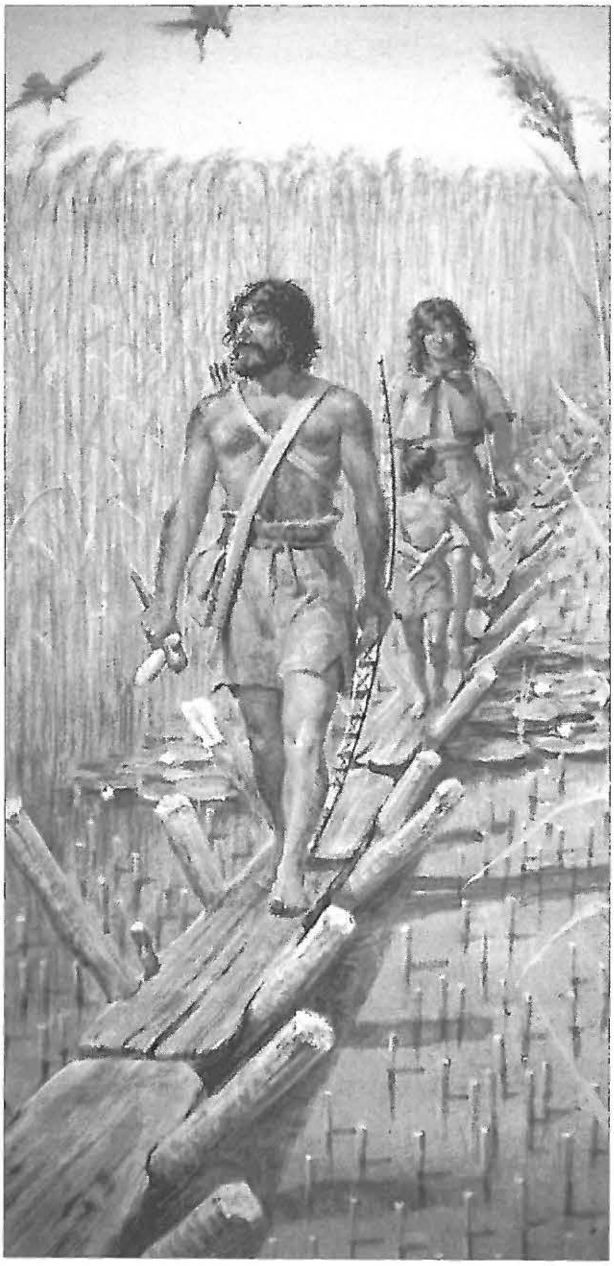

Figure 2: A reconstruction of the Sweet Track as it would have looked in 3806 BC. Picture: E Mortlemans.

industry by large conifer plantations. This can be seen in the archaeological record of fish traps at Magor Pill where the 12th and 13th century traps use a mixture of native deciduous similar to those used in the prehistoric buildings at Goldcliff, while the 18th century traps were mainly composed of larch and spruce (Nayling 2000).

The selection of material

The type of wood used in man-made structures is not a simple reflection of the local woodland resource since physical availability is just one of the factors involved. The selection of wooden raw materials involved an appreciation of the qualities of different species and their suitability for particular tasks. Social constraints, such as ownership or custom/religion, may have had a significant influence. It must also be recognised that the principle of least effort required to get any particular job done may have been as applicable to prehistoric communities as it is to the present day. This is especially the case when dealing with wooden structures such as trackways or houses that are likely to have a life expectancy of less than twenty years.

The predominance of brushwood trackways in the Somerset moors and at Goldcliff (Bell *et al.* 2000) can be seen as evidence of prehistoric people applying the least effort required to achieve a desired result. The Neolithic corduroy trackway in Somerset known as the Abbot's Way, can be seen in this light because the alder logs used in its construction were the main component of the closest woodland (Girling 1976; Orme and Coles 1985). The frequent occurrence of such simple constructions raises the question of why effort was expended to produce more complex structures. Hurdle and plank trackways are useful comparisons for studying the reasons behind the different constructional approaches taken.

Extensive hurdle trackways, such as the Neolithic Walton Heath (Figure 3) and the Bronze Age Eclipse tracks, utilised panels of woven stems largely derived from a form of coppiced hazel woodland (Coles and Orme 1977; Rackham 1977; Coles *et al.* 1982). They crossed areas of raised bog similar in character to that traversed by their near contemporary brushwood counterparts. The hurdles may have been easier to carry out into the bog than bundles of brushwood and would have been less likely to sink into the wet ground because of their greater surface area.

In addition to these purely functional factors the use of managed woodland must also be considered. Tree-ring analysis has shown that the hurdles did not derive from an area of formal coppice rotation where compartments in a wood are clear-felled on a 5-7 year cycle, as is known from medieval and post-medieval documentary sources. This should not be surprising as hazel stems soon become brittle upon seasoning, thus losing the quality essential for weaving hurdle panels or walls in buildings. This suggests that hazel is unlikely to have been stored for a long time before use. Therefore coppiced woodland is likely to have been utilised as and when a need arose, thus producing a mixture of different aged coppiced stools. A large project such as the Eclipse track, which is thought to have used 1,000 hurdles over its 2 km route, would

Figure 3: Hurdles made from coppiced hazel used in the neolithic Walton Heath tracks in the Brue valley, Somerset. Copyright: Somerset Levels Project.

have cleared a sizable area of the woodland in one go, producing coppice regrowth of the same age. This would only be archaeologically detectable in the subsequent uses of that coppiced woodland.

Plank construction was used in the Late Bronze Age Meare Heath and Nidons tracks in Somerset which had a similar structure and may have been part of the same routeway (Coles *et al.* 1988; Godwin 1960). The more complete evidence from Meare Heath shows that the track consisted of a walking surface made of pairs of split oak planks laid along the line of the route. These planks were supported by transverse timbers which were themselves secured by long split stakes driven through mortise holes near the ends of the timbers. Although the bog surface was becoming wetter in the Late Bronze Age when these structures were built, environmental determinism is not the sole explanation for this structure as other contemporary trackways, such as the Tinney's complex and Skinner's Wood (Coles and Orme 1978), adopted different approaches. The use of quality building timber could be seen as a status statement by the builders of the trackway which would have been apparent to all those who used the routeway. The same argument could be advanced for the Sweet Track.

A parallel example can be seen in the Iron Age buildings at Goldcliff on the Gwent Levels. These are all of roughly the same size and shape, are not very far apart in date and appear to have performed the same function. There is, however, a very significant difference in the materials used in their construction. Most of the buildings used a mixture of alder, ash, elm, hazel, oak, maple and willow for their wallposts, with alder roundwood dominant (Brunning 2000).

In contrast, building 6 at Goldcliff displays a completely different composition to the other structures. In this building the walls were chiefly formed from radially split oak posts from mature trees up to 1.7 m in diameter and 250 years old. This represents a valuable timber resource and its use in a building connected with seasonal pasturing of cattle on an encroaching saltmarsh may seem surprising. Timbers from at least four different oaks were used in the building with felling dates ranging from spring 273 BC, to winter 273-272 BC and 271 BC (Hillam 2000; Brunning 2000, 187-8).

The wood from just one of these large trees would have been sufficient to create the walls of the building. One explanation is that the building was constructed in 271 BC using material that had been building up over a two year period, possibly as a direct result of the desire to clear an area of mature oak trees. The use of these stockpiled oak planks may have been triggered by the need to quickly erect a building to replace one that had been destroyed by a storm or saltmarsh encroachment. This hypothetical stockpiling and semi-seasoning of oak timbers in the prehistoric period (Brunning 2000) is only possible because of the extensive sampling exercise that was undertaken for tree-ring dating, the knowledge of the other buildings for comparisons, and the environmental data to set the scene.

Techniques of woodworking

Many woodworking techniques have changed little in the last 6,000 years. The techniques for felling trees and splitting logs using wooden wedges take account of the natural planes of weakness in the material so that, for example, radially cleft boards are the most common products of oak and ash trees from the Neolithic to the medieval periods. The Severn Estuary region is fortunate in having a wide body of evidence for basic prehistoric timber preparation from the Somerset moors (Coles and Orme 1985; Orme and Coles 1983), the Welsh intertidal zone (Brunning 2000), and the Gwent Levels (Brunning and O'Sullivan 1997; Goodburn this volume discusses material from the London region).

The variation in the techniques for timber preparation is best exemplified in the boats remains from the region. The Bronze Age sewn boat planks from Caldicot and Goldcliff (McGrail 1997 and Bell *et al.* 2000, 74-82) were both made by splitting a log in two and then axing out the required shape of the plank and its central cleat ridge (Figure 4). This method was very wasteful of timber and time consuming to undertake. The finished planks lack the strength of radially cleft timbers and are liable to split along the rays running outwards from the centre of the tree. It appears that the demands of sewn boat building forced the Bronze Age wood-workers to make compromises which are not evident elsewhere.

The 13th century AD Magor Pill boat shows very different techniques in its timber preparation (Brunning *et al.* 1998). The main planks of the vessel were radially cleft boards of oak (strakes) and beech (ceiling planking) making the best use of the natural strengths of the material and losing little in waste during manufacture. The framing timbers were hewn to shape rather than split as this was the only way to achieve the precise shapes required.

The Roman boat from Barland's Farm (Nayling *et al.* 1994) illustrates techniques that have little in common with the local evidence for the prehistoric and medieval periods. The oak planks used to form the strakes in this vessel were sawn tangentially on a double trestle or over a saw pit. This allowed the builders to achieve wide planks from quite small sized trees. However, this technique incurs the same inherent weakness along the radial rays which the Bronze Age sewn boats exhibit. In the case of the Barland's Farm boat the driving force was not the demands of the joinery technique employed but rather the desire to get the most product from the least resource. This is shown by the inclusion of sapwood on some strakes and many of the framing timbers. Either only small trees were available to the boat builders or they were cutting costs to the extent that the strength of the vessel was being compromised.

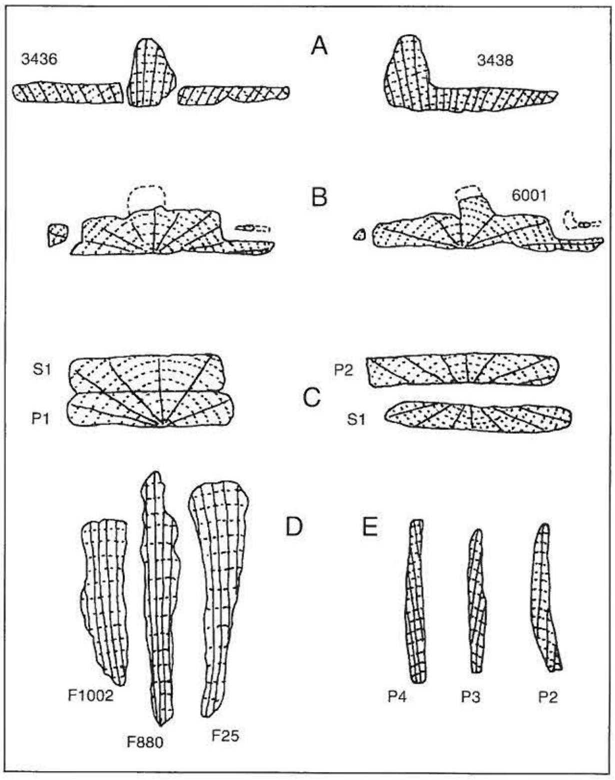

Figure 4: Cross sections showing conversion methods used on oak timbers of different periods (not to same scale). A. Two half split and hewn planks from a Bronze Age sewn boat, reused in a trackway at Goldcliff (Bell et al. *2000); B. Two sections through a half split and hewn plank of a Bronze Age sewn boat from Caldicot (Nayling and Caseldine 1997); C. Tangentially sawn planks from the Roman Barland's Farm boat; D. Radially split planks from the Neolithic Sweet Track (Orme and Coles 1983); E. Radially split planks from the medieval Magor Pill boat (Nayling* et al. *1994).*

In addition to the information from boat finds the Severn estuary region has the best evidence for wooden prehistoric structures and portable artefacts in the UK. Numerous wooden artefacts have been found in the Somerset peatlands. Some of these are associated with trackways, such as the wooden bowl, yew pins, toy axe, arrow shaft and bow fragments found beside the Sweet Track, or the human figurine from the Baker platform. Others are stray finds such as the Neolithic bow and yew mallet from Meare Heath or the wooden hay or reed fork from Skinner's Wood (Coles and Coles 1986). The palaeochannels around the buildings at Goldcliff have also been shown to contain artefactual material such as withy ties, stave built vessel fragments and tool handles (Brunning and Bell 2000). These all represent significant contributions to our understanding of early prehistoric material culture to balance against the ubiquitous evidence of pottery and flint.

The Severn estuary region has a range of waterlogged late prehistoric buildings unparalleled in the rest of the UK. Evidence for Bronze and Iron Age roundhouses has come from Rumney Great Wharf, Chapeltump and Collister Pill on the Welsh side (Allen 1996; Whittle 1989; Neuman and Bell 2000) and from the Meare and Glastonbury 'lake villages' on the English side (Bulleid and Gray 1911, 1917 and 1948). The rectangular Bronze and Iron Age buildings at Goldcliff (Bell *et al.* 2000) and Gwent Europark (Locock 2000) are almost without parallel in Britain and should cause a rethink of why circular domestic buildings dominate British and Irish prehistory in contrast to almost all of the rest of Europe.

Structural timbers have also been found reused in the late Bronze Age Tinney's and Skinner's Wood trackways in Somerset (Coles and Orme 1978 and 1985) and in several contexts at Caldicot (Brunning and O'Sullivan 1997). The presence of off-cut and other woodworking debris from timber producing species in four of the trackways at Goldcliff (1149, 1108, 970 and 1103) is probably a result of the building and repair of the nearby buildings to which some of the trackways lead (Brunning 2000). Such evidence may therefore assist in separating the trackways that lead to buildings from the other routeways and thus helping to locate buildings as yet uncovered by coastal erosion.

The great potential of the Severn estuary region is exemplified by the Iron Age settlement near Godney known as 'Glastonbury Lake Village'. This site was without doubt the most well-preserved prehistoric settlement ever discovered in the UK. The range of wooden artefacts is immense including basketry, tubs, ladles, strainers, troughs, mallets, a ladder, a frame for stretching hides, numerous tool handles, turned bowls and bentwood boxes (Bulleid and Gray 1911). The latter two categories are made and decorated with a level of skill that has not been bettered to this day. This settlement illustrates the broad range of material culture which existed everywhere, but which so rarely survives on archaeological sites. The evidence for structural joinery surpasses any other site in Britain from this period (Brunning 1995b).

The advancement of analytical techniques

Toolmarks

Many of the analytical techniques used on archaeological wood were pioneered by the work of John and Bryony Coles in the Somerset Levels Project. Their experiments with different types of prehistoric axe helped to advance the analysis of toolmarks and allow a characterisation system to be developed for their recognition (Coles and Orme 1985).

The next advance in toolmark analysis may come with the analysis of 'jam curves' (Brunning and O'Sullivan 1997) which are the lines left in wood where an axe blade has come to a stop. They therefore reflect the size and shape of the cutting blade. With great foresight Arthur Bulleid made some plaster casts of these features from Glastonbury Lake Village and numerous examples have sub-sequently been recorded on a number of sites in the region. As this data builds up it may become possible to link jam curves with known axe types which will allow the dates of use of axes to be compared to their dates of deposition in hoards or as stray finds.

Dendrochronology

Past human activity is composed of a series of events of very limited duration. Archaeologists, and especially prehistorians, often overlook this fact because the resolution of normal dating techniques such as typology, or radiocarbon dating, are not capable of isolating events.

Dendrochronology can be a very useful aid to our understanding of individual sites. It has allowed us to know that the wood for the Sweet Track was felled in the winter of 3807 or the early spring of 3806 BC and that repairs to the structure were still being made six years later. It also told us that the Post Track, the simpler structure which ran on a parallel course to the Sweet Track, was constructed in 3838 BC (Hillam *et al.*1990). The dendrochronological analysis of the fish weirs at Magor Pill provides another good example of the temporal complexities within and between the 12th century AD structures (Nayling 2000).

This can be seen in the example of five sites from the Severn estuary region, all of which would be indistinguishable from one another if radiocarbon dates were used. They are the Somerset sites of the Skinner's Wood trackway (Brunning 1995a) and the pile alignments at Greylake and Harter's Hill (Brunning 1998), the Gwent finds of a sewn boat plank from a trackway at Goldcliff (Bell *et al.* 2000, 74-82) and the bridge and riverside complex at Caldicot (Nayling and Caseldine 1997). Successful dendrochronological analysis at these sites has uncovered something of the complexity of the events which occurred.

1076 BC	The first trees are felled to form the pile structure at ***Harter's Hill***
1064 BC	More piles are added to the ***Harter's Hill*** alignment until at least this date
1017 BC	A sewn boat is made after this date and some of its planks are later reused in an Iron Age trackway at ***Goldcliff***
997 BC	Trees are felled to make morticed oak planks at ***Caldicot***
991 BC	A trackway at ***Caldicot*** is formed soon after this date
989 BC	A possible wooden bridge is made across the river at ***Caldicot***
982 BC	Trees are felled to make the jointed planks which are later reused in the ***Skinner's Wood*** trackway
963 BC	The pile structure at ***Greylake*** is created
952 BC	More timbers are added to the ***Greylake*** site until at least this date

The value of such information extends beyond the region. The ritual pile alignments at Greylake and Harter's Hill can be seen to have been built within the same period as the similar structure at Flag Fen (Neve 1992). The lack of sapwood on the timbers from the latter site restricts our under-standing of the chronological relationship between the three sites, but the last tree-ring from Flag Fen dated to 967 BC.

Further afield, 26 lakeside settlements in the French, German and Swiss Alps have dendro-chronologically dated construction phases within this same date span (1076-952 BC), allowing us, for example, to know that the last buildings were erected at Chalon-sur-Saone in France the year before the Greylake structure was made (Audouze and Büchsenschütz 1992, 40-41). The value of this information is cumulative, as larger patterns will only become evident with more data. This can be seen in the tree-ring dating analysis undertaken by Mike Baillie which has suggested a climatic disaster in 1159 BC (Baillie 1999).

Experimental archaeology

The value of experimentation to archaeological research has been recognised for a long time (e.g. Coles 1979; Robinson 1990). The technique is particularly applicable to wood studies and has often been used in recent years in the Severn region. The work of John and Bryony Coles on toolmarks has already been mentioned, but they also made reconstructions of prehistoric hurdle and plank trackways. More recently the Peat Moors Centre in Somerset has seen the erection of two roundhouses based on specific examples from Glastonbury Lake Village and the making of a logboat following the evidence of an Iron Age original found nearby at Shapwick Station (Figure 5).

A replica stretch of the Sweet Track has been erected in Shapwick Heath Nature Reserve in a reedbed similar to its original environment, using only tools that would have been available in the Neolithic – apart from the chainsaw which felled the tree and the lorry which delivered the log. This has helped to demonstrate the inherent instability of using very thin planks as a walkway surface in a 'V' shaped cradle. The crucial importance of the stakes driven at a slight angle through holes in the structure can now be appreciated, as they prevented the planks shifting sideways and catapulting pedestrians into the marsh. The experiment has also shown that even the very narrow planks found beside the original structure were practical as a walking surface. Passing was possible, if the individuals concerned did not mind some close body contact. Perhaps this made the routeway more popular? Within two months of its creation the replica track was entirely hidden in the reeds and perhaps the most valuable information will be derived from the life expectancy of the structure. Will it support the tree-ring evidence of a life as short as six years? We will know in another three years (replica built spring 1997).

Our understanding of individual artefacts can also be enhanced by experimentation. A replica of

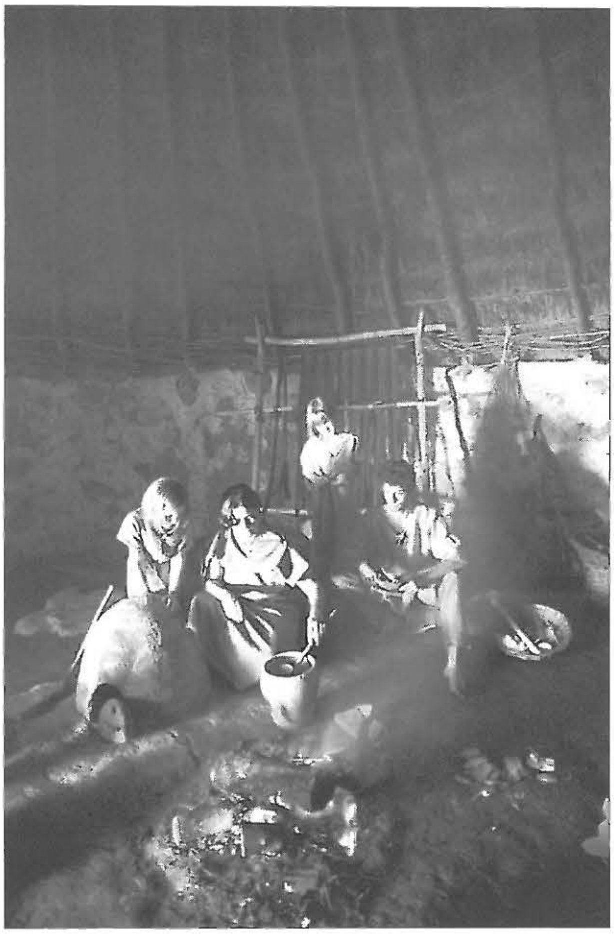

Figure 5: Experimental archaeological reconstruction of Iron Age wooden structures: inside one of the roundhouses at the Peat Moors Centre, Somerset (left), based on the evidence from Glastonbury Lake Village and (above) a replica of the dugout canoe from Shapwick Station. Copyright: Somerset County Council

the Neolithic Meare Heath bow has recently been made using only the tools which would have been available at that time (Prior 2000). This has demonstrated what an extremely well-made weapon the original was, as it could shoot at arrow at greater velocity than a medieval longbow and was accurate up to 90 m (100 yards). The leather binding, evident on the original, acted as a shock absorber and made the bow almost silent. The immense skill of Neolithic bowyers has been proved and the reassessment has also suggested that the breaking of the original weapon may have occurred deliberately as a ritual act rather than an accident.

In the experience of the author, all of the recent experiments mentioned above have proved to be very successful in drawing the general public into thinking more about archaeology and the past. It is inevitable that people will be more interested in things they can see and touch rather than dull paper reports. To renew public interest in the remarkable wetland archaeology of the region, reconstructions should be seen as a priority. Few things can capture the imagination as well as a boat, so the construction of working replicas of the Bronze Age, Iron Age, Roman and medieval boats and canoes from the area should be a target for the next ten years.

The survival of the resource

The advancement of analytical techniques has been discussed above, highlighting several exciting possibilities for the future. The region holds a large and nationally important archive collection of wood, especially with regard to the prehistoric period. However, the survival of the unexcavated resource is of greater importance than either of these two factors.

Development pressures on the Gwent and Avon Levels seem destined to threaten much of the wetland archaeology which still remains in those areas and in Somerset peat extraction will continue for many decades in the archaeologically rich Somerset moors. Government planning guidance has created a system for the mitigation of these threats, which has numerous problems in its applications to wetland environments but can still deliver excellent results.

The majority of sites known to contain wooden archaeological remains in the region are at risk from quite different factors. Coastal erosion is the greatest threat to the archaeological resource in the intertidal areas on both sides of the estuary (e.g. Bell *et al.* 2000). Global warming and sea level rise will only heighten this destruction. The erosion of river banks is also a significant problem (Grove and Brunning 1999). The realignment and rebuilding of sea and river defences are likely to cause direct and indirect damage to waterlogged remains. On land, agriculture remains the biggest agent of destruction. Deep ploughing can cause physical destruction and the rapid wastage of peat soils. Even in permanent

Figure 6: Goldcliff Building 1 showing areas of surviving flooring in December 1990 shortly after discovery of the building. In the background is the erroding peat edge which had cut into the building. All the buildings at Goldcliff and Redwick are in severe risk of erosion. Photograph: J. Parkhouse.

pasture low water levels in the middle of fields in the summer can cause peat wastage and the slow desiccation of archaeological wood (Armstrong 1996; Brunning 2001).

What response should the archaeological community be making? In the intertidal environment there is little option but rescue fieldwork. The work at Goldcliff, Redwick and elsewhere has shown what is possible in this respect (Figure 6). English Heritage have yet to follow the lead set by Cadw. The Environment Agency are taking note of archaeological considerations when carrying out work on sea and river defences and the situation is far better than it was ten years ago. Agri-environment schemes can be of use in restricting the extent of ploughing, but their agreements will have to be significantly changed if the threat of peat wastage and desiccation is to be reduced (Spoor *et al.* 1999).

The active hydrological management of archaeological sites can also be successfully achieved (Brunning *et al.* 2000) but such cases are likely to remain few and far between. The purchase of the most important sites is one of the best ways of managing and safeguarding their future (Coles 1995). Assessment of the condition of the known wetland sites is urgently required to establish baseline data concerning their condition and the scale of the threats to their continued survival. Analysis of the microbial decay of wooden remains should always form a part of such assessments. Some of the most important sites, such as the Iron Age wetland settlements at Meare, may be impossible to protect. Rescue excavation, as in the intertidal areas, may be the only option in such cases.

Waterlogged sites and the wooden remains they contain, constitute some of the most significant archaeology in the country. The comparative wealth of the Severn estuary region in this respect should be applauded but the archaeologists working in the Severn wetlands also bear the responsibility for looking to what the future holds for this valuable resource. The threats are known, it is now up to the archaeological community to advocate and implement the responses and solutions.

Bibliography

Allen, J.R.L. (1996) Three Late Bronze Age occupations at Rumney Great Wharf on the Wentlooge Level, Gwent. *Archaeology in the Severn Estuary* 6 (for 1995), 9-12.

Armstrong, A. (1996) *The conservation of peat soils on the Somerset Levels and Moors*. Taunton, English Nature.

Audouze, F. and Büchsenschütz, O. (1992) *Towns, villages and countryside of Celtic Europe*. Frome, Butler and Tanner.

Baillie, M. (1999) *Exodus to Arthur*. London, Batsford.

Bell, M., Caseldine, A. and Neumann, H. (2000) *Prehistoric intertidal archaeology in the Welsh Severn estuary*. CBA Research Report 120. York.

Brunning, R. (1995a) Fieldwork in the Somerset Levels and Moors. *Archaeology in the Severn Estuary* 5 (for 1994), 51-2. Lampeter. SELRC.

Brunning, R. (1995b) 'Joinery and structural carpentry'. In Coles, J.M. and Minnitt, S., *Industrious and Fairly Civilised: The Glastonbury Lake Village*. Taunton, Somerset County Council, 117-120

Brunning, R. (1998) Two Bronze Age wooden structures in the Somerset Moors. *Archaeology in the Severn Estuary* 8 (for 1997), 5-8.

Brunning, R. (2000) Wood and woodworking *c.* 400-1BC, in Bell, *et al.*, 176-195.

Brunning, R. (2001) *Archaeology and Peat Wastage on the Somerset Moors*. Taunton, Somerset County Council.

Brunning, R. and Bell. M. (2000) Wooden artefacts. In Bell, M. *et al.*, 116-118.

Brunning, R., Jones, J. and West, S. (1996) Excavations at Benedict Street, Glastonbury, 1993. *Proceedings of the Somerset Archaeology and Natural History Society*, 139, 17-46.

Brunning, R., Nayling, N. and Yates, A. (1998) The boat. In Nayling, N. *The Magor Pill Medieval wreck*. York, CBA Research Report 115, 45-103

Brunning, R. and O'Sullivan, A. (1997) Wood species selection and woodworking techniques, in Nayling, N. and Caseldine, A. (eds.), 163-186.

Brunning, R., Hogan, D., Jones, J., Jones, M., Maltby, E., Robinson, M. and Straker, V. (2000) Saving the Sweet Track. The *in situ* preservation of a Neolithic wooden trackway, Somerset, UK. *Conservation and Management of Archaeological Sites*, 4, 3-20.

Bulleid, A. and Gray, H. St. G. (1911) *The Glastonbury Lake Village Volume 1*. Glastonbury.

Bulleid, A. and Gray, H. St. G. (1917) *The Glastonbury Lake Village Volume 2*. Glastonbury

Bulleid, A. and Gray, H. St. G. 1948. *The Meare Lake Village Volume 1*. Glastonbury

Coles, J. M. (1979) *Experimental Archaeology*. Academic Press. London.

Coles, B.J. (1988) 'A wetland perspective'. In Purdy, B.A. (ed.) *Wet Site Archaeology*. Caldwell, New Jersey, Telford Press. 1-14.

Coles, B.J. (1995) *Wetland management: A survey for English Heritage*. Exeter, WARP Occasional Paper 9.

Coles, J.M. (2001) Wetlands, archaeology and conservation at AD 2001. In Coles, B.J. and Olivier, A. *The Heritage Management of Wetlands in Europe*. Exeter, University of Exeter. 171-192.

Coles, J.M., Caseldine, A.E. and Morgan, R.A. (1982) The Eclipse Track 1980. *Somerset Levels Papers* 14, 34-43.

Coles, B.J. and Coles J.M. 1986. *Sweet Track to Glastonbury: The Somerset Levels in Prehistory*. London, Thames and Hudson.

Coles, J.M., Coles, B.J., Morgan, R.A. and Caseldine, A.E. (1988) The Meare Heath Track 1985. *Somerset Levels Papers* 14, 6-33.

Coles, J.M., Heal, S.V.E. and Orme, B.J. (1978) The use and character of wood in Prehistoric Britain and Ireland. *Proceedings of the Prehistoric Society*, 44, 1-45.

Coles, J.M. and Orme, B.J. (1977) Neolithic hurdles from Walton Heath, Somerset. *Somerset Levels Papers* 3, 6-29.

Coles, J.M. and Orme, B.J. (1978) Multiple trackways from Tinney's Ground. *Somerset Levels Papers* 4, 48-81.

Coles, J.M. and Orme, B.J. (1985) Prehistoric woodworking from the Somerset Levels: 3. Roundwood. *Somerset Levels Papers* 11, 25-50.

Girling, M.A. (1976) Fossil Coleoptera from the Somerset Levels: The Abbot's Way. *Somerset Levels Papers* 2, 28-33.

Godwin, H. (1960) Prehistoric wooden trackways of the Somerset Levels: their construction, age and relation to climate change. *Proc. Prehistoric Soc.* 26, 1-36.

Grove, J. and Brunning, R (1999) The Romano-British salt industry in Somerset. *Archaeology in the Severn Estuary* 9 (for 1998), 61-68.

Hillam, J., Groves, C.M., Brown, D.M., Baillie, M.G.L., Coles, J.M. and Coles, B.J. (1990) Dendrochronology of the English Neolithic. *Antiquity* 64, 210-219.

Hillam, J. (2000) Dendrochronological dating, in Bell, M. *et al.*, 159-168.

McGrail, S. (1997) The boat fragments, in Nayling, N. and Caseldine, A., 210-217.

Locock, M. (2000) Iron Age and later freatures at Greenmoor Arch, (Gwent Europark), Newport. *Archaeology in the Severn Estaury* 10 (for 1999), 128-130.

Nayling, N. (2000) Medieval and late fish weirs at Magor Pill, Gwent Levels: Coastal change and technological development. *Archaeology in the Severn Estuary* 10 (for 1999), 99-113.

Nayling, N. and Caseldine, A. (1997) *Excavations at Caldicot, Gwent: Bronze Age paleochannels in the Lower Nedern valley*. York, CBA Research Report 108.

Nayling, N., Maynard, D. and McGrail, S. (1994) Barland's Farm, Magor, Gwent: a Romano-Celtic boat. *Antiquity*, 68, 593-603.

Neuman, H. and Bell, M. (2000) The intertidal peat survey. In Bell *et al.*, 282-321.

Neve, J. (1992) An interim report on the dendrochronology of Flag Fen and Fengate. *Antiquity* 66, 470-475.

Orme, B.J. and Coles, J.M. (1983) Prehistoric woodworking from the Somerset Levels: 1. Timber. *Somerset Levels Papers* 9. 19-43.

Orme, B.J. and Coles, J.M. (1985) Prehistoric woodland from the Somerset Levels: 2. Species selection and prehistoric woodlands. *Somerset Levels Papers* 11, 7-24.

Pedersen, L., Fischer, A. and Aaby, B. (eds.) (1997) *The Danish Storebælt since the Ice Age – man, sea and forest*. Copenhagen.

Prior, S. (2000) The skill of the neolithic bowyers – reassessing the past through experimental archaeology, in Webster, C.J. (ed.) *Somerset Archaeology*. Taunton, Somerset County Council. 19-24.

Rackham, O. (1977) Neolithic woodland management in the Somerset Levels: Garvin's, Walton's and Rowland's Tracks. *Somerset Levels Papers* 3, 65-71.

Robinson, D. E. (ed.) (1990) *Experimentation and Reconstruction in Environmental Archaeology*. Oxford, Oxbow Books.

Spoor, G., Gilbert, J. and Gowing, D. (1999) *Conservation of peat soils on the Somerset Levels and Moors, Part 4: Safeguarding peat soils*. Silsoe College, Cranfield University.

Whittle, A.W.R. (1989) Two Later Bronze Age occupations and an Iron Age channel on the Gwent Foreshore. *Bull Board of Celtic Studies*, 36, 20-23.

Richard Brunning
Archaeology Section
Environment and Property Department
Somerset County Council
County Hall
Taunton, TA1 4DY