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Later Bronze Age and Iron Age Environmental Background

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5.1 Introduction

This is not a full review of all the palaeoenvironmental studies carried out in the region, but a general summary with most emphasis placed on the environment in which later prehistoric communities lived. It does not provide a comprehensive review of crop and animal husbandry in the region. Reviews of environmental archaeology carried out or commissioned by English Heritage are in progress or complete and will give an account of knowledge in these areas. Those wishing to follow this up should consult the English Heritage website (`http://www.english-heritage.org.uk` and follow the links Research & Conservation → Archaeology & Buildings → Scientific Techniques → Environmental Studies → Regional Reviews). At the time of writing, the reviews on insects (Robinson 2002) and wood and charcoal (W Smith 2002) were available. Reviews of plant macrofossils, pollen, animal bones and geoarchaeology from southern England are in preparation and will be placed on the website when available. Rob Scaife very kindly made available a draft of his pollen review for this resource assessment. The excellent review by Bell (1984) is still a very useful source of information. There are also reviews of environmental evidence in the Urban Archaeological Assessments for Bath (not yet published) and Bristol (Brett 2005), which are of relevance for this period. The inclusion of "grey" literature has not been comprehensive.

The sources of evidence referred to in this resource assessment are plant and animal micro- and macrofossils, principally pollen, diatoms, plant macrofossils and charcoal, foraminifera, ostracods, bone, insects, snails and the soils and sediments in which they survive.

Geology, soils and hydrology are the most important factors in determining the types of palaeoenvironmental evidence likely to survive. For example, in the acid soils of the drier granite areas, pollen preservation is usually good, compared with other non-waterlogged remains, as the exine of pollen grains survives well in acid soils where soil acidity reduces decomposition by soil micro organisms. In contrast, shell and bone is poorly preserved or absent as the calcareous content is dissolved in acid conditions. Pollen, however, is poorly preserved in neutral to calcareous, biologically active soils.

Molluscs survive best in the base-rich soils of the chalk and limestone as well as shell-rich dune sand in many coastal areas, for example at Brean Down where several phases of sand-blow separate settlements of Early–Late Bronze Age date (Bell 1990). Molluscs provide general information about local ground conditions and have been particularly important in reconstructing the broad character of the chalk downland in Wiltshire and Dorset (see below).

Most studies of insects are from the upper Thames valley and Somerset peat moors. Robinson (2002, 70) comments that unlike in the Neolithic and Early Bronze Age where insect evidence is mainly from coastal areas and wetlands, in later prehistory there is more digging below the water table, and so deep ditches, water holes and ponds provide sources of evidence.

Pollen analysis is the technique which has most to offer for understanding vegetation history in general terms. However, interpretation of pollen assemblages requires an understanding of how pollen grains are dispersed (wind, insects, human agency) and differential pollen production (some species are more prolific pollen producers than others). There is also the question of differential preservation in poor conditions. In common with other micro- and macrofossils, the assemblage is also affected by the likely source area of the sampling site. Pollen is sourced both from the local area and wider catchment, the catchment size affected by the choice of sampling site. Pollen in buried soils allows reconstruction of vegetation of immediate and local origin, compared with that from some wetland sequences, where the sources of input can be diverse and from a wider area. Thus, data from both sources is valuable for building a representative picture for an area.

Plant macrofossils (fruits, seeds, wood, bud scales etc) and insects preserved in waterlogged deposits are invaluable for understanding local vegetation and placing structures and settlements into their environmental settings. Some pollen grains can only be identified to a type or genus and not to a species, whereas plant macrofossils can usually be identified to genus, if not to species. Thus, carried out in association with pollen analysis, they allow more precise interpretation of the local environment. Insects are very sensitive to changes in temperature and are thus earlier indicators of climate change than pollen, for example.

Diatoms (unicellular algae) and foraminifera (protists) are useful for identifying changes in salinity and nutrient levels. They have been used principally to study sea level, tidal regimes and coastal change and have been used extensively in the Severn Estuary levels. Examples include Haslett *et al.* (1997a) which demonstrates the use of modern foraminifera assemblages from known tidal conditions to interpret archaeological data and Carter *et al.* (2003) where multi-proxy analyses included pollen, diatoms, plant macrofossils, sediment and foram analyses from transects along the Severn levels in South Gloucestershire, in a study of mid-late Holocene landscape evolution.

5.2 Soils

Soils preserved under monuments or which have developed under or within naturally accumulated deposits such as alluvium, peat, sand dunes or hillwash, are important sources of information. Pedological, pollen and molluscan analyses of such palaeosols have proved particularly valuable for understanding the setting of monuments in the landscape and for human activities such as clearance, burning and farming. However, obtaining good dating evidence from buried soils can be difficult as datable material is often sparse and there is a high chance of the inclusion of residual charcoal or charred seeds. Where suitable material is found, radiocarbon dates give the date of the death of the organism being dated and therefore potentially the age of the surface on which the monument was built.

It is very difficult to make general statements about soils in a region as complex and diverse as the South West. As noted before (on page 65), away from the coasts and floodplains of the region, forest-supporting Brown Earths were thought to have developed continuously since the Devensian Late Glacial and were of variable thickness depending upon parent material (Limbrey 1975). This situation pertained to the Neolithic, but in the Bronze Age, a combination of climatic deterioration and human impact may have contributed to acidification and nutrient loss resulting in, for example, the development of podzols, particularly in the high moorland of the region where the parent geology is both impermeable and acidic. The areas include Dartmoor, Bodmin Moor, outcrops in the St Austell area and Carnmenellis, all of which have a granitic geological basement, and also the slate geologies of Exmoor.

Topographic features such as slope aspect may also be of great significance in soil development and burial. For example at Colliford on Bodmin Moor, Maltby and Caseldine (1984) describe a brown podzol beneath a barrow on a south-west facing slope and compare it with highly advanced podzolisation beneath a barrow on a north-east facing slope. They suggest that this difference could be attributed to aspect, differences in land-use or possible age differences concealed by calibrated age ranges of radiocarbon dates.

5.3 Scientific dating

Radiocarbon dating has been the principal scientific dating method used to understand the chronology of environmental change in the Bronze and Iron Ages. Dendrochronological (tree-ring) dates have provided precise dates for some waterlogged prehistoric structures in the Somerset levels and moors. OSL (Optically Stimulated Luminescence) dating is now being used to date inorganic sediments in Holocene and Pleistocene sequences and is likely to become of increasing importance as the technique develops. Its potential has been demonstrated recently at Gwithian, for example (Roberts 2006).

5.4 Climate, sea level and rivers

The Middle Bronze Age, Iron Age and later periods fall in the later part of the Holocene (or for the UK sometimes called the Flandrian), the most recent period of the Quaternary era. The literature on Quaternary palaeoenvironmental change (such as Roberts 1998, 200) frequently alludes to a deterioration of the climate in the Late Bronze Age to Early Iron Age. However, in his review of insects from southern England Robinson (2002), did not find changes in the insect fauna which he could definitely relate to climatic deterioration in the early 1st millennium BC. The insect evidence for temperature is somewhat ambiguous and could suggest that conditions were similar to or slightly warmer than at present (and see Bodmin Moor below, on page 112, for further discussion). Future studies making use of testate amoebae and chironomid larvae may add useful detail to climate change studies. Increases in wetness indicted by testate amoebae can reflect climate change and chironomids (non-biting midges) are sensitive to water temperature.

Analyses of testate amoebae in blanket mires on Dartmoor are in progress from Cut Hill and Whitehorse Hill (Hazell pers. comm.) and complete for Tor Royal where a 5000 year proxy-climate record for central Dartmoor has been established (Amesbury *et al.* in press). The Tor Royal record has a particular focus on testing existing models of climatically-driven expansion and contraction of settlement on Dartmoor, and resolves periods of amelioration and deterioration during prehistory.

As noted previously (on page 63), coastal change is fundamental to the changing environment of the South West. The major part of the post-glacial rise in sea level (*c*.55m in the last 11,500 years) was achieved by *c*.5000 BC, but subsequent changes have had a major impact on the shape of the coast (see Figure 3.2 on page 65). Haslett *et al.* (1997b); Allen (2001) have noted problems such as sediment compaction associated with some of the data used in the sea level curve published by Heyworth and Kidson (1982) and added to by Jennings *et al.* (1998). This still gives a useful overall impression of sea level change, but other recent research (such as Haslett *et al.* 2001) shows the importance of understanding local coastal changes, some of which were very significant. For example, the episodes of flooding in the 1st millennium BC in the Somerset peat moors (see below on page 108) had a major impact on land use. The flood event in the early centuries of the millennium was related to sea level rise and later episodes noted below may also have been, at least indirectly. Where estuarine silts did not extend landwards, ponding up of freshwater was an indirect effect. On the south coast at Poole Harbour, a Middle to Late Iron Age marine incursion has also been identified (Long and Scaife in Ladle and Woodward forthcoming).

As has been seen (on page 64), by the beginning of the Neolithic, rivers in the South West had evolved meandering or anastomosing bedforms (AG Brown 1997, 210). River behaviour only appears to have altered further during the Late Bronze Age and later when sedimentation of mineral silts and clays on floodplains is attributed to widespread forest clearance of floodplains and in the wider river catchment (Robinson 1992). Robinson (1992; 2002) comments that in earlier periods, hydrological changes in wetlands were mainly due to natural agencies such as sea level change, but in the later prehistoric period, human activity played a significant part. He suggests that the flooding of the raised bog at Meare in the Somerset peat moors and increased wetness noted in the upper Thames valley (see below on page 107) could be due to clearance in the river catchments causing increased runoff. For some flooding events, both human impact and an indirect effect of sea level rise may be factors.

5.5 Area reviews

A brief summary of present knowledge is given for each of the physiographic sub-regions, broadly similar to those used in Chapter 3.

5.5.1 Chalk downland, heaths (Wiltshire and Dorset)

Scaife (forthcoming) notes that for Wiltshire, "knowledge of Holocene palaeovegetation especially in relation to human activity is limited". This is due to the absence of peat-forming mire vegetation and the fact that the groundwater is carbonate-rich and high in dissolved oxygen even where organic sequences are present. The same can be said for parts of Dorset. As a result, most data on vegetation change comes from molluscan studies of colluvium, soils and ditch sediments, and while this gives general information, it does not provide detail about the species composition of the various habitats.

Exceptions, where palynological investigations have been carried out, are floodplain palaeochannels, Poole Harbour, greensand soils (such as the Devizes area) and the Dorset heaths. There are also occasional valley peats and organic lenses on the Thames terraces in north Wiltshire (see below on page 107).

Allen (1988) argued, on the basis of soil and mollusc studies, that large areas of the Wessex chalk downland of Wiltshire and Dorset were cleared of secondary woodland by the Middle Bronze Age and constituted a farmed landscape. In east Dorset, evidence for this comes mainly from studies along the route of the A35 Tolpuddle By-Pass (Allen 1999). In the west of the county, excavation in the Dorchester area has provided a series of data sets from the Neolithic onwards. Allen (1997b), drawing together the evidence from soil descriptions by Staines, plant macrofossils (Straker and Letts), animal bones (Bullock and Reilly) and molluscs concludes that from the mid-2nd millennium BC until the Middle Iron Age, increasing arable farming is indicated. Colluvial sequences, such as those at Middle Farm and Fordington Bottom date to this period and suggest erosion of thin chalky soils. There is also evidence for large scale mixed farming on the downland. The particularly large sheep from Middle and Late Bronze Age contexts at Middle Farm may suggest the introduction of new flocks to the area, while cattle husbandry was probably for meat rather than dairy produce. By the later Iron Age, *c*.450 cal BC, extensive tillage had led to soil depletion in some areas. At Flagstones and Fordington Bottom, for example, long standing arable land may have reverted to lightly grazed grassland. New arable land was established elsewhere, such as in the area round Fordington Farm barrow. There is speculation that in the later Iron Age, some grain was imported to the Dorchester area and stored in pits.

A peat-filled palaeochannel of the Easterton Brook at Market Lavington, near Devizes, proved an exceptional find for the area (Wiltshire 2006). The site was on a low greensand ridge at the foot of the north west scarp of the Salisbury Plain chalk. The earliest dated sediments at 1540–1580mm depth were Iron Age (800–200 cal BC, with 89.3% probability of the date being between 800 and 350 BC, OxA-2998) and pollen assessment allowed a crude reconstruction of the vegetation at, and below, this level. A mainly pastoral open landscape is inferred from the Late Bronze Age (and possibly earlier) until the Iron Age. The virtually treeless environment contained very low levels of hazel-type, oak and alder, but plentiful, weedy grassland and heath vegetation (Wiltshire 2006). However, the most important palaeoenvironmental information comes from the Early Medieval fills of the palaeochannel where pollen preservation was good permitting detailed analysis (see page 164).

A rare opportunity to study both charred and mineralised plant remains arose during the excavation of a Late Bronze Age–Early Iron Age midden at Potterne, near Devizes (Straker 2000; Carruthers 2000). The midden developed on greensand soils, but gley soils on Gault clay and rendzinas on chalk are also to be found locally. The charred plant macrofossils mostly relate to arable farming of crops typical for the period (spelt wheat, hulled barley) and associated weeds, however the species of mineralised seeds are less biased by human activity in their composition and so afford a glimpse of local environmental conditions, similar to those often preserved by waterlogged assemblages. The predominant group of plants was of wasteland and disturbed ground, including species such as henbane (*Hyoscyamus niger*) and stinging nettles (*Urtica dioica*) and members of the Chenopodiaceae family (goosefoots). Micromorphological and geochemical analyses by MacPhail (2000) suggested that long term stabling or pounding of animals on the midden enhanced the levels of phosphorous, but plant macrofossil evidence for stabling or pounding is absent (Carruthers 2000). Carruthers also notes the very good preservation of mineralised plant remains at East Chisenbury, 15km to the south-east on Salisbury Plain and considerable potential for further study. Charcoal analysis at Potterne (Straker 2000) was limited, but demonstrated that the main species selected for burning were oak, hazel and Pomoidae (a group which includes hawthorn, apple, pear, whitebeam and rowan) with some *Prunus* (cherry or sloe). Apart from the oak, these are all efficient secondary colonisers and all could have been collected from local stands of woodland, scrub or hedgerows.

At Durrington, in the Avon valley, pollen survives in some floodplain sediments and detailed analysis is in progress. The sequence starts in the Devensian Late Glacial–Early Holocene (see page 48) and is likely to continue to the Medieval period with some hiatuses. However, one of these hiatuses may cover the Late Bronze Age and Iron Age (Scaife in Cleal *et al.* 2004; Scaife forthcoming).

On Cranborne Chase, a peat-filled palaeochannel produced a late prehistoric and historic pollen profile. The earliest record is Late Bronze Age (1050–830 cal BC, Beta-189162) and was largely herb-dominated (Scaife forthcoming).

Scaife (forthcoming) summarises the vegetation history studies of the Dorset heathlands which have received attention from several workers, starting with the pioneering studies of Dimbleby (in Case 1952) on a pre-barrow soil and Seagrief (1959) at Wareham Bog. Soil profiles beneath barrows have been the subject of studies by several workers. The open heath and woodland identified at Bourne Bottom, Poole (Dimbleby in Case 1952) is typical for many such pre-barrow soils in the present heathlands of central southern England. Scaife gives the references for other pre-barrow pollen analyses; the profiles obviously predate the barrows, but are not closely dated and further well-dated analyses would be useful.

A recent study at Golden Cap on the Dorset coast, demonstrated that away from the heathland soils, clearance is not so evident. The pre-barrow hazel scrub at Golden Cap may be intermediate vegetation between woodland, clearance and pasture (Scaife 1993; Scaife in Papworth 1997, 56–9).

Work on the peat beds in Poole Harbour is discussed in full in the forthcoming report on the excavations at Bestwall which is located on the western side of Poole Harbour (Long and Scaife in Ladle and Woodward 2007; Ladle and Woodward forthcoming). A recurring feature is a marine incursion dating from the Middle to Late Iron Age. At Bestwall itself, Scaife has identified pollen from a range of features including a small basin whose fills date from the Neolithic to the Early Medieval period. An Early to Middle Bronze Age date coincides with major clearance of the open oak-hazel woodland, the lime element having been removed earlier (in the Neolithic or Early Bronze Age). The clearance appears to have been for arable purposes, and arable and pasture episodes are noted in both the Bronze and Iron Ages. Scaife (forthcoming) points out that unlike other parts of this region (such as the west side of Poole Harbour and Hengistbury Head) the vegetation here did not revert to heathland.

The present heathlands on the western side of Poole Harbour and Furzey Island have been studied as a result of the development of the Wytch Farm oilfield. Scaife (in Cox and Hearne 1991) found Bronze Age heathland in two sequences and he also postulated the presence of areas of late prehistoric pine woodland. The full publication of the Bestwall and Poole Harbour results will make a major contribution to our knowledge of vegetation and coastal change in south Dorset.

Further east on the coast at Hengistbury Head, pollen from the "eastern depression", which was found to be the upper end of a truncated valley, showed that it had supported woodland during the Neolithic and Bronze Age including species such as oak, lime, ash, alder and birch. In a soil profile under a bank and dated to 1880–1440 cal BC (HAR-6186) the vegetation was fairly similar, but although lime was no longer evident, holly was present (Scaife 1992), adding to data on the decline in lime on the south coast. This Early Bronze Age vegetation was subsequently replaced by heathland.

5.5.2 Jurassic uplands (Cotswolds and Mendip)

Knowledge of vegetation history and landscape change is virtually absent for this period, apart from a general understanding of the principal crop plants and domesticated animals. However, the sites at Latton and Latton Lands in the upper Thames valley (see on this page) are also on the dip slope of the Cotswolds, and thus provide some general information relevant to this area.

A molluscan study from Malmesbury gives some useful information of local interest. Snails were analysed from Iron Age ditches and buried soils (Davies 2002). Short-turfed grassland was evident, with some areas of longer, more shaded, grassland associated with the ditches and/or palisades. Burnt freshwater species were found in ditch 3; these are thought to originate from burnt daub containing clay from a wetland source, which was found in the ditch fills.

5.5.3 Upper Thames valley, Gloucestershire (and Wiltshire)

Woodland clearance was probably complete in the main valley of the Thames downstream of the Cotswold Water Park by the Late Bronze Age, though it was still taking place on some of the tributary floodplains at this time (Robinson 1992, 53; Robinson 2007, 357). The area of the Cotswold Water Park, the southern and eastern hinterland of Cirencester (Miles *et al.* 2007) may not have been fully cleared of woodland until the end of the Bronze Age, however Robinson (1992; 2007) noted a rise in water table in the Late Bronze Age caused by the effects of clearance and agricultural intensification. It was at this time, for example, that the effects were noted on the previously dry soils at Latton "Roman pond" (see below).

The Late Bronze Age economy of the upper Thames valley was mostly concerned with cattle rearing and a pastoral system (Lambrick 1992, 21). More mixed farming economies are evident in the Early Iron Age, with an increase in both arable and pasture. The extent of arable may have been greater further downstream, as for example at the Ashville Trading Estate (Robinson 2007).

Drawing together the evidence from charred and waterlogged plant macrofossils, insects and molluscs from a number of sites in the Cotswold Water Park, including major centres such as Claydon Pike (Miles *et al.* 2007) and Thornhill Farm (Jennings *et al.* 2004), Robinson (2002; 2007) suggests that by *c.*650 BC both the floodplain and first gravel terrace supported agricultural land-use. The Middle Iron Age landscape in the Cotswold Water Park area was open and agricultural with the main emphasis on raising domestic animals, with fields on drier ground supporting arable crops including winter-sown cereals (Robinson 2007). This is broadly in support of the views expressed by Lambrick (1992) based on sites further downstream. Robinson (2007) notes that Claydon Pike was sited at a junction between the floodplain and first gravel terrace, the wetter floodplain would have provided good summer grass for pasture whereas the first terrace could have supported some cultivation and over-wintering of animals. More specifically, the evidence from insects summarised by Robinson (2002) suggests that the landscape surrounding the enclosed and unenclosed Middle and Late Iron Age settlements was grassland, with heavier grazing pressure around the unenclosed sites. Here, shorter turfed grassland is indicated and the settlements are regarded as specialised, grazing domestic animals on the floodplain. This does not appear to have been typical of higher gravel terraces in the Thames or elsewhere where mixed farming was the norm.

Although flooding in the Early Iron Age was noted in some areas further downstream (for example at Yarnton, Oxfordshire), it was not seen at Claydon Pike. Robinson (1992, 54) identified the effects of agricultural intensification in the Middle Iron Age causing flooding with the onset of deposition of alluvium starting in the Late Iron Age.

A few kilometres upstream on the Gloucestershire/Wiltshire border, peat accumulated in a shallow palaeochannel in the top of the first gravel terrace of the Thames known as Latton "Roman pond". This was examined during the excavations along the A419 (Ermin Street) between Cricklade and Birdlip Quarry (Mudd *et al.* 1999). Molluscs, plant macrofossils and pollen were studied by Robinson (1999b, 497–500) and Scaife (1999c). As noted above, dry conditions had allowed tree growth on the bed of the palaeochannel, but the raised water table in the later Bronze Age killed the trees and allowed fen peat to accumulate. In the local area at around 1380–970 cal BC (NZA-8579), oak-lime-hazel woodland was being cleared, though some oak-hazel-alder woodland persisted suggesting some selective clearance of lime. Scaife (1999c) considers that the lime clearance took place in the Late Bronze Age, however Mudd *et al.* (1999, 521) suggested that this was in the Early Iron Age. The remaining woodland was removed in a later phase of clearance and herbs of arable and pasture are evident. This was most marked in the upper part of the profile (particularly zone 3) in what are regarded as Iron Age levels. This study is of major importance; however, as Mudd notes, the sequence is not precisely dated. Pelling (1999, 474–5) studied the charred plant remains from the sites along the route and noted that the cereal cultivation in the Cotswolds and this part of the upper Thames valley appeared to have been on a small scale when compared to Oxfordshire upper Thames valley sites and the Wessex chalklands, implying greater emphasis on pasture.

Contrasting results from another site nearby on the first Thames terrace at Latton (Latton Lands) demonstrates the value of spatial sampling within a local area. Pollen from a waterhole suggested a settlement in a much more open landscape than at the "Roman pond" with high percentages of arable and pasture species as well as local aquatic/fen taxa (Huckerby in Stansbie and Granville Laws 2004, 135). It is not clear from the radiocarbon dates of 1450–1190 cal BC (WK-12942) and 1440–1250 cal BC (WK-12941) whether the two sites are contemporary with varied vegetation or whether there is short-term vegetation change. More recent excavation on another part of the site, supported by a larger number of radiocarbon dates interpreted using Bayesian modelling, may clarify this (Rebecca Nicholson pers. comm.).

5.5.4 Coastal lowlands (Somerset, Severn and Avon Levels)

There is a considerable body of literature regarding the environmental changes in the Somerset Levels and Moors, particularly for the last 6000 years. This can be found in the *Somerset Levels Papers* and research papers in various specialist and period journals, books and theses. Examples include Clapham and Godwin (1948), Godwin (1955), Beckett and Hibbert (1979), Caseldine (1988b), Housley *et al.* (1999) and Aalbersberg (1999). Most work has concentrated in the Brue valley where studies were related principally to establishing the environmental setting of tracks of Neolithic to Iron Age date and the Iron Age villages at Meare East and West, and Glastonbury. They also gave some insight into the vegetation and land-use on the "dry" land of the Lias limestone "islands" and surrounding hills. The principal sources of information were pollen, plant macrofossils including wood, and insects.

The wetland vegetation was varied in character throughout the area, as noted in a general summary by Straker (2006b). In the Brue valley, the basic vegetation sequence was first recognised by Clapham and Godwin (1948), Godwin (1955) and Beckett and Hibbert (1979). After the mid-Holocene reed swamp and fen wood successions, raised bog was established by *c.*3100 cal BC and the prehistoric tracks run through this environment. The character of the raised bog vegetation is identified by pollen, plant macrofossils and also the insect fauna, with species feeding on heathers and cotton grass with water beetles in acid peaty pools within the raised bog. Robinson (2002) summarises Girling's results from the Meare Heath and Tinneys Gound Trackways (Girling 1982a;b), where scarabeoid dung beetles suggest that domestic animals were driven along the track. The raised bog would have provided good grazing.

The onset of wetter conditions in the Late Bronze to Early Iron Age has been identified in different locations by many workers including Clapham and Godwin (1948), Beckett and Hibbert (1979), Girling (1982a), Housley (1995), and J Jones and Tinsley (2007). Flooding of the raised bog on Meare Heath started *c.*910–750 cal BC (90.9% probability, SRR-914, Girling 1982a). This lasted until *c.*400–200 cal BC (SRR-913) and resulted in an increased percentage of water beetles, notably those with a preference for calcareous water, and the replacement of some raised bog with fen species. On Common Moor, to the west of Glastonbury, the onset of wetter conditions took place after 1260–920 cal BC (Q-2464, Housley 1995).

At Sharpham Manor, one of the sequences investigated by the MARISP project was a largely inorganic flood-deposited clay within a peat sedimentary sequence. The clay is bracketed by a lower date range of 1045–905 cal BC (OxA-16248, OxA-16249, weighted mean) and upper range of 800–500 cal BC (SUERC-9835, SUERC-9839, weighted mean, J Jones and Tinsley 2007). This suggests that it was laid down in the Late Bronze Age or Early Iron Age and that flooding ceased by the Middle Iron Age or before.

The most detailed palaeoenvironmental study is Housley's research into the environment of Glastonbury Lake Village (Housley 1986; 1988; 1995), but as noted below there are other more recent analyses which complement his findings. Drawing together the evidence from his research with the earlier work of Godwin (1955), Housley (1995) concluded that the settlement was sited on a patch of alder-willow-fen carr surrounded by sedge fen fringing a shallow, open freshwater lake, the result of the onset of wetter conditions which drowned much of the fen wood. This may be the indirect result of an increase in the rate of sea level rise in the second half of the 1st millennium BC (and see below for further discussion of flooding episodes). The raised bog of the present central Brue valley would have been visible to the west of the village. There was most probably local diversity in wetland environments and Housley (1995, 135) sees a "varied mosaic of different plant communities, each needing different water depths, nutrient conditions, types of rooting strata, flow tolerances and of differing potential exploitative value to man".

Aalbersberg (1999) and Aalbersberg and Brown (forthcoming) have re-examined the evidence for setting of Glastonbury Lake Village and carried out new stratigraphic studies and pollen and diatoms analyses. On the basis of the microfossil evidence, they conclude that tidal channels created by marine flooding in the Early to Middle Iron Age remained open in the late 1st millennium BC (Late Iron Age). This has important implications for the setting of Glastonbury Lake Village which could, therefore effectively have functioned as a port with access to the coast.

It is generally thought (for example by Coles and Minnitt 1995) that increased flooding and a rise in water table could have resulted in the abandonment of the lake village, however Aalbersberg and Brown (forthcoming) find no convincing evidence for this and suggest that cultural rather than environmental factors should be examined more closely. New analysis carried out by the MARISP project at Glastonbury Lake Village, identified a phase of increased wetness (at what is anyway a very wet site) indicated by a change in sedimentation in the Late Iron Age, occurring immediately after 200–50 cal BC (OxA-16237, OxA-16238, J Jones and Tinsley 2007). The dating of Glastonbury Lake Village is in some doubt, as artefactual evidence suggests that it was established about 250 BC, whereas radiocarbon dates on bone appear earlier (Coles and Minnitt 1995). The latter dating is supported by radiocarbon dates from peat undertaken for the MARISP project. Until the dating is resolved, the debate on the effect of a Late Iron Age rise in water table on the settlement will continue.

On Meare Heath, raised bog was re-established but Girling (1982a) noted a further Late Iron Age episode of flooding starting probably in the last 200 years BC. The flooding events noted in the inner Brue valley for the last few centuries BC are freshwater events rather than inundations by the sea; however as noted above, these are likely to have been the indirect effects of sea level rise. Whether or not this is also related to climatic deterioration is not always clear.

The environmental context of the Meare lake villages, situated in the raised bog area of the central Brue valley, is discussed by Caseldine (1986; 1988a). Insect evidence for human habitation is restricted to that from Meare West where the house timbers showed notable infestation by woodworm *Anobium punctatum* in the centre of the settlement where the houses were closely spaced (Robinson 2002). The intensity of occupation is also reflected by the percentage of species feeding on moulds in thatch, old hay etc. and debris from food preparation and cereal waste (Robinson 1981, species groups 8 and 9 respectively). Robinson (2002) noted that compared with contemporary sites in the Oxfordshire Thames valley, the occupation appeared to be denser or more intense at Meare West.

The environment at Woolavington Bridge, towards the coast, was raised bog from the Late Mesolithic to the Early Medieval period, but this area was close to the limit of tidal influence (Tinsley 2003). Some 2km further west at Withey Bridge on the Huntspill, the environment was one of salt marsh from the Late Bronze Age onwards (Vickery 1999).

In the Axe valley to the north, marine flooding penetrated through the Bleadney–Panborough gap reaching to the north-west of Glastonbury (Housley 1995; Housley *et al.* 1999). Here, the inundation dates from the late 2nd to mid-1st millennium BC but on the coast the intercalated peats and silts were finally covered by estuarine silts by the later Bronze Age or before.

For the dry land, the pollen diagrams from the Brue valley chart woodland clearance and regeneration in the later Bronze Age with increased evidence for clearance and cultivation in much of the 1st millennium BC. This takes place in regional pollen zone F and is noted in the pollen diagrams for the Abbot's Way (Beckett and Hibbert 1979), Meare Heath (Beckett and Hibbert 1979) and Eclipse tracks (Coles *et al.* 1982), summarised in the excellent paper synthesising prehistoric environmental exploitation in the Somerset Levels by Caseldine (1988b). She notes that elm (*Ulmus*) declines for a third time and lime (*Tilia*) for a second. A reduction in tree pollen is accompanied by an increase in the quantity and range of herbaceous pollen types. A further marked expansion in clearance is evident at the Abbot's Way and Meare Heath in the last centuries of the 1st millennium BC, probably coincident with the on-site evidence for consumption of domestic animals and crops from the Meare and Glastonbury lake villages.

The various analyses prompted mainly by development on the Severn levels in Bristol and South Gloucestershire have provided some insight into the landscape in the mid-Severn estuary. The sedimentary sequence relates to the Upper Wentlooge formation described by Allen and Rae (1987) and comprises intercalated silts and peats with a thicker back fen-type peat in some locations near to the junction with the higher ground of Mercia Mudstone and Lias. There is little evidence for established raised bog on the south bank of the Severn in this part of the valley, unlike on the Welsh side. The silts supported various types of saltmarsh. The dry ground was, as in Somerset, still largely wooded in the 1st and 2nd millennia BC, though there is little detailed analysis and in general it is not yet possible to identify well-dated episodes of clearance and regeneration as has been done for the hills surrounding the Somerset peat moors. A possible exception is a study from the Aust pipeline near Oldbury where a Middle to Late Bronze Age reduction in lime woodland was noted (Scaife 2006; and Scaife in Jordan 2004). Most analyses have been concerned with establishing the nature of the wetland environment. However, preservation of macrofossils is variable and in many cases analysis has been taken to assessment level only. A successful study of ostracods on the Severn floodplain near Bristol demonstrated estuarine conditions in the latest prehistoric to Romano-British period (Wessex Archaeology 2006).

The Historic Environment Records include reports of many studies from the Severn levels in Bristol and South Gloucestershire, not all of which are published, but some variations in the wetland and settlement patterns are evident.

Carter *et al.* (2003) reported on the stratigraphy from boreholes and excavations and various palaeoenvironmental analyses on the route of the Seabank pipeline in South Gloucestershire. They present a useful overview of landscape evolution in the area and the constraints and opportunities afforded by putative buried soil horizons within the silts of the Upper Wentlooge sequence. The identification of areas of higher bedrock buried beneath alluvium gives an indication of possible areas of potential for prehistoric settlement and emphasises a past variety in the landscape that cannot be seen today.

JP Gardiner *et al.* (2002) describe palaeoenvironmental studies from geotechnical pits, cores and excavations in relation to the Second Severn Crossing and associated roads. Both this publication and Carter *et al.* (2003) are very valuable as they draw together a range of studies from similar parts of the Bristol and South Gloucestershire levels, an area under intense development pressure. JP Gardiner *et al.* (2002) suggest a model for the exploitation of the levels based on pastoralism from the Neolithic to the Romano-British period. The principal late prehistoric settlement was at Hallen, to the north-west of Bristol. Upper salt marsh, dominated by the pollen types of the Chenopodiaceae family predated the Middle–Late Iron Age settlement. The dry land to the east supported oak, hazel, ash and some lime. The saltmarsh was succeeded by grassland and pasture, probably in the period of the settlement, which was then later covered by marine alluvium (Scaife 2001). JP Gardiner *et al.* (2002) suggest that the main preoccupation of the population at Hallen was shepherding on the grassland which was accessible at least in summer months.

The mature mid-late Holocene woods of the dry land in the Bristol area do appear to have had a greater component of lime (*Tilia*) than their more south-westerly counterparts and lime is still a distinctive feature of the woods of the carboniferous limestone of the Avon Gorge. At Temple Back in Bristol, lime and other trees were identified at the base of a largely historic sequence (Scaife 2004) and similarly in the earlier (Neolithic) sequence at Deanery Road (Tinsley and Wilkinson 2005).

Further upstream in the Severn valley in Gloucestershire and Worcestershire, AG Brown (1982; 1987) identified Bronze Age clearance of lime woodland on river terraces at Ashmoor Common, Ripple Brook and Callow End between *c.*1700 and 700 BC. Later, for a long period between 500 BC and AD 1000 (Middle Iron Age to Medieval) clearance or management of alder carr was accompanied by the development of wet meadow vegetation. Both AG Brown (1982; 1987) and Hewlett and Birnie (1996) studied profiles at Longney, in the estuarine zone south of Gloucester. Brown identified floodplain alder woodlands with a component of oak and lime. Hewlett and Birnie (1996) found a 4.5m thick woody peat at Longney, which contrasts with the later prehistoric intercalated peats and clays to be found downstream on the Severn Levels. The alder woodland represented by much of the peat was replaced by a wet sedge vegetation. The calibrated age range (800–200 cal BC, Beta-51686) of the basal date covers most of the Iron Age, but there is a probability of 91.9% that the date falls between 800 and 350 cal BC. The floodplain sediments in this area may also include a general pollen signal for the western edge of the Cotswolds, but because of the distance it will be affected by differential pollen transport.

5.5.5 Triassic and Devonian hills and valleys (south Somerset, Devon and Cornwall)

There are no relevant palaeoenvironmental data from south Somerset, however, recent studies from the Exe valley and central Devon have added useful information relating to local palaeoenvironments.

Fyfe *et al.* (2003a) report on studies from three spring mires on Exmoor's southern fringe (Long Breach valley/spring mire, Gourt Mires and Anstey's Combe). These sites allow detailed reconstruction of the local vegetation and show the scale of variation in vegetation type around the southern moorland edge. Gourt Mires (2400 BC–AD 1000) and Long Breach (3500 BC–AD 1300) show extensive woodland clearance in the Middle to Late Iron Age after 760–370 cal BC (Wk-10623). However, the authors state that there is "no discernible Roman or post-Roman period impact on the vegetation". This suggests stability of the cultural processes causing detectable impacts on the environment from the Late Iron Age to the Early Medieval period (and see also Fyfe and Rippon 2004). At Anstey's Combe, the sequence runs from the Late Iron Age (*c.*100 cal BC) until *c.*AD 1500. Unlike other sites, in the Late Iron Age the oak-hazel woodland was retained on the steep valley sides.

On Knowstone and Rackenford Moors four local sequences from central Devon cover all or parts of the period (Fyfe *et al.* 2004). These are from Lobb's Bog (Late Iron Age to Medieval), Hare's Down (*c.*300 BC–AD 900), North Middle Combe (*c.*1000 BC–AD 1400) and Windmill Rough (*c.*1000 cal BC to present). These suggest a predominantly pastoral landscape by the start of the Iron Age, with valley-side alder cleared in the Middle to Late Iron Age. The sequence from Middle North Combe shows that the most pronounced anthropogenic change within the cultural landscape took place in the Middle Bronze Age, also confirmed from the site at Moles Chamber on Exmoor (Fyfe 2000). All the sites show that the land use remained as pasture throughout Roman period and continues to the recent period with no obvious change in intensity of use.

Elsewhere in Devon, new analyses on the Blackdown Hills, the Hartland peninsula and in the Clyst valley took place as part of the Heritage Lottery-funded Community Landscapes project. The first palaeoenvironmental data for the Blackdowns come from Bywood Farm and Greenway. At Bywood, a Late Bronze Age to Early Medieval sequence started to accumulate *c.*1270–1130 BC; there are no independent dates from Greenway. The sites show Late Bronze Age woodland clearance with arable cultivation first recorded in the Iron Age and no detectable changes in the Roman period. However, oak and hazel also remain significant after the Iron Age and suggest that woodland persists through the Holocene probably on steeper slopes and under management, possibly as a result of resources needed by the iron industry (Hawkins 2005; A G Brown pers. comm.).

At Kennerland on the Hartland peninsula, a valley/spring peat started to form in the earlier centuries of the Iron Age when the landscape was predominantly open with some arable cultivation and pockets of deciduous woodland. This is an area with a high density of Bronze Age barrows and the possibility of early clearance (Hawkins 2005; A G Brown pers. comm.).

Studies at several sites in the Clyst valley (Helling's Park, Broadclyst Moor and Moshayne) show woodland clearance in the Late Bronze Age–Early Iron Age, associated with cereal cultivation. However, the the late appearance of cereals here may be connected with the removal of a filtering effect by trees after the woodland clearance (Hawkins 2005; A G Brown pers. comm.).

In south Devon at Woodbury Castle hillfort near Axminster, pollen analysis by Dimbleby (in Miles 1975b) on a palaeosol seen in various places beneath the rampart showed variable vegetation of open oak woodland and grassy glades with bracken.

An intertidal peat with submerged forest remains at Thurlestone Rock in the South Hams was the subject of limited work but has produced useful results (Reed and Whitton 1999). Pollen, plant macrofossils and insects indicated open grazed pasture close to the wet fen vegetation. This unusual record for an intertidal peat was most noticeable in the uppermost sample. The peat was of Late Bronze Age date, which again is unusual for an intertidal deposit and suggests very rapid coastal change in the area. Severe coastal erosion is evident today and is clearly not a recent phenomenon.

Tinsley (2000) studied the pollen in the upper 2.3m of a 9m deep peat deposit in a coastal valley at North Sands, Salcombe. The mire vegetation in the Middle Bronze Age (1530–1250 cal BC, Wk-8103) was alder carr and fen which was replaced by an open and wetter plant community and, by cal AD 50–350 (Wk-8102), the carr woodland disappeared. The site appeared to have dried out during or after the Roman period. Tinsley attributed the phase of increased wetness to local hydrological change, possibly associated with human activity. This was indicated by herbs characteristic of disturbance throughout the profile, but particularly in the Bronze Age levels.

5.5.6 Moorland (Isles of Scilly and west Cornwall, Bodmin, Carnmenellis, St Austell area, Dartmoor and Exmoor)

Isles of Scilly Pollen analysis and assessment that covers the later part of the Bronze Age and the Iron Age has been carried out at various locations on the Isles of Scilly. Locations range from the sequences at Higher and Lower Moors on St Mary's (Scaife 1984; with some reinterpretation by Ratcliffe and Straker 1996), the intertidal organic soils on Crab's Ledge, Tresco (Iron Age, Ratcliffe and Straker 1996) and buried soils at Bar Point, St Mary's (Iron Age, Evans 1984), Innisidgen, St Mary's (Dimbleby 1976–7), Halangy Porth, St Mary's (probably Iron Age, Dimbleby *et al.* 1981; Dimbleby in Ashbee 1996, 171–3) and Shipman Head, Bryher (below the rampart of the cliff castle, Ratcliffe and Straker 1996). At Higher and Lower Moors, some regeneration of the birch, oak and hazel woodland is evident in the Middle to Late Bronze Age, with herbaceous and cereal pollen also pointing to some open areas.

The start of the main phase of woodland clearance is dated at Higher Moors to the Late Bronze Age–Early Iron Age (820–410 cal BC, HAR-3724 and 800–

200 cal BC, HAR-3723). The soil pollen analyses noted above all testify to open environments with a little alder, oak, birch and hazel recorded at Bar Point but not at Halangy Porth. The open ground is mainly grazed grassland but at Innisidgen, arable was also suggested. Pollen of heathland plants is rare, but the charcoal of heather and gorse/broom at Bonfire Carn and Porth Killier show that it was used as fuel from as early as the Middle Bronze Age (Ratcliffe and Straker 1996). The Crab's Ledge pollen and plant macrofossils are of grasses and members of the Cheopodiaceae family including annual sea blite, suggesting coastal grassland and saltmarsh (Ratcliffe and Straker 1996).

West Cornwall A summary review of past work in Cornwall west of Truro was carried out for the HEATH project (Straker in Dudley and Herring 2006). This showed convincing, if poorly dated, evidence for heathland development, as well as some pasture and possibly arable, before barrow construction on the Lizard. Greater hazel cover than present today was also noted. The sites studied included Trelan (Balaam in G Smith 1984), Caern Dhu (Crabtree 1980) and Higher Polcoverack (Staines in Goodden 1977, reported in Bell 1984). The only evidence for Penwith is from Carn Euny where Dimbleby (in Christie 1978) investigated the land surface pre-dating the settlement and considered to be 5th century BC or earlier. The early part of the sequence shows mainly wooded conditions with, as in earlier periods, the main trees being oak and hazel. Dimbleby noted a clearance episode which suggested pasture in the local area. By the time of the settlement there was a noticeable decline in oak and hazel and associated increase in grasses with a suggestion of arable and pasture with herbs such as sorrels (*Rumex*), great plantain (*Plantago major*), and members of the Cruciferae, Urticaceae (nettle family) and Umbelliferae. The results provide a contrast to the Lizard with clearance showing no clear evidence for heathland.

Current analysis of new sites on Penwith and Carnmenellis, in progress as part of the HEATH project, should provide better dated evidence for the onset of heathland.

Settlement features at Penhale Round, located on the shillet, but close to the edge of the metamorphic aurole near Indian Queens, provided some information on local vegetation in the 1st millennium BC. Scaife (in Johnston *et al.* 1998) analysed pollen from a gully associated with an Iron Age house which suggested varied background vegetation of woodland copses, heathland, grassland and arable. Greig's assessment from earlier features on another part of the same site suggests establishment of grassland and heath before the later Bronze Age monuments were constructed (Greig 1997).

Bodmin Moor The earliest published pollen analyses were from Parson's Park (Connolly *et al.* 1950) and Hawks Tor (AP Brown 1977) and both suggested a largely pastoral environment in the areas in the Bronze and Iron Ages. However, the dating resolution was poor compared with more recent analyses. A review of the evidence for Bodmin was later summarised by (Caseldine 1980). A reduction in the oak/hazel woodland was evident by *c.*1100 BC though there may have been some woodland remnants on sheltered hillsides.

There is now a good body of evidence for past vegetation and land use from the Stannon–Rough Tor area of Bodmin Moor. Radiocarbon dates for clearance at Rough Tor South (1690–1440 cal BC, OxA-6008) and Tresellern Marsh on East Moor (1260–900 cal BC, Beta-84825) confirm the scale of human activity in the 2nd millennium BC (Gearey and Charman 1996; Gearey *et al.* 2000b). These sites identified a peak in human activity in the Middle Bronze Age with pasture in much of the area, however, there is some evidence for slight woodland (oak/hazel dominated) in the mid-2nd millennium BC.

Likewise in the Stannon area the first permanent grasslands became established in the Early Bronze Age on higher parts of the down after 2020–1760 cal BC (SUERC-3624) causing a reduction in the area of oak-hazel woodland, probably associated with the activities of the cairn builders (Tinsley 2004; Tinsley in AM Jones forthcoming). As at Rough Tor, grazing was intense in the Middle Bronze Age. At Stannon, the wet alder woodland in the valley that had developed in the Late Mesolithic–Early Neolithic period became less dense in the Bronze Age but continued to exist until some time in the Iron Age. Tinsley (Tinsley 2004; Tinsley in AM Jones forthcoming) notes a major landscape change between 1260–1000 cal BC (SUERC-3625) with an expansion in grassland, further increase in microscopic charcoal and establishment of herbs typical today of upland acid grasslands such as tormentil, devil's bit scabious and sheep's bit with a now continuous pollen record for *Calluna* (ling). The presence of ling, a strongly calcifuge plant, from the Early Bronze Age shows that the woodland-supporting acid brown earths established in the early–mid-Holocene had started to degrade. Podzolisation had also started in some places as evident from soil beneath cairn 2. This development broadly coincides with the spread of field systems and house-building in the area (Mercer 1970; Johnson and Rose 1994). The results of Gearey *et al.* (2000b) support these findings.

At Stannon, in the Early Iron Age, there is a notable increase in wet conditions on the bog surface resulting in the establishment of aquatic herbs including marsh St Johns wort, flag iris, bog moss (*Sphagnum*) and other species in pools of open water, which started to develop sometime before 730–380 cal BC (or 550–380 cal BC at 91.3% confidence, SUERC-3626).

The marked reduction in valley alder woodlands was subsequently redressed somewhat, but in the later Iron Age they decreased significantly (Tinsley 2004; J Jones in AM Jones forthcoming).

There seems general agreement that after the Bronze Age there was a decline in the intensity in upland land use, and Gearey *et al.* (2000b) suggest that this may not have been until the Late Iron Age or even Roman period at their sites on Rough Tor and East Moor. Certainly at Stannon, Tinsley (2004 and in AM Jones forthcoming) suggests that the decline is not until at least the Late Iron Age. She feels that the late prehistoric increase in heathland (heathers) could be due to increased soil acidification, reduction in grazing or the use of fire to manage the balance of heather/ grass moorland. Charcoal analysis (Gale in AM Jones forthcoming) showed the increased use of shrubby species such as gorse (*Ulex* sp.) or broom (*Cytisus* sp.), in the Iron Age. This confirms the heathland development suggested by the pollen, however, oak (*Quercus* sp.) and hazel (*Corylus avellana*) charcoal was still more common than gorse and broom.

Gearey *et al.* (2000b) discuss the explanation for the apparent shift in emphasis of settlement from the upland to lowlands at the end of the Bronze Age and the possible role of climatic deterioration among other factors. Their conclusion was that soil deterioration was not far advanced on a landscape scale by the late prehistoric period and that pollen evidence suggested that the quality of the sward remained fairly good at that time. Gearey *et al.* (2000b, 505) found little evidence for climatic deterioration around the Late Bronze Age–Early Iron Age transition in the South West of England but felt that, as the evidence is variable and the dating resolution poor, it could not yet be discounted.

In the later Iron Age at Stannon, around 520–380 cal BC, increasingly wet conditions were evident. However, whether they resulted mainly from deforestation and decreased evapotranspiration, rather than climatic deterioration, is not clear (Tinsley 2004 and in AM Jones forthcoming).

In the De Lank valley, the Bronze Age and subsequent sequence dates from 1890–1680 cal BC (Wk-11549). The vegetation changes are complex and may be largely associated with human activity (J Jones *et al.* 2004). Conclusive evidence for cereal cultivation in the mid–late 2nd millennium BC is at present known only from the relatively sheltered De Lank valley and at Tresellern Marsh.

At Colliford, Maltby and Caseldine (1984) studied soil profiles and pollen beneath barrows, hedges and ridge and furrow, prior to the flooding of the area by the reservoir. The Bronze Age vegetation was open grassland with localised hazel scrub and some woodland and heathland. The authors also noted that the evidence for soil degradation in prehistory had to some extent been reversed in the more modern profiles. Pollen analysis from the Colliford buried soils show open grassland suggesting pastoralism present before barrow construction. Typical species include grasses, ribwort plantain, dandelions, devils-bit scabious and *Potentilla*-type.

On the northern fringes and to the north of the moor, soil profiles beneath the Crig a Minnis, Otterham and Wilsey barrows showed some evidence of podzolisation. Pollen analysis at Crig a Minnis demonstrated heathland development in clearings in possibly secondary woodland (Dimbleby in Christie 1960, 94–96; Dimbleby 1963).

Other studies of pre-barrow soils by Bayley (1975) showed that the landscape on the St Austell granite at Caerloggas and Watch Hill comprised grassland, heath and hazel scrub. In the same general area, Crabtree (in Johns and Herring 1994, 31–2) found similar grassland and heath vegetation in the soil beneath Littlejohns Barrow.

Dartmoor On Dartmoor, in contrast to the Neolithic period, for which good quality pollen data is scarce, the Bronze and Iron Ages fare rather better. This is largely because of the extensive fieldwork carried out by the Dartmoor Reaves and Shaugh Moor projects in the late 1970s and early 80s which have thrown light on the environments during the 2nd millennium BC (Balaam *et al.* 1982; Maguire *et al.* 1983; Fleming 1988; K Smith *et al.* 1981). This provides a baseline from which to view the later centuries.

Caseldine and Hatton (1994) and Caseldine (1999) have summarised the main findings from these projects. By the early 2nd millennium BC, there was open moorland above the reaves comprising acid grassland, though wood was available elsewhere as shown by the pre-stone wooden structures. Within the reave system there was good pastureland with some small-scale arable cultivation within the field systems. The soils, were acidic, owing to the parent granitic substrate, but generally did not show leached horizons or peat or iron-pan development. The palaesols excavated in the Dartmoor Reaves Project (Fleming 1988) showed an active soil fauna which would not be evident in very acid soils. There is, however, some evidence of soil deterioration and peat growth below the Saddlesborough Reave, the onset of which would have been by the 2nd millennium BC. Caseldine (1999) feels that without further question-based research on sites with high dating potential, little progress is likely to be made on understanding the post-reave landscape of Dartmoor.

The Shovel Down Project (Brück *et al.* 2003) aims to test some of the findings of the original reave project (Fleming 1988), specifically the chronology, form, function and historic and contemporary landscape context of sub-division of the landscape in the Bronze Age. Environmental work is focusing on generation of regionally-relevant climate reconstruction records (Amesbury *et al.* in press), landscape-scale soil work to examine the differences within and without the field systems, and differences between different forms of field system (co-axial and aggregate enclosure) and local vegetation histories. This last includes pollen analysis and assessment of coleopteran samples from a mire section which incorporates a reave in situ in peat (Fyfe and Davies in prep.). Initial results indicate a clear phase of landscape improvement and subsequent abandonment local to the Shovel Down field system, firmly dated within the Middle Bronze Age.

Many of the other early pollen studies on Dartmoor (see Bell 1984 for a summary) do show local variability and some records are derived from more local sources than others. However, many are not well-dated by today's standards.

A comparison with the upland is provided by Sourton Down, on the northern fringes of Dartmoor. A small valley mire at only 290m OD, revealed a long sequence of local vegetation change starting in the early 7th millennium BC (Straker 1997). In contrast with the Dartmoor massif, the vegetation at Sourton shows little evidence of major human impact before the clearance of local alder fen in the Late Iron Age or Early Roman period (170 cal BC–cal AD 70, OxA-6000). The alder woodland was replaced by sedge fen and the drier ground supported damp grassland with stands of trees and scrub. A 1st century Roman road passed close to the site and increased human presence and use of wood for fuel or building material may account for the changes, however Late Iron Age clearance cannot be ruled out.

Exmoor Until the late 1990s research on Exmoor focused exclusively on pollen analysis from the higher blanket peat sequences (Merryfield and Moore 1974; Francis and Slater 1990; 1992; Straker and Crabtree 1995). This work demonstrates that the timing of blanket peat initiation varies across the upland, from the Late Neolithic through the later Iron Age. By the Middle Bronze Age the upland was predominantly open, as demonstrated by the work from Hoar and Codsend Moor (Francis and Slater 1990; 1992) and Moles Chamber (Fyfe 2000).

More recent work has focused on smaller, more discrete mires, both in valley contexts (such as the Brightworthy palaeochannel in the Barle valley, Fyfe *et al.* 2003a) and from the upland fringes (a series of mires on Molland Common, Fyfe *et al.* 2003a). This more recent pollen work broadly confirms a predominantly open upland landscape by the Middle Bronze Age, but areas such as Molland Common (on the south Exmoor fringe) are characterised by a mosaic landscape, with the potential for localised survival of woodland remnants within the predominantly open landscape. Further clearance is apparent during the Late Iron Age, for example at Moles Chamber, dated shortly before cal AD 80–330 (Beta-140873, Fyfe 2000).

Further pollen and geochemical work in is progress with a focus on examination of the chronology and local landscape impacts of metal extraction and processing on Exmoor, in collaboration with the Exmoor Iron project (Ralph Fyfe, pers. comm.). This geochemical and palaeoecological work is underway from mires close to the large smelting site at Sherracombe Ford, and the mining site at Roman Lode. Although both these sites are major historic period centres, both are likely to have been important during later prehistory.

5.6 Discussion

In common with other periods, many of the more recent studies focus on understanding the diversity of the landscape and local land use by studying several small catchments in a local area. The multiple studies such as on Bodmin Moor and the Somerset and Severn levels also allow a better understanding of the chronology and nature of events such as clearances, woodland regeneration, flooding episodes and heathland development.

The timing of lasting clearance of secondary woodland is variable; generally this was in the 1st millennium BC, but there are variations. The Wessex chalklands and parts of the high moors were cleared by the Middle Bronze Age, as were parts of the Lizard peninsula. Parts of the upper Thames valley were largely open by the Late Bronze Age, and on the Isles of Scilly and in the Clyst valley in Devon, this was the case by the Late Bronze Age–Early Iron Age. In parts of central and north Devon, clearance took place in or by the Early Iron Age, whereas on the southern fringe of Exmoor, this was not until the Middle to Late Iron Age. In the Somerset and Severn levels some areas were still wooded in the earlier part of the Iron Age.

Heathland had developed in parts of south Dorset by the Middle Bronze Age, but the open ground on the high moors supported both pasture and heathland; the balance depended on management by grazing and/or fire.

The integration of a range of palaeoenvironmental analyses in many wetland and upland areas has made it possible to identify episodes of flooding or increasingly wet conditions. In the lowlands, some are the direct or indirect result of sea level change. Better dating for these events will improve understanding of their effect and extent. It is unfortunate that many are during the 1st millennium BC, when there is a "plateau" in the radiocarbon calibration curve and dating strategies should be designed with this in mind.

There is much scope for further research on climate change. For example, the topic of Late Bronze Age to Early Iron Age climatic deterioration is still a matter for debate, with no clear evidence from the south west. There is an understanding that, for example, some phases of flooding or increased wetness could be due to factors such as reduced evapotranspiration after woodland clearance. New or under-used techniques such as insect (including chironomid) and testate amoebae analyses could be usefully added to existing methods, to better understand climate change in contemporary upland and lowland sequences. Techniques such as oxygen isotope analysis may also be appropriate. Tufa deposits, for example, are well-suited to this and are a useful source where other indicators may not be well-preserved.

Improved dating for on and off-site sequences is essential if further advances in understanding are to be made. This means that far more attention should be paid to designing scientific dating programmes and ensuring that the necessary funding is in place.

Finally, there are several parts of the region where our knowledge of the later prehistoric environment is very poor, most notably the central and northern Cotswolds, Mendip and south Somerset.

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5.7 Radiocarbon dates

Table 5.1: *Details of radiocarbon dates used in the text. Calibrated ranges are at 2σ (95.4%) and were calculated with OxCAL 3.10 (Bronk Ramsey 2005) using the probability method and the IntCal04 calibration curve (Reimer* et al. *2004).*

Lab. Ref.	^{14}C age BP	Cal BC	Site	Context	Reference
Beta-51686	2360±60	800–200	Longney	Peat	Hewlett and Birnie (1996)
Beta-84825	2880±60	AD1260–900	Tresellern Marsh A	Peat 40–50cm	Gearey *et al.* (2000b)
Beta-140873	1820±40	AD80–330	Moles Chamber	Peat	Fyfe (2000)
Beta-189162	2800±40	1050–830	Cranborne Chase	Peat	Scaife (forthcoming)
HAR-3723	2360±60	800–200	Higher Moors, Isles of Scilly	Peat	Scaife (1984)
HAR-3724	2540±80	820–410	Higher Moors, Isles of Scilly	Peat	Scaife (1984)
HAR-6186	3350±90	1880–1440	Hengestbury Head	Buried soil	Barton (1992)
NZA-8579	2943±63	1380–970	Latton "Roman pond"	Peat	Mudd *et al.* (1999)
OxA-2998	2370±80	800–200	Market Lavington	Peat	Wiltshire (2006)
OxA-6000	2025±45	170–AD70	Sourton Down	Peat	Straker (1997)
OxA-6008	3275±50	1690–1440	Rough Tor South	Peat at 150cm	Gearey *et al.* (2000a)
OxA-16237	2122±29	350–50	Glastonbury Lake Village	Peat (humin fracton)	J Jones and Tinsley (2007)
OxA-16238	2114±29	340–40	Glastonbury Lake Village	Peat (humic fracton)	J Jones and Tinsley (2007)
OxA-16248	2835±33	1120–900	Sharpham Moor	Peat (humin fracton)	J Jones and Tinsley (2007)
OxA-16249	2809±30	1050–890	Sharpham Moor	Peat (humic fracton)	J Jones and Tinsley (2007)
Q-2464	2890±50	1260–920	SLP - Peat Monoliths, Common Moor, GV34	1.07-1.13m below surface	Coles and Dobson (1989)
SRR-913	2252±45	400–200	SLP - Peat Monoliths, Meare Heath		Coles and Dobson (1989)
SRR-914	2624±45	910–590	SLP - Peat Monoliths, Meare Heath		Coles and Dobson (1989)
SUERC-3624	3550±35	2020–1760	Stannon	Peat	Tinsley (2004)
SUERC-3625	2915±35	1260–1000	Stannon	Peat	Tinsley (2004)
SUERC-3626	2370±35	730–380	Stannon	Peat	Tinsley (2004)
SUERC-9835	2510±35	800–510	Sharpham Moor	Peat (humic fracton)	J Jones and Tinsley (2007)
SUERC-9839	2545±35	810–540	Sharpham Moor	Peat (humin fracton)	J Jones and Tinsley (2007)
Wk-8102	1830±60	AD50–350	North Sands, Salcombe	Peat	Tinsley (2000)
Wk-8103	3130±60	1530–1250	North Sands, Salcombe	Peat	Tinsley (2000)
Wk-10623	2380±60	760–370	Long Breach	Peat	Fyfe *et al.* (2003b)
Wk-11549	3444±34	1890–1680	De Lank	Peat	J Jones *et al.* (2004)
Wk-12941	3085±42	1440–1250	Latton Lands		Stansbie and Granville Laws (2004)
Wk-12942	3076±50	1450–1190	Latton Lands		Stansbie and Granville Laws (2004)