Dozmary Pool

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Highlights

Dozmary Pool is a key pollen site with a radiocarbon-dated record spanning almost the entire Holocene. Changes in the relative proportions of tree-shrub-herb pollen, in association with occurrences of charcoal in the peat layers, are central to the controversy surrounding the extent of human activity on Bodmin Moor during the Mesolithic.

Introduction

Organic deposits at Dozmary Pool preserve the most complete Holocene pollen sequence yet known from Bodmin Moor, and provide a key record of the vegetational history of South-West England for this period. Dozmary Pool is a reference site for interpreting more discontinuous Holocene pollen sequences found elsewhere in the region, for example, at Parsons Park, Stannon Clay Pit and Hawks Tor. The site was first referred to in an archaeological context by Whitley (1866), Brent (1886) and later by Robson (1944). The pollen biostratigraphy has been studied by Conolly *et al.* (1950), Brown (1972, 1977, 1980) and Simmons *et al.* (1987). Evidence from the site was also discussed by Caseldine (1980) and Bell *et al.* (1984) in reviews of environmental change in Cornwall during the last 13 000 years.

Description

Dozmary (Dozemare) Pool GCR site [SX 192 743] lies on Bodmin Moor at *c.* 265 m OD, some 4.5 km east of Hawks Tor (Figure 4.1). The pool occupies a peaty depression to the north-east of Gillhouse Downs between the Fowey and St Neots rivers: the GCR site consists of a rectangular bog (*c.* 300 m x 150 m) situated at the south-west end of the lake where there is a small outlet stream (Figure 4.17). This raised mire has a vegetation community of *Eriophorum vaginatum, Rhynchospora alba, Erica tetralix, Calluna vulgaris, Molinia caerulea, Juncus effusus* and *Narthecium ossifragum.* The sediment sequence comprises *c.* 2.5 m of lake muds, sedge and fen peats topped by decreasingly humified raised bog peats. Conolly *et al.* (1950) recorded the following stratigraphy from a core of the deposits:

7. Non-humified fresh peat (0.72 m)

6. *Sphagnum–Eriophorum* peat with lake mud at base (0.23 m)

5. Moderately humified *Sphagnum–Calluna* peat with layers of ash and charcoal (0.90 m)

4. *Sphagnum–Eriophorum* peat and some organic mud (0.23 m)

3. Brown and black organic lake muds (0.23 m)

2. White lake mud (0.30 m)

1. Dark brown lake mud with *Phragmites* (0.10 m)

Brown (1977) recorded a deeper profile, with the following stratigraphy:

9. Coarse, non-humified *Sphagnum/ Eriophorum vaginatum* peat (0–64 cm)

8. Slightly humified *Sphagnum/Eriophorum vaginatum* peat (64–77 cm)

7. Coarse, non-humified *Sphagnum/Eriophorum vaginatum* peat with angular quartz gravel (< 1 cm diameter) at 80–85 cm (77–93 cm)

6. Blackish, well-humified *Sphagnum/Eriophorum vaginatum/Calluna* (raised bog) peat with carbonized material throughout, and charcoal fragments in distinct bands at 146, 154, 170 and 175–180 cm; large chunks of burnt peat at 145–150 cm. *Calluna* flowers, leaves and twigs frequent throughout (93–188 cm)

5. Highly humified monocotyledonous peat with fresh wood fragments at 190, 193 and 197 cm; thin black band at 198 cm; frequent minute carbonized fragments throughout, fungal perithecia frequent in the upper half of the bed (188–207 cm)

4. Highly humified sedge peat with abundant fresh *Salix* wood; *Carex* nutlets are frequent at the top and *Juncus* seeds at the base (207–215 cm)

3. Medium and fine muds with a fibrous layer at 220 cm and dark band at 223 cm; *Juncus* seeds frequent throughout. *Carex* nutlets, *Littorella uniflora* and *Hydrocotyle vulgaris* fruits, *Menyanthes trifoliata* seeds occasional towards the base (215–224 cm)

2. Fine, very silty mud; megaspores of *Isoëtes lacustris* and *Isoëtes echinospora* abundant; oospores of *Nitella* type, *Elatine hexandra, Luronium natans,* and *Juncus* seeds occasional; *Potamogeton natans* fruits rare; *Sphagnum* leaves present (224–235 cm)

1. Kaolin clay (below 235 cm)

Although Simmons *et al.* (1987) recorded a slightly deeper profile, their stratigraphy is essentially similar to that given by Brown (1977) (see above), although they do not record the highly humified sedge peat with abundant *Salix* wood (bed 4). Brown's stratigraphic sequence is given here in preference because his reconstructed pollen assemblage zones cover most of beds 2–6. Simmons *et al.* (1987), on the other hand, concentrated their pollen analyses on beds 5 and 6 only: the muds (beds 2 and 3), the sedge peat (bed 4) and the upper peats (beds 7–9) were not analysed. Brown's pollen analyses were supported by five radiocarbon dates (Q–1021 to Q–1025). Five additional radiocarbon dates (HAR–5077 to HAR–5080 and HAR–5083) for the profile were provided by Simmons *et al.* (1987).

Interpretation

Artefacts

First mentioned in the scientific literature by Whitley (1866), Dozmary Pool attracted archaeological attention: over 100 'very perfect flint-flakes' were recovered from around the site, mainly from the uppermost soil layers. Brent (1886; pp. 60–61) remarked that

'Although no traces of Lake Dwellings could be observed when Dosmare Pool was entirely dry in the summer of 1866, yet the presence of hut-circles, barrows, &c., on the surrounding moor; the five 'Kings' Graves', one since destroyed, on Bron Gully; and the vast quantity of flakes, pieces, and some arrowheads from the peat; would indicate that there was once a large population in this interesting district.'

Robson (1944) noted that 'Neolithic' flints occurred beneath the peat at Dozmary Pool, thereby proving the 'recent formation of the peat'. More up-to-date accounts of the microlith assemblages were given by Wainwright (1960) and Jacobi (1979). Wainwright described the microliths found at Dozmary (mostly during the nineteenth century) which have now been dispersed to various museum collections, including 2500 flints to Plymouth Museum alone: their original stratigraphic provenance is unknown. Brown (1977) recorded burnt peat within the sequence (his bed 6) immediately prior to the 'elm decline' (see below). He therefore argued that the microliths might be late Mesolithic in age. Jacobi (1979), on the other hand, has linked the microliths from Dozmary with an assemblage from Thatcham in the Kennet Valley, suggesting an early eighth millennium date, namely very early Mesolithic. Such an age would place the Dozmary flints in a period when pollen shows that *Empetrum* heath and juniper scrub grew on the gentle local hillslopes, and before the spread of birch woodlands. Such a view implies that the microliths either come from, or can be correlated with, a very much earlier deposit in the sequence than suggested by Brown (1977) (Simmons *et al.,* 1987).

Pollen biostratigraphy and radiocarbon dating

Conolly *et al.* (1950) provided an arboreal pollen diagram based on analyses in their beds 3–5 and from the lower layers of bed 6. The diagram follows the standard zonation with full detail for Pollen Zones VI–VII, and parts of Zones V and VIII. They noted that it was likely that the top metre of peat (beds 6 and 7) was formed in Pollen Zone VIII: there was also an ample depth of mud (beds 1 and 2) beneath the lowest counted sample to record the vegetation history in Pollen Zone IV and the earlier part of Zone V. The incompletely analysed record for Pollen Zone V (in bed 3) shows birch and hazel to be dominant: the latter, however, declines rapidly towards the end of the zone. The upper part of bed 3 (lake mud) and most of bed 4 (peat and lake mud) contain an arboreal pollen assemblage characteristic of Pollen Zone VI — with a rapid decrease in birch and the progressive invasion of oak. Alder first becomes continuously represented in this zone while hazel maintains steady values. A Pollen Zone VII assemblage occurs in the very lowest part of bed 4 and throughout bed 5 (moderately humified peat). This shows the progressive decline of birch to low but stable levels, the continued increase of oak and the steady maintenance of alder and hazel in the developing mixed deciduous forest. Conolly *et al.* (1950) further noted that the layer of ash and charcoal in bed 5 (Pollen Zone VIII) probably reflected the activities of prehistoric humans in clearing the local forests.

Brown (1972, 1977) reinvestigated the pollen biostratigraphy of the site, providing detailed evidence (absolute pollen frequencies) for the vegetation history of the beds which had previously yielded Pollen Zone VI and VII assemblages (Conolly *et al.,* 1950): a summary of this work was given by Brown (1980). His work covers an important gap in the existing site record — namely the early Holocene.

According to Brown (1977), the basal silty muds (his bed 2) started to accumulate at *c.* 9053 ± 120 BP (Q–1021), and are characterized by a local pollen assemblage zone dominated by grasses. Pollen and plant macrofossil evidence confirms that deposition took place in a shallow, clear-water, base-poor lake with a gravelly bed. The high grass and low tree pollen values, together with a rich herb flora, show that the early Holocene landscape was open, dominated by a short-turf grassland, with trees limited to only small areas or more continuously distributed at some distance (Brown, 1977).

A second pollen assemblage zone (DP2), found in beds 2 and 3, consists of an early Corylus–Gramineae zone with a subsequent Cyperaceae subzone (Brown, 1977). The first stage of a hydroseral succession is shown by increasing Cyperaceae values, the occurrence of *Carex* nut-lets in the mud, the appearance of abundant *Sphagnum* spores and the disappearance of most aquatic pollen. This indicates that open-water conditions were gradually replaced by a *Carex/Sphagnum* mire which formed above the local water-table, and that Dozmary Pool itself was reduced in area shortly after 9000 BP in response to drier conditions (Brown, 1977). Elm pollen appears in the profile for the first time at a level dated by radiocarbon methods to 8829 ± 100 BP (Q–1022). A persistence of herb and grass pollen was taken to indicate the limited extent of the local woodland, which was perhaps restricted to sheltered valleys (Brown, 1977).

Local pollen assemblage zone DP3 (bed 4; humified sedge peat with *Salix* wood) is broadly similar to the preceding subzone, although *Salix* pollen reaches high values in the lower part of the wood peat: together with higher levels of birch pollen, and the occurrence of *Salix* wood itself, the evidence points to a mixed tree layer forming fen carr in the immediate vicinity (Brown, 1977).

The succeeding pollen biozone (DP4) is marked by high *Corylus,* with a *Calluna* subzone (DP4a): it spans the upper part of the wood peat laid down in a fen carr (bed 4) and the majority of bed 5. Following an initial persistence of birch/willow-dominated fen carr, dated to *c.* 7925 ± 100 BP (Q–1023), the carr was swamped by active mire growth as shown by high *Sphagnum* frequencies and the appearance of *Calluna* pollen (Brown, 1977). This zone is also characterized by a sparse but varied herb flora, fern spores and increasing Gramineae values. Oak and elm values are also higher and are taken as showing the continued spread of open woodland to well-drained hillside locations.

Zone DP5 and its subzone DP5a span the upper part of bed 5 (highly humified peat) and the base of the dark *Sphagnum/Eriophorum/Calluna* peat (bed 6). A radiocarbon date of 6793 ± 70 BP (Q–1024) from the upper layers of bed 5, provides a maximum age for the sediments covered by pollen assemblage zone DP5. This characteristic hazel/fern biozone sees a peak in grass and birch pollen early in the zone (DP5). Fluctuations in the pollen curve in this zone, and the appearance of ferns, may indicate the restriction of the woodland on better soils by fire (Brown, 1977). Pollen assemblage zone DP5 may well cover the driest period in a climatic regime which had improved continuously since the opening of the Holocene some 3000 years earlier.

Calluna/Alnus subzone DP5a commences at 6451 ± 65 BP (Q–1025): the lower boundary of the zone corresponds with the base of the raised bog peat (bed 7). The appearance of alder for the first time in this zone reflects the development of alder carr around the mire, together with *Fraxinus* and *Tilia cordata.* Brown has argued that the presence of these trees shows the onset of a mild, but wetter, climate as does the ensuing development of the raised bog itself. Indeed, a general recession of woodland is indicated as waterlogging of local sites progressed (Brown, 1977).

Brown did not provide a detailed analysis of pollen present in the remainder of the beds (upper bed 6 and beds 7–9): the likely biozonation of these beds is, however, thought to conform with analyses carried out on comparable beds at nearby sites (e.g. Hawks Tor and Parson's Park) (Brown, 1977). Radiocarbon dates were not attempted from the upper peats at any of these sites due to the likely effects of modern rootlet contamination (Brown, 1977). It is assumed, on the basis of preliminary pollen work and on inter-site correlation, that the 'elm decline' is manifest in bed 6 in the Dozmary Pool record somewhere between 120–160 cm (Brown, 1977).

From the pollen and plant macrofossil evidence given by Brown (1972, 1977, 1980), the course of vegetation development and hydroseral succession, right up to and including the climatic optimum of the Boreal period, is clear. Initially, the Dozmary area was occupied by a base-poor clear lake. This was partially replaced by a sedge and *Sphagnum* mire, then by birch and willow carr and finally by raised bog. The latter may have been caused by the local development of fen carr near the present lake outlet. This would have impeded drainage from the lake (Thurston, 1930; Brown, 1977) which may indeed have been present continuously in the vicinity, albeit in varying size, since the Late Devensian (Brown, 1977).

Other salient features of Brown's pollen diagram, which covers the early and middle Mesolithic periods only (between *c.* 9000 and 6500 BP), include the maintenance of some open ground at this altitude throughout the period, and a tendency towards treelessness in the later part covered by the diagram. The latter coincides with increases in bracken spores and the pollen of grasses and *Potentilla.* He has argued that fluctuations in the pollen record at *c.* 6541 ± 75 BP (Q–1025) may indicate the restriction by fire of oak and elm, with a corresponding rapid spread of birch, ferns and grasses. He has correlated these changes with evidence from Dartmoor (see Blacklane Brook) where a record of forest recession, similar rises in fern spores and grass pollen, have been taken to indicate forest clearance by Mesolithic inhabitants (Simmons, 1964a). Brown has suggested, however, that such deliberate woodland clearance would have been unnecessary on Bodmin Moor where, at this time, the pollen evidence reveals an already open landscape.

It is against the background of Brown's work that Simmons *et al.* (1987) subsequently concentrated their pollen analyses on beds 5 and 6, where they judged the fluctuating conditions associated with Mesolithic activities to be present. All the vegetational changes recorded within this part of the sequence fall within a single local pollen assemblage zone (Simmons *et al.,* 1987).

Generally low total tree pollen percentages, together with sporadic occurrences of a range of herbs and open-land indicators, point to the persistence of some unwooded land in the vicinity of the site throughout the period (Simmons *et al.,* 1987). Some large fluctuations in the relative pollen contributions of trees, shrubs, small (ericaceous) shrubs and herbs do occur, with a major fluctuation between 209 and 203 cm in an equivalent of Brown's bed 6, coincident with much charcoal and mineral matter. Oak is dominant in the tree pollen record throughout: *Alnus* is lacking in the lowest samples (bed 5) but rises steadily before fluctuating and finally rising again to reach similar values. Pine is not judged to have been a constituent of the woods on Bodmin Moor during the period covered by the diagram constructed by Simmons *et al.* (1987). Elm pollen is generally low and is probably absent where charcoal is found in bed 4 at 205 cm (Simmons *et* al., 1987).

Although the oldest radiocarbon date of 7590 ± 100 BP (HAR–5083) falls between Brown's (1977) dates of 7925 ± 100 BP (Q–1023) and 6793 ± 70 BP (Q–1024) derived from similar monocotyledonous peat (bed 5), covered by an equivalent pollen assemblage zone (Brown's DP4), the other radiocarbon dates given by Simmons *et al.* pose considerable problems of interpretation: these dates are not arranged in the expected chronological order in the profile. Since sample contamination is considered unlikely, the radiocarbon dates proba bly show that the site here was not disturbed by fire alone, but by the physical removal of peat and the inversion of the profile: this may have been on two separate occasions — at least as recently as *c.* 2740 BP in the case of the lower disturbance, and 510 BP for the upper. Alternatively, and more likely, both apparent disturbances may have happened simultaneously after the latter date. Considerable fluctuations in the pollen, charcoal and mineral contents at the 201–209 cm-levels lend much support to the latter view (Simmons *et al.,* 1987).

Dozmary Pool is a reference site for upland vegetation history in South-West England with one of the most extensive Holocene pollen records in the region. It is a member of a network of pollen sites in Britain which shows regional and altitudinal variations in the course of vegetation succession, and is particularly important for demonstrating the effect of oceanicity — that is, a local climate dominated by exposure to wind and rain — on vegetation development. In this respect, the vegetation record from Dozmary Pool shows strong similarities with sites on the western fringes of Britain and indeed areas on the seaboard of continental Europe, but contrasts with other inland and montane sites (Brown, 1977). In particular, the strong record of birch throughout the Holocene, as shown in part from the evidence at Dozmary Pool, contrasts markedly with other parts of southern England and even Dartmoor: its persistence here may be ascribed to its survival in a very open landscape, one maintained by exposure to the elements rather than by human activity (Brown, 1977).

Similarly, both on Bodmin Moor and on Dartmoor, oak is believed to have invaded rapidly, and although it never completely covered the uplands, being restricted by the lack of shelter, it soon reached its maximum extent to become the dominant tree species (Brown, 1977). Its rapid domination of the landscape may have been facilitated by the extensive areas of grasslands, open birch woods (see above) and immature hazel scrub which covered the uplands and which offered little competition for the advancing oak populations (Brown, 1977). Again, the open landscape is believed to have been strongly influenced by the oceanicity of the climate.

On the other hand, *Pinus* does not seem to have been a major constituent of the early forests of the South-West. Evidence from Dozmary Pool (and elsewhere) shows that it was absent on the moorlands of the South-West (Brown, 1977), although it may have been present at lower altitudes and in more sheltered southern coastal locations (Ussher, 1879c; Clarke, 1970). In this respect, the evidence from Dozmary Pool shows strong similarities with sites in Brittany (van Zeist, 1963; Brown, 1977). Elsewhere in the British Isles, *Pinus* spread rapidly north-westwards in response to the improving climate of the early Holocene. Where *Pinus* was not established, as in South-West England, hazel and oak expanded rapidly (cf. south-west Ireland and Northern Ireland). Brown (1977) has argued that the oceanicity of the Atlantic seaboard in these parts of Europe put *Pinus at* a disadvantage when in direct competition with *Quercus* as the climate improved. It is possible that light-demanding pine seedlings were quickly shaded-out when birch arrived (Brown, 1977), although the precise requirements of different genera are still poorly understood and must be established before definitive statements can be made about regional variations in forest composition (for discussion of these problems see Jessen, 1949; Iversen, 1954; Jones, 1959; Planchais, 1967; Carlisle and Brown, 1968; Bennett, 1989; Bennett and Birks, 1990).

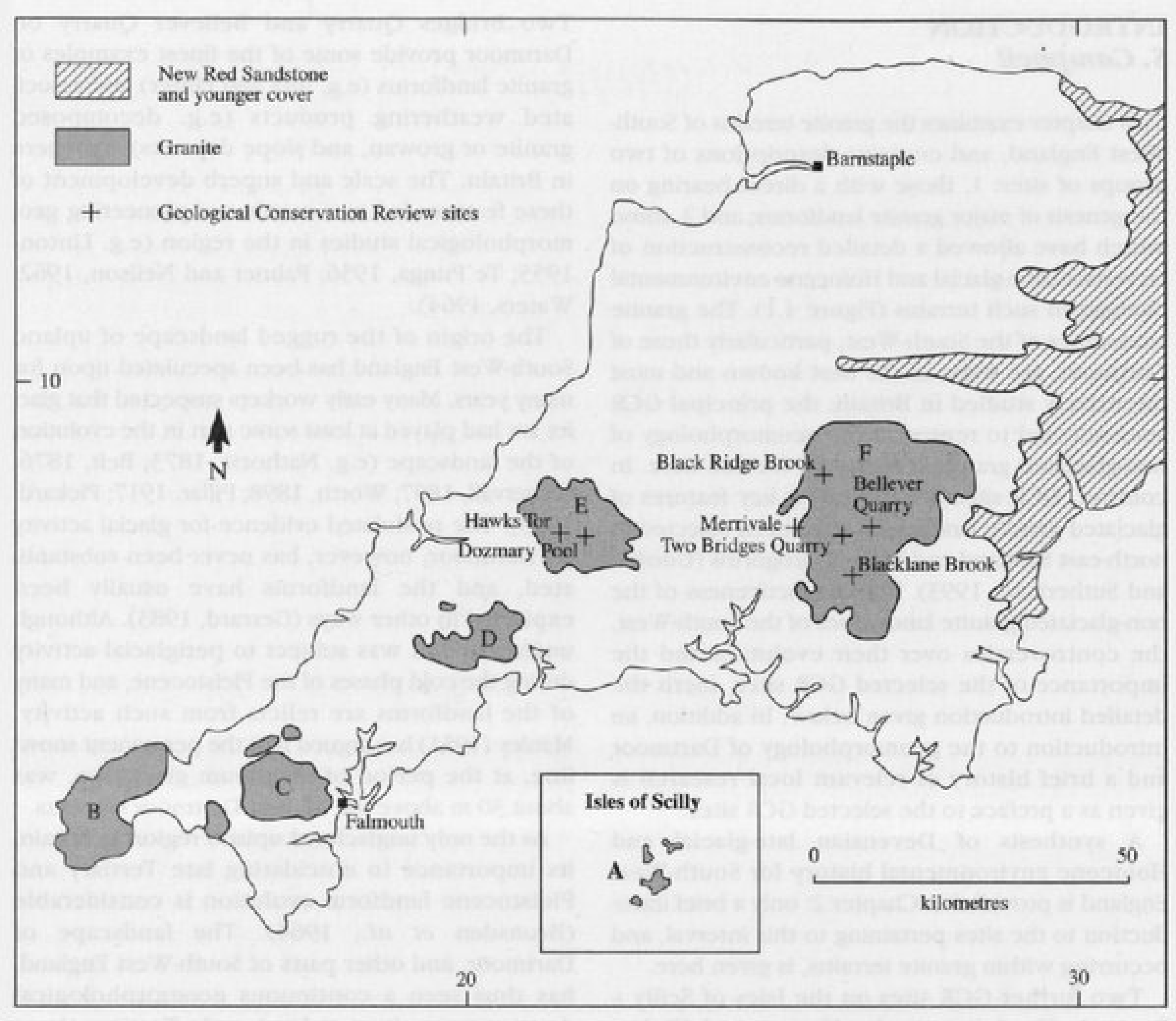
Another important regional contrast exhibited by the pollen evidence from Dozmary Pool concerns the relative expansions of oak and elm in Britain during the early Holocene. Mitchell (1951) has shown that elm tended to expand in calcareous areas first, and this is clearly shown by pollen records from the calcareous areas of southern England where *Ulmus* either expanded before or simultaneously with *Quercus* (e.g. Seagrief, 1959, 1960; Seagrief and Godwin, 1960). Farther west in South-West England, on the other hand, oak expanded before elm, and this was clearly a result of the acidic upland soils, particularly those on Dartmoor and Bodmin Moor (Brown, 1977). The unbroken record of vegetation succession in Pollen Zone VII at Dozmary Pool is particularly important: it is almost certainly due to the continuously adequate water supply at the site, allowing anaerobic preservation throughout the climatic optimum of the Holocene (*c.* 7900–6500 BP). This contrasts with Hawks Tor and Parsons Park where the mires dried out at this time, fossil (pollen) preservation ceased, and where erosion probably occurred (Brown, 1980). Retention of water sufficient to form a lake and support the growth of a mire at Dozmary Pool during the driest (Boreal) period, may have been promoted by the restricted drainage outlet (see above), and may also have been a function of the greater annual rainfall which would have been received at these higher altitudes (Shorter *et al.,* 1969). In any event, Dozmary Pool contains arguably the most complete Holocene pollen sequence on Bodmin Moor with an unbroken pollen/sediment sequence through Pollen Zones V and VI, although this evidence has been supplemented recently by archaeological and palynological data from Rough Tor on Bodmin Moor (Gearey and Charman, 1996). The evidence from Dozmary Pool has been instrumental in revealing the existence of unconformities in other regional profiles which date approximately from this time (see Hawks Tor and Blacklane Brook). The pollen stratigraphic record from Dozmary Pool is therefore a key to the interpretation of more abbreviated sequences found elsewhere in upland South-West England.

The potential of the site for assessing the extent of Mesolithic activities in the area has not, unfortunately, been realized from the pollen evidence, although it will remain central to resolving the controversy, and may provide complementary evidence to the Rough Tor site in this respect (Gearey and Charman, 1996). The apparently continuous pollen record from a peat sequence containing Mesolithic flints and charcoal, provides great scope for elaborating the patterns and timings of various postulated Mesolithic clearances in the area. The most recent study of these phenomena was severely hampered by unforeseen disturbances to the peat profile at the chosen sample point. Although positive evidence of Mesolithic clearance, as interpreted from pollen sequences on Dartmoor (Blacklane Brook and Black Ridge Brook), cannot yet be demonstrated at Dozmary Pool, the evidence afforded from the most recent study here has wide implications. The evidence from Dozmary Pool suggests that stratigraphical and pollen data from cores alone, especially where no peat faces are available, may provide misleading results: the disturbances and inversion of parts of the Dozmary profile were not visible in the sample core. Only the radiocarbon evidence reveals the scope of the problem and highlights the need for detailed radiocarbon calibration for all pollen biostratigraphic studies carried out on core material. It is possible that the disturbances noted at Dozmary Pool are localized: further pollen work with additional radiocarbon dates may well prove the extent of disturbance and reveal the true importance of anthropogenic factors on the regional vegetation history.

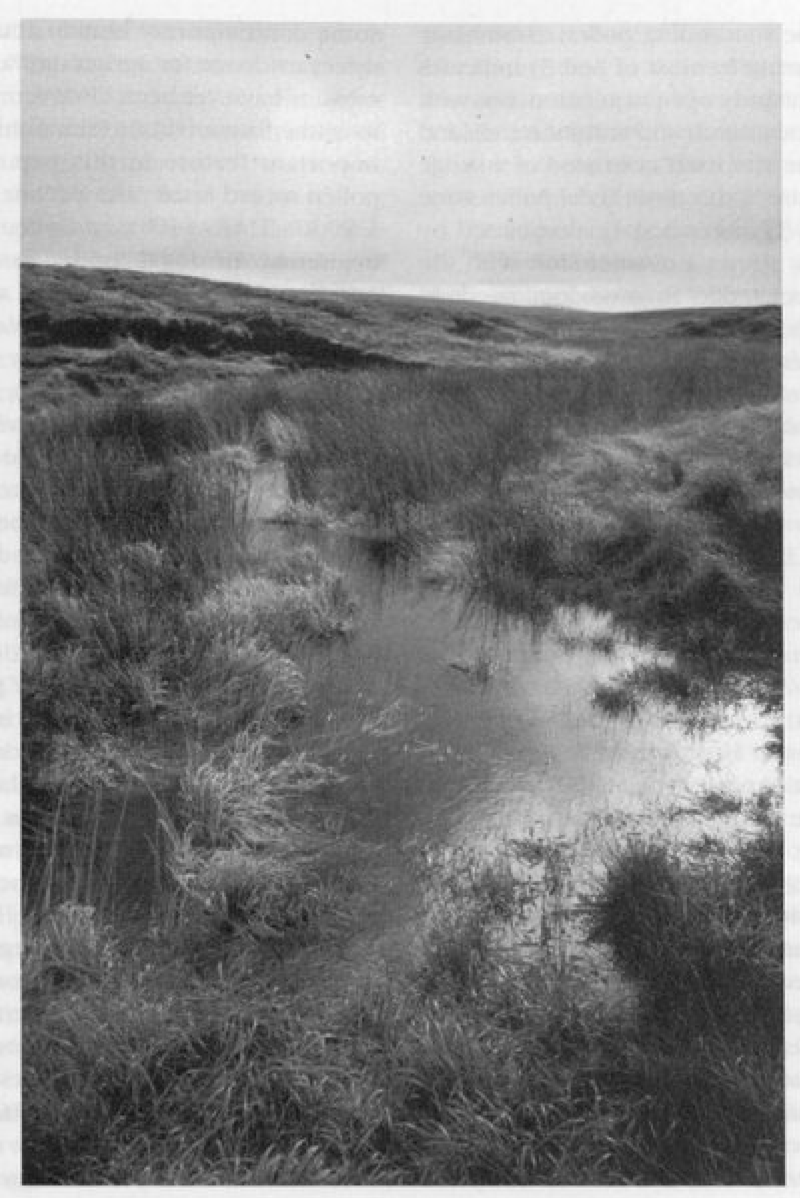
Conclusion

Peat and lake muds at Dozmary Pool preserve the fullest record of changing Holocene environmental conditions on Bodmin Moor. This radiocarbon-dated sequence, and that of Blacklane Brook on Dartmoor, together provide some of the best available Holocene vegetational and inferred climatic records for upland South-West England. The conservation value of this GCR site stems not only from the unusual combination of archaeological and stratigraphic evidence, but from the apparently continuous sedimentary record which spans the driest (Boreal) part of the Holocene, a time when water supplies at other sites were inadequate to allow continued peat growth and pollen preservation. The pollen record demonstrates very clearly that the vegetation of Bodmin Moor developed throughout the Holocene in response to exposure to the elements, and a generally open, sparsely wooded landscape is indicated. Although there is clear archaeological evidence for anthropogenic activities at the site, the relative roles of climatic change and human interference in vegetational development are not entirely clear from the site evidence. Recent studies here, using radiocarbon dating methods, demonstrate very clearly the potential pitfalls of interpreting pollen data from borehole cores without the use of such calibration.

References



(Figure 4.1) Location of GCR sites in relation to: A, Isles of Scilly Granite; B, Land's End Granite; C, Carrunellis Granite; D, St Austell Granite; E, Bodmin Moor Granite; and F, Dartmoor Granite. (Adapted from Floyd et al., 1993.)



(Figure 4.17) The peat bog at the south-west end of Dozmary Pool, Bodmin Moor. (Photo: S. Campbell.)