Crose Mere

[SJ 430 306]

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Introduction

Crose Mere is an important site for reconstructing the Devensian Late-glacial and Holocene vegetation and environmental history of the north Midlands. The mere is typical of the many shallow depressions (the 'mosses and meres') of this part of Shropshire and its pollen record provides important comparisons both regionally and nationally. Beaks (1980) obtained a sediment core from beneath the deepest part of the lake and used this to reconstruct the Late Devensian and Holocene vegetational history of the area surrounding the mere. Pollen analysis was used to determine changes in the vegetation and radiocarbon dating of organic deposits was used to provide geochronological control on the timing of these events. Overall, the pattern and timing of vegetational change at Crose Mere show close similarities with those obtained from other sites in the north-west of England. Barber and Twigger (1987) have considered Crose Mere in part of their wider discussion of the Late Quaternary vegetational history of the Severn Basin, and Twigger (1988) and Hobby (1990) provide overviews of the palaeoecology of Shropshire as a whole. Details of the modern vegetation communities at the site are given by Sinker (1962). The general limnology and water chemistry of Crose Mere are described by Gorham (1957). The phytoplankton of the mere has been described in a series of papers (Reynolds, 1971, 1973a, b; Reynolds and Reynolds, 1985). Finally, the modern invertebrate community of the mere has been documented by Harrison and Hildrew (1998).

Description

Crose Mere is located 6 km to the south of Ellesmere in Shropshire. In this area are numerous shallow depressions, many of which are developed on an irregular topography composed of glaciogenic deposits. This irregular terrain traditionally has been interpreted as part of an end moraine complex extending from Ellesmere to Bar Hill, probably associated with the recession or a minor readvance of the Late Devensian ice-sheet in this area (Boulton and Worsley, 1965; Worsley, 1969; Shaw, 1972b). Crose Mere is typical of the lakes associated with the Ellesmere-Bar Hill moraine. It is a shallow dimictic lake, with an overall area of 15.2 ha and a maximum water depth of 9.2 m (Beales, 1980). Underlying the lake deposits are (from top down): glaciogenic sands and gravels, till, and Triassic bedrock.

Together with Whattall Moss and Sweat Mere, Crose Mere is part of a complex of three lakes. There is some evidence of a recent lowering of the levels of these meres. In 1864, drainage operations at the site yielded an iron-fashioned oak dug-out canoe in Whattall Moss, similar to one from Breconshire attributed to Roman times (Fox, 1926). This has been taken as evidence for open water conditions in the area at the time. The 1864 drainage operations caused a drop in the water level of Crose Mere of 2 to 3 m (Hardy, 1939). A ditch of unknown age crossing the gravel ridge that separates Crose Mere from Whattall Moss indicates that at some point in the past Crose Mere was 2.5 m higher than its present 87 m OD (Peake, 1909). Chemical analyses show that the modern lake water is rich in $Ca2^+$ and HCO_3^-, with a conductivity of 300 to 400 µmho cm^{-1} (Gorham, 1957; Reynolds, 1973a). Bare ground covers the sandy south-east and stony north-east shores, whereas the remainder of the lake is typically reedswamp with limited areas of alder. The surrounding mosses, such as Whattall Moss, support pine–birch woodland, *Myrica gale, Deschampsia flexuosa, Vaccinium oxycoccos, Dryopteris* spp. and *Sphagnum* spp. (Sinker, 1962).

The pollen diagram produced by Beales (1980) from coring of the lake bed at Crose Mere is shown in summarized form in (Figure 6.38). The core has been divided into 10 pollen assemblage zones (LPAZ) based upon pollen and spore content, each of which is given the local code CMCP.

CMCP-1 (612–598 cm) Gramineae–Cyperaceae LPAZ

Herb pollen is over 60% with Gramineae pollen the dominant type, followed by Cyperaceae, *Artemisia* and *Thalictrum.* Arboreal pollen is less than 15%, with some *Juniperus communis* pollen values over 10%.

CMCP-2 (598–563 cm) *Betula*–Gramineae LPAZ

Betula pollen values are 20 to 40%, with Gramineae over 30%. Cyperaceae pollen is less that 10%. Shrub pollen consistently exceeds 10%, with *Salix* and *Juniperus* the major contributors.

CMCP-3 (563–532 cm) Gramineae–*Betula*–Cyperaceae LPAZ

Herb pollen values are 60 to 80%, with Gramineae pollen 20 to 50% and Cyperaceae pollen 10 to 25%. Some *Artemisia* and *Rumex acetosella* pollen values exceed 10%. Shrub pollen is less than 10%, with *Salix* the major type.

CMCP-4 (532–516 cm) *Betula* LPAZ

Arboreal pollen (predominantly *Betula*) is 50 to 80%. *Salix* pollen is the dominant shrub type, with values of 5 to 15%. *Corylus* pollen is less than 1%. *Calluna vulgaris* and *Empetrum nigrum* show continuous curves. Herb pollen values are between 10 and 30%, with Gramineae dominant. *Filipendula* pollen values are more than 2%.

CMCP-5 (516–447 cm) *Corylus avellana* LPAZ

Corylus avellana pollen percentages are 50 to 75%, with diverse arboreal pollen present, including *Quercus* and *Ulmus.* Herb pollen is less than 10%.

CMCP-6 (447–407 cm) *Pinus sylvestris–Quercus* LPAZ

Pinus sylvestris pollen is 10 to 25% and *Quercus* pollen is consistently over 15%. *Alnus glutinosa* pollen also is present but less than 10%. *Ulmus* pollen exceeds 5%. *Tilia cordata* is present. *Corylus avellana* is the major pollen contributor (30 to 60%) and herb pollen is consistently below 2%.

CMCP-7 (407–274 *cm) Quercus Alnus glutinosa* LPAZ

Arboreal pollen is consistently 50% or more, with *Quercus* pollen values consistently 20% or greater and *Alnus glutinosa* pollen between 15 and 25%. *Pinus sylvestris* pollen is consistently under 5% and *Betula* is less than 10%. *Ulmus* pollen values vary, and *Tilia cordata* and *Fraxinus excelsior* pollen are continuously present. *Corylus avellana* pollen is over 30%. Herb pollen is less than 10%.

CMCP-8 (274–193 cm) Gramineae Pteridium *aquilinum* LPAZ

Herb pollen is 20 to 35% with Gramineae over 10%. Pteridophyte spores are 5 to 15%, with *Pteridium aquilinum* values over 5%. Arboreal pollen is less than 50%, with *Alnus glutinosa, Quercus, Betula* and *Pinus* the major contributors. *Calluna vulgaris* pollen is consistently over 1%.

CMCP-9 (193–146 cm) *Quercus–Betula* LPAZ

Quercus pollen levels are consistently over 20% and *Betula* values 5 to 25%. *Alnus glutinosa* pollen generally exceeds 15% and *Fraxinus excelsior* pollen ranges from 2 to 5%. Other arboreal pollen values are low. Herb pollen is diverse, but values are less than 20%, with Gramineae dominant.

CMCP-10 (146–11 cm) Gramineae–Cannabiaceae LPAZ

Herb pollen is 20 to 50%, with Gramineae 10 to 40%. Herb pollen is diverse with, *Cerealia*-type pollen consistently over 2% and *Plantago lanceolata* pollen 1 to 6%. Cannabiaceae pollen shows values over 15%. Arboreal pollen is less than 50%, with diverse types. *Picea* and *Acer* pollen are restricted to this zone.

Interpretation

The pollen diagram shows evidence for three temporal divisions in the environmental history of Crose Mere (Beales, 1980):

1. The Late Devensian (pre-10 300 years BP), comprising CMCP-1 to CMCP-3;
2. 10 300 to 5300 years BP, comprising CMCP-4 to CMCP-6;
3. 5300 years BP to recent times, comprising CMCP-7 to CMCP-10.

Late Devensian (pre-10 300 years BP)

During the Late Devensian there is a dominance of Gramineae and Cyperaceae pollen, indicating predominantly treeless conditions. High percentages of pollen and spores of wetland plants (*Sparganium*-type, *Typha latifolia, Potamogeton*-type and *Equisetum*) and plants often associated with wet conditions, such as Cyperaceae, in the basal layers suggest a dominance of the pollen rain by the local component and a low regional contribution. *Salix* also appears to be well represented locally. Upland areas of waterlogged ground also are possible. The maximum percentage of *T. latifolia* pollen and the occurrence of *Myriophyllum spicatum* suggest that the lake waters were relatively high in ions and drainage basin soils unleached. The calcium carbonate percentage is substantial initially. Dryland herb types are diverse, with *Rumex acetosella*-type the most abundant. The presence of pollen of *Saxifraga hypnoides*-type, *Epilobium, Artemisia, Ranunculus acris*-type, Rubiaceae, *Thalictrum* and spores of *Botrychium lunaria* indicates open grassland.

The herb pollen spectra above 610 cm in the core suggest a trend towards drier soils. Pollen percentages of Cyperaceae and wetland types are considerably lower and *Artemisia, Thalictrum* and Rubiaceae pollen increase. The abundance of *Artemisia* and the presence of Chenopodiaceae point to disturbed, well-drained soils, which is consistent with the sediment inorganic values, which are high throughout. *Helianthemum* (probably *chamaecistus*) pollen appears and is suggestive of short turf communities on well-drained soils. Throughout the Late Devensian there appears to be a steady increase in concentrations of Gramineae and *Betula,* representing climatic amelioration during and after the deglaciation of Shropshire.

10 300 to 5300 years BP

During the period 10 300 to 5300 years BP, there is a substantial increase in birch woodland around 10 310 ± 210 years BP. The fourfold increase in sediment organic content points to stabilizing drainage-basin soils, and early peaks of *Filipendula* and *Juniperus communis* are consistent with a climatic improvement. Although considerable, the *Betula* percentages need not indicate closed woodland, and other woodland indicators are rare. The appearance of *Ribes nigrum* pollen is, however, of interest. The depression of non-arboreal pollen percentages may represent a percentage effect with a greater influx of tree pollen, as herb pollen concentrations do not decrease. The more organic sediment may, however, imply a slower sedimentation rate. The diversity of herb types suggests persistent treeless areas, as does the presence of j*uniperus communis* pollen.

Increased *Salix* pollen percentages indicate considerable local willow scrub, probably in the vicinity of the lake. The subsequent decline in *Salix* pollen may not represent only a replacement of willow by birch, but also the development of *Betula–Salix* carr, as *Salix* is poorly represented by its pollen in such situations.

The expansion of *Quercus* and *Ulmus* pollen after *c.* 8800 years BP suggests the establishment of these trees in the regional vegetation. The sediment organic content increases and stabilizes, which is consistent with the development of a more closed forest system. The decline of *Betula* pollen percentages probably reflects competition with oak, although some of the decline possibly represents a percentage effect. *Corylus avellana* remains the dominant pollen type and it may exercise a considerable inertia to the establishment of mixed oak forest, representing a particular barrier to *Quercus.* It is possible that on suitable soils, developing *Quercus* woodland had a hazel understorey.

The expansion of *Pinus sylvestris* pollen percentages at 8502 ± 190 years BP to become the most abundant arboreal type by *c.* 7900 years BP suggests a substantial spread of pine into the area. On the continent and in south and eastern

England it clearly expands before *Corylus.* Its failure to do so in Shropshire may result from its slow dispersal and the relatively strong preferences of its seedlings, resulting in a potentially slow migration rate that possibly allowed it to be overtaken by competitors on the way north. *Pinus sylvestris* seedlings cannot regenerate under hazel, and even birch woodland provides a barrier.

The environment into which pine expanded is difficult to determine. Development in established mixed oak forest is unlikely. The slight increase in *Betula* percentages may indicate colonization of openings, caused either by fire or windthrow, but these openings are probably insufficient to explain the high pine pollen for over 1000 years duration. Drying out of waterlogged areas with an initial colonization by birch succeeded by pine provides a plausible explanation. An increase in sediment minerogenic content contemporaneously with the pine maximum would be consistent with a lowering of water levels and some marginal erosion. It is probable that pine occupied areas previously devoid of extensive woodland. Permanent soil deterioration is unlikely owing to the later increase of plants of richer soils.

The decrease of *Corylus avellana* pollen percentages probably reflects its restriction by expanding mixed oak forest, pollen production being considerably reduced by shading. The continued presence of the light-demanding trees indicates the persistence of openings in the canopy.

Alnus glutinosa pollen first appears *c.* 9000 years BP, but from the commencement of a continuous curve at *c.* 8150 years BP to the first value over 5% takes about 500 years and to the maximum plateau, where percentages reach 20%, takes a further 1000 years, although maximum concentration and deposition rates are reached slightly earlier. *Alnus glutinosa* can be restricted by late spring frosts or high winds, but the presence of suitable damp soils would seem the most important determinant of distribution in the region. Its slow expansion therefore can be related to lack of such soils, which is consistent with the expansion of pine during a phase of lower water-tables.

5300 years BP to recent times

A modification in forest composition is indicated at 5296 ± 150 years BP, with a decline of *Ulmus* pollen percentages and accompanying declines in *Alnus glutinosa* and *Tilia cordata,* and a rise in *Fraxinus excelsior. Ulmus* values fall from 9% to 1% in 30 cm (400 to 500 years). The main percentage increase is that of *Corylus avellana,* possibly representing a response to the removal of forest canopy or some replacement of *Ulmus.* Herb pollen percentages shown no significant increase and remain low. The *Pteridium aquilinum* spore curve becomes continuous and points to a more open woodland, as does the reappearance of *Calluna vulgaris* pollen.

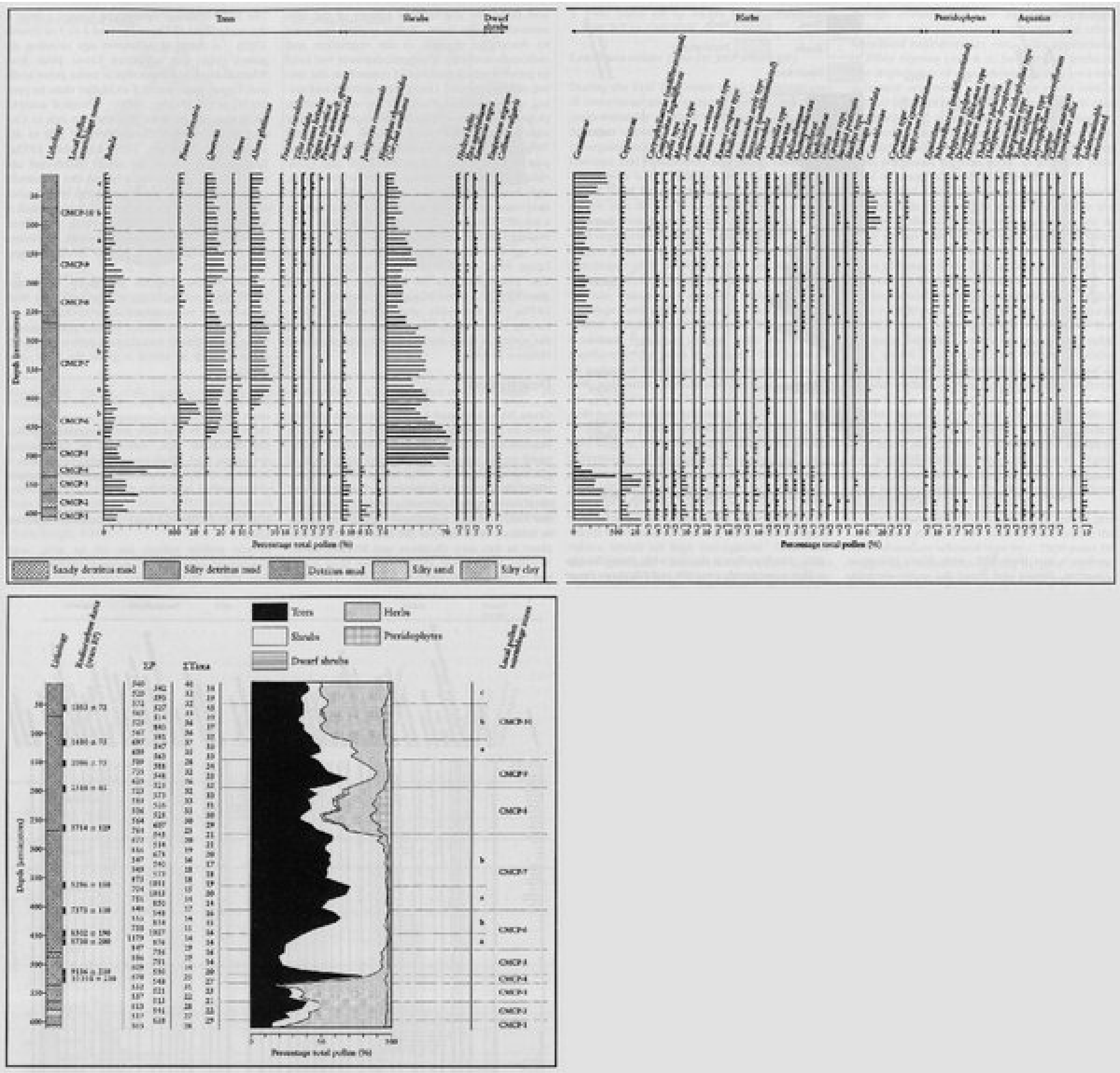
More conclusive evidence of openings in the forest canopy are provided by the small peaks of herb pollen after 303 cm. Percentages reach 7% at 287 cm in the core, coinciding with a further decline in *Ulmus* and *Tilia cordata* pollen percentages. Herb pollen types are not diverse, but include *Plantago lanceolata, P. major/P. media,* Chenopodiaceae, *Rumex acetosella*-type and *Ranunculus acris*-type. *Ilex aquifolium,* a tree favoured by high light intensities (Godwin, 1960b) whose pollen production is severely limited in forests, first appears in the pollen record. The appearance of *Lonicera periclymenum* and *Viscum album* and the start of a continuous curve for *Hedera helix* pollen also may be interpreted as a reflection of openings in the forest.

Beales (1980) considered this pattern of change and the lack of progressive deforestation to be consistent with a more settled form of agriculture of a homestead nature. Herb communities appear varied and pollen of plants of open and sandy soils and woodland continue to be represented.

Conclusions

The pollen diagram from Crose Mere represents the only pollen sequence from north Shropshire that includes the Late Devensian, the first from a site characterized by open water conditions throughout its history, and the only pollen record from this area with a long sequence of radiocarbon dates. The pollen record indicates that during the Late-glacial Pollen Zone I the area was treeless and dominated by grasses and sedges. During Zone II, tree birches expanded in the area but substantial frequencies of herbaceous taxa suggest the absence of closed woodland. In Zone III, frequencies of herbaceous pollen increased and grassland vegetation dominated. The early Holocene is dominated by arboreal pollen, before a sharp decline in elm at 5296 ± 150 years BP. The first significant human impact on vegetational composition appears around 3900 years BP, where the pollen record indicates a mainly pastoral economy with some cereal crops. Environmental reconstructions from Crose Mere therefore provide a framework within which shorter records from other sites in north Shropshire and Cheshire can be compared. Overall, the site provides valuable information regarding the nature and rate of vegetation change in the north Midlands from the Late Devensian through to the present day.

References



(Figure 6.38) Pollen diagram from Crose Mere, Shropshire (adapted from Beales, 1980).