Fen Bogs

[SE 853 977]

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Introduction

Fen Bogs, North Yorkshire is one of the deepest peat sequences in the British Isles, with a maximum depth of 11.2 m. The pollen stratigraphy has contributed evidence critical for understanding the Holocene vegetation history of the North York Moors. Atherden (1972, 1976a, b) first studied the stratigraphy and development of Fen Bogs, focusing upon the impact of people on the Holocene vegetation of the eastern North York Moors. The pollen sequence at Fen Bogs is a cornerstone of wider discussion of vegetation change in north-east Yorkshire (Jones *et al.,* 1979; Simmons *et al.,* 1993; Atherden, 1999). Research at Fen Bogs also has focused upon the finer detail of vegetation changes and climate change during the past 2000 years (Chiverrell, 1998; Chiverrell and Atherden, 1999, 2000).

Description

Fen Bogs developed in the deeply incised glaciofluvial channel of Newton Dale. Newton Dale is a former glacial drainage channel cut in a north-south direction across the Middle Jurassic central plateau of the North York Moors (Gregory, 1962a, b, 1965). The bog has formed at an altitude of 164 m on the watershed between Eller Beck and Pickering Beck, is 1.5 km in length, 0.3 km in width and covers an area of about 300 m2. The surface is flat and bordered by steep slopes rapidly rising 90 m on both the east and west sides. The stratigraphical development of Fen Bogs was determined by Atherden (1972, 1976b). Chiverrell (1998) focused upon stratigraphical changes in the top 3 m.

A composite stratigraphy for the centre of the bog is presented in (Table 8.10). The basal sequence reflects the early stages of peat inception, with well-humified peat-rich material and inorganic material overlying periglacial clays (beds 6–5). Alder, birch and willow fen woodland deposited peat sediments containing abundant woody remains (beds 4–3). *Phragmites australis* reed-swamp succeeded the fen woodland, and moorland plants (Ericaceae, *Eriophorum* and *Sphagnum*)became more abundant. The upper 1.4 m contains a change to a more ombrotrophic community typical of the present-day mire, with *Sphagnum* and *Eriophorum vaginatum* replacing *Phragmites australis* (Atherden, 1976b). After colonization by an ombrotrophic mire flora the changes in peat stratigraphy appear to identify fluctuations in mire surface wetness (Chiverrell, 1998; Chiverrell and Atherden, 1999). Borings from the bog margins encountered an in-wash stripe of pale grey clay that is attributed to increased erosion after *c.* 4720 ± 90 years BP (Simmons *et al.,* 1975).

Atherden (1972) first studied the pollen biostratigraphy at Fen Bogs and published a complete Holocene pollen diagram from the centre of the mire (Figure 8.46). The basal stratigraphy identifies the sequence of woodland colonization in north-east England during the early Holocene. Five radiocarbon dates secure the age of the vegetation sequence for the past 5000 years, and illustrate the impact that prehistoric and historic communities had upon the landscape. An undated pollen diagram sampled close to Atherden's original site contains an identical sequence of vegetation changes (Chiverrell and Atherden, 1999, 2000).

(Table 8.10) Peat stratigraphy at Fen Bogs, North York Moors (after Atherden, 1976a; Chiverrell, 1998).

Bed	Depth (cm)	Environment	Stratigraphy
1	0–140	Ombrogenous mire	Poorly humified *Sphagnum* and Monocotyledonous peat
2	0–140	Ombrogenous mire	Well-humified Monocotyledonous peat

3	140–600	*Phragmites* reed-swamp	Well-humified *Phragmites australis* peat, with occasional other mire plant remains (Eriophorum spp., Ericaceae and *Sphagnum*)
	600–820	Partially wooded *Phragmites* reed-swamp	Well-humified *Phragmites* peat, with occasional wood remains (*Betula, Alnus* and *Salix*)
4	820–920	Fen/Carr woodland mire	Well-humified wood peat, with *Betula, Salix* and occasional *Phragmites* remains
5	920–960	Mire inception	Well-humified peat rich with inorganic material
6	960–	Periglacial valley	Blue-grey clay solifluction deposits

Interpretation

Atherden (1976a, b) synthesized the vegetation development of the eastern North York Moors using the Fen Bogs pollen diagram (Figure 8.46). Peat deposition began during the early Holocene, with pollen zone FB1 dominated by *Betula, Pinus* and Cyperaceae. The basal sediments are undated, but clearly it pre-dates the arrival of the thermophilous trees before 8500 years BP during the early Holocene. In pollen zone FB2 the early dominance by *Betula* is relinquished in favour of a mixed coniferous– deciduous forest dominated by *Pinus* and *Corylus,* with *Quercus* and *Ulmus* appearing for the first time. The early Holocene sequence of woodland immigration is not dated at Fen Bogs. Extensive research across the moors has dated key events in the pollen biostratigraphy — including the *Corylus* rise *c.* 9000 years BP and the *Alnus* rise *c.* 7500 calibrated years BP at Seamer Carr (Vale of Pickering) and West House Moss in Eskdale (Jones, 1977b; Cloutman, 1988a, b; Day, 1995).

Woodland pollen frequencies peak in FB2 and decline in the subsequent FB3, probably reflecting local expansion of mire communities (Chiverrell and Atherden, 1999). The middle Holocene landscape was covered with *Quercus, Corylus* and *Alnus* woodland, with *Ulmus, Tilia* and *Fraxinus* significant components of the forest (FB3 and FB4). There is considerable evidence for woodland disturbance by nomadic Mesolithic people elsewhere on the moors — for example North Gill and Bonfield Gill Head (Simmons and Innes, 1988a, b). It appears likely that the combination of early peat inception and Mesolithic woodland disturbance produced a scrubby open-work woodland cover, interspersed with moorland and open-ground communities perhaps producing the lower tree pollen frequencies in FB3 (Simmons and Innes, 1988a; Chiverrell and Atherden, 1999; Atherden, 1999).

The Elm Decline, widely documented at many British sites, is clearly seen at the top of FB3; it has been dated at Fen Bogs to 4730 ± 90 years BP. Pollen zones FB4 and FB5 are characterized by fluctuations in several pollen curves. Cyclic reductions in tree pollen and increases in ruderal and heliophytic taxa identify small temporary clearances. These temporary clearances begin in FB4, which is dated to the Neolithic between 4730 ± 90 years BP and 3400 ± 90 years BE The clearances increase in frequency during FB5, which is dated to the Bronze Age between 3400 ± 90 years BP and 2280 ± 120 years BP. Cycles of woodland clearance are in keeping with abundant archaeological evidence for human activity (Spratt, 1993). Neolithic settlement was concentrated in the southern North York Moors and there is abundant archaeological evidence for settlement and farming by Bronze Age communities (Spratt, 1993).

Pollen zone FB 6 contains the most substantial woodland clearance event at Fen Bogs, which is dated to 2280 ± 120 years BP. Woodland pollen frequencies decline to values equivalent to the present day, and there are increases in Poaceae and all other non-woodland taxa alongside the continuous presence of cereal pollen. The scale of the clearance reflects the establishment of permanent settlements encouraging sustained grazing pressure farther into the moors, preventing the regrowth of trees (Atherden, 1976a; Chiverrell and Atherden, 1999, 2000). The remaining trees may have been coppiced locally to sustain the charcoal needed for iron smelting, which would suppress pollen production. This Iron Age and Romano-British woodland decline was controlled by increased landscape pressure from farming activities arising from population expansion around and into the moors, perhaps combined with a more commercial approach to farming during Roman occupation of Britain (Chiverrell and Atherden, 1999).

Pollen zones FB7 to FB10 contain two phases of woodland regeneration separated by a further decline. All woodland taxa, but particularly *Betula* and *Corylus* recover in FB7, which is dated to between 1530 ± 130 years BP and 1060 ± 160 years BP This regeneration has been identified and dated at six sites across the North York Moors (Chiverrell, 1998; Blackford and Chambers, 1999; Chiverrell and Atherden, 1999). Woodland recovered perhaps owing to a reduced scale of agriculture linked to economic malaise in the aftermath of the Roman withdrawal from England. Towards the end of the first millennium AD, during FB8, tree species decline and Poaceae and cereal pollen increase, signifying increased agricultural endeavour. Vegetation changes during the Anglo-Scandinavian period reflect economic revival and population expansion, and these trends continue until a sharp increase in woodland taxa below the FB9 boundary.

The woodland recovery in FB9 starts below a radiocarbon date of 390 ± 100 years BP and research at an adjacent mire, May Moss, encounters a similar woodland recovery before *c.* 685 ± 50 years BP, probably during the 12–14th centuries (Chiverrell and Atherden, 1999). Causes of this minor woodland recovery could include the devastation in the wake of the 'harrying of the north' in AD 1069–1070 and demographic collapse during the 14th century owing to incidence of Black Death (Harrison and Roberts, 1989). Woodland decline and expansion of agricultural indicators during the 11–12th centuries and after AD 1500 (FB 8 and FB10) probably reflect concerted attempts to colonize upland Britain and to exploit marginal land for agriculture (Parry, 1976; Harrison, 1993).

The peat stratigraphy of Fen Bogs is dominated by *Phragmites australis,* revealing little environmental information other than the site was a wet upland valley fen. After the mire was colonized by an ombrogenous mire flora the stratigraphy yields useful palaeohydrological information, with the initial expansion of poorly humified *Sphagnum* peat reflecting this colonization. *Sphagnum* species decline between 130 and 95 cm, signifying drier surface conditions. The change to poorly humified *Sphagnum papillosum* at 95 cm indicates a wetter mire surface during FB8. Relatively wet conditions persist until the drier environmental indicator *Sphagnum* section *Acutifolia* replaces *Sphagnum papillosum* during FB9. This dry phase is short-lived, terminating with a return to wetter conditions evidenced by the replacement of *Sphagnum* section *Acutifolia* with the wet environmental indicator, *Sphagnum* section *Cuspidata.*

The sequence of moisture changes in the upper 1.4 m occurs entirely within the past 800–700 years and appears to parallel Little Ice Age climatic fluctuations identified at other peat sites on the moors (Chiverrell, 1998). The uppermost stratigraphy contains evidence of human interference, almost certainly related to the building of the Whitby to Pickering railway across Fen Bogs in 1836 (Statham, 1989). Mires are an easily damaged environment and this unprecedented scale of human activity on the western edge of Fen Bogs could quite conceivably have had a catastrophic impact on the hydrology and flora.

Conclusions

Fen Bogs is an important site because it has yielded a significant record of vegetational and environmental change during the last 10 000 years. Detailed pollen records coupled with radiocarbon dating demonstrate the landscape history of the North York Moors. The sequence is one of few dated pollen profiles focusing upon mid- and late- Holocene times. The sequence identifies the impact that Neolithic, Bronze Age, Iron Age and historic communities had upon the landscape of North Yorkshire. Correlation of vegetation history with archaeological and documentary records has given this site particular importance, because Fen Bogs has produced the region's most complete and thoroughly dated pollen diagrams.

References

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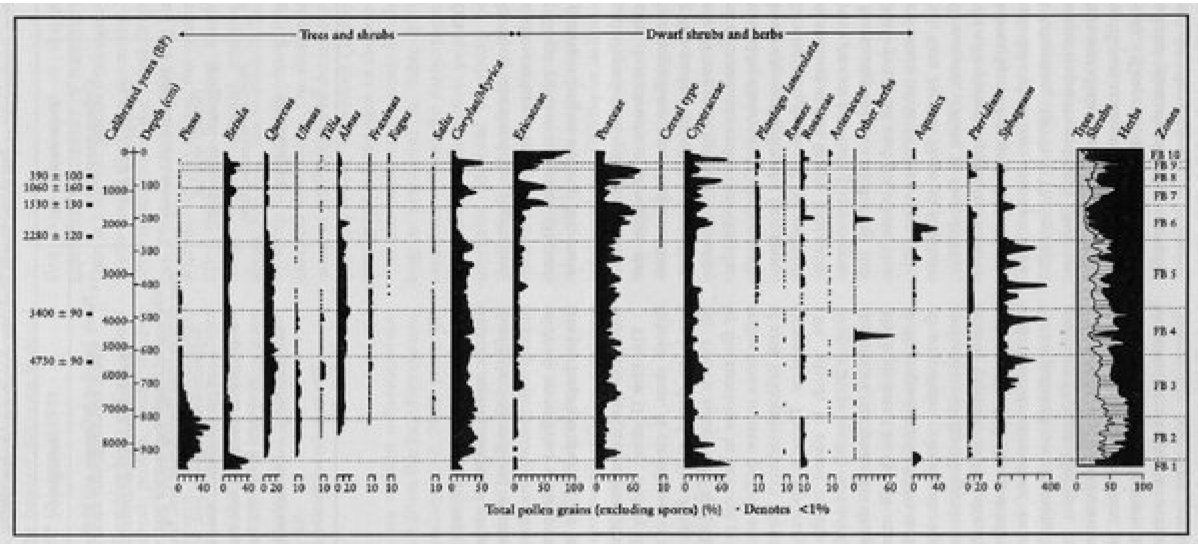

(Figure 8.46) Atherden's pollen diagram from Fen Bogs (after Chiverrell and Atherden, 1999).