Highcliffe

[SZ 195 927]-[SZ 199 928]

Introduction

Highcliffe (also sometimes known as 'Friars Cliff, Mudeford') is the type section for the Boscombe Sand Formation, which is an arenaceous deposit immediately below the Barton Clay. This is the only site known to yield abundant plant macrofossils from the Eocene Boscombe Sand Formation. Over 50 species have been reported and it is the type locality for 14 of them. For 11 species and 3 genera, this is the only known British locality. The flora includes a mixture of wetland and paratropical rain forest plants, and represents a transitional phase in the history of European Palaeogene vegetation.

Plant fossils here were noted first by Prestwich (1849), but for many years they remained unstudied, at least partly due to the difficulties of collecting significant quantities of fresh material. During the 1930s, however, the direction of outflow of the River Run changed, causing the cliff to be eroded at its base (Burton, 1931). For two years, the resulting cliff-falls allowed considerable quantities of material to be collected, but in 1935 another change in the river flow caused this to cease and since then collecting has been difficult. Most of what we know about this site comes from Chandler's (1963b) descriptions of the fossils collected then.

Description

Stratigraphy

Daley (in Daley and Balson, 1999) discusses details of the geology of this site. The exposed sequence consists of about 14 m mainly of sands, which have been interpreted as being prograding mouth-bars at the seaward end of a tidal channel (Plint, 1988). Dinoflagellate biostratigraphy (Costa *et al.,* 1976) suggests that the Boscombe Sands are the same age as the upper Selsey Formation further east, and are thus late Lutetian in age (see also Collinson, 1996b).

Palaeobotany

Chandler (1963b) gives details of the plant fossils that were found here. These include ferns, principally *Lygodium kaulfussii* Heer (Schizaeaceae), and the conifers *Pinus* sp., *Sequoia couttsiae* Heer (see footnote to (Table 8.2)) and *Cupressistrobus gardneri* Chandler. There are also conifer shoots originally described as '*Araucarites' sternbergii* Goppert but which may belong to *Sequoiadendron fordii* Chandler, 1978 (Chandler, 1978, p.36–40; see comments on *Araucarites'* in the Bracklesham GCR site report). However, the angiosperms were by far the most diverse components; those included are listed in (Table 9.1). The plant remains are mostly preserved as delicate compression fossils. Compared with some of the other Tertiary fruit and seed sites in southern England, the fossils here are sparse.

Interpretation

The Boscombe Sand flora belongs to the 'Late Middle Eocene floras' of Collinson and Hooker (1987), which they state to be poorly known. Highcliffe is the only known locality to have yielded abundant plant remains from these deposits. Lignites in the Boscombe Sands at Bournemouth have yielded some plant remains but they are poorly preserved (Chandler, 1963b). The flora is probably coeval with the basal Hengistbury Head assemblage (Chandler, 1960) and the upper Selsey Formation exposed at Bracklesham Bay (Collinson, 1996b), but these have not yielded anywhere near as diverse assemblages as Highcliffe.

Although not abundant, the plant fossils from Highcliffe are of considerable interest as they throw some light on the vegetational changes taking place in Europe during middle Palaeogene times. They represent the stratigraphically highest occurrence of several taxa of angiosperm, including *Rutaspermum rugosum, Toddaliospermum ornatum, Oncoba rugosa, Thymelaeaspermum bournense* and *Nyssoidea eocenica.* On the other hand, it yields the oldest known remains

of Cladiocarya foveolata, ?Gordonia truncata, Microdiptera parva and Epacridicarpum mudense. Ten species have not been reported from other localities in the British Tertiary: Scleriocarya tribracteata, Toddalia excavata, Grewia minima, Eurya mudense, Clethra hantonense, Sambucus mudensis, Cucurbitospermum mudense and three species of Carpolithus.

Two genera are unique as fossils to Highcliffe. *Scleriocarya* was established for fruits similar to those of the living razor-sedge (*Scleria*), but which differed in details of shape and surface from any living species. The record of *Grewia* was based on a single endocarp that is very similar to those of the fruits of the mainly tropical living genus of that name. Highcliffe is also the only British site to yield fossils of *Clethra*, although it has been recorded from Polish amber (Conwentz, 1886) and Danish Miocene deposits (Friis, 1985). Friis (1985) considered the inclusion of the Highcliffe species in *Clethra as* uncertain.

Chandler (1963b) regarded the assemblage as having more in common with the Ypresian, para-tropical rain forest vegetation than of the later Eocene and Oligocene floras. Some of the families found at Highcliffe (e.g. dogwood, flacourtia, moonseed and tea families) indeed suggest the surrounding vegetation had a tropical aspect. However, neither the mangrove palm *Nypa*, which forms such a characteristic element of the Ypresian fossil floras, nor '*Scirpus' lakensis* occur at Highcliffe (Collinson, 2000a). Also absent are many of the characteristic families of the Ypresian paratropical forests, such as the sumac, custard apple, dogbane, frankincense, icacina, laurel and soapberry families. The presence of some sedges, pondweeds, water lilies and frog's bits indicates that freshwater wetlands were already starting to become a dominant habitat in southern England. It would seem that the Highcliffe flora represents a transition between the Ypresian paratropical mangroves and rain forests, and the late Eocene wetlands, but with, on the whole, more in common with the latter.

Conclusions

Highcliffe is the only site known to yield a significant number of fossil fruits and seeds from the Boscombe Sand Formation, about 42 Ma old. The flora includes 11 species and 3 genera that are unique in the British Tertiary deposits. It reflects the transition between the paratropical rain forests of early Eocene times and the wetlands of late Eocene times, and is thus important for understanding the vegetational and climatic changes that were occurring in Britain during that time.

(Table 9.1). Composition of the angiosperm flora from the Boscombe Sand Formation, Highcliffe. Species are described in Chandler (1963b) unless otherwise referenced. Some are also discussed by Mai and Walther (1978, 1985) and Mai (2000). The family classification listed here is summarized in Chapter 1 of the present volume.

Family	Species							
Astinidianaa	Actinidia eocenica Chandler							
Acunidiaceae	<i>Saurauia crassisperma</i> (Chandler) Mai ¹							
Arecaceae	Calamus daemonorops (Unger) Chandler							
Betulaceae	Carpinus boveyanus (Heer) Chandler							
Boraginaceae	Genus? (?Ehretioideae)							
Caprifoliaceae	Sambucus mudensis Chandler							
Caryophyllaceae	Hantsia pulchra (Chandler) Chandler							
Clethraceae	Clethra hantonensis Chandler							
	Dunstania glandulosa (Chandler) Chandler, 1961c (see also							
	Chandler, 1963b) ²							
Cornaceae (including Mastixiaceae)	Eomastixia rugosa (Zenker) Chandler							
	Mastixia? glandulosa Chandler							
	Mastixicarpum crassum Chandler							
Cucurbitaceae	Cucurbitospermum mudense Chandler							
	Caricoidea obscura Chandler							
Cyperaceae	Scleriocarya tribrachteata Chandler							
	Cladiocarya foveolata Reid and Chandler							

Cyrillaceae ³	<i>Epacridicarpum headonense</i> Chandler <i>E. mudense</i> Chandler							
Epacridaceae	?Leucopogon sp.							
Flacourtiaceae	Oncoba rugosa Chandler							
Hydrocharitaceae	Stratiotes hantorzensis Chandler							
	<i>Microdiptera parva</i> Chandler							
Lythraceae	Palaeolythrum bournense Chandler							
Menispermaceae	Palaeosinomenium spp.							
Nymphaeaceae	Sabrenia chandlerae Collinson							
Nyssaceae	Nyssoidea eocenica Chandler							
	Potamogeton pygmaeus Chandler (see Collinson, 1983a)							
Potamogetonaceae	Limnocatpus forbesii (Heer) Chandler emend. Collinson							
-	1982a							
Rosaceae	Rubus acutiformis Chandler							
	Rutaspermum rugosum Chandler							
Rutaceae	Toddalia excavata (Chandler) Gregor ⁴							
	Toddaliospermum ornatum Chandler							
Solanaceae	Solanispermum reniforme Chandler							
Symplocaceae?	Genus?							
	?Clevera sp.							
	<i>Eurva dubia</i> (Chandler) Mai ⁵							
Theaceae	Eurva stiamosa (Ludwig) Mai ⁶							
	Eurva mudensis Chandler							
	?Gordonia truncata Chandler ⁷							
Thymelaeaceae	Thymelaeaspermum bournense Chandler							
Tiliaceae	Grewia minima Chandler							
Vitaceae	Vitis sp							
	Carpolithus echinatus Chandler							
	C ornatus Chandler							
	<i>C. mudense</i> Chandler							
Incertae sedis	Dicotylophyllum pinnatifidum Reid and Chandler							
	Rhamnospermum bilobatum Chandler							
	Wessexia fibrosa (Chandler) Chandler							
	¹ Formerly <i>Hordwellia crassisperma</i> (Chandler) Chandler							
	(see Mai and Walther, 1985).							
	² See Footnote 4 to (Table 8.1).							
	³ See comment on <i>Epacridicarpum</i> in the Barton GCR site report.							
	⁴ Formerly <i>Toddaliospermum excavatum</i> Chandler (see Mai and Walther, 1978).							
	⁵ Formerly <i>Cleyera? lentiformis</i> Chandler (see Mai and Walther, 1985).							
	⁶ Formerly <i>Cleyera? stigmosa</i> (Ludwig) Chandler (see Mai and Walther, 1978, 1985).							
	⁷ <i>Gordonia truncata = Polyspora truncata</i> (Chandler) Gregor (see Mai and Walther, 1985). <i>Gordonia</i> and <i>Polyspora</i> are both modern genera, which are considered synonyms by							

some authors.

References

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(Table 8.2) Composition of floras from the Dorset Pipe Clays, Hampshire Basin. Species descriptions, or references to them, can be found in Chandler (1962), unless otherwise referenced. Discussions on some of these species can also be found in Manchester (1994), Mai and Walther (1978, 1985), Mai (2000) and Collinson (1996b, in press a). The family classification used here is summarized in Chapter 1 of the present volume

Actinidiaceae	Species						
	Actinidia eocenica Chandler						
	Sauraula crassisperma (Chandler) Mai ¹						
Arecaceae	Calamus daemonorops (Unger) Chandler						
Betulaceae	Carpinus boveyanus (Heer) Chandler						
Boraginaceae	Genus? (?Ehretioideae)						
Caprifoliaceae	Sambucus mudensis Chandler						
Caryophyllaceae	Hantsia pulchra (Chandler) Chandler						
Clethraceae	Cletbra bantonensis Chandler						
Cornaceae (including Mastixiaceae)	Dunstania glandulosa (Chandler) Chandler, 1961c (see also Chandler, 1963b) ²						
	Eomastixia rugosa (Zenker) Chandler						
	Mastixia? glandulosa Chandler						
	Mastixicarpum crassum Chandler						
Cucurbitaceae	Cucurbitospermum mudense Chandler						
Cyperaceae	Caricoidea obscura Chandler						
	Scleriocarya tribrachteata Chandler						
	Cladiocarya foveolata Reid and Chandler						
Cyrillaceae ³	Epacridicarpum beadonense Chandler						
	E. mudense Chandler						
Epacridaceae	Leucopogon sp.						
Flacourtiaceae	Oncoba rugosa Chandler						
Hydrocharitaceae	Stratiotes bantonensis Chandler						
Lythraceae	Microdiptera parva Chandler						
	Palaeolythrum bournense Chandler						
Menispermaceae	Palaeosinomenium spp.						
Nymphaeaceae	Sabrenia chandlerae Collinson						
Nyssaceae	Nyssoidea eocenica Chandler						
Potamogetonaceae	Potamogeton pygmaeus Chandler (see Collinson, 1983a)						
	Limnocarpus forbesii (Heer) Chandler emend. Collinson 1982a						
Rosaceae	Rubus acutiformis Chandler						
Rutaceae	Rutaspermum rugosum Chandler						
	Toddalia excavata (Chandler) Gregor						
	Toddaliospermum ornatum Chandler						
Solanaceae	Solanispermum reniforme Chandler						
Symplocaceae?	Genus?						
Theaceae	Aclevera sp.						
	Eurya dubia (Chandler) Mal ⁵						
	Eurya stiemosa (Ludwig) Mal ⁶						
	Eurova mudensis Chandler						
	Gordonia truncata Chandler						
Thymelaeaceae	Thymelaeasbermum bournense Chandler						
Thymelaeaceae Tiliaceae	Ibymelaeaspermum bournense Chandler Grewig minimg Chandler						
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Thymelaeaceae Tiliaceae Vitaceae Incertae sedis	Thymetaecapternum bournense Chandler Grewia minima Chandler Witis sp. Carpolithus echinatus Chandler C. ornatus Chandler C. mudense Chandler Disortischedulum timmatificium Reid and Chardler						
Thymelaeaceae Tiliaceae Vitaceae Incertae sedis	Thymelaecspermum bourmense Chandler Grewia minima Chandler Witis sp. Carpolithus echinatus Chandler C. ornatus Chandler C. mudense Chandler Dicotylophyllum pinnatifidum Reid and Chandler Rhamostermum bilohatun Chandler						

authors.

(Table 9.1) Composition of the angiosperm flora from the Boscombe Sand Formation, Highcliffe. Species are described in Chandler (1963b) unless otherwise referenced. Some are also discussed by Mai and Walther (1978, 1985) and Mai (2000). The family classification listed here is summarized in Chapter 1 of the present volume.

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(Table 8.1) Angiosperm fruit, seed, wood and twig fossils from the Eocene London Clay GCR sites. Species and details from Reid and Chandler (1933) and Chandler (1961a), unless otherwise referenced. The family classification used here is summarized in Chapter 1 of the present volume.