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						
Actinidiaceae	Actinidia eocenica Chandler						
Actilidaceae	Saurauia 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	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						

Cyrillaceae³
Epacridaceae
Flacourtiaceae

Hydrocharitaceae

Lythraceae

Menispermaceae Nymphaeaceae Nyssaceae

Potamogetonaceae

Rosaceae

Rutaceae

Solanaceae Symplocaceae?

Theaceae

Thymelaeaceae

Tiliaceae Vitaceae

Incertae sedis

Epacridicarpum headonense Chandler

E. mudense Chandler ?Leucopogon sp.

Oncoba rugosa Chandler

Stratiotes hantorzensis Chandler Microdiptera parva Chandler

Palaeolythrum bournense Chandler

Palaeosinomenium spp.

Sabrenia chandlerae Collinson Nyssoidea eocenica Chandler

Potamogeton pygmaeus Chandler (see Collinson, 1983a) Limnocatpus forbesii (Heer) Chandler emend. Collinson

1982a

Rubus acutiformis Chandler

Rutaspermum rugosum Chandler

Toddalia excavata (Chandler) Gregor⁴ Toddaliospermum ornatum Chandler Solanispermum reniforme Chandler

Genus? ?Cleyera sp.

Eurya dubia (Chandler) Mai⁵ Eurya stigmosa (Ludwig) Mai⁶

Eurya mudensis Chandler ?Gordonia truncata Chandler⁷

Thymelaeaspermum bournense Chandler

Grewia minima Chandler

Vitis sp.

Carpolithus echinatus Chandler

C. ornatus Chandler
C. mudense Chandler

Dicotylophyllum pinnatifidum Reid and Chandler

Rhamnospermum bilobatum Chandler Wessexia fibrosa (Chandler) Chandler

¹ Formerly *Hordwellia crassisperma* (Chandler) Chandler (see Mai and Walther, 1985).

² See Footnote 4 to (Table 8.1).

³ See comment on *Epacridicarpum* in the Barton GCR site report.

⁴ Formerly *Toddaliospermum excavatum* Chandler (see Mai and Walther, 1978).

⁵ Formerly *Cleyera? lentiformis* Chandler (see Mai and Walther, 1985).

⁶ Formerly *Cleyera? stigmosa* (Ludwig) Chandler (see Mai and Walther, 1978, 1985).

⁷ Gordonia truncata = Polyspora truncata (Chandler) Gregor (see Mai and Walther, 1985). Gordonia and Polyspora are both modern genera, which are considered synonyms by some authors.

References

Family	Species	Lake	Arne	Studland	Family	Species	Lake	Arne	Studlan
Pteridaceae	Acrostichum Ianzaeanum (Visiani) Chandler		×	×	Icacinaceae	Josles acutiformis Chandler	×	×	
Schizaeaceae	Lygodium kaufiusti Heer emend. Gardner and			×	100 miles (100 miles)	Natsiatum econicum Chandler ¹¹	×	111111111111111111111111111111111111111	
	Ettingshausen				100000000000000000000000000000000000000	Palaeophytocrene foreolata Reid and Chandler	×		
	L. poolesuis Chandler	×				Icacinicarya inomata Chardler	×	×	
	Anemia poolensis Chandler	×	×		Lauraceue	Laurocarpum spp.	×.	100	
	Ruffordia subcretacea (Saporta) Barthel, 1976		×		Lythraceae	Ammannia Lobensis Chandler	×		
Taxodiaceae	Taxodium labensis Chandler	×	×			Alatospermum lakense Chandler	×		
	Sequola confinae Heer			×	Menispennaceae	Tinospora arnevats Chandler	×	×	
Actinidiaceae	Sauraula crassisperma (Chandler) Mai ⁵	×				Palaeococculus Iakensis Chandler	×	×	
	S. poolemais (Chandler) Mai, 1970	×				Wardensbeppeya poolensis (Chandler) Eyde,		×	
Anacardiaceae	Dracontocarya glandulosa Chandler	×				1970			
	Lannea sp.	×			Moraceae	Ficsu Incidus Chandler (see Collinson, 1989)	ж.		
	Rhus Inkensis Chandler	×				F. sp.		100	×
	R. spp.	×		1	Moraceae	Oricarpum reticulatum Chundler (see		×	
Аросупасеве	Apocynospermum acutiforme Chandler	×				Collinson, 1989)			
	A. lakense Chandler				Nymphaeaceae	Nymphaeaceae Palaeonymphaea eocenica Chandler (see			
Arrestese	Calamus daemonorops (Unger) Chandler				Collinson 1980u)				
2000	/Sahal ap.		×		Nyssaceae	Nyusoidea eocenicum Chandler	×	×	
Boraginaceae	Ebretia lakensis Chandler	×			Rosaceae	Rubus acutiformis Chandler			×
Burseraceae	Palaeobursera lakensis Chundler	×			Rotaceae	Phellodendron contatum Chandler		×	
Саррагасеве	Burtonella emarginata Chandler	×	×	×		Rutaspermum excavatum Chandler		×	
- Property	Palaeocleome lakensis Chandler	×		-		R. glabrum Chandler	×		
	Palaeocteome lakensis Chundler Capparidispermum eocenicum Chandler				and the latest of	R. magnificum Chandler		×	
Caprifoliaceae	Sambucus parenda Chandler	×		_		R. striatum Chandler	×		
Cornaceae	Dunstania labensis Chandler ²	×		_	Sabiaceae	Melioona sheppeyensis Reid and Chandler	×		
(including	Eomastixia rugosa (Zenker) Chandler (see Mai,	×	×	_	Sapotaceae	iSapoticarpum sp.		×	
Mastixiaceae)	1993)				Solanaceae	Solanum amenue Chandler		×	
,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,	E. urceolata Chandler	×		_	Section 1	Solanighermum reniforme Chandler		×	
	Mastixsa cantiensis Reid and Chandler	-	×		Styracaceae	Styrax elegans Chandler	×		
	Mastinicarpum crassum Chandler (see Mai,	×	-		Symplocaceae	Symplocos beadonensis Chandler	7.5	×	
	1995)					S. Jakensis Chandler	×	×	
	Surida quadrilocularis (Chandler) Mai, 1999 ^a	×			Theaceae	Geyera' obliqua Chandler	×		
Cucurhitaceae	Cucurbitospermum lakense Chandler	×		_		Kordonia sp.	×		
	C. obliguem Chandler	×			Thymelaeaceae	Thymelaeapermum lakeuse Chandler	×	×	
Cyperaceae	'Scirpus' labousis Chandler	×	×			T.! rulcatum Chandler	×		
Officere	Scirpur sp.		×		Vitaceae	Vitis ambigua Chandler	×		
	Garicoidea armei Chandler		×	_		V. armenais Chandler		×	
	G obscura Chandler	×	-	_		V. coneata Chandler	×	-	_
	'Garicoidea sp.	×		_	AND THE RESERVE	V. expense Chandler	×		_
	Gladiocaryst minima (Chandler) Mai in Mai and	_^	×	_		V. Labouata Chandler	×		_
	Walther, 1978*					V. Insatica Czeczott and Skirgiello ¹²	×	×	-
Denaceae	Diogryros bradonensis Chandler	×		+		V. platysperma Chandler	×	×	_
Euphorbiaceae	Eughorbiotheca Inhensis Chandler	×				V. poolensis Chandler	×	-	
- Contract of the Contract of	E. platysperma Chandler	×		_		V. pygmaea Chandler	×	×	_
	E. tuberculata Chandler	×				V. goodhartii Chandler	×	×	
	E. digitata Chandler	×	_	_		V. gwwetrica Chandler	×	-	_
	Euphorbiospermum punctatum Chandler	×				V. triangularis Chandler	-	×	
	Wetherellia variabile Bowerbank		×	_		Tetrastigma acuminata Chandler		×	1
Flacourtiaceae	Oncoba rugosa Chandler		×			77. Iobata Chandier	×	1	+
Hamamelidaceae		×	^	_	Zingiberaceae	Alpinia arnesse (Chandler) Mai in Mai and	^	×	+
riamamelidaceae	1 Stringguera Indiagona Lice.					Wakher, 198519	-		
					Incertae sedis	Rhanmospermum bilohatum Chandler	×	×	
						Carpolithus amense Chandler	-	×	1

(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

Family	Species						
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Caprifoliaceae	Sambucus mudensis Chandler						
Caryophyllaceae	Hantsia pulcbra (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							
Lyttiraceae	Microdiptera parva Chandler						
Manhaman	Palaeolythrum bournense Chandler						
Menispermaceae	Palaeosinomenium spp.						
Nymphaeaceae	Sabrenia chandlerae Collinson						
Nyssaceae	Nyssoidea eocenica Chandler						
Potamogetonaceae	Potamogeton pygmaeus Chandler (see Collinson, 1983a)						
	Limnocarpus forbesti (Heer) Chandler emend. Collinson 1982						
Rosaceae	Rubus acutiformis Chandler						
Rutaceae	Rutaspermum rugosum Chandler						
	Toddalia excavata (Chandler) Gregor ⁴						
	Toddaliospermum ornatum Chandler						
Solanaceae	Solanispermum reniforme Chandler						
Symplocaceae?	Genus?						
Theaceae	?Cleyera sp.						
	Eurya dubia (Chandler) Mai*						
	Eurya stigmosa (Ludwig) Mai ⁶						
	Eurya mudensis Chandler						
	?Gordonia truncata Chandler						
Thymelaeaceae	Thymelaeaspermum bournense Chandler						
Tiliaceae	Grewia minima Chandler						
Vitaceae	Vitis sp.						
Incertae sedis	Carpolithus echinatus Chandler						
	C. ornatus Chandler						
	C. mudense Chandler						
	Dicotylophyllum pinnatifidum Reid and Chandler						
	Rhamnospermum bilobatum Chandler						
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Gordonia truncata = Poi	yspora truncata (Chandler) Gregor (see Mai and Walther, 1985).						
	are both modern genera, which are considered synonyms by some						

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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.