Bouldnor Cliff

[SZ 375 901]-[SZ 398 917]

Introduction

Bouldnor Cliff is the only site known to yield plant fossils from the Hamstead Member (Bouldnor Formation). It is the youngest Palaeogene flora in Britain and provides a link with the younger floras found in continental Europe. It is also the type locality for *Sequoia couttsiae* Heer, one of the most widely occurring conifers in the Tertiary deposits of Europe.

The Bouldnor Formation is the youngest succession of Tertiary strata in southern Britain, as well as the youngest to yield plant macrofossils. It provides the final part of the story of the Palaeogene vegetational history of this part of the world, as summarized by the sites reviewed in this and the previous chapters. Collecting at the foreshore between Bouldnor and Bouldnor Cliff is difficult and can only be done for a short time near low tide (Figure 9.33), (Figure 9.35). Consequently, the fossil flora here has not been widely investigated, the only published descriptions being by Chandler (1963a, 1978), based largely on material collected by G.W. Colenutt and R.L.E. Ford. Some additional material is also described in an unpublished thesis by Collinson (1978a) and the floras formed a crucial part of the overviews of changing British vegetation by Collinson (1990b, 1992) and Collinson and Hooker (1987). Boulter and Hubbard (1982) included palynological material from here in their study of floral and climatic change in southern England.

Description

Stratigraphy

This is the only site where the middle part of the Bouldnor Formation (Hamstead Member) can be seen and for this reason it is included in the Tertiary stratigraphy volume of the GCR (Daley in Daley and Balson, 1999; (Figure 9.33) and (Figure 9.34) where more details of the geology can be found. The Hamstead Member here is 78 m thick and consists predominantly of mudstones and siltstones (Figure 9.34). Most of the plant fossils described by Chandler (1963a) came from two levels, one known as the 'White Band', and the other the Waterlily Bed'. These lie above the Grande Coupure mammal event and are there fore Oligocene in age (Collinson, 1992; Hooker, 1992). Other post-Grande Coupure levels also yield plant fossils (Collinson, 1992, pers. obs.).

Palaeobotany

The Bouldnor fossil flora consists predominantly of angiosperms, the 18 species being listed in (Table 9.3). In addition, there are four species of conifer: *Sequoiadendron fordii* Chandler, *Sequoia coutsiae* Heer (see Footnote 2 to (Table 8.2), this volume), *Pinus fordii* Chandler and *P.* sp.. So far, no fern remains have been found here. The plants are preserved as carbonaceous fossils, often (but not always) covered by a layer of amorphous pyrites.

Interpretation

These are the youngest plant remains in the Palaeogene deposits of southern Britain. As with most other floras of the Bouldnor Formation, the flora here is dominated by aquatic plants, especially of the water soldier, water lily and pondweed families. It shares many species with the aquatic floras of the lower Bouldnor Formation, such as at Thorness Bay and Hamstead Ledge, but there are some differences, suggesting that climatic changes were continuing (Collinson, 1990b). Most notable is the appearance of two new *Stratiotes* species, *S. websteri* and *S. acuticostatus*. Collinson *et al.* (1981) state that *Stratiotes neglectus* becomes extinct at these higher levels. Chandler (1963a) described well-preserved specimens of this species but there was some question as to whether they actually originated from this horizon. *Potamogeton pygmaeus,* which is common and characteristic of the earlier Eocene–Oligocene transitional floras, has become extinct in Britain by Hamstead Member times and is replaced by *P. tenuicarpus*, which had made its first

appearance in the Bembridge Marls (Collinson, 1983a; Collinson *et al.*, 1993a). Chandler (1963a) argued that *77pba latissima* extended through into the Hamstead Member but Collinson (1978a) suggested that these stratigraphically higher specimens belonged to a new and still unnamed species. *Acrostichum anglicum is* lost in the post-Grande Coupure floras, possibly due to continuing climate change or to other factors associated with the terminal Eocene event.

Unlike most of the other British Tertiary floras, fruits and seeds from the surrounding forest vegetation here are rare. Instead, pyritized leafy shoots, cones and logs are relatively abundant, especially of palms and conifers (Figure 9.35). The most completely known is the taxodiaceous conifer *Sequoiadendron fordii*, for which leafy shoots, cones and seeds are known (Chandler, 1978), and for which this is the only known locality. In contrast, the *Pinus* and *Sequoia* species are only known from cones. The palm fossils are mainly leaves, especially that described as *Sabal major* (probably not in fact a true *Sabal*) but one fruit has also been found.

Chandler (1978) described the remains of an unidentified flower preserved in pyrite from Bouldnor Cliff. Although a detailed description was given, no attempt was made to establish its affinities. Remains of flowers are extremely rare in the Tertiary deposits of Britain.

In summary, during the formation of the Hamstead Member this area was probably covered by a bulrush-dominated marsh, also supporting a range of other aquatic plants. Surrounding the marsh were probably forests dominated by taxodiaceous conifers. Together, this invites comparison with the cypress swamps of south-eastern USA. The site offers considerable research potential because the floras are associated with mammalian faunas and together these can track environmental changes across the Eocene-Oligocene boundary (Collinson and Hooker, 1987).

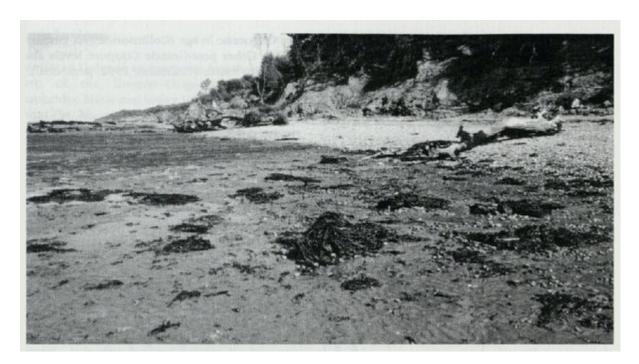
Conclusions

Bouldnor Cliff has yielded the youngest known plant macrofossils from southern Britain. They originated from the lower Oligocene Hamstead Member and are *c.* 33–34 Ma old. Aquatic plants, including bulrushes, water soldiers, water lilies and pondweeds, dominated the flora. There are also some remains of forest plants, especially of taxodiaceous conifers. The vegetation of this part of Britain during early Oligocene times therefore has some similarities with that of the American cypress swamps of today. The British exposures of the Bouldnor and Hamstead sites are the only places in Europe where it is possible to study the association of plant and mammal fossils, enabling the study of land environments across the Eocene–Oligocene transition, a time of major global change.

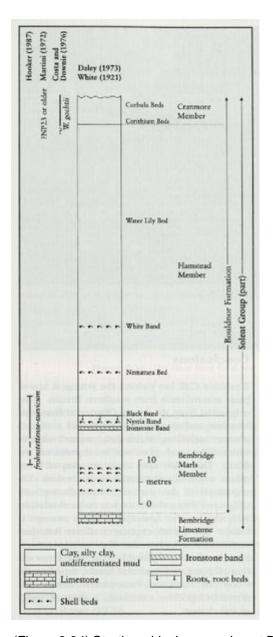
References



(Figure 9.33) Hamstead Member exposed on the foreshore below, Bouldnor Cliffs. (Photo: M.E. Collinson.)



(Figure 9.35) A foreshore exposure of in-situ logs covered with seaweed, preserved low in the Hamstead Member near Bouldnor. (Photo: M.E. Collinson.)



(Figure 9.34) Stratigraphical succession at Bouldnor Cliff, Isle of Wight. (After Daley and Balson, 1999, fig. 5.39.)

		Thorness Bay (Insect Limestone)	Hamstead Ledge	Houldner	Family	Species	Thorness Bay (Insect Limestone)	Hamstead Ledge	Houldner		
Acanthaceae	Acanthus regates Beid and Chandler	×			Morsceae	Ficus sp.	×				
Actinidiaceae	tActividia sp.	×			Najadaceae	Natar oligocowica Reid and Chandler	×				
Alismataceae	Aliamaticarpum alatum Collinson		×		Nymphaeucrae	Nymphaea Herinty Collinson*		×			
Apocynaccae	Apocymoghermum striatum Reid and	×				Sabrenia chandlerae Collinson	×	×	×		
	Chundler				positional to project	Nelsonbium buchti Ettingshausen			×		
	A. rostnatum Resd and Chandler	×			Papaveraceae	Popurer picture Reid and Chandler	×		-		
	A. elegans Reid and Chandler	×			Potamogetonacese	Potemogeton pygmagus Chandler (see	×				
	A alwhism Reid and Chandler	×				Collinson, 1985a)					
Aquifoliacese	Mex sp.			×		P. tennicarpus Reid and Reid emend.		×	×		
Araceae	Epipremnites ornata (Reid and	×				Collinson, 1983u					
	Chandler) Gregor and Bogner (see Mai					P. spp.	×	×			
	and Walther, 1991)2					Limnocarpus forbesii (Heer) Chandler	×	×	×		
	Palmophyllum sp.	×				emend. Collinson, 1982a					
	Sahal major (Unger) Heer ⁵	×		×		L (?) spinosus Reid and Chandler (see	×				
Asclepiadaceae	Phyllanthera rectenats Reid and	×				Collinson, 1982a)	000 of 100				
	Chandler				Ranunculaceae	Clematis rectensts Reid and Chandler	×				
	Tydephone antique Reid and Chandler	×			March Cold Color	Myosarus beterostylus (Reid and	×				
Setulaceae	Autorocurpinus sp.*	×			And the latest and an agent to	Chandler) Mai in Mai and Walther,					
Ngoniacrae	Gatalpa rugosa Reid and Chandler	×				1978"					
-	Incarvilles prisins Rold and Chandler	×				Ramanculus orsaliformis (Reid and	×				
	Radermachera pulchra Reid and	×			No. of the last of	Chandler) Chandler	1000				
	Chandler	_ ^			Rhamnaceae	Zityphus paradisiacus (Unger) Reid	×				
Caprifoliaceae	Dipelta europana Reid and Chandler	×				and Chandler	1220000		-		
Caprinnancae	Sambucus parenda Chandler errord.	_ ^	×		Rosaceae	Kubur sp.			×		
	Collinson, 1984a		^		Retacear	Zanthooylum(?) contained licid and	×				
Cyperaceae	Karicoidea obscura Chardler		×		The state of the s	Chandler					
-Shearene	C. nitess (licer) Chandler	_	×	_	Sparganiaceae	Spargarium multiloculare Reid and	×		7.		
						Chandler			-		
	Garez gursumlif Reid and Chandler	X		-		S. sp.			×		
	Karicoldra minima (Chardler)			×	Typhaceae	Typhu fattanimu (Braun) Reid and	×	×	-		
	Chandler					Chandler (see Collinson, 1983a)	0.70	-			
	C sp	×	×	×	AND DESCRIPTION OF THE PERSON NAMED IN	T sp. (Collinson, 1983a)		×	×		
	Cladiocarya Joreolata Reid and	×			Zingiberscese/	Kinstau sp.	×	-	-		
	Chandler				Musaceae	Spirematupermum avetaleri (Hocr)	×	×			
glein management	Genus indet. (Collinson, 1983a)	-	×		DOUBLE CO.	Chandler ⁱⁱ	-	-			
Drosersceae	Aldrovanda intermedia Reid and Chardler	×		×	Incertae sedis	'Abelia' quadrialata Reid and Chandler ¹⁰	×				
Hydrocharitaceae	Ottelia britannica Reid and Chandler	×			the track of the Control		-		_		
	Stratiotes neglectus Chandler	×	X	1	Charles and the same	'A 'quinquestata Reid and Chandler'	×		_		
	S. seebsteri (Brongniart) Chandler			×	the second section is not a second	'A.' trialists Reid and Chandler."	×	-			
	5. acuticostatus Chundler			×		Carpolithes collomas Collinson	1000	×			
	5. sp. (leaf margin teeth - see	100 100 100 100 100	×	100		C. barrateadensis Collinson		×			
	Collinson, 1985a)					C spp.	×		×		
Juglandaceue	Palaeocarya macroptera (Brongniart)	×		The state of		Dicotylophyllum pinnatifidum Reid	×	×			
	Jähnichen, Friedrich and Takáč (see					and Chandler Habellicula amplica Brid and Chandler	×		_		
	Manchester, 1987) ⁶							17			
	Engelbardtia sp.	×				Monocotylophydlam sp.	×		-		
	Hooleya berwis (Heer) Reid and Chardler	×				Rhammospermam bilohatum Chandler	×	×	×		
luncaceae	Junçus sectensis Collinson		×			for Table 8.2, this volume.					
Laminceae	Melissa purea Reid and Chandler	×				wassen? orwate Reid and Chandler.					
	Ajuginucula pwithii Reid and Chandler	×	1000			a true Salval (Collinson, pers. obs.).					
Lauraceae	Duphnogene lanceolatum Unger	- ×			Described by Re-	id and Chandler (1926) as Garptimer sp. and	Abelia sp. 4, es	ich from a singl	e		
	Neolitana sp.	×			specimen. They were transferred to Autwocarpinus by Manchester and Donoghue (1995, p. 721). * Includes C. cf. macrima Chandler emenal. Chandler serior Collinson, 1985a (see Mai and Walther,						
					Reid and Chand Walther, 1978, 1 The generic pos- material (Collins	analist macroptera (Brongslart) Reid and G ler (1926) referred to this as Cinnatmonaure 965), licino of this species as a Nymphanet has been son and van Bergen, work in progress), caulus deverouijnas Reid and Chandler.	Loncrolatum ()	neside the			

(Table 9.3) Angiosperm floras from the Bouldnor Formation. Species descriptions or references to them may be found in Chandler (1963a) and Collinson (1980b, 1983a) unless otherwise referenced. The family classification used here is summarized in Chapter 1 of the present volume. (Note: records of Fagus and Quercus by Reid and Chandler (1926) are here considered indeterminate.)

Family	Species	Lake	Arne	Studland	Family	Species	Lake	Arne	Studlar
Pteridaceae	Acrostichum Ianzueanum (Visiani) Chandler		×	×	Icacinaceae	Jodes acutiformis Chandler	×	×	
Schizaeaceae	Lygodium kauffussii Heer emend. Gardner and			×	Constitution (Constitution)	Natriatum eocenicum Chandler ¹¹	×.	11-11-11	
	Ettingshausen			100		Palaeophytocrene foreolata Reid and Chandler	×		
	L. poolenate Chandler	×				Icacinicarya inomata Chardler	×	×	
	Anemia poolensis Chandler	×	×		Lauraceue	Laurocarpum spp.	×		
	Euffordia subcretacea (Saporta) Barthel, 1976		×		Lythraceae	Ammannia lakensis Chandler	×		_
Taxodiaceae	Taxodium labousis Chardler	×	×	_	- June accord	Alatospermum lakense Chandler	×		_
	Sequota continua Heer	_ ^	-	×	Menispermaceae	Tinospons amenuts Chandler	×	×	_
Actinidiaceae	Sauraula crassisperma (Chandler) Ma ⁵	×		-	Pricing Contractor	Palarococculus Labenutz Chandler	×	×	-
	S. poolensis (Chandler) Mai, 1970	×	_	-	1	Wardensbeppeya poolensis (Chandler) Eyde,	_ ^	×	-
	Dracontocarus glandulosa Chundler	×	_	1	100 200 200	1970		_	
Anacardiaceae		×	_	-	Moraceae	Ficus Iucidus Chandler (see Collinson, 1989)	×	_	-
	Lannea sp.		_	-	MOTRCERE			-	×
	Rhus lakensis Chandler	×		-	144	f sp.			
	R. spp.	×			Moraceae	Oricarpum reticulatum Chundler (see		×	
Apocynaceae	Apocymospermum acutiforme Chandler ¹	Х				Collinson, 1989)	120		-
	A. Jakense Chandler ⁵	×			Nymphaeaceae	Palaeonymphaea eocenica Chandler (see	×	10000	
Arecaceae	Galamus daemonorops (Unger) Chandler	X				Collinson 1980a)			-
	/Sahal ap.	0.0	×		Nyssaceae	Nyasoidea eocenicum Chandler	×	×	-
Boraginaceae	Ebretia lakensis Chandler	×	120		Rosaceae	Rubus acutiformis Chandler			×
Burseraceae	Palaeobursera lakensis Chundler	×			Rutaceae	Phellodendron contatum Chandler		×	
Capparaceae	Burtonella emarginata Chandler	ж.	×	×		Rutaspermum excavatum Chandler		×	
-	Palaeocleome lakensis Chandler	×				R. globrum Chandler	×		
	Capparidispermum eocenicum Chandler	×				R. magnificum Chandler		×	
Caprifoliaceae	Sambucus parenda Chundler	×			Laborate States	R. striatum Chandler	×		
Cornaceae	Dunstania lakensis Chandler ^b	×		_	Sabiaceae	Melioona sheppeyeosis Reid and Chandler	×		
(including Mastixiaceae)	Eomantixia rugosa (Zenker) Chandler (see Mai,	×	×	_	Sapotaceae	Sapoticarpum sp.		×	
	1993)	-	-		Solanaceae	Solanum arnense Chandler		×	_
	E. urceolata Chandler	-		_	A STATE OF THE PARTY OF THE PAR	Solanispermum reniforme Chandler		×	+
		×	-	-	Seyracaceae	Styrax elegans Chandler	×	-	+
	2Matrixia cawitewate Reid and Chandler	-	×			Symplocos beadonessis Chandler		×	+
	Mastixicarpum crassum Chandler (see Mai,	×			Symplocaceae		- 14	-	-
	1995)				Theaceae	S. Jakensis Chandler	×	×	-
	Steida quadrilocularis (Chandler) Mai, 1999	×				Geyera't obliqua Chandler	×		-
Cucurbitaceae	Cucurbitospermum lakense Chandler	×			Thymelaeaceae	Kiordonia sp.	×		-
	C. obliquum Chandler	ж				Thymelacapermum lakense Chandler	X	×	-
Cyperaceae	'Scirpus' labensis Chandler	×	×			T.? milconom Chandler	×		
	Scirpus sp.	×			Vitaceae	Vitis ambigus Chandler	×		
	Caricoidea arnei Chandler		×			V. armenuts Chandler		×	
	C. obscure Chandler	×				V. currente Chandler	X:		
	'Garicoldea sp.	×			AND THE REAL PROPERTY.	V. emerata Chandler	×		
	Cladiocarya minima (Chandler) Mai in Mai and		×			V. Labouits Chandler	×		
	Walther, 1978°					V. Issatica Czeczott and Skirgiello ¹²	×	×	_
Denaceae	Diostryros beadonensis Chandler	×		1		V. platysperma Chandler	×	×	-
Euphorbiaceae	Euphorbiotheca Lakenatis Chandler	×		1		V. poolenuis Chandler	×	-	-
	E. platysperma Chandler	×				V. pygmaea Chandler	×	×	_
	E. tuberculata Chandler	×				V. goodhartii Chandler	×	×	_
				-			×	×	-
	E. aligitata Chandler	×		-		V. gwmetrica Chandler	- ^		-
	Euphorbiospermum punctatum Chandler	×				V. triangularis Chandler	-	×	-
	Wetherellia variabilis Bowerbank		×			Tetrastigma acuminata Chandler		×	-
Flacourtiaceae	Oncoba rugosa Chandler		×			77. Iohata Chandler	×		
Hamamelidaceae	Steinbauera subglobosa Presi ¹⁰	×			Zingiberaceae	Alpinia armense (Chandler) Mai in Mai and Walther, 1985 ¹³		×	1
					Incertae sedis	Rhanmospermum bilohatum Chandler	×	×	
						Carpolithus amense Chandler	-	×	

(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