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 Some additional material is also described in an unpublished thesis by Collinson (1978a) and the floras formed a crucial part of the overviews of changing British vegetation by Collinson (1990b, 1992) and Collinson and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.

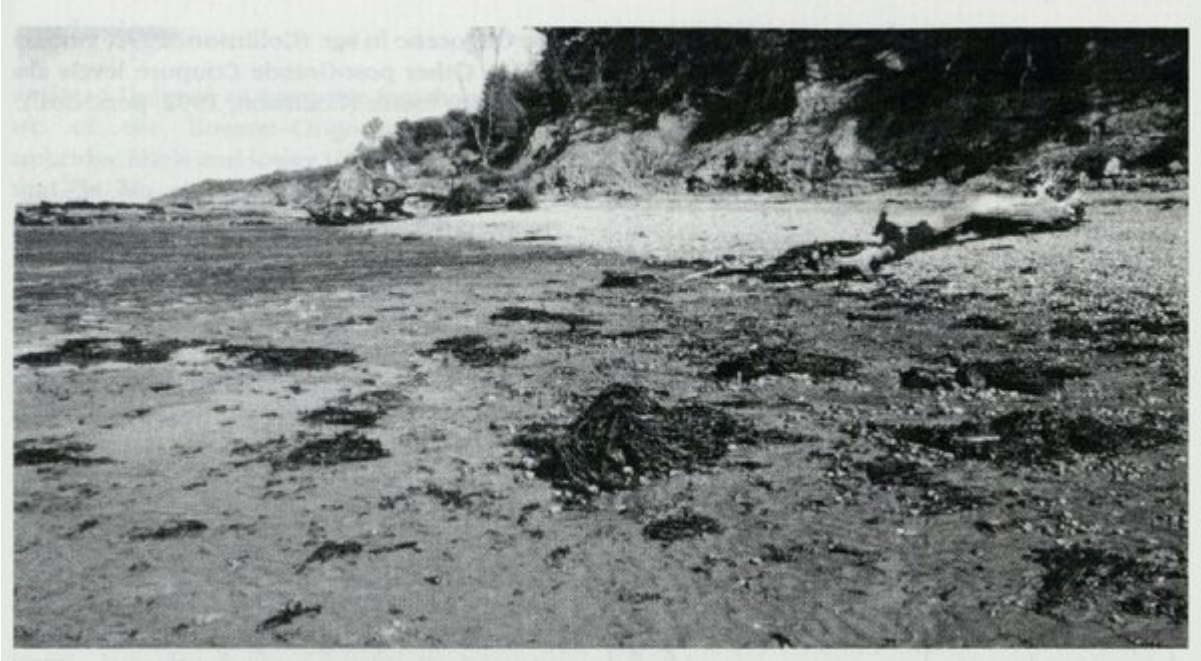
In summary, during the formation of the Hamstead Member this area was probably covered by a bulrush-dominated marsh, also supporting a range of other aquatic plants. Surrounding the marsh were probably forests dominated by taxodiaceous conifers. Together, this invites comparison with the cypress swamps 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

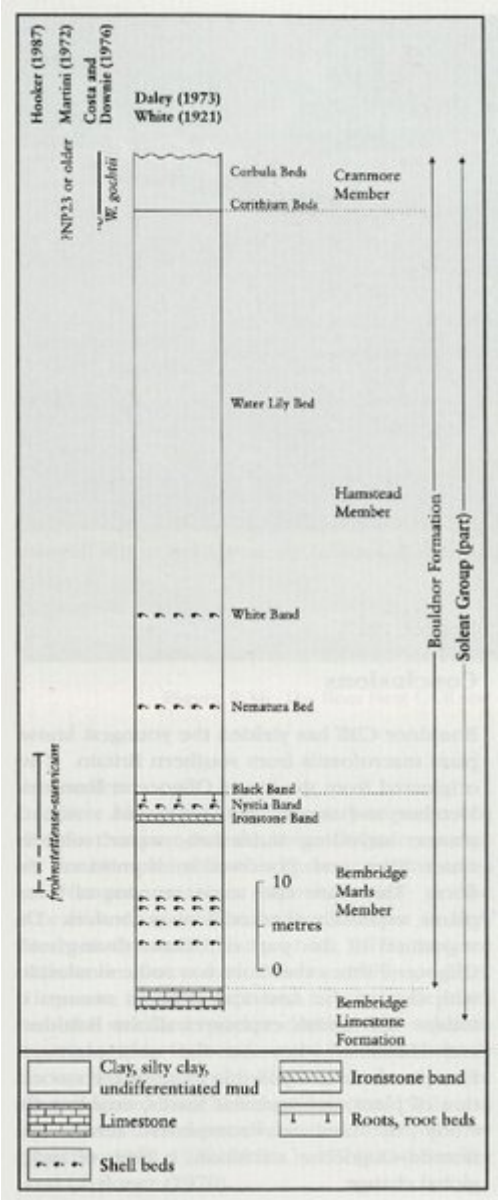
Bouldnor Cliff has yielded the youngest known plant macrofossils from southern Britain. They originated from the lower Oligocene Hamstead Member and are *c.* 33–34 Ma old. Aquatic plants, including bulrushes, water soldiers, water lilies and pondweeds, dominated the flora. There are also some remains 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.)

Family	Species	Thorness Bay (Insect Limestone)	Hamstead Ledge	Bouldnor Cliff
Acanthaceae	*Acanthus rugatus* Reid and Chandler	×		
Actinidiaceae	†*Actinidia* sp.	×		
Alismataceae	*Alismaticarpum alatum* Collinson		×	
Apocynaceae	*Apocynospermum striatum* Reid and Chandler[1]	×		
	A. rostratum Reid and Chandler[1]	×		
	A. elegans Reid and Chandler[1]	×		
	A. dubium Reid and Chandler[1]	×		
Aquifoliaceae	†*Ilex* sp.			×
Araceae	*Epipremnites ornata* (Reid and Chandler) Gregor and Bogner (see Mai and Walther, 1991)[2]	×		
Arecaceae	*Palmoxylon* sp.	×		
	Sabal major (Unger) Heer[3]	×		×
Asclepiadaceae	*Phyllanthera vectensis* Reid and Chandler	×		
	Tylophora antiqua Reid and Chandler	×		
Betulaceae	*Asterocarpinus* sp.[4]	×		
Bignoniaceae	*Catalpa rugosa* Reid and Chandler	×		
	Incarvillea pristina Reid and Chandler	×		
	Radermachera pulchra Reid and Chandler	×		
Caprifoliaceae	*Dipelta europaea* Reid and Chandler	×		
	Sambucus parvula Chandler *emend.* Collinson, 1983a		×	
Cyperaceae	†*Caricoidea obscura* Chandler		×	
	C. nitens (Heer) Chandler[5]		×	
	Carex gurnardi Reid and Chandler	×		
	†*Caricoidea minima* (Chandler) Chandler			×
	C. sp.	×	×	×
	Cladiocarya foveolata Reid and Chandler	×		
	Genus indet. (Collinson, 1983a)		×	
Droseraceae	*Aldrovanda intermedia* Reid and Chandler	×		×
Hydrocharitaceae	*Ottelia britannica* Reid and Chandler	×		
	Stratiotes neglectus Chandler	×	×	?
	S. websteri (Brongniart) Chandler			×
	S. acuticostatus Chandler			×
	S. sp. (leaf margin teeth – see Collinson, 1983a)		×	
Juglandaceae	*Palaeocarya macroptera* (Brongniart) Jährichen, Friedrich and Takáč (see Manchester, 1987)[6]	×		
	Engelhardtia sp.	×		
	Hooleya hernii (Heer) Reid and Chandler	×		
Juncaceae	*Juncus vectensis* Collinson		×	
Lamiaceae	*Melissa parva* Reid and Chandler	×		
	Apiginucula smithii Reid and Chandler	×		
Lauraceae	*Daphnogene lanceolatum* Unger[7]	×		
	Neolitsea sp.	×		

Family	Species	Thorness Bay (Insect Limestone)	Hamstead Ledge	Bouldnor Cliff
Moraceae	*Ficus* sp.	×		
Najadaceae	*Natar oligocenica* Reid and Chandler	×		
Nymphaeaceae	*Nymphaea limnia* Collinson[8]		×	
	Sabrenia chandlerae Collinson	×	×	×
	Nelumbium buchii Ettingshausen			×
Papaveraceae	*Papaver pictum* Reid and Chandler	×		
Potamogetonaceae	*Potamogeton pygmaeus* Chandler (see Collinson, 1983a)	×		
	P. tenuicarpus Reid and Reid *emend.* Collinson, 1983a		×	×
	P. spp.	×	×	
	Limnocarpus forbesii (Heer) Chandler *emend.* Collinson, 1982a	×	×	×
	L. (?) *spinosus* Reid and Chandler (see Collinson, 1982a)	×		
Ranunculaceae	*Clematis vectensis* Reid and Chandler	×		
	Myosurus heteroatylus (Reid and Chandler) Mai in Mai and Walther, 1978[9]	×		
	Ranunculus ovaliformis (Reid and Chandler) Chandler	×		
Rhamnaceae	*Ziziphus paradisiacus* (Unger) Reid and Chandler	×		
Rosaceae	*Rubus* sp.			×
Rutaceae	*Zanthoxylum*(?) *costatum* Reid and Chandler	×		
Sparganiaceae	*Sparganium multiloculare* Reid and Chandler	×		?
	S. sp.			×
Typhaceae	*Typha latissima* (Braun) Reid and Chandler (see Collinson, 1983a)	×	×	
	T. sp. (Collinson, 1983a)		×	×
Zingiberaceae/ Musaceae	*Nipa* sp.	×		
	Spirematospermum wetzleri (Heer) Chandler[10]	×	×	
Incertae sedis	'*Abelia*' *quadrialata* Reid and Chandler[10]	×		
	'*A.*' *quinquealata* Reid and Chandler[11]	×		
	'*A.*' *trialata* Reid and Chandler[11]	×		
	Carpolithes collomus Collinson		×	
	C. hamsteadensis Collinson		×	
	C. spp.	×		×
	Dicotylophyllum pinnatifidum Reid and Chandler	×	×	
	Flabellicula anglica Reid and Chandler	×		
	Monocotylophyllum sp.	×		
	Rhamnospermum bilobatum Chandler	×	×	×

[1] See Footnote 5 for Table 8.2, this volume.
[2] Formerly *Epipremnum? ornata* Reid and Chandler.
[3] This may not be a true *Sabal* (Collinson, pers. obs.).
[4] Described by Reid and Chandler (1926) as *Carpinus* sp. and *Abelia* sp. 4, each from a single specimen. They were transferred to *Asterocarpinus* by Manchester and Donoghue (1995, p. 721).
[5] Includes *C.* cf. *maxima* Chandler *emend.* Chandler *sensu* Collinson, 1983a (see Mai and Walther, 1978).
[6] Formerly *Engelhardtia macroptera* (Brongniart) Reid and Chandler.
[7] Reid and Chandler (1926) referred to this as *Cinnamomum lanceolatum* (Unger) Heer (see Mai and Walther, 1978, 1985).
[8] The generic position of this species as a *Nymphaea* has been confirmed by new, more complete material (Collinson and van Bergen, work in progress).
[9] Formerly *Ranunculus heteroatylus* Reid and Chandler.
[10] See text for the Hordle GCR site for discussion of *Spirematospermum*.
[11] These are regarded as *incertae sedis* by Manchester and Donoghue (1995).

(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
Pteridaceae	*Acrostichum lanzaeanum* (Visiani) Chandler		×	×
Schizaeaceae	*Lygodium kaulfussii* Heer *emend.* Gardner and Ettingshausen			×
	L. poolensis Chandler	×		
	Anemia poolensis Chandler	×	×	
	Ruffordia subcretacea (Saporta) Barthel, 1976[1]		×	
Taxodiaceae	*Taxodium labensis* Chandler	×	×	
	Sequoia couttsiae Heer[2]			×
Actinidiaceae	*Saurauia crassisperma* (Chandler) Mai[3]	×		
	S. poolensis (Chandler) Mai, 1970[3]	×		
Anacardiaceae	*Dracontocarya glandulosa* Chandler	×		
	†*Lannea* sp.	×		
	Rhus labensis Chandler	×		
	R. spp.	×		
Apocynaceae	*Apocynospermum acutiforme* Chandler[4]	×		
	A. labense Chandler[5]	×		
Arecaceae	*Calamus daemonoropsis* (Unger) Chandler	×		
	†*Sabal* sp.		×	
Boraginaceae	*Ehretia labensis* Chandler	×		
Burseraceae	*Palaeoburseva labensis* Chandler	×		
Capparaceae	*Bartonella emarginata* Chandler	×	×	×
	Palaeocleome labensis Chandler	×		
	Capparidispermum eocenicum Chandler	×		
Caprifoliaceae	*Sambucus parvula* Chandler	×		
Cornaceae (including Mastixiaceae)	*Dunstania labensis* Chandler[6]	×		
	Eomastixia rugosa (Zenker) Chandler (see Mai, 1995)	×	×	
	E. urceolata Chandler	×		
	†*Mastixia cantiensis* Reid and Chandler[7]		×	
	Mastixicarpum crassum Chandler (see Mai, 1995)	×		
	Stetila quadrilocularis (Chandler) Mai, 1999[8]	×		
Cucurbitaceae	*Cucurbitospermum labense* Chandler	×		
	C. obliquum Chandler	×		
Cyperaceae	'*Scirpus*' *labensis* Chandler	×	×	
	†*Scirpus* sp.	×		
	Caricoidea arnei Chandler		×	
	C. obscura Chandler	×		
	†*Caricoidea* sp.	×		
	Cladiocarya minima (Chandler) Mai in Mai and Walther, 1978[9]		×	
Ebenaceae	*Diospyros headonensis* Chandler	×		
Euphorbiaceae	*Euphorbicoebeca labensis* Chandler	×		
	E. platysperma Chandler	×		
	E. tuberculata Chandler	×		
	E. digitata Chandler	×		
	Euphorbiospermum punctatum Chandler	×		
	Wetberellia variabilis Bowerbank		×	
Flacourtiaceae	*Oncoba rugosa* Chandler		×	
Hamamelidaceae	*Steinhauera subglobosa* Presl[10]	×		

Family	Species	Lake	Arne	Studland
Icacinaceae	*Iodes acutiformis* Chandler	×	×	
	Nattiatum eocenicum Chandler[11]	×		
	†*Palaeophytocrene foveolata* Reid and Chandler	×		
	Icacinicarya incornata Chandler	×	×	
Lauraceae	*Laurocarpum* spp.	×		
Lythraceae	*Ammannia labensis* Chandler	×		
	Alatospermum labense Chandler	×		
Menispermaceae	†*Tinospora armensis* Chandler	×	×	
	Palaeococculus labensis Chandler	×	×	
	Wardenabeppeya poolensis (Chandler) Eyde, 1970		×	
Moraceae	*Ficus lucidus* Chandler (see Collinson, 1989)	×		
	F. sp.			×
†Moraceae	*Oreicarpum reticulatum* Chandler (see Collinson, 1989)		×	
Nymphaeaceae	*Palaeonymphaea eocenica* Chandler (see Collinson 1980a)	×		
Nyssaceae	*Nyssoidea eocenicum* Chandler	×	×	
Rosaceae	*Rubus acutiformis* Chandler			×
Rutaceae	*Phellodendron costatum* Chandler		×	
	Rutaspermum excavatum Chandler		×	
	R. glabrum Chandler	×		
	R. magnificum Chandler		×	
	R. striatum Chandler	×		
Sabiaceae	†*Meliosma sheppeyensis* Reid and Chandler	×		
Sapotaceae	†*Sapoticarpum* sp.		×	
Solanaceae	*Solanum arnense* Chandler		×	
	Solanispermum reniforme Chandler		×	
Styracaceae	*Styrax elegans* Chandler	×		
Symplocaceae	*Symplocos headonensis* Chandler		×	
	S. labensis Chandler	×	×	
Theaceae	*Cleyera*? *obliqua* Chandler	×		
	†*Gordonia* sp.	×		
Thymelaeaceae	*Thymelaeaspermum labense* Chandler	×	×	
	T.? *sulcatum* Chandler	×		
Vitaceae	*Vitis ambigua* Chandler	×		
	V. armensis Chandler		×	
	V. cuneata Chandler	×		
	V. excavata Chandler	×		
	V. labensis Chandler	×		
	V. lusatica Czeczott and Skirgiello[12]	×	×	
	V. platysperma Chandler	×	×	
	V. poolensis Chandler	×		
	V. pygmaea Chandler	×	×	
	V. goodhartii Chandler	×	×	
	V. symmetrica Chandler	×		
	V. triangularis Chandler		×	
	Tetrastigma acuminata Chandler		×	
	?T. lobata Chandler	×		
Zingiberaceae	*Alpinia armenae* (Chandler) Mai in Mai and Walther, 1985[13]		×	
Incertae sedis	*Rhamnospermum bilobatum* Chandler	×	×	
	Carpolithus armense 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