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 Some additional material is also described in an unpublished thesis by Collinson (1978a) and the floras formed a crucial part of the overviews of changing British vegetation by Collinson (1990b, 1992) and Collinson and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

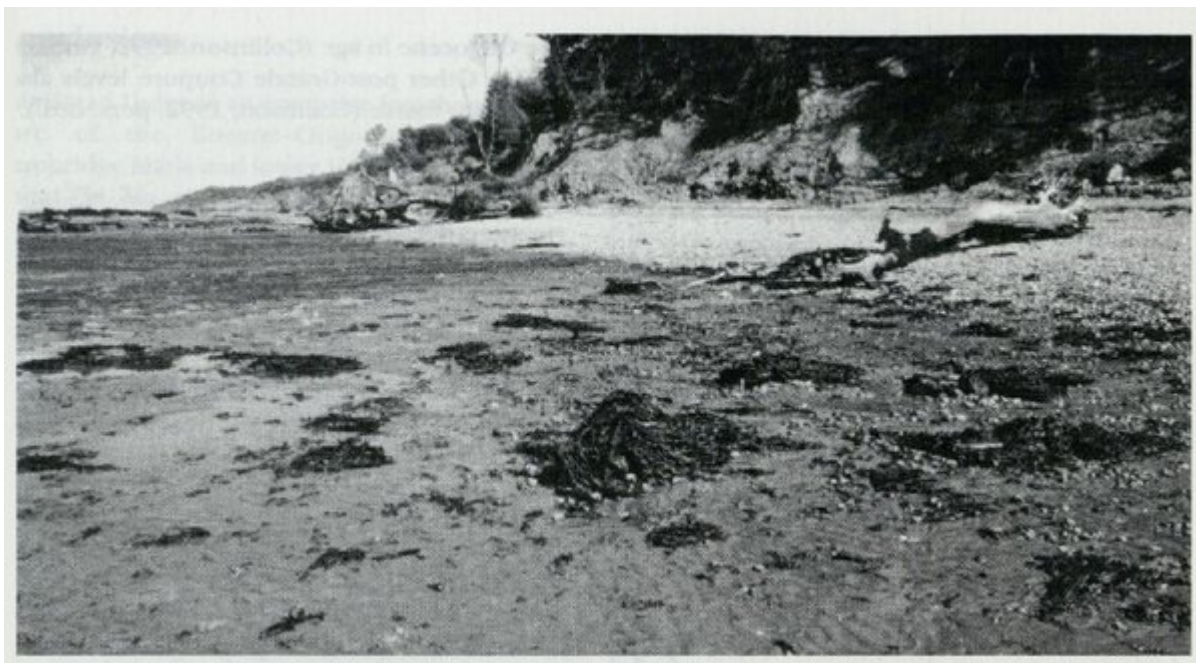
Conclusions

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.

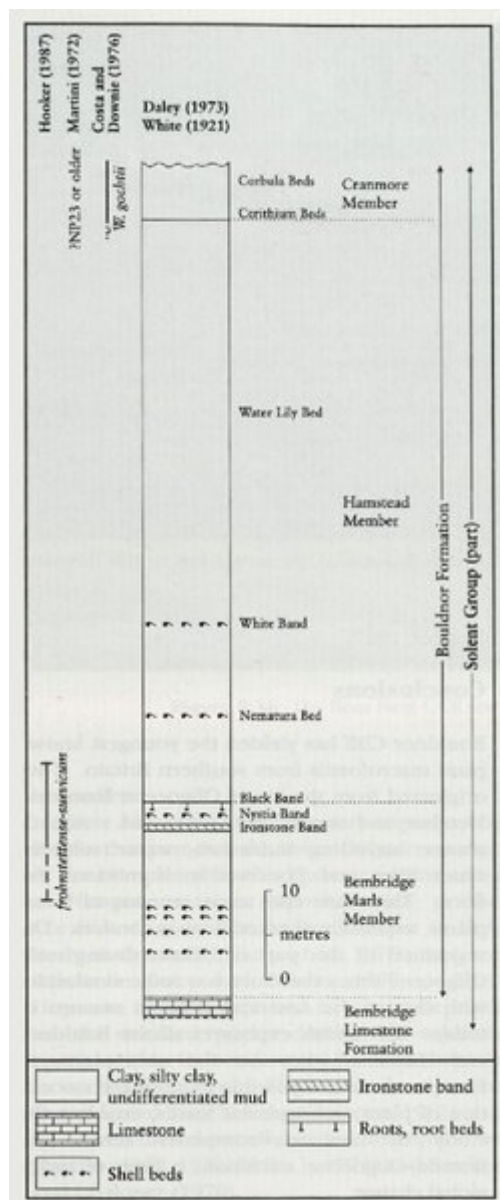
References



(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	<i>Acanthus rugatus</i> Reid and Chandler	x		
Actinidiaceae	<i>Actinidia</i> sp.	x		
Alismaceae	<i>Alismacarpus alatus</i> Collinson		x	
Apocynaceae	<i>Apocynopernum striatum</i> Reid and Chandler ¹	x		
	<i>A. rotundum</i> Reid and Chandler ²	x		
	<i>A. elegans</i> Reid and Chandler ³	x		
	<i>A. obdum</i> Reid and Chandler ⁴	x		
Agrobolaceae	<i>Ulex</i> sp.			x
Araceae	<i>Epipremnum ornata</i> (Reid and Chandler) Greger and Bogner (see Mai and Walther, 1991) ⁵	x		
Arceaceae	<i>Palmyridium</i> sp.	x		x
	<i>Sabal major</i> (Unger) Heer ⁶	x		
Asclepiadaceae	<i>Phyllanthus rectus</i> Reid and Chandler	x		
	<i>Tylosiphon antiquus</i> Reid and Chandler	x		
Betulaceae	<i>Asterocarpus</i> sp. ⁷	x		
Bignoniaceae	<i>Gatalpa rugosa</i> Reid and Chandler	x		
	<i>Jacarilla pratensis</i> Reid and Chandler	x		
	<i>Radermachera pulchra</i> Reid and Chandler	x		
Caprifoliaceae	<i>Dipelta ruscifolia</i> Reid and Chandler	x		
	<i>Sambucus parvula</i> Chandler <i>emend.</i> Collinson, 1983a		x	
Cyperaceae	<i>Caricoides obacura</i> Chandler		x	
	<i>C. nitens</i> (Heer) Chandler ⁸		x	
	<i>Carex gurnardii</i> Reid and Chandler	x		
	<i>Caricoides minima</i> (Chandler) Chandler			x
	<i>C. sp.</i>	x	x	x
	<i>Cladocarpus foeculata</i> Reid and Chandler	x		
	Genus <i>indet.</i> (Collinson, 1983a)		x	
Droseraceae	<i>Alabrostris intermedia</i> Reid and Chandler	x		x
Hydrocharitaceae	<i>Ottelia bristowensis</i> Reid and Chandler	x		
	<i>Syringites neglecta</i> Chandler	x	x	f
	<i>S. aculeatus</i> (Brongniart) Chandler			x
	<i>S. aculeatus</i> Chandler			x
	<i>S. sp.</i> (leaf margin teeth – see Collinson, 1983a)		x	
Juglandaceae	<i>Palaeocarya macroptera</i> (Brongniart) Jährichen, Friedrich and Také (see Manchester, 1987) ⁹	x		
	<i>Engelhardtia</i> sp.	x		
	<i>Hondrya hermsi</i> (Heer) Reid and Chandler	x		
Juncaceae	<i>Juncus rectus</i> Collinson		x	
Lamiaceae	<i>Melissa parva</i> Reid and Chandler	x		
	<i>Apogonoclea embleti</i> Reid and Chandler	x		
Lauraceae	<i>Daphnogene lanceolatum</i> Unger ¹⁰	x		
	<i>Nerolana</i> sp.	x		

Family	Species	Thorness Bay (Insect Limestone)	Hamstead Ledge	Bouldnor Cliff
Monacae	<i>Ficus</i> sp.	x		
Najadaceae	<i>Najas oligocarpa</i> Reid and Chandler	x		
Nymphaeaceae	<i>Nymphaea limicola</i> Collinson ¹¹		x	
	<i>Najas chandlerae</i> Collinson	x	x	x
	<i>Najasbuchia</i> Hingst			x
Papaveraceae	<i>Papaver pectinatum</i> Reid and Chandler	x		
Potamogetonaceae	<i>Potamogeton pygmaeus</i> Chandler (see Collinson, 1983a)	x		
	<i>P. tenuicarpus</i> Reid and Reid <i>emend.</i> Collinson, 1983a		x	x
	<i>P. sp.</i>	x	x	x
	<i>Limnocarpos forbesii</i> (Heer) Chandler <i>emend.</i> Collinson, 1982a	x	x	x
	<i>L. (?) sp.</i> (see Reid and Chandler (see Collinson, 1982a))	x		
Ranunculaceae	<i>Chamae rectus</i> Reid and Chandler	x		
	<i>Myosurus heterostylus</i> (Reid and Chandler) Mai in Mai and Walther, 1978 ¹²	x		
	<i>Ranunculus ovaliformis</i> (Reid and Chandler) Chandler	x		
Rhamnaceae	<i>Ziziphys parviflorus</i> (Unger) Reid and Chandler	x		
Rosaceae	<i>Rubus</i> sp.			x
Rutaceae	<i>Zanthoxylum (?) rotundum</i> Reid and Chandler	x		
Sparganiaceae	<i>Sparganium multilobatum</i> Reid and Chandler	x		f
Typhaceae	<i>Typha latifolia</i> (Brongniart) Reid and Chandler (see Collinson, 1983a)	x	x	x
	<i>T. sp.</i> (Collinson, 1983a)		x	x
Zingiberaceae/Monacae	<i>Nerolana</i> sp.	x		
	<i>Spirematopernum wetleri</i> (Heer) Chandler ¹³	x	x	
<i>Incertae sedis</i>	<i>Abelia quadrilobata</i> Reid and Chandler ¹⁴	x		
	<i>A. quadrilobata</i> Reid and Chandler ¹⁵	x		
	<i>A. trilobata</i> Reid and Chandler ¹⁶	x		
	<i>Carpodites collinus</i> Collinson		x	
	<i>C. hamsteadensis</i> Collinson		x	
	<i>C. sp.</i>	x		x
	<i>Dicostylidium pinnatifidum</i> Reid and Chandler	x	x	
	<i>Flabellaria anglica</i> Reid and Chandler	x		
	<i>Monoecophyllum</i> sp.			
	<i>Rhamnospermum bilobatum</i> Chandler	x	x	x

- 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 *Garpinus* sp. and *Abelia* sp. 4, each from a single specimen. They were transferred to *Asterocarpus* by Manchester and Donoghue (1995, p. 721).
⁵ Includes *C. cf. macrocarpa* 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 *Cissampelos 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 heterostylus* Reid and Chandler.
¹⁰ See text for the Hoedle GCR site for discussion of *Spirematopernum*.
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	Stodland
Pieridaceae	<i>Acrostichum lanxianum</i> (Visian) Chandler		x	x
Schizaceae	<i>Ugandium bonifantii</i> Heer <i>emend.</i> Gardner and Hingst			x
	<i>E. poolensis</i> Chandler	x		
	<i>Artemisia poolensis</i> Chandler		x	
	<i>Ragfollia subcretaea</i> (Saporta) Barthel, 1976 ¹		x	
Taxodiaceae	<i>Taxodium labensis</i> Chandler	x		
	<i>Sequoia confertifolia</i> Heer ²			x
Actinidiaceae	<i>Saurauia crassipetala</i> (Chandler) Mai ³	x		
	<i>S. poolensis</i> (Chandler) Mai, 1970 ⁴	x		
Anacardiaceae	<i>Dracopis caryophyllata</i> Chandler	x		
	<i>Lamnea</i> sp.	x		
	<i>Rhus labensis</i> Chandler	x		
	<i>R. sp.</i>	x		
Apocynaceae	<i>Apocynopernum acutiforme</i> Chandler ⁵	x		
	<i>A. labense</i> Chandler ⁶	x		
Arceaceae	<i>Galium alamoscorpi</i> (Unger) Chandler	x		
	<i>Sabal</i> sp.		x	
Boraginaceae	<i>Ehretia labensis</i> Chandler	x		
Burseraceae	<i>Palaeobursera labensis</i> Chandler	x		
Capparidaceae	<i>Bartonella emarginata</i> Chandler		x	x
	<i>Palaeocleome labensis</i> Chandler	x		
	<i>Cappariopsis eocenica</i> Chandler	x		
Caprifoliaceae	<i>Sambucus parvula</i> Chandler	x		
Cornaceae (including Mastoiaceae)	<i>Duranta labensis</i> Chandler ⁷	x		
	<i>Romatixia rigosa</i> (Zemke) Chandler (see Mai, 1993)	x	x	
	<i>E. arceolata</i> Chandler	x		
	<i>Mastixia confertifolia</i> Reid and Chandler ⁸	x	x	
	<i>Mastixicarpus crassus</i> Chandler (see Mai, 1993)	x		
Cucurbitaceae	<i>Sclera quadriflorata</i> (Chandler) Mai, 1999 ⁹	x		
	<i>Cucurbitopernum labense</i> Chandler	x		
	<i>C. obliquum</i> Chandler	x		
Cyperaceae	<i>Scirpus labensis</i> Chandler	x	x	
	<i>Scirpus</i> sp.	x		
	<i>Caricoides arnei</i> Chandler		x	
	<i>C. obacura</i> Chandler	x		
	<i>Caricoides</i> sp.	x		x
	<i>Cladocarpus minima</i> (Chandler) Mai in Mai and Walther, 1978			
Dienaceae	<i>Diapryos laudonensis</i> Chandler	x		
Euphorbiaceae	<i>Euphorbia labensis</i> Chandler	x		
	<i>E. platyphora</i> Chandler	x		
	<i>E. tuberculata</i> Chandler	x		
	<i>E. digitata</i> Chandler	x		
	<i>Euphorbiaopernum punctatum</i> Chandler	x		
	<i>Wetberella variabilis</i> Bowbank		x	
Flacourtiaceae	<i>Oncoba rigosa</i> Chandler		x	
Hamamelidaceae	<i>Strobilastera subglobosa</i> Presl ¹⁰	x		

Family	Species	Lake	Arne	Stodland
Isosinaceae	<i>Isosin</i> <i>emend.</i> Chandler	x	x	
	<i>Nastium eocenicum</i> Chandler ¹¹	x		
	<i>Palaeophytocrene foeculata</i> Reid and Chandler	x		
	<i>Isosin</i> <i>emend.</i> Chandler	x	x	
Lauraceae	<i>Lauracarpus</i> spp.	x		
Lythraceae	<i>Ammanthus labensis</i> Chandler	x		
	<i>Alatopernum labense</i> Chandler	x		
Menispermaceae	<i>Timopora armenia</i> Chandler	x	x	
	<i>Palaeococcus labensis</i> Chandler	x	x	
	<i>Wardleya poolensis</i> (Chandler) Hyde, 1970		x	
Moraceae	<i>Ficus lucida</i> Chandler (see Collinson, 1989)	x		
	<i>F. sp.</i>			x
Moraceae	<i>Oricarpium reticulatum</i> Chandler (see Collinson, 1989)		x	
Nymphaeaceae	<i>Palaeonymphaea eocenica</i> Chandler (see Collinson, 1980a)	x		
Nymphaeaceae	<i>Najasbuchia eocenica</i> Chandler	x	x	
Rosaceae	<i>Rubus acutiformis</i> Chandler			x
Rutaceae	<i>Phellodendron rotundum</i> Chandler	x	x	
	<i>Rutaopernum eocenicum</i> Chandler	x		
	<i>R. glabrum</i> Chandler	x		
	<i>R. magnificum</i> Chandler		x	
	<i>R. striatum</i> Chandler	x		
Sabiaceae	<i>Melasma thuyoides</i> Reid and Chandler	x		
Sapotaceae	<i>Sapotocarpum</i> sp.		x	
Solanaceae	<i>Solanum armenia</i> Chandler	x		
	<i>Solanopernum rufiforme</i> Chandler	x		
Seyracaceae	<i>Styrax elegans</i> Chandler	x		
Symplocaceae	<i>Symplocos beudanticus</i> Chandler		x	
	<i>S. labensis</i> Chandler	x	x	
Theracae	<i>Cleyera obliqua</i> Chandler	x		
	<i>Coronilla</i> sp.			
Thymelaeaceae	<i>Thymelaeopernum labense</i> Chandler	x	x	
	<i>T. rufatum</i> Chandler	x		
Vitaceae	<i>Vitis ambigua</i> Chandler	x		
	<i>V. armenia</i> Chandler		x	
	<i>V. cuneata</i> Chandler	x		
	<i>V. eximata</i> Chandler	x		
	<i>V. labensis</i> Chandler	x		
	<i>V. lasatica</i> Cretzoi and Skogljo ¹²	x	x	
	<i>V. platyphora</i> Chandler	x		
	<i>V. poolensis</i> Chandler	x		
	<i>V. pygmaea</i> Chandler	x	x	
	<i>V. goodii</i> Chandler	x	x	
	<i>V. gymnetica</i> Chandler	x		
	<i>V. triangularis</i> Chandler		x	
	<i>Tetrastigma acuminata</i> Chandler		x	
	<i>T. lobata</i> Chandler	x		
Zingiberaceae	<i>Alpinia armenia</i> (Chandler) Mai in Mai and Walther, 1985 ¹³		x	
<i>Incertae sedis</i>	<i>Rhamnospermum bilobatum</i> Chandler	x	x	
	<i>Carpodites armenia</i> Chandler		x	

(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