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# Colwell Bay

[SZ 330 884]

## Introduction

Colwell Bay is another of the classic lower Tertiary stratigraphical sites in southern Britain, and it is described in detail by Daley (in Daley and Balson, 1999). It is the only site yielding plant fossils from the Linstone Chine Member (upper Headon Beds of earlier authors), of late Eocene age. The flora consists mainly of aquatic plants and includes over 40 species, for some of which this is the only known site.

The plant fossils that occur here in the late Eocene Linstone Chine Member have been described by Chandler (1955, 1963a) and Collinson (1980a,b). Chandler (1961c, p. 101) also described a small flora from the Totland Bay Member here (see (Table 9.2)). Charophytes occur at various levels (Feist-Castell, 1977).

## Description

### Stratigraphy

The sequence has been described by Keeping and Tawney (1881), Reid and Strahan (1889) and Daley (in Daley and Balson, 1999). There are c. 33 m of the Headon Hill Formation, between the Totland Bay and Osborne Marls Members (Figure 9.20) and (Figure 9.21). The plant fossils mostly occur in carbonaceous bands within a unit of laminated clays and sands, at the base of the Linstone Chine Member. This unit contains abundant fossils of the bivalve *Potamomya*, indicating brackish conditions.

### Palaeobotany

The plant fossils found here are mainly carbonaceous fruits and seeds, often with replacement by amorphous pyrite. Chandler (1963a) states that there are some 38 taxa known from here, 27 of which were named to species. Angiosperms are by far the commonest, and over half of these are aquatic or marsh plants, including rushes, water soldiers, water lilies and pondweeds ((Figure 9.22); a full list of the angiosperm fruits and seeds found here is given in (Table 9.2)). The remains of plants that grew in drier conditions are much scarcer, although fragments of twigs, seeds and cone-scales of the taxodiaceous conifer *Sequoia couttsiae* Heer (see Footnote 2 to (Table 8.2), this volume) are locally common. In addition, there are rare fruits of elder (*Sambucus*), fig (*Ficus* — see comments by Collinson, 1989), bog-myrtle (*Myrica*) and silkwood (*Zanthoxylon*).

Ferns are uncommon here, but Chandler (1955) described a single fertile pinnule of the schizaeacean *Anemia colwellensis* Chandler. Barthel (1976) regarded this species as a synonym of *Ruffordia subcretacea* (Saporta) Barthel. *Ruffordia* clearly belongs in a Glade including *Anemia* and is very similar to *Anemia* (Collinson, 1996a, in press a). Collinson (1980b) described the megaspore of the water fern *Azolla colwellensis* Collinson, which is unique to this site, and is the youngest record of the primitive form with many 'floats' in the megaspore (Figure 9.23).

## Interpretation

Chandler (1963a) was of the view that the Colwell Bay flora 'is not a very remarkable or informative one'. It is indeed similar in many ways to that from the lower part of the Headon Hill Formation (Totland Bay Member), such as seen at Hordle, consisting predominantly of aquatic and marsh plants. However, there are many features that make the Colwell Bay flora distinctive and important, not least the fact that it is the type locality for nine species: *Azolla colwellensis*, *Anemia colwellensis*, *Carex colwellensis*, *Cladiocarya colwellensis*, *Myrica colwellensis*, *Decodon vectensis*, *Sambucus colwellensis* (synonymized with *S. parvula* Chandler by Collinson, 1983a), *Epacridicarpum colwellense* and *Carpolithus colwellensis*. The *Anemia* has been tentatively identified from another locality (Chandler, 1964) and is more widespread if

included in *Ruffordia subcretacea* (Barthel, 1976). *Decodon vectensis* ranges up into the early Miocene deposits in Europe; the record from Colwell Bay is the oldest (Mai, 2000).

Colwell Bay is the only site to yield plant fossils from the late Eocene Linstone Chine Member (Headon Hill Formation), and as such is important for establishing the pattern of vegetational and climatic change in southern England during the Palaeogene Period. This is most clearly seen in the aquatic part of the flora. It shows the extinction of *Stratiotes hantonensis*, which becomes replaced by the larger *S. headonensis*, and the youngest possible occurrences of *?Caricoidea angulata* and *?C. obscura*. Collinson (1983a) considered these specimens of *?C. obscura* to be similar to some from the Bembridge Marls but probably distinct from those in older strata. Also here is the first appearance of *Nymphaea* in the British fossil record.

The forest component provides less evidence of the environmental changes occurring at this time, but this is probably merely a function of the scarcity of the fossils of this part of the flora. It is nevertheless of note that these beds include the youngest occurrences of *Ficus lucidus*, *Hordwellia crassisperma* and *Epacridicarpum headonense*. Bulk sampling has the potential for yielding plant fossils from other levels in this section and it is worth noting that *Stratiotes* has been recovered from the *Venus* Beds (Collinson, pers. obs.). Charophytes, of value in palaeoenvironmental analysis and biostratigraphy, occur throughout the site (Feist-Castell, 1977).

## Conclusions

Colwell Bay is the only British site to have yielded plant fossils from the Linstone Chine Member (Headon Hill Formation), of late Eocene age (c. 36 Ma old). It is thus crucial for understanding variations in the geographical and temporal distribution of these floras. The fossils are mainly the fruits and seeds of aquatic and marsh plants, and they help demonstrate the progressive cooling of the climate that was taking part in southern Britain at this time. Although the flora is not as diverse as at some other Lower Tertiary sites in Britain, it has yielded seven species that are unique to this site.

## References

Family	Species	Hordle Cliffs	Colwell Bay (Totland Bay Member)	Colwell Bay (Linstone Chine Member)
Acanthaceae	<i>Acanthus</i> sp.	x		
Actinidiaceae	<i>Actinidia</i> sp.	x		
	<i>Saurauia crassispina</i> (Chandler) Mai <sup>1</sup>	x		x
Anacardiaceae	<i>Genus ?</i> (Sapotaceae?)	x		
Araceae	<i>Genus ?</i>	x		
Arceuthaceae	<i>Leuce</i>	x		
Betulaceae	<i>Carpinus boreynensis</i> (Heer) Chandler	x		
Boraginaceae	<i>Omphalodes platycarpa</i> Chandler	x		
Burseraceae	<i>Palaeobursera luteovita</i> Chandler	x		
Caprifoliaceae	<i>Sambucus parvifolia</i> Chandler <sup>2</sup>	x		x
Carophyllaceae	<i>Hieracium pulchrum</i> (Chandler) Chandler	x		
	<i>H. glabra</i> Chandler	x		
Cercidiphyllaceae	<i>Nyssiaum archicum</i> (Heer) Björkstén <sup>3</sup>	x		
Cornaceae (including Mastixaceae)	<i>Dumetia glandulosa</i> (Chandler) Chandler <sup>4</sup>	x		
	<i>Eumastix rugosa</i> (Zanker) Chandler	x		
	<i>Sida quadrilocularis</i> (Chandler) Mai, 1999 <sup>5</sup>	x		
	<i>Genus ?</i>	x		
Cucurbitaceae	<i>Cucurbitopernum rotundifolium</i> Chandler	x		
Cyperaceae	<i>Caryocoma angulata</i> Chandler <sup>6</sup>			x
	<i>C. nitens</i> (Heer) Chandler			x
	<i>C. obscura</i> Chandler			x
	<i>Cladocarya minutum</i> (Chandler) Mai <sup>7</sup>	x		
	<i>C. colwellensis</i> (Chandler) Mai <sup>8</sup>			x
	<i>Carex colwellensis</i> Chandler			x
	<i>C. spp.</i>			x
	<i>Scleria</i> sp.			x
	<i>Scleria borewellensis</i> Chandler	x		
Cyrtaceae <sup>9</sup>	<i>Epacridicarpum headonense</i> Chandler	x		x
	<i>E. colwellense</i> Chandler			x
Dioscoreaceae	<i>Albomaria ovata</i> (Chandler) Chandler	x	x	x
Ebenaceae	<i>Diogyne headonensis</i> Chandler	x		
Euphorbiaceae	<i>2 Genera ?</i>	x		
Hamamelidaceae	<i>Strainhamia angulifolia</i> Presl <sup>10</sup>	x		
Hydrocharitaceae	<i>Stratiotes headonensis</i> Chandler	x	x	x
	<i>S. hantonensis</i> Chandler	x		
Iaciniaceae	<i>Hadra</i> sp. (or <i>Natantium</i> )	x		
	<i>Hadra borewellensis</i> Chandler	x		
	<i>Hadra hantonensis</i> Chandler	x		
	<i>I. bechtoldensis</i> Chandler	x		
	<i>Natantium cocoricum</i> Chandler <sup>11</sup>	x		
	<i>Genus ?</i>	x		
	<i>2 Genera ?</i>	x		
Lythraceae	<i>Decodon erectus</i> Chandler			x
	<i>Microulteria parva</i> Chandler			?
	<i>Genus ?</i>	x		
Menispermaceae	<i>Palaeonitensium obliquatum</i> (Chandler) Chandler	x		
Moraceae <sup>12</sup>	<i>Chlorophora bicarinata</i> Chandler	x		
	<i>Broussonetia rugosa</i> Chandler	x		
	<i>Morinda boreynensis</i> Chandler <sup>13</sup>	x		
	<i>Bechtoldia hantonensis</i> Chandler	x		
	<i>Ficus lucidus</i> Chandler			x

Family	Species	Hordle Cliffs	Colwell Bay (Totland Bay Member)	Colwell Bay (Linstone Chine Mbr)
Myricaceae	<i>Myrica boreynensis</i> (Heer) Chandler	x		x
	<i>M. colwellensis</i> Chandler			x
Nymphaeaceae	<i>Sabrenia chandleyae</i> Collinson 1980a	x	x	x
	<i>Sabrenia spinosa</i> Chandler	x		x
	<i>S. oblonga</i> Chandler	x		x
	<i>Nymphaea</i> sp.			x
Oleaceae	<i>Olea headonensis</i> Chandler	x		
Potamogetonaceae	<i>Potamogeton pygmaeus</i> Chandler (see Collinson, 1983a)	x	x	x
	<i>P. sp.</i>	x		x
	<i>Limonocarpus forbesii</i> (Heer) Chandler <sup>14</sup>	x	x	x
Rhamnaceae	<i>Fraxinus borewellensis</i> Chandler	x		
Rosaceae	<i>Rubus acutiformis</i> Chandler	x		
Rutaceae	<i>2E. microcarpum</i> Heil and Heil			x
	<i>Phellodendron costatum</i> Chandler	x		
	<i>Acronychia ornata</i> (Chandler) Mai, 1976 <sup>15</sup>	x		
	<i>Zanthoxylum borewellense</i> Chandler	x		x
	<i>Z. compressum</i> Chandler	x		
Sabiaceae	<i>Melicope</i> sp.	x		
Sterculiaceae	<i>Myrtilis elegans</i> Chandler	x		
Symplocaceae	<i>Symplocos headonensis</i> Chandler	x		
	<i>S. sp.</i>			x
	<i>Asarodes?</i> costata Chandler			x
Theaceae	<i>Viburnum borewellense</i> (Chandler) Mai <sup>16</sup>	x		
	<i>Farya bechtoldensis</i> Chandler	x		
	<i>F. atpensis</i> (Ludwig) Mai <sup>17</sup>	x		
	<i>Gordonia minutum</i> Chandler	x		
	<i>Polypora truncata</i> (Chandler) Gregg <sup>18</sup>	x		
Thymelaeaceae	<i>Genus?</i>	x		
Typhaceae	<i>Typha</i> sp.			x
Vitaceae	<i>Ampelopsis rotundata</i> Chandler	x		
	<i>Parthenocissus borewellensis</i> Chandler	x		
	<i>Ternstroemia lobata</i> Chandler	x		
	<i>Vitis hantonensis</i> Chandler	x		
Zingiberaceae/ Musaceae	<i>Spirmatopernum isozteri</i> (Heer) Chandler <sup>19</sup>	x		
Incertae sedis	<i>Caryophyllus fibrosus</i> Chandler	x		
	<i>C. apocyniformis</i> Chandler	x		
	<i>C. colwellensis</i> Chandler			x
	<i>C. spp.</i>			x
	<i>Rhamnospermum bechtoldense</i> Chandler	x		

<sup>1</sup> Formerly *Borewellia crassispina* (Chandler) then included within the Theaceae (see Mai and Walther, 1985).

<sup>2</sup> This includes *Sambucus borewellensis* Chandler (see Collinson, 1983a).

<sup>3</sup> See Crane (1984).

<sup>4</sup> See Footnote 4 to Table 8.1.

<sup>5</sup> Originally *Genus quadrilocularis* Chandler.

<sup>6</sup> See Collinson (1983a).

<sup>7</sup> See Mai and Walther (1978).

<sup>8</sup> See Footnote 7 to Table 9.1.

<sup>9</sup> Includes *Edogadendron borewellense* Chandler and *Protobaptia hantonensis* Chandler (see Mai and Walther, 1985).

<sup>10</sup> See Footnote to Tables 8.1 and 8.2.

<sup>11</sup> See Collinson (1989).

<sup>12</sup> Includes *Morinda borewellensis* Chandler (see Mai and Walther, 1978).

<sup>13</sup> Enrolled by Collinson (1982a).

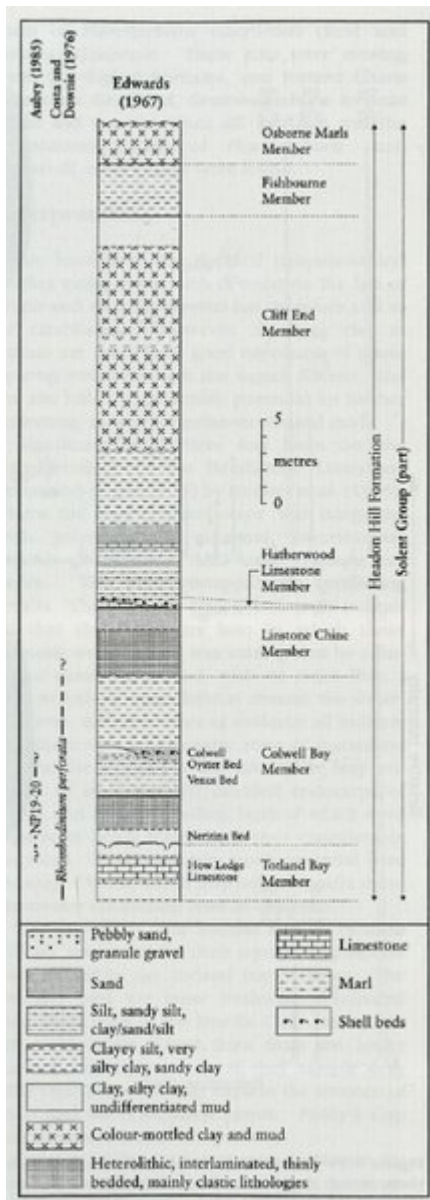
<sup>14</sup> Formerly *Rutaepernum ornatum* (Chandler) (see Mai, 1976; Collinson and Gregg, 1988).

<sup>15</sup> Formerly *Caryophyllus borewellensis* Chandler (see Mai and Walther, 1991).

<sup>16</sup> Formerly *Clypeol* *stiposus* (Ludwig).

<sup>17</sup> See text under Hordle site for discussion of *Spirmatopernum*.

(Table 9.2). Angiosperm floras from the Headon Hill Formation. Species descriptions or reference to them may be found in Chandler (1961c, 1963a), unless otherwise referenced. Discussion and other records for some of these species may be found in Mai and Walther (1978, 1985, 1991) and Mai (2000). The family classification used here is summarized in Chapter 1 of the present volume.



(Figure 9.20) Stratigraphical succession at Colwell Bay, Isle of Wight. (After Daley and Balson, 1999, fig. 5.33.)



*(Figure 9.21) View looking north in Colwell Bay, spanning Brambles Chine to Cliff End, Fort Albert (now a hotel). The exposures are mainly of the Colwell Bay and Cliff End members, Headon Hill Formation. (Photo: M.E. Collinson.)*

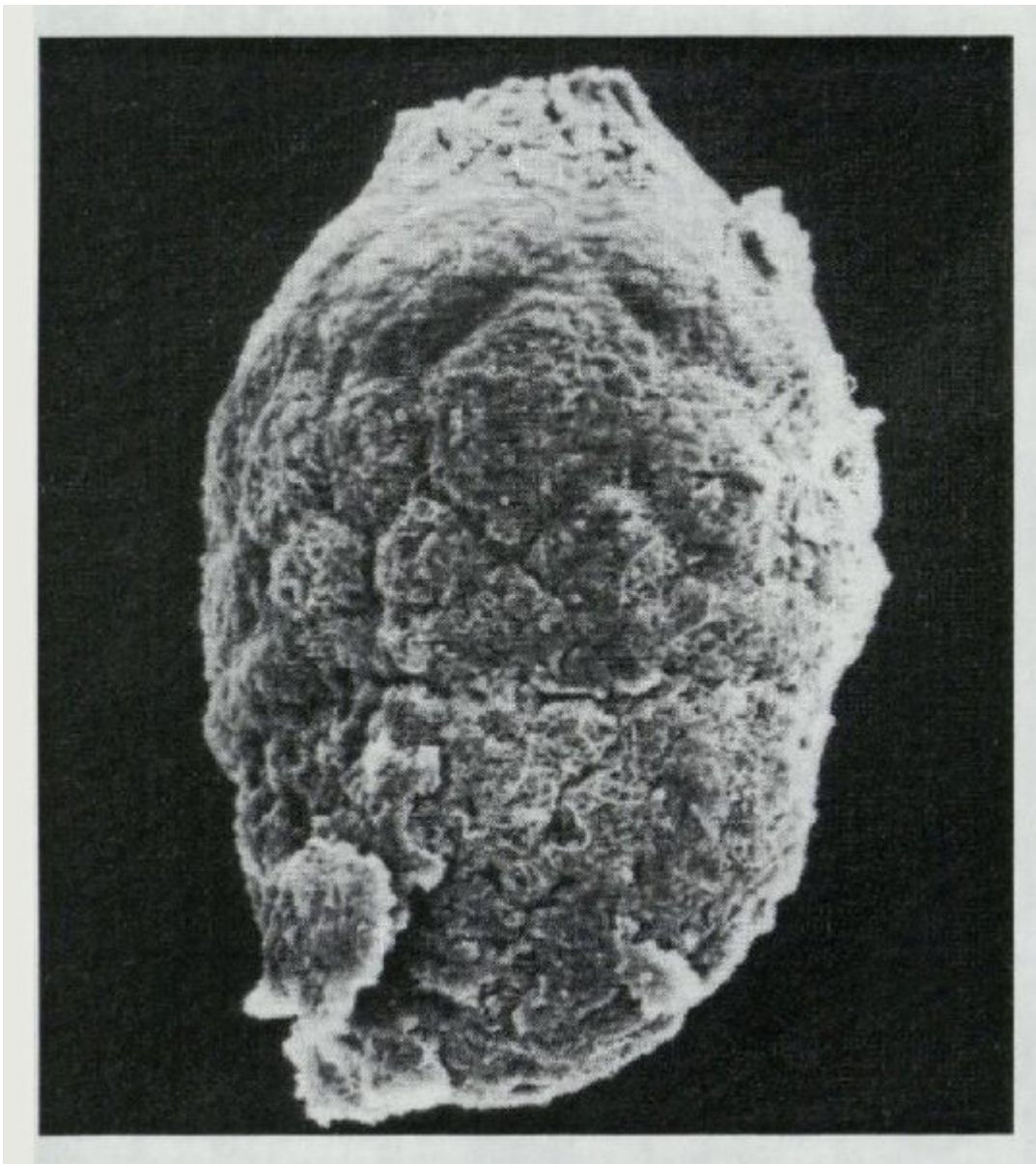


*(Figure 9.22) Bedding surface in the Headon Hill Formation covered in fruits of the pondweed Potamogeton, x 8, from Colwell Bay. (Photo: M.E. Collinson.)*



Family	Species	Lake	Arne	Stadland	Family	Species	Lake	Arne	Stadland
Pteridaceae	<i>Acrostichum lanuvianum</i> (Vahl) Chandler		x	x	Jacobiaceae	<i>Isola acutiformis</i> Chandler	x	x	
Schizaceae	<i>Igodiom banifusci</i> Heer emend. Gardner and Eisinghausen			x		<i>Nastium eocenicum</i> Chandler <sup>11</sup>	x		
	<i>I. poolenii</i> Chandler	x				<i>Palaeophytocrene foerata</i> Reid and Chandler	x		
	<i>Artemisia poolenii</i> Chandler	x	x			<i>Isotricorys inornata</i> Chandler	x	x	
	<i>Rajfordia subretacea</i> (Saporta) Barthel, 1976 <sup>1</sup>		x		Lauraceae	<i>Lauraceum</i> spp.	x		
Taxodiaceae	<i>Taxodium labensii</i> Chandler	x	x		Lythraceae	<i>Ammonia labensii</i> Chandler	x		
	<i>Sagoula confertifolia</i> Heer <sup>2</sup>			x		<i>Alatoparman labensii</i> Chandler	x		
Actinidiaceae	<i>Saxatula crassipetala</i> (Chandler) Mai <sup>3</sup>	x			Menispermaceae	<i>Tinospora armenis</i> Chandler	x	x	
	<i>S. poolenii</i> (Chandler) Mai, 1970 <sup>4</sup>	x				<i>Palaeococcus labensii</i> Chandler	x	x	
Anacardiaceae	<i>Dracostocarya glandulosa</i> Chandler	x				<i>Wardlesteppeya poolenii</i> (Chandler) Hyde, 1970		x	
	<i>Lamnea</i> sp.	x			Moraceae	<i>Ficus lucida</i> Chandler (see Collinson, 1989)	x		
	<i>Rhus labensii</i> Chandler	x				<i>F.</i> sp.			x
	<i>R.</i> spp.	x			Moraceae	<i>Oreocarpum reticulatum</i> Chandler (see Collinson, 1989)		x	
Apocynaceae	<i>Apocynoparman acutiforme</i> Chandler <sup>5</sup>	x			Nymphaeaceae	<i>Palaeonymphaea eocenica</i> Chandler (see Collinson 1980a)	x		
	<i>A. labense</i> Chandler <sup>5</sup>	x			Nyctaceae	<i>Nyctoleia eocenicum</i> Chandler	x	x	
Arceaceae	<i>Galama darmonorpha</i> (Unger) Chandler	x			Rosaceae	<i>Rubus acutiformis</i> Chandler			x
	<i>Sabal</i> sp.		x		Rutaceae	<i>Phellodendron cotatum</i> Chandler		x	
Boraginaceae	<i>Eberia labensii</i> Chandler	x				<i>Rutaeparman excavatum</i> Chandler		x	
Burseraceae	<i>Palaeobursera labensii</i> Chandler	x				<i>R. glabrum</i> Chandler	x		
Capparidaceae	<i>Bartonella emarginata</i> Chandler	x	x	x		<i>R. magnificum</i> Chandler		x	
	<i>Palaeocleome labensii</i> Chandler	x				<i>R. striatum</i> Chandler	x		
	<i>Capparioloparman eocenicum</i> Chandler	x			Sabiaceae	<i>Meliosma steppeyense</i> Reid and Chandler	x		
Caprifoliaceae	<i>Sambucus parvula</i> Chandler	x			Sapotaceae	<i>Sapotocarpum</i> sp.		x	
Cornaceae (including Mastoiaceae)	<i>Danantaria labensii</i> Chandler <sup>6</sup>	x			Solanaceae	<i>Solanum armenae</i> Chandler		x	
	<i>Eomartesia rugosa</i> (Zenker) Chandler (see Mai, 1993)	x	x			<i>Solaniparman reniforme</i> Chandler		x	
	<i>E. arcuolata</i> Chandler	x			Seyracaceae	<i>Syrax elegans</i> Chandler	x		
	<i>Martesia canaliculata</i> Reid and Chandler <sup>7</sup>	x	x		Symplocaceae	<i>Symplocos beudanticus</i> Chandler		x	
	<i>Mastoiocarpus eximus</i> (Chandler) (see Mai, 1993)	x				<i>S. labensii</i> Chandler	x	x	
	<i>Sactia quadrilocularis</i> (Chandler) Mai, 1999 <sup>8</sup>	x			Theaceae	<i>Cleyera? obliqua</i> Chandler	x		
Cucurbitaceae	<i>Cucurbitoparman labense</i> Chandler	x				<i>Georhiza</i> sp.	x		
	<i>C. obliquum</i> Chandler	x			Thymelaeaceae	<i>Thymelaeoparman labense</i> Chandler	x	x	
Cyperaceae	<i>Scirpus? labensii</i> Chandler	x	x			<i>T. sulcatum</i> Chandler	x		
	<i>Scirpus</i> sp.	x			Vitaceae	<i>Vitis ambigua</i> Chandler	x		
	<i>Caricoides arnei</i> Chandler		x			<i>V. armenis</i> Chandler		x	
	<i>C. obtusata</i> Chandler	x				<i>V. comata</i> Chandler	x		
	<i>Caricoides</i> sp.	x				<i>V. ovata</i> Chandler	x		
	<i>Glaucocarya minima</i> (Chandler) Mai in Mai and Walther, 1978 <sup>9</sup>		x			<i>V. labensii</i> Chandler	x		
Theracae	<i>Dioplyra beudanticus</i> Chandler	x				<i>V. justica</i> Cretton and Skogella <sup>14</sup>	x	x	
Euphorbiaceae	<i>Euphorbia? labensii</i> Chandler	x				<i>V. platyperma</i> Chandler	x	x	
	<i>E. platyperma</i> Chandler	x				<i>V. poolenii</i> Chandler	x		
	<i>E. tuberculata</i> Chandler	x				<i>V. pygmaea</i> Chandler	x	x	
	<i>E. aligata</i> Chandler	x				<i>V. goodhartii</i> Chandler	x	x	
	<i>Euphorbioparman punctatum</i> Chandler	x				<i>V. symmetrica</i> Chandler	x		
	<i>Wetherillia variabilis</i> Bowcherbank		x			<i>V. triangularis</i> Chandler		x	
Flacourtiaceae	<i>Oncoba rugosa</i> Chandler		x			<i>Tetrastigma acuminata</i> Chandler		x	
Hamamelidaceae	<i>Stenbanera subglobosa</i> Presl <sup>10</sup>	x				<i>T. lobata</i> Chandler	x		
					Zingiberaceae	<i>Alpinia armenae</i> (Chandler) Mai in Mai and Walther, 1985 <sup>11</sup>		x	
					Isocretae seeds	<i>Rhamnospermum bilobatum</i> Chandler	x	x	
						<i>Carpodites armenae</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



(Figure 9.23) Megaspore of the water fern *Azolla colwellensis* from Colwell Bay, with attached microspore massula, viewed under Scanning Electron Microscope,  $\times 195$  (see Collinson, 1980b). (Photo: M.E. Collinson.)