# Barton

[SZ 207 931]-[SZ 227 931]

## Introduction

This is the best site for yielding fossil plants from the Barton Clay Formation, of late middle Eocene age. It has yielded 28 species, for five of which this is the type locality. It shows clear evidence of a mixed forest and wetland vegetation, which shows evidence of the initial Eocene climatic cooling.

The Barton Clay Formation has generally yielded only very poor fossil floras. This is unfortunate, as it represents a crucial time, when a marked cooling of the climate was taking place. Gardner (1884, 1887b) described conifer cones and twigs from Barton Cliff; but unfortunately the specimens have been lost, presumably through degradation. A number of fragments were discovered by Burton (1933) and examined by Reid and Chandler. However, a more significant set of plant fossils was collected from the same locality in 1952 by D. Curry, and was the basis of the palaeobotanical study by Chandler (1960). One additional specimen of *Pinus dixonii* cone was documented by Chandler (1964, p. 129), and a second was found in 1980 (Figure 9.3). Chandler (1978) later added a single species to those known from here.

## Description

#### Stratigraphy

The classic paper on the stratigraphy of this site was by Burton (1933), whose classification of the beds is still widely used. More recently, the stratigraphy has been revised by Hooker (1986) (see also Daley in Daley and Balson, 1999). Within the boundary of this GCR site are exposed about 40 m of the Barton Group, including all of the Barton Clay and Becton Sand Formations (Beds A–K of Burton, 1933) (Figure 9.4). They represent upward-coarsening cycles interpreted by Hooker (1986) as representing marine transgressions in a littoral environment.

#### Palaeobotany

The bulk of the specimens reported by Burton (1933) and Chandler (1960) came from Burton's unit A3 in the Barton Clay, at the top of the first coarsening-upwards cycle. The bed is sometimes referred to as the 'Highcliff Sands', but it should not be confused with the plant bed in the Highcliffe GCR site discussed previously. Plant fossils have also been recovered from Burton's beds AI, C, D and E (Chandler, 1960; Collinson, pers. obs.). Those described by Chandler from A3 were reported to have come from a pocket of sediment, also containing fossil shells that had been trapped on the lee side of a log of wood. Dominant are fruits and seeds of aquatic or sub-aquatic plants, including water soldiers (Stratiotes hantonensis Chandler), sedges (Caricoidea obscura Chandler), water lilies (Sabrenia chandlerae Collinson 1980a) and lythraceaens (Decodon gibbosus (Reid) Reid, Microdiptera minor (Chandler) Mai, Palaeolythrum bournense Chandler), together with the enigmatic Rhamnospermum bilobatum Chandler. However, there are also fully terrestrial plants, including members of the families of Chinese gooseberries (Saurauia crassisperma (Chandler) Mai), grape vines (Parthenocissus hordewilensis Chandler), icacinas (Icacinicarya pygmaea Chandler, ?Natsiatum eocenicum Chandler see footnotes to (Table 8.1) and (Table 8.2), mezerums (?Daphne sp.), sweetleafs (Symplocos sp.) and teas (Ternstroemia bartonensis (Chandler) Mai, Eurya stigmosa (Ludwig) Mai). Mai (1976, 2000) and Mai and Walther (1978, 1985) included Epacridicarpum within the cyrilla family (two species at Barton: Epacridicarpum headonense Chandler and ?E. mudense Chandler) but Friis (1985) and van der Burgh (1988) have favoured an assigment to the heathers. Also present are conifer remains: Pinus sp. and Sequoia couttsiae Heer (see Footnote 2 to (Table 8.2)). Taxonomical and nomenclatural work and other records of these species can be found in Chandler (1960) or in Chandler (1961c, p.34 — Parthenocissus hordewllensis); Mai and Wather (1978 — Eurya stigmosa); Mai and Wather (1985 — Microdiptera minor, Saurauia crassisperma, Ternstroemia bartonensis); and Mai (2000 — Microdiptera minor).

Conifer remains also came from the clays above the Highcliff Sands. In addition to the above two mentioned taxa, Chandler (1960) identified ?'Araucarites' sternbergii Goppert from here (see comments on the 'Araucarites' in the Bracklesham GCR site report). Finally, Chandler (1960) reported *Rutaspermum* sp. from clays below the Highcliff Sands.

Chandler (1960, 1978) also reported taxa whose exact provenance within the sequence is unknown, including *Anonaspermum* spp., *Rutaspermum* sp., *Stizocarya* sp. and *Eomaxtisia rugosa* (Zenker) Chandler.

Chandler (1960) described the bulk of the plant fossils from here as being carbonaceous entities heavily impregnated with pyrite. This makes the fossils extremely vulnerable to degradation and they should be studied as soon as possible after collection.

### Interpretation

This is one of the few British sites to have yielded any diversity of plant macrofossils from the lower Bartonian Stage. It demonstrates a continuation of the vegetational trend seen through the British Palaeogene deposits, which is generally interpreted as being due to climatic cooling. As with other sites in the upper middle and lower upper Eocene, such as Highcliffe, the flora consists of a mixture of the remains of wetland and forest vegetation. The forest vegetation includes several families that suggest warm climatic conditions (custard apple, icacina and mastic trees of the dogwood families) but they are less abundant and diverse than in earlier floras. Instead conifers appear to becoming more abundant and diverse.

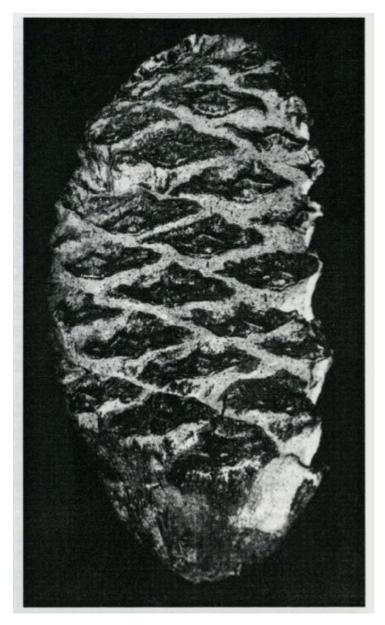
The remains of wetland plants also show changes. The mangrove palm (*Nypa*) and the '*Scirpus' lakensis* Chandler, both characteristic plants of the early and middle Eocene floras, had disappeared by this time (Collinson, 1996b, 2000a). As with some of the stratigraphically lower localities (e.g. Highcliffe), *Stratiotes* and *Sabrenia* are important components, probably indicating freshwater conditions. The most notable addition seen at Barton is *Decodon gibbosus*, a species better known from the Neogene deposits of continental Europe (Reid, 1920b), and which is similar to the swamp willow of North America (*Decodon verticillatus*).

The only other site to yield plant fossils from this part of the British Palaeogene record is Hengistbury Head in Hampshire. Chandler (1960) described a range of plant fossils from the upper Hengistbury Beds, which Curry (1976) correlated with bed A2 of Barton Cliff (see also Collinson, 1996b). However, the Hengistbury flora is not as diverse in species, especially in those taxa regarded as evidence of the paratropical forests (custard apple and icacina families). The fossils are also rarer and less well preserved than those at Barton Cliff.

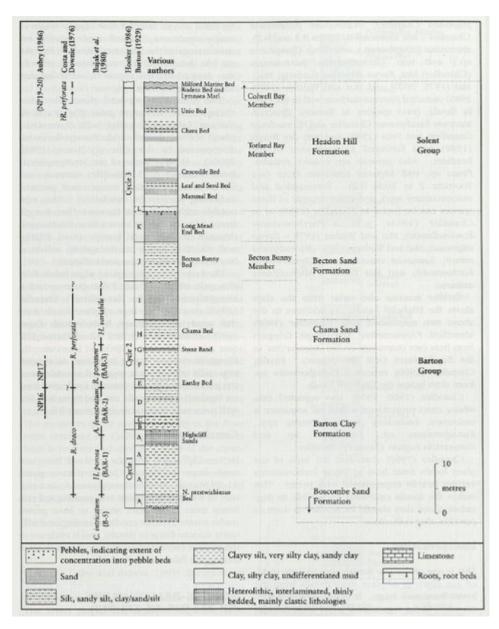
## Conclusions

Barton Cliff is the best site for fossil fruits and seeds from the Barton Clay Formation, about 41–38 Ma old. The fossils originated from a mixture of wetland vegetation and paratropical rain forest trees. The flora seems to have grown under cooler climatic conditions compared with older Eocene floras in Britain, and is evidence of the general cooling of the climate that took place during the Palaeogene Period.

#### **References**



(Figure 9.3) Cone of Pinus dixonii, a remarkable and rare fossil from Barton found in 1980, × 0.9 (specimen number BMNH V.60468). (Photo: Natural History Museum, London.)



(Figure 9.4) Stratigraphical succession at Barton Cliffs. (After Daley and Balson, 1999, fig. 6.14.)

	(Speiller	Date be	ther.	(Males)	Tank	Sprine .	here be	( Name	(Heart)	bash .	Marina .	No. be	(Marc)	-
-	Compton and inter Charden	100	-	1		Version Network and the set of th	-			-	Onefficientel Gaude, 179	-	-	
	and Chardiet (Asside) Descention of photoset had and					I share throbs					Amaginal continue Roll and			
	Party and address of the owner.			-		F supervise that and charden		1.1			mater Daniller			
	1988.	-	-	-		E president Chandral					A standard first and i bushing	- A		
	Charafter 2 produces (host and Charafter)	-	1.0			respect Spatia Andre Handen Andre Handen Antonio Kanden Antonio Kanden Antonio Kanden		-	1.0	Permanent	And the second s			1.5
	charder					F adgridules (builds	-			Terroriter of	distances appropriate linear and			
	1.7. advergious had no bands.			-C		Adult providences had not limited	. A	DC:		Annual State	A statement for an lander troughput production for an	- 1 -	-	$\Rightarrow$
	Charden Annual And and Charden Annual					1 Arginus (Red and Chauffel)	1.1				Conceptional georgenites from and Characteria		1.0	- X
	Charden Marchines, 1995	-	10			A produce of the original statements Mark with the second statements and the second statements and the second statements and the second statements in the second statements and the second statements				Sector .	Analysis And a second second second second second second s			
	end Charden 7 adjudge Aut and Standard	10000				Manhanapper op. Charden, 1978	_	1	_		A Augustance Charden	×		
	Product And and Deaths				Second .	Solid group of Automatics 1979.					A comparison from and ( Specified			1
	Bandhard Indiana Barar				begrate.	Persing alterative Standar see Standar. With Description alterative. Candida a appaired to an Annahu a apparent filterative a searchard filterative a searchard filterative a searchard filterative a searchard filterative and filterative and filterative searces (Standar Hannahum) and and and Standard and and and and Standard and and and and Standard and and and and Standard and and and and and and Standard and and and and and and Standard and and and and and and and Standard and and and and and and and and Standard and and and and and and and and standard and		1.0			Approvement (Sacolite anguert Association anguert Associ			
	Onestin Advantages from and	-			Barmont.	Records approx and others. Character		100			A shipper had and Danks			1
	Character second and the set					A supplement that and character		-	100		A additional field and Chardler	_		-
	Accurate and a second s	-				8 mail: Charafter		1.1			A adjustance to a secondar	_		
	Provide     Provide Provi					Astandorary Agentein (Apple)		1.1	-		A setument character			
	A complementary first post linearity.			1000		Proper storighters starights (ked and Charaller		1.0			R restor Red and Charafter	-		
	A completence Chandler				-	Conder Translitter Lannaux Resoluted Inner Liberthe, 27% Comparison relativistic Rel and Description	1		100		A showing host and Charden			
	A approach local and Charafter		1.00		Capacitic on Colorado	Company where the sale and			100		A Approve his set limber			
	A publican line and Chardler	1		1.1		College-text-led-livest Rel'ard		-			Cognitional and the set of the set			-
	A committee field and therefore		-	1.0	a taxes photose	Charles		-	-		Technolis untable investment one			
	1 consistent foil and finally 1 constant of any finally 1 constant of a set of a set of a 1 constant of a set of a set of a 1 constant of a set of a set of a 1 constant of a set of a set of a 1 constant of a set of a set of a 1 constant of a set of a set of a 1 constant of a set of a	_			phylania	Charles Ander son Statement (1996) Fach per Villagen, 1986 Frankling andream (Frankling)			1000	-		-		
	Frame water three and Charakers		1	1.0		Indiction to the lot and					Verder unseller Annehmen bei gest Steader Verderanden gestemmen bei mit Annehm Verderander Anderen bei auf Oberheit Antergenzen geschlicheten bei			1.0
-	Andreading and the set Opening - Schwarzahle Augescheid wird auf			1	Constraint of the local data	Robotic supristance for out					and Chernitel			
	Patronale Appoint Art at	1.1.8.1.			Retained.	1 Instantion of Section Stational and Son, 1989					The Article publication had and			1.1
hinter .	degreeners a Charden 1791		1	-		Personal Property in which the Person of	4.7	-		Patrogener .	Automptories gradefunction feed			
		-				And and Cheveler P. mobilesters has not the day together has not	1	1.0		-	Construction of the Charles			
	(Sender Gruppe and sender the data of the Compared and sender the data of the Compared Sender (Sender Sender Sender Senders) Sender Sender (Senders) Sender Sender (Senders)			1		Langence Monitorie front and Charaller			*		10 Augustus Charles		1	
	1. Antonia they are Charafter	-		1.5		Ration include his or Darks	1				A Real Property lies and the second s			1
	Straftene College, 161, 1884		-	-		R parts flor and builts	1	1000			and Walker, 1984		-	1.0
	Charles and a set of the set				Concession of	Incompare the index limits	1	1			Antoine controls hourses.	-		1
						Mader Martin Roberts Martin Martin Agentis Martin Martin Agentis Martin			. ×		An and a second			
			-	-	-	L merghden Daube	-		-	-	Lo and the Constant			-
Common State	And a second sec	Same Real	1	and the second second	Sandy.		Date for	August.	Strates.	farming - come	Spectra Antonio como bala sel Anneles Antonio basedante bala sel	Acres for	And a	-
Married Woman	Clouder report Claudes, 1978		1.1	-		<ul> <li>Appendix Recentals Recard Dealer</li> <li>Dealer</li> <li>Dealer&lt;</li></ul>					Conversion in such as in the local sectors of			
	Responsible and sol and					Carbon Charden			1		And a second sec			- 3
	Control Control of Control Con	1.0				/ pairs that and thanks	- A		1		A general day first and fraudus			
	Concerns that and Charles			1		A produced from and ( handle)	- 1		1		C. regress had and Darahy	-		- 1
	Antepho coline concernationers					And and Address of the other					Comparison of the second second second			
Destate	Address of the party of the other	-	-	-		A matching had and lineafter					Sandar A specificare Chastler A strain Chastler			-
				-		A scents had and Deadler			1.0		department Autom     department			
and the second second	Interprete graditionist had not	1				Contractory Darroller		1			and the second s		1	
1. A. A.	April 10 general party on Red			-		<ol> <li>Antenders from and Charides</li> <li>Antenders from and Charides</li> </ol>					A second set from the set of the set of the second set of the second sec			
	A descence for an interface the inter- temportant of the interface the inter- ment of the interface the interface the inter- section of the interface the interface the inter- section of the interface the interface the interface of the interface the interfa		-			1 avenues boar and charafter					A protein this and Charles			- 3
	A regret Danille	1.1	_			Anterior comment light		1			A physical part and the state of the state o			
	A comparison had not baseline	1				Astrophytopics and gas had and Charden					contraction from these and ( handhad	-		
	A failure fairt and Charoliter					Annual Indiana (had and (handha)		100	1	Lane .	Cambre		1.1	
	A other had not limited					And and Ontarias Real and					Character of the other			- 5
	A subplication that be been been been been been been been								1.	lower	Condex Condex As an experiment for the first for and Consider Conserve relianders from and			
	A dissipation first and Charitles			1		Compress that are thanker			10	Gebraria	manageria intications fear and			1
	Sath-Bolley and a Church	1.00			- Inglandarow				1.1		Another succession advances lives and		-	
	A sense had not have be					I sugar ( Sandal )		_			Provide encoders for all Standar Heart common allow for an Oracle Standar Antopicson proposition for an Oracle Internation of provide all all Internations of provide all all Internations	-	-	-
	A discussion of Dardin					resp. Resched for all     resp. Resched			-		and Chardler			
	A Characteristic Real and Characteristic					a supreme have and therefore			-		Concernations, in Supervised, Real and Street			
	Approache referantera detti anti					Contrast Character				Matchine	August agent for an Uniteda August agent for an Uniteda A cost Charles A Actual Charles A Actual Charles A Actual Charles			
				-		Charles 1911	1.00				A dense Charley			
Partners in	States and the state	1.1		1		A adaption Changing, 1978		Ł	×		Caroline			
	ed Charden Solf-paperson planetser bei ed Charden Societ	-		1	-	And Annual Supervises Annuals			1		Constant - paperties Touchts - the Analysis - Charles Merculand, Not and			- 0
	and i families					A result to Bull and Charlin			1		W Adapter (Remodencia, Not and		1	1
_	- Mandar And exploring publications have	_		1		A present bot and chardle			10		A Aspense Strendsch, Son and		1000	
	and Charden					A paperson first and Decoder			- 1 - 1		A chicago liberatori			
Terrare States	Content of the Content					- Cherriter					A Aspense Chapter		_	- 5
	1.1.1. Integering Charlie		1.1			A amplement first and Chambles	1				A advectory had any Chapter		1.1	
	Annual and the state of the local day.			1		Cardin		-	-		A adaptation paint description		1.0	
hanna	and Waldow 1980'	1	-			Catterpre bade	1.1	1.1	1		A advertised and the set			
	Andrewson argumentation ( health)					Condition of the second		- 1-		Bullacian .	Alexa percentral Not an     Charles     Argence (Arrowski) Not an     Charles     Argence (Arrowski) Not ar     Argence (Arrowski)		1	
	The second secon	-				Card Chargen			-				-	-
Tanifa	( Species	Door Bu	Name .	Manager 1	ALC: N	hanna .	State Sec. 7	Same 1	Second 7	Family 1	April 1	See Sec.	April 1	-
Biorghouses .	Other Anterna (haulter		-	1	- and	Annual Constant Data (C. S.		-	-	family horize and	Agender Scopelitike and an planet franker.			
					and the second second	17% not the Bookway, 198, 1970.	-		-		Adapting Gaulte, NY			
	P. alora Chandler					Introdu advantation division							-	1
-	F up tot. (Witness 1981) Roberts			-							4. Annumber to and Charafter			1.0
1010	7 alone (Analos 7 al and Alfanama, 1985) Malan al Juntime granific face and Danific 7, math face and Gamilia		л.			I feasible ( Bar to Res prof Battine )			1.20		Second State			
	F data (Andre) F g tak (Niemen, 100) Anter to Institution provide And ext (Andre) C with their and Charder C with their and Charder I degramme fait are familie		х.	Ì	heater	Charactery Ray to Kay and Future 1980" Relativistical in stress Reid and Charactery Ref."	- 1		-			_	_	
100	<ul> <li>Antes (Sandar, 1980)</li> <li>Antes and Alfonson, 1980)</li> <li>Antes and Alfonson, 1980)</li> <li>Antes and Antes and Antella (Antes and Antes and Antella (Antes and Antes and Antes and Antes (Antes and Antes and Antes and Antes (Antes and Antes and A</li></ul>		×.	i	Spinson .	I handheir Barto Karpel Father 1997 Shahradhad in disar Brid and Cheolait Bart Semilari ceremi beit and Cheolar	- 1		1.20					1
	Approvement that a second	3	•		Nonana Tenginana	Handher far in fan yn Pratine 1997 Maar witserfen er sen 'Noel oef Oneden fan' Urenfens en rene fan en 'Noeder I geseldense fan in Sender I geseldense fan en 'Noeder			1.20		<ul> <li>corto: Remotanti Itali ad Obsete</li> <li>desensato bei anti Disalte</li> <li>desensato bei anti Disalte</li> </ul>			*
	de la construir de la con	-			Notana Vegineen	Handher für bei der per Protein Weiter Statister anderer sonne ficht auf Statister für Anstellen Statister ficht auf Unselle- angestellenenen ficht auf Unselle- Freisenster ficht auf Statister (Freisenster ficht auf Statister (Freisenster) fichter Statister fichter (Freisenster) fichter			1.20		<ol> <li>andre Romolauli, Roll and Dealer</li> <li>downstreak, Keit and Dealer</li> <li>partie threadwale, Keit and</li> <li>Dealer</li> <li>benjamen threadwale, Keit and</li> </ol>		*	1 1 1
	4. Annual trees local and Charafter Comparison and party Charafter				Nonana Vegetaran Nonan			Ŧ	1.20		<ol> <li>andre Romolauli, Roll and Dealer</li> <li>downstreak, Keit and Dealer</li> <li>partie threadwale, Keit and</li> <li>Dealer</li> <li>benjamen threadwale, Keit and</li> </ol>			
	4. Annual trees local and Charafter Comparison and party Charafter	*	*. * *		Norman Vegetaren Norman	Handley for to fix you'll faile and the second second field of the handley first of the second field of the production of the second field of the second field of the production of the second field of the second field of the production of the second field of the second field of the production of the second field of the second field of the production of the second field of the second field of the production of the second field of the second field of the production of the second field of the second field of the production of the second field of the second field of the production of the second field of the second field of the production of the second field of the second field of the production of the second field of the second field of the production of the second field of the second field of the second field of the production of the second field of the second field of the second field of the production of the second field		-	1.20		<ol> <li>andre Romolauli, Roll and Dealer</li> <li>downstreak, Keit and Dealer</li> <li>partie threadwale, Keit and</li> <li>Dealer</li> <li>benjamen threadwale, Keit and</li> </ol>	3	÷	
	4. Annual trees local and Charafter Comparison and party Charafter	*			Norma Solare Norma Norma Norma	Includes the total part Parties and the second sec			1.20		<ul> <li>array Annotacity Rail and Charles Annormality Net and Charles Annormality Net and Annormality Net and Net Annormality Net and Net annormality Annormality Net annormality Annormality</li></ul>	-		
	4. Annual trees local and Charafter Comparison and party Charafter					Note what is a new Not or bracket, Mr. Papelson construction of Sanda- papelson to the an Sanda- relations for an Sanda- relation for an Sanda- Sanda San		r			<ul> <li>array Annotacity Rail and Charles Annormality Net and Charles Annormality Net and Annormality Net and Net Annormality Net and Net annormality Annormality Net annormality Annormality</li></ul>	3	*	
	4. Annual trees local and Charafter Comparison and party Charafter	*			hanna Tapinan Name Tana Tana	Make share a second but and Sociality invasion concrete fact and Sociality invasion concrete fact and Sociality in and Sociality and Sociality in the second second second second second second second second second second second factor of general factor (Sociality Constitute Vision Constitu- Constitute Vision Constitute Constitute Vision Constitu- Constitute Vision Constitu- Constitute Vision Constitu- Constitute Vision Constitu- Constitute Vision Constitute Constitute Vision Constitute Constitute Constitute Vision Constitute Constitute Visi		1	1.20		<ul> <li>and the second last of the second last</li></ul>			
	4. Annual trees local and Charafter Comparison and party Charafter	* * * *			hanna Tapinan Name Tana Tana	Make share a second but and Sociality invasion concrete fact and Sociality invasion concrete fact and Sociality in and Sociality and Sociality in the second second second second second second second second second second second factor of general factor (Sociality Constitute Vision Constitu- Constitute Vision Constitute Constitute Vision Constitu- Constitute Vision Constitu- Constitute Vision Constitu- Constitute Vision Constitu- Constitute Vision Constitute Constitute Vision Constitute Constitute Constitute Vision Constitute Constitute Visi		1			1 comparison (Ed. 2) Condition of the second contract (Condition of the second contract (Condition) (Condition) (Condition) Condition of the second contract (Condition) of the second contr	4		
	4. Annual trees local and Charafter Comparison alappearing Charafter	* * *			hanna Tapinan Name Tana Tana	Make share a second but and Sociality invasion concrete fact and Sociality invasion concrete fact and Sociality in and Sociality and Sociality in the second second second second second second second second second second second factor of general factor (Sociality Constitute Vision Constitu- Constitute Vision Constitute Constitute Vision Constitu- Constitute Vision Constitu- Constitute Vision Constitu- Constitute Vision Constitu- Constitute Vision Constitute Constitute Vision Constitute Constitute Constitute Vision Constitute Constitute Visi					1 comparison (Ed. 2) Condition of the second contract (Condition of the second contract (Condition) (Condition) (Condition) Condition of the second contract (Condition) of the second contr			
****	<ul> <li>Comparison for any constraint of the second s</li></ul>	* * * ***			Name Name Name Name Name Name Name	Note and a series that and the series of the series of the series of the series of the series of the series of the series of the series of the series of the series of the series of the series of the series of the series the series of the series of the series the series of the series of the series o		1			1 comparison (Ed. 2) Condition of the second contract (Condition of the second contract (Condition) (Condition) (Condition) Condition of the second contract (Condition) of the second contr	•		
	<ul> <li>Comparison for any constraint of the second s</li></ul>	* * * *	· · · ·		Name Name Name Name Name Name Name	Note and a series that and the series of the series of the series of the series of the series of the series of the series of the series of the series of the series of the series of the series of the series of the series the series of the series of the series the series of the series of the series o					L carrier, Armschall, Sald all demokraski kara (Carlier Armschalt, Kara (Carlier Armschalt, Kara (Carlier Armschalt, Kara (Carlier Martine Martine Carlier Martine Ma			a se a seconda a succ
dana -	<ul> <li>Comparison for any constraint of the second s</li></ul>	* * * ****	5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5	· ···· · · · · · · · · ·	Name Name Name Name Name Name Name	Note and a series that and the series of the series of the series of the series of the series of the series of the series of the series of the series of the series of the series of the series of the series of the series the series of the series of the series the series of the series of the series o					Correspondence (2014) and 2014 and 2014 particular the second constru- ption of the second construc		-	a se a seconda a socia a
dana -	<ul> <li>Comparison for any constraint of the second s</li></ul>	* * * ****			Name Name Name Name Name Name Name	Note and a series that and the series of the series of the series of the series of the series of the series of the series of the series of the series of the series of the series of the series of the series of the series the series of the series of the series the series of the series of the series o	-	*			Correspondence (2014) and 2014 and 2014 particular the second constru- ption of the second construc	-	1	a se a sources a source a
una a	<ul> <li>Comparison for any constraint of the second s</li></ul>			· ···· ···· · ···· ···	Name Name Name Name Name Name Name	Note and a series that and the series of the series of the series of the series of the series of the series of the series of the series of the series of the series of the series of the series of the series of the series the series of the series of the series the series of the series of the series o	-				Correspondence (2014) and 2014 and 2014 particular the second constru- ption of the second construc	-	*	· · · · · · · · · · · · · · · ·
-	<ul> <li>Comparison for any constraint of the second s</li></ul>				Name Name Name Name Name Name Name	Note and a series that and the series of the series of the series of the series of the series of the series of the series of the series of the series of the series of the series of the series of the series of the series the series of the series of the series the series of the series of the series o	-	*			<ul> <li>and the second se</li></ul>			
	<ul> <li>Comparison for any constraint of the second s</li></ul>				Name Name Name Name Name Name Name	Note and a series that and the series of the series of the series of the series of the series of the series of the series of the series of the series of the series of the series of the series of the series of the series the series of the series of the series the series of the series of the series o	-	*			c unception hash (and a gamma hash near the host hash hash hash hash hash hash hash ha			
	<ul> <li>Comparison for any constraint of the second s</li></ul>			· · · · · · · · · · · · · · · · · · ·	Name Name Name Name Name Name Name	Note and a series that and the series of the series of the series of the series of the series of the series of the series of the series of the series of the series of the series of the series of the series of the series the series of the series of the series the series of the series of the series o	-	*		Pantinesi ba ber	<ul> <li>and the second se</li></ul>		-	
	<ol> <li>Strandbard Statistics (Statistics)</li> <li>Strandbard Statistics (Statistics)</li> <li>Strandbard Statistics (Statistics)</li> <li>Strandbard Statistics</li> <li< td=""><td></td><td>2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2</td><td>· ···· · ···· · · ··· ·· ·</td><td>Name Name Name Name Name Name Name</td><td>Note and a series that and the series of the series of the series of the series of the series of the series of the series of the series of the series of the series of the series of the series of the series of the series the series of the series of the series the series of the series of the series o</td><td>-</td><td>*</td><td></td><td>Pantinesi ba ber</td><td><ul> <li>and the second se</li></ul></td><td></td><td>-</td><td></td></li<></ol>		2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2	· ···· · ···· · · ··· ·· ·	Name Name Name Name Name Name Name	Note and a series that and the series of the series of the series of the series of the series of the series of the series of the series of the series of the series of the series of the series of the series of the series the series of the series of the series the series of the series of the series o	-	*		Pantinesi ba ber	<ul> <li>and the second se</li></ul>		-	
Arra	<ol> <li>Strandbard Statistics (Statistics)</li> <li>Strandbard Statistics (Statistics)</li> <li>Strandbard Statistics (Statistics)</li> <li>Strandbard Statistics</li> <li< td=""><td></td><td></td><td>· ···· · · · · · · · · · · ·</td><td>Name Name Name Name Name Name Name</td><td>Note and a series that and the series of the series of the series of the series of the series of the series of the series of the series of the series of the series of the series of the series of the series of the series the series of the series of the series the series of the series of the series o</td><td>-</td><td>*</td><td></td><td>Pantinesi ba ber</td><td><ul> <li>and the second se</li></ul></td><td></td><td>-</td><td>· · · · · · · · · · · · · · · · · · ·</td></li<></ol>			· ···· · · · · · · · · · · ·	Name Name Name Name Name Name Name	Note and a series that and the series of the series of the series of the series of the series of the series of the series of the series of the series of the series of the series of the series of the series of the series the series of the series of the series the series of the series of the series o	-	*		Pantinesi ba ber	<ul> <li>and the second se</li></ul>		-	· · · · · · · · · · · · · · · · · · ·
ana a	<ol> <li>Strandbard Statistics (Statistics)</li> <li>Strandbard Statistics (Statistics)</li> <li>Strandbard Statistics (Statistics)</li> <li>Strandbard Statistics</li> <li< td=""><td></td><td>· · · · · · ·</td><td></td><td>Name Name Name Name Name Name Name</td><td>Note and a series that and the series of the series of the series of the series of the series of the series of the series of the series of the series of the series of the series of the series of the series of the series the series of the series of the series the series of the series of the series o</td><td></td><td></td><td></td><td>Pantinesi ba ber</td><td><ul> <li>and the second se</li></ul></td><td></td><td>-</td><td></td></li<></ol>		· · · · · · ·		Name Name Name Name Name Name Name	Note and a series that and the series of the series of the series of the series of the series of the series of the series of the series of the series of the series of the series of the series of the series of the series the series of the series of the series the series of the series of the series o				Pantinesi ba ber	<ul> <li>and the second se</li></ul>		-	
	<ul> <li>Antonio de la construcción de la const</li></ul>		× ××		Name Name Name Name Name Name Name	Alexandra and Al				Pantinesi ba ber	<ul> <li>and the second se</li></ul>		-	
	<ul> <li>Antonio de la construcción de la const</li></ul>		x		Name Name Name Name Name Name Name	Alexandra and Al				Pantinesi ba ber	<ul> <li>and the second se</li></ul>		-	· · · · · · · · · · · · · · · · · · ·
	<ul> <li>Antonio de la construcción de la const</li></ul>		x		Name Name Name Name Name Name Name	Alexandra and Al				Pantinesi ba ber	<ul> <li>and the second se</li></ul>		-	The second secon
	<ul> <li>Antonio de la construcción de la const</li></ul>		* ** **** * *		Name Name Name Name Name Name Name	Alexandra and Al				Andreas (and ) Andreas (and ) Resolution (2011) Andreas (2011) And		Ange State, 199 Ange State, 19		
	<ul> <li>Antonio de la construcción de la const</li></ul>	a se a se se a se	* ** **** * *	-	Name Name Name Name Name Name Name	Hannessen und Karl Mithemation of Head Mithematical Mithe				Andreas (and ) Andreas (and ) Resolution (2011) Andreas (2011) And		Ange State, 199 Ange State, 19		· · · · · · · · · · · · · · · · · · ·
	<ul> <li>Anternational of a constraint of constraint of a constraint of a</li></ul>		* ** **** * *		Name Name Name Name Name Name Name	Hannessen und Karl Mithemation of Head Mithematical Mithe				Andreas (and ) Andreas (and ) Resolution (2011) Andreas (2011) And		Ange State, 199 Ange State, 19		
	<ul> <li>Antonio de la construcción de la const</li></ul>			-	Name Name Name Name Name Name Name	Alexandra and Al				Andreas (and ) Andreas (and ) Resolution (2011) Andreas (2011) And	<ul> <li>and the second se</li></ul>	Ange State, 199 Ange State, 19		

(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.

Family Pteridaceae Schizaeaceae	Species Acrostichum Ianzaeanum (Visiani) Chandler	Lake	Arne	Studland					
Schizaeaceae			×	×	Icacinaceae	Jodes acutiformix Chandler	×	×	
	Lygodium kaudiustii Heer emend. Gardner and			×	1.	Natsiatum econsicus Chandler <sup>11</sup>	×	110.000	1.000
	Ettingshausen		1000	0		3Palaeophytocrene foreolata Reid and Chandler	×		
	L poolenuis Chandler	×				Icacinicarya inornata Chandler	×	х	
	Anemia poolensis Chandler	×	×		Lauraceae	Laurocarpun spp.	×		
	Ruffordia subcretacea (Saporta) Barthel, 19761		×		Lythraceae	Ammannia Labenuis Chardler	×		
Taxodiaceae	Taxodium labensis Chardler x x				Alatospermon lakense Chandler	×			
	Sequenta continuar Heer <sup>2</sup>			×	Menispermaceae	70nosporat armenats Chandler	×	×	
Actinidiaceae	Sauraula crassisperma (Chandler) Ma <sup>5</sup>	×				Palarococculus Lakensis Chandler	×	х	1.000
	S. poolenais (Chandler) Mai, 1970"	х				Wardenabeppeya poolenais (Chandler) Erde,		×	
Anacardiaceae	Dracontocarya glandulosa Chandler	×				1970			1000
	Lannea sp.	×			Moraceae	Ficus Incidus Chandler (see Collinson, 1989)	×		-
	Rhus labouris Chandler X			-		F.sp.			×
	R. spp.	×			Moraceae	Oricarpum reticulation Chandler (see	1.00	×	-
Apocynaceae	Abocynospermum acutiforme Chandler <sup>1</sup>	×				Collinson, 1989)			1000
	A Jakense Chandler <sup>3</sup>	×			Nymphaeaceae	Palaeonymphaea eocenica Chandler (see	×		
Arecaceae	Calamus daemonorops (Unger) Chandler	×				Collinson 1980a)			1000
	ISabal ap.		×		Nyssaccae	Nyusoidea escenicum Chandler	ж	×	
Boraginaceae	Ebretia lakenzis Chandler	×			Rosaceae	Rubus acutiformis Chandler	1000		×
Burseraceae	Palaeobursera labensis Chundler	×			Rutaceae	Phellodendron coatatum Chandler		×	
Capparaceae	Burtonella emarginata Chardler	×	×	×		Rutasperman excavatum Chardler	1.1	×	-
capparaceae	Palaeocleome lakensis Chandler	×	-	-		R. glabrum Chandler	×		-
	Capparidistermum excenicum Chandler	x			and the beautiful to the second se	R. magnificum Chandler		×.	
Caprifoliaceae	Sambucus parenda Chandler	×			and the second second	R. striatum Chardler	×		
Cornaceae	Dunstania labensis Chandler <sup>2</sup>	x			Sabiaceae	Melioswa sheppeyewais Reid and Chandler	×	-	-
(including	Eomastizia rugosa (Zenker) Chandler (see Mai,	×	×	-	Sapotaceae	(Sapot/carpant sp.		×	
Mastiniaceae)	1995)	^	-		Solanaceae	Solanon amenar Chandler		×	
	E urceolata Chandler	×			and the second second	Solaniapermum reniforme Chandler	-	×	-
	2Mantixia cavitienate Reid and Chandler?		×		Styracaceae	Stynux elegans Chardler	х	1.1.1.1	
	Masticelearpum crassum Chandler (see Mai,	×			Symplocaceae	Symplocos beadonensis Chandler		×	
	1995)	-				S. Jakennis Chandler	×	×	
	Swida quadrilocularis (Chardler) Mai, 1999 <sup>8</sup>	×		-	Theacear	Cleveral obligua Chandler	×		-
Cucurbitaceae	Cacarbitosperman lakense Chandler	×				Kiordonia sp.	×		-
Contraction	C. oblignum Chandler	×		-	Thymelaeaceae	Thymelaeuperman lakeuse Chandler	×	×	-
Cyperaceae	'Sciepus' labensis Chandler	×	×	-		T.) nalcation Chandler	×	-	-
Cyperaceae	Escirpur sp.	×	-		Vitaceae	Vitis ambigua Chandler	×		
	Garicoldea arnel Chandler		×			V. armenuis Chandler		×	-
	C obscura Chandler	×	-	-		V. coneato Chandler	×	-	
	3Garicoidea sp.	×		-	And States	V. auranata Chandler	×		
	Gladiocarput minima (Chandler) Mai in Mai and	~	×		and the second sec	V. Jakenais Chandler	×		
	Walther, 1978"		-			V. Justition Creczott and Skingiello <sup>12</sup>	×	×	
Denacrae	Diospyros bradonensis Chandler	×				V. platysperma Chandler	×	X	
Euphorbiaceae	Euphorbiotheca Labenate Chandler	×				V. poolennis Chandler	×	-	
- apartment	E. platysperma Chandler	×		-		V. pygmaea Chandler	×	×	
	E. tuberculata Chandler	×			2	V. goodbartii Chandler	×	X	
	E. digitata Chandler	×	-			V. symmetrics Chandler	×		
	Euphorbiopermum punctatum Chandler	×				V. triangularis Chandler	-	×	-
	Wetberellia sariabilis Bowerbank	-	×	-		Tetratigna acuminata Chandler		×	-
Flacourtiaceae	Oncoba rugosa Chandler		×	-		17. Johata Chandler	×	-	-
tamamelidaceae		x	-	-	Zingiberaceae	Alpinia amenae (Chandler) Mai in Mai and	~	×	
tansame soaceae	Steinbauera subgloboas Pecsl <sup>10</sup>				vollocracesc	Wakher, 1985 <sup>10</sup>		-	
					Incertae sedis	Rhannogermum bilohatum Chandler	×	×	
					incense seuts	Carpolithus amenue Chandler	A	×	-

(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