Tertiary Research	**13** (2-3)	155-175	1 Plate, 4 Text-figs	Leiden June 1992

A review of the Early Eocene molluscs of Bognor Regis (Hampshire Basin), England.

STEVE TRACEY

Abstract: Venables' (1963) list of molluscs from the London Clay Formation of Bognor, West Sussex, is revised with updated nomenclature and the addition of recent records. Much of the Bognor material in the Natural History Museum, London, has been reexamined, together with the molluscs in the private collection of D. A. Bone and taxonomic comments are given where appropriate. One new species of gastropod, *Acteocina venablesi*, and one bivalve, *Miocardiopsis venablesi*, are described. Lectotypes are selected for *Glycymeris brevirostris* (J. de C. Sowerby) and *Semimodiola elegans* (J. Sowerby). The name *Sconsia striata* (J. Sowerby, 1812) is considered to be a senior homonym of *Sconsia striata* (Lamarck, 1816).

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PREVIOUS RESEARCH

Fifty seven species of fossil mollusc from Bognor foreshore, mostly from the Bognor Rock Bed, were recorded by J. de C. Sowerby (in Dixon, 1850) and 36 of them were figured. Examples of some of these in the F. E. Edwards collection were listed by Newton (1891), but no further species were added. Venables (1929) recorded 62 mollusc species from the various beds at this locality, later extending the list to a total of 128 (Venables, 1963). Some of these have been described or discussed in the taxonomic papers of Wrigley (1925-1953). Most of the listed specimens are in the Natural History Museum, London (NHM), although it is likely that some of the material, now missing, has been lost through pyrite decay.

PRINCIPAL MOLLUSCAN HORIZONS

The foreshore exposures at Bognor Regis have been described in detail and the fauna of the individual beds listed (Venables, 1929, 1963; Bone, 1978). The fossiliferous horizons occur within King's (1981) informal divisions A3 to C of the London Clay Formation.

The lowest clay beds of division A3 (*Astarte*, Starfish and *Cyprina* beds) contain rather well preserved molluscs, although often slightly crushed. In the upper sandier part of A3 (Sandy Clay and Soft Rock) the shells are usually very fragile although, in the indurated Bognor Rock, aragonitic shells have been either wholly decalcified, leaving internal moulds, or replaced by resistant calcite.

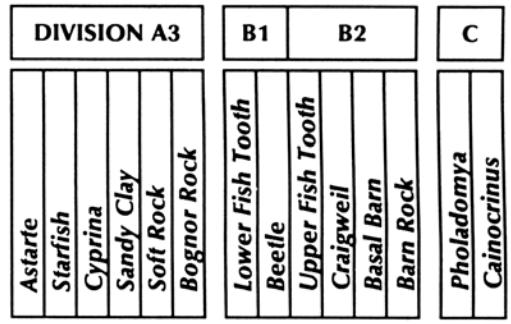
The principal molluscan horizons in the clays of division B are the Beetle Bed and the Upper Fish-tooth Bed in which the molluscs occur as pyrite internal moulds, in some cases with shell preserved. As material collected from these beds tends to come from *ex situ* concentrations, there is always a possibility that longshore drift has moved some of it away from its original horizon. Above these beds the Kingsway Beds have provided a small fauna of fragmentary molluscs. At the top of division B is the Barn Rock Bed, a reddish sandstone with finely preserved fossils.

The clays of division C (*Pholadomya* and *Cainocrinus* beds) contain very fragile, rather crushed shells.

MOLLUSCAN LIST.

The following is based on the list of Venables (1963). Square brackets indicate parts of the names used by Venables which differ from the present classification. The systematic order follows that of Vaught (1989). The taxonomic notes are original observations based on the author's researches. Accession numbers are given for significant Bognor specimens among the material examined and, except where otherwise indicated, refer to items in the collections of the NHM, London. These collections are abbreviated as follows: A. Fuller (AF); A. G. Davies (AD); A. Wrigley (AW); E. M. Venables (EV); F. Dixon (FD); F. E. Edwards (FE); J. S. Bowerbank (JB); J. de C. Sowerby (JS); the Natural History Museum, London - other collections) (BM); the D. A. Bone private collection (DB) contains most of the other material studied, of which numbered specimens are in the Natural History Museum.

KEY:
● = common ● = occasional • = rare
? = dubious record.
Hollow symbols o o o denote published records that have not been examined by the author.
* indicates a new record not in Venables' 1963 list.
‡ indicates a text entry.



GASTROPODA

TURRITELLIDAE

Haustator cf. *interpositus* (Deshayes 1857) *[Turritella]* ‡
Haustator cf. *dixoni* (Deshayes 1866) *[Turritella* sp.*]* ‡

APORRHAIDAE

Aporrhais sowerbii sowerbii (Fleming, 1828)
Aporrhais sowerbii intermedius Wrigley, 1938
Aporrhais sowerbii clarendonensis Wrigley, 1938 ‡

STROMBIDAE

Tibia sublucida (Edwards in Lowry, 1866)

CALYPTRAEIDAE

Sigapatella echinulata (J. Sowerby, 1815) *[Calyptraea* sp.*]* ‡

NATICIDAE

Globularia bognorensis Wrigley, 1946 ‡
Globularia adurni Wrigley, 1946 ‡
Natica argillacea Wrigley, 1949 ‡
Euspira glaucinoides (J. Sowerby, 1812)
Euspira regnorum Wrigley, 1949 ‡
Polinices bognorensis Wrigley, 1949 ‡
Tectonatica davisi Wrigley, 1949 ‡
Sigatica hantoniensis (Pilkington, 1804)
Sinum cf. clathratum (Gmelin, 1791) *[Sinum* sp.*]*

FICIDAE

Priscoficus smithii (J. de C. Sowerby, 1827) *[Ficus]*
Priscoficus vincenti (Wrigley, 1929) *[Ficus]* ‡
Priscoficus londini (Wrigley, 1929) *[Ficus]*
Ficopsis multiformis (Wrigley, 1929)

CASSIDAE

Galeodea gallica Wrigley, 1934 ‡
Sconsia striata (J. Sowerby, 1812) *["Semicassis"]* ‡

CRERITHIOPSIDAE

Seila mundula (Deshayes, 1865) ‡

TRIFORIDAE

Orthochetus elongatus Wrigley, 1940 *[Cerithiella* sp.*]* ‡

EPITONIIDAE

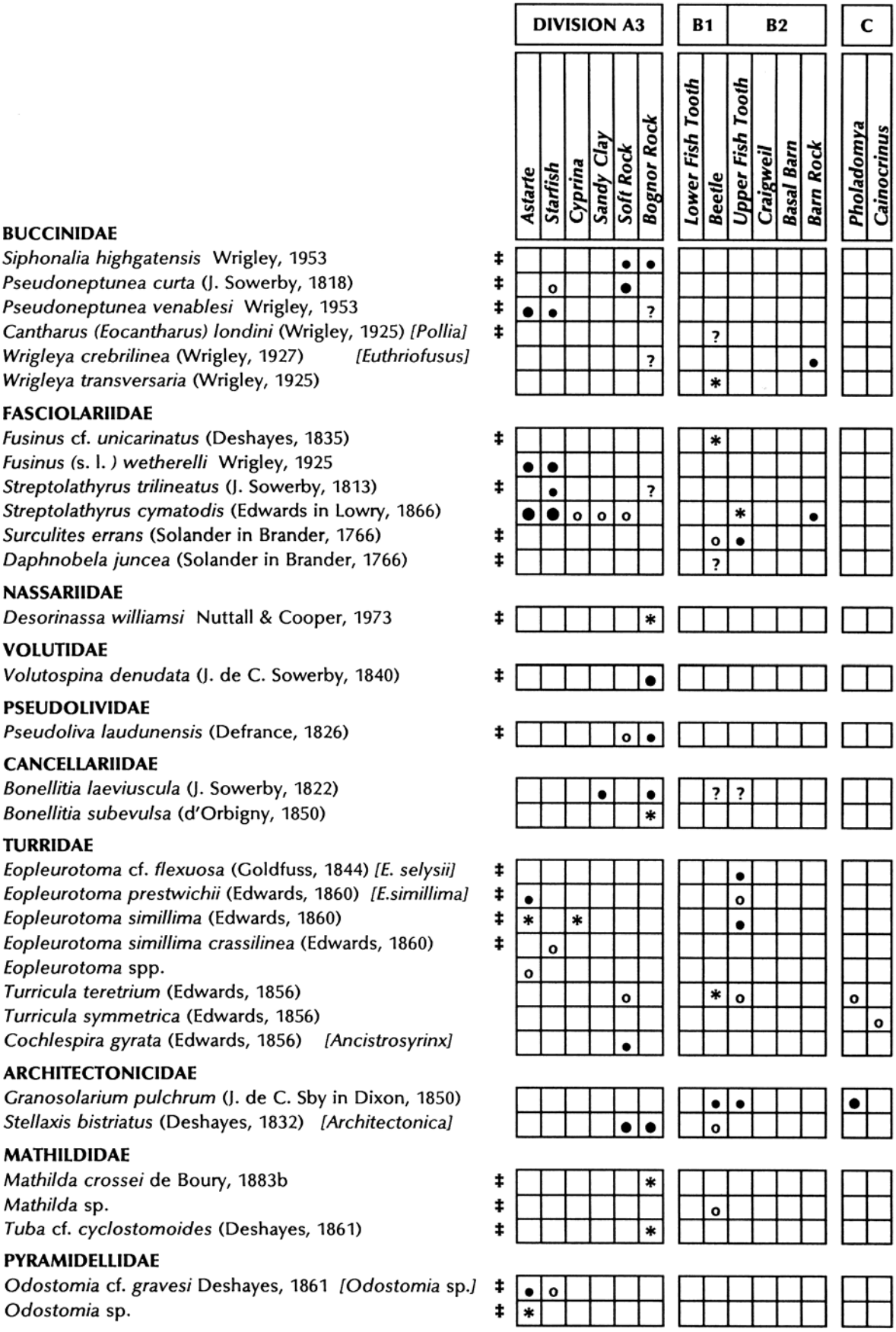
Littoriniscala scalarioides (J. de C. Sby in Dixon, 1850) ‡
Acrilla ? sp. ‡
Opalia n. sp. *[Scala* sp.*]* ‡
Crisposcala dadanti de Boury, 1886 ‡

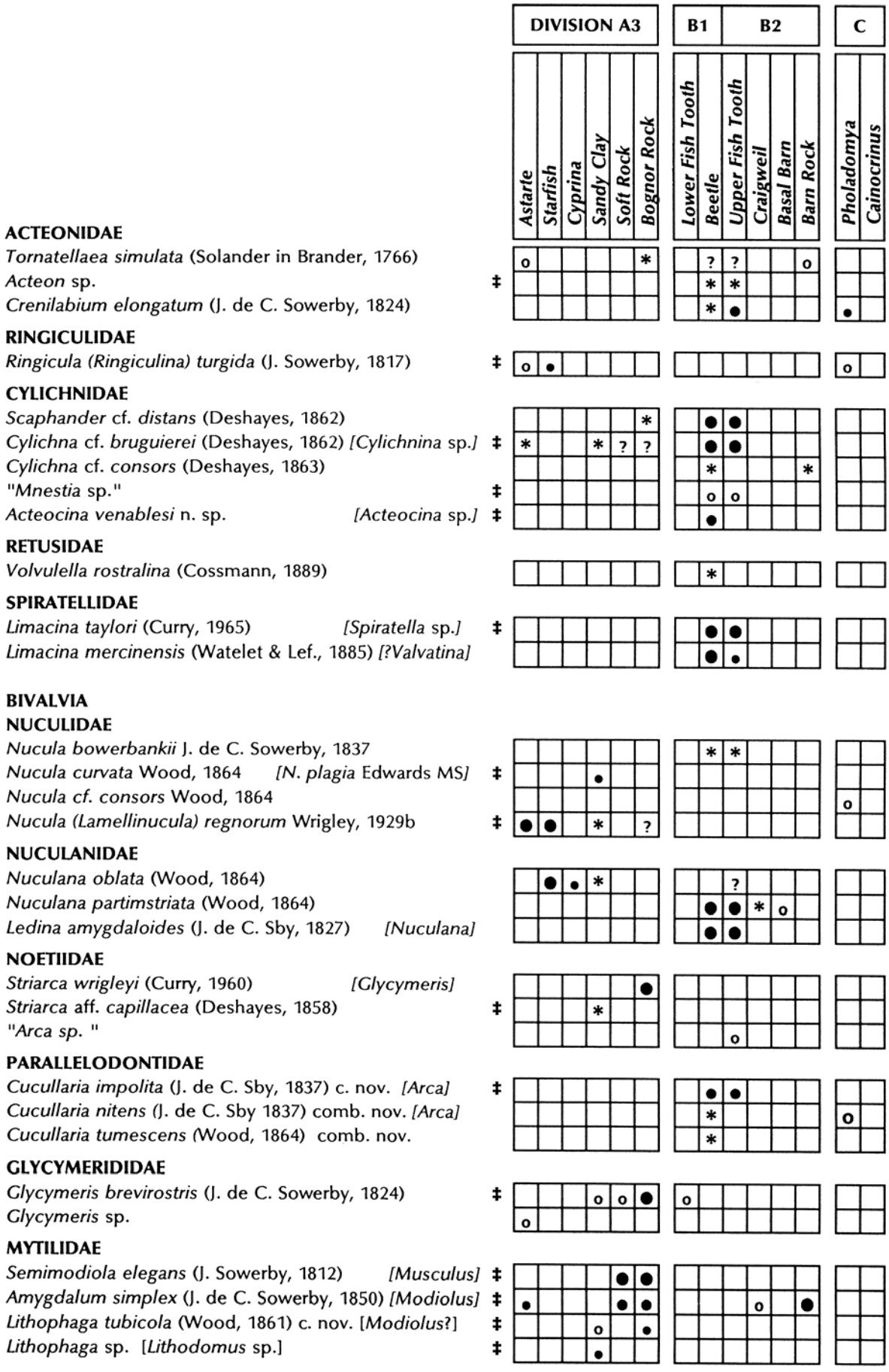
EULIMIDAE

Eulima (s. l.) cf. *regalis* Wrigley, 1944 ‡
Eulima (s. l.) sp. ‡

MURICIDAE

Laevityphis muticus (J. de C. Sowerby, 1834) *[Typhis* sp.*]*


DIVISION A3
B1
B2
C
Astarte
Starfish
Cyprina
Sandy Clay
Soft Rock
Bognor Rock
Lower Fish Tooth
Beetle
Upper Fish Tooth
Craigweil
Basal Barn
Barn Rock
Pholadomya
Cainocrinus
BUCCINIDAE
Siphonalia highgatensis Wrigley, 1953
Pseudoneptunea curta (J. Sowerby, 1818)
Pseudoneptunea venablesi Wrigley, 1953
Cantharus (Eocantharus) londini (Wrigley, 1925) [Pollia]
Wrigleya crebrilinea (Wrigley, 1927) [Euthriofusus]
Wrigleya transversaria (Wrigley, 1925)
FASCIOLARIIDAE
Fusinus cf. unicarinatus (Deshayes, 1835)
Fusinus (s. l.) wetherelli Wrigley, 1925
Streptolathyrus trilineatus (J. Sowerby, 1813)
Streptolathyrus cymatodis (Edwards in Lowry, 1866)
Surculites errans (Solander in Brander, 1766)
Daphnobela juncea (Solander in Brander, 1766)
NASSARIIDAE
Desorinassa williamsi Nuttall & Cooper, 1973
VOLUTIDAE
Volutospina denudata (J. de C. Sowerby, 1840)
PSEUDOLIVIDAE
Pseudoliva laudunensis (Defrance, 1826)
CANCELLARIIDAE
Bonellitia laeviuscula (J. Sowerby, 1822)
Bonellitia subevulsa (d'Orbigny, 1850)
TURRIDAE
Eopleurotoma cf. flexuosa (Goldfuss, 1844) [E. selysii]
Eopleurotoma prestwichii (Edwards, 1860) [E.simillima]
Eopleurotoma simillima (Edwards, 1860)
Eopleurotoma simillima crassilinea (Edwards, 1860)
Eopleurotoma spp.
Turricula teretrium (Edwards, 1856)
Turricula symmetrica (Edwards, 1856)
Cochlespira gyrata (Edwards, 1856) [Ancistrosyrinx]
ARCHITECTONICIDAE
Granosolarium pulchrum (J. de C. Sby in Dixon, 1850)
Stellaxis bistriatus (Deshayes, 1832) [Architectonica]
MATHILDIDAE
Mathilda crossei de Boury, 1883b
Mathilda sp.
Tuba cf. cyclostomoides (Deshayes, 1861)
PYRAMIDELLIDAE
Odostomia cf. gravesi Deshayes, 1861 [Odostomia sp.]
Odostomia sp.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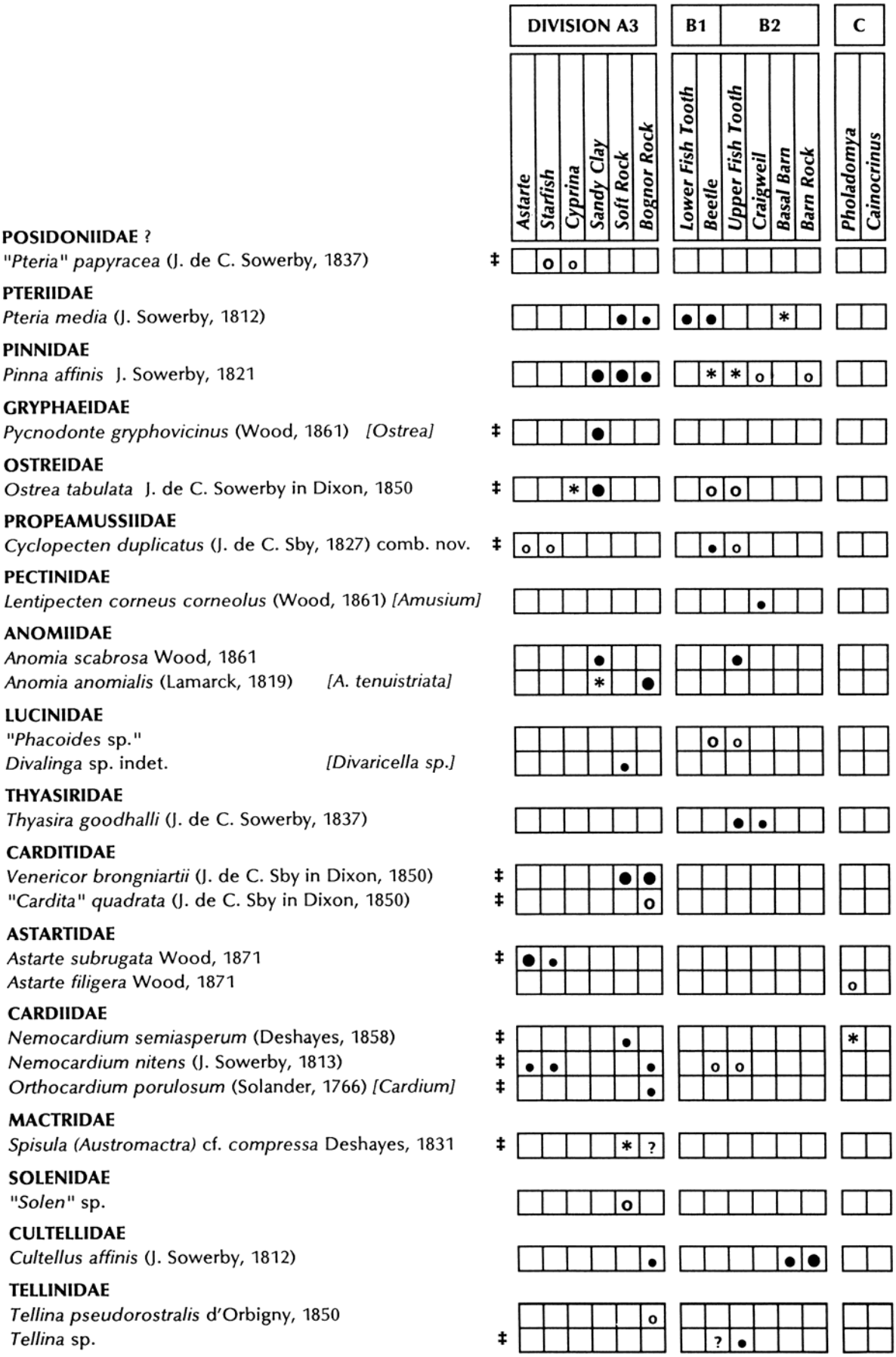
Cainocrinus
ACTEONIDAE
Tornatellaea simulata (Solander in Brander, 1766)
Acteon sp.
Crenilabium elongatum (J. de C. Sowerby, 1824)
RINGICULIDAE
Ringicula (Ringiculina) turgida (J. Sowerby, 1817)
CYLICHNIDAE
Scaphander cf. distans (Deshayes, 1862)
Cylichna cf. bruguierei (Deshayes, 1862) [Cylichnina sp.]
Cylichna cf. consors (Deshayes, 1863)
"Mnestia sp."
Acteocina venablesi n. sp. [Acteocina sp.]
RETUSIDAE
Volvulella rostralina (Cossmann, 1889)
SPIRATELLIDAE
Limacina taylori (Curry, 1965) [Spiratella sp.]
Limacina mercinensis (Watelet & Lef., 1885) [?Valvatina]
BIVALVIA
NUCULIDAE
Nucula bowerbankii J. de C. Sowerby, 1837
Nucula curvata Wood, 1864 [N. plagia Edwards MS]
Nucula cf. consors Wood, 1864
Nucula (Lamellinucula) regnorum Wrigley, 1929b
NUCULANIDAE
Nuculana oblata (Wood, 1864)
Nuculana partimstriata (Wood, 1864)
Ledina amygdaloides (J. de C. Sby, 1827) [Nuculana]
NOETIIDAE
Striarca wrigleyi (Curry, 1960) [Glycymeris]
Striarca aff. capillacea (Deshayes, 1858)
"Arca sp. "
PARALLELODONTIDAE
Cucullaria impolita (J. de C. Sby, 1837) c. nov. [Arca]
Cucullaria nitens (J. de C. Sby 1837) comb. nov. [Arca]
Cucullaria tumescens (Wood, 1864) comb. nov.
GLYCYMERIDIDAE
Glycymeris brevirostris (J. de C. Sowerby, 1824)
Glycymeris sp.
MYTILIDAE
Semimodiola elegans (J. Sowerby, 1812) [Musculus]
Amygdalum simplex (J. de C. Sowerby, 1850) [Modiolus]
Lithophaga tubicola (Wood, 1861) c. nov. [Modiolus?]
Lithophaga sp. [Lithodomus sp.]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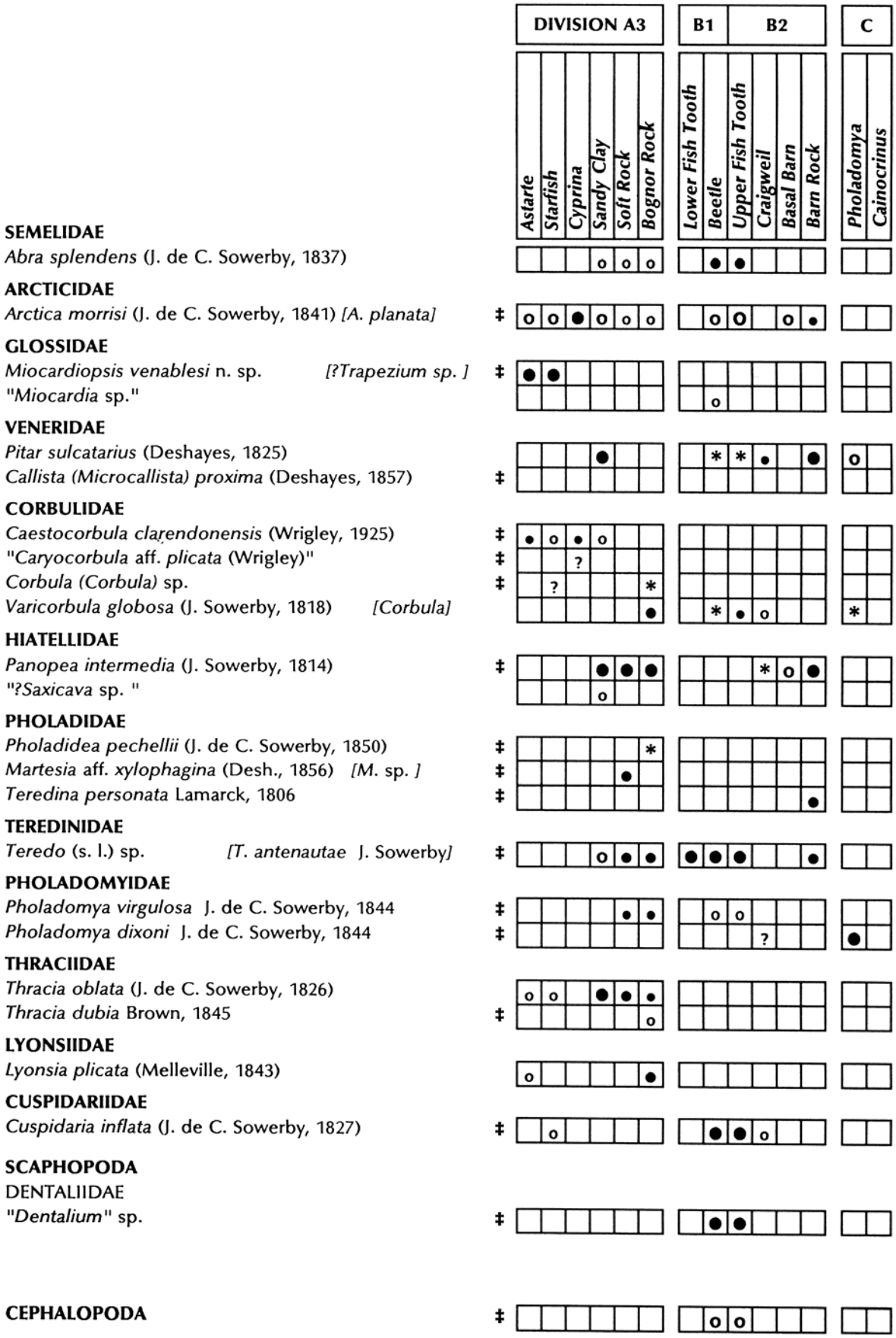
POSIDONIIDAE ?
"Pteria" papyracea (J. de C. Sowerby, 1837)
PTERIIDAE
Pteria media (J. Sowerby, 1812)
PINNIDAE
Pinna affinis J. Sowerby, 1821
GRYPHAEIDAE
Pycnodonte gryphovicinus (Wood, 1861) [Ostrea]
OSTREIDAE
Ostrea tabulata J. de C. Sowerby in Dixon, 1850
PROPEAMUSSIIDAE
Cyclopecten duplicatus (J. de C. Sby, 1827) comb. nov.
PECTINIDAE
Lentipecten corneus corneolus (Wood, 1861) [Amusium]
ANOMIIDAE
Anomia scabrosa Wood, 1861
Anomia anomialis (Lamarck, 1819) [A. tenuistriata]
LUCINIDAE
"Phacoides sp."
Divalinga sp. indet. [Divaricella sp.]
THYASIRIDAE
Thyasira goodhalli (J. de C. Sowerby, 1837)
CARDITIDAE
Venericor brongniartii (J. de C. Sby in Dixon, 1850)
"Cardita" quadrata (J. de C. Sby in Dixon, 1850)
ASTARTIDAE
Astarte subrugata Wood, 1871
Astarte filigera Wood, 1871
CARDIIDAE
Nemocardium semiasperum (Deshayes, 1858)
Nemocardium nitens (J. Sowerby, 1813)
Orthocardium porulosum (Solander, 1766) [Cardium]
MACTRIDAE
Spisula (Austromactra) cf. compressa Deshayes, 1831
SOLENIDAE
"Solen" sp.
CULTELLIDAE
Cultellus affinis (J. Sowerby, 1812)
TELLINIDAE
Tellina pseudorostralis d'Orbigny, 1850
Tellina sp.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Pholadomya
Cainocrinus
SEMELIDAE
Abra splendens (J. de C. Sowerby, 1837)
ARCTICIDAE
Arctica morrisi (J. de C. Sowerby, 1841) [A. planata]
GLOSSIDAE
Miocardiopsis venablesi n. sp. [?Trapezium sp.]
"Miocardia sp."
VENERIDAE
Pitar sulcatarius (Deshayes, 1825)
Callista (Microcallista) proxima (Deshayes, 1857)
CORBULIDAE
Caestocorbula clarendonensis (Wrigley, 1925)
"Caryocorbula aff. plicata (Wrigley)"
Corbula (Corbula) sp.
Varicorbula globosa (J. Sowerby, 1818) [Corbula]
HIATELLIDAE
Panopea intermedia (J. Sowerby, 1814)
"?Saxicava sp. "
PHOLADIDAE
Pholadidea pechellii (J. de C. Sowerby, 1850)
Martesia aff. xylophagina (Desh., 1856) [M. sp.]
Teredina personata Lamarck, 1806
TEREDINIDAE
Teredo (s. l.) sp. [T. antenautae J. Sowerby]
PHOLADOMYIDAE
Pholadomya virgulosa J. de C. Sowerby, 1844
Pholadomya dixoni J. de C. Sowerby, 1844
THRACIIDAE
Thracia oblata (J. de C. Sowerby, 1826)
Thracia dubia Brown, 1845
LYONSIIDAE
Lyonsia plicata (Melleville, 1843)
CUSPIDARIIDAE
Cuspidaria inflata (J. de C. Sowerby, 1827)
SCAPHOPODA
DENTALIIDAE
"Dentalium" sp.
CEPHALOPODA

TAXONOMIC NOTES

***Haustator* cf. *interpositus* (Deshayes, 1857)** Plate, 1, fig. 2
A slender species, the juvenile whorls with flush sutures and 4 granulated spiral cords. Adult whorls more convex, developing single intermediaries which bring the total to 7 fine spiral cords (DB). Several small and poorly preserved examples from the same horizon were seen (AD,EV).

***Haustator* cf. *dixoni* (Deshayes, 1866)**
Represented by internal moulds which retain a strong ridge in the suture.

***Aporrhais sowerbii clarendonensis* Wrigley, 1938**
The only Bognor example assigned to this subspecies is the paratype, G66067 (FD), figured in Dixon (1850: pl. 14, fig. 21). It is a well preserved, uncrushed specimen and empty of matrix. If the stated locality is correct then it may possibly be from an unconsolidated part of the Bognor Rock Bed.

***Sigapatella echinulata* (J. Sowerby, 1815)**
This species differs from *Sigapatella aperta* (Solander in Brander, 1766) mainly in the more convex, voluminous spire whorls and the smaller umbilicus. *S. echinulata* ranges throughout the English Early and Middle Eocene, from the Blackheath Beds to the basal Selsey Formation. Palaeocene records need confirmation.

***Globularia bognorensis* Wrigley, 1946**
The holotype G66260 (FE) is from the Bognor Rock Bed.

***Globularia adurni* Wrigley, 1946**
Not listed by Venables. The paratypes G48729, G67868, 70292A (EV), (FE), (JB) are from the Bognor Rock Bed. The higher spire and steeper slope of the whorl below the suture in *G. adurni* are the best characters to separate it from *G. bognorensis*, although Wrigley allowed *G. adurni* considerable variation in these and other features. The two seem to be connected by intermediate forms at Bognor.

***Natica argillacea* Wrigley, 1949**
The holotype G67387 and 2 other specimens (BM) are from the *Astarte* Bed.

***Euspira regnorum* Wrigley, 1949**
The holotype G48712 (EV) is from the Starfish Bed.

***Polinices bognorensis* Wrigley, 1949**
The holotype G67412 (EV) is from the *Astarte* Bed.

***?Tectonatica davisi* Wrigley, 1949**
Listed by Venables from the *Astarte* Bed but the specimen was not found in the NHM. The shell of *T. davisi* is rather similar to that of *Polinices bognorensis* and the record requires confirmation.

***Priscoficus vincenti* (Wrigley, 1929)**
The holotype G48546 (FE), from the Bognor Rock Bed, is the only specimen that can be given this name with any certainty.

***Galeodea gallica* Wrigley, 1934**
The spire whorls of the Bognor form (Dixon, 1850: pl. 15, fig. 8) are rather higher and more convex than is usual for English examples. Moulds of this species can be confused with those of *Priscoficus smithii* and *Siphonalia highgatensis* which occur at the same horizon.

***Sconsia striata* (J. Sowerby, 1812)**
One specimen was recorded and figured by Dixon (1850: pl. 15, fig. 9 as *Cassis ambigua*) but the specimen could not be found. Venables' record from the Sandy Clay is represented by the silicone cast of part of a whorl apparently showing three rows of shoulder spines (EV), and cannot represent *striata*. Pyrite moulds from division B2 are also dubious (DB). One Barn Rock Bed specimen labelled as *S. striata*, G 48752 (EV), is partly obscured by matrix but is probably a *Sinum*. Of the material

examined, only one specimen with a crushed spire and part of the body whorl, GG22497 (EV) from the *Pholadomya* Bed, seems to be true *S. striata*.

Sacco (1890:69) considered this species to belong to the genus *Galeodosconsia* Sacco, 1890. Neither Cossmann (1903:133) nor Wrigley (1934: 117) could separate *Galeodosconsia* from *Sconsia* Gray, 1847, while Glibert (1963a: 109) synonomized the two, noting that "*Cassis*" *striata* (J. Sby), among others, should be included in *Sconsia*. This logical course is followed here, the result of the action being that the type species of the genus, *Sconsia striata* (Lamarck, 1816), becomes a secondary junior homonym. However, the name *Sconsia grayi* (A. Adams) may be a subjective junior synonym of and thus available as a replacement name for *Sconsia striata* (Lamarck, 1816).

***Seila mundula* (Deshayes, 1865)**
A very small shell having slightly imbricated, flat-sided whorls with 3 spiral cords and very fine axial ornament between them. The protoconch, (as seen in a Kingsclere specimen) is polygyrate and smooth, agreeing with French examples. *S. mundula* occurs frequently elsewhere in the London Clay and ranges up to the lower Selsey Formation.

***Orthochetus elongatus* Wrigley, 1940** Plate, 1, fig. 3
An adult example from the Sandy Clay, GG14486 (DB) is illustrated. The few examples with the outer shell preserved are typical in having flat to slightly convex whorls reticulated by regular vertical ribs crossing three equally thick spiral cords. They differ from the type by the spiral cords increasing in prominence abapically, the middle cord being closer to the upper cord than to the lower and the basal fourth cord being hidden by the suture throughout growth. Examples from higher horizons of the London Clay at other localities tend to be much more atypical, with concave whorls and 4 or 5 spiral cords. Venables recorded a *Cerithiella* sp. (not found in the NHM) which was probably a young *O. elongatus*.

Although the most characteristic feature of *Orthochetus* is the relatively long, slightly oblique siphonal canal, shown by the type species *O. leufroyi* (Michelin), it has not been seen to exist in any specimens of *O. elongatus*, whose broken apertures often show the oblique pleat at the base of the columella and twisted canal seen also in fossil species of *Cerithiella*, such as *C. pulcherrima* (Deshayes) and *C. cancellata* (J. de C. Sowerby). It seems possible that *O. elongatus*, in view of its relatively large size, may provide a link between *Cerithiella* and *Orthochetus*.

***Littoriniscala scalarioides* (J. de C. Sowerby in Dixon, 1850)**
The holotype GG22496 (FD) has a Bognor Rock matrix and was figured in Dixon (1850: pl. 15, fig. 10)

***Acrilla*? sp.**
An internal mould with signs of very weak axial ribs. The whorls enlarge relatively rapidly. (DB).

***Opalia* sp.**
A small and narrow species with rather convex whorls, numerous low, rounded ribs and a thick spiral cord around the basal disc. At Bognor it is only known from pyrite moulds, G78069 (EV, DB) and probably represents the species listed by Newton (1891) under the *nomen nudum* of *Scala pupa* Edwards MS. from the London Clay of Clarendon, Wiltshire.

***Crisposcala dadanti* de Boury, 1886** Plate, 1, fig. 4
The only specimen known from the English Tertiary, GG14483 (DB *ex* EV), has $2\frac{1}{2}$ whorls remaining. The principal generic characters are the narrow ribs, each one sinuously folded back to touch the previous rib and the vesicular structure of the calcitic shell, showing through wherever the netted microsculpture is worn away. The species is distinguished by the angulation of the ribs at the shoulder, and this is visible on the less damaged parts of the specimen. The holotype came from the Early Eocene Sables de Cuise at Cuise-la-Motte (Oise), France. A few other species of *Crisposcala* occur, although very rarely, at several levels in the middle Eocene beds of Bracklesham Bay and Barton.

***Eulima* (s. l.) cf. *regalis* Wrigley, 1944**
This compares well with *E. regalis* in shape but is rather larger. The aperture is obscured by pyrite.

Eulima (s. l.) sp.
A pyrite mould with deeper sutures than *E. regalis* (DB). Venables' specimens from the same horizon were not found in the BM.

***Siphonalia highgatensis* Wrigley, 1953**
Figured in Dixon (1850: pl. 14, fig. 29) as *Fusus tuberosus* J. Sowerby.

***Pseudoneptunea curta* (J. Sowerby, 1818)**
Compared to the typical form with somewhat shouldered ribs that appeared later in the London Clay, the Bognor shells are more elongate and evenly rounded. They also include convex-whorled forms with more numerous ribs which approach *Siphonalia cooperi* Wrigley, 1953 from the Oldhaven Member of the east Thames area.

***Pseudoneptunea venablesi* Wrigley, 1953**
The holotype, G70527 (BM) is from the *Astarte* Bed.

***Cantharus (Eocantharus) londini* (Wrigley, 1925)**
The common representative of the genus in the London Clay of the Hampshire basin was named *Fusus morrisii* Edwards in Lowry, 1866 (originally misspelt *morissii* but implicitly named after John Morris and corrected under ICZN Article 32c,d by Glibert, 1963b:78). This is a more elongate shell than typical *londini* with stronger persistent ribs and deeper sutures. Wrigley was apparently unaware of *C. morrisii* when he described *londini* (1925: 244) in which he included some probable examples of *C. morrisii*. *C. londini* is distinguished by its fatter shell with a shorter spire, shallow sutures and obsolescent ribs. As Venables' specimen was not found in the NHM, the Bognor record needs confirmation. Tertiary shells of this group are considered to belong to the genus *Pollia* by some authors. However, while they are almost certainly congeneric with several living species assigned to *Pollia* or to *Cantharus (sensu stricto)*, they appear to differ considerably from the type species of those genera and should preferably be included in the subgenus *Eocantharus* Clark, 1938.

***Fusinus* cf. *unicarinatus* (Deshayes, 1835)**
An internal mould with faint ribs and a slight carina, perhaps represents this species (DB).

***Streptolathyrus trilineatus* (J. Sowerby, 1813)**
This is typically a relatively short spired shell ornamented with 6 square spiral cords per whorl. One specimen, G48719 (EV) from the Starfish Bed, has 7 spirals but seems correctly identified. An impression in Bognor Rock, G75305 (EV) could also be *S. trilineatus*. Other comparable examples seen have higher spires and show traces of 12 spiral cords per whorl, including G66080 (FD) in a block of sand with *Rotularia*, figured in Dixon (1850: pl. 14, fig. 22) as "*Buccinum* ? internal cast". However, the condition of this and other specimens leaves their identity in doubt.

***Surculites errans* (Solander in Brander, 1766)**
Only one poor specimen found in the NHM.

***Daphnobela juncea* (Solander in Brander, 1766)**
No Bognor material of this species was found in the BM and the record was probably based on a pyrite mould. As the species is not otherwise recorded from the Hampshire Basin, the identification must be considered suspect.

***Desorinassa williamsi* Nuttall & Cooper, 1973**
Not listed by Venables. The holotype GG19706 (BM), and 3 paratypes GG19707,19708/1-2 are the only known examples.

Volutidae
Volutospina tricorona (J. de C. Sowerby, 1840) was listed by Venables but the only specimen, G60577 (JS), labelled as *V. tricorona* from the Bognor Rock Bed, is large with a rounded shoulder and single row of tubercles, and is quite indistinguishable from the many specimens of *V. denudata* of this bed. Although this specimen is in Sowerby's collection, he himself (in Dixon, 1850) did not record *V. tricorona* from Bognor.

***Pseudoliva laudunensis* (Defrance, 1826) [= *Buccinum semicostatum* Deshayes, 1835, non Brocchi, 1814]** Plate, 1 fig. 6.
Described but not figured by Defrance (1826:247) from the area around Laon in the Paris Basin. Photographs of the two original shells in the Defrance collection were published as "cotypes" by Cossmann (1905). The larger of these (figs. T1,a,b), a ribbed shell agreeing closely with the original description, can be considered typical and the smaller ribless shell, (figs. T2,a), probably represents its smooth form. Cossmann (1905) estimated their origin as "l'un des gisements de lignites de la région de Soissons" and gave the range as Late Sparnacian. Deshayes (1835:657) added the localities Vauxbin, Sinceny and Rilly.

In England this species occurs from the Blackheath Beds to division C of the London Clay Formation. The short ribs of the juvenile shell are either lost at a very early stage or continued as sinuous rib-like folds, strongest at the periphery. The smoother shells have generally been identified as *P. fissurata* (Deshayes, 1835) and the ribbed ones as *P. semicostata* or *P. laudunensis*. However, both forms are present at most English localities together with intermediate examples.

Deshayes distinguished *P. semicostata* from *P. fissurata* by its ribs, its strongly concave columella with a pointed extremity and the shallow depth of its basal groove. These differences are not easily assessed on the available English specimens which do, however, compare well with a specimen labelled *P. semicostata* from the "Sables Inférieurs" of Soissons, France (BM). Plate, 1, fig. 6 illustrates a large specimen from the Bognor Rock Bed. In the final stage of adult growth, the top of the last whorl is increasingly thickened to form a high, humped shoulder.

Genus: *Eopleurotoma* Cossmann, 1889
The basic features of this genus are the fusiform outline with marked sutures and produced rostrum, the sinus placed on the shoulder angulation of the whorl, the low rounded ribs, pronounced only around the shoulder and the subordinate spiral striation. Most Palaeocene and many Lower Eocene species have poorly defined ornament which has a tendency to become obsolete on the adult whorls, a feature seen occasionally in most turrid groups. However these forms are linked to later, more sharply sculptured species by many gradational forms.

Glibert (1960:18) and Powell (1966:49) have used *Fusiturris* Thiele, 1929, an extant group with angular whorls and weak ribs, to include fossil species with superficially similar reduced ornament. This has, not suprisingly, resulted in a polyphyletic group which includes species of *Gemmula* among others. *Fusiturris* probably developed from species of *Eopleurotoma* in the Late Eocene, and while there do not seem to be any important features dividing the two genera, Cossmann's genus is the earlier and more appropriate one for the following London Clay forms.

***Eopleurotoma* cf. *flexuosa* (Goldfuss, 1844) [*E. selysii* (Edwards)]**
The one specimen, G75293 (EV), is similar to the Clarendon shells figured under the name of *Pleurotoma flexuosa* by Edwards (1860: pl. 32, fig. 8). The relationship of these to the German species *E. flexuosa* needs clarification.

***Eopleurotoma simillima* (Edwards, 1860)**
Distinguished from the related species *E. prestwichii* by its shorter ribs, forming a turreted shoulder. As the original descriptions of both species match their respective type specimens, it seems possible that Edwards (1860: pl. 30) has inadvertently reversed his figures 3 and 4, illustrating *simillima* as *prestwichii* and *vice versa*.

***Eopleurotoma prestwichii* (Edwards, 1860) [*E.flexuosa, E. koninckii, E. simillima*]** Plate, 1, fig. 5.
There is some variety in the degree of slenderness of outline but the whorls are convex, the spire shows axial ribs, rather thicker than those of *E.* cf. *flexuosa* Goldfuss, and spiral striae that are missing in mid-whorl. This ornament may become obsolete and virtually smooth on the later whorls.

***Mathilda crossei* de Boury, 1883b**
An unlisted specimen in a piece of matrix from the Bognor Rock Bed, G74564 (EV), labelled *Mathilda* sp. The Beetle Bed specimen, recorded by Venables as *Mathilda* sp., was not found in the NHM.

***Tuba* cf. *cyclostomoides* (Deshayes, 1861)**
Venables apparently overlooked the specimen, G66090 (FD), figured by Dixon (1850:227, pl. 14, fig. 23) as *Littorina sulcata*. The specimen is an internal mould in Bognor Rock Bed matrix, with a portion of the outer shell remaining. The spire is relatively higher than that of *Tuba sculpta* (J. de C. Sowerby, 1823) (= *Turbo sulcatus* Pilkington, 1804 *non* Gmelin, 1791) and more closely resembles that of *T. cyclostomoides*, only recorded in England from the London Clay of Highgate Wood Tunnel, north London.

***Odostomia* cf. *gravesi* Deshayes, 1861** Plate, 1, fig. 7
Broadly conical, fairly flat-sided with shallow sutures and a bluntly angular periphery. The two Bognor examples are from the *Astarte* Bed, GG14485 (DB) and from the Starfish Bed, G75332 (EV). These differ from the French Thanetian species, *O. gravesi,* in having a very weak columella fold, reduced to a swelling in the adapical corner of the aperture.

***Odostomia* sp.** Plate 1, fig. 8
The single specimen from the *Astarte* Bed, GG14484 (DB), is an elongate odostomiid with convex whorls, and with several weak lirae which extend inside the aperture. The specimen is not sufficiently well preserved for a full description, but strongly resembles other undescribed odostomiids occurring in the Blackheath Beds of south east London.

***Acteon* sp.**
Several small internal moulds (EV), none showing any sign of double columella folds which would indicate the genus *Tornatellaea*.

***Ringicula (Ringiculina) turgida* (J. Sowerby, 1817) comb. nov. [*Ringicula* cf. *lignitarum* & *Ringicula* sp. 2]**
Despite some variation in the height of the spire, it seems likely that all records of *Ringicula* from the lower beds at Bognor belong to a single taxon. The inside of the lip is smooth, without crenulations, which is the distinguishing character of the subgenus *Ringiculina*. The constant specific features are the two sharp, oblique columellar folds and distinct parietal pleat, the lightly thickened outer lip and the columellar enamel that spreads to cover much of the base. This species is locally abundant in the Oldhaven Member of south Essex where it is seen to be particularly variable in size, shape and ornament.

Ringicula lignitarum Cossmann, 1902 is based on a unique specimen from Pourcy near Reims, France which shows a smooth space in the spiral ornament shortly below the suture Cossmann, 1902: 105. Some of the English shells have similar bands but to varying extents and in various positions. *R. lignitarum* differs in its weak horizontal columellar folds and narrow enamel, its lightly crenulated outer lip and also in having a doubled parietal pleat, (probably an individual aberration). Typical *R. turgida* from the London Clay of Highgate differs from Bognor examples mainly by its thicker outer lip.

***Cylichna* cf. *bruguierei* (Deshayes, 1862)**
Mostly represented by pyrite internal moulds which are cylindrical with a broad apex and narrowly umbilicate spire. A few specimens with some shell remaining show fine spiral striae, mostly around the base and apex. One example with half of the shell preserved, (AW), shows similar spiral striae, and also irregular raised growth lines as in *C. sectifera* Cossmann, 1889. Better material is necessary to establish the true identity of these forms. *Bulla uniplicata* J. de C. Sowerby as figured in Dixon (1850: pl. 7, fig. 8) from Bracklesham would appear to be an earlier name for *bruguierei;* however the holotype seems less cylindrical than it has been drawn and has a resemblance to *Cylichna consors* (Deshayes, 1863).

***Mnestia* sp.**
No specimens marked as such were found in NHM, but some of the pyrite internal moulds from divisions B1 and B2 may well represent such species as are commonly included in *Roxania, Atys* or *Mnestia*.

***Acteocina venablesi* n. sp.** Description see page 170, Text-fig. 3

***Limacina taylori* (Curry, 1965)**
The holotype GG7101 (BM) and numerous paratypes were found *ex situ* in the region of the Beetle Bed.

***Nucula curvata* Wood, 1864**
Nucula consobrina Wood, 1864 from the London Clay is probably the same species. The species listed by Newton (1891) under the *nomen nudum* of *N. plagia* Edwards MS, differs in having a straighter dorsal margin.

***Nucula (Lamellinucula) regnorum* Wrigley, 1929b**
The holotype is a left valve, L52490 (EV), from the *Astarte* Bed.

***Striarca* aff. *capillacea* (Deshayes, 1858)**
One very young valve (AW), finely but rather sharply decussate. The oblong shape and straight ventral margin distinguish it from *S. wrigleyi*. This is the juvenile of an undescribed species, recently found in Division A3 of the London Clay near Havant, West Sussex. It is closely related to similar forms recorded from the Blackheath Beds of southeast London (Tracey, 1986) and the "London Clay Basement Bed" of Harefield, Middlesex, (Cooper, 1976, as *Barbatia*).

***Cucullaria impolita* (J. de C. Sowerby, 1837 comb. nov.**
The hinge teeth of this species were unknown to earlier authors but a separated valve from the London Clay of Kingsclere, Hants shows that the lateral teeth are long and horizontally aligned. This, together with the shape and faintly cancellate ornament indicate the genus *Cucullaria*.

***Glycymeris brevirostris* (J. de C. Sowerby, 1824)**
The originals of the two shells from Bognor, figured by Sowerby (1824: pl. 472, fig. 1) as *Pectunculus brevirostris*, are now in the Natural History Museum, London. The well preserved pair of valves, LL18613 (JS) represented by the lower figure, is herein chosen as lectotype, and the other, 43189b (JS), a mould, as paralectotype. The matrix of both is indurated sand of the Bognor Rock Bed, where the species occurs abundantly.

***Semimodiola elegans* (J. Sowerby, 1812)**
Sowerby (1812:31) clearly regarded his Highgate, north London, specimens as typical of his *Modiola elegans* and the pair of valves, LL18417 (JS), figured (1812: pl. 9, upper left fig.) is herein chosen as lectotype. The Bognor shells, 43239b, (Sowerby, 1812, middle and lower left figs) become paralectotypes. Their matrix is indurated Bognor Rock Bed.

***Amygdalum simplex* (J. de C. Sowerby in Dixon, 1850)**
The holotype, L17184A (FD) is probably from the Bognor Rock Bed.

***Lithophaga tubicola* (Wood, 1861) comb. nov.**
This species occurs rarely, nestling in the burrows of *Teredo*-bored wood. Wrigley's (1930:376) suggestion, that this species is probably a *Lithodomus (= Lithophaga)*, is followed here in view of its similar shell morphology.

***Lithophaga* sp.**
A relatively short species, rounded anteriorly and obliquely truncate posteriorly, with strong concentric growth lines. It is found in borings in *Ostrea tabulata* at Bognor and also at Clarendon, Wiltshire, from where it was listed by Newton (1891) under the *nomen nudum* of *Modiola clarendonensis* Edwards MS.

***Pycnodonte gryphovicinus* (Wood, 1861)**
The spat of this oyster are often found encrusting shells of *Ostrea tabulata*. The generic name is derived from the Greek, πυκνος - thick, οδους οδοντε (masc.) - teeth and should therefore be masculine (ICZN Article 30) although treated as feminine by its author and neuter elsewhere.

Text-fig. 1. *Ostrea tabulata* J. de C. Sowerby. Left valve of a pair, L52951 (EV), from the Sandy Clay, Bognor. (natural size). An unpublished drawing by Venables (DB). The (hidden) right valve is concave and shows the characteristic, matt irridescent shell layer beneath a thin, fibrous outer layer.

***Ostrea tabulata* J. de C. Sowerby in Dixon, 1850.** Text-fig. 1
The species was described from Bognor in Dixon (1850:226) but not figured. Wood (1861:pl.4, fig.1a) figured a Bognor shell, 72453 (FE). Text-fig. 1 is a previously unpublished illustration by Venables of a large specimen, L52951 (EV).

***Cyclopecten duplicatus* (J. de C. Sowerby, 1827) comb. nov.**
This distinctive species, clearly not closely related to *Pecten sensu stricto*, is here tentatively assigned to *Cyclopecten* Verrill, 1897 on the basis of the dissimilar sculpture of the opposing valves. This genus is assigned to the Propeamussiidae by virtue of the outer prismatic calcite layer on the right valve and the lack of a ctenolium in the byssal notch. The shell structure of *duplicatus* remains to be tested.

***Venericor brongniartii* (J. de C. Sowerby in Dixon, 1850) [*Venericardia planicosta*]**
The name *brongniartii* originated as a *nomen nudum* by Mantell (1833:368) but was first validly published by J. de C. Sowerby in Dixon (1850:225, pl. 14, fig. 33). The holotype L75964 (FD) is partly concealed by its matrix of Bognor Rock Bed. Various authors have commented on the differences that separate this from *Venericor planicosta* (Lamarck, 1806) but a full revision of the genus in Europe is needed.

***Cardita quadrata* J. de C. Sowerby in Dixon, 1850 (*non* d'Orbigny, 1843) [*Venericardia*]**
The syntypes figured in Dixon (1850: pl. 14, fig. 12) are lost. An examination of all the remaining material (FD)(BM), a poor assemblage of moulds in Bognor Rock and largely decalcified, suggests that these are only juveniles of *Venericor brongniartii*.

***Astarte subrugata* Wood, 1871**

Text-fig. 2. Left valve, probably from the *Astarte* Bed, Bognor, (probably natural size). A manuscript drawing by Venables (DB) of an unlocated specimen.

***Nemocardium semiasperum* (Deshayes, 1858) [*N. semigranulatum* (J.Sby)]**
(= *Protocardium bognoriense* Newton, 1891 *nomen nudum*). Three Bognor specimens are the only examples known from England, although the species from Alum Bay and Portsmouth, figured by Tremlett (1950: 117, pl. 15, fig. 3) as *N. hornesi [sic]*, seems much closer to, *N.semiasperum* than it does to the French *N. hoernesi* (Deshayes, 1858).

***Orthocardium porulosum* (Solander in Brander, 1766)**
One partly decalcified valve (DB) that appears to have had about 30 ribs, as in typical *porulosum*. Tremlett (1950) did not consider the species to occur below the Middle Eocene.

***Spisula (Austromactra)* cf. *compressa* Deshayes, 1831 [*Mactra* sp.]**
The specimen L90174 (EV) from the Soft Rock, not listed by Venables, is an internal mould of a pair of valves with a thin shell coating, about 30mm long with the anterior end drawn out. The prominent umbones are placed nearer to the indented posterior margin. This resembles examples of the Late Eocene *S. compressa* although the shell is relatively slightly taller.

***Tellina* sp.**
A unique closed pair, L90233 (EV), with the posterior rostra slightly twisted to the right. The actual shell is preserved and the valves are smooth, c. 7 x 13mm with a central umbo.

***Arctica morrisi* (J. de C. Sowerby, 1841)**
The common species of *Arctica* from the lower beds at Bognor appears to be the Palaeocene and early Eocene species, *A. morrisi*, which compared to *A. planata* (J. de C. Sowerby, 1841) is smaller, more elongate and less inflated (A. J. Rundle, unpublished PhD thesis). Whether *A. planata*, characteristic of higher levels of the London Clay, is also present at Bognor was not ascertained. *Cyprina ? nana* J. de C. Sowerby, 1850, figured in Dixon (1850: pl. 14, fig. 8), is based on a fairly typical juvenile *A. morrisi*, 21 x 16mm, appearing polished with very close fine concentric striae. Holotype, LL41500 (FD), a closed pair of valves in a matrix resembling the Barn Rock Bed.

***Miocardiopsis venablesi* n. sp.** Text-figs. 5-6, Plate, 1, fig. 1
Description see page 171.

***Callista (Microcallista) proxima* (Deshayes, 1857)**
Tremlett's record (1953:17) may be an error as no specimens have been found to substantiate it, and the species was not listed by Venables. The specific name dates from Deshayes'(1857: pl. 30) published figure.

***Caestocorbula clarendonensis* (Wrigley, 1925)**
Adult right valves, L53080 (EV), occasionally occur at Bognor, but these have the umbonal region characteristically sheared off and do not show the shell's early development. One small left valve, L53016 (BM), listed by Venables as *Corbula* aff. *plicata* Wrigley, may well be a juvenile *C. clarendonensis*.

***Corbula (Corbula)* sp.**
Not listed by Venables. A pair of valves (AF) with indurated infilling and one probable left valve, L52923 (BM), from the Starfish Bed.

***Panopea intermedia* (J. Sowerby, 1814)**
The holotype, 43022a (J. Sowerby, 1814:173, pl. 76, fig. 1), and another specimen figured by J. de C. Sowerby (1823: pl. 419, fig. 2) are both paired valves in Bognor Rock matrix. The apical part of the holotype valve has pronounced regular concentric ridges and, as a juvenile 17mm long, would have had a height of about 12.5mm. *Panopea puella* J. de C. Sowerby in Dixon (1850:224, pl. 14, fig. 14) is a 17 x 11mm juvenile of *intermedia*. The holotype, LL41438 (FD), is one of 3 juvenile pairs and several impressions in a small piece of Bognor Rock. In later Eocene examples assigned to *P. intermedia*, the juvenile shell tends to be considerably more elongate with weaker ornamentation.

***Pholadidea pechellii* (J. de C. Sowerby in Dixon, 1850)**
Not listed by Venables. The holotype, LL41437 (FD), figured in Dixon (1850: pl. 14, fig. 10), consists of paired valves, 35mm long with callum in place, in a matrix resembling Bognor Rock Bed. Another pair, 73122 (FE), is *in situ* in a boring in wood, filled with hard sand.

***Martesia* (s. l.) aff. *xylophagina* (Deshayes, 1856)**
The French Thanetian *xylophagina* is longer and less attenuated posteriorly. Both species are distinguished from other martesiines by the single umbonal-ventral sulcus, by the hook-like upturned anterior / dorsal corner and by the coiled umbones, produced so as to rest on the anterior slopes of the valves. The Bognor shells appear to be conspecific with a unique specimen found in a boring in an oyster shell in the Blackheath Beds of Elmstead, Kent, L23198 (BM).

***Teredina personata* Lamarck, 1806**
Venables excluded this species (1963:269), considering his specimen to be indeterminate. The specimen in question, L53044, appears to be a twig. However, a large *Teredina*, 64412 (FD), complete with protoplax, callum and part of the attached tube, was figured in Dixon (1850: pl. 14, fig. 5,5a). The matrix of this and other specimens examined appears to be the Barn Rock Bed (BM, DB). Two other specimens, 43003B (JS) & 73130 (FE), recorded as *Teredina* by Newton (1891), comprise paired valves partly buried in burrow-shaped sediment and may be referable to *Teredo (sensu lato)*.

***Teredo* (s. l.) sp.**
Common as massed tubes in wood and, as such, they are specifically indeterminate.

***Pholadomya virgulosa* J. de C. Sowerby, 1844**
The holotype from Bognor, 46458 (FD), in probable Bognor Rock Bed matrix, was figured by Sowerby (1844: pl. 630, fig. 1) and again in Dixon (1850: pl. 14, fig. 31). This is an elongate, rounded-oblong species with convex valves and little or no anterior umbonal ridge. The length rarely exceeds 70mm.

***Pholadomya dixoni* J. de C. Sowerby, 1844**
The matrix of the holotype from Bognor, 46459 (JS), appears to be the Barn Rock Bed. A larger shell than *P. virgulosa*, not so elongate, with a marked anterior umbonal ridge that angulates the margin. There seems to be much variation between individuals in this genus and paired valves often show post-depositional distorsion. These facts would justify a reappraisal of the five species recorded by Newton (1891:82) from the London Clay of the Hampshire Basin.

***Thracia dubia* Brown, 1845: 229**
No material of this species has been found in the NHM and it seems likely that it will prove to be a synonym of *T. oblata* (J. de C. Sowerby).

***Cuspidaria inflata* (J. de C. Sowerby, 1827)**
One large specimen from the Beetle Bed (DB), 21 x 26mm (rostrum broken), seems to correspond with the (gerontic ?) form listed under the *nomen nudum* of *Neaera rostratissima* Edwards MS by Newton (1891:91).

***"Dentalium"* sp.**
The indeterminate material comprises several smooth pyrite internal moulds of a small scaphopod.

Cephalopoda
Venables recorded 4-5 species which are discussed by Hewitt (1992 - this volume).

DESCRIPTIONS OF NEW SPECIES

Family CYLICHNIDAE A. Adams, 1850

Genus *Acteocina* Gray, 1847.

Acteocina venablesi n. sp.

Text-fig. 3

1963 *Acteocina* sp. Venables: p. 262 (listed)

Holotype: GG14487 (AW) London Clay Formation, Bognor Regis, Sussex: *ex situ* on surface of Beetle Bed; Paratypes: GG14488-90 (AW), GG8230-33 (EV), 11 specimens from the same locality; all internal moulds in pyrite.

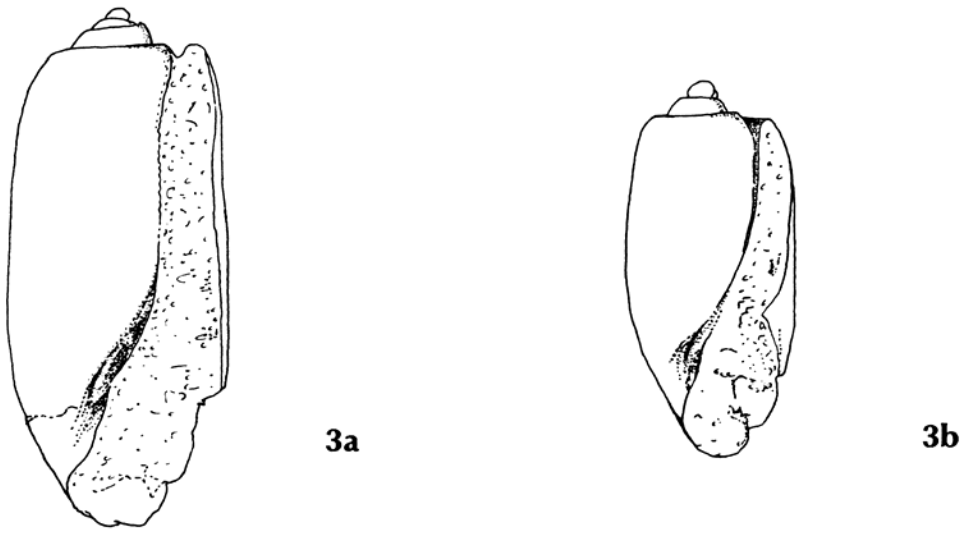
Diagnosis: A small, virtually cylindrical, bullomorph shell with a short, elevated and stepped spire.

Description: Protoconch heterostrophic, with a slightly projecting nucleus and, 1½ sinistral whorls, which are tilted 90° to the axis of coiling and half buried in the first teleoconch whorl. This forms a button on the apex, 0.12mm high. Teleoconch 3½ whorls, the spire turreted with straight, sloping sides, a subangular shoulder and deep canaliculate sutures (as preserved on the mould). Last whorl comprises 90% of the total height and has almost straight sides which are slightly divergent on the upper two thirds of the whorl from the shoulder to the periphery, then narrowing rather abruptly into the rounded-conical base. Aperture narrow and parallel sided in its adapical half, enlarged by a sloping paries which meets the rather steeper columella at a wide angle. Umbilical region of the mould furrowed, indicating a former thickening of the columella. Lip profile somewhat obscured by damage, but interpreted from the paratypes as being straight and vertical, finally curving to form the basal lip. On the holotype and some paratypes, the adapical end of the last whorl curves upward to the preceding suture just before reaching the aperture. The mould is smooth with no traces of ornament.

Measurements of holotype: height 5.0mm, width 2.2mm.

Distribution: Early Eocene, known only from the area of the Beetle Bed, division B1 of the London Clay Formation, at Bognor Regis.

Comparisons: This species differs in its more vertical sides and much higher spire from *A. leai* (Aldrich, 1895) of the Early Eocene of Alabama, USA. It is also less lenticular in profile than *A. exerta* (Deshayes, 1862) from the Oligocene of France and the penultimate whorl is relatively higher than that of *A. lajonkaireana* (Basterot, 1825) from the Miocene of France. *A. grignonensis* (Deshayes, 1862), from the



Text-fig. 3. *Acteocina venablesi* n. sp. Internal moulds in pyrite; *ex situ* on surface of the Beetle Bed, Bognor x13. **3a**. Holotype GG14487 (AW), 5.0 x 2.2mm. **3b**. Paratype GG14488 (AW), a juvenile, 3.8 x 1.7mm.

Middle and upper Eocene of France, also has a high spire, but differs in its more convex profile and more rapidly expanding triangular aperture.

Remarks: This is the first record of *Acteocina* from the English Palaeogene, and perhaps the earliest record of the genus in Europe, except for two European Jurassic forms (listed as *Tornatina*) by Cossmann (1895:81).

Family GLOSSIDAE Gray, 1847

Genus *Miocardiopsis* Glibert, 1936

Miocardiopsis venablesi n. sp.

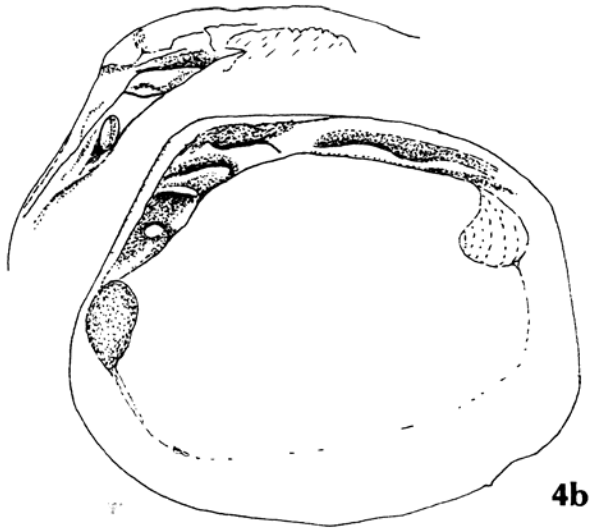
Text-fig. 4, Pl. 1, fig. 1a, b.

1963: *?Trapezium* sp. Venables,p. 263 (listed)

Holotype: BM(NH) L52918(EV), an adult right valve embedded in matrix, showing interior. London Clay Formation, Bognor Regis, Sussex: *Astarte* Bed; Paratypes: L52913-7, L52919, L90215 (EV)(AD), single and paired valves from the *Astarte* Bed and L52936-7 (EV) from the Starfish Bed at the same locality;, 11 specimens in all.

Diagnosis: A short tumid shell, trapeziform when young, becoming rounded with age. The umbo is inconspicuous and prosogyrate; there is a straight posterior truncation.

Description: The shell is thin and ovate, up to 10.9mm high x 12.6mm long, with an inconspicuous prosogyrate umbo placed slightly in front of the mid-line. There is neither escutcheon nor lunule. The postero-dorsal margin is short and evenly curved. The antero-dorsal margin is short, straight and oblique, but strongly rounded where it meets the long, evenly curved ventral margin. The posterior margin is short, straight and vertical, meeting the adjoining margins at blunt, obtuse angles. The holotype is a right valve, the hinge a little damaged and with a gerontic appearance, but having a relatively thick and strongly curved hinge plate. The nymph is short and broad, situated a short distance behind the umbo. The right posterior cardinal (3b) is broad and oblique with a central furrow, its anterior edge forming a prominent ridge. The right anterior cardinal is absent, probably obliterated by spreading of the hinge plate into the area around the umbo. The right anterior lateral (AI) forms a short tubercle, seated in a shallow elongate socket. The right posterior laterals (PIII, PI) are long, parallel with the dorsal margin and separated by a deep furrow. The ventral tooth (PI) is by far the stronger and forms a sharp ridge. The hinge details of the left valve are unknown at present as all the Bognor examples are slightly crushed and embedded in clay blocks. The adductor muscle scars are oval, equal in size, the posterior scar shallow while the anterior is deeply impressed. The pallial line appears to be entire. The shell's outer surface is smooth with faint concentric growth lines which



Text-fig. 4.

Miocardiopsis venablesi n. sp. Interior views of right valves; *Astarte* Bed, Bognor. x6.

4a. Paratype L52914 (EV) Hinge, the posterior part fractured and obscured by matrix.

4b. Holotype: L52918 (EV), 9.6 x 12.0mm. The hinge plate has spread outwards, reducing the umbonal area - a gerontic feature.

become regular and widely spaced towards the margin. Juvenile valves have a more angularly rhombic outline.

Measurements of holotype: height 9.6mm, width 12mm.

Distribution: As yet only known from the Early Eocene, base of division A3 of the London Clay Formation at Bognor, where disarticulated valves occur abundantly at some levels.

Comparisons: This is closely related to two other listed but undescribed species in the Oldhaven Member of Herne Bay, Kent (as *Trapezium* n. sp., Cooper, 1934) and the Swanscombe Member of Harefield, Middlesex (as "*Miocardiopsis oldhavenensis* Rundle MS", Cooper, 1976). Both of these are larger and more elongate than the present species. The rounded outline and inconspicuous umbo distinguish it from *M. eocaenica* (Bayan), the type species of *Miocardiopsis*.

Remarks: Hinges of both valves of this species may also be present among some hinge fragments from the London Clay at Aldwick Pumping Station, Sussex, LL41501-5 (AW), but as they show such variable features it seems unsafe to include these as paratypes.

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Plate 1.

1a, b. *Miocardiopsis venablesi* n. sp. Paratype L52914 (EV), *Astarte* Bed, Bognor. Two views of the right valve, 10.9 x 12.5mm. The matrix that fills the interior has partly obscured the fractured hinge (see Text-fig. 5).

2. *Haustator* cf. *interpositus* (Deshayes). GG14495 (DB), Soft Rock, Bognor. 34.0 x 8.3mm.

3. *Orthochetus elongatus* Wrigley. GG14486 (DB) Sandy Clay, Bognor. 20. 4 x 7.1mm.

4a, b. *Crisposcala dadanti* de Boury. GG14483 (DB *ex* EV) *ex situ* on *Astarte* Bed, Bognor. Specimen with $2\frac{1}{2}$ whorls remaining, 15.4 x 11.3mm.

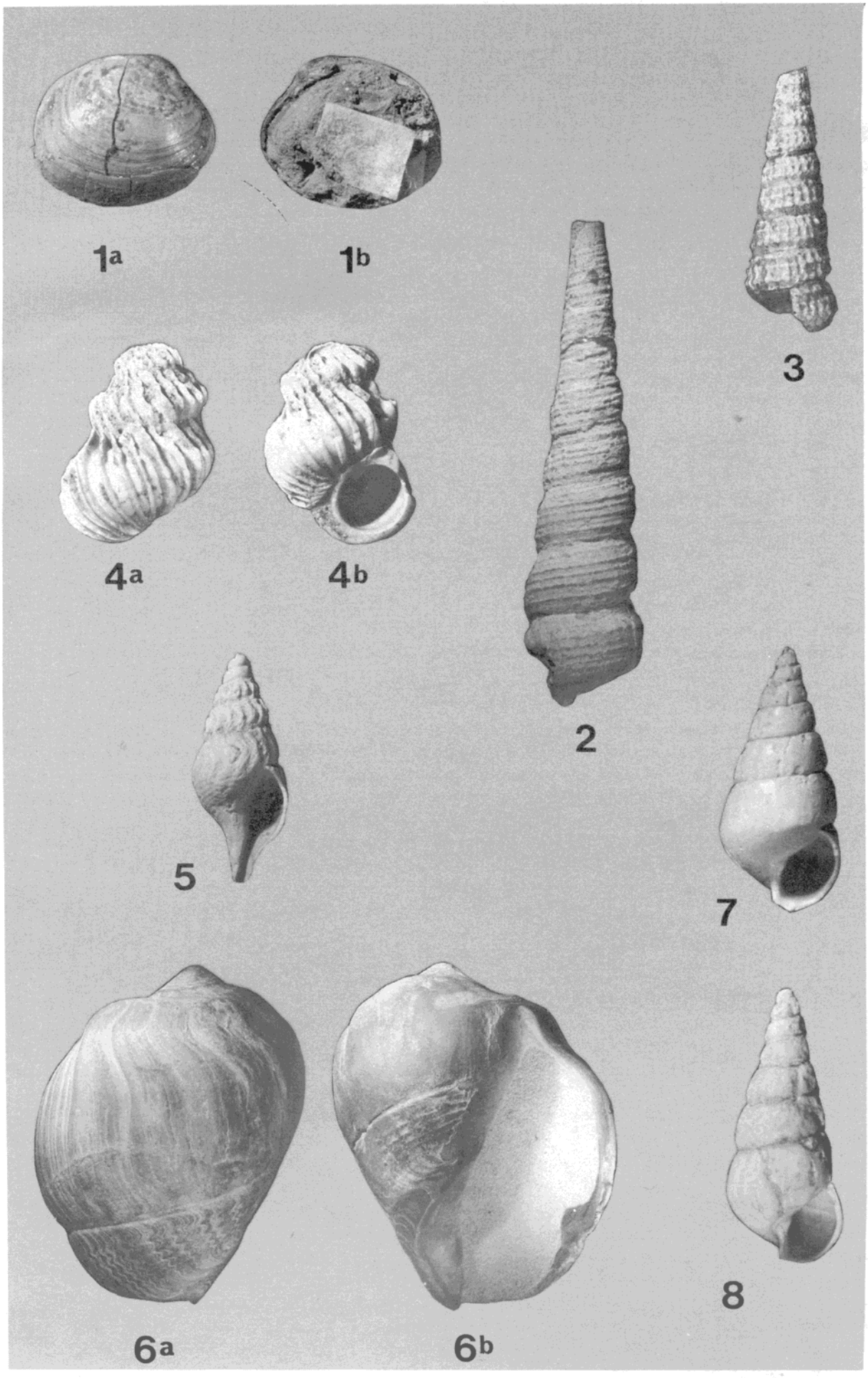
5. *Eopleurotoma prestwichii* (Edwards). GG14494 (DB) *Astarte* Bed, Bognor. 16.2 x 6.6mm.

6a, b. *Pseudoliva laudunensis* (Defrance). GG14493 (BM) Bognor Rock Bed, Bognor. A large example, 55.5 x 44.5mm.

7. *Odostomia* cf. *gravesi* Deshayes. GG14485 (DB) *Astarte* Bed, Bognor. A form with a weak columellar pleat, 5.4 x 2. 5mm.

8. *Odostomia* sp. GG14484 (DB) *Astarte* Bed, Bognor. An elongate species with lirae inside the lip, 5.7 x 2.4mm.

Magnification: figs 1-5 x2.5, fig. 6 x1.2, figs 7-8 x9


1a
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