SOME NEW BRITISH ALBIAN OSTRACODA

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CONTENTS

SYNOPSIS

Twenty new species and subspecies of Ostracoda are described from the Gault Clay (Middle and Upper Albian) of England. Additiona information is given on nine already described species and four ostracod synonyms (*Clithrocytheridea ventricola* Damotte & Grosdidier, *Cytheropteron punctata* Kaye, *Cythereis angulata* Kaye and *Cythereis lamplughi* Kaye) are corrected. Four forms are left under open nomenclature.

I INTRODUCTION AND ACKNOWLEDGEMENTS

A quantitative study of the distribution of Ostracoda in the English Gault (Middle and Upper Albian) has been carried out by the collection of accurately localized samples at small vertical intervals in as many Gault exposures as are currently available. Over three hundred and fifty samples have been collected, a large proportion of which have already been analysed working on a 1,500 gram basic starting weight of sediment. The project as a whole is only partially complete but a certain number of undescribed species have already been found. The description of these new species together with other relevant taxonomic information is the subject of the

present paper. Twenty species and subspecies belonging to fifteen genera are described for the first time. Additional information is given on nine already known species and four Cretaceous ostracod synonyms are corrected. Four forms are left under open nomenclature. The known range of each described species is given and its value as an index fossil is noted where possible. A complete list of the Gault exposures sampled during the course of the overall project is given. A palaeontological zonation of the Middle and Upper Albian based on ammonites is given as Text-fig. 1. All specimens described and illustrated in this paper are deposited in the collections of the British Museum of Natural History (B.M.N.H.) but considerable numbers of comparative forms are retained in the author's private collections.

This study has been carried out during the tenure of a D.S.I.R. Research Fellowship at the Sedimentology Research Laboratory, Dept. of Geology, Reading University, and I am extremely grateful to Professor P. Allen for all his help and encouragement. I would also like to thank many of my colleagues at Reading, particularly Dr. A. W. Medd, Mr. G. H. Scott and Mr. D. B. Williams for help in field work and Mr. J. L. Watkins for the photography. I would also like to express my gratitude to Mr. H. G. Owen and Mr. R. A. Milbourne whose help concerning Gault stratigraphical problems has been of immense value.

II LOCATION OF SAMPLES

A list of the localities from which Gault Ostracoda have been obtained is as follows :

(i) Lower and Upper Gault at the British Portland Cement Co's pit, Small Dole near Henfield, Sussex. Grid. Ref. TQ. 218131

(ii) Lower Gault at the Honey Lane Brickworks, Selbourne, Hampshire. Grid. Ref. SU. 768342

(iii) Lower Gault at the Greatness Lane Brick pit, Sevenoaks, Kent. Grid. Ref. TQ. 536578.

(iv) Lower and Upper Gault at Ford Place pit, Wrotham, Kent. Grid. Ref. TQ. 636591

(v) Upper Gault at the Rugby Portland Cement Co's pit, Paddlesworth, near Maidstone, Kent. Grid. Ref. TQ. 695623

(vi) Upper Gault at Sandown Bay and also Blackgang, Isle of Wight

(vii) Upper Gault at Pinhay Point, Devon. Grid. Ref. SV. 342928

(viii) Lower Gault at Devizes, Wiltshire. Grid. Ref. ST. 986612

(ix) Lower Gault at Culham, near Abingdon, Oxfordshire. Grid. Ref. SV. 510949

(x) Lower and Upper Gault at Mundays Hill pit, Leighton Buzzard, Bedfordshire. Grid. Ref. TL. 915978

(xi) Upper Gault at the London Brick Co's pit, Arlesey, Bedfordshire. Grid. Ref. TL. 185352

(xii) Upper Gault at Fisons Brickpit, Burwell, Cambridgeshire. Grid. Ref. TL. 516691

(xiii) Upper Gault at Eastwoods Cement pit, Barrington, Cambridgeshire. Grid. Ref. TL. 394507

ALBIAN ZONES and SUB ZONES

UPPER ALBIAN	Stoliczkaia dispar	Mortoniceras perinflatum
		Arraphoceras substuderi
	Mortoniceras inflatum	Mortoniceras inflatum var. aequatorialis
		Callihoplites auritus
		Hysteroceras varicosum
		Hysteroceras orbignyi
MIDDLE ALBIAN	Euhoplites lautus	Dipoloceras cristatum
		Anahoplites daviesi
		Euhoplites nitidus
		Euhoplites meandrinus
		Dipoloceras subdelaruei
		Dimorphoplites doris
	Hoplites dentatus	Dimorphoplites niobe
		Anahoplites intermedius
		Hoplites spathi
		Hoplites benettianus
		Hoplites eodentatus
LOWER ALBIAN	Douvilleiceras mammillatum	Protohoplites puzosianus
		Otohoplites raulinianus
		Cleoniceras floridum
		Sonneratia kitchini
	Leymeriella tardefurcata	Leymeriella regularis
		Hypacanthoplites milletioides
		Farnhamia farnhamensis

(xiv) Lower Gault at Castles Farm pit, near Ely, Cambridgeshire. Grid. Ref. TL. 600775

(xv) Lower Gault at Speeton, E. Yorkshire. Grid. Ref. TA. 150758

(xvi) Lower Gault at West Heslerton, E. Yorkshire. Grid. Ref. TA. 913759

(xvii) Lower and Upper Gault at Folkestone, Kent. Grid. Ref. TR. 242365

(xviii) Upper Gault at Ashford, Kent. Grid. Ref. TR. 058435

(xix) Gault at Swanage, Lulworth, Osmington and Black Ven near Lyme Regis, Dorset.

Many other pits, particularly in the Lower Gault of the Wealden area have been found to be barren of Ostracoda. These include :

(i) Lower Gault at Hassocks, Sussex. Grid. Ref. TQ. 310155

(ii) Lower Gault at the Marley Tile pit, Storrington, Sussex. Grid. Ref. TQ. 094138

(iii) Lower Gault at Nyewood Brick pit, Nyewood, near Petersfield, Hampshire. Grid. Ref. SU. 800218

(iv) Lower Gault at Wrecclesham, near Farnham, Hampshire. Grid. Ref. SU. 826448

(v) Lower Gault at Arnold's sand pit, Buckland, Kent. Grid. Ref. TQ. 231512

(vi) Lower Gault at Squerry's pit, Westerham, Kent. Grid. Ref. TQ. 442538

(vii) Lower Gault at Uffingham, Oxfordshire. Grid. Ref. SU. 315905

(viii) Lower Gault at Badbury Wick, near Swindon, Wiltshire. Grid. Ref. SU. 192818

(ix) Lower Gault at Thame, Oxfordshire. Grid. Ref. SP. 691055

(x) Lower Gault at Coney Hill Sandpit, Oxted, Surrey. Grid. Ref. TQ. 375526

III SYSTEMATIC DESCRIPTIONS

Suborder CLADOCOPINA

Family **POLYCOPIDAE**

Genus ***POLYCOPE*** Sars 1866

Polycope nuda sp. nov.

(Pl. 4, figs. 1–3)

DERIVATION OF NAME. nuda—referring to the lack of surface ornament.

DIAGNOSIS. Large moderately inflated *Polycope* with subcircular outline and smooth valve surface.

HOLOTYPE : A single left valve, B.M.N.H. Io. 2847, from the Lower Gault *niobe* Subzone ; Wrotham, Kent.

PARATYPES : B.M.N.H. Io. 2848–2850. Three carapaces from the same subzone and locality.

MEASUREMENTS.

	Length (mm.)	Height (mm.)	Width (mm.)
Left valve (B.M.N.H. Io. 2847, holotype)	0·55	0·50	0·16
Carapace (B.M.N.H. Io. 2848) . . .	0·58	0·50	0·32

DESCRIPTION. Valves large, moderately inflated, subcircular in outline. There is a slight flattening dorsally along the hinge line forming two weak cardinal angles. The anterior margin is more bluntly rounded than the posterior margin. Lateral surface mainly smooth but with some weak irregular reticulation particularly antero-ventrally in certain specimens. Overlap strong particularly posteriorly and ventrally. Hinge simple with a groove in the margin of the right valve to accommodate the sharp edge of the left valve. Duplicature not seen. Muscle scars, a triangular

FIG. 2. Muscle scars of *Polycope nuda* sp. nov. ×2500.

patch composed of three scars, the apex pointing dorsally. The two ventral scars are roughly triangular in shape, the dorsal scar is diamond shaped, fitting between the points of the other two scars.

REMARKS. Only one other species of the genus *Polycope* has been previously recorded from the Cretaceous. This species, *P. bonnemai* Herrig 1964, is known from the Maastrichtian of the Isle of Rugen and a similar form *Polycope* sp. was described by Bonnema (1940) from the Maastrichtian of the Netherlands. *P. nuda* is therefore the first pre-chalk Cretaceous reference to the genus and is closely related and presumably ancestral to *P. bonnemai*. It is closely similar in size and ornamentation to the latter but differs in details of the shape and overlap, lacking the anterior and postero-dorsal marginal thickening of *P. bonnemai*. In shape the anterior and posterior margins are more evenly rounded in *P. nuda*. *P. oweni* described below, also from the British Albian, is much smaller and strongly ornamented. The genus is fairly common in the Jurassic where several species are known, particularly from the Liassic and Oxfordian. In general these forms are smaller, much more flattened and usually strongly ornamented. *P. nuda* is found consistently throughout the Gault first making its appearance in the *niobe* Subzone. It is never very common though its relative abundance in the *niobe* Subzone is a useful indicator of that horizon.

Polycope oweni sp. nov.

(Pl. 4, figs. 11–15)

DERIVATION OF NAME. After H. G. Owen whose work on Gault stratigraphy has been invaluable to me in my studies of the distribution of the Ostracoda in the Gault.

HOLOTYPE. A left valve, B.M.N.H. Io. 2859, from the *H. orbignyi* Subzone (Upper Gault) ; Wrotham, Kent.

PARATYPES. B.M.N.H. Io. 2858, 2860–63. Four valves and two carapaces from the same horizon and locality.

DIAGNOSIS. Small subcircular *Polycope* with valve reticulately ornamented. Along and at the junction of the reticulation are numerous small spines.

MEASUREMENTS.

	Length (mm.)	Height (mm.)	Width (mm.)
Left valve (B.M.N.H. Io. 2859, holotype)	0·42	0·37	0·11
Carapace (B.M.N.H. Io. 2858) . . .	0·42	0·37	0·22

DESCRIPTION. Valves small, weakly inflated, subcircular in outline. The valves have a slightly greater length than height but there is only very slight flattening along the hinge line. The valves are slightly asymmetrical anteriorly but the anterior and posterior margins are without cardinal angles. Marginal protuberances are absent but the whole of the margin is thickened. The lateral surfaces are strongly but variably ornamented ranging from reticulation to spination. The basic ornament is the reticulation covering the whole of the surface on a somewhat concentric pattern. Small spines are developed along the ridges of the reticulations giving rise to a completely spined appearance in many of the specimens. Overlap is marked all round the margin except dorsally.

The hinge is simple ; the margins in both valves being flattened to form sharp marginal bars which overlap each other. Dorsally in the right valves there is a weak groove above the bar. Muscle scars, three equal-sized oval scars arranged in a triangle. One apex of the triangle points dorsally.

REMARKS. *P. oweni* is not abundant in the Gault and is found rarely in clays of post *A. intermedius* Subzone age. It differs from *P. nuda* in the details of the shape, hinge, muscle scars and ornamentation and is smaller.

Suborder PODOCOPINA

Family **BAIRDIIDAE**

Genus ***BAIRDIA*** McCoy 1844

Bairdia pseudoseptentrionalis (Mertens)

(Pl. 2, figs. 1, 3–6)

? 1840 *Cytherina subdeltoidea* Munster ; Roemer : 105, pl. 15, fig. 22.
? 1845 *Cytherina subdeltoidea* Munster ; Reuss : 16, pl. 5, fig. 38.
1849 *Bairdia subdeltoidea* (Munster) ; Jones : 23, pl. 5, figs. 15*a–f*.
? 1874 *Bairdia subdeltoidea* (Munster) ; Reuss : 140, pl. 26, figs. 5*a–c*.
1890 *Bairdia subdeltoidea* (Munster) ; Jones & Hinde : 5, pl. 2, figs. 31–34.
? 1927 *Bairdia subdeltoidea* (Munster) ; Alexander, pl. 6, figs. 2, 4.
? 1929 *Bairdia subdeltoidea* (Munster) ; Alexander : 61, pl. 3, fig. 5.
1956 *Bairdoppilata pseudoseptentrionalis* Mertens : 182, pl. 8, figs. 7–10, pl. 13, figs. 89–90.
? 1956 *Bairdoppilata roemeri* Deroo : 1509, pl. 1, figs. 9–12.
1958 *Bairdoppilata pseudoseptentrionalis* Mertens ; Howe & Laurencich : 82.
? 1958 *Bairdoppilata ? roemeri* Deroo ; Howe & Laurencich : 82.

MATERIAL. B.M.N.H. Io. 2828–2832, 4 valves and 1 carapace from the Gault just below the Cambridge Greensand at Arlesey, Beds.

MEASUREMENTS.

	Length (mm.)	Height (mm.)
Left valve (B.M.N.H. Io. 2828) .	1·32	0·87
Right valve (B.M.N.H. Io. 2829)	1·34	0·75

REMARKS. For a long time all Cretaceous species of *Bairdia* were placed in *B. subdeltoidea* (Munster) a Tertiary form. In 1956 Deroo re-named the Cretaceous references to *B. subdeltoidea* as *Bairdoppilata roemeri*. Earlier in the same year Mertens had, however, erected a new species *Bairdoppilata pseudoseptentrionalis* which seems to be identical with Deroo's form. Both authors had referred their species to the genus *Bairdoppilata* which is said to differ from true *Bairdia* in having two rows of denticles at either end of the hinge line in the right valves. However, as van Morkhoven (1963) has pointed out, the presence or absence of such denticles is a characteristic of most of the genera within the Bairdiidae each genus containing species both with and without them. It therefore seems unwise to perpetuate the genus *Bairdoppilata*.

Bairdia pseudoseptentrionalis occurs rarely in the Lower Gault but is more abundant in the Upper Gault.

Genus ***PONTOCYPRELLA*** Mandelstam 1956

Pontocyprella semiquadrata sp. nov.

(Pl. 3, figs. 1–8)

DERIVATION OF NAME. Semiquadrate–alluding to the shape.

DIAGNOSIS. *Pontocyprella* with semiquadrate shell. Anterior margin semicircular, posterior margin bluntly rounded.

HOLOTYPE. A left valve, B.M.N.H. Io. 2834, from the *H. orbignyi* Subzone, Upper Gault ; Wrotham, Kent.

PARATYPES. B.M.N.H. Io. 2835–2837. Three valves from the same horizon and locality.

MEASUREMENTS.

	Length (mm.)	Height (mm.)
Left valve (B.M.N.H. Io. 2834, holotype) .	0·70	0·40
Right valve (B.M.N.H. Io. 2836)	0·73	0·40

DESCRIPTION. Valves elongate, compressed, semiquadrate in shape. Dorsal margin weakly convex, without cardinal angles ; ventral margin weakly concave. Anterior margin semicircular, posterior margin bluntly rounded forming a weak bulge at $\frac{2}{3}$ height. Greatest height and width at mid-length. Lateral surface smooth. Inner lamella broad with large anterior and posterior vestibules. Dupli-

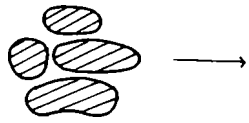

FIG. 3. Muscle scars of *Pontocyprella semiquadrata* sp. nov. ×2500.

cature narrow, crossed by numerous short straight fine radial pore canals. Normal pore canals few, small and irregularly scattered. Muscle scars a central rosette of 4 scars. Hinge simple. In the left valve there is a marginal bar with a long narrow shelf-like furrow below it. In the right valve there is a narrow marginal shelf with a high bar below it.

REMARKS. *Pontocyprella semiquadrata* occurs rarely in the upper part of the Lower Gault and more commonly in the Upper Gault. Its overall shape and particularly the shape of the anterior and posterior margins distinguish it from other Cretaceous species of the genus *P. superba* Neale 1962 and *P. rara* Kaye 1965 have an acute posterior end whilst *P. harrisiana* Jones is larger, more elongate and has the anterior margin bulged dorsally and the posterior margin bulged ventrally. *P. semiquadrata* is closest to *P. mandelstami* Kaye 1965 differing in that the latter is kidney shaped rather than semiquadrate. *P. maynci* Oertli 1958 has the dorsal margin strongly arched.

Family **CYPRIDIDAE**

Genus ***ARGILLOECIA*** Sars 1866

Argilloecia valvula sp. nov.

(Pl. 7, figs. 20–25)

DERIVATION OF NAME. valvulus L. = husk.

DIAGNOSIS. *Argilloecia* with arched dorsal margin and acute posterior margin.

HOLOTYPE. A right valve, B.M.N.H. Io. 2914, from the *H. orbignyi* Subzone, Upper Gault ; Wrotham, Kent.

PARATYPES. B.M.N.H. Io. 2915–2920. Four valves and two carapaces from the same horizon and locality.

MEASUREMENTS.

	Length (mm.)	Height (mm.)
Right valve (B.M.N.H. Io. 2914, holotype)	0·52	0·20
Left valve (B.M.N.H. Io. 2915) . . .	0·48	0·16

DESCRIPTION. Valves, thin, small, elongate, laterally compressed. Dorsal margin strongly arched, without cardinal angles ; ventral margin long and straight. Anterior margin forming a blunt point antero-ventrally ; posterior margin meeting ventral margin at an angle of 90° ventrally. Greatest height just in front of mid-length ; greatest width just behind mid-length. Right valve larger than left, over-

lapping around the entire margin but particularly strongly antero-dorsally and postero-dorsally. Lateral surface smooth. Duplicature narrow, crossed by few short, straight radial pore canals. Inner margin and line of concrescence separate, forming large vestibules anteriorly and posteriorly. Normal pore canals few, irregularly scattered. Hinge simple consisting of a groove in the dorsal margin of the right valves to accommodate the dorsal edge of the smaller left valves.

Muscle scars a central rosette of five scars.

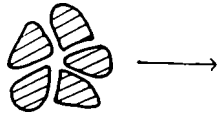

FIG. 4. Muscle scars of *Argilloecia valvula* sp. nov. ×2500.

REMARKS. *Argilloecia valvula* occurs rarely in the Upper Gault and the upper part of the Lower Gault. It is the first record of the genus in the Lower Cretaceous. The larger right valve separating the genus from most Cyprids, a feature only otherwise occurring in *Macrocypris* and *Pontocypris*. *Argilloecia* differs from these latter two genera in size, hinge and marginal features. The large size of the known Albian species of *Macrocypris* easily differentiates them from *A. valvula*. *M. parva* Kaye 1965 from the Hauterivian and Barremian of Northern England is similar in size but differs appreciably in shape.

Genus ***PARACYPRIS*** Sars 1866

Paracypris wrothamensis sp. nov.

(Pl. 9 figs. 9–14)

DERIVATION OF NAME. After the village of Wrotham, Kent the type locality for the species.

DIAGNOSIS. Large *Paracypris* with strongly drawn out acute posterior end and high strongly angular anterior cardinal angle.

HOLOTYPE. A left valve B.M.N.H. Io. 2959 from the *H. orbignyi* Subzone (Upper Albian); Wrotham Kent.

PARATYPES. B.M.N.H. Io. 2955–58, 2960, 2961. Three left valves, three right valves and two carapaces from the same horizon and locality.

MEASUREMENTS.

	Length (mm.)	Height (mm.)
Left valve (B.M.N.H. Io. 2959, holotype)	0·92	0·35
Right valve (B.M.N.H. Io. 2958) . .	0·90	0·35
Carapace (B.M.N.H. Io. 2957) .	0·90	0·35

DESCRIPTION. Valves large, compressed, very elongate. Greatest height at $\frac{1}{4}$ length, greatest width at $\frac{1}{3}$ length. In lateral view elongate subtriangular with the dorsal margin straight and the ventral margin weakly concave. Anterior margin broadly rounded forming a marked cardinal angle with the strongly sloping dorsal margin. Posterior drawn out forming a strongly acute point postero-ventrally. A well marked postero-dorsal cardinal angle occurs. Lateral surface smooth. Left valve larger than right overlapping particularly dorsally and ventrally.

Large crescentic anterior and large triangular posterior vestibules occur. Zone of fusion very narrow anteriorly and posteriorly, doubling in width ventrally. Crossed by few thick short radial pore canals branching distally (8–10 anteriorly). Normal pore canals small, few, irregularly scattered. Hinge simple, the dorsal edge of the right valve fitting into a narrow shelf-like groove along the dorsal margin of the left valve. An anterior prolongation of the dorsal marginal bar of the left valve forms a tooth-like extension corresponding with a slight incurving of the margin in front of the anterior cardinal angle in the right valve. Muscle scars a central rosette of five or six oval scars.

REMARKS. *P. wrothamensis* occurs throughout the Gault in England. It first appears in the *intermedius* Subzone but is rare in the Lower Gault. It becomes abundant in the Upper Gault and its abundance is a useful indicator of Upper Gault age. It is strongly related to the Lower Cretaceous species *P. acuta* (Cornuel) 1848. This latter species is poorly described and rather confused but is smaller and not so acute posteriorly as *P. wrothamensis*. *P. sinuata* Neale 1963 from the Hauterivian and Barremian is probably, at least in part, synonymous with *P. acuta*. *P. sinuata* differs from *P. wrothamensis* in being lower, having a less well marked anterior cardinal angle and being much less acute. Of other Cretaceous species *P. depressa* Bonnema 1940 and *P. jonesi* Bonnema 1940 have the cardinal angles rounded and the greatest height further forward; *P. gracilis* (Bosquet) and *P. siliqua* Jones & Hinde 1890 differ markedly in outline.

Genus ***KRAUSELLA*** Ulrich 1894

Krausella sp.

(Pl. 3, figs. 15, 16)

MATERIAL. Two right valves B.M.N.H. Io. 2845–2846, from the upper part of the Lower Gault at Castles Farm, Ely.

MEASUREMENTS.

	Length (mm.)	Height (mm.)
Right valve (B.M.N.H. Io. 2845) .	0·55	0·27

REMARKS. Only one other species of this genus (*K. minuta* Triebel) is known from the Cretaceous. It is smaller and is not so pointed posteriorly. The strong inequality of the valves distinguishes the genus.

Family **CYTHERIDEIDAE**

Genus ***CLITHROCYTHERIDEA*** Stephenson 1936

Clithrocytheridea heslertonensis Kaye

(Pl. 1, figs. 8–12)

1963*a* *Clithrocytheridea heslertonensis* Kaye : 30, pl. 1, figs. 10–13.
1963 *Clithrocytheridea ? ventricola* Damotte & Grosdidier : 53, pl. 1, figs. 1*a–f*.

MATERIAL. B.M.N.H. Io. 2825–2827, Female left and right valves, and carapace from Bed N. 5, Middle Albian *spathi* Subzone, West Heslerton, East Yorks.

REMARKS. Specimens of *Clithrocytheridea ? ventricola* kindly sent to me by Dr. E. Grosdidier show that this form is synonymous with *C. heslertonensis* Kaye. *Clithrocytheridea heslertonensis* is found abundantly in the *H. spathi* Subzone of the Lower Gault and appears to be confined to that subzone. It is a valuable zonal index and has been recorded from West Heslerton, Speeton, Devizes, Culham and Henfield in clays of that age.

Genus ***SCHULERIDEA*** Swartz & Swain 1946

Schuleridea dimorphica sp. nov.

(Pl. 5, figs. 1–6)

DERIVATION OF NAME. Alluding to the strongly dimorphic nature of the species.

DIAGNOSIS. Small strongly dimorphic *Schuleridea* with weak ocular sulcus and without cardinal angles.

HOLOTYPE. A male left valve, B.M.N.H. Io. 2864, from the *H. orbignyi* Subzone, Upper Gault ; Wrotham, Kent.

PARATYPES. B.M.N.H. Io. 2865–2870. Twelve valves and two carapaces from the same horizon and locality.

MEASUREMENTS.

	Length (mm.)	Height (mm.)
Male left valve (B.M.N.H. Io. 2864, holotype)	0·64	0·41
Female left valve (B.M.N.H. Io. 2867) . . .	0·52	0·40
Male right valve (B.M.N.H. Io. 2866) . . .	0·63	0·35
Female right valve (B.M.N.H. Io. 2868) . .	0·50	0·34

DESCRIPTION. Valves relatively small, ovate, laterally compressed. Dorsal margin strongly arched in left valves, weakly arched in right valves. Cardinal angles absent from both valves. Ventral margin convex in the left valves, straight in the right. Anterior margin broadly rounded ; posterior bluntly pointed just below mid-height. Greatest height just in front of mid-length, greatest width at mid-length. Eye spot very weak with a short, shallow, oblique sulcus posterior to it. Lateral surface smooth. There is a slight ventral tumidity particularly in the right valves. Duplicature broad, crossed by numerous fine radial and pseudoradial pore canals. These canals are bent upwards anterodorsally. No marginal denticulation in either valve. Inner margin and line of concrescence coincide throughout Normal

pore canals abundant and irregularly scattered over the lateral surface. Hinge strongly developed, having in the left valves two terminal divided sockets, open ventrally, separated by a shelf-like furrow. Dorsal of the median furrow is a high, smooth bar and a narrow, shallow accommodation groove. In the right valves there are two bar-like denticulate terminal teeth (5 denticles in each) separated by a low, median bar. Above the hinge is a prominent median shelf.

Sexual dimorphism is particularly strong.

REMARKS. *Schuleridea dimorphica* occurs abundantly in the Upper Gault and is a valuable index form for that age. Its small size and ovoid shape distinguish it from most other species of the genus. It is closest to *S. sulcata* Kaye 1965*a* from the Aptian of the Isle of Wight, differing in the poorer development of the eye tubercle and ocular sulcus and in the shape of the dorsal and posterior margins. Smaller and differing in hingement from the only other known Albian species *S. jonesiana* (Bosquet) 1852, it is also flatter and lacks the cardinal angles and prominent eye tubercle of *S. virginis* Grosdidier 1964 and the truncate posterior end of *S. bernouilensis* Grosdidier 1964. In shape and dimorphic features it differs also from *S. derooi* Damotte & Grosdidier 1963*a*.

Genus ***HABROCYTHERE*** Triebel 1940

Habrocythere fragilis Triebel

(Pl. 6, figs. 7–13)

1940 *Habrocythere fragilis* Triebel : 166, pl. 1, figs. 10–13, pl. 9, fig. 101.
1956 *Habrocythere fragilis* Triebel ; Mertens : 198, pl. 10, figs. 51–52.
1963 *Habrocythere fragilis* Triebel ; Kaye : 33, pl. 3, figs. 8–9.

MATERIAL. Four normal specimens B.M.N.H. Io. 2882, 2884, 2887, 2888, from the *D. cristatum* Subzone (Middle Albian) ; Wrotham, Kent.

Three anomalous specimens, B.M.N.H. Io. 2883, 2885, 2886, from the same subzone and locality.

REMARKS. *Habrocythere fragilis* is common throughout the English Albian. Certain specimens have, however, been found that may throw light upon the origin of this monotypic genus. Amongst the normal assemblages of this species certain specimens occur which are identical to the species in its general accepted sense but have a large eye spot mounted on a large tubercle set antero-dorsally. They also have the ventro-lateral portion of the valves drawn out into a weak alate expansion. These specimens have to be included in *H. fragilis* on the basis of their other features and their close association with normal specimens of the species but are closely similar to species of the genus *Euryitycythere*. It is therefore, very likely that *Euryitycythere* known from Valanginian to Aptian strata has evolved into the genus *Habrocythere* with certain specimens of the latter genus showing recapitulation. The major diagnostic features of *Euryitycythere* are the eye tubercle, the inflated alate ventro-lateral area, the wide flattened marginal area and the hinge. The wide flattened marginal area and associated radial canals are found in all specimens of *Habrocythere* whilst the eye tubercle and inflation are shown in the " recapitulation " specimens.

The variability of the hinge in Ostracoda and its modification during phylogeny is well known in Ostracoda and modification during the Hauterivian-Albian time interval is quite feasible. The Aptian occurrence of the genus (Kaye 1965*a*) is of a single closed carapace and the hinge features are not known. Slight simplification of the hinge structure during the phylogeny can perhaps be related to the small size and light build of *Habrocythere* and can be used as evidence against making *Euryitycythere* Oertli 1958 a synonym of *Habrocythere* Triebel 1940.

Specimens of *H. fragilis* showing affinities with *Euryitycythere* have been found from several localities. They occur mainly in the *daviesi* and *cristatum* Subzones at Wrotham and in the *subdelaruei* Subzone at Sevenoaks. They are useful indicators for recognizing the upper part of the Lower Gault and it is possible that ecological conditions in the Weald at this time stimulated this diversification.

Genus ***DOLOCYTHERIDEA*** Triebel 1938

Dolocytheridea typica sp. nov.

(Pl. 3, figs. 9–14)

DERIVATION OF NAME. Typicus L. = typical.

DIAGNOSIS. Small *Dolocytheridea*, inflated posteriorly, with dorsal margin strongly arched postero-dorsally. Posterior end rather truncated.

HOLOTYPE. A left valve, B.M.N.H. Io. 2839, from the basal Upper Gault (Upper Albian) ; Pinhay, Devon.

PARATYPES. B.M.N.H. Io. 2838, 2840–44. Eight valves and two carapaces, from the same horizon and locality.

MEASUREMENTS	Length (mm.)	Height (mm.)
Left valve (B.M.N.H. Io. 2839 holotype)	0·59	0·33
Right valve (B.M.N.H. Io. 2838)	0·57	0·28

DESCRIPTION. Valves small, elongate, laterally inflated particularly posteriorly. Dorsal margin strongly arched, without cardinal angles ; ventral margin straight. Anterior margin broadly rounded, posterior margin bluntly rounded rather truncate. Greatest height and width at $\frac{2}{3}$ length. Lateral surface smooth, eye spots absent. Duplicature broad, crossed by a very large number of thin, rather sinuous, simple radial pore canals. Inner margin and line of concrescence coincide throughout. Normal pore canals fairly abundant, irregularly scattered. Muscle scars, not usually seen, appear to consist of a vertical row of four oval scars with a V-shaped scar anterior to them. Other smaller scars probably occur above and below the main group. The hinge is simple consisting in the left valves of a curved smooth groove deepened at its ends accommodating the dorsal edge of the smaller right valve. The dorsal margin of the right valve is enlarged to form weak smooth terminal teeth.

REMARKS. This species is much smaller than most other species of the genus. It differs significantly from the even smaller *D. minuta* Kaye in shape and greater inflation.

From the *D. hilseana—D. intermedia—D. bosquetiana* lineage it differs in the greater inflation posteriorly and the truncation of the posterior end as well as in size.

D. typica has so far only been found from the basal Upper Gault at Pinhay in Devon.

Family **CYTHERURIDAE**

Genus ***EUCYTHERURA*** Muller 1894

Eucytherura aff. ***nuda*** Kaye

(Pl. 7, figs. 17, 18)

MATERIAL. B.M.N.H. Io.2912–13. Two specimens from the *H. orbignyi* Subzone, Upper Gault ; Wrotham, Kent.

REMARKS. Specimens similar to the Barremian form *E. nuda* Kaye 1964 occur rarely in the Upper Gault. They are comparable with true *E. nuda* but have the postero-ventral lobe more strongly inflated and a stronger surface reticulation. It is almost certain that extra material will show that the Gault specimens belong to a separate species or subspecies. A single valve of a related but distinct form has been found from the uppermost Lower Gault at Castles Farm, Ely. This specimen is similar in shape and size to *E. nuda* but has two rows of low surface nodes, one row dorsally and a more prominent one ventrally.

Genus ***HEMICYTHERURA*** Elofson 1941

Hemicytherura euglyphea sp. nov.

(Pl. 8, figs. 1–4)

DERIVATION OF NAME. euglypheus L. = distinctly marked.

DIAGNOSIS. Sexually dimorphic *Hemicytherura* with strong surface ornament of longitudinal ridges.

HOLOTYPE. A male left valve, B.M.N.H. Io. 2921, from the *H. orbignyi* Subzone, Upper Gault ; Wrotham, Kent.

PARATYPES. B.M.N.H. Io. 2922–2925. Five valves and one carapace from the same horizon and locality.

MEASUREMENTS.

	Length (mm.)	Height (mm.)
Male left valve (B.M.N.H. Io.2921, holotype)	0·40	0·19
Female left valve (B.M.N.H. Io. 2924) . .	0·33	0·16
Male right valve (B.M.N.H. Io. 2923) . .	0·40	0·20
Female right valve (B.M.N.H. Io. 2922) . .	0·33	0·17

DESCRIPTION. Valves small, elongate, laterally compressed. Dorsal margin well arched in the right valves, weakly arched in the left valves ; without cardinal angles.

Ventral margin straight. Anterior margin broadly rounded; posterior drawn out into a short acute caudal process just above mid-height. Greatest height and width at mid-length. Lateral surface strongly ornamented, tumid ventrally. Eye spot distinct, low and glassy. Ornament consists of a series of longitudinal ridges joined by weaker vertical cross ridges. The pattern of longitudinal ridges is not regular in the centro-lateral area where a flattened irregularly ridged patch occurs. The strong ornament covers the whole of the valve exterior, even anteriorly where several longitudinal ridges run strongly across the marginal area.

Duplicature moderately broad, crossed by few straight, simple radial pore canals. There is a well developed ocular pit antero-dorsally in the interior of the valves. Hinge rather complex. In the right valve there are two faintly denticulate terminal bar-like teeth. Above each tooth is a shelf-like furrow accommodating the dorsal edge of the left valve. Between and in line with the teeth and furrows the valve remains open but above the general line of the hinge there is a median dorsal marginal bar. In the left valve the dorsal margin is enlarged to form a curved marginal bar, more prominent at the ends where it fits above the terminal teeth of the right valve. Below this marginal bar both anteriorly and posteriorly there are shelf-like terminal grooves to accommodate the terminal teeth of the right valve. Sexual dimorphism well marked.

REMARKS. *H. euglyphea* occurs rarely in the upper part of the Lower Gault and more commonly in the Upper Gault, being distinguished from most other species of related genera on account of shape, hinge and ornament. It is closest to *Cytherura reticulosa* (Chapman) which itself is probably a *Hemicytherura*, differing in being less arched dorsally, in lacking the alate spine postero-ventrally and in details of the surface ornamentation. *H. euglyphea* differs from other Cretaceous species such as *H. unisulcata* Veen, *H. bisulcata* Veen and *H. asiculcata* Veen in lacking vertical sulcation and in surface ornamentation.

Genus ***CYTHEROPTERON*** Sars 1866

Cytheropteron (C.) arguta sp. nov.

(Pl. 8, figs. 12–17)

DERIVATION OF NAME. arguta L. = distinct.

DIAGNOSIS. *Cytheropteron* with strongly reticulate lateral surface and ridged posteriorly pointing alate expansion.

HOLOTYPE. A left valve, B.M.N.H. Io. 2936, from the *H. orbignyi* Subzone, Upper Gault; Wrotham, Kent.

PARATYPES. B.M.N.H. Io. 2933–2935, 2937–2939. Six valves and one carapace from the same horizon and locality.

MEASUREMENTS.

	Length (mm.)	Height (mm.)
Left valve (B.M.N.H. Io. 2936 holotype)	0·42	0·26
Right valve (B.M.N.H. Io. 2933) . .	0·42	0·24

DESCRIPTION. Valves small, ovate, strongly ornamented. Dorsal margin strongly arched, without cardinal angles ; ventral margin weakly convex. Anterior margin bluntly rounded, posterior drawn out into a caudal extension at mid-height. Greatest height and width at mid-length. A rounded ventro-lateral alate expansion occurs. Along its crest there is a prominent ridge starting anteriorly at the margin at $\frac{1}{4}$ height and terminating posteriorly in a small posteriorly directed spine. The anterior end of the ridge forms a spine on the margin. The lateral surface is strongly reticulate. The ventral undersurface is weakly striated. Duplicature moderately broad, crossed by few straight, thick radial pore canals. Normal pore canals and muscle scars not seen. Hinge very strongly developed with two long, almost interdentate, terminal sockets separated by a short straight coarsely crenulate bar in the left valve. Above the hinge is a wide marginal shelf. In the right valve there are two terminal rows of denticles (6 or 7 in each) decreasing in height towards the median element and separated by a short interdentate furrow. Above the hinge is a narrow marginal shelf.

REMARKS. *Cytheropteron* (*C.*) *arguta* appears to be confined to the Upper Gault. It is extremely abundant in the *H. orbignyi* Subzone and can be used as an index species. It has been found so far at Wrotham, Henfield and Pinhay.

The strength of the ornamentation and hinge make *C.* (*C.*) *arguta* distinct from other known species as does the shape of the alae. It is closest to *C.* (*C.*) *punctata* Kaye from the Barremian of Northern England which has a similar ridged alae. The latter, however, has the ridge separated from the anterior margin and lacks the strong ornamentation.

Cytheropteron (C.) milbournei sp. nov.

(Pl. 7, figs. 4, 6–9)

DERIVATION OF NAME. After R. H. Milbourne whose stratigraphical work on the Gault has been an invaluable assistance to my study of the distribution of Ostracoda in the Gault.

DIAGNOSIS. *Cytheropteron* with drawn out postero-ventrally directed alate expansion and punctate ornament over whole lateral surface.

HOLOTYPE. A left valve, B.M.N.H. Io. 2898, from the *subdelaruei* Subzone, Lower Gault ; Wrotham, Kent.

PARATYPES. B.M.N.H. Io. 2899, a left valve from the same horizon and locality as the holotype ; B.M.N.H. Io. 2900–02. Two valves and one carapace from the *niobe* Subzone at Sevenoaks.

MEASUREMENTS.

	Length (mm.)	Height (mm.)
Left valve (B.M.N.H. Io. 2898, holotype) . .	0·37	0·22
Right valve (B.M.N.H. Io. 2900)	0·35	0·22

DESCRIPTION. Valves small, elongate, laterally compressed and with a prominent ventro-lateral alate expansion. Dorsal margin weakly arched ; ventral margin

straight. Anterior margin semicircular, posterior end drawn out into a blunt caudal extension at $\frac{2}{3}$ height. Greatest height in front of mid-length ; greatest width at $\frac{2}{3}$ length. Dorsal margin without cardinal angles. Alae directed postero-ventrally and bearing a weak vertical sulcus on its crest. Whole of lateral surface covered with a series of pits. The ventral underside of the alae bears a few short longitudinal riblets. Duplicature moderately broad, crossed by few thick, straight radial pore canals (5 anteriorly). Hinge merodont consisting of a long straight denticulate median bar and two small divided terminal sockets in the left valve. Above the median element is a wide marginal shelf.

REMARKS. *Cytheropteron* (*C.*) *milbournei* is known from the top part of the Lower Gault at Sevenoaks and Wrotham and it is never very abundant. It differs from *C.* (*C.*) *nanissimum* principally in the shape of the alae and in its ornamentation.

Cytheropteron (C.) nanissimum nanissimum Damotte & Grosdidier

(Pl. 7, figs. 13, 15)

1963 *Cytheropteron* (*C.*) *nanissumum* Damotte & Grosdidier : 56, pl. 1, figs. 2*a–f*.

MATERIAL. B.M.N.H. Io. 2907–08, two left valves from the *H. orbignyi* Subzone, Upper Gault ; Wrotham, Kent.

REMARKS. This subspecies occurs throughout the Gault, appearing first in the *niobe* Subzone but not becoming abundant until the Upper Gault.

Cytheropteron (C.) nanissimum fenestrata subsp. nov.

(Pl. 7, figs. 14, 16. 19)

DERIVATION OF NAME. fenestrata L. = window.

DIAGNOSIS. Subspecies of *Cytheropteron* (*C.*) *nanissimum* with fenestrate ornamentation on ventral alae.

HOLOTYPE. A left valve, B.M.N.H. 2910, from the *H. spathi* Subzone, Lower Gault ; Henfield, Sussex.

PARATYPES. B.M.N.H. Io. 2909, 2911. Two left valves from the same horizon and locality.

MEASUREMENTS.

	Length (mm.)	Height (mm.)
Left valve (B.M.N.H. Io. 2910, holotype) . .	0·33	0·20

DESCRIPTION. Valves small, elongate with a ventro-lateral alate expansion. Dorsal and ventral margins convex, greatest height at mid-length. Anterior margin semicircular, posterior margin bluntly pointed forming a weak cardinal angle dorsally. Alae directed, posteriorly, with a small spine at its end and a weak vertical sulcus on its upper surface. Above the alae near the dorsal margin is a low node. From this node a rib runs downwards to the crest of the alae, whilst a short longitudinal

rib runs across the ala at mid-height of the valves. The two ribs cross on the alae and form a " window like " pattern of ornament. The rest of the lateral surface is smooth.

Internal features identical with *C. nanissumum* s.s.

REMARKS. This subspecies is closely similar to *C.* (*C.*) *nanissimum* s.s. differing only in the nature of the ornamentation on the alae. In *C. nanissumum* s.s. the dorsal node and vertical rib are much stronger than in *C.* (*C.*) *nanissumum fenestrata* whilst the cross rib is absent.

The limited occurrence of *C.* (*C.*) *nanissumum fenestrata* in the *H. spathi* Subzone points to an ancestral relationship to *C. nanissumum* s.s. which does not appear until the *A. niobe* Subzone. *C.* (*C.*) *reightonensis* Kaye 1964 from the Barremian of Northern England is also very closely related being ornamented with rows of pits along the alae.

Cytheropteron (Cytheropteron) lamplughi nom. nov.

1964 *Cytheropteron* (*C.*) *punctata* Kaye : 103, pl. 5, figs. 7–8.

REMARKS. Professor W. A. Van den Bold of Louisana State University has kindly pointed out that the form I erected from the Lower Barremian at Speeton is in synonomy with *Cytheropteron punctatum* Brady (1868 : 449). I have therefore renamed my form *Cytheropteron* (*C.*) *lamplughi* in honour of G. W. Lamplugh and his basic research on the British Lower Cretaceous.

Subgenus ***EOCYTHEROPTERON*** Alexander 1933

Cytheropteron (Eocytheropteron) protonsa sp. nov.

(Pl. 6, figs. 1–6)

DERIVATION OF NAME. Protonsa L. = stretched out.

DIAGNOSIS. Large *Cytheropteron* with bilobed wing-like alate expansion and prominent upturned posterior caudal process.

HOLOTYPE. A left valve, B.M.N.H. Io. 2879, from the *D. cristatum* Subzone, Lower Gault ; Wrotham, Kent.

PARATYPES. B.M.N.H. Io. 2880–81. Two valves from the same horizon and locality.

MEASUREMENTS.

	Length (mm.)	Height (mm.)
Left valve (B.M.N.H. Io. 2879 holotype) . .	0·70	0·42
Right valve (B.M.N.H. Io. 2880)	0·67	0·42

DESCRIPTION. Valves large, elongate, laterally compressed. Dorsal margin strongly arched ; without cardinal angles in the left valves but with weak cardinal angles in the right valves. Ventral margin straight totally obscured by the prominent ventral alate expansion. Anterior margin broadly rounded ; posterior elon-

gated into a prominent upturned caudal process at $\frac{2}{3}$ height. A large wing-like bilobed alate expansion occurs ventro-laterally; the posterior lobe being more extended. The lateral surface is covered with irregular vertical riblets which are only poorly developed anteriorly but are stronger posteriorly. The ventral undersurface bears a series of longitudinal ridges. A weak eye node occurs antero-dorsally. Duplicature rather narrow, crossed by few, straight, simple radial pore canals. Inner margin and line of concrescence coincide. Normal pore canals few. Hinge strongly developed. In the left valve there is a long interdentate furrow widest and deepest at the ends. In the right valve there is a long curved row of denticles, highest at the anterior and posterior ends.

REMARKS. *C. (E.) protonsa* occurs rarely in the upper part of the Lower Gault and in the Upper Gault. The wing-like bilobed alae, strong upturned caudal process, hinge and ornament make it quite unlike any other described species of *Cytheropteron* s.l.

Subgenus ***INFRACYTHEROPTERON*** Kaye 1964

Cytheropteron ? (Infracytheropteron) obscura sp. nov.

(Pl. 7, figs. 10–12)

DERIVATION OF NAME. obscura L. = obscure.

DIAGNOSIS. Ovate *Cytheropteron* s.l. with smooth lateral surface and rounded ventro-lateral tumidity. Hinge simple.

HOLOTYPE. A left valve, B.M.N.H. Io. 2903, from the *H. orbignyi* Subzone, Upper Gault, Wrotham, Kent.

PARATYPES. B.M.N.H. Io. 2904–06. Three valves and two carapaces from the same locality and horizon.

MEASUREMENTS.

	Length (mm.)	Height (mm.)
Left valve (B.M.N.H. Io. 2903 holotype)	0·42	0·25
Right valve (B.M.N.H. Io. 2905) . . .	0·40	0·25

DESCRIPTION. Valves small, smooth, ovate with a marked ventro-lateral tumidity. Dorsal margin strongly arched, without cardinal angles. Ventral margin short and straight. Anterior margin broadly rounded, posterior drawn out into a blunt caudal process at just over mid-height. Greatest height at $\frac{1}{3}$ length, greatest width at mid-length. Lateral surface strongly and evenly inflated but with a flat marginal shelf anteriorly, posteriorly and postero-ventrally. A low, smooth eye tubercle occurs antero-dorsally. Duplicature moderately broad, particularly anteriorly and postero-ventrally, crossed by few straight, thick radial pore canals (7–8 anteriorly). Inner margin and line of concrescence coincide. Normal pore canals small and few. Hinge simple consisting of a smooth marginal bar in the left valve which fits on a marginal shelf in the right valve. Below the marginal shelf is a narrow median bar being discontinuous anteriorly and posteriorly.

REMARKS. *C.* (*I.*) *obscura* occurs throughout the bulk of the Gault. It first appears in the *niobe* Subzone but only becomes common in the Upper Gault. The relationship of the species is rather problematical, and it has been placed in the genus *Cytheropteron* s.l. on account of its shape and size. The lack of a marked alate expansion makes it akin to the subgenus *Eocytheropteron* but the hinge places it in the subgenus *Infracytheropteron*. The species shows strong similarities to the Tertiary genera *Bythocythere* and *Loxoconcha*. It differs primarily in the hingement and lack of vestibules though it does have a wide marginal shelf anteriorly and postero-ventrally. It is closest to *Loxoconcha minuta* Jennings 1936 from the Maastrichtian of New Jersey which is similar in shape and size but has ornamented valves. This latter form is doubtfully referred to the genus *Loxoconcha*.

Genus ***ORTHONOTACYTHERE*** Alexander 1934

Orthonotacythere fordensis sp. nov.

(Pl. 5, figs. 7–13)

DERIVATION OF NAME. After Ford Place near Wrotham, Kent, the location of the holotype.

DIAGNOSIS. *Orthonotacythere* with weak but distinct ribbing, low tubercles and wide deep median sulcus. The postero-lateral area is reticulate and strongly inflated.

HOLOTYPE. A male left valve, B.M.N.H. Io. 2871, from the *intermedius* Subzone, Lower Gault, Wrotham, Kent.

PARATYPES. B.M.N.H. Io. 2872–78. Six valves and two carapaces from the same horizon and locality.

MEASUREMENTS.

	Length (mm.)	Height (mm.)
Male left valve (B.M.N.H. Io. 2871, holotype) .	0·57	0·30
Male right valve (B.M.N.H. Io. 2872) . . .	0·55	0·28
Female left valve (B.M.N.H. Io. 2873) . . .	0·50	0·30

DESCRIPTION. Valves elongate, compressed, divided by a wide deep vertical median sulcus. Dorsal margin straight, ventral margin convex. Anterior broadly rounded, posterior forming a blunt postero-dorsal process. The median sulcus is limited ventrally by an irregular longitudinal ridge, below which, on the ventral undersurface, lies a further straight longitidunal ridge. Faint cross riblets join the two ribs. Antero-dorsally there is a prominent glassy eye tubercle jointed by a short rib to a reticulate tubercle immediately below it. Two ridges run from this lower tubercle, one anteriorly to meet the anterior margin, the other posteriorly towards the sulcus to meet a small tubercle where it turns abruptly through 90° to run vertically to connect with an irregular tubercle at the anterior end of the upper ventral longitudinal ridge. The area between the ridges is reticulate and irregularly ribbed. The lower ventral ridge runs anteriorly to reach the margin at $\frac{1}{4}$ height and posteriorly to fade

out on the postero-ventral surface. The upper ventral ridge bears two weak tubercles ventrolaterally, the posterior one being more prominent. Faint irregular ridges run vertically from these tubercles merging with the general reticulation of the postero-lateral surface. This reticulation is made up of a series of weak longitudinal ridges joined by cross members. Antero-dorsally on the postero-lateral surface lies a low ridged tubercle. Internal features and hinge typical of the genus.

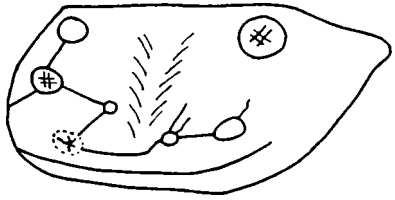

FIG. 5. Diagrammatic representation of the distribution of the ornamentation of *Orthonotacythere fordensis* sp. nov. ×75

REMARKS. *O. fordensis* occurs fairly commonly in the *A. intermedius* Subzone of the Lower Gault. It seems to be restricted to that subzone and is a valuable index form. *O. fordensis* is closely related to *O. inversa* (Cornuel) and related species forming an evolutionary sequence in the British Lower Cretaceous. It has all the major features of the group differing in minor details of the ornamentation and particularly in the subdued nature of the costation and tuberculation. Though almost certainly derived from these Lower Cretaceous forms it does not, however, show continuation of the trends seen there. The tendency towards increased tuberculation and simplification of costation is not followed and the species must therefore not be on the main "Boreal" stock. The related species of *Orthonotacythere* found in the "Tethyan" province do not follow the same trends during evolution, and ornamental patterns anomalous to that seen at Speeton have already been found (Kaye 1965*a*) in the Aptian of the Isle of Wight. It is to these species that close ancestry of *O. fordensis* must be attributed. The ornamentation of these Aptian species such as *O. catalaunica* Damotte & Grosdidier and *O. atypica* Kaye is closely similar to *O. fordensis* having the costation fairly complex with particularly the irregular nature of the upper ventral longitudinal ridge and the nature of the antero-dorsal costation in good agreement. The absence of *O. fordensis* s.s. from the Lower Gault at Speeton and its replacement by fragmentary specimens of a form intermediate between *O. fordensis* and *O. inversa tuberculata* seem to bear this out particularly on consideration of the joining of the " Boreal " and " Tethyan " seas in this area in Apto-Albian times.

Only a single specimen belonging to this group of the genus *Orthonotacythere* has so far been found from post *H. spathi* age Gault deposits. This specimen from the *nitidus* Subzone (Bed 31) at Henfield shows increased tuberculation, poor costation, poor development of the ventral longitudinal ridge and no surface reticulation. These features seem consistent with the overall trends seen at Speeton and the specimen perhaps shows a further stage of this major evolutionary pattern.

Orthonotacythere minutissima sp. nov.

(Pl. 8, figs. 5–11)

DERIVATION OF NAME. minutissimum L. = very small.

DIAGNOSIS. Very small *Orthonotacythere* with ventral alate longitudinal rib and prominent eye tubercle.

HOLOTYPE. A left valve, B.M.N.H. Io. 2926, from the *H. varicosum* Subzone, Upper Gault, Wrotham, Kent.

PARATYPES. B.M.N.H. Io. 2927–32. Five valves and one carapace from the same horizon and locality.

MEASUREMENTS.

	Length (mm.)	Height (mm.)
Left valve (B.M.N.H. Io. 2926, holotype)	0·28	0·16
Right valve (B.M.N.H. Io. 2927)	0·28	0·15

DESCRIPTION. Valves very small, elongate, compressed. Dorsal margin long and straight; ventral margin straight, shorter and parallel to it. Anterior margin bluntly rounded; posterior with a weak caudal process at the postero-dorsal cardinal angle. Eye tubercle exceedingly prominent, protruding well above the dorsal margin. Greatest height at $\frac{1}{5}$ length at the anterior cardinal angle; greatest width just behind mid-length. Lateral surface divided by a vertical median sulcus which is limited ventrally by a prominent alate longitudinal ridge. This ridge increases in height posteriorly, being drawn out into a blunt laterally directed spine. The base of the sulcus does, however, notch this rib slightly, weakly dividing it into two sections. A large tubercle occurs dorsally on the postero-lateral area. Lateral surface smooth or pitted. Anterior margin denticulate (5 denticles). Duplicature moderately broad, crossed by few, straight radial pore canals. Inner margin and line of concrescence coincide. Interior eye pit prominent. Hinge simple consisting of a long, straight denticulate bar in the left valve. In the right valve there is a long, straight interdentate furrow with a high smooth bar above it.

REMARKS. *O. minutissima* occurs rarely in the Upper Gault but has not yet been found in the Lower Gault. Its exceptionally small size makes it distinct from other species of the genus. The pattern of the main ornamentation shows no affinities to any other described form but I have found identical or closely comparable forms from the Hauterivian/Barremian of Lincolnshire. The hinge of this species is not strictly typical of the genus *Orthonotacythere*, lacking well defined terminal elements, but the shape, sulcus and ornamentation are all closely comparable to that genus. It may, however, be possible to include this species in a redefined subgenus such as *Stillina* Laurencich.

Orthonotacythere spinifera sp. nov.

(Pl. 7, figs. 1–3, 5)

DERIVATION OF NAME. Spinifera L. = spined.

DIAGNOSIS. Small *Orthonotacythere* with weak median sulcus, pronounced reticulation over whole of valves, and a series of large spines arranged over lateral surface.

HOLOTYPE. A left valve, B.M.N.H. Io. 2895, from the *A. intermedius* Subzone (Bed 13), Lower Gault, Wrotham, Kent.

PARATYPES. B.M.N.H. Io. 2894, a right valve from the *H. orbignyi* subzone (Bed 13), Upper Gault, Wrotham. B.M.N.H. Io. 2896–97, two valves from the *A. intermedius* Subzone, Lower Gault, Henfield, Sussex.

MEASUREMENTS.

	Length (mm.)	Height (mm.)
Left valve (B.M.N.H. Io. 2895, holotype)	0·42	0·22
Right valve (B.M.N.H. Io. 2894)	0·42	0·22

DESCRIPTION. Valves small, elongate, strongly laterally compressed. Dorsal margin long and straight ; ventral margin short, straight and parallel to it. Anterior margin bluntly rounded forming a well marked antero-dorsal cardinal angle ; posterior drawn out to form an acute postero-dorsal caudal process. Anterior and posterior margins strongly spined. Vertical median sulcus very weak or absent. Eye tubercle rounded and glassy, set at dorsal end of a short high, blade-like vertically elongated spine. A similar bladed spine lies at $\frac{2}{3}$ length on the dorsal margin with a further smaller spine at $\frac{1}{3}$ length just below the dorsal margin. An arcuate row of four extremely prominent spines runs parallel to the ventral margin. Below this row is a series of smaller semi-fused spines culminating posteriorly in a larger bilobed spine. A pair of smaller spines occur posteriorly, one on the dorsal margin, the other being vertically below it at $\frac{3}{4}$ height. The whole of the lateral surface is strongly reticulate.

Duplicature narrow, crossed by few straight radial pore canals. Normal pore canals and muscle scars not seen. Hinge strongly developed consisting in the left valve of two short, subdivided sockets separated by a long, straight, lobed bar. Above the median bar is a narrow marginal shelf. In the right valve there are two bar-like denticulate terminal teeth (5 denticles in each) separated by a wide, strongly divided, median groove.

REMARKS. *Orthonotacythere spinifera* is rare in most of the Gault, a few specimens having been found at a variety of levels and localities. It is more abundant in the Gault at Pinhay in Devon and is perhaps a littoral species. *O. spinifera* is quite unlike other described species of the genus having such characteristic features as the weak median sulcus entirely covered by the surface reticulations and the series of marginal and lateral spines. It is smaller than most other species of the genus but does show some affinities with the *O. inversa* group in the arrangement of the spines.

Family **BRACHYCYTHERIDAE**

Genus ***ALATACYTHERE*** Murray & Hussy 1942

Alatacythere robusta robusta (Jones & Hinde)

(Pl. 10, figs. 9, 10)

1964*b* *Alatacythere robusta* (Jones & Hinde) ; Kaye : 51, pl. 2, fig. 18.

MATERIAL. B.M.N.H. Io. 2964, 2965, two valves from the uppermost Gault immediately below the Cambridge Greensand, Arlesey Beds.

MEASUREMENTS.

	Length (mm.)	Height (mm.)
Left valve (B.M.N.H. Io. 2965)	1·05	0·51

Alatacythere robusta langi subsp. nov.

(Pl. 10, figs. 1–4)

DERIVATION OF NAME. After W. D. Lang in appreciation of his stratigraphical and palaeontological work on the Cretaceous in Devon and Dorset.

DIAGNOSIS. Subspecies of *Alatacythere robusta* (Jones & Hinde) 1890 having ventro-lateral alae less drawn out and dorsal longitudinal ridge more pronounced.

HOLOTYPE. A male left valve, B.M.N.H. Io. 2940, from the basal Upper Gault ; Pinhay, Devon.

PARATYPES. B.M.N.H. Io. 2941–44. Six valves from the same horizon and locality.

MEASUREMENTS.

	Length (mm.)	Height (mm.)
Male left valve (B.M.N.H. Io. 2940, holotype) .	1·02	0·54
Male right valve (B.M.N.H. Io. 2943) .	0·98	0·53
Female Right valve (B.M.N.H. Io. 2942) .	0·92	0·50
Female left valve (B.M.N.H. Io. 2941) .	0·95	0·50

DESCRIPTION. Valves large, elongate, laterally compressed. Dorsal and ventral margins straight, converging slightly posteriorly. There are well marked antero-dorsal and postero-dorsal cardinal angles. Anterior margin broadly rounded ; posterior margin weakly pointed at mid-height, both strongly denticulate. Each marginal tubercle corresponds to the extremity of a radial pore canal. Greatest height at $\frac{1}{4}$ length ; greatest width at $\frac{3}{4}$ length. Eye tubercle large and glassy, joined to a prominent anterior marginal ridge which follows the entire anterior margin to be continued along the crest of the high extended ventral alate expansion. This alate expansion obscures the whole of the ventral margin and strongly increases in height posteriorly where it terminates in a short ventro-laterally directed spine. The ventral undersurface lacks marked costation. A short, high longitudinal ridge occurs obscuring the posterior and central part of the dorsal margin. It is not continued to join the eye tubercle. The lateral surface is smooth. Duplicature moderately broad, crossed by numerous straight radial and pseudoradial pore canals. Inner margin and line of concrescence coincide throughout. Normal pore canals scarce over the bulk of the lateral surface but abundant along the ridged crest of the alae. Hinge strong, amphidont, consisting in the left valve of two terminal sockets, open ventrally and separated by a long, straight, denticulate bar. Below the anterior end of the median bar there is a high, smooth, circular tooth, whilst above the

whole of it there is a narrow marginal shelf but no accommodation groove. In the right valve there is a high " boss-like " anterior terminal tooth and a triangular, elongate, divided posterior tooth separated by a long straight locellate furrow. Anteriorly the median groove opens into a deep smooth circular socket. Above and below the median groove are narrow bars.

REMARKS. *A robusta langi* has so far been found from the basal Upper Gault, *H. orbignyi* Subzone at Pinhay, Devon, at Swanage, Dorset and in the Isle of Wight. It occurs earlier than *A. robusta* s.s. which is found in the topmost Gault of the Wealden Area and East Anglia. *A. robusta* s.s. is distinguished from *A. robusta langi* by the greater lateral elongation of the alae and the weak development of the dorsal ridge which does not obscure the margin. The greater elongation of the alae makes the valves higher. *A. robusta langi* is the earliest occurrence of the genus in the Cretaceous and specimens of *Cythereis reticulata* s.l. Jones & Hinde from the top Lower Gault have been found at Henfield showing weak ventral alation and typical *Alatacythere* shape though retaining the reticulation. Such forms are possibly intermediates between the two genera and indicate the origin of the genus *Alatacythere*.

Family **BYTHOCYTHERIDAE**

Genus ***MONOCERATINA*** Roth 1928

Monoceratina longispina (Bosquet)

(Pl. 1, figs. 3–7)

1854 *Cythere longispina* Bosquet: 86. pl. 6. figs 7*a d*
1941 *Monoceratina longispina* (Bosquet); Bonnima: 40, pl. 6 fihs 67-76
1964*b* *Monoceratina longispina* (Bosquet); Kaye: 53, pl. 3 fig 1
1964 *Monoceratina longispina* (Bosquet); Szczechura: 388, pl, 3, fig 5 pl. 11, fig. 1:

MATERIAL. B.M.N.H. Io. 2820–23 from the *H. orbignyi* Subzone, Upper Gault ; Wrotham, Kent. B.M.N.H. Io. 2824 from the *E. doris* Subzone, Lower Gault ; Wrotham, Kent.

MEASUREMENTS.

	Length (mm.)	Height (mm.)
Adult left valve (B.M.N.H. Io. 2820) .	0·82	0·42
Adult right valve (B.M.N.H. Io. 2821) .	0·80	0·38
Juvenile carapace (B.M.N.H. Io. 2822) .	0·65	0·35
Juvenile left valve (B.M.N.H. Io. 2823) .	0·56	0·32

DESCRIPTION. The finding of additional material allows a fuller description of this species than that given by Kaye (1964*b*).

Valves elongate, inflated laterally. Dorsal and ventral margins straight and parallel. Cardinal angles well developed. Anterior margin broadly rounded ; posterior triangular, angled postero-dorsally. Lateral surface inflated with a prominent vertical median sulcus. Below the sulcus is a broad based conical,

laterally directed spine. This spine and associated swelling limit the sulcus strongly. Apart from a few rows of faint concentric reticulation along the crest of the alae the lateral surface is smooth. Some faint reticulation does, however, occur on the swollen antero-lateral part of the valves in certain specimens. The greatest width is just posterior to the mid-point of the valves. The marginal parts of the valves are rather flattened particularly anteriorly and ventrally.

The hinge consists of a long narrow groove in the right valve which accommodates the long, straight, smooth marginal bar of the left valve. Weak false sockets are sometimes developed, particularly anteriorly in the left valve. The porcellaneous preservation of the specimens obtained make the radial pore canals and muscle scars invisible, normal pore canals are, however, rather small and irregularly scattered over the lateral surface.

Juveniles are rather dissimilar to the adults. In general they have a rounded alate expansion and no spine. This difference is, however, seen in the adults of certain species of *Monoceratina* (particularly from the British Oxfordian) and is possibly a dimorphic feature. By no means all the juveniles of *M. longispina* are just alate and a few specimens with spines have been found. The occurrence of specimens without spines is not common to all species of *Monoceratina* and no specimens without spines belonging to *M. umbonata* Williamson have been found in the Gault even though the species is much more abundant than *M. longispina*. The juveniles of *M. longispina* are themselves variable in ornamentation and two instars are illustrated. Penultimate instars have a wide marginal flattened area. The inflated alate expansion is strongly reticulate and a large node covered with reticulation occurs anterior to the sulcus. A narrow ridge crosses the sulcus and runs on to the postero-lateral area. Smaller instars are much less inflated and lack the flattened marginal area. They are completely smooth and have the sulcus wider and more open. Besides being strongly limited ventrally the sulcus is weakly limited dorsally giving the form of a wide median depression.

REMARKS. This species is not common but occurs consistently throughout the Gault. The original description was from the Senonian and I have recorded it from the Cambridge Greensand at Barrington. It has so far been found in the Gault of the Wealden area at Folkestone, Wrotham, Sevenoaks and Henfield where specimens occur in clays ranging in age from *A. intermedius* Subzone to *H. varicosum* Subzone. It has not been found in the *spathi* Subzone assemblages but probably occurs in the higher subzones of the Upper Gault which have not yet been studied. The closest species of *M. longispina* seems to be *M. parallela* Alexander 1934 from the Santonian of Texas which is a little smaller and more strongly inflated. Good details of *M. parallela* are lacking and it is possible that the two forms are synonymous. *M. longispina* differs from *M. acanthoptera* (Marsson) 1880 in that the latter is much smaller and has the spine set much further back on the carapace. The form recorded as *M. acanthoptera* (Marsson) by Alexander (1934) probably belongs to *M. parallela*. As shown earlier *M. umbonata acanthoptera* (Jones & Hinde) is a separate species viz. *M. umbonatoides* Kaye 1964*b*.

Monoceratina sp.

(Pl. 11, figs. 9–10)

MATERIAL. A right valve, B.M.N.H. Io. 2945, from the *H. spathi* Subzone, Middle Albian ; Devizes, Wiltshire.

MEASUREMENTS.

	Length (mm.)	Height (mm.)
Right valve (B.M.N.H. Io. 2945) .	0·55	0·25

DESCRIPTION. Valves elongate, with straight parallel dorsal and ventral margins. Lateral surface inflated with a vertical median sulcus, limited ventrally by an alate expansion. The crest of the ala bears a short broad based conical spine. This spine is set just behind the ventral end of the sulcus and is laterally directed. A large smooth semicircular swelling occurs dorsally on the antero-lateral surface whilst a short slightly curved ridge runs near to the dorsal margin on the postero-lateral surface. A weak anterior marginal rib occurs which is not joined to the ala ventrally. The ventral and posterior marginal areas are flattened. The lateral surface is smooth.

REMARKS. Only a single specimen of this species has so far been found, which seems to bear no relationship to other species of the genus found in the Albian and occurs earlier than them (in the *H. spathi* Subzone). Its closest relative is *M. bonnemai* Kaye 1964*b* from which it differs in size and ornamentation and in having only one laterally directed spine.

Family **PROGONOCYTHERIDAE**

Genus ***ACROCYTHERE*** Neale 1960

Acrocythere striata sp. nov.

(Pl. 4, figs. 4–10)

DERIVATION OF NAME. Striatus L. = striate.

DIAGNOSIS. *Acrocythere* with ornamentation of numerous longitudinal striate ridges.

HOLOTYPE. A left valve, B.M.N.H. Io. 2853, from the basal Upper Gault (Upper Albian) ; Pinhay, Devon.

PARATYPES. B.M.N.H. Io. 2851–52, 2854–57. Eight valves and two carapaces from the same horizon and locality.

MEASUREMENTS.

	Length (mm.)	Height (mm.)
Left valve (B.M.N.H. Io. 2853, holotype) . .	0·58	0·28
Right valve (B.M.N.H. Io. 2852)	0·58	0·23

DESCRIPTION. Valves small, elongate, strongly compressed laterally. Dorsal and ventral margins long and straight ; tapering slightly posteriorly in the left valves but parallel in the right valves. Dorsal margin without marked cardinal angles. Anterior margin broadly rounded ; posterior margin pointed at mid-height. Greatest height at $\frac{1}{4}$ length ; greatest width at mid-length. Lateral surface ornamented by numerous longitudinal striate ridges. The ridges continue over the whole of the lateral surface being usually ten in number. Anteriorly they tend to swing slightly ventrally and certain of them coalesce. Vertical cross ribbing is absent, the area between the ridges being finely pitted. Eye spots are absent.

Duplicature fairly broad crossed by few, very fine, simple radial pore canals (8–10 anteriorly). Normal pore canals rather few, confined to the crests of the ridges. Inner margin and line of concrescence coincide throughout. Muscle scars not seen. Hinge strong merodont consisting in the left valves of two deep strongly divided terminal sockets separated by a long, straight, coarsely denticulate bar. In the right valve there are two triangular terminal teeth, highest away from the centre of the valve and each divided into four large denticles. Between the terminal teeth there is a long, straight coarsely crenulate (almost interdentate) furrow.

REMARKS. *A. striata* differs considerably from the other members of the genus in ornamentation and lack of even a rudimentary median sulcus and eye spots. Its dissimilarities are such that it could possibly belong to a new genus. The hinge and basic longitudinal striate ornamentation are strongly reminiscent of *Pleurocythere* and *Lophocythere*.

Genus **NEOCYTHERE** Mertens 1956

Subgenus ***PHYSOCYTHERE*** Kaye 1963

Neocythere (Physocythere) tenuis sp. nov.

(Pl. 6, figs. 14–17)

DERIVATION OF NAME. Tenuis L. = thin.

DIAGNOSIS. Small *Neocythere* with thin shell and weakly developed hinge. Lateral surface devoid of ornamentation.

HOLOTYPE. A left valve, B.M.N.H. Io. 2889, from Bed 1, *A. intermedius* Subzone, Lower Gault ; Small Dole, Henfield, Sussex.

PARATYPES. B.M.N.H. Io. 2890–93 from the same horizon and locality.

MEASUREMENTS.

	Length (mm.)	Height (mm.)
Left valve (B.M.N.H. Io. 2889 holotype) .	0·50	0·30
Right valve (B.M.N.H. Io. 2890)	0·50	0·28

DESCRIPTION. Valves small, ovate, thin shelled. Dorsal margin straight ; ventral margin weakly convex and subparallel to it. Anterior and posterior margins broadly rounded. Lateral surface smooth, inflated. Greatest height at $\frac{1}{3}$ length ;

greatest width at mid-length. In dorsal view valves convex with acute anterior and posterior ends. A slight ventro-lateral tumidity occurs. Duplicature rather narrow, crossed by few (7–8 anteriorly) thick, straight radial pore canals. Inner margin and line of concrescence coincide throughout. Normal pore canals rather large, irregularly scattered over most of the lateral surface, but forming two concentric rows along the crest of the ventro-lateral expansion. Hinge weak having, in the left valves, two faintly divided sockets separated by a weakly denticulate bar. Above the median bar is a prominent marginal shelf but no accommodation groove. The terminal teeth in the right valve are low, triangular in shape and weakly divided. Muscle scars a slightly postero-dorsally inclined row of four oval scars with a U-shaped scar antero-dorsally and a small oval scar antero-ventrally of them.

REMARKS. This species has been recorded from the Lower Gault *A. intermedius* Subzone at Henfield but is known to occur abundantly in the Upper Gault in East Anglia. It differs from other species of *Neocythere* s.l. in its shape, thinness of shell, weak hinge and lack of ornamentation. In shape and size it is nearest to *N.* (*P.*) *pustulosa* Kaye 1965*a* from the Upper Aptian of the Isle of Wight but lacks the strong ornamentation. Certain related undescribed specimens occur in the Aptian but they are larger and of unequal inflation.

Family **PROTOCYTHERIDAE**

Genus ***VEENIA*** Butler & Jones 1957

Veenia compressa Kaye

(Pl. 11, figs. 13–15)

1965*a* *Veenia compressa* Kaye : 44, pl. 7, figs. 6, 7.

MATERIAL. Two valves and one carapace, B.M.N.H. Io. 2868–70, from the basal Upper Gault ; Pinhay, Devon.

REMARKS. This species previously recorded from the Upper Aptian of the Isle of Wight has now been found rather more abundantly and somewhat better preserved in the basal Upper Aptian at Pinhay in Devon. These latter specimens are identical although somewhat smaller (0·58 mm.).

Veenia florentinensis Damotte

(Pl. 11, figs. 1–8)

1961 *Veenia* (*Protoveenia*) *florentinensis* Damotte : 102, pl. 1, figs. 1–3, pl. 2, figs. 1–6.

MATERIAL. B.M.N.H. Io. 2974–75, two valves from the *H. spathi* Subzone Lower Gault ; Henfield. B.M.N.H. Io. 2971–73, 2976–79, ten valves and two carapaces from the *H. orbignyi* Subzone Upper Gault ; Pinhay, Devon.

MEASUREMENTS.

	Length (mm.)	Height (mm.)
Left valve (B.M.N.H. Io. 2975)	0·50	0·28
Right valve (B.M.N.H. Io. 2974)	0·49	0·25
Left valve (B.M.N.H. Io. 2978)	0·70	0·36
Left valve (B.M.N.H. Io. 2971)	0·65	0·35
Right valve (B.M.N.H. Io. 2976)	0·58	0·28
Right valve (B.M.N.H. Io. 2977)	0·54	0·28
Left valve (B.M.N.H. Io. 2972)	0·50	0·30
Left valve (B.M.N.H. Io. 2979)	0·48	0·27
Right valve (B.M.N.H. Io. 2973)	0·48	0·25

REMARKS. Damotte erected this species in 1961 placing it within a new subgenus *Protoveenia*. This subgenus was differentiated primarily on a basis of having very few radial pore canals. Damotte's specimens came from the Lower Gault and comparable specimens occur in the *H. spathi* and *A. intermedius* Subzones in Britain. Other specimens of this species occur at higher horizons particularly in Devon, Dorset and the Isle of Wight in clays from the *H. orbignyi* Subzone, Upper Gault and these specimens have a much larger size range than those from the Lower Gault. The Lower Gault forms have a length in the range of 0·40–0·50 mm., whilst specimens from the Upper Gault reach as much as 0·70 mm. in length. The largest specimens differ slightly from the smaller ones but specimens of typical Lower Gault size and features and all intermediates occur together with them in the same sample. The larger specimens are more inflated, have the longitudinal ribs less keel-like than the small ones and have the dorsal ridge and antero-dorsal hinge ear less well separated. They also have more radial pore canals and therefore make the subgenus *Protoveenia* unusable and its postulated ancestry to *Veenia* improbable. The smaller specimens in the Upper Gault are identical with Damotte's Lower Gault forms and it appears that the species is therefore not only of variable size but that the number of radial pore canals is a direct function of the size. Sexual dimorphism is not known from the Lower Gault specimens but is well marked in the Upper Gault forms.

Family **TRACHYLEBERIDIDAE**

Genus **CYTHEREIS** Jones 1849

Cythereis angulatoides nom. nov.

1964*a* *Cythereis angulata* Kaye : 327, pl. 54, fig. 11.

REMARKS. Professor W. A. Van den Bold of Louisiana State University has kindly pointed out that the form erected as *C. angulata* from the Upper Aptian of Surrey has the name preocupied by Sars (1866 : 40). I have therefore renamed my form *C. angulatoides*.

Cythereis gatyensis Damotte & Grosdidier

(pl. 11, figs. 11, 12)

1963 *Cythereis ? gatyensis* Damotte & Grosdidier : 58, pl. 3, figs. 8*a–g*.
1963*b* *Cythereis lamplughi* Kaye : 236, pl. 19, figs. 14–16.
1965*a* *Cythereis lamplughi* Kaye; Kaye: 46, pl. 7, figs. 14, 15.

MATERIAL. B.M.N.H. Io. 2966–67. Two specimens from the *H. spathi* Subzone, Lower Gault ; Culham, Oxfordshire.

REMARKS. Specimens kindly sent to me by Dr. E. Grosdidier show that *Cythereis lamplughi* Kaye 1963*b* is synonymous with *Cythereis gatyensis* Damotte & Grosdidier 1963, the latter having two months' priority. *C. gatyensis* is abundant but restricted to the *H. spathi* Subzone in the Gault. It is also known from the Upper Aptian of the Isle of Wight. It is a valuable index fossil for the *H. spathi* Subzone having been found in clays of that age at Speeton, West Heslerton, Culham and Henfield.

Cythereis glabrella Triebel

(Pl. 10, figs. 5–8)

1940 *Cythereis glabrella* Triebel : 196, pl. 6, figs. 60–62.

MATERIAL. B.M.N.H. Io. 2962–63. Two valves from the basal Upper Gault at Pinhay, Devon.

MEASUREMENTS.

	Length (mm.)	Height (mm.)
Left valve (B.M.N.H. Io. 2962)	0·90	0·55
Right valve (B.M.N.H. Io. 2963)	0·90	0·50

REMARKS. This smooth, inflated species is not common in the British Gault having been found so far only at Pinhay and in the top Red Chalk at Speeton, Yorks. It differs from the much more abundant *C. folkstonensis* Kaye 1964*b* in its less angular appearance, smaller size and in having a smooth rather than spined median rib. It is similar to *C. nuda* Jones & Hinde 1890 differing in being larger, more inflated and in having the median rib well developed.

Cythereis pinhayensis sp. nov.

(Pl. 9, figs. 1–8)

DERIVATION OF NAME. After Pinhay Point, Devon, the only known occurrence of the species.

DIAGNOSIS. Small, reticulate but not spined *Cythereis* with prominent muscle node and weakly convergent long margins.

HOLOTYPE. A male left valve, B.M.N.H. Io. 2946, from the basal Upper Gault ; Pinhay Point, Devon.

PARATYPES. B.M.N.H. Io. 2947–54. Ten valves and two carapaces from the same horizon and locality.

MEASUREMENTS.

	Length (mm.)	Height (mm.)
Male left valve (B.M.N.H. Io. 2946 holotype)	0·95	0·50
Male right valve (B.M.N.H. Io. 2947)	0·95	0·48
Female left valve (B.M.N.H. Io. 2948)	0·85	0·50

DESCRIPTION. Valves elongate, laterally compressed. Dorsal and ventral margins straight, converging slightly posteriorly. Antero-dorsal and postero-dorsal cardinal angles well marked. Anterior margin broadly rounded, posterior triangular, angled just below mid-height. Anterior and posterior margins strongly denticulate, each tubercle marking the distal end of a radial pore canal. Greatest height at $\frac{1}{5}$ length; greatest width at $\frac{2}{5}$ length. Eye tubercle glassy, distinct, joined to a prominent anterior marginal ridge. This ridge bears a row of tubercles on its upper surface each marking the extremities of a pseudoradial pore canal. A large, high, smooth subcentral muscle node occurs, separated from the anterior end of a short median longitudinal ridge but it is joined by a weak vertical ridge to the eye tubercle. A short straight low ridge follows the dorsal margin, being connected by a vertical cross ridge posteriorly to the posterior end of the median ridge. A shallow depression separates the anterior end of the dorsal rib and the muscle node. A prominent ridge, increasing in height posteriorly follows the ventral margin. Anteriorly it is continuous with the anterior marginal ridge. A small tubercle, the porenkagel, occurs at mid-length between the median and ventral longitudinal ribs. Ventral undersurface covered with faint longitudinal riblets. Lateral surface strongly reticulate.

Duplicature fairly broad, crossed by numerous thin, straight radial and pseudoradial pore canals. Hinge strong amphidont, consisting in the left valve of two terminal divided sockets, open ventrally, separated by a long, straight, smooth bar. Below the anterior end of the median bar is a high, smooth, circular tooth whilst above the median element is a narrow marginal shelf. In the right valve there are two high boss-like terminal teeth, each with weak lobation on the summit, separated by a long, straight, shelf-like median furrow. Anteriorly the furrow opens into a deep circular socket. Above the median furrow is a high narrow smooth marginal bar.

REMARKS. *C. pinhayensis* is only known from the basal Upper Gault at Pinhay Point in Devon where it is one of the most abundant members of the fauna. It differs from the *C. reticulata* (Jones & Hinde) 1890, *C. hirsuta* Damotte & Grosdidier 1963 group in being smaller, less inflated and lacking the spination of the longitudinal ribs. *C. lurmannae* Triebel 1940*a* and *C. corrigenda* Kaye 1964*b* differ in being more strongly compressed laterally, more strongly convergent posteriorly and lacking the pronounced reticulation. *C. glabrella* Triebel 1940*a* is more inflated and smooth whilst *C. folkstonensis* Kaye 1964*b* has all the characteristics of *C. reticulata* in addition to being smooth. *C. matronae* Damotte & Grosdidier 1963 is smaller, smooth and has rows of spines rather than well marked longitudinal ridges whilst *Cythereis thorenensis* 1940*a* Triebel lacks the muscle node and median longitudinal ridge. The

closest form is *C. geometrica fittoni* Kaye 1965*a* from the Upper Aptian of the Isle of Wight which differs in being more angular in outline, particularly posteriorly and in having the long margins more strongly convergent. True *C. geometrica* Damotte & Grosdidier 1963*a* is smooth whilst *C. sutterbyensis* Kaye 1965*b* and *C. bekumensis* Triebel 1940*a* have less marked reticulation and a short spined median longitudinal rib. *C. acuticostata* Triebel 1940*a* has the median rib and muscle node joined. *C. blanda* Kaye 1963*b* is similar and lacks surface reticulation. *C. angulata* Kaye 1964*a* differs in the distribution of the ribs and lacks a muscle node whilst *C. cristata* Kaye 1964*a* is much more strongly compressed, pitted and has weak ribbing.

Suborder MYODOCOPINA

Family **CONCHOECIIDAE**

Genus ***CONCHOECIA*** Dana 1849

Conchoecia sp. A

(Pl. 2, figs. 2, 7)

MATERIAL. A single carapace, B.M.N.H. Io. 2833, from the Upper Albian, *H. orbignyi* Subzone ; Wrotham, Kent.

MEASUREMENTS.

	Length (mm.)	Height (mm.)
Carapace (B.M.N.H. Io. 2833).	0·58	0·35

REMARKS. Only one previous fossil occurrence of the genus *Conchoecia* is known. This species, *C. cretacea* Pokorny 1964, is known as two pyrite infilled carapaces from the Upper Cretaceous of Bohemia. The present record extends the range of the genus into the Lower Cretaceous. The valves are extremely thin and very fragile, the single specimen being a pyrite filled carapace. It is similar to Pokorny's form in shape and ornamentation but is approximately half the size. This may indicate that it is an instar of *C. cretacea.* The anterior rostrum is particularly well developed but the posterior prolongation of Pokorny's form is absent. It also differs in ornamentation being less strongly ribbed and having the cross ribs more prominent.

Conchoecia sp. A. differs markedly from the form described as ? *Conchoecia* sp. B. in shape, ornament and in the weak or absent rostrum in the latter.

? ***Conchoecia*** sp. B

(Pl. 1, figs. 1–2)

MATERIAL. A carapace, B.M.N.H. Io. 2819, from the basal Upper Albian, *H. orbignyi* Subzone ; Wrotham, Kent.

MEASUREMENTS.

	Length (mm.)	Height (mm.)
Carapace (B.M.N.H. Io. 2819)	0·87	0·62

DESCRIPTION. One large pyrite filled carapace of this species has been found together with four smaller similarly preserved specimens. The shell is extremely thin and is broken in places. In shape the specimens are suboval and inflated ; the greatest height and width being at $\frac{2}{3}$ length. The dorsal margin is strongly arched ; the ventral margin is weakly convex or straight. The anterior and posterior ends are bluntly rounded, without prominent extensions or a marked rostrum. The valves are ornamented with a series of shallow longitudinal grooves. They are scattered irregularly over the surface, being more concentrated posteriorly. They measure 0·10–0·12 mm. in length.

REMARKS. The inflation, shape and ornamentation of the specimen differs somewhat from Pokorny's form and it is undoubtedly a distinct species. The lack of a pronounced rostrum could place it in a different genus, its similarities in shape and ornamentation layout to the Palaeozoic Entomozoidae perhaps indicating a relationship.

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PLATE 1

All figures ×60

? ***Conchoecia*** sp. B p. 250

FIG. 1. Carapace, from left. Io. 2819, Wrotham
FIG. 2. Carapace, from right. Io. 2819, Wrotham

Monoceratina longispina (Bosquet) p. 242

FIG. 3. Adult left valve, lateral view. Io. 2820, Wrotham
FIG. 4. Adult right valve, lateral view Io. 2821, Wrotham
FIG. 5. Juvenile carapace, lateral view Io. 2822, Wrotham
FIG. 6. Juvenile carapace, dorsal view. Io. 2822, Wrotham
FIG. 7. Juvenile left valve, lateral view. Io.2823, Wrotham

Clithrocytheridea heslertonensis Kaye p. 228

FIG. 8. Female left valve, lateral view. Io. 2825, W. Heslerton
FIG. 9. Female right valve, lateral view. Io. 2826, W. Heslerton
FIG. 10. Female right valve, internal view. Io. 2826. W. Heslerton
FIG. 11. Female carapace, dorsal view. Io. 2827, W. Heslerton
FIG. 12. Female left valve, internal view. Io. 2825, W. Heslerton


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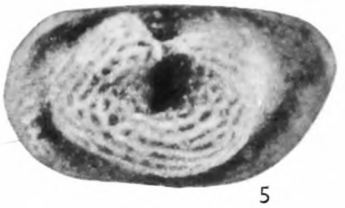
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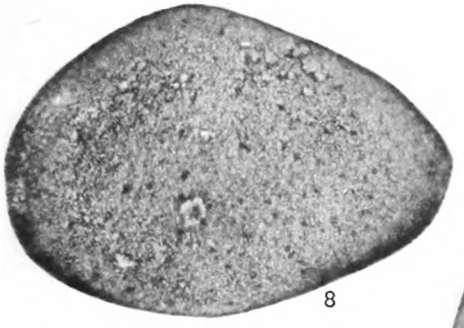
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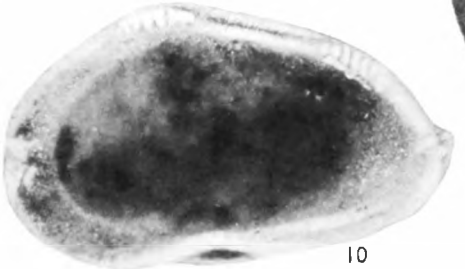
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PLATE 2

All figures ×60

Bairdia pseudoseptentrionalis (Mertens) p. 223

FIG. 1. Left valve, lateral view. Io. 2828, Arlesey
FIG. 3. Right valve, lateral view. Io. 2929, Arlesey
FIG. 4. Right valve, internal view. Io. 2830, Arlesey
FIG. 5. Left valve, internal view, Io. 2831, Arlesey
FIG. 6. Carapace, from right. Io. 2832, Arlesey

Conchoecia sp. A p. 250

FIG. 2. Carapace, from left. Io. 2833, Wrotham
FIG. 7. Carapace, from right. Io. 2833 Wrotham

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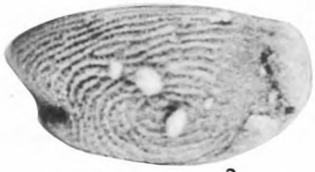

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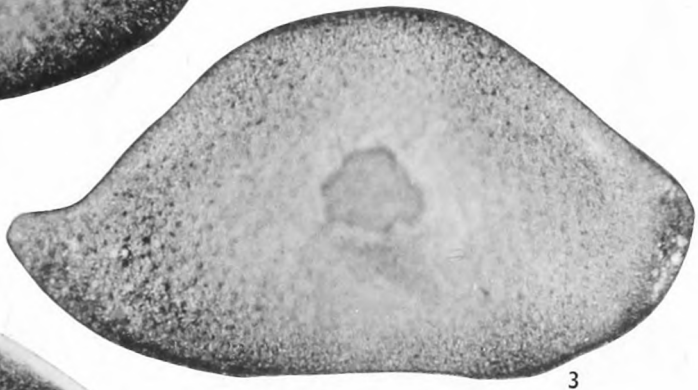

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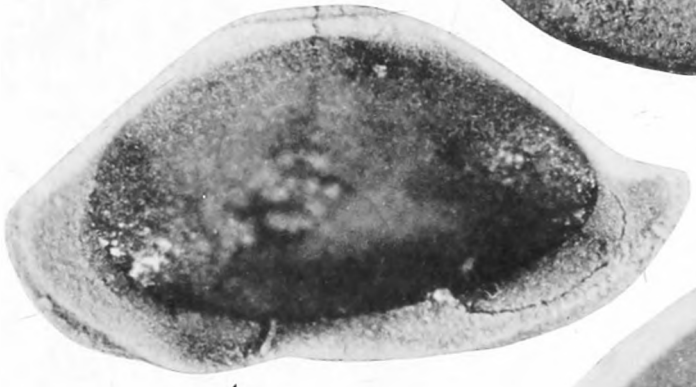

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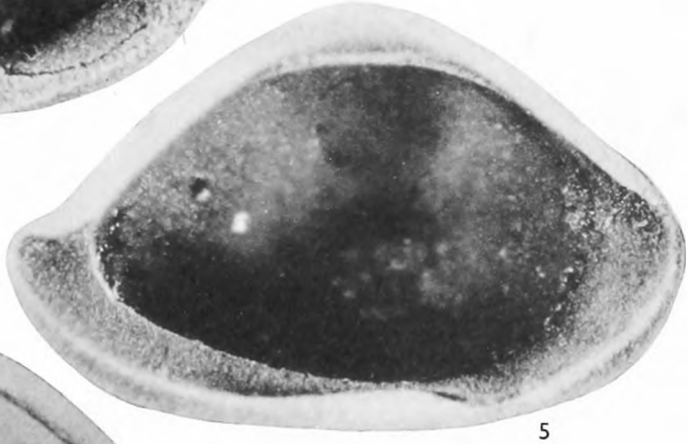

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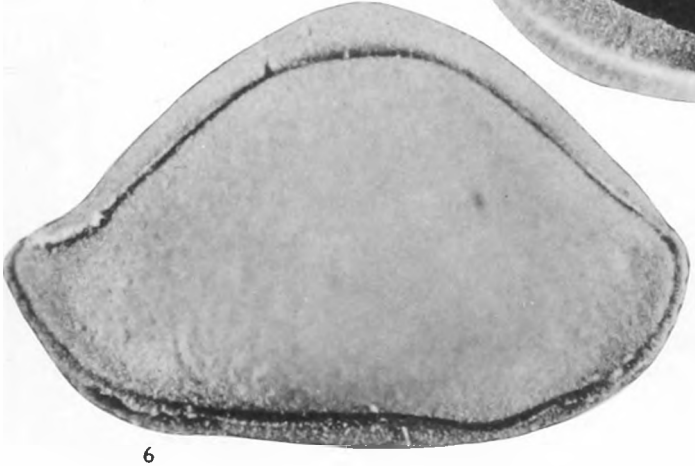

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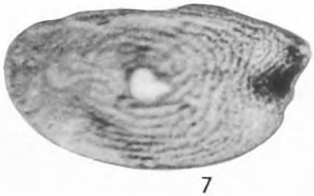

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PLATE 3

All figures ×80

Pontocyprella semiquadrata sp. nov. p. 224

FIG. 1. Left valve holotype lateral view. Io. 2834. Wrotham
FIG. 2. Right valve, dorsal view. Io. 2836, Wrotham
FIG. 3. Left valve, lateral view. Io. 2835, Wrotham
FIG. 4. Right valve, lateral view. Io. 2836, Wrotham
FIG. 5. Right valve, lateral view. Io. 2837, Wrotham
FIG. 6. Left valve, internal view. Io. 2835, Wrotham
FIG. 7. Left valve, holotype, dorsal view. Io. 2834, Wrotham
FIG. 8. Right valve, internal view. Io. 2837, Wrotham

Dolocytheridea typica sp. nov. p. 230

FIG. 9. Right valve, lateral view. Io. 2838, Pinhay
FIG. 10. Left valve, holotype, lateral view. Io. 2839, Pinhay
FIG. 11. Left valve, lateral view. Io. 2840, Pinhay
FIG. 12. Carapace, dorsal view. Io. 2841, Pinhay
FIG. 13. Right valve, lateral view. Io. 2842, Pinhay
FIG. 14. Left valve, internal view. Io. 2843, Pinhay

Krausella sp. p. 227

FIG. 15. Right valve, lateral view. Io. 2845, Ely
FIG. 16. Right valve, internal view. Io. 2845, Ely

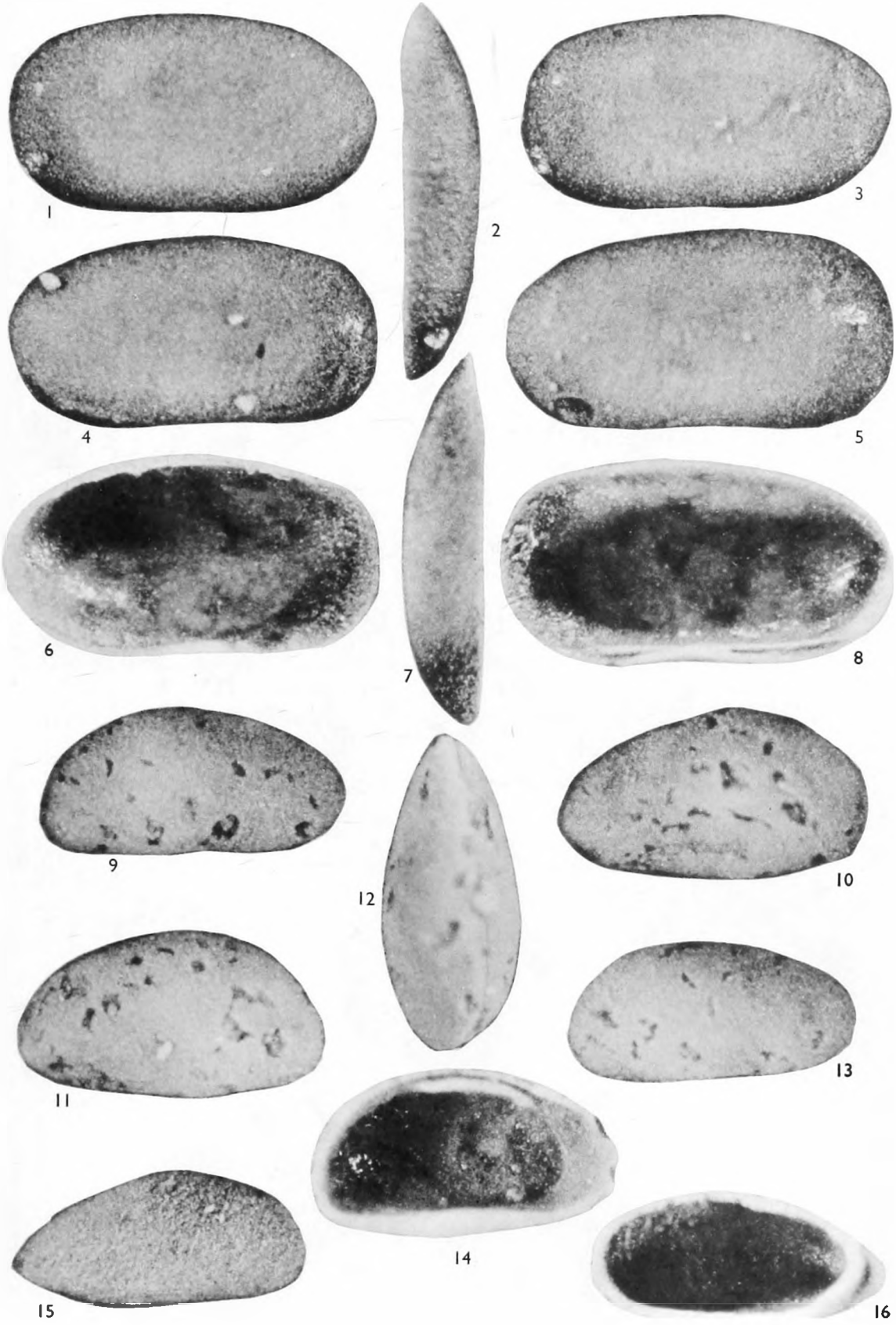
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PLATE 4

All figures $\times 80$

Polycope nuda sp. nov. p. 221

FIG. 1. Left valve, holotype, lateral view. Io. 2847, Wrotham
FIG. 2. Carapace, from left. Io. 2848, Wrotham
FIG. 3. Carapace, from left. Io. 2849, Wrotha

Acrocythere striata sp. nov. p. 244

FIG. 4. Left valve, lateral view. Io. 2851, Pinhay
FIG. 5. Right valve, lateral view. Io. 2852, Pinhay
FIG. 6. Left valve, holotype, lateral view. Io. 2853, Pinhay
FIG. 7. Carapace, dorsal view. Io. 2854, Pinhay
FIG. 8. Right valve, lateral view. Io. 2855, Pinhay
FIG. 9. Right valve, lateral view. Io. 2856, Pinhay
FIG. 10. Right valve, internal view. Io. 2856, Pinhay

Polycope oweni sp. nov. p. 222

FIG. 11. Carapace, from left. Io. 2858, Wrotham.
FIG. 12. Left valve, holotype, lateral view. Io. 2859, Wrotham.
FIG. 13. Left valve, lateral view. Io. 2860, Wrotham.
FIG. 14. Carapace, from left. Io. 2861, Wrotham
FIG. 15. Left valve, internal view. Io. 2862, Wrotham

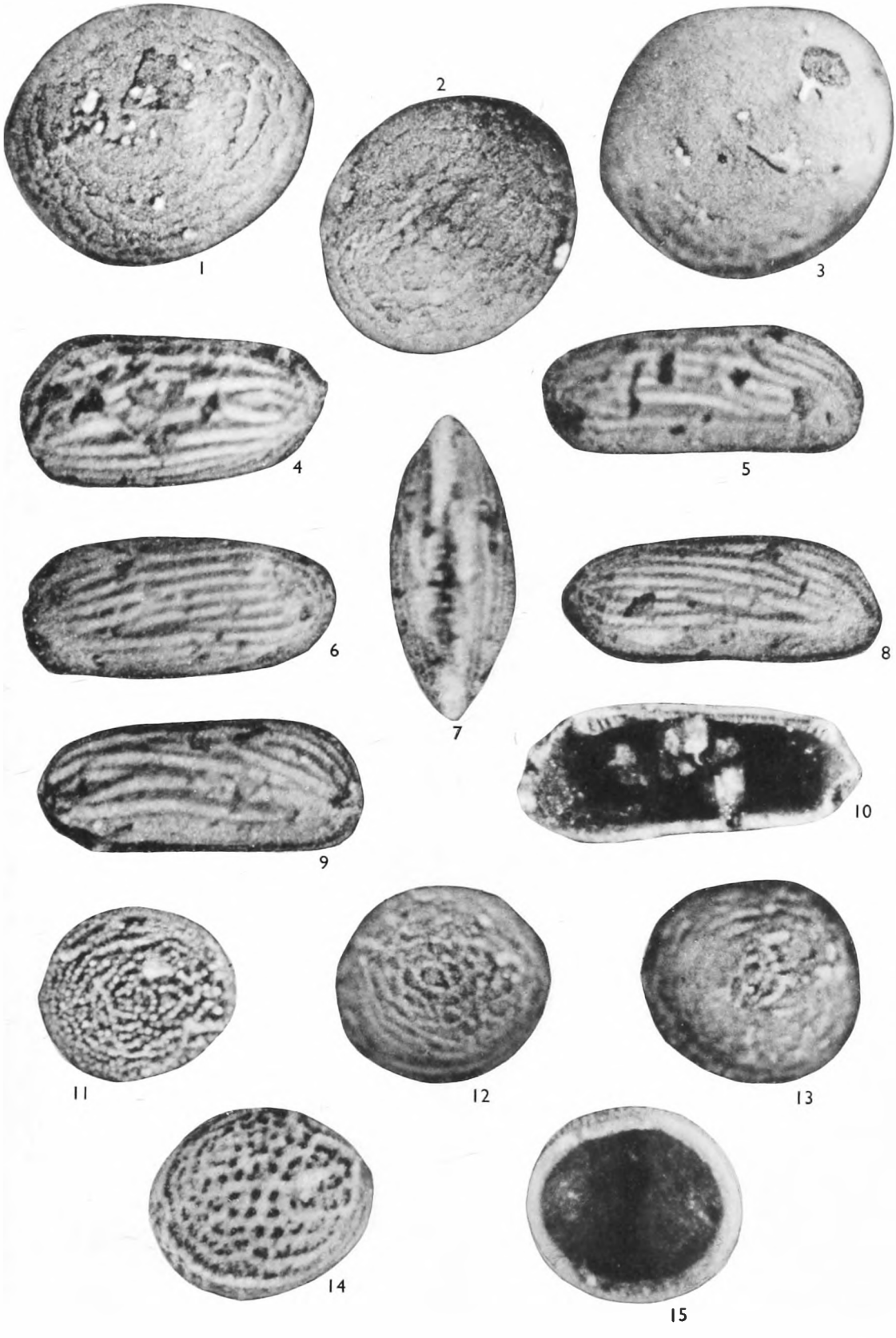
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PLATE 5

All figures × 80

Schuleridea dimorphica sp. nov. p. 228

FIG. 1. Male left valve, holotype, lateral view. Io. 2864, Wrotham
FIG. 2. Male left valve, internal view. Io. 2865, Wrotham
FIG. 3. Male right valve, lateral view. Io. 2866, Wrotham
FIG. 4. Female left valve, lateral view. Io. 2867, Wrotham
FIG. 5. Female right valve, lateral view. Io. 2868, Wrotham
FIG. 6. Male right valve, internal view. Io. 2869, Wrotham

Orthonotacythere fordensis sp. nov. p. 237

FIG. 7. Male left valve, holotype, lateral view. Io. 2871, Wrotham
FIG. 8. Male right valve, lateral view. Io. 2872, Wrotham
FIG. 9. Female left valve, lateral view. Io. 2873, Wrotham
FIG. 10. Male carapace, dorsal view. Io. 2874, Wrotham
FIG. 11. Female right valve, lateral view. Io. 2875, Wrotham
FIG. 12. Male left valve, internal view. Io. 2876, Wrotham
FIG. 13. Female right valve, internal view. Io. 2877, Wrotham

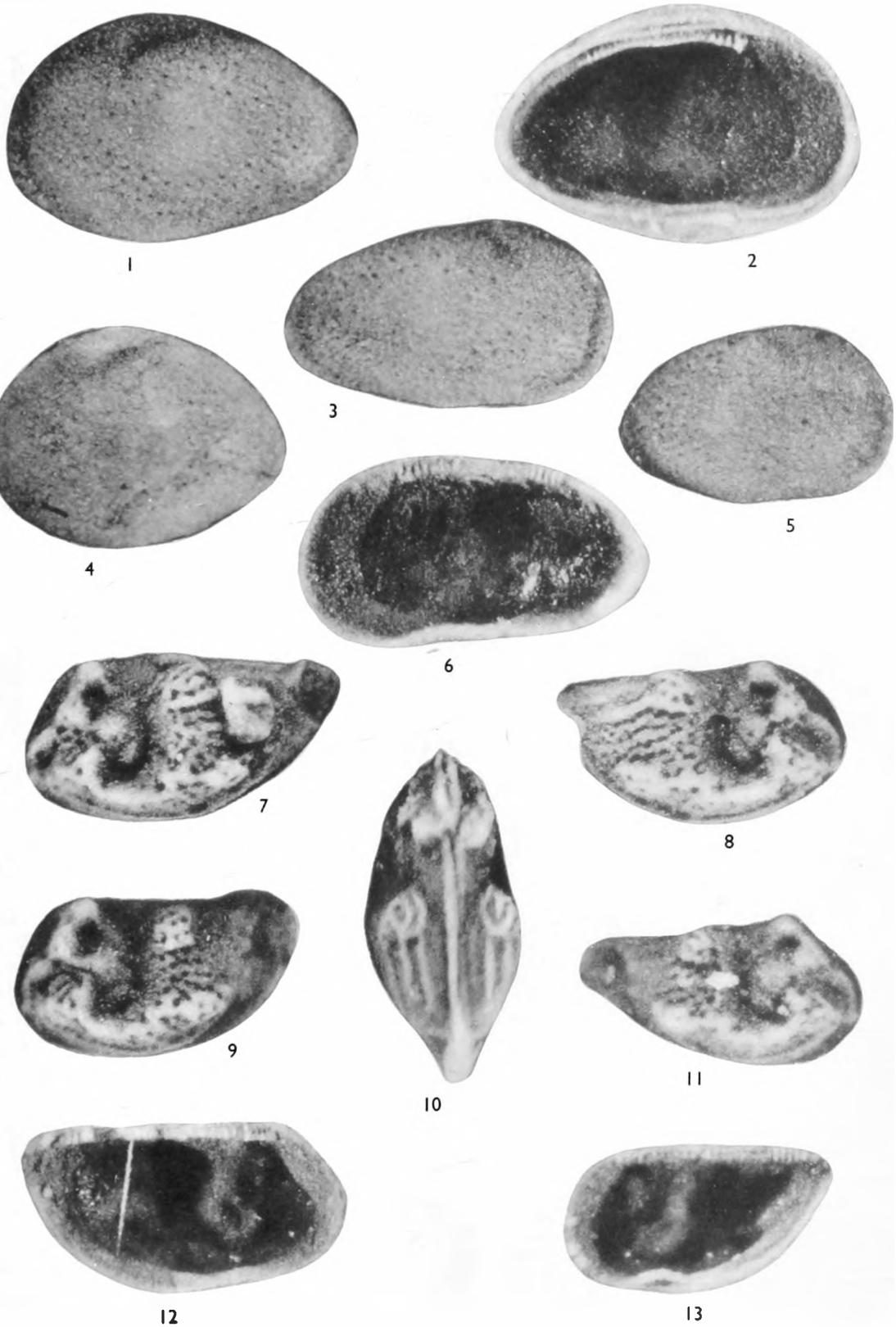
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PLATE 6

All figures ×80

Cytheropteron (Eocytheropteron), protonsa sp. nov. p. 235

FIG. 1. Left valve, holotype, lateral view. Io. 2879, Wrotham
FIG. 2. Right valve, lateral-view. Io. 2880, Wrotham
FIG. 3. Left valve, dorsal view. Io. 2881, Wrotham
FIG. 4. Left valve, lateral view. Io. 2881, Wrotham
FIG. 5. Right valve, dorsal view. Io. 2880, Wrotham
FIG. 6. Left valve, holotype, internal view. Io. 2879, Wrotham

Habrocythere fragilis Triebel p. 229

FIG. 7. Male left valve, normal type, lateral view. Io. 2882, Wrotham
FIG. 8. Male left valve anomalous type, lateral view. Io. 2883, Wrotham
FIG. 9. Female left valve, normal type, lateral view. Io. 2884, Wrotham
FIG. 10. Male left valve, anomalous type, lateral view. Io. 2885, Wrotham
FIG. 11. Female right valve, anomalous type, lateral view. Io. 2886, Wrotham
FIG. 12. Male right valve, normal type, lateral view. Io. 2887, Wrotham
FIG. 13. Female right valve, normal type, lateral view. Io. 2888, Wrotham

Neocythere (Physocythere) tenuis sp. nov. p. 245

FIG. 14. Left valve, holotype, lateral view. Io. 2889, Henfield
FIG. 15. Right valve, lateral view. Io. 2890, Henfield
FIG. 16. Left valve, lateral view, Io. 2891, Henfield
FIG. 17. Right valve, lateral view. Io. 2892, Henfield

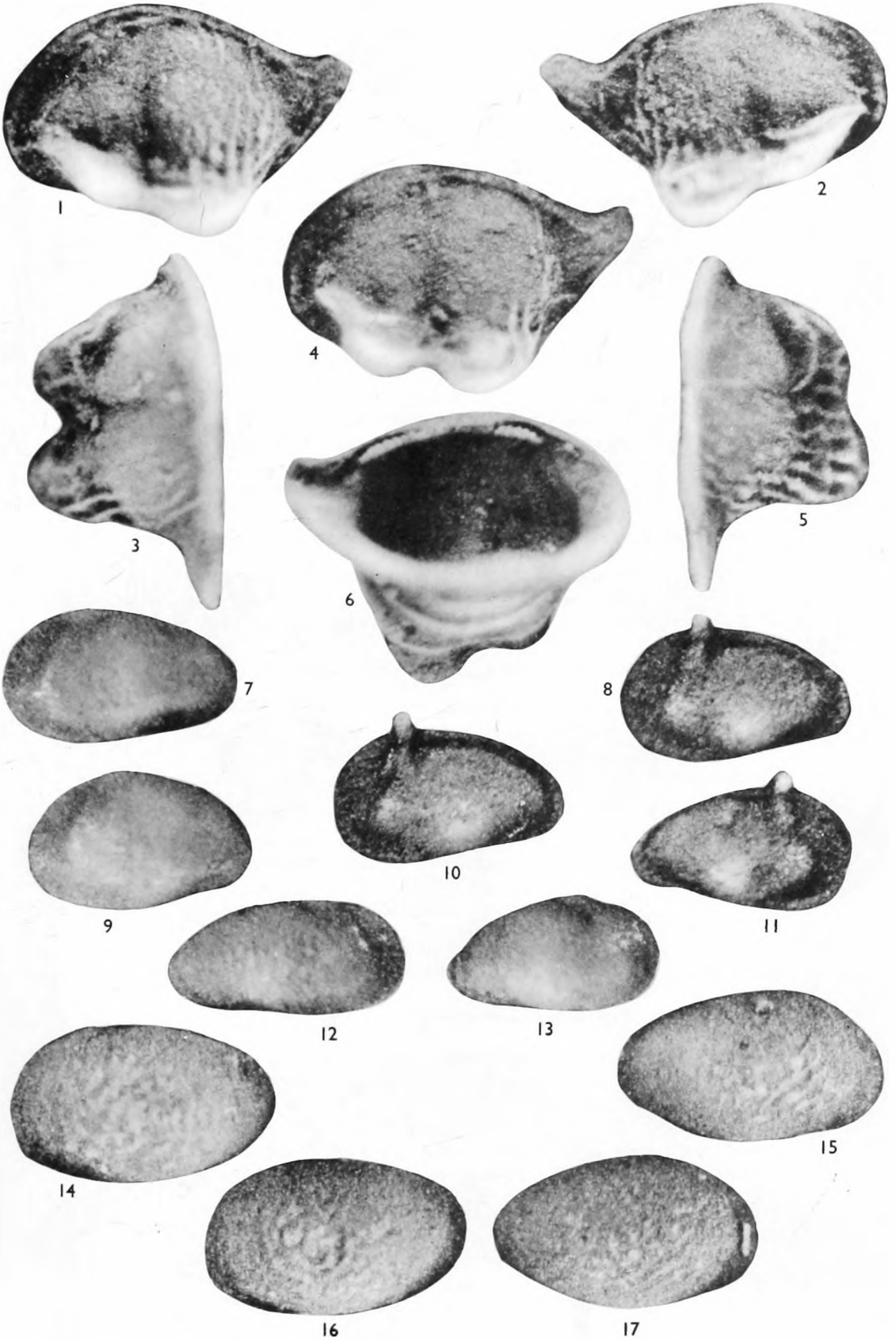
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PLATE 7

All figures ×80

Orthonotacythere spinifera sp. nov. p. 239

FIG. 1. Right valve, lateral view. Io. 2894, Wrotham
FIG. 2. Right valve, lateral view. Io. 2896, Henfield
FIG. 3. Left valve, holotype, lateral view. Io. 2895, Wrotham
FIG. 5. Left valve, lateral view. Io. 2897, Henfield

Cytheropteron (C.) milbournei sp. nov. p. 233

FIG. 4. Left valve, holotype, lateral view. Io. 2898, Wrotham
FIG. 6. Left valve, lateral view. Io. 2899, Wrotham
FIG. 7. Right valve, lateral view. Io. 2900, Sevenoaks.
FIG. 8. Carapace, dorsal view. Io. 2901, Sevenoaks.
FIG. 9. Left valve, internal view. Io. 2902, Sevenoaks

Cytheropteron (Intracytheropteron) obscura sp. nov. p. 236

FIG. 10. Left valve, holotype, lateral view. Io. 2903, Wrotham
FIG. 11. Right valve, lateral view, Io.2904, Wrotham
FIG. 12. Right valve, lateral view. Io. 2905, Wrotham

Cytheropteron (C.) nanissimum nanissimum Damotte & Grosdidier p. 234

FIG. 13. Left valve, lateral view. Io. 2907, Wrotham
FIG. 15. Left valve, lateral view. Io. 2908, Wrotham.

Cytheropteron (C.) nanissimum fenestrata ssp. nov. p. 234

FIG. 14. Left valve, lateral view. Io. 2909, Henfield
FIG. 16. Left valve, holotype, lateral view. Io. 2910, Henfield
FIG. 19. Left valve, lateral view. Io. 2911, Henfield

Eucytherura aff. nuda Kaye p. 231

FIG. 17. Left valve, lateral view. Io. 2912, Wrotham
FIG. 18. Right valve, dorsal view. Io. 2913, Wrotham

Argilloecia valvula sp. nov. p. 225

FIG. 20. Right valve, holotype, lateral view. Io. 2914, Wrotham
FIG. 21. Left valve, lateral view. Io. 2915, Wrotham
FIG. 22. Carapace, from left. Io. 2916, Wrotham
FIG. 23. Right valve, lateral view., Io. 2917, Wrotham
FIG. 24. Left valve, lateral view. Io. 2918, Wrotham
FIG. 25. Right valve, internal view. Io. 2919, Wrotham

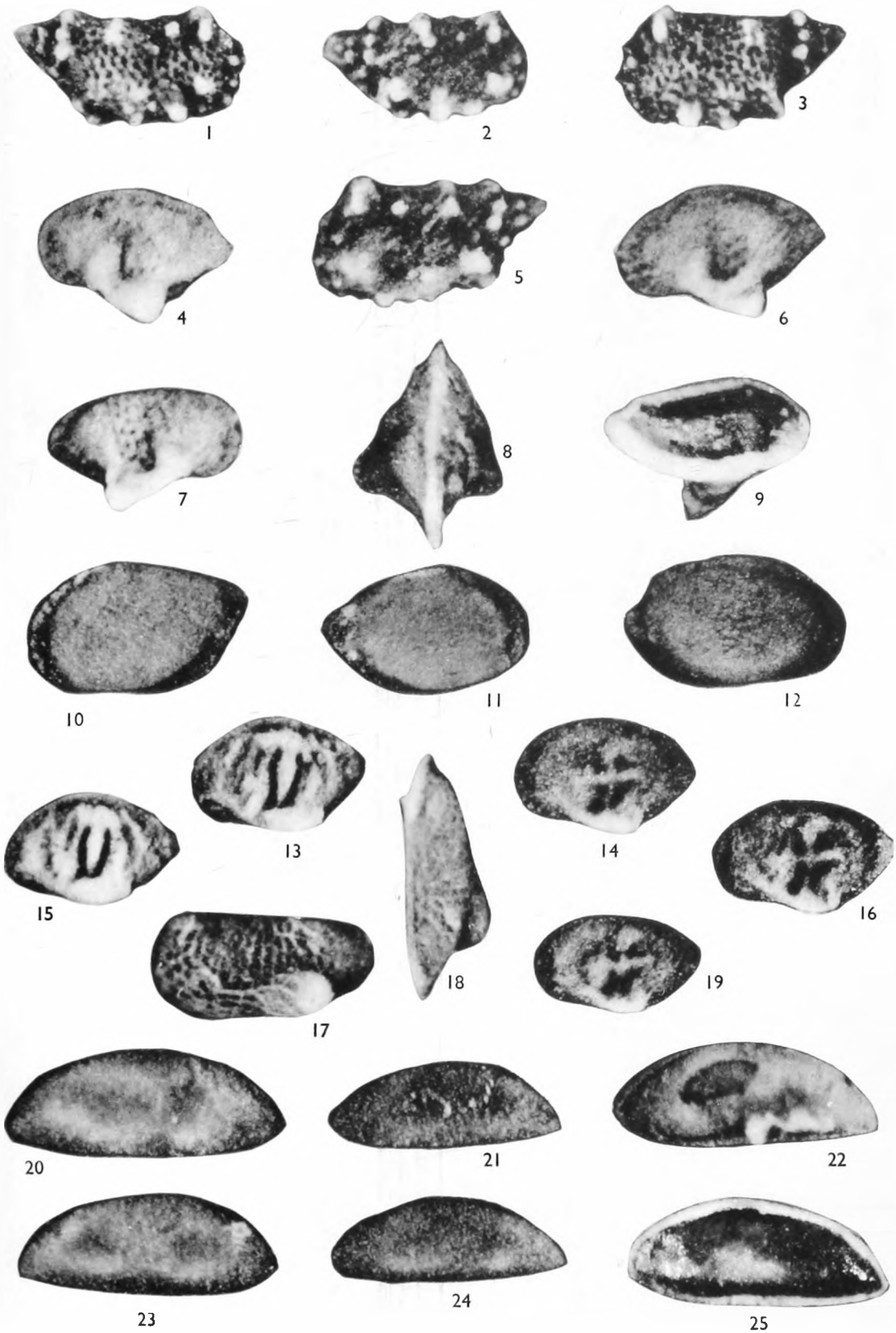
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PLATE 8

All figures × 120

Hemicytherura euglyphea sp. nov. p. 231

FIG. 1. Male left valve, holotype, lateral view. Io. 2921, Wrotham
FIG. 2. Female right valve, lateral view. Io. 2922, Wrotham
FIG. 3. Male right valve, lateral view. Io. 2923, Wrotham
FIG. 4. Female left valve, lateral view. Io. 2924, Wrotham

Orthonotacythere minutissima sp. nov. p. 239

FIG. 5. Left valve, holotype, lateral view. Io. 2926, Wrotham
FIG. 6. Right valve, lateral view. Io. 2927, Wrotham
FIG. 7. Carapace, dorsal view. Io. 2928, Wrotham
FIG. 8. Left valve, internal view. Io. 2929, Wrotham
FIG. 9. Right valve, lateral view. Io. 2930, Wrotham
FIG. 10. Left valve, lateral view. Io. 2931, Wrotham
FIG. 11. Left valve, lateral view. Io. 2932, Wrotham

Cytheropteron (C.) arguta sp. nov. p. 232

FIG. 12. Right valve, lateral view. Io. 2933, Wrotham
FIG. 13. Carapace, dorsal view. Io. 2934, Wrotham
FIG. 14. Right valve, lateral view. Io. 2935, Wrotham
FIG. 15. Left valve, holotype, lateral view. Io. 2936, Wrotham
FIG. 16. Left valve, lateral view. Io. 2937, Wrotham
FIG. 17. Left valve, internal view. Io. 2938, Wrotham

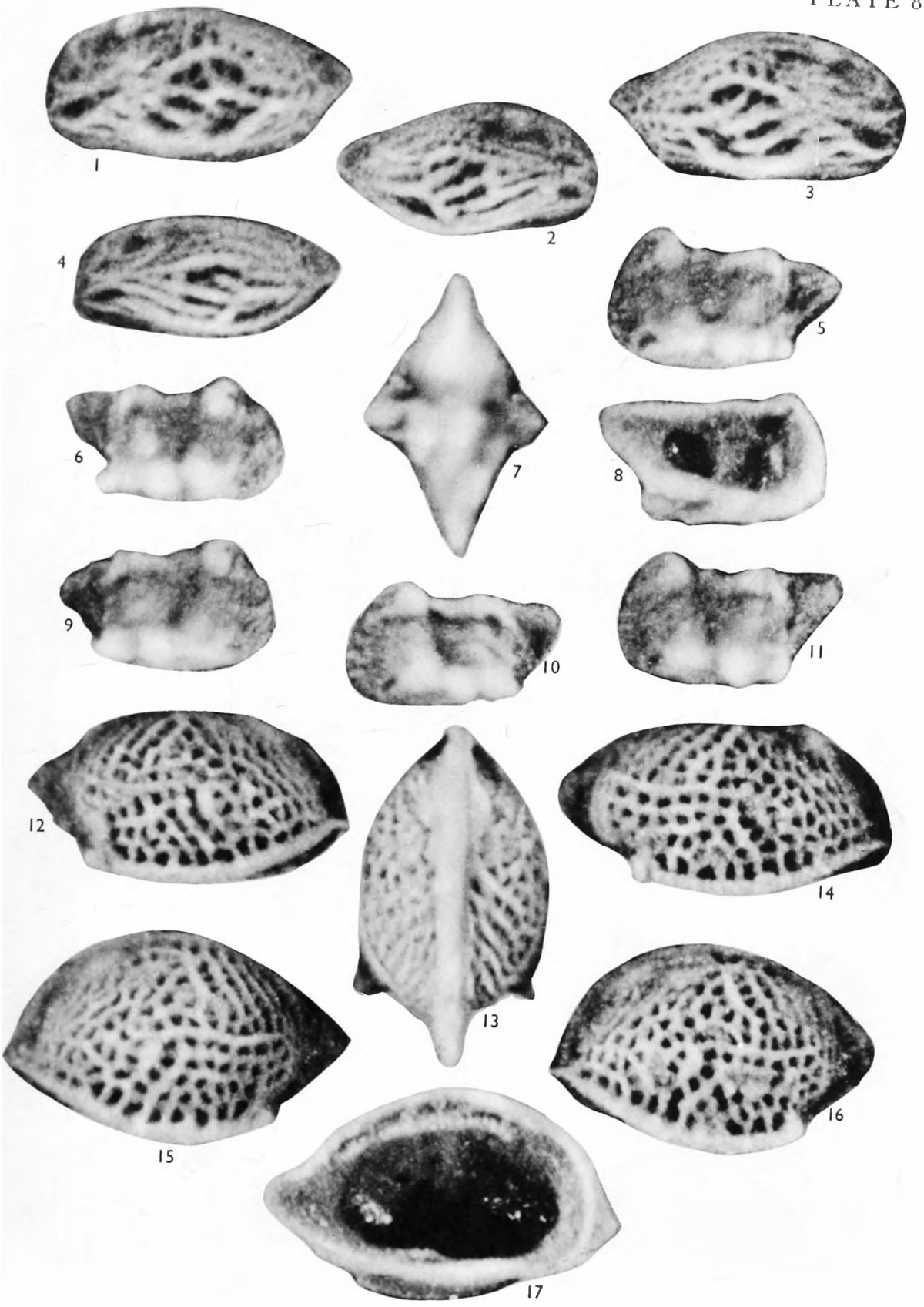
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PLATE 9

All figures ×60

Cythereis pinhayensis sp. nov. p. 248

FIG. 1. Male left valve, holotype, lateral view. Io. 2946, Pinhay
FIG. 2. Male right valve, lateral view. Io. 2947, Pinhay
FIG. 3. Female left valve, lateral view. Io. 2948, Pinhay
FIG. 4. Female right valve, lateral view. Io. 2949, Pinhay
FIG. 5. Male left valve, lateral view. Io. 2950, Pinhay
FIG. 6. Female carapace, dorsal view. Io. 2951, Pinhay
FIG. 7. Female right valve, internal view. Io. 2952, Pinhay
FIG. 8. Male left valve, internal view. Io. 2953, Pinhay

Paracypris wrothamensis sp. nov. p. 226

FIG. 9. Left valve, internal view. Io. 2955, Wrotham
FIG. 10. Left valve, lateral view. Io. 2956, Wrotham
FIG. 11. Carapace, dorsal view. Io. 2957, Wrotham
FIG. 12. Right valve, lateral view. Io. 2958, Wrotham
FIG. 13. Left valve, holotype, lateral view. Io. 2959, Wrotham
FIG. 14. Right valve, lateral view. Io. 2960, Wrotham

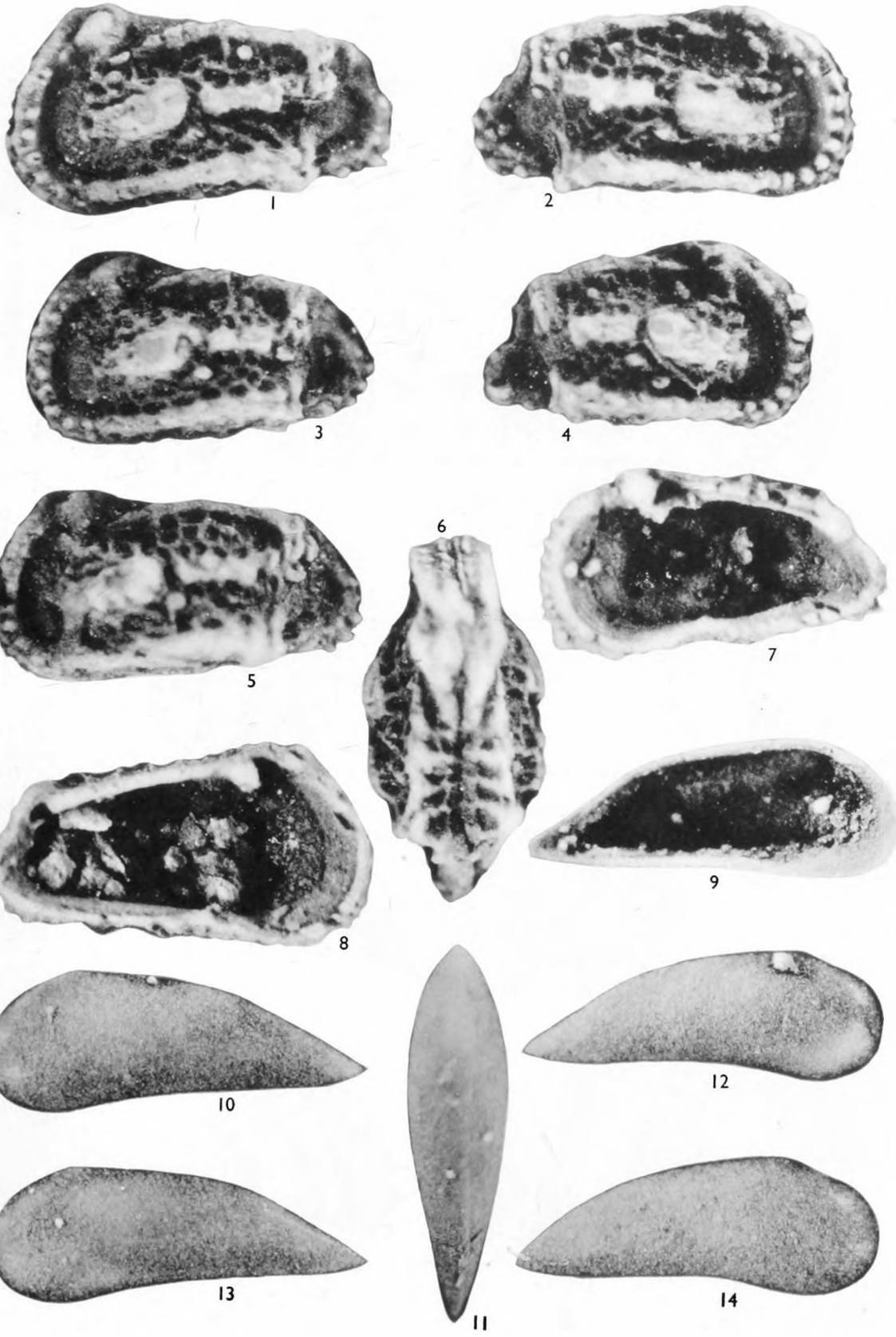
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PLATE 10

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Alatacythere robusta langi ssp. nov. p. 241

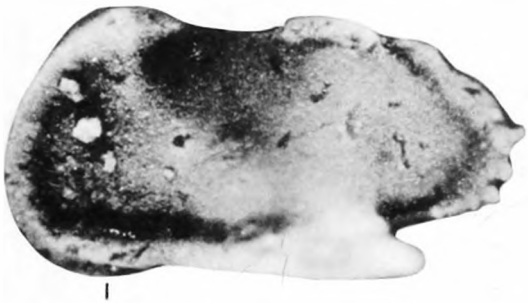
FIG. 1. Male left valve, holotype, lateral view. Io. 2940, Pinhay
FIG. 2. Female left valve, lateral view. Io. 2941, Pinhay
FIG. 3. Female right valve, lateral view. Io. 2942, Pinhay
FIG. 4. Male right valve, lateral view. Io. 2943, Pinhay

Cythereis glabrella Triebel p. 248

Fig. 5. Left valve, lateral view. Io. 2962, Pinhay
FIG. 6. Left valve, dorsal view. Io. 2962, Pinhay
FIG. 7. Right valve, dorsal view. Io. 2963, Pinhay
FIG. 8. Right valve, lateral view. Io. 2963, Pinhay

Alatacythere robusta robusta (Jones & Hinde) p. 240

FIG. 9. Right valve, lateral view. Io. 2964, Arlesey
FIG. 10. Left valve, lateral view. Io. 2965, Arlesey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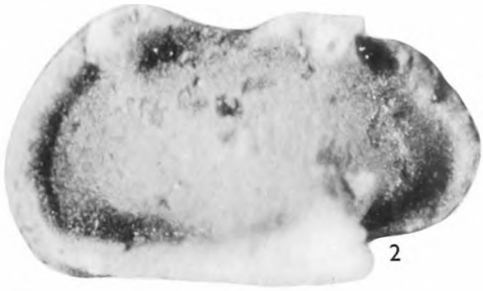
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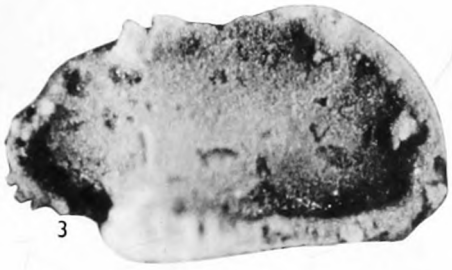
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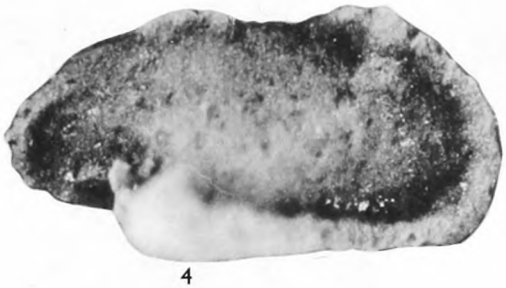
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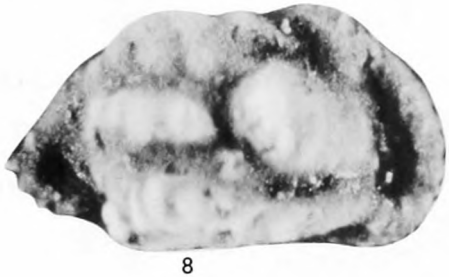
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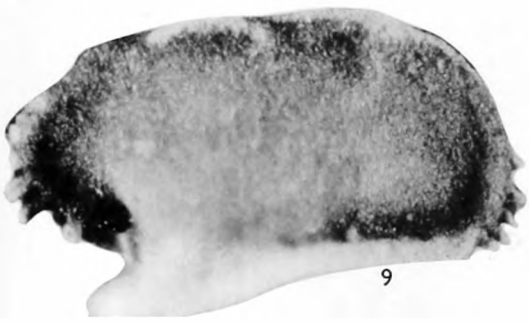
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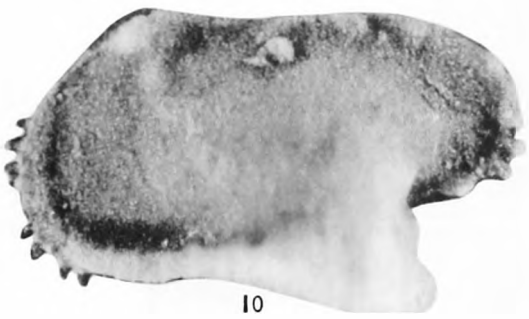
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PLATE 11

All figures ×80

Veenia florentinensis Damotte p. 246

FIG. 1. Left valve, lateral view. Io. 2971, Pinhay
FIG. 2. Left valve lateral view Io. 2971, Pinhay
FIG. 3. Right valve lateral view, Io: 2973 Pinhay
FIG. 4. Right valve, lateral view. Io. 2974, Henfield
FIG. 5. Left valve, lateral view. Io. 2975, Henfield
FIG. 6. Right valve, lateral view. Io. 2976, Pinhay
FIG. 7. Right valve, lateral view. Io. 2977, Pinhay
FIG. 8. Left valve, lateral view. Io. 2978, Pinhay

Monoceratina sp. p. 244

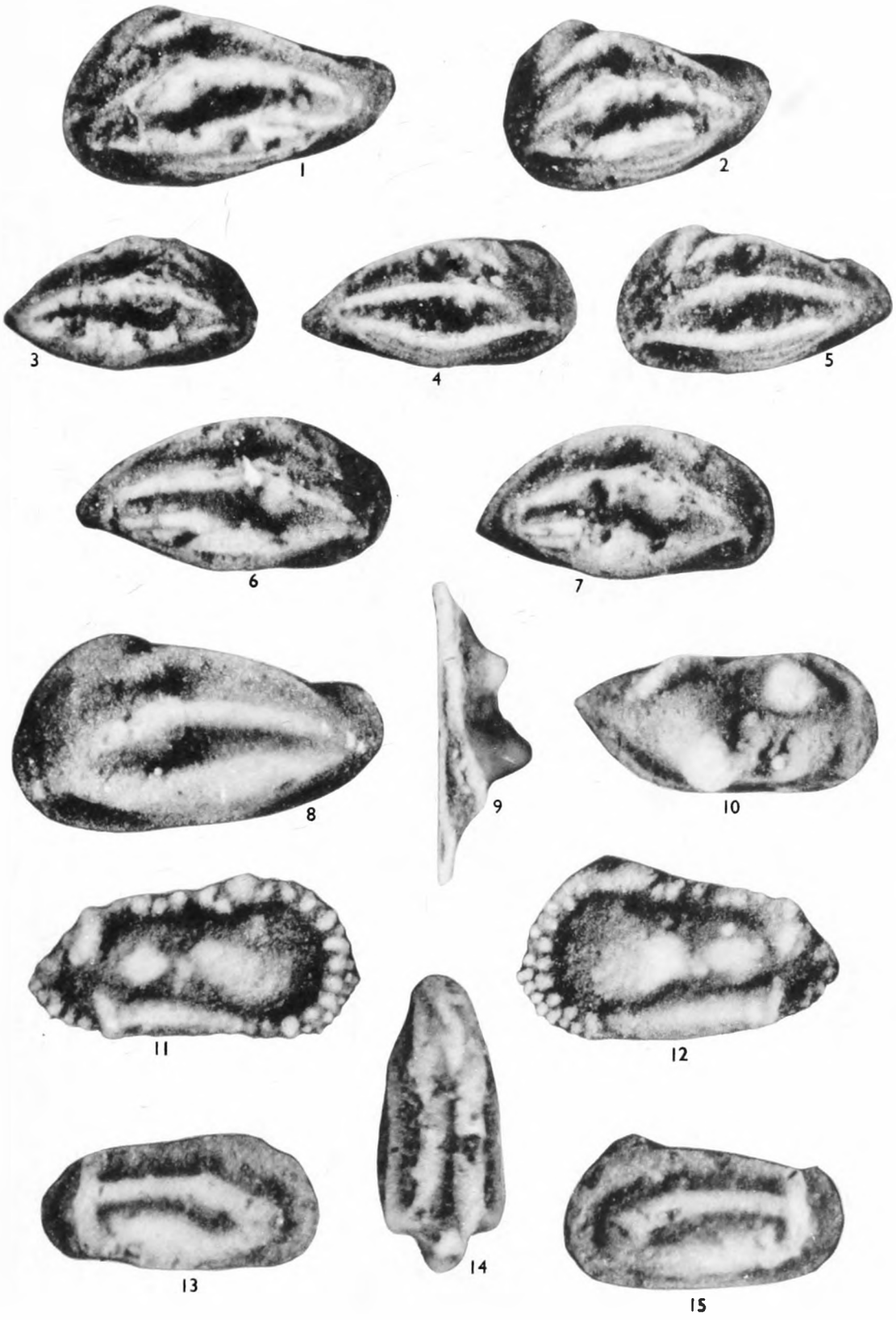
FIG. 9. Right valve dorsal view. Io. 2945, Devizes
FIG. 10. Right valve, lateral view. Io. 2945, Devizes

Cythereis gatyensis Damotte & Grosdidier p. 248

FIG. 11. Right valve, lateral view. Io. 2966, Culham
FIG. 12. Left valve, lateral view. Io. 2967, Culham

Veenia compressa Kaye p. 246

FIG. 13. Right valve, lateral view. Io. 2968, Pinhay
FIG. 14. Carapace, dorsal view. Io. 2969, Pinhay
FIG. 15. Left valve, lateral view. Io. 2970, Pinhay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