MIDDLE JURASSIC OSTRACODA FROM THE MILLEPORE SERIES, YORKSHIRE

BY

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Pp. 1–33 ; 14 *Plates*; 1 *Text-figure*

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By R. H. BATE

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SYNOPSIS

The ostracod fauna of the Middle Jurassic (Bajocian) Millepore Series of Yorkshire is described. Twenty genera, thirty-eight species and three subspecies belonging to the order Podocopida Müller 1894 are recorded, of which one genus, fourteen species and one subspecies are new. Six ostracods (incertae sedis) are listed under registration numbers to complete the fauna.

I INTRODUCTION AND ACKNOWLEDGEMENTS

The present paper, in which the ostracod fauna of the Millepore Series is described, is the third dealing with the Middle Jurassic Ostracoda of north-eastern England.

The Millepore Series consist in the main of a thick, oolitic limestone, which extends along the western outcrop of the Middle Jurassic as far north as Kirby Knowle, and in the east, as far north as Robin Hood's Bay. Southwards the Millepore Series extends to the river Humber, to the south of which it becomes part of the Lincolnshire Limestone.

In the neighbourhood of South Cave, the oolitic limestone is known locally as the Cave Oolite, whilst to the north it is known as the Whitwell Oolite. Along the coastal (eastern) outcrop, the limestone is referred to as the Millepore Oolite. Although all three occur at the same stratigraphical horizon, nowhere are they traceable one to the other. Above the Millepore Oolite, a marine sandstone/shale horizon occurs, the Yons Nab Beds (see Bate 1959). In the west a flaggy oolitic limestone (Upper Limestone of Hudleston 1874) overlies the Whitwell Oolite, from which it is separated by a bed of unconsolidated sand.

The Cave, Whitwell and Millepore Oolites, and the Upper Limestone and the Yons Nab Beds are here considered under the single heading, the Millepore Series. The term " Series " is retained to conform with the nomenclature in general use for the remainder of the Yorkshire Middle Jurassic, although " Formation " would be the more applicable.

A generalised table of the Middle Jurassic Beds of Yorkshire is given on p. 7. A more detailed consideration of the stratigraphy is to be undertaken in a later publication when it is hoped to discuss the suggestion of Kent (1955 : 208) that the Millepore Series is equivalent to the Upper Lincolnshire Limestone (Hibaldstow Oolite) of North Lincolnshire. An examination of the ostracods from the latter horizon is in progress.

The Millepore Series has been sampled at the following localities, the numbers corresponding with those indicated in Text-fig. 1 :—

Cave Oolite.

1. Eastfield Quarry, South Cave, map reference SE/913323.

Whitwell Oolite.

2. Westow Low Grange Quarry, map reference SE/766647.
3. Seamer Lime and Stone Co's. Quarry, at junction of York–Malton road and the Castle Howard station road, map reference SE/734672.
4. Stonecliff Wood, map reference SE/737675.
5. Quarry on the Bulmer–Welburn road, map reference SE/704678.

Upper Limestone.

2. Howl Beck, below Westow–Burythorpe road, map reference SE/766652.
3. Seamer Lime and Stone Co's. Quarry, map reference SE/734672.
4. Stonecliff Wood, below gate to the entrance of the Crambeck road, map reference SE/736675.

Millepore Oolite.

6. Yons Nab headland, Cayton Bay, map reference TA/084844.
7. Osgodby Nab headland, Cayton Bay, map reference TA/065855.
8. Cloughton Wyke, map reference TA/021958.

FIG. 1 Outcrop of Middle Jurassic Strata in N.E. England, with the localities [1-8] mentioned in the text.

Yons Nab Beds.

6. Yons Nab headland, Cayton Bay, map reference TA/084844.
8. Cloughton Wyke, map reference TA/021958.

TABLE 1

<table>
<tr><th>South West</th><th>North West</th><th>North East</th><th>Stages</th></tr>
<tr><td rowspan="2">Upper</td><td>Cornbrash ?</td><td>Cornbrash</td><td>Callovian</td></tr>
<tr><td>Upper Deltaic Series</td><td>Upper Deltaic Series</td><td>Bathonian</td></tr>
<tr><td rowspan="2">" Estuarine "
Series</td><td>Grey Limestone Series</td><td>Grey Limestone Series</td><td rowspan="6">Bajocian</td></tr>
<tr><td>Middle Deltaic Series (Upper)</td><td>Middle Deltaic Series (Upper)</td></tr>
<tr><td>Cave Oolite</td><td>Upper Limestone
Whitwell Oolite</td><td>Yons Nab Beds
Millepore Oolite</td></tr>
<tr><td>Basement Beds</td><td>Middle Deltaic Series (Lower)</td><td>Middle Deltaic Series (Lower)</td></tr>
<tr><td>Hydraulic Limestone</td><td>Hydraulic Limestone/ Eller Beck Bed</td><td>Eller Beck Bed</td></tr>
<tr><td rowspan="2">Lower " Estuarine " Series</td><td>Lower Deltaic Series</td><td>Lower Deltaic Series</td></tr>
<tr><td>Dogger</td><td>Dogger</td><td></td></tr>
<tr><td>Lias</td><td>Lias</td><td>Lias</td><td>Toarcian</td></tr>
</table>

TABLE 1. A generalized table of the Middle Jurassic Strata in Yorkshire.

Map references refer to the one inch Ordnance Survey map of Great Britain (seventh series).

Muscle scar types A–D, referred to in the text, are those established in Bate (1963).

I would like to record my sincere thanks to Professors L. R. Moore (Sheffield University) and P. C. Sylvester-Bradley (Leicester University) for the use of departmental facilities during the research of which the present paper is a part ; to Professor Sylvester-Bradley for much help and advice ; and to the Department of Scientific and Industrial Research for a grant which made the work possible.

The loan of type or comparative material from the following is also gratefully acknowledged : Dr. P. S. Ljubimova, V.N.I.G.R.I., Leningrad ; Drs. H. Malz, and E. Triebel, Senckenberg Museum, Frankfurt ; Dr. B. Moos, Amt für Bodenforschung, Hanover ; Dr. F. Plumhoff, Erdöl A.G., Wietze krs. Celle and Dr. F. Westphal, University of Tübingen.

All registered specimens mentioned in the text are in the collections of the Department of Palaeontology, British Museum (Natural History).

II SYSTEMATIC DESCRIPTIONS

Order PODOCOPIDA Müller 1894

Suborder PLATYCOPINA Sars 1866

Family **CYTHERELLIDAE** Sars 1866

Genus ***CYTHERELLOIDEA*** Alexander 1929

Cytherelloidea catenulata (Jones & Sherborn)

1888 *Cytherella catenulata* Jones & Sherborn : 274, pl. 5, fig. 6*a–c*.
1948 *? Cytherelloidea catenulata* (Jones & Sherborn) Sylvester-Bradley : 200, pl. 14, fig. 11, text-fig. 7.
1963 *Cytherelloidea catenulata* (Jones & Sherborn) ; Bate : 184, pl. 1, figs. 3–6.

REMARKS. Only two occurrences of this species have so far been noted within the Millepore Series, namely, single specimen in the Cave Oolite, Eastfield Quarry, and two specimens in the Whitwell Oolite, Seamer Lime and Stone Co's. Quarry.

Suborder PODOCOPINA Sars 1866

Superfamily **BAIRDIACEA** Sars 1888

Family **BAIRDIIDAE** Sars 1888

Genus ***BAIRDIA*** M'Coy 1844

Bairdia hilda Jones

1884 *Bairdia hilda* Jones : 771, pl. 34, fig. 20.
1888 *Bairdia fullonica* Jones & Sherborn : 253, pl. 5, fig. 4*a–c*.
1948 *Bairdia* cf. *hilda* Jones ; Sylvester-Bradley : 199, text-fig. 5.
1963 *Bairdia hilda* Jones ; Bate : 188, pl. 2, figs. 9–12, pl. 3, figs. 1–4.

REMARKS. Two valves represent this species at a single horizon within the Cave Oolite, Eastfield Quarry.

Superfamily **CYPRIDACEA** Baird 1845

Family **PARACYPRIDIDAE** Sars 1923

Genus ***PARACYPRIS*** Sars 1866

Paracypris bajociana Bate

1963 *Paracypris* sp. *D* Oertli ; Plumhoff : 18, pl. 1, figs. 9–11.
1963 *Paracypris bajociana* Bate : 186, pl. 2, figs 1–8.
1963*a* *Paracypris bajociana* Bate : 26.

Remarks. Although never abundant, the species occurs persistently throughout the Cave, Whitwell and Millepore Oolites and within the Upper Limestone and Yons Nab Beds.

Plumhoff (1963 : 18, pl. 1, figs. 9–11) figures a species of *Paracypris* which he considers to be conspecific with *Paracypris* sp. *D*. Oertli (1959 : 20, pl. 2, figs. 43, 44). There are, however, differences in the concavity of the ventral margin, in the narrowness of the anterior part of the carapace, and in the length of the postero-dorsal slope of the latter, which distinguish it from Plumhoff's specimens. Accordingly Oertli's species is not included in the synonymy.

Superfamily **CYTHERACEA** Baird 1850

Family **BYTHOCYTHERIDAE** Sars 1926

Genus ***MONOCERATINA*** Roth 1928

Monoceratina vulsa (Jones & Sherborn)

1888 *Cytheridea vulsa* Jones & Sherborn : 263, pl. 2, fig. 4*a–b*.
1938 *Monoceratina vulsa* (Jones & Sherborn) Triebel & Bartenstein : 516, pl. 3, figs. 17, 18.
1960 *Monoceratina* cf. *vulsa* (Jones & Sherborn) ; Lutze : 433, pl. 37, fig. 5*a–b*.
?1963 *Monoceratina* sp. juv. aff. *vulsa* (Jones & Sherborn) ; Plumhoff : 48, pl. 11, figs. 167, 168.
1963 *Monoceratina vulsa* (Jones & Sherborn) ; Bate : 189, pl. 3, figs. 5–12.
1963*a* *Monoceratina vulsa* (Jones & Sherborn) ; Bate : 26, pl. 1, fig. 6.

Remarks. Not common, but occurring sporadically throughout the Millepore Series, being found in the Cave, Whitwell and Millepore Oolites and also in the Upper Limestone. In Bate (1963 & 1963*a*) *Bythocythere aliena* Ljubimova (1955 : 34, pl. 2, fig. 3 *a–b*) was placed tentatively in synonymy with *M. vulsa*. Dr. Ljubimova has since sent me specimens of her species for comparison and it is quite clear that *B. aliena* should be taken out of synonymy.

Family **PROGONOCYTHERIDAE** Sylvester-Bradley 1948

Subfamily **PROGONOCYTHERINAE** Sylvester-Bradley 1948

Genus ***PROGONOCYTHERE*** Sylvester-Bradley 1948

Progonocythere cristata Bate

1963 *Progonocythere cristata* Bate : 191, pl. 4, figs. 5–15, pl. 5, figs. 1–6.
1963*a* *Progonocythere cristata* Bate ; Bate : 27.

Remarks. The species is poorly represented in the oolitic facies of the Millepore Series, where only a few specimens have been found at the top of the Millepore and

Whitwell Oolites of Yons Nab headland and the Seamer Lime and Stone Co's. Quarry, respectively. A single specimen has also been found in the Upper Limestone at the latter locality. Within the shale facies of the Yons Nab Beds, however, as exposed at Yons Nab, *P. cristata* becomes a common ostracod. In Lincolnshire, the species is present in the oolitic facies of the Lincolnshire Limestone (Bate 1963), but is more abundant within the Kirton Shale facies. It would appear, therefore, that, although not restricted by the facies present, this ostracod favours an environment having a muddy substratum.

Genus ***ACANTHOCYTHERE*** (Sylvester-Bradley 1956) emend Bate 1963

Subgenus ***PROTOACANTHOCYTHERE*** Bate 1963

Acanthocythere (Protoacanthocythere) faveolata Bate

1963 *Acanthocythere* (*P.*) *faveolata* Bate : 195, pl. 7, figs. 5–13, pl. 8, figs. 1–5.
1963*a* *Acanthocythere* (*P.*) *faveolata* Bate ; Bate : 28.

REMARKS. This species has so far been found only at two horizons within the Cave Oolite, as exposed in the Eastfield Quarry. In each case a single valve is all that represents the species. *Fuhrbergiella* (*Praefuhrbergiella*)? *favosa* Plumhoff (1963 : 26, pl. 3, figs. 52–55), which is very close to the present species, differs in the possession of a prominent posteroventral extension of the carapace, in the absence of spines, and in being larger.

Genus ***AULACOCYTHERE*** Bate 1963

Aulacocythere punctata Bate

1963 *Aulacocythere punctata* Bate : 199, pl. 9, figs. 4–9, 11–12, 14–15.
1963*a* *Aulacocythere punctata* Bate ; Bate : 28.

REMARKS. *A. punctata* is a rare member of the ostracod fauna within the Millepore Series. A single specimen has been found in the Millepore Oolite, Osgodby Nab, and isolated carapaces and valves occur sporadically throughout the Whitwell Oolite at the Seamer Lime & Stone Co's. Quarry. It is, however, nearly always present though rare in samples of the Cave Oolite, Eastfield Quarry.

Aulacocythere reticulata Bate

1963 *Aulacocythere reticulata* Bate : 200, pl. 9, figs. 10, 13, 16–25, pl. 10, fig. 1.

REMARKS. A single carapace was found in the Whitwell Oolite, Seamer Lime and Stone Co's. Quarry.

Genus ***FUHRBERGIELLA*** Brand & Malz 1962

Subgenus ***PRAEFUHRBERGIELLA*** Brand & Malz

Fuhrbergiella (Praefuhrbergiella) arens Bate

1963 *Fuhrbergiella* (*P.*) *arens* Bate : 197, pl. 8, figs. 6–15, pl. 9, figs. 1–3.

REMARKS. This species has so far been found only in the Cave Oolite, Eastfield Quarry, where it is more common towards the base of the limestone.

Fuhrbergiella (Praefuhrbergiella) minima sp. nov.

(Pl. 1, figs. 1–8)

DIAGNOSIS. *Praefuhrbergiella* with small, subquadrate carapace. Shell reticulate with oblique transverse ridges.

HOLOTYPE. Io.1021, Millepore Oolite, Cloughton.

PARATYPES. Io.1022–23 and Io.1035, horizon and locality as above and from the Whitwell Oolite, Seamer Lime and Stone Co's. Quarry.

DESCRIPTION. *Carapace* subquadrate with the greatest length passing through midpoint, greatest height in the anterior third, greatest width in the posterior third. Shell dimorphic, the more elongate specimens being considered to be the males. Dorsal margin straight, overreached posterodorsally by the strongly convex dorsolateral border. Ventral margin incurved anteromedially. Ventral surface overhung by the convex ventrolateral border. Anterior broadly rounded ; posterior broadly triangular in the female dimorph, more acute in the male, where the posterodorsal slope is strongly concave. Anterior and posterior with flattened marginal borders, the anterior border being characteristically directed obliquely back towards the anterior cardinal angle. Cardinal angles prominent. Shell surface reticulate, with a tendency for the reticulation to produce low ridges trending obliquely anteroventrally from the dorsal margin. A rounded eye swelling is situated at the anterior cardinal angle. Ventral surface with 3–4 low, parallel ridges. Left valve slightly larger than the right, which it overlaps along the ventral margin and to a lesser degree at the cardinal angles. Internal details unknown.

Dimensions

HOLOTYPE. Io.1021, female carapace (Pl. 1, figs. 1–4), length 0·50 mm. ; height 0·30 mm. ; width 0·27 mm.

PARATYPES. Io.1035, male carapace (Pl. 1, figs. 5–8), length 0·48 mm. ; height 0·27 mm. ; width 0·23 mm. Io.1022, male carapace, length 0·56 mm. ; height 0·30 mm. ; width 0·24 mm. Io.1023, male carapace, length 0·57 mm. ; height 0·26 mm. ; width 0·22 mm.

REMARKS. A rare species, found so far only in the Millepore and Whitwell Oolites.

Genus ***MICROPNEUMATOCYTHERE*** Bate 1963

Micropneumatocythere convexa Bate

?1960 Ostracod No. 3 Lutze : 434, pl. 38, fig. 1*a*, *b*.
1963*a* *Micropneumatocythere convexa* Bate : 29, pl. 2, figs. 12–13, pl. 3, figs. 1–15.

REMARKS. Although this species occurs in the Cave, Whitwell and Millepore Oolites, it is never common.

Micropneumatocythere globosa sp. nov.

(Pl. 1, figs. 9–20)

DIAGNOSIS. *Micropneumatocythere* with swollen, rather rotund carapace. Shell surface very finely punctate. Normal pore canal openings large.

HOLOTYPE. Io.1010, Cave Oolite ; Eastfield Quarry, South Cave.

PARATYPES. Io.1011–17, Io.1019 (six carapaces), Io.1020 (four carapaces), horizon and locality as above; from the Whitwell Oolite, Seamer Lime and Stone Co's. Quarry and Stonecliff Wood ; Yons Nab Beds and Millepore Oolite, Yons Nab ; and from the Millepore Oolite, Cloughton.

DESCRIPTION. *Carapace* ovoid, strongly convex in dorsal view. Ventrolateral border overhanging the ventral surface in lateral view. Species dimorphic, the presumed males being more elongate. Dorsal margin broadly convex ; ventral margin anteromedially incurved. Anterior broadly rounded ; posterior triangular with a slightly concave posterodorsal slope, particularly in the right valve, and a convex posteroventral slope. Greatest length passes through midpoint ; greatest height and width just behind midpoint. Shell surface smooth, very finely punctate in well preserved specimens. Ventral surface weakly striated. *Normal pore canal* openings large, widely scattered over the surface of the carapace. Left valve larger than the right, which it slightly overlaps midventrally. Along the dorsal margin, posterodorsal and anterodorsal slopes the left valve prominently overreaches the right. *Hinge* antimerodont ; left valve with a broad, shelf-like accommodation groove and a rather coarsely dentate median element. Hinge not clearly seen in the right valve, but there are approximately six posterior teeth. *Inner margin* and *line of concrescence* coincide ; *radial pore canals* short, straight and widely spaced, exact number not observed. *Duplicature* of moderate width. *Muscle scars* not observed.

Dimensions.

HOLOTYPE. Io.1010, female carapace (Pl. 1, figs. 9, 10, 15 & 16), length 0·42 mm. ; height 0·29 mm. ; width 0·28 mm.

PARATYPES. Io.1011, male carapace (Pl. 1, figs. 17–20), length 0·49 mm. ; height 0·30 mm. ; width 0·30 mm. Io.1012, female left valve (Pl. 1, figs. 11, 12), length 0·37 mm. ; height 0·25 mm. Io.1013, male left valve (Pl. 1, fig. 14), length 0·53 mm. ; height 0·32 mm. Io.1014, female right valve (Pl. 1, fig. 13), length 0·40 mm. ; height 0·25 mm. Io.1015, female carapace, length 0·39 mm. ; height 0·26 mm. ; width 0·26 mm. Io.1016, female right valve, length 0·40 mm. ; height 0·26 mm. Io.1017, female carapace, length 0·47 mm. ; height 0·29 mm. ; width 0·30 mm.

REMARKS. *Micropneumatocythere globosa* occurs throughout the Millepore Series, being a common member of the ostracod fauna at this horizon, particularly within the limestone facies. The species is either absent or not very common within the shale facies of the Yons Nab Beds.

Genus ***PNEUMATOCYTHERE*** Bate 1963

Pneumatocythere bajociana Bate

1963 *Pneumatocythere bajociana* Bate : 193, pl. 5, figs. 7–10, pl. 6, figs. 1–10, pl. 7, figs. 1–4.
1963*a* *Pneumatocythere bajociana* Bate ; Bate : 30.

REMARKS. This is a common ostracod within the shale and sandy limestone facies of the Yons Nab Beds (the type horizon) and in the limestone facies of the Millepore Oolite at Yons Nab and Osgodby Nab. It is virtually unrepresented within the Whitwell Oolite and Upper Limestone, and has not been found at all in the Cave Oolite.

Pneumatocythere carinata sp. nov.

(Pl. 2, figs. 1–9)

DIAGNOSIS. *Pneumatocythere* with strongly ornamented carapace : ornamentation consisting of prominent transverse ridges in the dorso-median part, breaking into a strong reticulation at about valve centre.

HOLOTYPE. Io.1024, Upper Limestone, Stonecliff Wood.

PARATYPES. Io.1025–34, Whitwell Oolite, Bulmer, and Seamer Lime and Stone Co's. Quarry ; Cave Oolite, Eastfield Quarry ; and Millepore Oolite, Yons Nab.

DESCRIPTION. *Carapace* ovoid, strongly convex in dorsal view. Ventrolateral border convex, overhanging the ventral surface, especially so just behind valve middle. Dimorphism was suggested by a single, more elongate specimen, probably a male, but unfortunately lost. All the remaining specimens appear to be females. Greatest length through midpoint ; greatest height and width, median. Shell surface strongly ornamented with transverse ridges which radiate outwards from the dorsal margin and which, at about valve centre, break up into a reticulate ornamentation. An oblique, rather deep groove is situated below the anterior cardinal angle. The ventral and ventrolateral surfaces combined possess 5–6 longitudinal ridges per valve. *Left valve* larger than the right, which it overlaps along the ventral margin, and overreaches along the dorsal and anterior margins. Dorsal margin slightly convex, with broadly rounded cardinal angles. Anterior and posterior rounded. Ventral margin incurved just anterior of valve middle. A distinct groove extends around the anterior margin. *Right valve* closely similar in outline to the left. The dorsal margin is, however, slightly less convex, and the anterodorsal slope, convex in the left valve, is here slightly concave ; posterodorsal slope concave in both valves, but more so in the right. *Hinge* antimerodont, only seen in the left valve : terminal sockets coarsely loculate, median bar strongly dentate, accommodation groove poorly developed. *Inner margin* and *line of concrescence* coincide. *Radial pore canals* short, straight and few in number, although the exact number has not been ascertained. *Duplicature* of moderate width. *Muscle scars* (Type A) consist of a vertical row of four oval adductor scars, rounded anterodorsal antennal scar, and a longitudinally elongate, anteroventral mandibular scar.

Dimensions

HOLOTYPE. Io.1024, female? carapace (Pl. 2, figs. 1–4), length 0·68 mm. ; height 0·47 mm. ; width 0·52 mm.

PARATYPES. Io.1025, female? carapace, length 0·65 mm. ; height 0·44 mm. ; width 0·48 mm. Io.1026, female? carapace, length 0·65 mm. ; height 0·40 mm. ; width 0·48 mm. Io.1027, female? carapace, length 0·70 mm. ; height 0·45 mm. ; width 0·49 mm. Io.1028, female? left valve (Pl. 2, fig. 8), length 0·65 mm. ; height 0·46 mm. Io.1029, female? left valve (Pl. 2, figs. 5, 6), length 0·60 mm. ; height 0·42 mm. Io.1030, female? left valve (Pl. 2, figs. 7, 9), length 0·66 mm. ; height 0·46 mm.

REMARKS. *P. carinata* is a rare member of the ostracod fauna, although it occurs widely throughout the Millepore Series. It is not, however, found in the Yons Nab Beds. Similar in appearance to *P. bajociana* (Bate 1963), it can be distinguished by the much more strongly convex dorsal margin and stronger ornamentation.

Subfamily **PLEUROCYTHERINAE** Mandelstam 1960

Genus ***PLEUROCYTHERE*** Triebel 1951

Pleurocythere kirtonensis Bate

1963 *Pleurocythere kirtonensis* Bate : 203, pl. 10, figs. 14–18, pl. 11, figs. 1–5.
1963*a* *Pleurocythere kirtonensis* Bate ; Bate : 31.

REMARKS. Two broken carapaces from the Whitwell Oolite, Seamer Lime and Stone Co's. Quarry.

Pleurocythere nodosa Bate

1963 *Pleurocythere nodosa* Bate : 204, pl. 11, figs. 6–21.

REMARKS. A right valve and a complete carapace found (at different horizons) within the Cave Oolite, Eastfield Quarry.

Family **CYTHERIDEIDAE** Sars 1925

Subfamily **CYTHERIDEINAE** Sars 1925

Genus ***DOLOCYTHERE*** Mertens 1956

Dolocythere maculosa Bate

1941 *Leptocythere* ? sp. Triebel : pl. 7, figs. 71–72.
1949 Ostracod 99 Brand : 337, pl. 10 (fauna 1), fig. 5, pl. 14.
1962 *Lophodentina* ? sp. 99 Brand ; Brand & Fahrion : 129, 136, pl. 17 (fauna 9), fig. 6, pl. 20, fig. 25.
1963 *Dolocythere maculosa* Bate : 205, pl. 12, figs. 1–11.
1963*a* *Dolocythere maculosa* Bate ; Bate : 31.

REMARKS. Although never common, *D. maculosa* is generally represented in the faunas of the Cave, Whitwell and Millepore Oolites, and to a lesser degree in the upper Limestone and Yons Nab Beds.

Family **SCHULERIDEIDAE** Mandelstam 1959

Subfamily **SCHULERIDEINAE** Mandelstam 1959

Genus ***ASCIOCYTHERE*** Swain 1952

REMARKS. *Asciocythere* was erected by Swain (1952 : 75) with *Bythocypris rotundus* Vanderpool (1928 : 102, pl. 13, figs. 5, 6) as the type species. In the description of the genus Swain states that the median hinge element of the left valve is either a smooth or a denticulate bar. The species placed here in the genus are characterised by possessing a strongly dentate median bar in that valve.

Asciocythere acuminata sp. nov.

(Pl. 2, figs. 10–12, Pl. 3, figs. 1–10)

DIAGNOSIS. *Asciocythere*, oval in outline, tapering anteriorly and posteriorly ; shell surface finely punctate ; greatest height median or just behind midpoint.

HOLOTYPE. Io.1072, Cave Oolite, Eastfield Quarry.

PARATYPES. Io.1073–76, horizon and locality as above, and from the Upper Limestone, Stonecliff Wood ; and the Basement Beds, below the Cave Oolite, Eastfield Quarry.

DESCRIPTION. *Carapace* oval in outline, tapering anteriorly and posteriorly, the greatest height at or just behind middle. Greatest length passes through midpoint ; greatest width in the posterior half. Shell surface finely punctate. Left valve larger than the right, which it overlaps along the ventral margin and along the posteroventral and posterodorsal slopes. Around the anterior and posterior margins and along the dorsal margin the left valve overreaches the right. Dorsal margin arched, without cardinal angles ; ventral margin strongly convex, incurved anteromedially. Anterior rounded ; extreme posterior pointed or very narrowly rounded. *Right valve* more elongate in outline than the left. Dorsal margin convex with distinct cardinal angles, the anterodorsal slope being long and slightly convex. Anterior rounded ; posterior acuminate with a concave posterodorsal slope and a convex posteroventral slope. Ventral margin with the incurvature extending from valve middle into the posterior half. *Hinge* antimerodont, only seen in the right valve : approximately 5 posterior teeth, anterior teeth not preserved in this material. Median groove broad, strongly loculate, overhung by the convex dorsal margin of the valve. *Inner margin* and *line of concrescence* appear to coincide ; anterior *radial pore canals* few in number and slightly curved, exact number not seen ; posterior canals short and straight, approximately 4 in number. *Muscle scars* of type C : adductor scars in a crescentic row with the anteromedian antennal scar kidney shaped.

Dimensions

HOLOTYPE. Io.1072, carapace (Pl. 2, figs. 10–12, Pl. 3 fig. 1), length 0·60 mm. ; height 0·37 mm.; width 0·32 mm.

PARATYPES. Io.1073, carapace (Pl. 3, figs. 4, 5, 9 & 10), length 0·59 mm. ; height 0·36 mm. ; width 0·29 mm. Io.1074, carapace (Pl. 3, figs. 6, 7), length 0·53. mm. ; height 0·31 mm. ; width 0·23 mm. Io.1075, right valve (Pl. 3, figs. 2, 3), length 0·56 mm. ; height 0·30 mm.

REMARKS. Only 5 specimens of this species are known so far, and these are placed in *Asciocythere* on account of shape, muscle scars, radial pore canals and hinge structure. The acuminate outline of this species distinguishes it from the others placed in the genus.

Asciocythere lacunosa Bate

1963*a* *Asciocythere lacunosa* Bate: 34, pl. 6, figs. 3–9, pl. 7, figs. 1–6.

REMARKS. Several specimens of this species have been found in the Cave Oolite, Eastfield Quarry.

Genus ***EOCYTHERIDEA*** Bate 1963

Eocytheridea? acuta sp. nov.

(Pl. 3, figs. 11–14)

DIAGNOSIS. *Eocytheridea?* with elongate carapace, tapering anteriorly ; drawn out, acuminate, posteriorly.

HOLOTYPE. Io.1036, limestone band (basal Upper Limestone), interbedded with yellow sand, overlying the Whitwell Oolite, Stonecliff Wood.

PARATYPES. Io.1037–39, horizon and locality as above, from the Yons Nab Beds, Cayton Bay ; and from the top of the Millepore Oolite, Osgodby Nab.

DESCRIPTION. *Carapace* elongate, tapering strongly to the anterior and posterior. Greatest length below midpoint ; greatest height equally at the anterior cardinal angle and at valve middle; greatest width situated just behind valve middle. Shell surface finely punctate where preservation permits, otherwise appears to be smooth. *Normal pore canal* openings prominent, widely scattered over the carapace. *Left valve* much larger than the right, which it overlaps along the ventral margin, particularly midventrally. The left valve also strongly overlaps the right in the region of the cardinal angles. Dorsal margin straight, dorsolateral margin medially incurved, cardinal angles broadly convex ; anterodorsal slope long, convex ; posterodorsal slope steeply angled, almost straight, very slightly concave. Anterior rounded ; posterior narrowly rounded, tapering. Ventrolateral margin medially convex, the convexity being represented also midventrally. Antero- and postero-ventral slopes convex. *Right valve* similar in outline, differing in having a slightly convex dorso-lateral margin and a much more strongly acuminate posterior; posterodorsal slope long, strongly concave, posterodorsal slope convex. Ventral margin medially convex, incurved antero- and postero-ventrally. *Hinge*, as seen through the translucent shell, merodont, with dentate/loculate terminal elements ; the median bar of the left valve may be denticulate but this cannot satisfactorily be ascertained. Other internal details not seen.

Dimensions

HOLOTYPE. Io.1036, carapace (Pl. 3, figs. 11–14), length 0·93 mm. ; height 0·44 mm. ; width 0·43 mm.

PARATYPES. Io.1037, carapace, length 0·83 mm. ; height 0·42 mm. ; width 0·40 mm. Io.1038, carapace, length 0·88 mm. ; height 0·41 mm. ; width 0·43 mm.

REMARKS. The lack of knowledge concerning the internal details of this species prevent its definite placing in *Eocytheridea*. External characteristics of shape and valvular relationship suggest that it may, however, belong here. *E.? acuta* is a rare ostracod found only within the Yons Nab Beds, at the top of the Millepore Oolite and at the base of the Upper Limestone. In the general outline of the carapace, particularly the strong posterior taper, this ostracod can easily be distinguished from the other species of the genus.

Eocytheridea? astricta sp. nov.

(Pl. 4, figs. 1–5)

DIAGNOSIS. *Eocytheridea ?* with oval, elongate carapace, tapering to the anterior and posterior with the greatest height at or just behind valve middle.

HOLOTYPE. Io.1040, basal Upper Limestone, Stonecliff Wood.

PARATYPES. Io.1041–47, horizon and locality as above, from the top of the Whitwell Oolite, Westow ; Yons Nab Beds and Millepore Oolite, Cayton Bay ; and from the Basement Beds below the Cave Oolite, Eastfield Quarry.

DESCRIPTION. *Carapace* elongate, rather narrow in side view with the greatest height varying from median to just behind valve middle. Greatest length through midpoint, greatest width in posterior third. Shell surface smooth. *Left valve* larger than the right, which it overlaps strongly along the ventral margin and in the region of the anterior and posterior cardinal angles. Dorsal margin straight, overreached by the convex or almost straight dorsolateral margin. Anterior cardinal angle very broad, passing smoothly into the convex anterodorsal slope. Posterior cardinal angle distinct. Anterior evenly rounded ; posterior truncated, with concave posterodorsal slope and broadly convex posteroventral slope. Ventral margin convex, incurved anteromedially. *Right valve* elongate-oval, dorsolateral margin convex ; anterior and posterior rounded, ventral margin anteromedially incurved. *Hinge* antimerodont, with coarsely dentate/loculate terminal elements and a coarsely dentate/loculate median element. Accommodation groove in the left valve elongate, not well developed. *Muscle scars*, type C : the anteromedian antennal scar, in a juvenile specimen, equal in size to two adductor scars. A small scar is situated in front of the antennal scar. Mandibular scar, small. *Duplicature*, as seen through the carapace, appears to be rather narrow ; *radial pore canals* not clearly seen.

Dimensions

HOLOTYPE. Io.1040, carapace (Pl. 4, figs. 1–4), length 0·98 mm.; height 0·05 mm.; width 0·49 mm.

PARATYPES. Io.1041, carapace, length 0·80 mm.; height 0·40 mm.; width 0·40 mm. Io.1042, carapace, length 0·79 mm.; height 0·41 mm.; width 0·41 mm. Io.1044, juvenile carapace (Pl. 4, fig. 5), length 0·67 mm.; height 0·31 mm.; width 0·27 mm. Io.1045, carapace, length 0·76 mm.; height 0·39 mm.; width 0·37 mm.

REMARKS. This species has been placed tentatively in *Eocytheridea*, although it differs from all the others in the possession of an antimerodont hinge. It is not a particularly common ostracod, although it is numerous in the sandy limestone at the top of the Yons Nab Beds.

Eocytheridea carinata sp. nov.

(Pl. 4, figs. 6–11, Pl. 5, figs. 1–8)

DIAGNOSIS. *Eocytheridea*, carapace with well developed carinae arranged in the shape of an inverted V.

HOLOTYPE. Io.1048, Whitwell Oolite, Bulmer.

PARATYPES. Io.1049–58, horizon and locality as above, from the Cave Oolite, Eastfield Quarry ; Whitwell Oolite, Stonecliff Wood ; Millepore Oolite, Cloughton ; and from the Yons Nab Beds, Cayton Bay.

DESCRIPTION. *Carapace* subquadrate in young instars and adult female dimorphs, elongate in the males. Greatest length through midpoint ; greatest height in the anterior third, at the anterior cardinal angle ; greatest width in the posterior third. Shell surface strongly ornamented with prominent carinae arranged in an inverted V, the apex of which reaches the dorsolateral margin just behind valve middle. The outermost V-ridge forms the boundary of a central convex area which, in dorsal view, stands out from the remainder of the valve. In young instars there are 3–4 carinae present, whilst in adult specimens the number increases to as many as 9, the increase being largely in the ventrolateral region. Ventral surface ornamented with 3–4 faint, longitudinal carinae. Anterior cardinal angle swollen, particularly noticeable in the left valve, and may represent an eye swelling. *Left valve* larger than the right, which it overlaps evenly along the ventral margin except for the anteroventral sector, where the overlap becomes less and finally non-existent. The left valve also overlaps the right in the region of the cardinal angles and strongly overreaches the right along the entire dorsal margin, in which region a dorsal keel is developed. Dorsal edge of valve, in side view, medially concave, cardinal angles broadly rounded ; anterior uniformly rounded ; posterior narrowly rounded. Ventral margin convex, incurved anteromedially. Ventrolateral margin broadly convex, slightly overhanging the ventral surface in side view. *Right valve* smaller in size, without the dorsal keel, otherwise similar in outline to the left valve. *Hinge* hemimerodont : terminal elements rather coarsely dentate/loculate. Accommodation groove poorly developed. *Inner margin* and *line of concrescence* coincide. Anterior *radial pore canals* few in number, widely spaced and slightly curved, exact number not seen. *Muscle scars*, type C : slightly curved row of 4 oval adductor scars with an irregularly rounded, anteromedian antennal scar and a rounded anteroventral mandibular scar.

Dimensions

HOLOTYPE. Io.1048, female carapace (Pl. 5, figs. 1–4), length 0·65 mm.; height 0·43 mm.; width 0·43 mm.

PARATYPES. Io.1049, female carapace, length 0·65 mm.; height 0·40 mm.; width 0·38 mm. Io.1050, male right valve (Pl. 4, fig. 11), length 0·69 mm.; height 0·34 mm. Io.1051, female left valve (Pl. 4, fig. 6), length 0·64 mm.; height 0·38 mm. Io.1052, juvenile carapace (Pl. 4, figs. 7–10), length 0·47 mm.; height 0·32 mm.; width 0·30 mm. Io.1054, male carapace (Pl. 5, figs. 5–8), length 0·68 mm.; height 0·38 mm.; width 0·38 mm. Io.1055, female left valve, length 0·62 mm.; height 0·41 mm.

REMARKS. *Eocytheridea carinata* has been found throughout the Millepore Series, with the exception of the Upper Limestone, and is one of the more commonly occurring members of the ostracod fauna, being readily distinguished from the other species of the genus by its characteristic ornamentation.

Eocytheridea elongata Bate

1963*a* *Eocytheridea elongata* Bate: 35, pl. 7, figs. 7–12, pl. 8, figs. 1–5.

REMARKS. Very rare. Represented by a single right valve within the Whitwell Oolite, Seamer Lime and Stone Co's. Quarry, and by several poorly preserved valves, possibly of this species, found in the Cave Oolite, Eastfield Quarry.

Eocytheridea? erugata sp. nov.

(Pl. 5, figs. 9–12, Pl. 6, figs. 1–3)

DIAGNOSIS. *Eocytheridea ?* with elongate carapace, posteriorly acuminate ; shell surface smooth ; greatest height in anterior third.

HOLOTYPE. Io.1059, base of Yons Nab Beds (bed 2, Bate 1959 : 159), Cayton Bay.

PARATYPES. Io.1060–64, from the Millepore Oolite, Osgodby Nab and Cloughton; Whitwell Oolite, Seamer Lime and Stone Co's. Quarry ; Upper Limestone, Stonecliff Wood ; and the Basement Beds below Cave Oolite, Eastfield Quarry.

DESCRIPTION. *Carapace* elongate, tapering posteriorly. Greatest length slightly below midpoint ; greatest height in the anterior third ; greatest width in the posterior third. Shell surface smooth. *Left valve* larger than the right which it overlaps along the ventral margin, along the anterodorsal and posterodorsal slopes and around the posterior margin. Dorsal margin slightly concave medially, sloping to the posterior ; cardinal angles rounded. Anterior broadly rounded ; posterior narrowly rounded. Ventral margin medially incurved. *Right valve* similar in outline to the left, differing in possessing a convex dorsal margin. *Hinge* merodont, but not clearly seen. *Muscle scars*, type " C ": a subvertical row of 4 adductor scars with an anteromedian, crescentic, antennal scar, which in one instance appears to be produced by the fusion of two small scars. Rounded mandibular scar antero-ventral in position. *Inner margin* and *line of concrescence*, as seen from the exterior, appear to coincide. *Radial pore canals* straight, widely spaced, 6–8 anteriorly.

Dimensions

HOLOTYPE. Io.1059, carapace (Pl. 5, figs. 9–11), length 0·67 mm.; height 0·33 mm.; width 0·29 mm.

PARATYPE. Io.1060, juvenile carapace (Pl. 5, fig. 12, Pl. 6, figs. 1–3), length 0·51 mm.; height 0·25 mm.; width 0·20 mm.

REMARKS. In outline, this species is close to *Dolocytheridea bosquetiana* (Jones & Hinde 1890 : 4, pl. 2, fig. 65, pl. 4, fig. 3) and the male dimorph of *Dolocytheridea intermedia* Oertli (1958 : 1505, pl. 3, figs. 68, 73, 74, pl. 4, figs. 75, 76, 80). There are, however, slight differences in outline, such as the possession of a narrower anterior margin and a slight concavity of the posterodorsal slope which distinguish *E. ? erugata* from the above mentioned ostracods. *E. ? astricta* tends to be more oval in outline than the present species and, like *E. ? acuta*, has a greater posterodorsal overlap of the right valve by the left and a distinct anterior taper. *E. ? erugata* is a rare species, occurring in the Millepore and Whitwell Oolites, the Yons Nab Beds and Upper Limestone, and in the Basement Beds below the Cave Oolite.

Eocytheridea faveolata sp. nov.

(Pl. 6, figs. 4–9)

DIAGNOSIS. *Eocytheridea*, with strong pitting producing a reticulate ornament.

HOLOTYPE. Io.1067, Yons Nab Beds (bed 7, Bate 1959 : 158), Cayton Bay.

PARATYPES. Io.1068–71, from the Millepore Oolite, Cayton Bay ; Whitwell Oolite, Seamer Lime and Stone Co's. Quarry ; Cave Oolite, Eastfield Quarry ; and Upper Limestone, Stonecliff Wood.

DESCRIPTION. *Carapace* oval-subquadrate, elongate in the male dimorph. Greatest length through midpoint ; greatest height median in adult instars, in the anterior third in juveniles ; greatest width in the posterior third. Shell surface strongly pitted, the pits being so close that a reticulate ornament is produced. The specific name given to this ostracod refers to the nature of the pits, which are 5–6 sided, in many cases with a large, circular, *normal pore canal* opening at the centre. *Left valve* larger than the right, which it overlaps along the ventral margin, in the region of the anterior cardinal angle and along the posterodorsal slope. Dorsal margin slightly convex, sloping to the posterior ; cardinal angles distinct. Anterior broadly rounded ; posterior more narrowly rounded. Ventral margin convex, incurved anteromedially. *Right valve* smaller, more elongate than the left, and with a noticeable dorsomedian convexity which projects above the dorsal margin. *Hinge*, as seen in a single right valve, rather poorly preserved, probably hemimerodont. *Inner margin* and *line of concrescence* coincide ; anterior *radial pore canals* long, slightly curved and grouped largely in the anteroventral sector ; exact number not seen but there appear to be about 10. *Muscle scars* of type C, as for genus.

Dimensions

HOLOTYPE. Io.1067, female carapace (Pl. 6, figs. 5–8), length 0·71 mm.; height 0·45 mm.; width 0·41 mm.

PARATYPES. Io.1068, juvenile carapace, length 0·61 mm.; height 0·35 mm.; width 0·31 mm. Io.1069, male carapace (Pl. 6, fig. 9), length 0·78 mm.; height 0·42 mm. (damaged) ; width 0·42 mm. Io.1070, female right valve (Pl. 6, fig. 4), length 0·61 mm.; height 0·35 mm.

REMARKS. *E. faveolata* appears to be closely related to *E. lacunosa* from which it differs only in the closeness of the surface pitting. In the latter species the pits are widely scattered over the shell surface. Here, however, the pits become so closely arranged that a reticulate ornament is produced. This type of reticulation is different from that described in *E. reticulata* sp. nov., where the ornament is produced by ridges rather than by pits. *E. faveolata* is not a common species, being found only at the localities mentioned for the type material.

Eocytheridea lacunosa Bate

1963*a* *Eocytheridea lacunosa* Bate : 36, pl. 8, figs. 6–11, pl. 9, figs. 1–8.

REMARKS. Although it seems probable that this species gave rise to *E. faveolata* in the Millepore Series, it is not entirely replaced by the latter, a single specimen (female dimorph) being found at the base of the Yons Nab Beds, Cayton Bay.

Eocytheridea reticulata sp. nov.

(Pl. 6, figs. 10, 11, Pl. 7, figs. 1–5)

DIAGNOSIS. *Eocytheridea* with fine reticulate ornament of obliquely transverse and longitudinal ridges.

HOLOTYPE. Io.1065, Millepore Oolite, Osgodby Nab.

PARATYPE. Io.1066, Kirton Cementstone Series, Greetwell Quarry, Lincolnshire (for locality see Bate 1963 : 177).

DESCRIPTION. *Carapace* subquadrate in the female dimorph, elongate in the male. Greatest length through midpoint ; greatest height in the anterior third ; greatest width in the posterior third. Shell surface reticulate. *Left valve* larger than the right, which it overlaps along the ventral margin and to a lesser extent in the region of the cardinal angles. Dorsal margin straight, sloping towards the posterior. Cardinal angles broadly rounded. Anterior and posterior margins uniformly rounded. Ventral margin convex, anteromedially incurved. *Right valve* smaller than the left, otherwise similar in outline. *Hinge* hemimerodont, only seen in the right valve (male dimorph), where there are 5 anterior and 6 posterior teeth, dorsally bifid. Median groove long and smooth. Other internal details not seen.

Dimensions

HOLOTYPE. Io.1065, female carapace (Pl. 6, figs. 10, 11, Pl. 7, figs. 1, 2), length 0·59 mm.; height 0·35 mm.; width 0·32 mm.

PARATYPE. Io.1066, male right valve (Pl. 7, figs. 3–5), length 0·70 mm.; height 0·34 mm.

REMARKS. Although only two specimens of this species have so far been found, they are sufficiently distinct as to be considered a separate species, differing from *E. faveolata* in size, in the dorsal margin (not strongly angled in the right valve) and in the reticulate ornament which is produced by ridges rather than by pitting.

Genus ***PRAESCHULERIDEA*** Bate 1963

Praeschuleridea subtrigona (Jones & Sherborn)

1888 *Cytheridea subtrigona* Jones & Sherborn : 265, pl. 2, fig. 9*a–c*.
1963 *Praeschuleridea subtrigona* (Jones & Sherborn) Bate : 207, pl. 12, figs. 12–16, pl. 13, figs. 1–9.
1963*a* *Praeschuleridea subtrigona* (Jones & Sherborn) ; Bate : 41.

REMARKS. Two subspecies of *Praeschuleridea subtrigona*, distinguished by the size of the adult carapace, are here recognized. They are : *P. subtrigona subtrigona* (Jones & Sherborn) and *P. subtrigona magna* subsp. nov.

Praeschuleridea subtrigona subtrigona (Jones & Sherborn)

SYNONYMY. As for the species.

DIAGNOSIS. A subspecies of *Praeschuleridea subtrigona* with oval-subtrigonal, punctate carapace. Length of adult carapace of the order of (female) 0·56 mm.; (male) 0·58 mm.

REMARKS. *P. subtrigona subtrigona*, when it occurs in a sediment, is very common, forming a large proportion of the ostracod fauna. It is present in the Cave Oolite, Eastfield Quarry, in the Whitwell Oolite, Seamer Lime and Stone Co's. Quarry and at Bulmer ; less certainly within the Millepore Oolite, Cloughton.

The instar at which dimorphism is fully developed is taken to represent the adult : as such the subspecies attains the same dimensions as recorded in Bate (1963 : 209). The maximum length of the female carapace is probably little more than 0·56 mm. and that of the male 0·58 mm. This is important, for, at many horizons throughout the Millepore Series, an ostracod virtually identical with *P. subtrigona subtrigona* occurs, having a maximum length of the order of 0·73 mm. for the female dimorph and 0·83 mm. for the male. The very slight differences which exist in the outline of this larger ostracod, for example, a slightly less steeply inclined and more convex dorsal margin in the left valve of the female dimorph, are probably related to the increase in size.

Only in one sample (out of a total of over 60) have the large and small specimens been found together, the presence of dimorphism in the smaller ostracod indicating that they are not simply young instars of the larger. This association is most probably due to the sample in this case taking in more than one bedding plane. The larger specimens are considered to be a separate subspecies of *P. subtrigona*, and are described below.

Praeschuleridea subtrigona magna subsp. nov.

(Pl. 7, figs. 6–11, Pl. 8, figs. 1–6)

DIAGNOSIS. A subspecies of *Praeschuleridea subtrigona* with oval-subtrigonal, punctate carapace. Normal pore canals prominent. Length of adult carapace of the order of (female) 0·73 mm., (male) 0·83 mm.

HOLOTYPE. Io.1077, Yons Nab Beds (bed 7, Bate 1959 : 158), Cayton Bay.

PARATYPES. Io.1078–87, Io.1139–49, horizon and locality as above, and from the Whitwell Oolite, Seamer Lime and Stone Co's. Quarry, and the Upper Limestone, Stonecliff Wood.

DESCRIPTION. Carapace ovoid-subtrigonal, strongly dimorphic, the males being quite elongate. Shell surface very finely punctate with large, circular, *normal pore canals* prominent. The oblique swelling, which probably represents an eye swelling in this species, is here only well developed in the right valve of the male dimorph ; it is barely discernible in the right valve of the female, and not at all in the left valve of either sex. Greatest length passes through midpoint ; greatest height and width median. *Left valve* larger than right, which it overlaps along the ventral margin and overreaches along the dorsal margin and around the anterior. Dorsal margin short, slightly convex, sloping posteriorly. Anterior cardinal angle at valve middle, giving the dorsal outline an " umbonate " appearance ; posterior cardinal angle may be rounded or sharply distinct. Ventral margin convex ; anterior and posterior margins rounded. *Right valve* more elongate than the left with distinct cardinal angles. Both valves possess a shallow groove which extends around the anterior margin, giving the impression of an outer rim. *Hinge* paleohemimerodont with 6, dorsally bifid, terminal teeth in the right valve and elongate, coarsely loculate sockets connected by a median groove in the left. *Inner margin* and *line of concrescence* coincide ; anterior radial pore canals few in number and curved, approximately 10 anteriorly and 4 posteriorly. *Muscle scars*, type C : anteromedian antennal scar rounded.

Dimensions

HOLOTYPE. Io.1077, female carapace (Pl. 7, figs. 6–9), length 0·73 mm.; height 0·48 mm.; width 0·40 mm.

PARATYPES. Io.1078, male carapace (Pl. 8, figs. 1–4), length 0·80 mm.; height 0·48 mm.; width 0·36 mm. Io.1079, female carapace (Pl. 8, figs. 5, 6), length 0·64 mm.; height 0·43 mm.; width 0·34 mm. Io.1080, female left valve (Pl. 7, fig. 11), length 0·70 mm.; height 0·45 mm. Io.1087, male carapace, length 0·83 mm.; height 0·49 mm.; width 0·43 mm.

REMARKS. *P. subtrigona magna* is very close to *P. subtrigona subtrigona* but differs primarily in respect of size, although the former tends to be more ovoid in outline, without the strong posterior angularity of the latter. Smaller specimens of *P. subtrigona magna* do show a greater degree of angularity, however. The female dimorphs of this new subspecies are very similar externally to *Asciocythere lacunosa* Bate (1963*a* : 34, pl. 6, figs. 3–9, pl. 7, figs. 1–6), from which they can be distinguished

by the more distinctly " umbonate " dorsal outline and tapered posterior margin, the latter being rather flattened in *A. lacunosa*. Internally the two ostracods are easily distinguishable by the type of hinge present.

P. subtrigona magna occurs largely in the shales and impure oolites of the Millepore Series as exposed in the north western and north eastern outcrops, and may well have favoured the lower salinity which was almost certainly present close to the delta. It is a very abundant ostracod, and like the other subspecies, forms the bulk of the ostracod fauna when present.

Praeschuleridea ventriosa (Plumhoff)

1963 *Procytheridea ? ventriosa* Plumhoff : 36.
1963 *Procytheridea ventriosa* Plumhoff ; Fischer : 298, text-fig. 2.

REMARKS. As mentioned in Bate (1963*a* : 46), although Plumhoff (1963 : 36) attributes the species *Procytheridea ? ventriosa* to Fischer, the fact that Fischer's publication (1963) was still in press at that time, means that the species name must be attributed to Plumhoff.

Praeschuleridea ventriosa ventriosa (Plumhoff)

1962 Ostracod No. 101 Klinger : 78, 115, pl. 11*a*, fig. 3, pl. 14, fig. 57, table 7.
1962 Ostracod No. 101 Klingler ; Brand & Fahrion : 127, pl. 16 (fauna 1), fig. 2, ? (fauna 6) fig. 6, pl. 17 (fauna 9), fig. 7 (non pl. 20, fig. 10).
1963 *Procytheridea ? ventriosa ventriosa* Plumhoff : 36, pl. 6, figs. 95–98.
1963*a* *Praeschuleridea ventriosa ventriosa* (Plumhoff) Bate : 39, pl. 10, figs. 8–13, pl. 11, figs. 1–9, pl. 12, figs. 1–4, 7, 8.

REMARKS. Three carapaces (2 male and 1 female) have been found at the base of the Yons Nab Beds, Cayton Bay. This species has not, so far, been found elsewhere in the Millepore Series.

The illustrations of ostracod No. 101 Klingler ; Brand & Fahrion (1962, pl. 16, (fauna 6) fig. 6, and pl. 17, (fauna 9) fig. 7), are such that it is impossible to state with certainty that they are of this species. Fig. 10, pl. 20, is most definitely not conspecific. The examination of Fischer's material A.R.1110/186–187 kindly lent by Dr. F. Westphal, Tübingen, has shown that his *Procytheridea ventriosa* (1963 : 298, text-fig. 2) belongs to the subspecies *Praeschuleridea ventriosa angulata* (Plumhoff 1963 : 36, pl. 6, figs. 99–100 ; pl. 7, figs. 101–103).

Family **CYTHERURIDAE** Müller 1894

Genus ***CYTHEROPTERINA*** Mandelstam 1956

Cytheropterina plana sp. nov.

(Pl. 8, figs. 7–10, Pl. 9, figs. 1–4)

DIAGNOSIS. *Cytheropterina* without ornamentation.

HOLOTYPE. Io.1088, Millepore Oolite, Cloughton Wyke.

PARATYPES. Io.1089–92, horizon and locality as above, and from the Upper Limestone, Stonecliff Wood ; and the Yons Nab Beds, Cayton Bay.

DESCRIPTION. *Carapace* convex in dorsal view, oval in lateral view. Sexual dimorphism indicated by the more elongate males. Greatest length below mid-point ; greatest height and width median. Shell surface smooth. Left valve larger than the right, which it overlaps slightly along the ventral margin and strongly overreaches along the dorsal margin. Dorsal margin in both valves convex ; arched in the female dimorph, elongate in the male. Cardinal angles rounded. Anterior rounded ; posterior triangular with a strongly concave posterodorsal slope and a convex posteroventral slope. Ventral margin convex ; ventrolateral margin alaeform, extending below the ventral surface. Internal details not seen.

Dimensions

HOLOTYPE. Io.1088, female carapace (Pl. 8, figs. 7–10), length 0·47 mm.; height 0·34 mm.; width 0·32 mm.

PARATYPES. Io.1089, male carapace (Pl. 9, figs. 1–4), length 0·60 mm.; height 0·36 mm.; width 0·35 mm. Io.1090, female carapace, length 0·44 mm.; height 0·33 mm.; width 0·31 mm. Io.1091, female carapace, length 0·37 mm.; height 0·25 mm.; width 0·27 mm.

REMARKS. *C. plana* is close to *C. triebeli* Neale (1962 : 437, pl. 3, fig. 7, pl. 4, figs. 1–4, pl. 12, fig. 33), but differs in being less elongate in outline, with the alae not backwardly projected, and lacking the ventral ornamentation present in *C. triebeli*. *C. plana* is also dimorphic. *Cytheropteron purum* Schmidt (1954 : 88, pl. 5, figs. 3–6, pl. 7, figs. 25–29, pl. 8, figs. 30, 31) is also very close to *C. plana*, but is more elongate in outline, the latter having a greater shell height in proportion to length than *C. purum*. *C. plana* is an uncommon species, found only in the Millepore Oolite and in the Yons Nab Beds and Upper Limestone.

Family **PROTOCYTHERIDAE** Ljubimova 1955

Subfamily **KIRTONELLINAE** Bate 1963

Genus ***KIRTONELLA*** Bate 1963

Kirtonella plicata Bate

1963 *Kirtonella plicata* Bate : 210, pl. 13, figs. 10–19, pl. 14, figs. 1–6, 11, 12.
1963*a* *Kirtonella plicata* Bate ; Bate : 43.

REMARKS. Two specimens, a complete carapace and a right valve, both female dimorphs, have been found in a sandy limestone (bed 7, Bate 1959 : 158) towards the top of the Yons Nab Beds, Cayton Bay.

Kirtonella reticulata sp. nov.

(Pl. 9, figs. 5–15, Pl. 10, figs. 1–2)

DIAGNOSIS. *Kirtonella* with strongly reticulate ornament.

HOLOTYPE. Io.1093, Yons Nab Beds (bed 2, Bate 1959 : 159), Cayton Bay.

PARATYPES. Io.1094–1102, horizon and locality as above, from the Millepore Oolite, Osgodby Nab and Cloughton ; and the Whitwell Oolite, Seamer Lime and Stone Co's. Quarry.

DESCRIPTION. *Carapace* subquadrate in side view, narrow in dorsal view with a slight median constriction, tapering more strongly to the posterior in the female dimorph, male elongate. Greatest length passes through midpoint, greatest height in the anterior third, greatest width in the posterior third. Anterior high, broadly rounded ; posterior tapering, triangular with a concave posterodorsal slope and a convex posteroventral slope. Dorsal margin slightly concave in the left valve, convex in the right ; cardinal angles broadly rounded. Ventral margin incurved anteromedially. Ventrolateral margin of both valves extends below the ventral surface, particularly posteroventrally. Shell surface strongly reticulate, the pits produced being 5–6 sided. The reticulate ornament is arranged in the form of longitudinal wrinkles in the ventral and ventrolateral regions. A distinct eye swelling is present to one side of the anterior cardinal angle. The *muscle scars* appear externally as smooth, upstanding prominences on the carapace, indicating a subvertical row of 4 adductor scars with an anterodorsal antennal scar and an anteroventral mandibular scar. The shape of the antennal scar cannot, however, be made out. The left valve is larger than the right, which it overlaps along the ventral margin and overreaches along the dorsal margin. *Hinge* antimerodont : left valve with terminal loculate sockets and a denticulate median bar, accommodation groove shallow. Right valve with approximately 5 terminal teeth, median groove tending to be overhung by the dorsal margin of the valve. *Inner margin* and *line of concrescence* coincide ; *radial pore canals* straight, simple and widely spaced, approximately 10 anteriorly and 5 posteriorly.

Dimensions

HOLOTYPE. Io.1093, female carapace (Pl. 9, figs. 5–8), length 0·54 mm.; height 0·32 mm.; width 0·27 mm.

PARATYPES. Io.1094, female left valve (Pl. 9, fig. 16), length 0·51 mm.; height 0·33 mm. Io.1095, female right valve (Pl. 10, figs. 1, 2), length 0·51 mm.; height 0·29 mm. Io.1096, male carapace (Pl. 9, figs. 10–13), length 0·55 mm.; height 0·31 mm.; width 0·26 mm. Io.1097, male carapace, length 0·66 mm.; height 0·34 mm.; width 0·32 mm. Io.1098, female carapace (Pl. 9, figs. 14, 15), length 0·48 mm.; height 0·28 mm.; width 0·26 mm. Io.1099, female carapace (Pl. 9, fig. 9), length 0·50 mm.; height 0·30 mm.; width 0·26 mm.

REMARKS. *K. reticulata* can be distinguished from *K. plicata* by its ornament. It is common within the shale facies of the Yons Nab Beds, fairly common, when present, in the Millepore Oolite (Osgodby Nab), but rare in the Millepore Oolite of Cloughton and the Whitwell and Cave Oolites.

Genus ***EKTYPHOCYTHERE*** Bate 1963

Ektyphocythere triangula (Brand)

1961 *Procytheridea triangula* Brand : 161, pl. 1, figs. 11–14.
1962 *Procytheridea triangula* Brand ; Brand & Fahrion : 129, 133, pl. 17 (fauna 9), fig. 9, pl. 20, figs. 27, 28.
1963 *Ektyphocythere triangula* (Brand) Bate : 214, pl. 15, figs. 5–18.
1963*a* *Ektyphocythere triangula* (Brand) ; Bate : 44.

Remarks. This ostracod is more frequently encountered in the Cave Oolite than elsewhere in the Millepore Series. It is not, however, common and shows a marked decrease compared to the numbers present in the Lower Lincolnshire Limestone. *E. triangula* occurs also in the Whitwell Oolite (Seamer Lime and Stone Co's. Quarry, and near Bulmer), Millepore Oolite (Cloughton), and at the base of the Yons Nab Beds, Cayton Bay.

Genus ***SOUTHCAVEA*** nov.

Diagnosis. Kirtonellinae with oval subquadrate carapace, ventrolateral border slightly overhanging ventral margin. Shell surface variously ornamented. Species may be dimorphic. Hinge hemimerodont/antimerodont : median hinge bar of left valve very finely denticulate along dorsal surface, in lateral view apparently smooth. Muscle scars as for family. Inner margin and line of concrescence coincide ; radial pore canals straight, 8–10 anteriorly. Left valve larger than right.

Type Species. *Southcavea reticulata* sp. nov.

Remarks. The genus (feminine) takes its name from South Cave, the locality of the type species. Three species are placed in it : *S. bajociana* (Bate 1963) ; *S. grandis* sp. nov., and *S. reticulata* sp. nov. The nature of the hinge is such that in most specimens it appears to be hemimerodont, but it is antimerodont in two species. However, as the denticulation of the median bar, left valve, is so fine as to be barely distinguishable, the presence of a species with a truly hemimerodont hinge within the genus is not ruled out.

Southcavea reticulata sp. nov.

(Pl. 10, figs. 3–14, Pl. 11, figs. 1–4)

Diagnosis. *Southcavea* with coarse reticulate ornament superimposed upon a punctate shell surface.

Holotype. Io.1103, Cave Oolite, Eastfield Quarry.

Paratypes. Io.1104–17, and Io.1138, horizon and locality as above, and from the Millepore Oolite, Osgodby Nab ; Whitwell Oolite, Seamer Lime and Stone Co's. Quarry, and from the Cementstone Series of the Lower Lincolnshire Limestone, Kirton Lindsey, Lincolnshire (for locality see Bate, 1963 : 177).

Description. *Carapace* subquadrate in side view, convex in dorsal view. Dimorphism strongly developed, the more elongate specimens considered to be males. Greatest length passes through midpoint, greatest height in the anterior third, though because of the convexity of the ventrolateral margin this may be just behind valve middle in the male dimorph the greatest height is in fact behind valve middle. Greatest width in both dimorphs in the posterior half. Dorsal margin slightly concave in the left valve, convex in the right ; cardinal angles broadly rounded ; anterior and posterior rounded ; ventral margin anteromedially incurved ; ventrolateral margin convex, overhanging the ventral surface, particularly just behind valve middle. Shell surface coarsely reticulate, the network of

ridges producing rather large, shallow, irregularly sided pits which are strongly punctate. Ventral surface ornamented with longitudinal ridges which converge towards the posterior. Left valve larger than the right, which it overlaps evenly along the ventral margin, and overreaches along the antero- and postero-dorsal slopes. *Hinge* antimerodont ; left valve with terminal loculate sockets and a broad, very finely denticulate, median bar. Accommodation groove virtually absent, represented by a narrow ledge. In the right valve the hinge has not been clearly seen, except for the median groove which is here overhung by the dorsal edge of the valve. *Muscle scars* of type D, consisting of a subvertical row of 4 adductor scars with an anterodorsal, V-shaped antennal scar, and a small, rounded, anteroventral mandibular scar. *Inner margin* and *line of concrescence* coincide, the duplicature being quite broad. Radial pore canals straight ; anteriorly widely spaced and about 8 in number ; 3 posteriorly.

Dimensions

HOLOTYPE. Io.1103, female left valve (Pl. 10, figs. 3–6), length 0·54 mm.; height 0·34 mm.

PARATYPES. Io.1104, male left valve (Pl. 10, fig. 13), length 0·60 mm.; height 0·33 mm. Io.1105, female carapace (Pl. 10, figs. 8–11), length 0·48 mm.; height 0·31 mm.; width 0·32 mm. Io.1106, female left valve (Pl. 10, fig. 14), length 0·49 mm.; height 0·30 mm. Io.1107, female right valve (Pl. 10, fig. 12), length 0·51 mm.; height 0·30 mm. Io.1108, female left valve, length 0·51 mm.; height 0·31 mm. Io.1109, male left valve (Pl. 10, fig. 7), length 0·62 mm.; height 0·32 mm. Io.1110, male carapace (Pl. 11, figs. 1–4), length 0·65 mm.; height 0·37 mm.; width 0·36 mm.

REMARKS. *S. reticulata* is quite common in the Cave Oolite, but very rare elsewhere at this horizon, only one specimen having been found in the Whitwell Oolite (Seamer Lime and Stone Co's. Quarry), and 2 specimens from the Millepore Oolite (Osgodby Nab). The species is also present in the Lower Lincolnshire Limestone (Kirton Cementstone Series), Kirton Lindsey (for locality see Bate, 1963), where it is, however, very rare.

In common with many other species of ostracod, female dimorphs outnumber males, of which only 3 specimens have been found.

Southcavea bajociana (Bate)

1963*a* *Kinkelinella* ? *bajociana* Bate : 44, pl. 13, figs. 12–19.

REMARKS. This species when first described was tentatively placed in the genus *Kinkelinella* Martin (1960 : 130). However, through the kindness of Dr. E. Triebel, I have since been able to examine paratype material of the type species, *K. tenuicostati* Martin (1960 : 131, pl. 12, figs. 12–15). The latter is almost alaeform with regard to its ventrolateral extension, whilst the anterior and posterior marginal borders are strongly delimited from the central inflation of the valve. These two characters, not particularly clear in the original illustration, are sufficient to remove the present species from the genus.

S. bajociana was originally considered to possess a hemimerodont hinge. Subsequently a complete carapace has been opened, using an ultrasonic vibrator. Although the median groove in the right valve appears to be smooth, the median bar in the left valve possesses very fine denticles along its dorsal surface. The hinge is, therefore, considered to be antimerodont.

Southcavea grandis sp. nov.

(Pl. 11, figs. 5–13, Pl. 12, fig. 1)

DIAGNOSIS. *Southcavea* with elongate-subquadrate carapace. Ornament uniformly reticulate. Radial pore canals short, straight, anteriorly 7–8 in number.

HOLOTYPE. Io.1119, Cave Oolite, Eastfield Quarry.

PARATYPES. Io.1120–22, horizon and locality as above, and from the Whitwell Oolite, nr. Bulmer.

DESCRIPTION. *Carapace* elongate-subquadrate in side view, with a strong, uniformly reticulate ornament. Greatest length through midpoint, greatest height median or slightly behind midpoint, greatest width in the posterior third. Ventrolateral border convex, overhanging the ventral surface, particularly behind valve middle. Left valve larger than the right, which it overlaps along the ventral margin and overreaches along the dorsal margin. Dorsal margin in both valves slightly convex with broadly rounded cardinal angles. Anterior broadly rounded, posterior more narrowly rounded. Ventral margin medially incurved. *Hinge* not determined. *Muscle scars* consist of a subvertical row of 4 oval adductor scars, a V-shaped anterodorsal antennal scar, and a rounded anteroventral mandibular scar. The antennal scar is produced by the fusion of a large, elongate-oval scar and a small scar situated anteroventrally to it. *Inner margin* and *line of concrescence* coincide, *duplicature* rather narrow ; anterior *radial pore canals* short, straight, and about 7–8 in number.

Dimensions

HOLOTYPE. Io.1119, carapace (Pl. 11, figs. 5–7, 13), length 0·70 mm. ; height 0·42 mm. ; width 0·42 mm.

PARATYPE. Io.1120, carapace (Pl. 11, figs. 8–11), length 0·55 mm. ; height 0·36 mm. ; width 0·34 mm.

REMARKS. *S. grandis* is a rare ostracod confined, so far, to the Cave Oolite and the Whitwell Oolite (Bulmer). This species is considerably larger than the others placed in the genus, from which it also differs in the possession of a uniformly reticulate ornament, lacking the punctae of *S. reticulata*.

Genus ***SYSTENOCYTHERE*** Bate 1963

Systenocythere exilofasciata Bate

1963 *Systenocythere exilofasciata* Bate : 212, pl. 14, figs. 7–10, 13–17, pl. 15, figs. 1–4.
1963*a* *Systenocythere exilofasciata* Bate ; Bate : 45.

REMARKS. This ostracod is fairly well represented throughout the Cave and Whitwell Oolites. It is noticeably reduced numerically in the Millepore Oolite and

in the Yons Nab Beds and Upper Limestone. As the restriction of this species does not appear to be directly related to facies, it might well be that a decrease in salinity resulting from the proximity of the northern delta had a restricting effect.

Systenocythere ? sp.

(Pl. 12, figs. 2–5)

REMARKS. A single carapace, found in the Whitwell Oolite, Stonecliff Wood, with a punctate surface is similar in outline to the female dimorphs of *Systenocythere exilofasciata*, from which it can be distinguished by surface ornamentation.

Dimensions

Io.1118, carapace (Pl. 12, figs. 2–5), length 0·57 mm. ; height 0·36 mm. ; width 0·36 mm.

INCERTAE SEDIS

A number of ostracods occur within the Millepore Series as complete carapaces only, no internal details being known. These ostracods are accordingly not assigned to any genus, but are merely identified by their registration numbers.

Io.1123–25, Pl. 12, figs. 6–11.

REMARKS. Carapace ovoid, dimorphic ; surface smooth, although in Io.1125 the shell surface possesses irregular transverse wrinkles. A characteristic feature of this species is the deep furrow which runs obliquely below the anterior cardinal angle. This is a rare ostracod which so far has been found only within the Millepore Oolite of Yons Nab, and the Whitwell Oolite at Westow.

Dimensions

Io.1123, female carapace (Pl. 12, figs. 6–9), length 0·62 mm. ; height 0·43 mm. ; width 0·41 mm. Io.1124, male carapace, length 0·70 mm. ; height 0·42 mm. ; width 0·40 mm. Io.1125, male carapace (Pl. 12, figs. 10, 11), length 0·74 mm. ; height 0·40. ; width 0·44 mm.

Io.1126–7 & Io.1150, Pl. 13, figs. 1–4.

REMARKS. Only 3 specimens (2 carapaces and a right valve) of this ostracod have so far been found, and all are from the Cave Oolite. In outline they are very close to *Orthonotacythere ? voigteiensis* Bartenstein & Brand (1959 : 232, pl. 29, fig. 7*a–c*), but do not possess its ornamentation.

Dimensions

Io.1127, carapace (Pl. 13, figs. 1–4), length 0·55 mm. ; height 0·35 mm. ; width 0·37 mm.

Io.1128 and Io.1151, Pl. 13, figs. 5–8.

REMARKS. Two carapaces found in the Millepore Oolite, Cayton Bay, have parallel-sided carapaces and a weak reticulate ornament. They may belong to the genus *Homocytheridea* Bate 1963*a*.

Dimensions

Io.1128, carapace (Pl. 13, figs. 5–8), length 0·71 mm. ; height 0·32 mm. ; width 0·36 mm.

Io.1129–31, Pl. 13, figs. 9–12.

Remarks. Carapace subquadrate with the greatest height behind valve centre. Dimorphic, the female possessing a marked swelling in the region of the posterior cardinal angle. This ostracod is largely restricted to the Millepore Oolite and Yons Nab Beds, but has been found in the Whitwell Oolite. It is never common.

Dimensions

Io.1129, female carapace (Pl. 13, figs. 11, 12), length 0·68 mm. ; height 0·41 mm. ; width 0·40 mm. Io.1130, male carapace (Pl. 13, figs. 9, 10), length 0·83 mm. ; height 0·43 mm. ; width 0·44 mm.

Io.1132–3, Pl. 14, figs. 1–4.

Remarks. A large, oval ostracod in which the greatest height of the carapace is median and the anterior is more narrowly rounded than the posterior. Left valve larger than the right, with a flap of the right valve overlapping the left midventrally. Two specimens have been found, one in the Whitwell Oolite, Seamer Lime and Stone Co's. Quarry (figured), and the other from the Yons Nab Beds, Cayton Bay.

Dimensions

Io.1132, carapace (Pl. 14, figs. 1–4), length 0·98 mm. ; height 0·51 mm. ; width 0·48 mm.

Io.1134, Pl. 14, figs. 5–8.

Remarks. A single carapace, strongly punctate, found in the uppermost part of the Millepore Oolite, Cayton Bay.

Dimensions

Io.1134, carapace (Pl. 14, figs. 5–8), length 0·65 mm. ; height 0·40 mm. ; width 0·39 mm.

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EXPLANATION OF PLATES

All the specimens illustrated are now in the Department of Palaeontology, British Museum (Natural History). All photographs, taken by the author, × 85 unless otherwise indicated.

PLATE 1

Fuhrbergiella (*Praefuhrbergiella*) *minima* sp. nov. . . p. 11

All from Millepore Oolite, Cloughton Wyke.

FIGS. 1–4. Right, left, dorsal and ventral views, female carapace. Holotype, Io. 1021.

FIGS. 5–8. Left, right, dorsal and ventral views, male carapace. Paratype, Io. 1035.

Micropneumatocythere globosa sp. nov. . . . p. 12

FIGS. 9–16. Cave Oolite, Eastfield Quarry.

FIGS. 17–20. Millepore Oolite, Yons Nab.

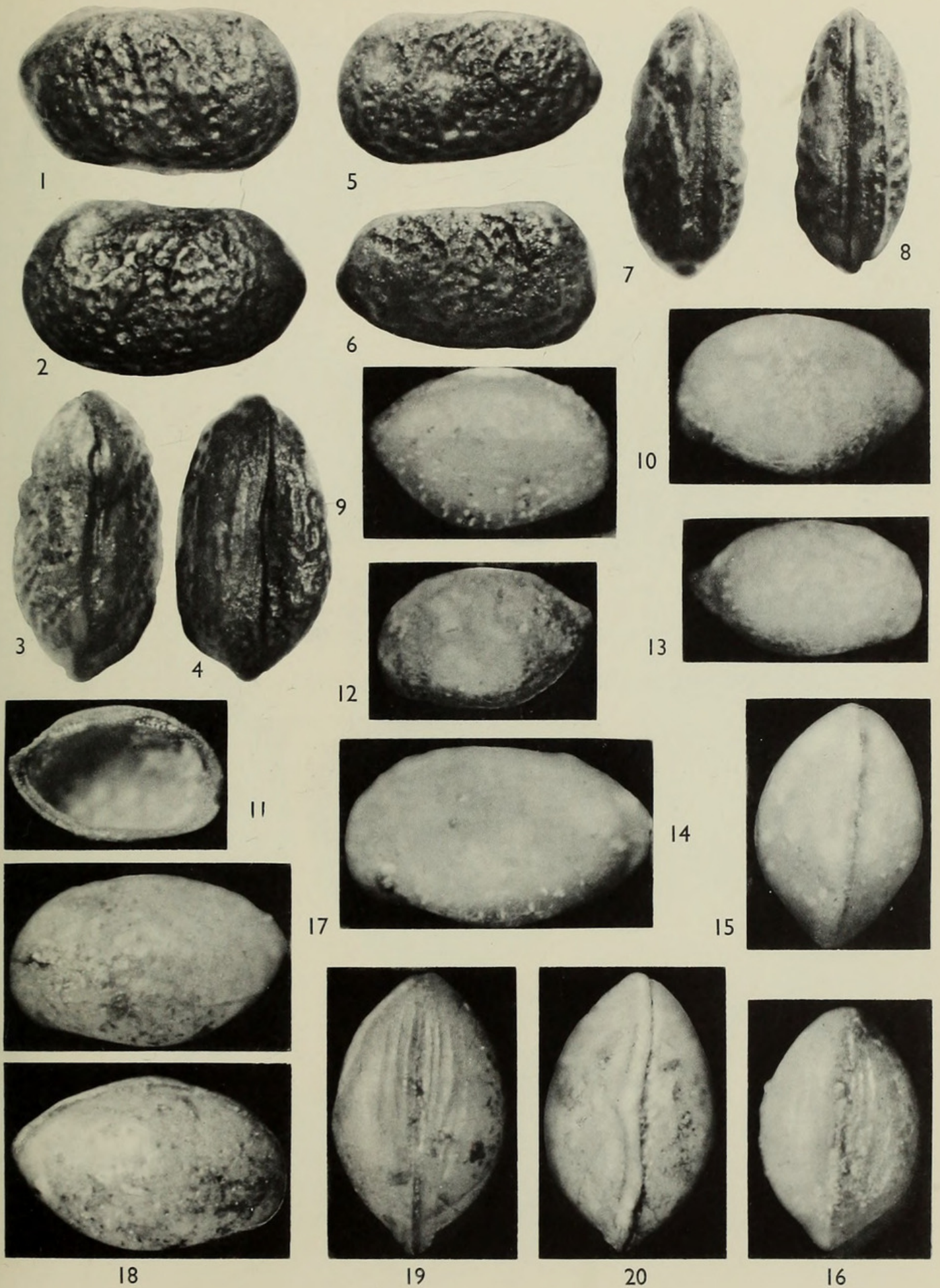
FIGS. 9, 10, 15, 16. Right, left, dorsal and ventral views, female carapace. Holotype, Io. 1010.

FIGS. 11, 12. Internal and external views, female left valve. Paratype. Io. 1012.

FIG. 13. External view, female right valve. Paratype, Io. 1014.

FIG. 14. External view, male left valve. Paratype, Io. 1013.

FIGS. 17–20. Left, right, ventral and dorsal views, male carapace. Paratype, Io. 1011.



FUHRBERGIELLA, MICROPNEUMATOCYTHERE

PLATE 2

Pneumatocythere carinata sp. nov. . . . . p. 13

FIGS. 1–4. Upper Limestone, Stonecliff Wood.

FIGS. 5–9. Cave Oolite, Eastfield Quarry.

FIGS. 1–4. Left, right, dorsal and ventral views, female? carapace. Holotype, Io. 1024.

FIGS. 5, 6. Internal and external views, female? left valve. Paratype, Io. 1029.

FIGS. 7, 9. Dorsal and lateral views of median hinge bar, female? left valve. Fig. 7 × 106. Paratype, Io. 1030.

FIG. 8. Muscle scars, female? left valve. Paratype, Io. 1028. × 200.

Asciocythere acuminata sp. nov. . . . . p. 15

Cave Oolite, Eastfield Quarry.

FIGS. 10–12. Right, left and dorsal views of complete carapace. Holotype, Io. 1072.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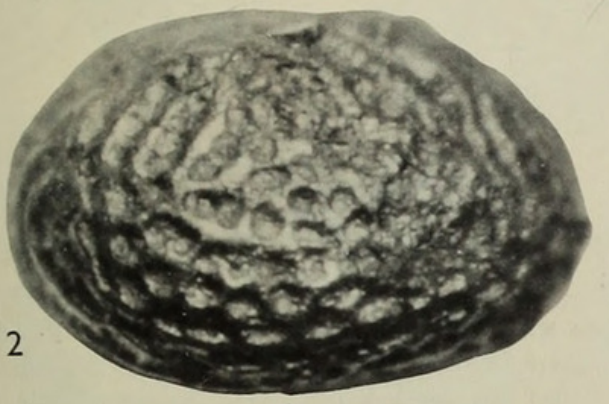
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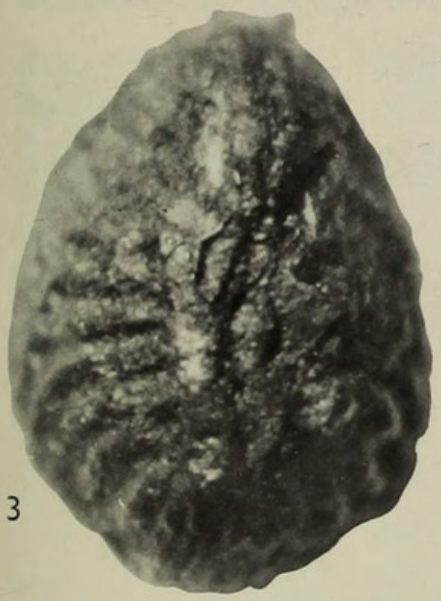
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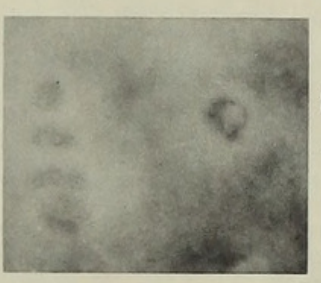
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PNEUMATOCYTHERE, ASCIOCYTHERE

PLATE 3

Asciocythere acuminata sp. nov. . . . . p. 15

FIGS. 1–3. Cave Oolite, Eastfield Quarry.

FIGS. 4, 5, 9, 10. Upper Limestone, Stonecliff Wood.

FIGS. 6–8. Basement Beds, Eastfield Quarry.

FIG. 1. Ventral view, complete carapace. Holotype, Io. 1072.

FIGS. 2, 3. External and internal views, right valve. Paratype, Io. 1075.

FIGS. 4, 5, 9, 10. Left, right, dorsal and ventral views, complete carapace. Paratype, Io. 1073.

FIGS. 6–8. Left side, muscle scars and right side of complete carapace. Paratype, Io. 1074.

Eocytheridea ? acuta sp. nov. . . . . p. 16

Upper Limestone, Stonecliff Wood.

FIGS. 11–14. Dorsal, ventral, left and right views, complete carapace. Holotype, Io. 1036.


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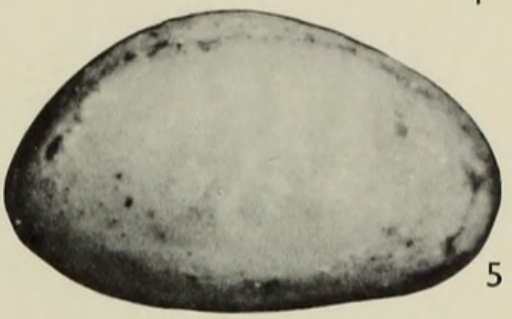
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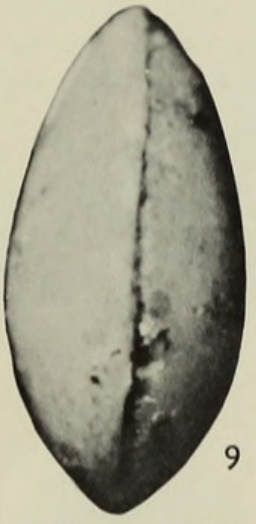
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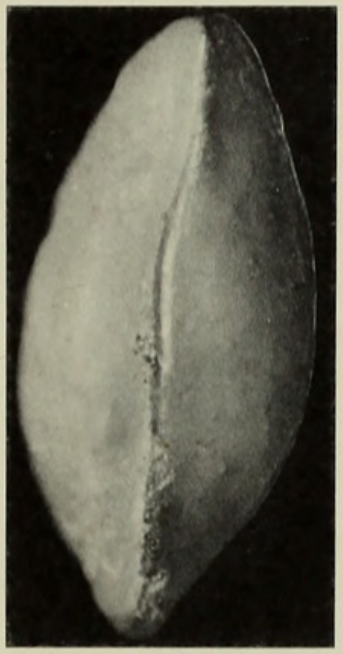
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ASCIOCYTHERE, EOCYTHERIDEA

PLATE 4

Eocytheridea ? astricta sp. nov. . . . . p. 17

FIGS. 1–4. Upper Limestone, Stonecliff Wood.

FIG. 5. Basement Beds, Eastfield Quarry.

FIGS. 1–4. Left, right, dorsal and ventral views, complete carapace. Holotype, Io. 1040.

FIG. 5. Muscle scars, juvenile carapace. Paratype, Io. 1044. ×480.

Eocytheridea carinata sp. nov. . . . . p. 18

Cave Oolite, Eastfield Quarry.

FIG. 6. External view, female left valve. Paratype, Io. 1051.

FIGS. 7–10. Left, right, dorsal and ventral views, juvenile carapace. Paratype, Io. 1052.

FIG. 11. External view, male right valve. Paratype, Io. 1050.

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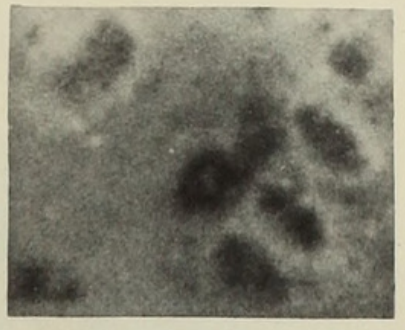

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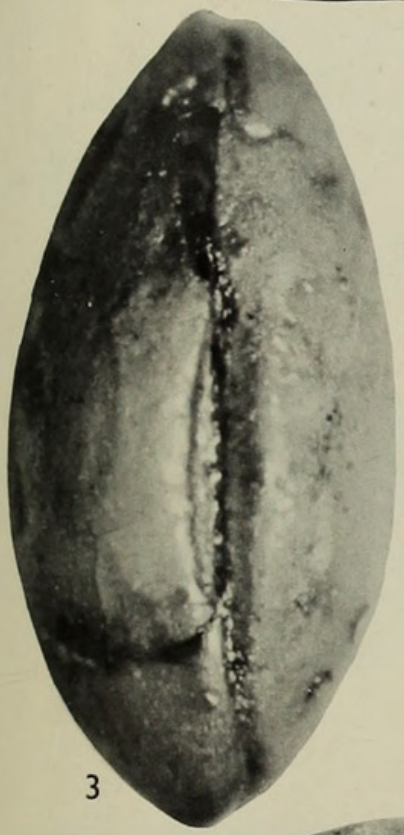

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PLATE 5

Eocytheridea carinata sp. nov. . . . . p. 18

FIGS. 1–4. Whitwell Oolite, Bulmer.

FIGS. 5–8. Cave Oolite, Eastfield Quarry.

FIGS. 1–4. Right, left, dorsal and ventral views, female carapace. Holotype, Io. 1048

FIGS. 5–8. Right, left, dorsal and ventral views, male carapace. Paratype, Io. 1054.

Eocytheridea ? erugata sp. nov. . . . . p. 19

FIGS. 9–11. Yons Nab Beds, Yons Nab.

FIG. 12. Basement Beds, Eastfield Quarry.

FIGS. 9–11. Right, left and ventral views, complete carapace. Holotype, Io. 1059.

FIG. 12. Right side of complete juvenile carapace. Paratype, Io. 1060.

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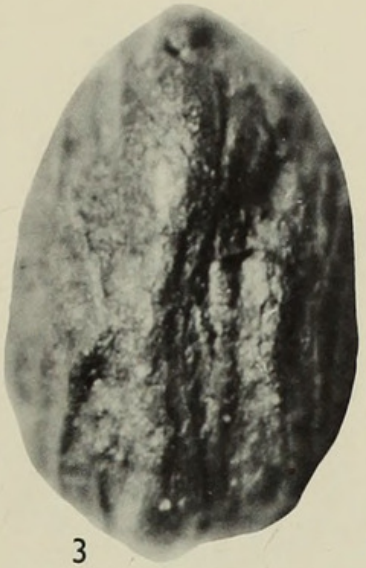

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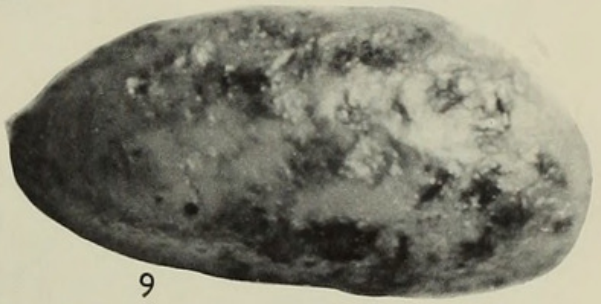

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EOCYTHERIDEA

PLATE 6

Eocytheridea ? erugata sp. nov. . . . . p. 19

Basement Beds, Eastfield Quarry.

FIGS. 1–3. Left, dorsal and ventral views, juvenile carapace. Paratype, Io. 1060.

Eocytheridea faveolata sp. nov. . . . . p. 20

FIG. 4. Cave Oolite, Eastfield Quarry.

FIGS. 5–8. Yons Nab Beds, Yons Nab.

FIG. 9. Whitwell Oolite, Seamer Lime and Stone Co's. Quarry.

FIG. 4. External view, female right valve. Paratype, Io. 1070.

FIGS. 5–8. Right, left, dorsal and ventral views, female carapace. Holotype, Io. 1067.

FIG. 9. Right side, male carapace. Paratype, Io. 1069.

Eocytheridea reticulata sp. nov. . . . . p. 21

Millepore Oolite, Osgodby Nab.

FIGS. 10, 11. Left and right views, female carapace. Holotype, Io. 1065.

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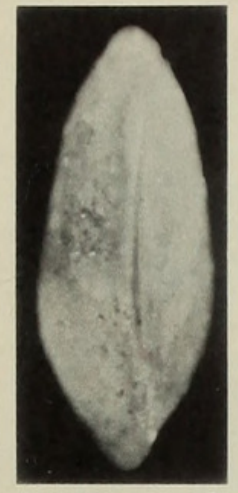

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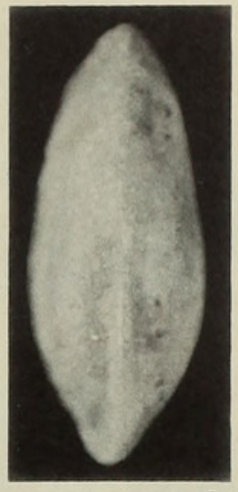

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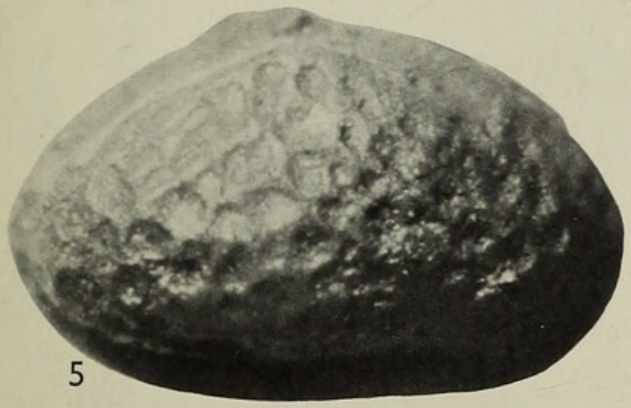

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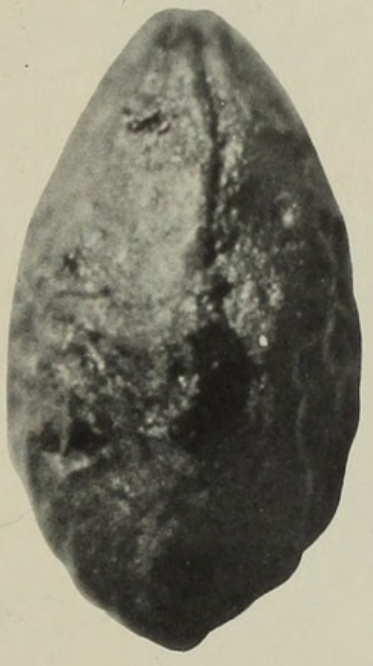

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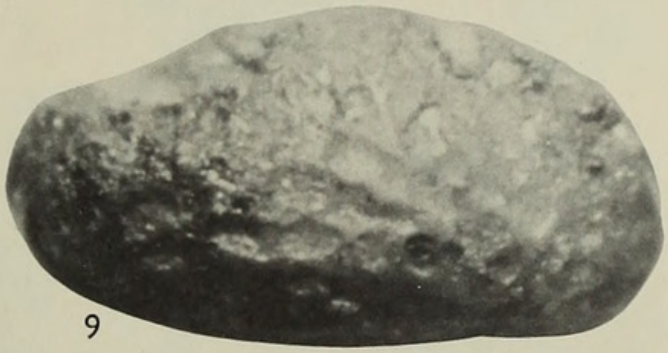

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EOCYTHERIDEA

PLATE 7

Eocytheridea reticulata sp. nov. . . . . p. 21

FIGS. 1, 2. Millepore Oolite, Osgodby Nab.

FIGS. 3–5. Kirton Cementstone Series, Lower Lincolnshire Limestone, Greetwell Quarry, Lincoln.

FIGS. 1, 2. Ventral and dorsal views, female carapace. Holotype, Io. 1065.

FIGS. 3–5. External, internal and dorsal views, male right valve. Paratype, Io. 1066.

Praeschuleridea subtrigona magna subsp. nov. . . . p. 23

FIGS. 6–10. Yons Nab Beds, Yon Nab.

FIG. 11. Whitwell Oolite, Seamer Lime and Stone Co's. Quarry.

FIGS. 6–9. Right, left, dorsal and ventral views, female carapace. Holotype, Io. 1077.

FIG. 10. Muscle scars, male carapace. Paratype, Io. 1082. ×200.

FIG. 11. Anterior radial pore canals, female left valve. Paratype, Io. 1080. ×150.


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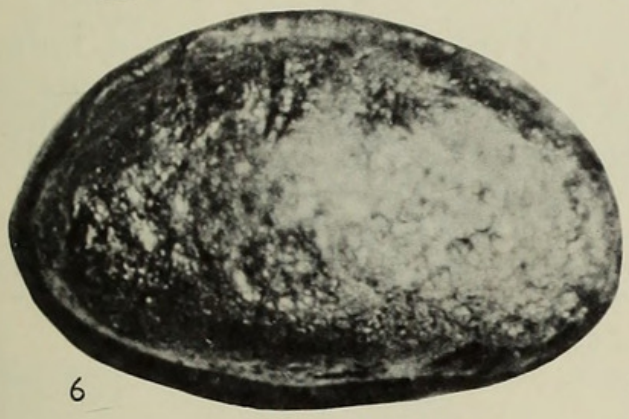
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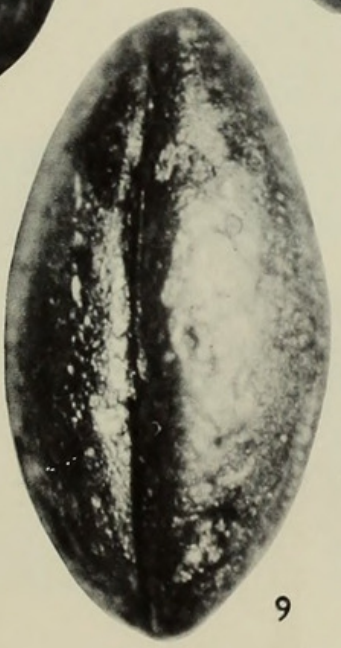
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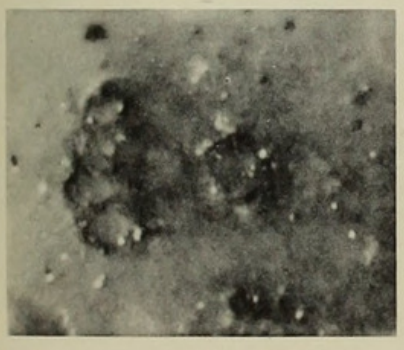
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EOCYTHERIDEA, PRAESCHULERIDEA

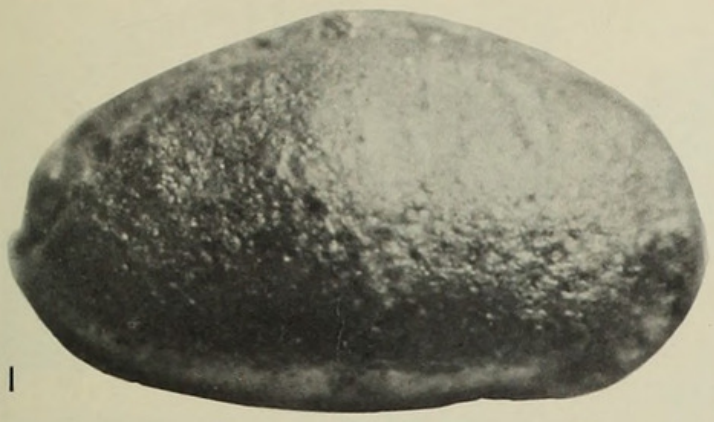
PLATE 8

Praeschuleridea subtrigona magna subsp. nov. . . . p. 23
Yons Nab Beds, Yons Nab.

FIGS. 1–4. Right, left, dorsal and ventral views, male carapace. Paratype, Io. 1078.
FIGS. 5, 6. Right and left views of female carapace. Paratype, Io. 1079.

Cytheropterina plana sp. nov. . . . . p. 24
Millepore Oolite, Cloughton Wyke.

FIGS. 7–10. Left, right, dorsal and ventral views, female carapace. Holotype, Io. 1088.



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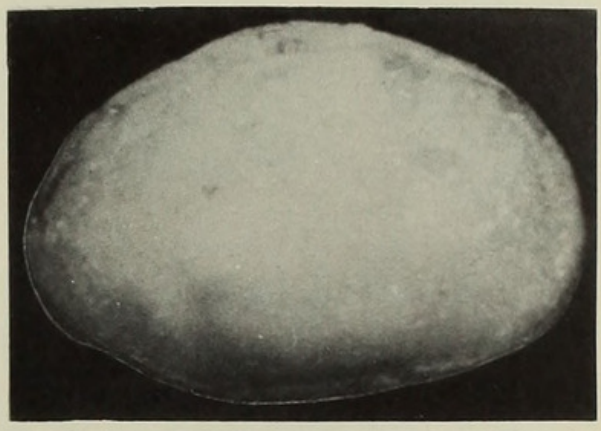

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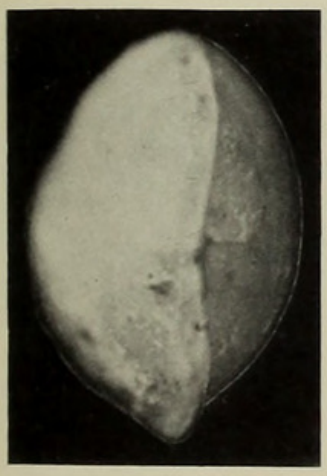

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PRAESCHULERIDEA, CYTHEROPTERINA

PLATE 9

Cytheropterina plana sp. nov. . . . . p. 24

Millepore Oolite, Cloughton Wyke.

FIGS. 1–4. Right, left, dorsal and ventral views, male carapace. Paratype, Io. 1089.

Kirtonella reticulata sp. nov. . . . . p. 25

FIGS. 5–13, 16. Yons Nab Beds (base), Yons Nab.

FIGS. 14, 15. Whitwell Oolite, Seamer Lime and Stone Co's. Quarry.

FIGS. 5–8. Right, left, dorsal and ventral views, female carapace. Holotype, Io. 1093.

FIG. 9. Right view of female carapace. Paratype, Io. 1099.

FIGS. 10–13. Right, left, dorsal and ventral views, male carapace. Paratype, Io. 1096.

FIGS. 14, 15. Right and left views, female carapace. Paratype, Io. 1098.

FIG. 16. Dorsal view of hinge, female left valve. Paratype, Io. 1094.


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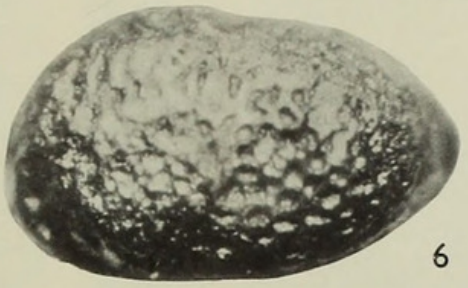
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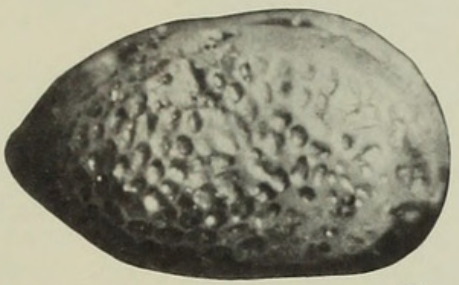
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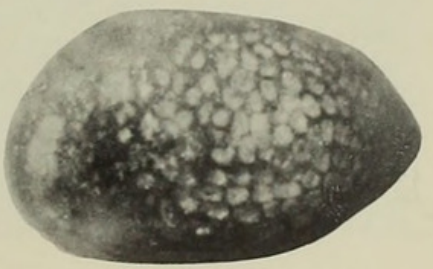
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CYTHEROPTERINA, KIRTONELLA

PLATE 10

Kirtonella reticulata sp. nov. . . . . p. 25

Yons Nab Beds, Yon Nab.

FIGS. 1, 2. Internal view, showing radial pore canals. Fig. 1, × 350, fig. 2, ×92. Female right valve. Paratype, Io. 1095.

Southcavea reticulata sp. nov. . . . . p. 27

FIGS. 3–13. Cave Oolite, Eastfield Quarry.

FIG. 14. Kirton Cementstone Series, Lower Lincolnshire Limestone, Kirton Lindsey, Lincolnshire.

FIGS. 3–6. External and internal views of valve, and lateral and dorsal views of hinge (note fine denticulations along dorsal surface of median bar). Figs. 5 and 6, ×120. Female left valve. Holotype, Io. 1103.

FIG. 7. Dorsal view of hinge, showing fine denticulations of median bar, male left valve. Paratype, Io. 1109. ×100.

FIGS. 8–11. Right, left, ventral and dorsal views, female carapace. Paratype, Io. 1105.

FIG. 12. External view, female right valve. Paratype, Io. 1107.

FIG. 13. External view, male left valve. Paratype, Io. 1104.

FIG. 14. Muscle scars, female left valve. Paratype, Io. 1106. ×320.

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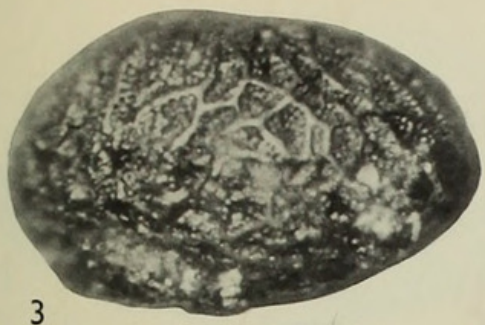

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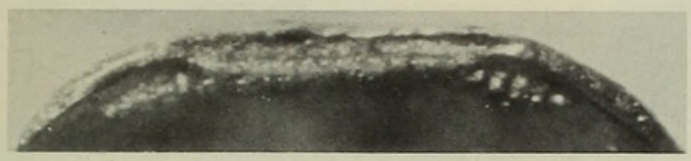

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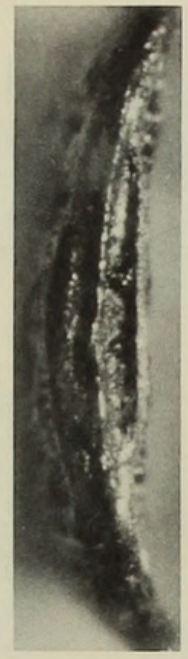

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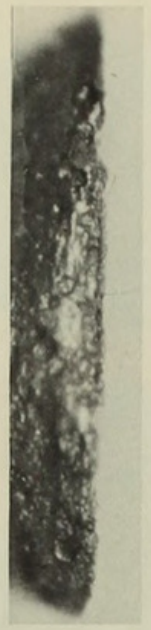

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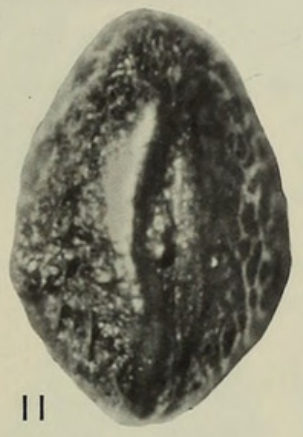

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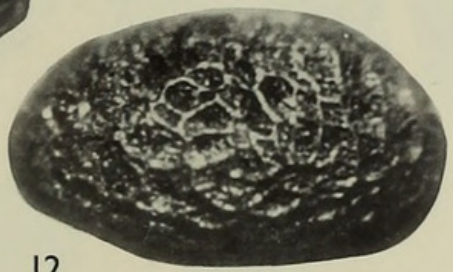

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KIRTONELLA, SOUTHCAVEA

PLATE 11

Southcavea reticulata sp. nov. . . . . p. 27

Cave Oolite, Eastfield Quarry.

FIGS. 1–4. Left, right, dorsal and ventral views, male carapace. Paratype, Io. 1110.

Southcavea grandis sp. nov. . . . . p. 29

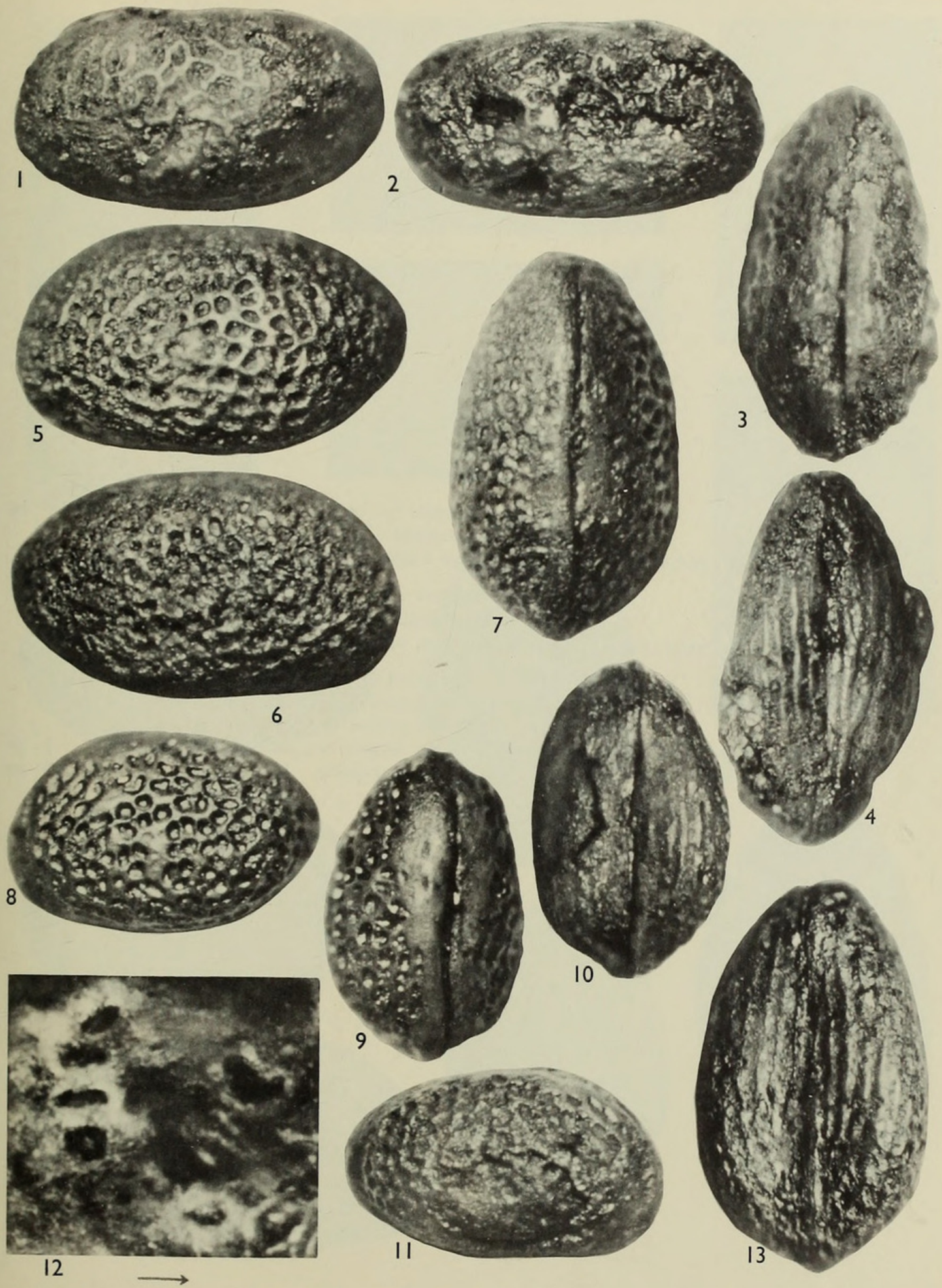
FIGS. 5–7, 12, 13. Cave Oolite, Eastfield Quarry.

FIGS. 8–11. Whitwell Oolite, Bulmer.

FIGS. 5–7, 13. Left, right, dorsal and ventral views, complete carapace. Holotype, Io. 1119.

FIGS. 8–11. Left, dorsal, ventral and right views, complete carapace. Paratype, Io. 1120.

FIG. 12. Muscle scars, left valve fragment. Paratype, Io. 1121. ×310.



SOUTHCAVEA

PLATE 12

Southcavea grandis sp. nov. . . . . p. 29

Cave Oolite, Eastfield Quarry.

FIG. 1. Anterior radial pore canals, left valve fragment. Paratype, Io. 1121. ×250.

Systenocythere ? sp. . . . . p. 30

Whitwell Oolite, Stonecliff Wood.

FIGS. 2–5. Left, right, dorsal and ventral views, complete carapace. Io. 1118.

INCERTAE SEDIS

FIGS. 6–9. Millepore Oolite, Yons Nab.

FIGS. 10, 11. Whitwell Oolite, Westow.

FIGS. 6–9. Right, left, dorsal and ventral views, female carapace. Io. 1123 . p. 30

FIGS. 10, 11. Right side and dorsal view of male carapace. Io. 1125 . . p. 30

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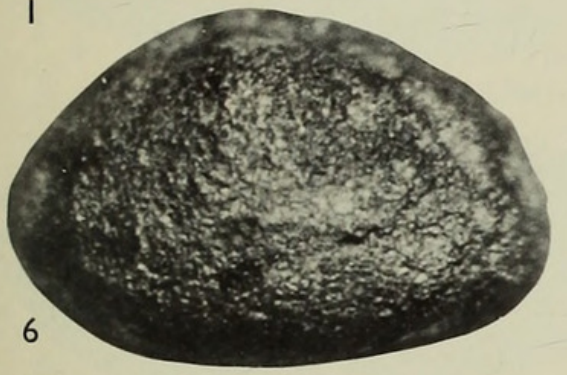

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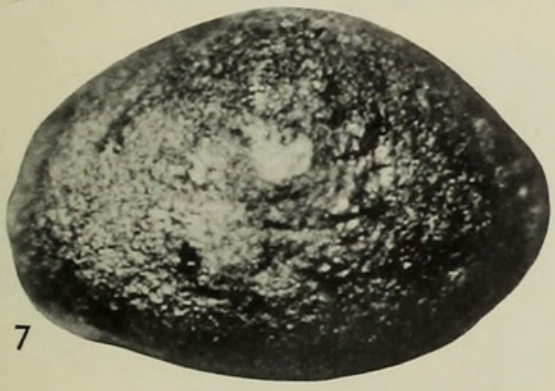

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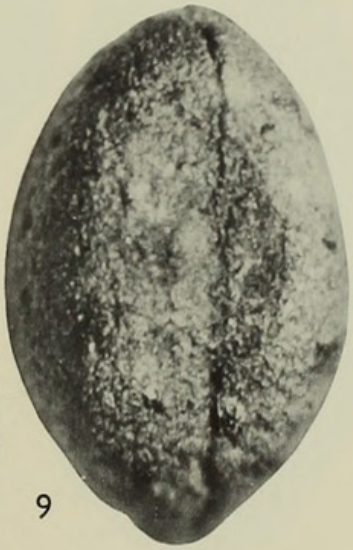

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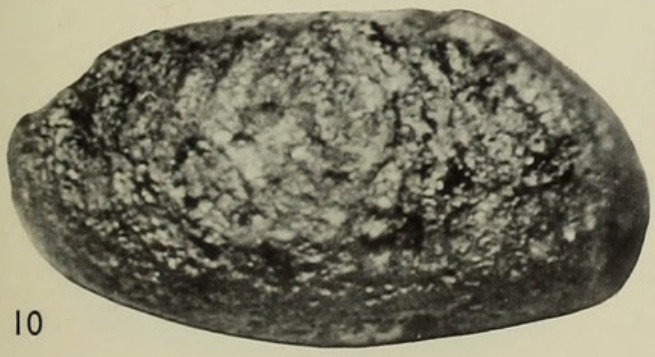

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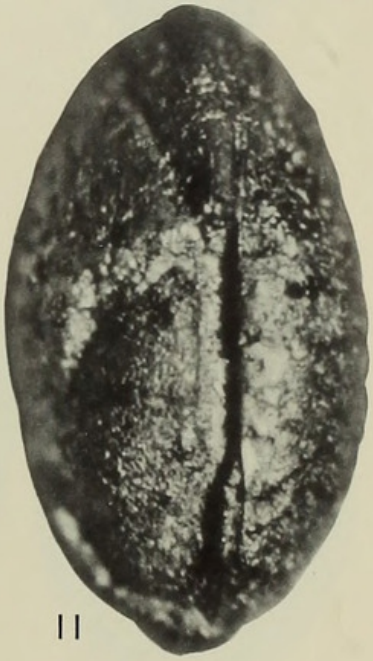

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SOUTHCAVEA, SYSTENOCYTHERE, INCERTAE SEDIS

PLATE 13

INCERTAE SEDIS

FIGS. 1–4. Cave Oolite, Eastfield Quarry.

FIGS. 5–8. Millepore Oolite, Yons Nab.

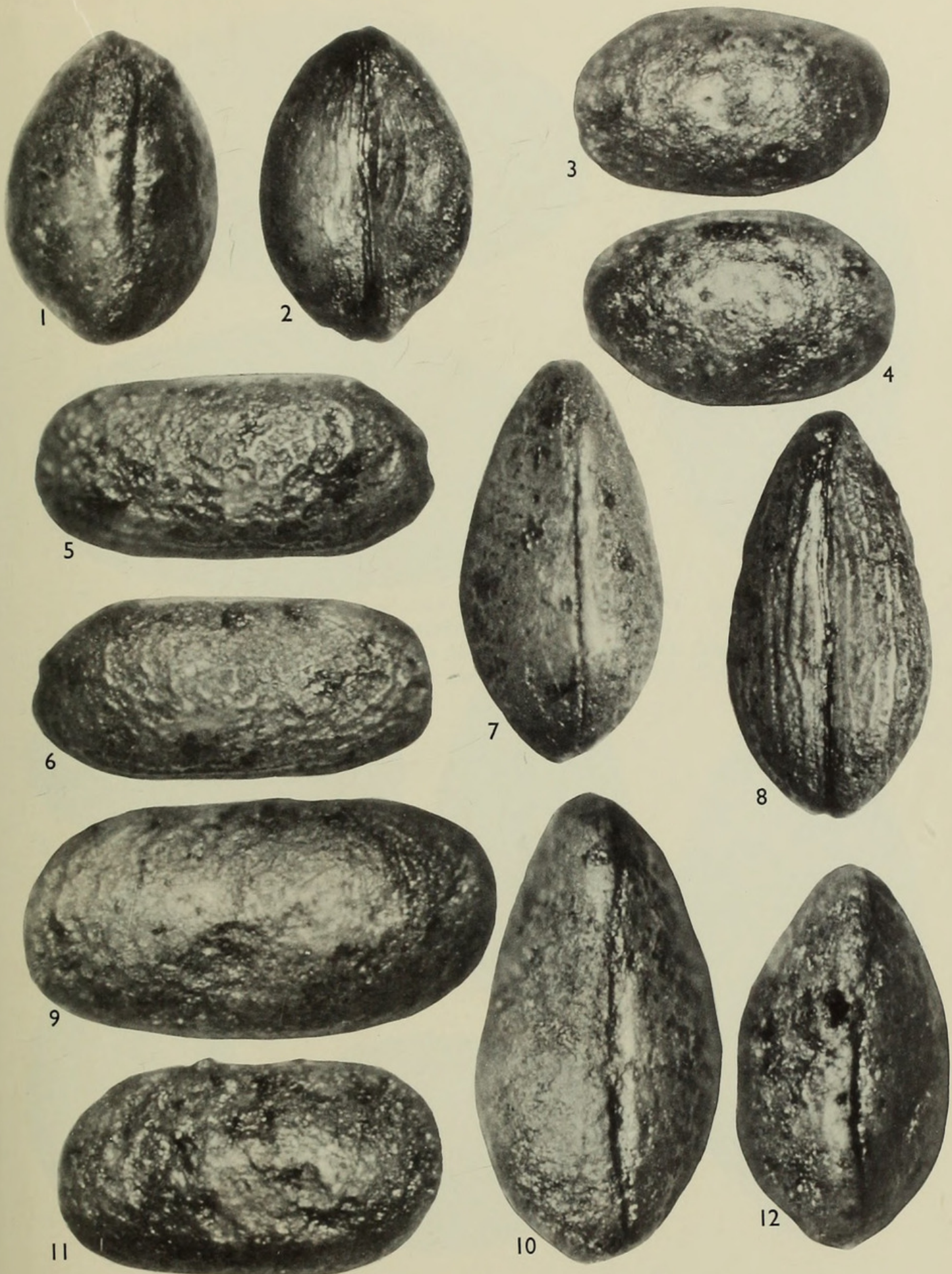
FIGS. 9–12. The Yons Nab Beds, Yons Nab.

FIGS. 1–4. Dorsal, ventral, left and right views, complete carapace. Io. 1127 . p. 30

FIGS. 5–8. Right, left, dorsal and ventral views, complete carapace. Io. 1128 . p. 30

FIGS. 9, 10. Left and dorsal views, male carapace. Io. 1130 . . . . p. 31

FIGS. 11, 12. Left and dorsal views, female carapace. Io. 1129 . . . p. 31



INCERTAE SEDIS

PLATE 14

INCERTAE SEDIS

FIGS. 1–4. Whitwell Oolite, Seamer Lime and Stone Co's. Quarry.

FIGS. 5–8. Millepore Oolite, Yons Nab.

FIGS. 1–4. Left, right, dorsal and ventral views, complete carapace. Io. 1132 . p. 31

FIGS. 5–8. Right, left, dorsal and ventral views, complete carapace. Io. 1134 . p. 31

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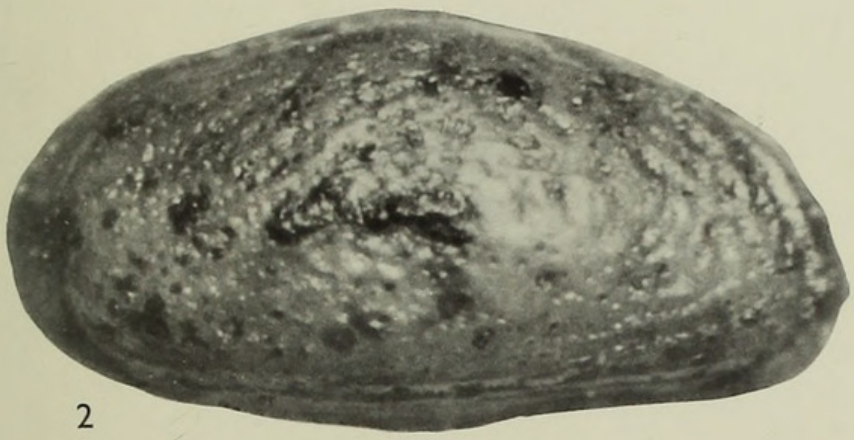

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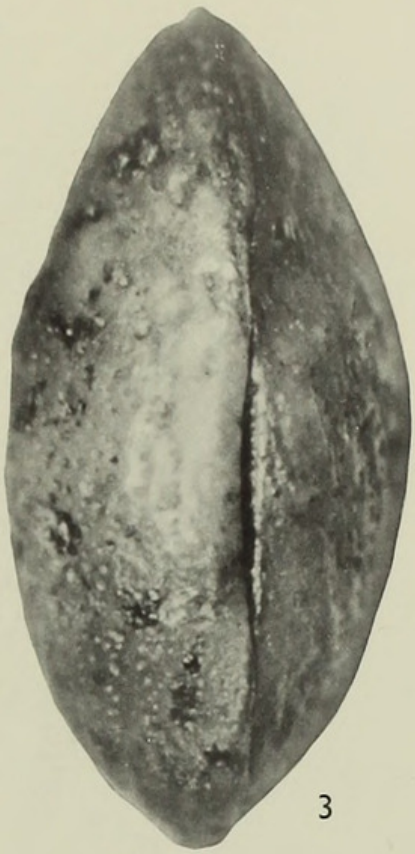

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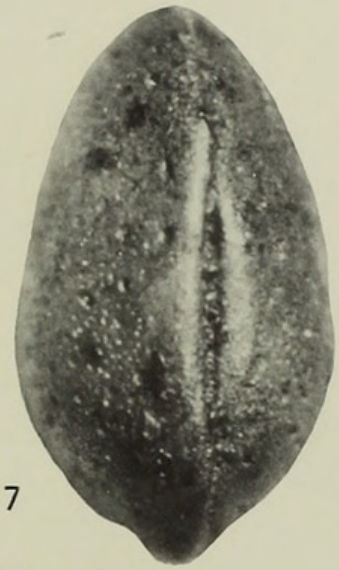

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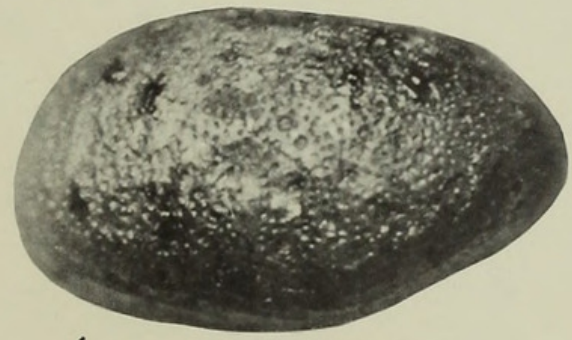

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