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## Notes on the Foraminifera and Ostracoda from the Deep Boring at Richmond

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### Notes

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49. NOTES on the FORAMINIFERA and OSTRACODA from the DEEP BORING at RICHMOND. By T. RUPERT JONES, Esq., F.R.S., F.G.S. (Read June 25, 1884.)

## [PLATE XXXIV.]

- § I. Specimens 1-8 came from 1145' 9" to 1146' 6".  
 § II. Specimens 11-19 came from 1151' to 1151' 6".  
 § III. Specimens 21-57 came from 1205'.

They have all been carefully mounted, and will be deposited in the British Museum and elsewhere. The numbers here indicated are the numbers of the specimens as mounted and preserved, and have no reference to the order of the species as described in this paper.

§ I. Depth of 1145 feet 9 inches to 1146 feet 6 inches.

FROM the bed, 9 inches thick, at the depth above mentioned, there were obtained seven specimens of Foraminifera, and several Entomostracan valves.

## 1. FORAMINIFERA.

These comprise six specimens of *Cristellaria* and one *Lituola*. The latter may be regarded as *L. nautiloidea*, var., and is small, discoidal, depressed (slightly biconcave), with blunt or rounded edge. It belongs to the *Haplophragmium* division, is much like the recent *H. emaciatum*, H. B. Brady, 'Report on the Foraminifera obtained during the Voyage of the "Challenger,"' p. 305, pl. 33. f. 27, and is not far removed from *H. nanum*, H. B. B., and *H. acutidorsatum*, Hantken; but the last is involute, instead of evolute, in its growth.

The specimen before us may be termed *Lituola nautiloidea*, Lam., var. (*Haplophragmium*) *depressa*, nov., or, for convenience, *L. depressa*. It looks so smooth and worn that it is possibly a derived fossil. Pl. XXXIV. fig. 2.

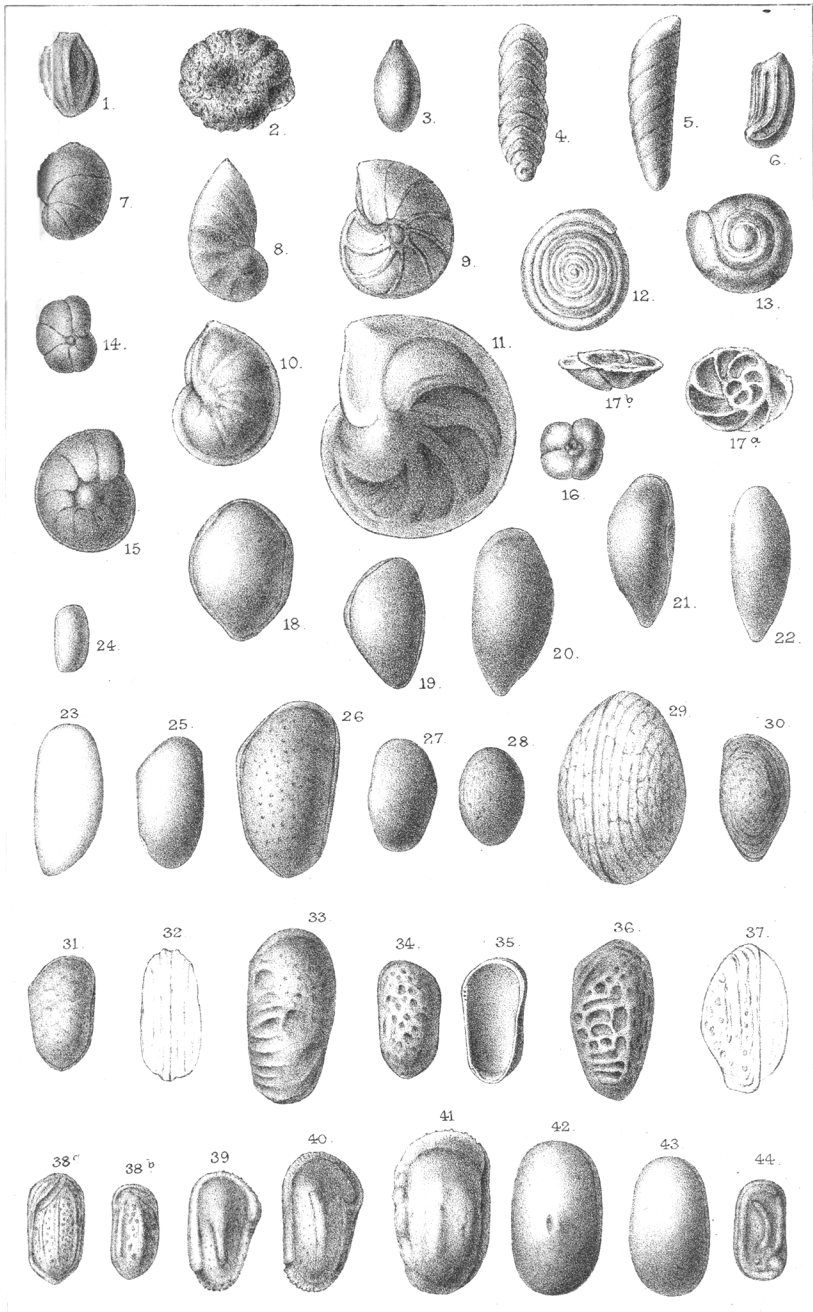
Of the *Cristellariae*, which are all of small size, and some minute, there are the following species or varieties:—

(1) *Cristellaria rotulata* (Lamarck), thin-edged, with convex umbilicus, and raised septal lines; the chambers are rather small, very oblique and subfalcate, about nine in the last whorl (Pl. XXXIV. fig. 9). There is also a very small, ill-grown *C. rotulata*, with the posterior angle of some of the chambers projecting from the circular edge; not an uncommon condition.

(2) *Cristellaria cultrata* (Montfort), with keel, central boss, thick and raised septa, and about 7 chambers in the last whorl, Pl. XXXIV. fig. 11.

(3) A less circular (more elliptical) variety of the last-mentioned form, with 6 chambers visible, the last of which projects slightly forwards, Pl. XXXIV. fig. 10.

(4) *Cristellaria rotulata* (Lamarck). A somewhat Marginuline



Geo. West & Sons del. Lith. et imp.

MICROZOA from the RICHMOND BORING.

*Cristellaria*, in which the chambers are few and ventricose, increasing rapidly in size. The last chamber is set on nearly straight, not in a spiral direction. The septal lines are depressed. Pl. XXXIV. fig. 7. This matches some varieties allied to *Marginulina simplex*, D'Orb., *Cristellaria mirabilis*, Reuss, &c.

In this limited group of Foraminifera (§ I.), there is nothing especially characteristic. These forms range through the Secondary and Tertiary formations to the Recent Period. Indeed *Cristellaria*\* is of Silurian occurrence, and *Haplophragmium* is known in the Carboniferous rocks.

## 2. ENTOMOSTRACA (OSTRACODA).

### 1. MACROCYPRIIS BRADIANA, sp. nov. (Pl. XXXIV. fig. 23.)

Smooth, subelliptical, with an obliquely tapering posterior end, and the dorsal edge more convex than the other. Two specimens, one larger than the other; the former shows the outside (fig. 23), and the other the inside of a valve.

In shape this is near to, but more oblong than, *M. tumida*, G. S. Brady, 'Report on the Ostracoda of the "Challenger" Expedition,' p. 43, pl. 6. fig. 2.

### 2. CYTHERE SCHWAGERIANA, sp. nov. (Pl. XXXIV. fig. 27.)

One valve. Smooth, subovate, somewhat of the peach-stone shape; more convex on the dorsal than on the ventral border, the hinge-joint being slightly prominent. The ventral region is convex, slightly bulging over its border.

The name of Dr. Conrad Schwager, who has described many Jurassic Microzoa, is associated with this species.

### 3. CYTHERE JUGLANDICA, sp. nov. (Pl. XXXIV. figs. 36, 37.)

Three specimens. In shape somewhat like a long peach-stone; coarsely reticulate, and rough like a walnut-shell; the meshes more elongate on the ventral region.

The kind of reticulation here seen is met with in *Cytheræ* of different shapes, fossil and recent. In the specimens under notice, and among others from other parts of the deep boring at Richmond, there is considerable variation in the strength or depth of the coarsely sculptured network ornament of the valves.

### 4. CYTHERE (CYTHEREIS) QUADRILATERA, Römer. (Pl. XXXIV. figs. 39, 40, 41.)

One valve (fig. 39), irregularly oblong in outline, the anterior hinge-joint standing out on the dorsal margin. Bordered all round with a raised smooth rim of varying thickness, thickest at the antero-dorsal margin. Ridged medially, from the anterior third

\* *C. rotulata* has been figured by Mr. E. O. Ulrich from the Lower Silurian of Cincinnati (Journ. Cincinn. Soc. Nat. Hist. vol. v. (1882?), p. 119, pl. 5, figs. 1, 1 a), and M. O. Terquem has noticed a *Cristellaria* from the Devonian of Paffrath (Bullet. Soc. Geol. Fr. 3, viii. p. 414, &c., 1860).

backwards, with a smooth thickening of the test, beginning with an irregular boss just behind the front hinge-joint. Posterior margin narrowed, depressed, bordered with a very slight, tubercled rim. Some specimens from other depths in the boring (figs. 40, 41) are larger and show variation in the intensity of the tubercles.

This is the *Cythere* (*Cythereis*) *quadrilatera*, Römer, 'Monogr. Cretaceous Entom. England,' Pal. Soc. p. 18, pl. 3, fig. 10; pl. 4, fig. 10. It occurs also in the Portland Oolite of Dorset.

5. Two obscure specimens suggest the possibility of their having been—one a *Cythereis* and the other a *Cythere*, but they are undeterminable.

The above-described Ostracoda from § I. belong to common types, and offer nothing specially characteristic of any particular formation; similar forms ranging through Secondary and Tertiary into Recent times. *C. quadrilatera* is well known in the Chalk and Gault; and it accompanies other "Cretaceous" forms in the soft, white, chalky Portland Oolite at Ridgeway, Upway, Dorset. See Quart. Journ. Geol. Soc. xxxvi. p. 236.

## § II. *From the Stratum at 1151 feet to 1151 feet 6 inches.*

### 1. FORAMINIFERA.

#### 1. CRISTELLARIA ROTULATA (Lamarck).

Small; with nine triangular chambers in the last whorl; and with a subtranslucent convex umbilicus, a flush surface, sharp edge, and nearly straight septal lines.

#### 2. CRISTELLARIA ITALICA (DeFrance).

Small, short, thick; a well-known triangular (arrested?) form of *Cristellaria*.

#### 3. CRISTELLARIA, sp. indet.

A small broken specimen, probably *derived*; white and rather rough. It looks like the butt-end (early chambers) of an elongate or Marginuline *Cristellaria*.

### 2. OSTRACODA.

#### 1. BAIRDIA JUDDIANA, sp. nov. (Pl. XXXIV. fig. 18.)

Very broad (that is, the valve is very high if placed in its natural position), subovate, smooth, delicately pitted.

Prof. J. W. Judd's name is associated with this species, found by his careful researches in the deep strata at Richmond.

#### 2. BAIRDIA TRIGONALIS, sp. nov. (Pl. XXXIV. fig. 19.)

Narrower than the foregoing, but broad and almost triangular; smooth and delicately pitted.

3. *CYTHERIDEA SUBPERFORATA*, sp. nov. (Pl. XXXIV. figs. 25, 26.)

Two specimens (fig. 25, and a broken valve). Smooth; subovate but rather long; obliquely rounded in front, the antero-dorsal border sloping; rounded posteriorly; dorsal border subangular at the front joint; hinge-line oblique, but straight; ventral border nearly straight. Closely allied to *C. perforata* (Römer), which is a Cretaceous species.

4. *CYTHERE SUBCONCENTRICA*, sp. nov. (Pl. XXXIV. figs. 28, 29.)

Six or seven specimens. Small and plump; of the peach-stone pattern; smaller and rather smoother than *C. concentrica*, Reuss, which is not rare in the Chalk. It is faintly marked with a linear subconcentric reticulation, or shallow elongate pittings, particularly on the ventral region. It reminds us of the species just mentioned, and, at first sight, of its smooth variety *virginea*. See Monogr. Cret. Entom. Pal. Soc. 1849, p. 11, pl. 1. fig. 2; and Geol. Mag. vol. vii. p. 74. One specimen shows minute spots, like the bases of prickles.

5. *CYTHERE JUGLANDICA*, see above, p. 766. (Pl. XXXIV. figs. 36, 37.)

Two specimens of this well-defined *Cythere* of the peach-stone type; convex, suboblong or subquadrate, and rugose, being coarsely reticulate like a walnut-shell, with the meshes more elongate on the ventral region.

6. *CYTHERELLA SYMMETRICA*, sp. nov. (Pl. XXXIV. fig. 42.)

Symmetrically oblong-oval, or oblong with rounded ends; edge-view subuneiform; delicately pitted; subcentral sunken spot present.

There are many oblong *Cytherella*, and some of them closely approach this form. *C. fraterna* (Reuss), from the Trias, is the nearest, but is not so perfectly symmetrical in outline; so also the recent *C. scotica*, G. S. Brady; but this is rather contracted medially. Among the many published figures of the Cretaceous *C. Muensteri* (Römer), some nearly match our specimen. *C. parallela*, Reuss, is symmetrical, but too narrow. For a list of the published *Cytherella*, and for a classification of the species, see the 'Monograph of the Carboniferous Cypridinidæ and their Allies' (Palæontographical Society), 1884 (now in the press).

The *Cytherella* under notice may well be named *C. symmetrica*.

7. A small *Cythere* (?) or short *Bairdia* (?), obscure; and a broken solid carapace of a *Cytherella*?

Of the Foraminifera and Ostracoda from 1151' to 1151' 6" (§ II.), the former are *Cristellaria*, of no special geological horizon; and some of the latter have a Cretaceous aspect, but these are associated with less marked species.

*Miscellanea of § II.*

A rolled, bilobed granule, and another, obscure.

Two small solid spirals (Gasteropodous?).

Small, curved, tapering, solid body, pentagonal in section; smooth, shining, and cross-marked with very delicate striæ (comp. Blake, 'Lias,' pl. 17, f. 20, "spicule").

§ III. *From the Stratum at 1205 feet.*

## 1. FORAMINIFERA.

1. *MILIOLA* (QUINQUELOCULINA), sp. (Pl. XXXIV. fig. 1.)

Small; edges of chambers narrow and projecting.

Such little sharp-edged *Miliolæ* are not wanting in some of the Mesozoic strata.

2. *LAGENA* LÆVIS, Walker and Jacob. (Pl. XXXIV. fig. 3.)

Small, neat, simple, smooth, flask-shaped; not different from the recent form. This kind of *Lagena* occurs all through the Jurassic formations; and is known even in Silurian strata.

3. *FRONDICULARIA* OOLITHICA, Terquem, var. *regularis*. (Pl. XXXIV. fig. 4.)

Two Linguline *Frondiculariæ*, belonging to the group described and illustrated by M. O. Terquem in his 'Troisième Mém. sur les Foram. du Système Oolithique, &c.,' Metz, 1870, pl. 22, and comprising his *F. oolithica*, *spissa*, *spatulata*, &c. from the Lower Oolite. It is also a Liassic form. Our specimens begin with the usual little round knob of earliest chambers, and take on about 9 chevron-like, nearly equal chambers, limited in lateral extension, and varying somewhat in that development. Surface plain, nearly flush, and roughish.

4. *VAGINULINA* LEGUMEN\* (Linné), var. *LÆVIGATA* (Römer). (Pl. XXXIV. fig. 5.)

Two specimens, small and neat; one with a slight curvature of growth (fig. 5), the other straight. These belong to the *lævigata* variety of the type, which, in one form or other, is widely spread and has a long range in time, occurring certainly in the Lias and Oolites.

5. *MARGINULINA* RAPHANUS (Linné). (Pl. XXXIV. fig. 6.)

Two specimens; very small, but typical. It is known in the Lias and the Lower Oolite. Compare Schwager's short, ribbed *Cristellaria oolithica* in Benecke's 'Geogn.-paläont. Beitr.' 1867, p. 657, pl. 34. fig. 10; also *Marginulina picta*, Terquem, in the 'Yorkshire Lias,' p. 462, pl. 19. fig. 6 b.

\* See 'Monogr. Foram. Crag,' Pal. Soc. 1866, p. 64 &c.

6. *CRISTELLARIA CREPIDULA* (Fichtel & Moll.) (Pl. XXXIV. fig. 8.)

A small elongate Cristellarian form, with smooth surface, not limbate. Certainly as old as the Lias, frequent in the Oolites, and living now.

7. *CRISTELLARIA ROTULATA* (Lamarck). See above, p. 765.

Several specimens. 1. One smooth, flush-surfaced, thin-edged. 2. Some, both small and largish, of ordinary character; occasionally limbate. 3. One small, flush, subtranslucent.

8. *CRISTELLARIA CULTRATA* (Montfort). See above, p. 765.

Several; largish and small; one with a jagged keel. (?=*C. calcar*, or broken.)

9. *SPIRILLINA HELVETICA*, Kübler & Zwingli, 'Mikrosk. Bild. Urw. Schweiz.' 1867, p. 12, pl. 2. fig. 8. (Pl. XXXIV. fig. 12.)

One specimen: small, translucent, with nine whorls, increasing very slowly in size. We need not separate our specimen from those of the Swiss Jura. *Sp. Helvetica*, from the Opalinus-clay, was again described and figured by Zwingli and Kübler in 1870 (Foram. Schweiz. Jura), but as a *Cornuspira* (p. 13, pl. 2, i. fig. 3), together with *C. eichbergensis* from the Parkinsoni-clay, p. 17, pl. 2, iv. fig. 2; but they seem to belong to the same species; and both are "colourless and glass-clear" (one is "translucent"), so they cannot be *Cornuspira*.

10. *SPIRILLINA CRASSA* (Zwingli & Kübler), 'Foram. Schw. Jura,' 1870, p. 19, pl. 2, iv. fig. 2. (Pl. XXXIV. fig. 13.)

This specimen has about four whorls; the last is by far the widest. Subtranslucent, rather convex. The Swiss form (from the Callovian beds), which seems to be equivalent, was described as a *Cornuspira*, but it is "colourless and glass-clear." The specific name is not quite appropriate, unless the breadth of the whorl is taken as thickness; but we need not add to the catalogue of names.

11 & 12. *PLANORBULINA HAIDINGERI* (D'Orb.), and varieties (Pl. XXXIV. figs. 14, 15); and *PLANORBULINA FARCTA* (F. & M.), var. (Pl. XXXIV. fig. 16).

These small *Planorbulinae* are present as seven or more specimens, varying much in size and aspect; some are broken or otherwise obscure. Two of the most definite are figured here (figs. 14, 15) as belonging to the *Pl. Haidingeri* type; and one (fig. 16) as being nearer to *Pl. (Truncatulina) lobatula*, W. & Jacob. Analogous representatives of the Planorbuline group have been described and figured by Zwingli and Kübler from the Jurassic strata of Switzerland (Foram. Schw. Jura, 1870) under various names—as *Nonionina badensis* (p. 37) from the Corallian, *Nonionina birmentorfensis* (p. 29) and *Rotalina badensis* (p. 35) from the Oxfordian, and *Nonionina oblonga* (p. 21) from the Callovian beds.



13. *PULVINULINA ELEGANS*, D'Orb., var. *TENELLA*, nov. (Pl. XXXIV. figs. 17 a, 17 b.)

Only one specimen; small, depressed; deeply excavated on the upper face with the sunken tops of ten chambers; or, in other words, bearing their raised limbate coil and septa, which are not so symmetrical as in other varieties. The opposite face is subconical and smooth. This kind of *Pulvinulina* is abundant in the blue clay obtained at second-hand from the gypsum-pits at Chellaston, near Derby, and described in the Quart. Journ. Geol. Soc. vol. xvi. p. 452. Prof. Reuss long ago pointed out that these Chellaston Foraminifera had a Liassic aspect; and they were specially collated by Jones and Parker with those of the Lias and Oolites, at p. 456. As doubts were expressed about the geological stage whence the clay was derived, a search for the clay in place was made some time after, but without any good result, and the evidence is still what was stated at p. 452. *P. elegans* is described and figured, *op. cit.* 1860, p. 455, pl. 20. fig. 46, as *Rotalia elegans*; but its true relationships were pointed out in the Phil. Trans. 1865, pp. 393, 396, &c. *Pulvinulinae* belonging to this type occur in the Trias (St.-Cassian beds), Lower Oolites, &c., and abound in the Gault. *P. caracolla* (Römer\*) and *P. reticulata* (Reuss†), from the Hils Clay, are the nearest to our specimen, but they are too thick and symmetrical.

14. A small *Miliola*?, obscure; and a small, white, sandy (?), convex disk—*Webbina*?

2. ENTOMOSTRACA at 1205 feet.

1-4. BAIRDIA. (Pl. XXXIV. figs. 20, 21, 22.)

Several specimens occurred here, and of various outlines and shape.

*Bairdia Hilda*, sp. nov. (fig. 20), is longer than either fig. 18 or fig. 19 (see p. 767) in proportion, and more oblong in shape, but rounded anteriorly and acute behind (downwards in the figure).

*Bairdia jurassica*, sp. nov. (fig. 21), is a carapace with narrow valves, relatively long, and with outdrawn, but rather blunt, posterior angle.

*B. jurassica*, var. *tenuis*, nov. (fig. 22), shows the left valve (largest) of a very narrow thin *Bairdia*; but perhaps it need not be separated from fig. 21, except as a variety.

It is difficult to correlate these *Bairdiae* with known species. The differences in outline are often of trifling amount, but yet possibly essential, as may be seen also with the Carboniferous *Bairdiae*, in the Q. J. G. S. vol. xxxv. p. 565 &c., pls. 28 to 32; and in G. S. Brady's 'Report on the Ostracoda collected in the "Challenger" Expedition,' pls. 7 to 11; without referring to the many other published figures of *Bairdiae* from all formations, even from the Silurian upwards.

\* Verst. Norddeutsch. Kreideb. 1841, pl. 15. fig. 22.

† Sitzungsab. k. Akad. Wiss. Wien, vol. xlv. 1863, pl. 10. f. 4.

5. *CYTHERIDEA SUBPERFORATA*, sp. nov., see above, p. 768. (Pl. XXXIV. figs. 25, 26.)

Two specimens (represented here by the best, fig. 26). Triangular-ovate. Right valve the smallest, overlapped by the other nearly all round, especially on the dorsal and ventral edges. Surface smooth and shining, but pitted; in one specimen the pitting is delicate, in the other (fig. 26) coarse.

6. *CYTHERE*? *TENELLA*, sp. nov. (Pl. XXXIV. fig. 24.)

One specimen; very small and delicate; translucent; oblong, slightly oblique, with rounded ends.

7. *CYTHERE GUEMBELIANA*, sp. nov. (Pl. XXXIV. figs. 31, 32, 33.)

Several specimens, differing much in development. Generally ovate-oblong, somewhat oblique, or subquadrate. Convex, with surface shining, but impressed with a coarse reticulation, in some cases faint. The cross meshes make faint or strong wrinklings; and the longitudinal ridges often get strong on the ventral region. Oblique transverse imprints are more or less marked on the dorsal region (see especially fig. 33), with a central roughish round pit-like mark. The two extremes are figured. This species is named after Dr. C. W. Gümbel, F.M.G.S., of Munich, who has discovered and described many Jurassic microzoa.

8. *CYTHERE DRUPACEA*, sp. nov. (Pl. XXXIV. fig. 30.)

A specimen of the peach-stone form; convex, with full ventral region, arched back, tapering posterior and obliquely rounded anterior border. It has a coarse but faint wrinkling, with an inclination to strengthen some of the longitudinal lines. The wrinkles are oblique on the ventral region.

9. *CYTHERE* (*CYTHEREIS*) *QUADRILATERA*, Römer (see above, p. 766). (Pl. XXXIV. figs. 39, 40, 41.)

Two specimens (figs. 40, 41). Smooth, glossy, with scattered spots, like the bases of small prickles; end-borders slightly denticulate; and the ridges, medial and marginal, more or less tuberculate, especially in these older (larger) individuals.

10. *CYTHERE BLAKEANA*, sp. nov. (Pl. XXXIV. figs. 34, 35.)

Two valves; suboblong, obliquely rounded in front, narrower and rounded behind; anterior hinge-joint rather prominent; surface coarsely reticulate, meshes stronger and straighter on the ventral region. This approaches the young forms of *Cythere dictyon*, G. S. Brady, 'Challenger Report,' p. 99, pl. 24. Our specimens are named after the Rev. Prof. J. F. Blake, F.G.S., who has elucidated many Ostracoda of the Lias.

11. *CYTHERE BRADIANA*, sp. nov. (Pl. XXXIV. figs. 38 a, 38 b.)

Seven valves of a suboblong form, reticulate and costated; reticulation sometimes finer (fig. 38 a). The longitudinal meshes are developed into three or more subparallel ribs or ridges, joining

at the ends more or less completely, with considerable difference in their mode of convergence. Sometimes they meet at the ends of the valves, but in some cases run separately to one or the other end-margin.

*Cythere bermudæ*, G. S. B., 'Challenger Report,' p. 90, pl. 21. fig. 2, is one of the species having the same kind of sculpture. We name this fossil species after our friend Dr. G. S. Brady, F.R.S., whose careful and successful researches are well known.

12. *CYTHERELLA SUBOVATA*, sp. nov. (Pl. XXXIV. fig. 43.)

Ovate-oblong carapace; smooth, glossy, convex at posterior third; broader (higher) behind than before. This is near the Cretaceous *C. ovata* (Römer).

13. *CYTHERELLA JUGOSA*, sp. nov. (Pl. XXXIV. fig. 44.)

Valve depressed; faintly ridged near the margin and almost all round, with an interval and a knob at the postero-ventral region; also bearing a low curved ridge and a little tubercle on the flat medial area of the valve. There are approximations to this in Jurassic\* and other *Cytherellæ*, but nothing exactly the same. *C. Williamsoniana*, Jones, from the Chalk (Cret. Entom. 1842, pl. 7. fig. 26 f) has something like the pattern of *C. jugosa*.

14. A broken *Cythere*?, and a little peach-stone *Cythere*?; both obscure.

*Miscellanea of § III.*

Small, tuberculate, claviform Echinoderm spine.

A subcylindrical and a cylindrical rolled granule, obscure.

Of the Microzoa from the lowest stratum (§ III.) searched, namely at 1205 feet, some of the Foraminifera (Nodosarians—*Fronicularia*, *Vaginulina*, *Marginulina*, *Cristellaria*) are small, and look like those of the Lias, but are not peculiar to it, being found in the Lower Oolite and elsewhere. Both these and the other Foraminifera are of very wide range in time and space; but one only (*Cristellaria rotulata*) is actually present in each of the little portions of strata from the three particular depths noticed in the boring; but its close ally, *C. cultrata*, has turned up in two of them, § I. and § III.

Ten out of the eleven Ostracoda are apparently hitherto unknown forms; but they belong to well-known groups, and differ from others mostly in slight details. *Cytheridea subperforata* comes also in § II., and *Cythereis quadrilatera* in § I. The *Bairdiæ* of § III. are different from those of § II.

In a general view of the Foraminifera and Ostracoda obtained by Prof. Judd from the three special depths (§ I. 1145' 9" to 1146' 6"; § II. 1151' to 1151' 6"; and § III. 1205') in the deep boring at Richmond, they do not present any very special characteristics recognizable as belonging to particular horizons. The Foraminifera

\* For instance, *Cytherella ulmensis*, Gümbel, Sitzungsber. Akad. München, 1871, p. 71, pl. 1. fig. 22.

comprise several common forms or varieties of *Cristellaria*, *C. rotulata* occurring in each of the depths alluded to. Small *Nodosarinæ* occur in the lowest stratum of the three; also *Spirillina*, *Pulvinulina* (of the *elegans* type), several small individuals of *Planorbulina Haidingeri*, and vars., and one small *Miliola*. Some of the Foraminifera are readily comparable with known Jurassic forms.

Of the Ostracoda there are several forms not previously published; and, for the most part, they differ in the three stages alluded to; but one *Cythere* occurs in § I. and § II.; one in § I. and § III.; and a *Cytheridea* in § II. and § III. Some have alliances with known Upper Mesozoic species.

Excepting a general Upper Mesozoic aspect, these limited groups, so far as yet examined, offer no special characteristic.

Genera and Species.	Pages.	Pl. XXXIV. & figs.	Stages.
FORAMINIFERA.			
Quinqueloculina, sp. indet. ....	769	1	§ III.
Lituola depressa, nov. ....	765	2	§ I.
Lagena lævis, <i>W. &amp; J.</i> ....	769	3	§ III.
Frondicularis oolithica, <i>Terquem.</i> ....	769	4	§ III.
Vaginulina lævigata, <i>Römer</i> ....	769	5	§ III.
Marginulina raphanus, <i>Linné.</i> ....	769	6	§ III.
Cristellaria, sp. indet. ....	765	7	§ I.
— sp. indet. ....	767	—	§ II.
— italica, <i>DeFrance.</i> ....	767	—	§ II.
— crepidula, <i>F. &amp; M.</i> ....	770	8	§ III.
— rotulata, <i>Lam.</i> ....	765, 767, 770	9	§ I., § II., § III.
— cultrata, <i>Montf.</i> ....	765, 770	10, 11	§ I., § III.
Spirillina helvetica, <i>K. &amp; Z.</i> ....	770	12	§ III.
— crassa, <i>Z. &amp; K.</i> ....	770	13	§ III.
Planorbulina Haidingeri, <i>d'Orb.</i> , var. ...	770	14, 15	§ III.
— farceta, <i>F. &amp; M.</i> , var. ....	770	16	§ III.
Pulvinulina elegans, <i>d'Orb.</i> var. tenella, nov.	771	17a, 17b	§ III.
OSTRACODA.			
Bairdia Juddiana, nov. ....	767	18	§ II.
— trigonalis, nov. ....	767	19	§ II.
— Hilda, nov. ....	771	20	§ III.
— jurassica, nov. ....	771	21	§ III.
— —, var. tenuis. ....	771	22	§ III.
Macrocypris Bradiana, nov. ....	766	23	§ I.
Cytheridea subperforata, nov. ....	768, 772	25, 26	§ II., § III.
Cythere tenella, nov. ....	772	24	§ III.
— Schwageriana, nov. ....	766	27	§ I.
— drupacea, nov. ....	772	30	§ III.
— subconcentrica, nov. ....	768	28, 29	§ II.
— Blakeana, nov. ....	772	34, 35	§ III.
— Guembeliana, nov. ....	772	31, 32, 33	§ III.
— Bradiana, nov. ....	772	38a, 38b	§ III.
— juglandica, nov. ....	766, 768	36, 37	§ I., § II.
— (Cythereis) quadrilatera, <i>Römer.</i> ...	766, 772	39, 40, 41	§ I., § III.
Cytherella symmetrica, nov. ....	768	42	§ II.
— subovata, nov. ....	773	43	§ III.
— jugosa, nov. ....	773	44	§ III.

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## EXPLANATION OF PLATE XXXIV.

- Fig. 1. *Miliola* (*Quinqueloculina*), sp. × 40 diam.  
 2. *Lituola nautiloidea*, Lam., var. (*Haplophragmium*) *depressa*, nov. × 25 diam.  
 3. *Lagena levis*, W. & J. × 40 diam.  
 4. *Frondicularia oolithica*, Terquem, var. *regularis*, nov. × 25 diam.  
 5. *Vaginulina legumen* (Linn.), var. *laevigata*, Römer. × 25 diam.  
 6. *Marginulina raphanus* (Linn.). × 40 diam.  
 7. *Cristellaria* (*Marginulina* var.). × 25 diam.  
 8. — *crepidula*, F. & M. × 25 diam.  
 9. — *rotulata*, Lam. × 25 diam.  
 10. — *cultrata*, Montf. × 25 diam.  
 11. — — —. × 25 diam.  
 12. *Spirillina helvetica*, K. & Z. × 50 diam.  
 13. — *crassa*, Z. & K. × 50 diam.  
 14. *Planorbulina Haidingeri*, d'Orb., var. × 50 diam.  
 15. — — —, var. × 25 diam.  
 16. — *farcta*, F. & M., var. × 50 diam.  
 17a. *Pulvinulina elegans*, d'Orb., var. *tenella*, nov. Upper face. 17b. Edge view. × 25 diam.  
 18. *Bairdia Juddiana*, nov. Carapace, with right valve upward. × 25 diam.  
 19. — *trigonalis*, nov. Carapace with right valve upward. × 25 diam.  
 20. — *Hilda*, nov. Left valve. × 25 diam.  
 21. — *jurassica*, nov. Carapace showing right valve. × 25 diam.  
 22. — — —, var. *tenuis*, nov. Left valve. × 25 diam.  
 23. *Macrocypris Bradiana*, nov. Left valve. × 25 diam.  
 24. *Cythere?* *tenella*, nov. Carapace showing left valve. × 25 diam.  
 25. *Cytheridea subperforata*, nov. Right valve. × 25 diam.  
 26. — — —. Carapace showing right valve. × 25 diam.  
 27. *Cythere Schwageriana*, nov. Right valve. × 25 diam.  
 28. — *subconcentrica*, nov. Right valve. × 25 diam.  
 29. — — —. Edge of carapace. × 50 diam.  
 30. — *drupacea*, nov. Left valve. × 35 diam.  
 31. — *Guembeliana*, nov. Carapace showing right valve. Small form. × 25 diam.  
 32. — — —. Carapace, edge view. × 25 diam.  
 33. — — —. Right valve. × 25 diam.  
 34. *Cythere Blakeana*, nov. Left valve. × 25 diam.  
 35. — — —. Left valve, inside. × 25 diam.  
 36. — *juglandica*, nov. Right valve. × 25 diam.  
 37. — — —. Right valve, ventral edge, with outline of carapace. × 25 diam.  
 38a. — *Bradiana*, nov. Right valve. × 25 diam.  
 38b. — — —. Left valve. × 25 diam.  
 39. *Cythere* (*Cythereis*) *quadrilatera*, Römer. Left valve. × 25 diam. 40. Left valve. × 25 diam. 41. Right valve. × 25 diam.  
 42. *Cytherella symmetrica*, nov. Carapace, left valve upwards. × 25 diam.  
 43. — *subovata*, nov. Carapace, left valve upwards. × 25 diam.  
 44. — *jugosa*, nov. Right valve. × 25 diam.