12. *On the RHÆTIC and some LIASSIC OSTRACODA of BRITAIN.* By Prof. T. RUPERT JONES, F.R.S., F.G.S. (Read January 10th, 1894.)

[PLATE IX.]

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I. PUBLISHED OBSERVATIONS IN CHRONOLOGICAL ORDER.

THE occurrence of small Ostracoda in the Rhætic strata of England has been known for about half a century, chiefly owing to the researches of the Rev. P. B. Brodie, F.G.S., who discovered them in the sections exposed at Wainlode, Westbury, Aust Passage, and elsewhere.

1842-1845.—The Wainlode section is on the south side of the Severn, about halfway between Tewkesbury and Gloucester, and 3 miles W.S.W. from Coomb Hill. It was briefly described by H. E. Strickland,¹ and more fully by the Rev. P. B. Brodie.² Since then the Geological Surveyors and others have studied it in further detail.³

This section shows:—

1, 2, 3. Black clay, limestone, and shale of the Lower Lias.

4 [Rhætic?]. Insect-bed or *Monotis*-bed, containing "*Cypris*, apparently identical with that which marks the yellow limestone (No. 6) below." ('Fossil Insects,' etc., p. 59.)

5. Clay.

6. "Hard, yellow, nodular limestone, with small shells like *Cyclas*, a species of *Unio*, Plants (*Naiades*), *Cypris*, and very rarely scales of Fish." (*Ibid.*)

7-14. Clays, shales, and Bone-bed.

"Mr. Strickland has found the yellow *Cypris*-limestone with *Cyclas* (?), the Pecten- and Bone-beds . . . at Dunhamstead, on the line of the Gloucester- and -Birmingham Railway, near the Droitwich Station" ('Fossil Insects,' etc., p. 72); and at Evesham "are traces of the *Ostrea*-bed [Lias] above and of the *Cypris*-bed and Plant-bed below" (*ibid.*).

Among the specimens kindly lent me by the Rev. P. B. Brodie, one piece of the '*Cypris*-bed,' from the Wainlode Cliff, is a hard, sandy limestone, containing a '*Pteromya*.'

¹ Proc. Geol. Soc. vol. iii. part ii. (1842) p. 586; *ibid.* vol. iv. part i. (1843) p. 18.

² Proc. Geol. Soc. vol. iv. part i. (1843) pp. 15, 16; and 'A History of the Fossil Insects in the Secondary Rocks of England,' 1845, pp. 58, 59.

³ See H. B. Woodward's 'Geology of England and Wales,' 2nd edit. 1887, pp. 242-251.

⁴ According to the arrangement adopted by the Geological Survey.

The Garden-Cliff section, near Westbury-on-Severn, 8 miles from Gloucester ('Fossil Insects,' etc., p. 79), has at the top—

1 [Lias]. *Ostrea*-bed.

2 [Rhætic]. Insect-limestone, with *Monotis decussata*.

3. Shale and clay.

4. "Hard, yellow, and grey limestone, often slaty and sandy, . . . with supposed *Cyclas*, Plants (*Naiades*), *Cypris*, and scales of Fish identical with those at Wainlode."

5. Shale and clay.

6. Bone-bed. This series is stated to be "more developed . . . a little further to the north." At p. 80 it is stated that "The Plants (*Naiadita lanceolata*) and *Cypris* are here much more abundant, the surface of the slaty portions being covered with remains of the latter Crustacean, which are collected together in masses of some thickness, just as we find them in many freshwater deposits. . . . We have [here] a new and highly interesting feature in the history of this deposit. . . ."¹

The section at Aust Passage on the Severn, about 30 miles S.W. of Tortworth and 12 miles from Bristol ('Fossil Insects,' etc., p. 82), consists of:—

1. Rubble; 6 feet. 2 [Lias]. Oyster-bed, one of five beds of stone; 4 feet. 3. [Rhætic]. Landscape-stone; 5 feet. 4. Clay; 2 inches. 5. White stone: *Cypris*- and Plant-bed with *Cyclas*?; 6 feet. 6. Clay; 3 inches. Below this are the Pecten-bed with a clay and the Bone-bed.

At p. 102, *op. cit.*, the Rev. P. B. Brodie includes in his list of fossils:—

"*Cypris liassica* (Brod.), page 80 (*Cypris*-bed), Wainlode, Westbury, Bickmarsh, Bedminster,² Aust."

1848.—In 1848, H. G. Bronn ('Index Palæontologicus,' vol. i. p. 389) refers to "*Cypris liassica*, Brod. foss. ins. 80, 102 (an *Cytherinea*, sp.?)."

1854.—In 1854, J. Morris ('Catal. Brit. Foss.' 2nd edit. p. 104) refers *Cypris liassica* to "Brodie, Foss. Ins., p. 80. Lias. Wainlode."

1855. In the Mém. Soc. Géol. France, ser. 2, vol. v. part ii. p. 333, and pl. xxvi. fig. 12, O. Terquem figured and described an Ostracod as *Cypris liassica*, Brodie. But it does not correspond with any of our Rhætic forms, and was found in marine beds of the Lias in Luxemburg and the Department of the Moselle.

1861.—Mr. Charles Moore, after careful study of the Rhætic formation, noticed the occurrence of '*Cypris*' and '*Cypridæ*' in the White Lias of the Rhætic formation,³ and particularly of a

¹ Mr. Brodie adds in a footnote to this passage:—"I propose to call the *Cypris* *Cypris liassica*, as it is the only one of the kind at present known in that formation' [then regarded as Lower Lias, but afterwards (1865) known as Rhætic]."

² For C. Moore's notice of the section at Bedminster, near Bristol, see Quart. Journ. Geol. Soc. vol. xxiii. (1867) pp. 500, 501.

³ *Op. cit.* vol. xvii. (1861) p. 496.

form which he referred to "*Cypris liassica*, Brodie," at Beer-Crowcombe, Stoke, Vallis, etc.¹

The section at Beer-Crowcombe² shows:—

1 & 2. Some beds of the Lias, of and above the *Am. planorbis*-zone. 3. The Saurian Bed. 4 [Rhætic]. The White Lias. 5. The *Avicula-contorta*-zone. 6 [Trias]. The Keuper. No fossils are here especially mentioned.

One of the Ostracoda collected by C. Moore at Beer-Crowcombe has been kindly lent from the Bath Museum, through the courtesy of the Rev. H. H. Winwood, F.G.S.; it does not, however, correspond to the so-called *Cypris liassica*. About the occurrence of the latter (?) Mr. C. Moore states as follows³:—"The upper surfaces of the blocks of 'White Lias' in the sections near Taunton [Stoke St.-Mary, etc.] are frequently covered with the shells of this little Crustacean. The same conditions prevailed when the 'Flinty bed' at Beer-Crowcombe was deposited, as the shells are very numerous on its weathered surface. In the Vallis section it is very rare, and only represented by a single specimen, attached to a fragment of *Lima præcursor*."

1865.—The Rev. P. B. Brodie mentioned the occurrence of the *Cypris*-bed at Wootton Park, near Henley-in-Arden, in the Quart. Journ. Geol. Soc. vol. xxi. p. 160; and at p. 161 he expressed his opinion that this and the associated strata, below the Saurian Bed, would probably come "within the Rhætic series of the Trias."

1865.—Messrs. J. W. Salter and H. Woodward's 'Descriptive Catalogue of a Chart of Fossil Crustacea' contains figures of two 'Rhætic' (?) Ostracods from Somerset, enumerated at p. 21, as [fig.] "87, *Cythere liassica*, Jones, MS.," and "88, *Cythere*, sp. nov., Jones, MS." There is some confusion here, for the specific name given to fig. 87 is Brodie's, not Jones's; nor is it the '*Cypris liassica*,' but some form of *Cytheridea*. Fig. 88 is probably of the same species as that represented by fig. 6 in Pl. IX. Although the sketches for figs. 87 and 88 were supplied by me in 1865, all trace of them and of the specimens has been lost. These latter, however, may possibly have been found by me in some probably Lower-Liassic limestones near Taunton, Somerset.

1867.—Mr. C. Moore recorded the occurrence of '*Cythere liassica*' in the 'Rhætic White Lias' of the Camel Hill Railway-cutting⁴ on the Westbury-and-Weymouth line. Mr. E. Wilson has remarked⁵ that the fact of some of the whiter beds of the Lower Lias, as well as some of the Upper Rhætic, having both been termed 'White Lias,' leads to occasional confusion. He also informs me that Mr. C. Moore's 'List of Fossils' at p. 465, vol. xxiii. *op. cit.*, shows that it is a mixed series of Rhætic and Lower-Lias species; or it is

¹ Quart. Journ. Geol. Soc. vol. xvii. (1861) p. 514.

² *Ibid.* pp. 485, 486.

³ *Ibid.* p. 512.

⁴ Quart. Journ. Geol. Soc. vol. xxiii. (1867) p. 465.

⁵ *Op. cit.* vol. xlvii. (1891) p. 546.

even possible that all the 'White Lias' here alluded to may belong to the Lower Lias.

Mr. Moore also mentions as occurring at the Willsbridge cutting on the Mangotsfield Railway,¹ "2*b*. Laminated light-blue clay, with *Estheria minuta* [var. *Brodieana*?], *Cythere liassica*, *Avicula decussata*, etc.", lying on a representative of the well-known Landscape-stone. He further remarks²:—"The surface of the laminated clay (2*b*) is often entirely covered by *Cythere liassica*, the specimens being generally so uniformly arranged lengthwise as to show the direction of the current of the water by which they were last washed."

1876.—In that part of R. Tate and J. F. Blake's work on the 'Yorkshire Lias' which treats of the Crustacea, the Rev. J. F. Blake describes and figures a really Liassic Ostracod (p. 430, pl. xvii. fig. 1) as '*Bairdia liassica*, Brodie, sp.', which belongs to a different genus (probably *Cytheridea*). It is not like Brodie's '*Cypris liassica*,' referred to above, and of which a labelled specimen is preserved in the Geological Society's Collection. Nor does it agree with M. Terquem's description and figures of Terquem's *Cypris liassica*³ from the Lower Lias of Zetrich, Halberstadt, Metz, and Jamoigne, which is probably a *Cytheridea*, and included in Mr. Blake's synonyms (*op. cit.* p. 430). In the same list, "1872, *Bairdia* [?] *ellipsoidea* [G. S. Brady, MS.], Jones, Quart. Journ. Geol. Soc. vol. xxviii. p. 146," with a slightly modified description of the latter, and with some additions, is used for the *Bairdia liassica*, *loc. cit.*

1877.—H. Woodward, in his 'Catalogue of British Fossil Crustacea,' p. 102, refers to "*Cythere liassica*, Brodie, sp., 1845, Rhætic; Wainlode, Severn."

II. NAMED SPECIMENS.

Of authentically named specimens of Brodie's '*Cypris liassica*' I can find only one or two good examples in the Geological Society's Collection; but none in the British Museum (Natural History), nor in the Museum of Practical Geology. Nor is there a good published figure of that species.

Other hand-specimens, with Ostracods incorrectly named '*liassica*,' are also here enumerated.

I. In the Geological Society's Collection, at Burlington House, are some specimens of cream-coloured limestone full of obscure plant-remains, and bearing a few indications of a small Ostracod. These are labelled: "*Naiadites acuminata*, Buckm., Geol. Chelt., p. 93; Rhætic; Bristol; *Cypris liassica*, Brodie. Rev. P. B. Brodie, F.G.S."

The above-mentioned specimens exactly correspond in aspect and

¹ Quart. Journ. Geol. Soc. vol. xxiii. (1867) p. 498.

² *Ibid.* p. 499.

³ Mém. Soc. Géol. France, ser. 2, vol. v. part ii. (1855) p. 333, pl. xxvi. figs. 12*a*, *b*, *c*.

contents to some pieces of Rhætic limestone from Pylle Hill, near Bristol, sent to me by Mr. E. Wilson, F.G.S., in 1891, and noticed by him in Quart. Journ. Geol. Soc. vol. xlvii. (1891) pp. 545-549. They are similar also to a specimen from Uphill, near Weston-super-Mare, collected by Mr. C. Moore, and now in the Bath Museum.

In the Geological Society's Collection there are also three pieces of the "*Cypris*-bed with traces of small plants; Westbury. Mr. Brodie." One piece shows an edge-view of what seems to be an internal cast of *Darwinula liassica*.

In one of the drawers of the Collection is an old label purporting to be a "List of fossils from the Lower Lias of Gloucestershire :—

"Insects, Wainlodes Cliff.

"Insect-limestone and *Cypris*-bed, Wainlodes.

"Insect-limestone and *Cypris*-bed, Westbury, and minute plants."

These above-mentioned specimens may well have been those presented by the Rev. Mr. Brodie in 1842¹ as "Remains of Insects and other fossils from the Lower Lias [Rhætic?] near Cheltenham" [and elsewhere?].

II. The specimens lent from the Charles-Moore Collection in the Bath Museum in 1892-93 (see above, p. 158) comprised :—

1. "*Cypris liassica*. Rhætic Beds. Beer-Crowcombe." Consisting of numerous small, oval, black, smooth Ostracoda (*Cytheridea*, see Pl. IX. fig. 7), lying close together in a hard, grey marl.

2. "*Cypris liassica* (slab covered with). White Lias near Taunton." A buff-coloured limestone, with numerous small, oval, smooth Ostracoda, not so well preserved as in the grey-marl specimen, but apparently belonging to the same species. They lie on a bed-plane, together with fragments of shells (*Pecten*) and a piece of an Echinid spine; also the cast of a small furrow or trail. These are evidently not Brodie's species; but Mr. C. Moore seems to have met with the real form elsewhere, judging from his remark that on some bed-planes at the Willsbridge cutting (see above, p. 159) the carapace-valves lie uniformly lengthwise, as if they had a relatively long axial diameter, as is the case with *Darwinula liassica*.

3. A piece of cream-coloured limestone, containing fragments of *Naiadita* and valves of *Darwinula liassica*, from Uphill, near Weston-super-Mare, Somerset.

4. Some mounted Ostracoda, labelled "*Bairdia liassica*, Brodie; Lower Lias; Brocastle," belong to the genus *Cytheridea* most probably; and are really Lower-Liassic, not Rhætic.

III. The Rev. P. B. Brodie has kindly given me several interesting specimens from his Collection, but only one of them yields a form identical with his '*Cypris liassica*'; and there are other forms, of much interest, which will be noticed in the sequel.

IV. It is Mr. Edward Wilson's large series of shale and limestone (from Pylle Hill, Bristol), alluded to in Quart. Journ. Geol.

¹ Proc. Geol. Soc. vol. iv. part i. p. 50.

Soc. vol. xlvii. (1891) p. 548, that supplies us with the best material illustrating the particular Ostracodous forms under notice.

Old exposures at Bedminster, near Bristol (Mr. Wilson informs me), may have been a source for *Darwinula liassica* in former times, for the same limestone as that occurring at Pylle Hill is evidently referred to by the late Mr. W. W. Stoddard in his essay on the Geology of the Bristol Coal-field, part v., in the Proc. Bristol Nat. Soc. n. s. vol. ii. part 3 (1879), pp. 280, 281, where he states: "Immediately on leaving Bedminster we notice, on the left-hand side of the road and just under the reservoir, a small well, on the top of which is a thin bed of light cream-coloured limestone full of remains . . . of *Naiadites petiolata*," . . . and "valves of *Estheria* and *Cytheridæ*. Near, and behind a public-house, is a small quarry in which is a whitish cream-coloured bed containing . . . valves of *Cytheridæ* in . . . abundance . . . Eighteen inches above this is the well-known Cotham marble" with Insects and Landscape-stone. Remains of Insects and Entomostraca were found in a bed about 15 inches above the Cotham marble. Of the beds in this little quarry Mr. Stoddard gives a detailed section, and Mr. Wilson refers them to a higher zone than the *Naiadites*-bed above mentioned, which he correlates with the Upper-Rhætic bed 'l' of his Pylle Hill section. He thinks that, in Mr. Stoddard's section of the quarry, beds nos. 1-5 (21 inches thick) above the Cotham marble belong to the Lower Lias, and beds 6-10 (21 inches of thin clays and limestones) to the Upper Rhætic. The strata above the Cotham marble here are said by Mr. Stoddard to comprise a bed with *Monotis decussata* and fish-remains (and indistinguishable from that at Garden Cliff, near Westbury-on-Severn), overlying the bed (no. 3) with Insects. These beds are referred to the Rhætic series above, at p. 156, in accordance with the classification adopted by the Geological Survey.

Mr. Wilson informs me that in the roadside quarry on Bedminster Down, a little beyond the public-house referred to above, there are now exposed beneath the Cotham marble 2 to 3 feet of shales precisely similar to bed 'm' of his Pylle Hill section, without any hard beds in them.

V. Mr. William Cunnington, F.G.S., gave me some years ago a few specimens in bluish shale from Bedminster,¹ which prove to be *D. liassica*.

Another interesting specimen from Mr. Cunnington's Collection is a piece of greenish-grey argillaceous limestone, bearing, on a bed-plane, a multitude of individuals of *Darwinula liassica*, lying in an almost uniformly parallel arrangement, caused by the moving water in which they were left. This is marked 'Clifton' and (incorrectly) 'Mountain-limestone.' Mr. E. Wilson, F.G.S., having examined the specimen, states that it belongs probably to his 'Upper-Rhætic' Series, "perhaps a hard seam in the light greenish-blue shales marked 'm' in the Pylle Hill section" given by him in Quart.

¹ This may be the same, perhaps, as that referred to by Mr. E. Wilson, F.G.S., in Proc. Geol. Assoc. vol. xiii. (1893) p. 129.

Journ. Geol. Soc. vol. xlvii. p. 546. The footnote at that page refers to the late Mr. Tawney's section of the Rhætic beds at Oakfield Road, Clifton, where they are faulted down into the Keuper area; and Mr. Wilson thinks that the specimen under notice may have come from that excavation.¹

Other possible sources for it, he says, may be the exposures at Cotham, Pylle Hill, and Bedminster; but these localities could not have been termed 'Clifton.'

VI. We must not omit to state that from Linksfeld, near Elgin, in Morayshire, Scotland, many years since, specimens of some similar Rhætic Ostracoda were supplied by Mr. Patrick Duff, Mr. S. H. Beckles, and Mr. Charles Moore, as fully acknowledged in the Monogr. Foss. Estheriæ, Pal. Soc. 1862, p. 75.

III. DESCRIPTION OF THE SPECIES.²

1. DARWINULA LIASSICA (Brodie). (Pl. IX. figs. 1 *a*, 1 *b*, 1 *c*.)

	Length.	Height.	Thickness of carapace.
Fig. 1 <i>a</i>	·85	·35	— mm.
Fig. 1 <i>b</i>	·7	·3	— mm.
Fig. 1 <i>c</i>	·65	—	·35 mm.

Carapace sub-cylindrical or sub-reniform, varying in outline with slight differences probably due to either individual or sexual growth. The dorsal edge is more or less arched; and the ventral is somewhat hollowed, and more or less sinuous. The ends are rounded; but the front end has rather smaller dimensions than the other. Surface smooth.

The left valve overlaps the right along the back, but in some individuals unequal pressure gives rise to a different appearance.

The original amount of convexity of the surface can seldom be estimated, on account of the crushed condition of many specimens, the partial embedment of others, and the rarity of exposed edge-views. The carapace, however, is convex along the middle, and thickest at the posterior third (fig. 1 *c*).

Some exposed interiors show very simple edges, always somewhat broken.

With regard to other known species of *Darwinula*, it is to be noticed that, of several published figures of the small Ostracoda referable to *D. leguminella*³ (E. Forbes), none exactly agree in proportions with *D. liassica* (Brodie); and it differs also from *D. Stevensoni*, Brady and Robertson,⁴ especially in being less compressed anteriorly.

¹ [In this specimen from Clifton several slightly different forms of *Darwinula liassica* are recognizable; and indeed one relatively short form may prove to be specifically distinct.—Feb. 17th, 1894.]

² I have to acknowledge Mr. Frederick Chapman's kind help in preparing and sketching most of the Ostracoda here described.

³ In the Monogr. Foss. Estheriæ, Appendix, 1862, pl. v. fig. 31; Quart. Journ. Geol. Soc. vol. xli. (1885) pl. viii. fig. 30; Geol. Mag. 1886, pl. iv. fig. 4.

⁴ Ann. Mag. Nat. Hist. 1870, and elsewhere, 1874 and 1889.

Specimens of this species in the Geological Society's Collection came from the cream-coloured limestone with *Naiadites*, or '*Cypris*-bed,' at Westbury-on-Severn (see p. 157); and from a locality at 'Bristol,' which, from Mr. Brodie's information, appears to have been on the Wells Road.¹ These are similar to Mr. Wilson's limestones '*i*' and '*l*' at Pylle Hill, from which figs. 1 and 2 have been taken. The shale '*m*' also contains this species in abundance.

It occurs in a shale from Bedminster (p. 161), probably the same as some Rhætic shale which Mr. Wilson has found in a quarry on Bedminster Down,² over a mile west of Pylle Hill.

[It is present in the hard calcareous shale from the excavation at Clifton (p. 162).—February 17th, 1894.]

Also in a dark-grey, probably Rhætic shale 'above the Insect-limestone' in the Wainlode section (P. B. Brodie).

A limestone, similar to that of Pylle Hill, with *D. liassica* and *Naiadites*, is in the Charles-Moore Collection, Bath Museum, from Uphill, near Weston-super-Mare (see p. 160).

1*. *DARWINULA LIASSICA* (Brodie), var. MAJOR, nov. (Pl. IX. fig. 2.)

Length.	Height.
1 mm.	·55 mm.

The valve in this variety is much larger than what appears to be the normal form; the extremities are more unequal in size, and the anterior is definitely smaller than the other end. (See fig. 1 *b*.)

This variety occurs, in company with the smaller valves (but rarely) in the light-blue shales of Pylle Hill ('*m*', E. Wilson), in that of Bedminster, and in the shale 'above the Insect-limestone' at Wainlode Cliff (Brodie). [Also in Mr. Cunningham's specimen from Clifton.—Feb. 17th, 1894.]

2. *DARWINULA GLOBOSA* (Duff). (Pl. IX. figs. 3, 4 *a*, 4 *b*.)

Cypris globosa, Duff, 'Sketch of the Geology of Moray,' 1842, p. 16 and p. 19.

Candona? *globosa*, Jones, Monogr. Foss. Estheriæ, Pal. Soc. Appendix, 1862, pp. 126, 127, pl. v. figs. 23 and 24.

	Length.	Height.
Fig. 3	·95	·45 mm.
Fig. 4 <i>a</i>	·95	·4 mm.

"Carapace subcylindrical, smooth; carapace-valves oblong, straight on the ventral edge, slightly arched on the dorsal, rounded at the ends, but obliquely at the antero-dorsal region, so that the fore end is narrower than the other." The lucid spots (muscle-marks) are not so much like those of *Candona Forbesii* (Monogr. Tertiary

¹ Mr. Wilson tells me that the exposure here may have been the old Pylle-Hill section, abutting on that road.

² Proc. Geol. Assoc. vol. xiii. (1893) p. 129.

Entom. pl. iv. fig. 8, p. 18) as at first supposed. They are much more like those of *Darwinula*.¹

The edge view of the carapace or of either valve cannot be satisfactorily determined, because of their generally crushed state.

This species from Linksfield, near Elgin,² is so much broader (higher) than known *Darwinulae* that it may probably belong to the genus of that larger form, somewhat similar in shape, referred to *Cyprione* in Quart. Journ. Geol. Soc. vol. xli. (1885) pp. 343, 344, pl. viii. figs. 27-29, 32. Of this latter, however, we do not yet know the muscle-spot.

Darwinula (or *Cyprione*?) *globosa* "occurs in great numbers, and in many laminae, in the greyish calcareous shale or marl at Linksfield; and *Estheria minuta*, var. *Brodieana*, sometimes appears in the same bed," Monogr. Foss. Esth. p. 127.

2*. *DARWINULA GLOBOSA* (Duff), var. *STRICTA*, nov. (Pl. IX. fig. 5.)

	Length.	Height.
Fig. 5....	·9 mm.	·35 mm.

In company with the usual form in the Linksfield shale another, but rare, form, with more truly parallel and nearly straight dorsal and ventral margin, is found.

It has a less arched back and more equal ends than the common specimens, and may be regarded as a variety, possibly of sexual relationship.

3. *CYTHERIDEA ELLIPSOIDEA* (Jones). (Pl. IX. figs. 6 *a*, 6 *b*, 6 *c*.)

Cythere, sp. nov., Jones MS., Salter & Woodward, Descript. Catal. Chart Foss. Crustac. 1865, p. 21, fig. 88.

Bairdia ? *ellipsoidea* (G. S. Brady MS.), Jones, Quart. Journ. Geol. Soc. vol. xxviii. (1872) p. 146.

Bairdia liassica (not Brodie's sp.), Blake, 'Yorkshire Lias,' 1876, p. 430, pl. xvii. figs. 1, 1 *a*.

	Length.	Height.	Thickness of carapace.
Fig. 6 <i>a</i>	·65	·45	— mm.
Fig. 6 <i>b</i>	·65	·4	— mm.
Fig. 6 <i>c</i>	·65	—	·35 mm.

Carapace almost obovate, but more highly arched at the anterior third of the dorsal region, where the hinge is most pronounced, making the carapace broader (higher) there than behind. The

¹ Ann. Mag. Nat. Hist. ser. 4, vol. vi. (1870) pl. vii. fig. 7; Monogr. Post-Tert. Entom., Pal. Soc. 1874, pl. ii. fig. 17; and Quart. Journ. Geol. Soc. vol. xli. (1885) p. 347, note.

² The shales of Linksfield, and their fossil Entomostraca, are treated of in the Monogr. Foss. Estheriæ, Palæont. Soc. 1862, pp. 74-78; but a fuller account both of the bibliographic history of this interesting section, and of its geological and palæontological characters, is given in detail by Prof. J.W. Judd, F.R.S., in Quart. Journ. Geol. Soc. vol. xxix. (1873) pp. 145-149.

right valve (fig. 6 *b*) is narrower (less high) than the left (fig. 6 *a*), and straighter on the ventral edge.

Being strongly convex in the middle, and compressed at the extremities, especially in front, the edge-view of the carapace is broad acute-oval (fig. 6 *c*).

Surface smooth and shining; the convexity of the right valve is emphasized by a central swelling.

This is to a great extent comparable with two species, undoubtedly of *Cytheridea*, from the Fuller's-earth Oolite, in plate ii. Proc. Bath Nat. Hist. & Antiq. F. Club, vol. vi. (1889) pp. 264 & 265, namely *Cytheridea obovata*, J. & S., fig. 6, and *C. subtrigona*, J. & S., fig. 9; but it differs from both of them in some details, especially in the edge-view.

The specimens, of a reddish colour, some in a hard, and some in a soft (weathered?) limestone, probably from the Lower Lias of either the Wainode or the Westbury section (see pp. 156, 157), were collected by the Rev. P. B. Brodie some years ago.

Figs. 6 *a*, *b*, *c*, are reductions of drawings made by my friend Mr. J. W. Kirkby from the curious, red-coloured, little carapaces, in hard brownish limestone, probably (Mr. Brodie thinks) from Wainode. He has, however, had similar specimens from either Hatherley or Westbury; therefore the locality is uncertain.

Besides the comparable forms noted above, there is a somewhat similar species from the Lias of Antrim, which has been collected by Mr. Joseph Wright, F.G.S., Belfast.

There is a noticeable resemblance of the right valve (fig. 6 *a*) to the woodcut, fig. 1, p. 11, Supplem. Monogr. Tert. Entom., Pal. Soc. 1889, representing the outline of the right valve of *Potamocypis Brodiei*, J. & S., from the Isle of Wight, but the latter is much narrower and thinner.

4. *CYTHERIDEA* MOOREI, sp. nov. (Pl. IX. figs. 7 *a*, 7 *b*, 7 *c*, 8 *a*, 8 *b*.)

	Length.	Height.	Thickness of carapace.
Fig. 7 <i>a</i>	·65	·35	— mm.
Fig. 7 <i>b</i>	·65	·325	— mm.
Fig. 7 <i>c</i>	·65	—	·25 mm.
Fig. 8 <i>a</i>	·675	·35	— mm.
Fig. 8 <i>b</i>	·675	—	·3 mm.

This has a shape modifications of which are common among *Cytherideæ*. Somewhat obovate, or subtrigonal with rounded ends; the front semicircular, the hinder extremity contracted and elliptically rounded; the back slightly arched, and the ventral edge oblique; surface gently convex, glabrous, but minutely pitted; the edge view of the carapace lanceolate, acute in front, and somewhat rounded behind. In exposures of the inside the edges are seen to be bevelled within, and the dorsal edge shows some faint evidence of teeth.

These are strong little valves and carapaces, almost black, congregated in a bluish-grey marl from Beer-Crowcombe, Somerset (see

above, p. 160), in the Charles-Moore Collection, Bath Museum, labelled '*Cypris liassica*.' This is, however, quite different from that form, and probably came from the Lias of the locality mentioned.¹

Being sufficiently distinct, it may be appropriately named after its discoverer, who devoted much time and labour to the study of the Lias and Rhætic beds.

Numerous individuals having the same shape, but not dark-coloured, crowd the bed-plane and constitute a small thickness of a piece of yellowish limestone, from Long Itchington in Warwickshire (collected by the Rev. P. B. Brodie some time ago).

With *Cytheridea* having this subtrigonal character we can associate the form described and figured by Terquem as *Cypris liassica* in 1855 (see above, p. 159); also Salter and Woodward's fig. 87, '*Cythere liassica*,' 1865 (see above, p. 158).

5. CYTHERIDEA, sp. (indeterminable). (Pl. IX. fig. 9.)

Length.	Height.
1·3 mm.	·9 mm.

This seems to be the right valve of a large, smooth *Cytheridea*, but it is not sufficiently exposed from the matrix for definite determination. It occurs in a small piece of compact yellowish limestone, collected by the Rev. P. B. Brodie some years since, and labelled 'Bristol.' The matrix is not like any of the known Rhætic limestones of that locality, and it may have come from some neighbouring exposure of the Lower Lias.

6. CYTHERE RETICOSTATA, sp. nov. (Pl. IX. fig. 10.)

Length.	Height.
1·25? mm.	·7 mm.

This is a fine, strong, obliquely-subquadrate valve. The front edge slopes from the antero-ventral corner to the anterior hinge, and bears a thickened edge, which dies out along the oblique dorsal margin before reaching the contracted and rounded hinder extremity. The ventral margin is also oblique, and nearly straight as far as can be seen. The surface is ornamented with a row of pits within the anterior border, accompanied with parallel ridges, which, passing along the dorsal region, are connected by an open meshwork; and this appears to become rather looser and less marked on the rest of the surface, as far as exposed.

This kind of ornament is not unusual among the *Cytheridae*. Both for shape, partially, and the arrangement of riblets and reticulation, some resemblance is noticeable in *Cythere septentrionalis*, Brady.²

¹ For the section, see Quart. Journ. Geol. Soc. vol. xvii. (1861) pp. 485, 486.

² Trans. Zool. Soc. vol. v. (1866) pl. ix. fig. 4; and Trans. Roy. Dubl. Soc. ser. 2, vol. iv. (1889) pl. xvi. fig. 13.

The specimen under notice is in a friable cream-coloured limestone full of Ostracoda (*Cythere*?) and without *Naiadites*, from the Rev. P. B. Brodie's Collection, labelled 'White Lias, Bristol.' Figs. 11 and 12 accompany it. Collected some years ago, it was probably from one of the whitish beds of the Lower Lias somewhere near Bristol, perhaps at Bedminster.

7. *CYTHERE WILSONI*, sp. nov. (Pl. IX. figs. 11 *a*, 11 *b*, 11 *c*.)

	Length.	Height.	Thickness of carapace.
Fig. 11 <i>a</i>	1·2	·75	— mm.
Fig. 11 <i>b</i>	1·25	—	·6 mm.
Fig. 11 <i>c</i>	—	·8	·6 mm.

Carapace suboblong, smooth, elliptically rounded in front, smaller and more symmetrically rounded behind. Anterior hinge well marked; dorsal edge rather oblique, and curving at the lower hinge to meet the narrow end of the valve; ventral edge somewhat sinuous, projecting a little at the front third (fig. 11 *a*), but slightly incurved behind it, and deeply sunken along the junction of the valves (figs. 11 *b*, 11 *c*). Edge view, subacute-oval; end view, obcordate.

This is abundant in the piece of friable limestone which also contains figs. 10 and 12. Collected, and formerly labelled 'White Lias, Bristol,' by the Rev. P. B. Brodie. Probably not from the Rhætic White Lias, but really Liassic. I name it in honour of Mr. Edward Wilson, F.G.S., whose researches in the geology of Bristol and its vicinity are well known, and who has obliged me with much valuable information whilst preparing this notice of the local Ostracoda.

8. *CYTHERE*, sp.? (Pl. IX. fig. 12.)

Length.	Height.	Thickness of carapace.
1·7 mm.	—	·75 mm.

The dorsal aspect of an embedded carapace of a *Cythere* is here seen, such as fig. 11 would probably possess if it were of a larger size. The left valve is broken at each end; but the right valve, excepting that the hinder hinge has been chipped out, shows a perfect dorsal aspect.

It is in the friable whitish limestone labelled 'White Lias, Bristol;' probably Liassic, not Rhætic. Collected by Mr. Brodie.

9. *CYTHEROPTERON BRODIEI*, sp. nov. (Pl. IX. figs. 13 *a*, 13 *b*, 13 *c*, 13 *d*.)

	Length.	Height.	Thickness of carapace.
Fig. 13 <i>a</i>	·6	·45	— mm.
Fig. 13 <i>b</i>	·6	—	— mm.
Fig. 13 <i>c</i>	·6	—	·4 mm.
Fig. 13 <i>d</i> ...	—	·375	·45 mm.

This is a small, somewhat peachstone-shaped Ostracod, probably a *Cytheropteron*, judging by its shape, more especially of that division of the genus embracing the *C. concentricum*, var. *virginea*, J.¹ (of the Chalk), and the recent *C. depressum* and *C. læve*, B. & N.² The specimen under notice, however, though very small, is relatively much fuller and more nearly rotund than the recent forms.

The carapace in side view is nearly oval, but subacute in front, and quite sharp behind. The back has a semicircular curve and a sharp edge. The ventral margin is broad, arcuate in profile, and deeply sunken along its centre, where the edges in meeting make a slight ridge within an inverted arch. The edge view is acute-oval; the end view trigonal and broadly obcordate.

This little fossil Ostracod has a distant resemblance to the carapace of a *Metacypripis* in some points as to shape, but its relationship to *Cytheropteron* is much closer.

It is probably Liassic, occurring with figs. 10, 11, and 12, and is here named after the enthusiastic veteran geologist, my respected friend, the Rev. P. B. Brodie, F.G.S., who collected the specimen many years ago somewhere in the Bristol district.

EXPLANATION OF PLATE IX.

(The figures are all magnified 20 diameters.)

- Fig. 1. *Darwinula liassica* (Brodie). *a*, right valve, large individual; *b*, right valve, small individual; *c*, edge view of carapace. Pylle Hill, Bristol.
Fig. 2. *Darwinula liassica* (Brodie), var. *major*, nov. Left valve. Pylle Hill.
Fig. 3. *Darwinula globosa* (Duff). Left valve. Linksfeld.
Fig. 4. *Darwinula globosa* (Duff). *a*, left valve; *b*, muscle-spot. Linksfeld.
Fig. 5. *Darwinula globosa* (Duff), var. *stricta*, nov. Left valve. Linksfeld.
Fig. 6. *Cytheridea ellipsoidea* (Jones). *a*, left valve; *b*, right valve; *c*, dorsal view of carapace. Westbury-on-Severn?
Fig. 7. *Cytheridea Moorei*, sp. nov. *a*, right valve; *b*, left valve; *c*, edge view of carapace. Beer-Crowcombe, Somerset.
Fig. 8. *Cytheridea Moorei*, sp. nov. *a*, left valve; *b*, edge view of carapace. Long Itchington, Warwickshire.
Fig. 9. *Cytheridea*, sp. Right valve. Near Bristol.
Fig. 10. *Cythere reticostata*, sp. nov. Right valve, imperfect. Near Bristol.
Fig. 11. *Cythere Wilsoni*, sp. nov. *a*, left valve; *b*, ventral aspect of carapace; *c*, end view of carapace. Near Bristol.
Fig. 12. *Cythere*, sp. Dorsal view of carapace, not quite perfect. Near Bristol.
Fig. 13. *Cytheropteron Brodiei*, sp. nov. *a*, carapace showing right valve; *b*, carapace placed obliquely, with the right valve uppermost; *c*, dorsal aspect of carapace; *d*, end view of carapace. Near Bristol.

DISCUSSION.

The PRESIDENT complimented the Author on this further addition to the history of the Ostracoda, so many of his papers on this subject having already enriched the Quarterly Journal. The

¹ Suppl. Mouogr. Cret. Entom., Pal. Soc. 1890, p. 31, pl. ii. figs. 14-17.

² Trans. Roy. Dubl. Soc. ser. 2, vol. iv. (1889) pp. 210, 218, etc.

present paper was of particular interest as giving a critical *résumé* of the present state of our knowledge, which it appeared was very much needed, in addition to his other work. It would be desirable to know how far the study of the Ostracoda throws any material light upon the change between Rhætic and Lias, and whether the separation was sharp or not. He also alluded to the difference of opinion between Mr. Horace B. Woodward and Mr. Edw. Wilson as to where the line should be drawn.

Dr. HENRY WOODWARD also spoke.

The AUTHOR, in reply to the President's question,—whether the Ostracoda served to decide where the line of junction between the Rhætic and the Lower Lias actually occurs,—stated that in Mr. Wilson's 'Upper-Rhætic' beds *Darwinula liassica* (Brodie) abounds, and indicates either freshwater or brackish-water conditions; also at Westbury-on-Severn. Some sections near Bristol (localities not well defined) have shown, above these beds, which contain plant-remains (*Naiadites*), limestones with *Cytheridea*, estuarine or marine, and *Cythere*, a marine genus. This succession shows that the 'Rhætic White Lias' (Wilson) passed up into the other 'White Lias' above, by one or more passage-beds, probably included by the Geological Survey in the 'Rhætic' series. The habits and conditions of recent forms of the recognized genera supply the data for determining the probable habits of the fossil species.

E. C. Knight ad nat. lith.

West. Newman imp.

RHÆTIC & LIASSIC OSTRACODA.