PALÆONTOGRAPHICAL SOCIETY.

VOL. XXVIII.

POST-TERTIARY ENTOMOSTRACA.

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CARBONIFEROUS ENTOMOSTRACA.

PART I.

(CYPRIDINADÆ.)

PAGES 1—56; PLATES I—V.

FOSSIL TRIGONIÆ.

No. II.

PAGES 53—92; PLATES X—XIX.

ISSUED FOR THE YEAR 1874.

PALÆONTOGRAPHICAL SOCIETY.

VOLUME XXVIII.

CONTAINING

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ISSUED FOR 1874.

JULY, 1874.

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THE DATES OF ISSUE OF THE ANNUAL VOLUMES;

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„ XVIII.	„	1864	The Fossil Echinodermata, Vol. II, Part II (Liassic Ophiuroidea), by Dr. Wright, 6 plates. The Trilobites of the Silurian, Devonian, &c., Formations, Part III, by Mr. J. W. Salter, 11 plates. The Belemnitidæ, Part II, Liassic Belemnites, by Prof. Phillips, 7 plates. The Pleistocene Mammalia, Part I, Introduction, Felis spelæa, by Messrs. W. Boyd Dawkins and W. A. Sanford, 5 plates. Title-pages, &c., to the Monographs on the Reptilia of the London Clay, Cretaceous, and Wealden Formations.
„ XIX.*	„	1865	The Crag Foraminifera, Part I, No. 1, by Messrs. T. Rupert Jones, W. K. Parker, and H. B. Brady, 4 plates. Supplement to the Fossil Corals, Part I, Tertiary, by Dr. Duncan, 10 plates. The Fossil Merostomata, Part I, Pterygotus, by Mr. H. Woodward, 9 plates. The Fossil Brachiopoda, Part VII, No. 1, Silurian, by Mr. Davidson, 12 plates.
„ XX.*	„	1866	Supplement to the Fossil Corals, Part IV, No. 1, Liassic, by Dr. Duncan, 11 plates. The Trilobites of the Silurian, Devonian, &c., Formations, Part IV (Silurian), by Mr. J. W. Salter, 6 plates. The Fossil Brachiopoda, Part VII, No. 2, Silurian, by Mr. Davidson, 10 plates. The Belemnitidæ, Part III, Liassic Belemnites, by Prof. Phillips, 13 plates.
„ XXI.*	„	1867	Flora of Carboniferous Strata, Part I, by Mr. E. W. Binney, 6 plates. Supplement to the Fossil Corals, Part IV, No. 2, Liassic, by Dr. Duncan, 6 plates. The Fossil Echinodermata, Cretaceous, Vol. I, Part II, by Dr. Wright, 14 plates. The Fishes of the Old Red Sandstone, Part I, by Messrs. J. Powrie and E. Ray Lankester, 5 plates. The Pleistocene Mammalia, Part II, Felis spelæa, continued, by Messrs. W. Boyd Dawkins and W. A. Sanford, 14 plates.

* These Volumes are issued in two forms of binding; first, with all the Monographs stitched together and enclosed in one cover; secondly, with each of the Monographs separate, and the whole of the separate parts placed in an envelope. The previous volumes are not in separate parts.

CATALOGUE OF WORKS—Continued.

Vol. XXII.* Issued for the Year	1868	Supplement to the Fossil Corals, Part II, No. 1, Cretaceous, by Dr. Duncan, 9 plates. The Fossil Merostomata, Part II, Pterygotus, by Mr. H. Woodward, 6 plates. The Fossil Brachiopoda, Part VII, No. 3, Silurian, by Mr. Davidson, 15 plates. The Belemnitidæ, Part IV, Liassic and Oolitic Belemnites, by Prof. Phillips, 7 plates. The Reptilia of the Kimmeridge Clay, No. 3, by Prof. Owen, 4 plates. The Pleistocene Mammalia, Part III, Felis spelæa, concluded, with F. lynx, by Messrs. W. Boyd Dawkins and W. A. Sanford, 6 plates.
„ XXIII.* „	1869	Supplement to the Fossil Corals, Part II, No. 2, Cretaceous, by Dr. Duncan, 6 plates. The Fossil Echinodermata, Cretaceous, Vol. I, Part III, by Dr. Wright, 10 plates. The Belemnitidæ, Part V, Oxford Clay, &c., Belemnites, by Prof. Phillips, 9 plates. The Fishes of the Old Red Sandstone, Part I (concluded), by Messrs. J. Powrie and E. Ray Lankester, 9 plates. The Reptilia of the Liassic Formations, Part II, by Prof. Owen, 4 plates. The Crag Cetacea, No. 1, by Prof. Owen, 5 plates.
„ XXIV.* „	1870	The Flora of the Carboniferous Strata, Part II, by Mr. E. W. Binney, 6 plates. The Fossil Echinodermata, Cretaceous, Vol. I, Part IV, by Dr. Wright, 10 plates. The Fossil Brachiopoda, Part VII, No. 4, Silurian, by Mr. Davidson, 13 plates. The Eocene Mollusca, Part IV, No. 3, Bivalves, by Mr. S. V. Wood, 5 plates. The Fossil Mammalia of the Mesozoic Formations, by Prof. Owen, 4 plates.
„ XXV.* „	1871	The Flora of the Carboniferous Strata, Part III, by Mr. E. W. Binney, 6 plates. The Fossil Merostomata, Part III, Pterygotus and Slimonia, by Mr. H. Woodward, 5 plates. Supplement to the Crag Mollusca, Part I (Univalves), by Mr. S. V. Wood, with an Introduction on the Crag District, by Messrs. S. V. Wood, jun., and F. W. Harmer, 7 plates and map. Supplement to the Reptilia of the Wealden (Iguanodon), No. IV, by Prof. Owen, 3 plates The Pleistocene Mammalia, Part IV, Felis pardus, &c., by Messrs W. Boyd Dawkins and W. A. Sanford, 2 plates. The Pleistocene Mammalia, Part V, Ovibos moschatus, by Mr. W. Boyd Dawkins, 5 plates.
„ XXVI* „	1872	Supplement to the Fossil Corals, Part III (Oolitic), by Prof. Duncan, with an Index to the Tertiary and Secondary Species, 7 plates. The Fossil Echinodermata, Cretaceous, Vol. I, Part V, by Dr. Wright, 5 plates. The Fossil Merostomata, Part IV (Stylonurus, Eurypterus, Hemiaspis), by Mr. H. Woodward, 10 plates. The Trigoniæ, No. I, by Dr. Lycett, 9 plates.
„ XXVII* „	1873	The Fossil Echinodermata, Cretaceous, Vol I, Part VI, by Dr. Wright, 8 plates. Supplement to the Fossil Brachiopoda, Part I (Tertiary and Cretaceous), by Mr. Davidson, 8 plates. Supplement to the Crag Mollusca, Part II (Bivalves), by Mr. S. V. Wood, 5 plates. Supplement to the Reptilia of the Wealden (Iguanodon), No. V, by Prof. Owen, 2 plates. Supplement to the Reptilia of the Wealden (Hylæochampsa) No. VI, by Prof. Owen. The Fossil Reptilia of the Mesozoic Formations, Part I, by Prof. Owen, 2 plates.
„ XXVIII „	1874	The Post-Tertiary Entomostraca, by Mr. G. S. Brady, Rev. H. W. Crosskey, and Mr. D. Robertson, 16 plates. The Carboniferous Entomostraca, Part I (Cypridinadæ), by Prof. T. Rupert Jones and Messrs. J. W. Kirkby and G. S. Brady, 5 plates. The Trigoniæ, No. II, by Dr. Lycett, 10 plates.

* These Volumes are issued in two forms of binding; first, with all the Monographs stitched together and enclosed in a cover; secondly, with each of the Monographs separate, and the whole of the separate parts placed in an envelope.

LIST OF MONOGRAPHS

Completed, in course of Publication, and in Preparation.

MONOGRAPHS which have been COMPLETED:—

The Tertiary, Cretaceous, Oolitic, Devonian, and Silurian Corals, by MM. Milne Edwards and J. Haime.
The Polyzoa of the Crag, by Mr. G. Busk.
The Tertiary Echinodermata, by Professor Forbes.
The Fossil Cirripedes, by Mr. C. Darwin.
The Post-Tertiary Entomostraca, by Mr. G. S. Brady, the Rev. H. W. Crosskey, and Mr. D. Robertson.
The Tertiary Entomostraca, by Prof. T. Rupert Jones.
The Cretaceous Entomostraca, by Prof. T. Rupert Jones.
The Fossil Estheriæ, by Prof. T. Rupert Jones.
The Tertiary, Cretaceous, Oolitic, Liassic, Permian, Carboniferous, Devonian, and Silurian Brachiopoda, by Mr. T. Davidson.
The Mollusca of the Crag, by Mr. S. V. Wood.
Supplement to the Crag Mollusca, by Mr. S. V. Wood.
The Great Oolite Mollusca, by Professor Morris and Mr. J. Lycett.
The Cretaceous (Upper) Cephalopoda, by Mr. D. Sharpe.
The Fossils of the Permian Formation, by Professor King.
The Reptilia of the London Clay (and of the Bracklesham and other Tertiary Beds), by Professors Owen and Bell.
The Reptilia of the Cretaceous, Wealden, and Purbeck Formations, by Professor Owen.
The Fossil Mammalia of the Mesozoic Formations, by Professor Owen.

MONOGRAPHS in course of PUBLICATION:*—

The Flora of the Carboniferous Formation, by Mr. E. W. Binney.
The Crag Foraminifera, by Messrs. T. Rupert Jones, W. K. Parker, and H. B. Brady.
Supplement to the Fossil Corals, by Dr. Duncan.
The Echinodermata of the Oolitic and Cretaceous Formations, by Dr. Wright.
The Carboniferous Entomostraca, by Messrs. T. Rupert Jones, J. W. Kirkby, and G. S. Brady.
The Fossil Merostomata, by Mr. H. Woodward.

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* Members having specimens which might assist the authors in preparing their respective Monographs are requested to communicate in the first instance with the Honorary Secretary.

MONOGRAPHS in course of PUBLICATION—*Continued.*

The Trilobites of the Mountain-Limestone, Devonian, and Silurian Formations, by Mr. J. W. Salter.*

The Malacostracous Crustacea, by Professor Bell.

Supplement to the Fossil Brachiopoda, by Mr. T. Davidson.

The Trigoniæ, by Dr. Lycett.

The Eocene Mollusca, by Mr. S. V. Wood.

The Belemnites, by Professor Phillips.†

The Fishes of the Old Red Sandstone, by Messrs. J. Powrie and E. Ray Lankester, and Professor Traquair.

The Reptilia of the Wealden Formation (Supplements), by Professor Owen.

The Reptilia of the Kimmeridge Clay, by Professor Owen.

The Reptilia of the Liassic Formations, by Professor Owen.

The Reptilia of the Mesozoic Formations, by Professor Owen.

The Pleistocene Mammalia, by Messrs. Boyd Dawkins and W. A. Sanford.

The Cetacea of the Crag, by Professor Owen.

* Unfinished through the death of the Author, but will be continued by Mr. H. Woodward.

† Unfinished through the death of the Author.

MONOGRAPHS which are in course of PREPARATION :‡—

The Flora of the Tertiary Formation, by Mr. W. S. Mitchell.

The Cretaceous Foraminifera, by Messrs. T. Rupert Jones, W. K. Parker, and H. B. Brady.

The Foraminifera of the Lias, by Mr. H. B. Brady.

The Graptolites, by Professor Wyville Thomson.

The Polyzoa of the Chalk Formation, by Mr. G. Busk.

The Palæozoic Polyzoa, by Dr. Duncan.

The Crinoidea, by Professor Wyville Thomson.

The Wealden, Purbeck, and Jurassic Entomostraca, by Messrs. T. Rupert Jones and G. S. Brady.

The Post-Tertiary Mollusca, by Mr. J. Gwyn Jeffreys.

The Cretaceous Mollusca (exclusive of the Brachiopoda), by the Rev. T. Wiltshire.

The Purbeck Mollusca, by Mr. R. Etheridge.

The Inferior Oolite Mollusca, by Mr. R. Etheridge.

The Rhætic Mollusca, by Mr. R. Etheridge.

The Liassic Gasteropoda, by Mr. Ralph Tate.

The Ammonites of the Lias, by Dr. Wright.

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‡ Members having specimens which might assist the authors in preparing their respective Monographs are requested to communicate in the first instance with the Honorary Secretary.

Dates of the Issue of the Yearly Volumes of the Palæontographical Society.

The Volume for	1847	was issued	to the	Members,	March, 1848.
,,	1848	,,	,,	,,	July, 1849.
,,	1849	,,	,,	,,	August, 1850.
,,	1850	,,	,,	,,	June, 1851.
,,	1851	,,	,,	,,	June, 1851.
,,	1852	,,	,,	,,	August, 1852.
,,	1853	,,	,,	,,	December, 1853.
,,	1854	,,	,,	,,	May, 1855.
,,	1855	,,	,,	,,	February, 1857.
,,	1856	,,	,,	,,	April, 1858.
,,	1857	,,	,,	,,	November, 1859.
,,	1858	,,	,,	,,	March, 1861.
,,	1859	,,	,,	,,	December, 1861.
,,	1860	,,	,,	,,	May, 1863.
,,	1861	,,	,,	,,	May, 1863.
,,	1862	,,	,,	,,	August, 1864.
,,	1863	,,	,,	,,	June, 1865.
,,	1864	,,	,,	,,	April, 1866.
,,	1865	,,	,,	,,	December, 1866.
,,	1866	,,	,,	,,	June, 1867.
,,	1867	,,	,,	,,	June, 1868.
,,	1868	,,	,,	,,	February, 1869.
,,	1869	,,	,,	,,	January, 1870.
,,	1870	,,	,,	,,	January, 1871.
,,	1871	,,	,,	,,	June, 1872.
,,	1872	,,	,,	,,	October, 1872.
,,	1873	,,	,,	,,	February, 1874.
,,	1874	,,	,,	,,	July, 1874.

SUMMARY OF THE MONOGRAPHS ISSUED TO THE MEMBERS (*up to* JULY, 1874): *showing in the* FIRST *column whether each Monograph hitherto published be* complete, *or in the* course of completion; *in the* SECOND *column, the yearly volumes which contain each particular Monograph (as a guide to binding the same); and in the* FOURTH *and following columns, the number of pages, plates, figures, and species described in the different Monographs.*

I. SUBJECT OF MONOGRAPH.	II. Dates of the Years *for which* the volume containing the Monograph was issued.	III *m*. Dates of the Years *in which* the Monograph was published.	IV. No. of Pages of Letterpress in each Monograph.	V. No. of Plates in each Monograph.	VI. No. of Lithographed Figures and of Woodcuts.	VII. No. of Species described in the Text.
The Flora of the Carboniferous Strata, by Mr. E. W. Binney, in course of completion	1867, 1870, 1871	1868, 1871, 1872	96	18	110	15
The Crag Foraminifera, by Messrs. T. Rupert Jones, W. K. Parker, and H. B. Brady, in course of completion	1865	1866	78	4	211	43
Tertiary, Cretaceous, Oolitic, Devonian, and Silurian Corals, by MM. Milne-Edwards and J. Haime, *complete* (*k*)	1849, 1851, 1852, 1853, 1854	1850, 1851, 1852, 1853, 1855	406	72	800	319*g*
Supplement to the Fossil Corals, by Prof. Duncan, in course of completion	1865, 1866, 1867, 1868, 1869, 1872	1866, 1867, 1868, 1869, 1870, 1872	232	49	797	149
The Polyzoa of the Crag, by Mr. G. Busk, *complete*	1857	1859	145	22	641	122
The Tertiary Echinodermata, by Prof. Forbes, *complete*	1852	1852	39	4	144	44
The Oolitic Echinodermata, by Dr. Wright. Vol. I, *complete* (*l*)	1855, 1856, 1857, 1858	1857, 1558, 1859, 1861	474	43	724	109*h*
" " Vol. II, in course of completion	1861, 1864	1863, 1866	154	19	218	29
The Cretaceous Echinodermata, by Dr. Wright. Vol. I, in course of completion	1862, 1867, 1869, 1870, 1872, 1873	1864, 1868, 1870, 1871, 1872, 1874	224	58	774	66
The Fossil Cirripedes, by Mr. C. Darwin, *complete*	1851, 1854, 1858*a*	1851, 1855, 1861	137	7	320	54
The Fossil Merostomata, by Mr. H. Woodward, in course of completion	1865, 1868, 1871, 1872	1866, 1869, 1872, 1872	180	30	249	35
The Post-Tertiary Entomostraca, by Mr. G. S. Brady, Rev. H. W. Crosskey, and Mr. D. Robertson, *complete*	1874	1874	237	16	515	134
The Tertiary Entomostraca, by Prof. Rupert Jones, *complete*	1855	1857	74	6	233	56
The Cretaceous Entomostraca, by Prof. Rupert Jones, *complete*	1849	1850	41	7	176	27
The Carboniferous Entomostraca, by Prof. Rupert Jones and Messrs. J. W. Kirkby and G. S. Brady, in course of completion	1874	1874	56	5	285	50
The Fossil Estheriæ, by Prof. Rupert Jones, *complete*	1860	1863	139	5	158	19*i*
The Trilobites of the Mountain-limestone, Devonian, Silurian, and other Formations, by Mr. J. W. Salter (incomplete through the Author's death)	1862, 1863, 1864, 1866	1864, 1865, 1866, 1867	216	31	703	114
The Malacostracous Crustacea (comprising those of the London Clay, Gault, and Greensands), by Prof. T. Bell, in course of completion	1856, 1860	1858, 1863	88	22	215	50
Fossil Brachiopoda, Vol. I. The Tertiary, Cretaceous Oolitic, and Liassic Brachiopoda, by Mr. T. Davidson, *complete*	1850, 1852, 1853, 1854	1851, 1852, 1853, 1855	409	42	1855	160
" " Vol. II. The Permian and Carboniferous Brachiopoda, *complete*	1856*d*, 1857, 1858, 1859, 1860	1858, 1859, 1861, 1861, 1863	331	59	1909	157
" " Vol. III. The Devonian and Silurian Brachiopoda, *complete*	1862, 1863, 1865, 1866, 1868, 1870	1864, 1865, 1866, 1867, 1869, 1871	528	70	2766	321
Supplement to the Fossil Brachiopoda, by Mr. Davidson, in course of completion	1873	1874	72	8	317	47
The Trigoniæ, by Dr. Lycett, in course of completion	1872, 1874	1872, 1874	92	19	178	60
		CARRIED FORWARD...	4448	616	14,298	2180

SUMMARY OF THE MONOGRAPHS ISSUED TO THE MEMBERS (*up to* JULY, 1874)—*continued.*

I. SUBJECT OF MONOGRAPH.	II. Dates of the Years *for which* the volume containing the Monograph was issued.	III *m.* Dates of the Years *in which* the Monograph was published.	IV. No. of Pages of Letterpress in each Monograph.	V. No. of Plates in each Monograph.	VI. No. of Lithographed Figures and of Woodcuts.	VII. No. of Species described in the Text.
		BROUGHT FORWARD...	4448	616	14,298	2180
The Mollusca of the Crag, by Mr. S. V. Wood:—						
Vol. I. (Univalves), *complete*	1847, 1855*b*	1848, 1857	216	21	581	244
Vol. II. (Bivalves), *complete*	1850, 1853, 1855, 1858*c*	1851, 1853, 1857, 1861	344	31	691	253
Supplement to the Crag Mollusca, by Mr. S. V. Wood, *complete*	1871, 1873	1872, 1874	262	12	360	172
The Eocene Mollusca, Cephalopoda and Univalves, by Mr. F. E. Edwards, in course of completion	1848, 1852, 1854, 1855, 1858	1849, 1852, 1855, 1857, 1861	332	33	578	161
The Eocene Mollusca, Bivalves, by Mr. S. V. Wood, in course of completion	1859, 1862, 1870	1861, 1864, 1871	182	25	531	194
The Great Oolite Mollusca, by Prof. Morris and Dr. Lycett, *complete*	1850, 1853, 1854	1850, 1853, 1855	282	30	846	419
„ „ „ Supplement by Dr. Lycett, *complete*	1861	1863	129	15	337	194
The Belemnites, by Prof. Phillips, in course of completion	1863, 1864, 1866, 1868, 1869	1865, 1866, 1867, 1869, 1870	128	36	622	69
The Upper Cretaceous Cephalopoda, by Mr. D. Sharpe, *complete*	1853, 1854, 1855	1853, 1855, 1857	67	27	319	79
The Fossils of the Permian Formation, by Prof. King, *complete*	1849, 1854*e*	1850, 1855	287	29	511	138
The Fishes of the Old Red Sandstone, by Messrs. J. Powrie and E. Ray Lankester, in course of completion	1867, 1869	1868, 1870	62	14	195	21
The Reptilia of the London Clay [and of the Bracklesham and other Tertiary Beds], by Profs. Owen and Bell, *complete* ‡	1848, 1849, 1856*f*	1849, 1850, 1859	150	58	304	39
The Reptilia of the Cretaceous Formations, by Prof. Owen, *complete* ‡	1851, 1857, 1858, 1862	1851, 1859, 1861, 1864	184	59	519	26
The Reptilia of the Wealden and Purbeck Formations, by Prof. Owen, *complete* ‡	1853, 1854, 1855, 1856, 1857, 1858, 1862	1853, 1855, 1857, 1858, 1859, 1861, 1864	155	62	251	17
The Reptilia of the Wealden Formations (Supplements) in course of completion	1871, 1873	1872, 1874	40	5	50	2
The Reptilia of the Kimmeridge Clay Formation, by Prof. Owen, in course of completion	1859, 1860, 1868	1861, 1863, 1869	16	6	23	3
The Reptilia of the Liassic Formations, by Prof. Owen, in course of completion	1859,‖ 1860,‖ 1863, 1869	1861, 1863, 1865, 1870	121	37	177	8
The Crag Cetacea, by Prof. Owen, in course of completion	1869	1870	40	5	43	7
The Pleistocene Mammalia, by Messrs. W. Boyd Dawkins and Mr. W. A. Sanford, in course of completion	1864, 1867, 1868, 1871	1866, 1868, 1869, 1872	266	32	250	7
The Fossil Mammalia of the Mesozoic Formations, by Prof. Owen, *complete*	1870	1871	115	4	247	30
The Fossil Reptilia of the Mesozoic Formations, by Prof. Owen, in course of completion	1873	1874	14	2	40	10
		TOTAL	7840	1159	21,773	4273

a Index. *b* Title-page to Univalves. *c* Note to Crag Mollusca. *d* Contains the Permian. *e* Two corrections of Plates. *f* Supplement.
g Many of the species are described, but not figured. *h* British species only reckoned. *i* British species only reckoned. *k* A Supplement is now in course of publication.
l Wants Index. *m* Useful for establishing the dates of new species.
‡ **Title-pages and Index will be found in the 1864 Volume, or may be had separately.** ‖ Marked on outside label 'Reptilia of Oolitic Formations.'

STRATIGRAPHICAL TABLE *exhibiting the* BRITISH FOSSILS *already figured and described in the* ANNUAL VOLUMES (1847—1874) *of the* PALÆONTOGRAPHICAL SOCIETY.

	PLANTS.	PROTOZOA.		RADIATA.		ARTICULATA.						MOLLUSCA.				VERTEBRATA.		
		Sponges.	Foraminifera.	Corals.	Echinodermata.	Cirripedes.	Cypridæ, Cytherinæ, &c.	Estheriæ.	Merostomata.	Trilobites.	Malacostracous Crustacea.	Polyzoa.	Brachiopoda.	Monomyaria, Dimyaria, and Gasteropoda.	Cephalopoda.	Fishes.	Reptiles.	Mammalia.
Pleistocene …	…	…	…	…	……	……	1874	…	……	……	…	…	1873	……	…	…	……	1864, 1867, 1868, 1871
Crag …………	…	…	1865	1849	1852	1851, 1854	…	…	……	……	…	1857	1852, 1873	1847, 1850, 1853, 1855, 1871, 1873	…	…	……	1869
Eocene ….. ..	…	…	…	1849, 1865	1852	1851, 1854	1855	…	……	……	1856	…	1852, 1873	1852, 1854, 1855, 1858, 1859, 1862, 1870	1848	…	1848, 1849, 1856	
Cretaceous …	…	…	…	1849, 1868, 1869	1862, 1867, 1869, 1870, 1872, 1873	1851, 1854	1849	…	……	……	1860	…	1852, 1854, 1873	1872	1853, 1854, 1855		1851, 1857, 1858, 1862	
Wealden …. .	…	…	…	…	……	……	…	1860	……	……	…	…	……	……	…	…	1853, 1854, 1855, 1856, 1857, 1862, 1871, 1873	
Oolitic ………	…	…	…	1851, 1872	1855, 1856, 1857, 1858, 1861	1851	…	1860	……	……	…	…	1850, 1852	1850, 1853, 1854, 1872, 1874	1850, 1861, 1868, 1869	…	(Purbeck) 1853, 1858 (Kim. Clay), 1859, 1860, 1868, 1873	1870
Liassic ………	…	…	…	1851, 1866, 1867	1855, 1856, 1858, 1861, 1864	……	…	…	……	……	…	…	1850, 1852	1874	1863, 1864, 1866, 1868	…	1859, 1860, 1863, 1869, 1873	
Triassic ……	…	…	…	…	……	……	…	1860	……	……	…	…	……	……	……	……	……	1870
Permian ……	1849	1849	1849	1849, 1852	1849	……	1849	1860	……	……	…	1849	1849, 1856	1849	1849	1849	1849	
Carboniferous	1867, 1870, 1871	…	…	1852	……	……	1874	1860	1872	……	…	…	1856, 1857, 1858, 1859, 1860					
Devonian ……	…	…	…	1853	……	……	…	1860	1865, 1868, 1872	1862	…	…	1862, 1863	……	…	1867, 1869		
Silurian ……	…	…	…	1854	……	……	…	…	1868, 1871, 1872	1862, 1863, 1864, 1866	…	…	1865, 1866, 1868, 1870					
Cambrian ……	…	…	…	…	……	……	…	…	……	1864								

NOTE.—The numbers in the above List refer to the Volumes issued for those Dates.

THE

PALÆONTOGRAPHICAL SOCIETY.

INSTITUTED MDCCCXLVII.

VOLUME FOR 1874.

LONDON:

MDCCCLXXIV.

A MONOGRAPH

OF THE

POST-TERTIARY ENTOMOSTRACA

OF

SCOTLAND

INCLUDING SPECIES FROM

ENGLAND AND IRELAND.

BY

GEORGE STEWARDSON BRADY, C.M.Z.S.,

THE REV. HENRY WILLIAM CROSSKEY, F.G.S.,

AND

DAVID ROBERTSON, F.G.S.

LONDON:

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1874.

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SYNOPSIS OF CONTENTS.

A MONOGRAPH

OF THE

POST-TERTIARY

ENTOMOSTRACA OF SCOTLAND

(INCLUDING SPECIES FROM ENGLAND AND IRELAND).

INTRODUCTION.

The larger part of the Ostracoda, described in the following Monograph, occur in the Glacial and Post-glacial beds of Scotland, and their geological position is a matter of very considerable importance. A mere catalogue of species under the vague general title of "Post-tertiary" would have little or no geological value. The numerous deposits, which such a term as "Post-tertiary" includes, are widely separated from each other, both in age and in the climatic conditions they represent. A vast series of clays, sands, and gravels were deposited during the epoch intervening between the commencement and cessation of more vigorous conditions of climate than are now prevalent in Great Britain; while that cessation itself was certainly gradual and may possibly prove to have been accompanied by its own recurring periods of increased heat and returning cold. It would be foreign to the purpose of this Monograph to discuss any theoretical explanations of the phenomena of the Glacial Epoch; but we shall endeavour to indicate the precise characters of the various beds containing the species of Ostracoda we describe. Whatever position in the great sequence of deposits any bed we have examined may ultimately be pronounced to occupy, we trust that its identification with our description may be sufficiently easy to permit the facts we have ascertained concerning its composition and fauna to be of service to future students.

This task is not without its difficulty, since many different writers upon the Glacial Epoch have employed the same terms, without meaning the same things. Three terms we shall at once discard. The term *Northern Drift* is far too loose to afford any help in the identification of the position of a bed; while one of the peculiar characteristics of the clay of the Clyde district, in which the fauna of the epoch is most perfectly preserved, is that it is in no sense whatever a drift, but one of the most gradually and quietly formed of deposits. The term *Brick Clay* is equally objectionable, since clay capable of making bricks may belong to any period, and the brick clay of one part of the country may be geologically distinct from that of another. The use of the term *Till* is also in danger of misleading through its employment by the older Scotch geologists in a very vague sense; in fact, whenever a bed of coarse silt, or clay, or sandy loam was found containing boulders it was called *Till*.

While retaining the term "Boulder Clay," we cannot employ it without considerable explanation. If we were to content ourselves with noting that certain species of Ostracoda occur *in* the "Boulder Clay," or *beneath* the "Boulder Clay," without specifying the precise character of the deposit to which we refer, it would lead to great confusion. Under the general term "Boulder Clay" a very miscellaneous collection of deposits, attributable to different causes and belonging to various periods of the great Glacial Epoch, has been vaguely included. Any clay containing boulders is not necessarily identical with the oldest Boulder Clay of Scotland. A fossiliferous Arctic clay may contain boulders (as boulders may be found scattered through the Paisley Shell-beds), and yet cannot be described as Boulder Clay without an extreme misuse of terms. Boulders have been in all probability dropped into the Shell Clay from ice floating over the Firth of Clyde, precisely as they are dropped from the ice floating at the present day in the St. Lawrence, and this Shell Clay, into which the boulders fell, *may* have been resting upon an old "Boulder Clay" and have been formed long subsequently to its deposition and by entirely different agencies. A "Boulder Clay" *may* have been carried from the land into the sea by a glacier breaking off into an iceberg, and thus have covered littoral Shell Clays, and have become mixed with fragments of shells, although not itself of marine origin.

Without theorizing, therefore, upon the origin of the various beds roughly included under the general terms "Northern Drift," "Brick Clay," "Till," "Boulder Clay," it is necessary to note their characteristics in order that the physical geologist may understand the exact positions in which the Ostracoda we catalogue occur.[1]

[1] These deposits have been treated of to some extent in the series of Memoirs on the Post-tertiary fossiliferous beds of Scotland, by Messrs. Crosskey and Robertson, in the 'Transactions of the Geological Society of Glasgow,' vol. ii, p. 267; vol. iii, pp. 113, 321; and vol. iv, pp. 40, 128. See also Mr. Crosskey's paper on the Boulder Clay, ibid., vol. iii, p. 149.

§ I. VARIETIES OF BOULDER-CLAY.

I.—One bed is so distinct in character and so easily recognised that one of the writers of these pages proposed, some years ago, that to it the term "Boulder Clay" should be entirely restricted,[1] and this course will be followed in the present Monograph.

This Boulder Clay contains a large number of striated and polished stones which have been worn down, and not broken, by the process through which they have passed. These polished and striated surfaces are so freshly preserved that the stones could not have been rolled on a beach subsequently to their production. Any trituration would at once destroy the fineness of the glaciated surfaces.

The included stones are chiefly traceable to the heights nearest the locality in which the special bed under examination is found, although a distinct proportion have been derived from the more distant mountains. In some cases the included boulders have travelled from distances in the direction along which a glacier would naturally have moved, according to the general conformation of the country.

The colour, as well as the general character of the enclosed stones, is determined by the mineral character of the district in which it is found.

There is no distinct stratification, although there are occasional seams of sand and clay. The Boulder Clay varies in tenacity; but, as a rule, is toughly compact and hard to be worked even with a pick-axe.

Its thickness is excessively variable, extending from a mere surface-covering of the rock to a depth of one or two hundred feet.

The highest point at which the stratified clay containing glacial shells has yet been found in Scotland is at Chappel Hall, near Airdrie, 526 feet above the sea; but an unstratified and unfossiliferous Boulder Clay, of the character just described, may be traced to very considerable heights. It has been seen by Mr. J. Geikie on the tops of the Ochils, 1500 feet; by Mr. Croll on the Pentland Hills, 1617 feet; by Mr. Milne Home, near Schehallion, 2000 feet above the sea; and it may be found in almost every nook and corner of the Highlands. At lower levels it is very largely developed, both in the plains themselves and on the flanks of the hills bordering wide valleys.

While this Boulder Clay reaches to a height of at least 1500 feet beyond that at which any arctic shell-clay has yet been discovered, it at the same time *underlies* the shell-bed throughout the whole of the west of Scotland, as well as in some of the Eastern districts. Many instances of this fact will be noted in the detailed descriptions

[1] See a paper "On the *Tellina calcarea* Bed at Chappel Hall, near Airdrie," by Henry W. Crosskey, in the 'Quarterly Journal Geolog. Soc.,' 1865, vol. xxi, p. 219.

of the beds we have examined. Shell-beds have also been found, under circumstances needing special local examination, intercalated between masses of Boulder Clay of the same character.

The only cases in which a Boulder Clay physically analogous to that of which we are treating contains fossils are those which will presently be described as a second type of Boulder Clay, which forms cliffs near the shore and never extends beyond a few miles inland.

Whatever explanation of its origin may be given, so far as present investigations extend, there seems to be ample evidence for the existence of a Boulder Clay: (1) Older than the stratified clay containing Arctic shells; (2) extending to far greater heights than either any fossiliferous Boulder Clay or any stratified clay; (3) unsubjected to any action of the tidal wave upon the shore; (4) and connected with the more remote and extreme Arctic conditions of the Glacial Epoch.

The position of the beds from which we have obtained Ostracoda in relation to this Boulder Clay will at any rate furnish a guide available for the practical use of the advocates of any theory regarding their succession, which may be in debate.

II. There are *fossiliferous Boulder Clays* which have several striking peculiarities.

1. They occur (so far as we yet know) either close to the coast or within a distance of four or five miles, and generally form low cliffs immediately on the shore. They may be seen on the north-east coast of Scotland, along the north-east coast of Ireland, on the north-east coast of England, on the Lancashire coast, and along the banks of the Mersey.

2. The shells they contain are very seldom perfect, except in the case of a univalve, like *Turritella communis;* and, even when perfect, they are not found in their natural living position. These features form a remarkable contrast to the state of the fossils in the great shelly beds resting upon the Boulder Clay in the Clyde districts. In those beds numerous specimens of such Molluscs as *Saxicava* (*Panopæa*) *Norvegica,* and *Mya Uddevallensis* are found in their natural upright position, with fragments of the syphon preserved; while *Pecten Islandicus, Astarte sulcata,* and almost every other bivalve, together with the Ostracoda, occur with united valves; and in many cases, when they are taken freshly from the clay, the connecting ligament may be detected, although it quickly decays on exposure to the air.

3. The fauna is sometimes less Arctic in character than that yielded by the stratified glacial clay immediately resting upon the lowest unstratified Boulder Clay. The Caithness Boulder Clay, which reaches a thickness of more than 100 feet, contains (writes Mr. Jamieson) "remains of sea shells all through it, often from top to bottom, and these shells are broken, rubbed, and scratched, evidently by the same agency that marked the rocks and boulders," while "the group is the most modern, except that of

Fort William," and "the proportion of Arctic species is less than at any of the other localities."[1]

Mr. Jamieson gives the following explanation of the probable origin of the Caithness fossiliferous Boulder Clay:—"A set of marine beds containing Arctic shells were probably deposited over the low part of Caithness; and much drifting ice seems to have passed over the district from the north-west, which crushed and destroyed these marine beds, broke the shells, and mixed them up with other superficial *débris* into that mass of rough pebbly mud which now overspreads the surface. These marine beds were probably of different ages; the older containing Arctic species, the later containing chiefly Boreal and southern forms. This would account for that mixture of species which we observe in the Caithness list."[1]

4. The fauna, also in *some* of the fossiliferous Boulder Clays, is somewhat mixed.

Foraminifera, *e.g.*, are found in the Caithness Boulder Clays, which have been derived from the wearing down of the oolite, lias, and chalk blocks they contain. In the same clays there is also a mixture of southern, British, northern, Arctic, and North-east American species of Mollusca.[2]

While this Boulder Clay possesses the general appearance of the Boulder Clay first described, containing the usual striated and polished stones and being compact and unworkable, these characteristics may fairly be described as, in many instances, not quite so intense in their development, although often their only distinguishing mark is the presence of shell fragments.

Its peculiar position in cliffs near the shore, the occurrence of fossils, and its general composition, seem to sustain the theory that in some cases it marks the point where the *débris* of great glaciers was pressed to the bottom of the sea at their final point of descent; and it may be of the same age as the shell-beds, which, in other localities, rest in hollows of the unfossiliferous Boulder Clay; while in other cases it may be an accumulation dropped from icebergs, and in others a wash from an older bed during the final re-elevation of the land.

Without reference, however, to the method of its formation, as a matter of fact there exists a fossiliferous Boulder Clay (1) not *necessarily* of the same age as the unfossiliferous Boulder Clay; (2) with an included fauna more or less Arctic, although mixed and fragmentary; (3) chiefly developed in the neighbourhood of the shore, in the form of sea cliffs; (4) physically, not always distinguishable from that which underlies the Shell Clay of the Clyde district, although sometimes marked by a diminution in the intensity of its ice-marks.

[1] "On the Glacial Phenomena of Caithness," by T. F. Jamieson, F.G.S., 'Quarterly Journal of Geol. Soc.,' 1866, vol. xxii, pp. 272, 273.

[2] Jamieson, paper cited, p. 278.

1. Wick Harbour.

We examined the fossiliferous Boulder Clay at Wick Harbour and Burn of Haster, for Ostracoda. It is a hard compact mass with striated and polished boulders, similar in composition to that Boulder Clay in the west of Scotland, in which we have failed as yet to detect fossils. We are unable to make any physical distinction between the two Boulder Clays now mentioned.

The Caithness Boulder Clay varies in depth and is generally overlain by shingly gravel, succeeded by surface soil. The fossils are thinly interspersed from top to bottom through the section, and are very much worn and fragmentary. They appear very equally distributed, as if the whole mass had been mixed up and kneaded together, and can be obtained, although sparingly, on the face of weather-beaten sections. On some strong valves of *Cyprina Islandica* glacial striæ may be observed.

Mr. Jamieson gives the following section at Wick Harbour:

1. Reddish-brown clay, with boulders;
2. Dark pebbly silt, with broken shells;
3. Old Red Sandstone;

and adds the following description: "In the banks beside the harbour (at Pulteney Town) the drift is fifty or sixty feet deep. The lowermost two thirds of it are a sandy mud or silt of a very dark grey colour, solid and firm, as if much compressed, and although there are a good many small pebbles dispersed through it, yet they do not form a large proportion of the mass, and there is an absence of big stones. Fragments of shells are in many places not uncommon, and are scattered through it in an irregular manner, not occurring in horizontal lines or seams. There is, in short, no distinct stratification, although in some places there is an approach to it, owing to patches of a more sandy nature occurring; it is an unstratified pebbly silt, the greater part of the mass consisting of fine sand. The upper part of the bank, on the other hand, is of a browner, more ferruginous colour, much coarser in quality, with more muddy sediment, and few or no shells; it is also full of stones and large ice-worn boulders of sandstone, quartzose mica-schist, and granite, on which the glacial scoring is well marked; one of these granite blocks is twelve feet in length. I cannot say that there is any clear line of separation between this coarse upper stuff and the dark siltier matter beneath; for although in some places the distinction is pretty well marked, in others they seem to graduate into each other. When the rock rises in the cliff, the dark silty portion thins out, and the coarse brown mud full of boulders rests immediately upon the ice-worn surface of the Caithness flags."[1]

We washed 12 lbs. of the dry shell-bearing clay, and found that it lost 4 lbs. through a sieve of ninety-six threads to the inch, leaving 8 lbs. residue, of which 2 lbs.

[1] 'Quarterly Journal of Geol. Soc.,' 1866, vol. xxii, p. 265.

was retained in a sieve of one eighth of an inch mesh, and consisted of small stones more or less worn and striated. The remaining 6 lbs. was chiefly sand.

The following Ostracoda were found:

Cythere viridis, Müller.
— *mirabilis*, Brady.
— *Dunelmensis* (Norman).
— *tuberculata* (G. O. Sars).
— *tenera*, Brady.
— *lutea*, Müller.
Cytheridea punctillata, Brady.
— *papillosa*, Bosquet.
Loxoconcha impressa (Baird).
Cytherura undata, G. O. Sars.
Cytheropteron latissimum (Norman).

2. Burn of Haster.

Along the banks of the Burn of Haster, near Wick, Mollusca are more abundant than at Wick Harbour, although the Boulder Clay is very coarse and contains many stones of large size.

The following Ostracoda were found:

Cythere villosa (G. O. Sars).
— *concinna*, Jones.
— *Finmarchica* (G. O. Sars).
Cytheridea punctillata, Brady.
Xestoleberis depressa, G. O. Sars.
Cytherura undata, G. O. Sars.
Cytherideis subspiralis, nov. sp.

III. A third clay, which has been improperly, we believe, termed Boulder Clay, is precisely of the same age, although not of the same physical character, as the stratified shell-bearing clays of the Clyde and other districts. An example may be seen near Lag Arran, overlying the older Boulder Clay from which it is very distinctly separated; it is hard and compact, but not so hard and compact as the clay on which it rests, while the stones it contains are generally smaller, much more worn, and, except in a few exceptional cases, far less distinctly striated. The Arctic shells found scattered through it, although chiefly in single valves and broken, are decidedly better preserved than in the fossiliferous Boulder Clay just described. A *Leda*, indeed, has been found with both valves united, and the bed contains species as characteristic of the ordinary Glacial Clays as *Pecten Islandicus*, *Astarte borealis*, *Leda pernula*, *Cyprina Islandica*, together with Foraminifera and Ostracoda. Patches of sand and gravel are common. This clay is evidently the wash of an old Boulder Clay upon a somewhat exposed coast. The angular blocks have been jumbled together, their striations half obliterated, and their polish somewhat worn off, while the clay has been washed and rewashed around them, and a rude and rough habitat formed for the scanty development of a marine fauna. In an account of these beds given by Dr. Bryce and one of the authors of this paper,[1] it is pointed out that the upper part of the shell-bed is a little sandy, while in the lower part the character more closely approximates to the underlying Boulder Clay.[2]

The following Ostracoda were found in the shell-bearing clay, of the character now described, on the banks of the Cloinid Burn, near Lag Arran. A complete section of the bank will be given as we proceed to notice the next division of so-called Boulder Clays:

Cythere pellucida, Baird.
— *concinna*, Jones.
— *Clutha*, nov. sp.
— *emarginata* (G. O. Sars).
— *Dunelmensis* (Norman).
Cytheridea punctillata, Brady.
— *papillosa*, Bosquet.
Cytherura nigrescens (Baird).
— *undata*, G. O. Sars.
Cytheropteron nodosum, Brady.

IV. A series of deposits composed of sand, gravel, and clay, and containing boulders often in large numbers, must be carefully discriminated from the "Boulder Clay" of this paper.

Instead of the innumerable finely polished and striated stones characteristic of the "Boulder Clay," these beds contain stones with coarsely worn surfaces and half oblite-

1 'Arran and other Clyde Islands,' by J. Bryce, LL.D., 4th ed., p. 184.

2 A different view of this clay is taken by the Rev. R. B. Watson, B.A., in his paper "On the Great Drift Beds with Shells in the South of Arran," 'Trans. Royal Soc. Edin.,' vol. xxiii, p. 523.

rated striæ, while many retain no signs of ice-action. Differing in texture, they are often loose and rubbishy—sandy and earthy—and to a large extent have been exposed to the wear and tear of air and water.

They sometimes contain blocks even larger and heavier than those in the lower clay; but these blocks *may* have been dropped into the bed by floating ice.

1.—Some of the beds of this series consist of a thick clay with many boulders, and on a cursory examination might easily be mistaken for "Boulder Clay" in the sense in which we have employed the term. They may be distinguished, however, by observing that the included stones while often angular and subangular, have a feeble polish, and preserve only faint reminiscences of their former striations. Generally speaking, also, the clay and the boulders are far less compactly pressed together, and are not welded, like the old Boulder Clay, into an almost solid mass.

Sometimes a shell bed may be seen intervening between an upper bed of this kind and a lower Boulder Clay; and at other times the two clay beds may be seen in contact, the shell bed having been eliminated.

During some excavations at Chappel Hall, near Airdrie, the following sections were exposed within seven yards of each other

	ft.	in.
Upper clay with boulders	14	0
Finer clay, containing smaller stones, with *Tellina calcarea* and *Cyprina Islandica;* in the deepest part (but rapidly thinning out) .	2	1
Boulder Clay, not pierced.		

At seven yards' distance the shell bed disappeared and the two clays met.

	ft.	in.
Upper clay with boulders	5	3
Boulder Clay, not pierced through	9	6

We carefully examined these two clays, and found the distinctions between them very decidedly marked. The boulders in the lower bed were polished with extreme fineness, and the striations upon them were numerous and clear, but in the upper bed only a few stones had slight indications of striæ, while many had the appearance of having been worn down. The upper clay was also looser and more easily worked than the lower.

2.—Other beds of this series are composed of sand and gravel rather than clay, and are either unstratified or very rudely stratified, and often contain angular and imperfectly stratified boulders.

Between these beds also and the older Boulder Clay shell beds have been discovered. The following section occurs along the banks of the Cloinid burn, near Lag Arran.[1]

1.	Surface soil.	
2.	Upper drift of sand and stones	variable thickness.
3.	Compact bed of stones with little sand	5 to 6 ft.
4.	Upper drift of sand and stones	variable thickness.
5.	Dark sandy bed with open texture	4 to 5 ft.
6.	Stony clay bed, with Arctic shells	7 to 10 ft.
7.	Boulder Clay	12 to 20 ft.

In this section we may see in regular and ascending order—

An older Boulder Clay (I of this paper, p. 3), unfossiliferous and typical.

A fossiliferous clay (III of this paper, p. 7); a wash from an older bed, with a scattering of striated stones.

A younger series of clays, sands, and gravels (IV of this paper, p. 8); unfossiliferous (in this case), loose and sandy, and retaining some feebly striated stones.

From the diverse characteristics of the deposits now described, and which have all been included more or less generally under the terms—Till, Northern Drift, Boulder Clay, it is evidently of the utmost importance that precise descriptions of the clays in which Ostracoda and other fossils have been discovered should be given. Employing a vague nomenclature, a species may be said to occur *in* the Boulder Clay, and yet have been found either in the second or third or fourth of the beds discriminated in this paper; or a species may be said to occur *under* the Boulder Clay, and have been found under the first or the fourth.

A fossil really belonging to the age of the Paisley Clay might thus, for example, be ascribed to a more remote or a more recent era almost *ad libitum*, to the great confusion of any attempts to understand either the variations of climate or the distribution of species which may have taken place during the Glacial Epoch and the subsequent physical history of Great Britain.

[1] Bryce, 'Arran,' &c., p. 185.

§ II. VARIETIES OF FOSSILIFEROUS DEPOSITS, NOT BEING BOULDER-CLAYS.

NECESSARY as it is to distinguish the so-called "Boulder Clays" from each other, it is equally necessary to note the differences existing between those numerous Post-tertiary fossiliferous deposits of Scotland which cannot under any circumstances be described as Boulder Clays, and in the larger number of which Ostracoda occur in more or less abundance.

In the earlier researches into the Post-tertiary beds of Scotland two superficial deposits alone were noted. The lowest was vaguely termed "Till, a stiff unstratified clay mixed with boulders," while the upper was described as brick or finely laminated clay overlain by sand and gravel. The whole of the fossils found were classed together and catalogued by Mr. Smith of Jordan Hill, in the first catalogue ever issued,[1] as belonging to the "Newer Pliocene deposits in the British Islands."

As Mr. Smith's investigations proceeded he discovered that he had confounded two distinct sets of beds, and that there were in the elevated marine beds of sand, gravel, and clay, which cover the older formations, *at least* two deposits differing in climate and fauna, and separated by wide intervals of time.[2] He discriminated the "glacial deposits" of Great Britain and Ireland from the "raised beaches," and a Glacial Epoch was added to the geological record.

Mr. Smith published a second catalogue in which he confined himself to the marine Testacea, including Cirripedia, Annelida, and Foraminifera"—Ostracoda had not then been detected—of the "glacial deposits."[3] This catalogue, however, presents many difficulties. Apart from the fact that there is a very perplexing employment of synonyms, the original specimens from which several "new species" were described have not been preserved, so that it is impossible to decide whether some of them may not have been identical with the varieties of modern conchologists, and many of the *localities* are far too vaguely specified for identification.

The simple distinction between "raised beaches" and "glacial deposits" does not at all cover the whole ground occupied by the fossiliferous beds in question.

[1] 'Transactions of the Wernerian Society.' 1839.

[2] 'Researches in Newer Pliocene and Post-tertiary Geology.' By James Smith, F.R.S. Glasgow: John Gray. 1862.

[3] Ibid., p. 46. In connection with this department of Scotch Geology, the name of Mr. Smith ought always to be honourably remembered, and the results of his researches acknowledged. His collected papers indicate the successive steps which led to his great discovery, and constitute a chapter of great value in the history of Post-tertiary geology.

Professor Edward Forbes, in his paper " On the Connection between the Distribution of the Existing Fauna and Flora of the British Isles and the Geological Changes which have affected their area, especially during the Epoch of the Northern Drift,"[1] while referring in his catalogue of " species of marine animals found fossil in beds of the Glacial Epoch " to localities so broadly defined as " Scotland," " drift beds of Scotland and Ireland," and " Clyde beds," nevertheless, by the whole course of his arguments plainly indicates that these beds themselves must differ from each other in their general characteristics, and require to be studied separately rather than be roughly gathered into one group.

Among the " chief conclusions " (some of which subsequent researches have necessarily modified) in which he sums up the results of the facts and arguments stated in the essay the following occur, which bear upon the existence, among the Post-tertiary fossiliferous deposits under discussion, of many varieties of beds deposited neither at one time nor under one set of circumstances.

" The greater part of the terrestrial animals and flowering plants now inhabiting the British Islands are members of specific centres beyond their area, and have migrated to it over continuous land before, during, or after the Glacial Epoch " (p. 399).

" The termination of the Glacial Epoch in Europe was marked by a recession of an Arctic fauna and flora northwards, and of a fauna and flora of the Mediterranean southwards, and in the interspace thus produced there appeared on land the general Germanic fauna and flora, and in the sea that fauna termed Celtic " (p. 401).

" The causes which thus preceded the appearance of a new assemblage of organized beings were the destruction of many species of animals, and probably also of plants, either forms of extremely local distribution or such as were not capable of enduring many changes of conditions,—species, in short, with very limited capacity for horizontal or vertical diffusion " (p. 401).

" All the changes before, during, and after the Glacial Epoch appear to have been gradual and not sudden, so that no marked line of demarcation can be drawn between the creatures inhabiting the same element and the same locality during two proximate periods " (p. 401).

The recession of one fauna and flora and the advance of another, the changes in the local distribution of species caused by the elevation and subsidence of the land, and the gradual passage from one set of conditions to another, must be indicated in the varying composition of the different deposits.

The first important attempt to classify the various beds belonging to the " Scotch glacial drift," as well as explain their origin and determine their sequence, was made by Prof. A. Geikie, whose treatise " On the Phenomena of the Glacial Drift of Scotland " was published in 1863.[2]

[1] 'Memoirs of the Geological Survey of Great Britain,' vol. i. London, 1846.

[2] 'Transactions of Geological Society of Glasgow,' vol. i, part ii.

Other investigators, including Mr. Jamieson, of Aberdeen, Mr. Croll, Mr. Milne Home, Mr. James Geikie, and many other geologists, have largely advanced our knowledge; and the reader may be referred to many papers which during the last few years have appeared in almost every volume of the 'Transactions of the Geological Society of Glasgow;' 'Transactions of the Philosophical Society of Glasgow;' 'Transactions of the Royal Society of Edinburgh;' 'Transactions of the Geological Society of Edinburgh;' 'Proceedings of the Royal Physical Society of Edinburgh;' 'Geological Magazine;' 'Quarterly Journal of the Geological Society,' &c.

We proceed to describe the various fossiliferous deposits, not being Boulder Clays, which have come under examination for the purposes of this paper.

There are various striking differences both in position and character existing among the Post-tertiary fossiliferous glacial clays, sands, and gravels, which raise questions of great intricacy and importance, and by which (at any rate for the purposes of study) they must be more or less distinctly separated from each other.

In the following remarks (as well as throughout this paper) we mean by "Boulder Clay" the first clay which we described[1] among the varieties to which that name has been affixed.[2]

I. *Fossiliferous beds, the remains either of the immediate Pre-glacial period or Inter-glacial or Glacial, have been discovered immediately beneath the Boulder Clay, and without any Boulder Clay for their base.*

The fact of the occurrence of these fossiliferous beds in this position does not, of course, either prove them to belong to one epoch or determine their precise age at all, but its significance will be illustrated by the following examples.

1. Slains and Cruden, Aberdeenshire.

In the parishes of Slains and Cruden, on the east coast of Aberdeenshire, some thick masses of sand and gravel have been described by Mr. Jamieson, ranging up to 200 feet above the sea-level, which are covered in many places "by the red clay of the Glacial Period, containing large boulders and ice-scratched stones," and have no Boulder Clay below them, and which contain a fauna allied to that of the Crag strata of England.[3]

There can be no doubt that the group of species mentioned in the following passage

[1] See page 3.

[2] Mr. James Geikie, in his elaborate and remarkable work on "The Great Ice Age," which has been published while these pages are passing through the press, restricts the term *Till* to the *Boulder Clay* of this paper.

[3] 'Quarterly Journal Geol. Soc.,' 1865, vol. xxi, p. 161.

is entirely different from any group discovered either in the older glacial or the more recent deposits of Scotland.

"There are fragments of *Voluta Lamberti, Cyprina rustica, Nucula Cobboldiæ, Fusus contrarius, Purpura incrassata, Nassa elegans, Nassa reticosa, Turritella incrassata,* and probably *Trophon costiferum,* forms unknown either in our glacial beds or in our present sea. Besides these there are the broken remains of many others, of the genera Cardium, Pecten, Venus, and Astarte, which differ from those found in any of our glacial beds, and one of the most common shells is *Pectunculus glycimeris,* which attained a large size."[1]

2. Kilmaurs, near Kilmarnock.

Messrs. John Young and Robert Craig have published notes "On the occurrence of Freshwater Plants and Arctic Shells, along with the remains of the Mammoth and Reindeer, in beds under the Boulder Clay at Kilmaurs."[2]

Since the discovery (1816) of the remains of *Elephas primigenius* and *Cervus tarandus* at Woodhill quarry, Kilmaurs, near Kilmarnock, considerable interest has attached to the beds underlying the Boulder Clay in this neighbourhood. Dr. Bryce has published[3] the following section of beds exposed during excavations made under his direction. One of the writers of this paper noted the section in company with Dr. Bryce, and is perfectly satisfied that the sixteen feet of Boulder Clay consist of precisely the same clay as that unfossiliferous Boulder Clay we have described and to which we limit the term.

1. Carboniferous Sandstone, terminating upwards in beds of sandy clay, resembling a fire-clay	
2. Hard gravel, with a little clay, and small bits of round smooth stones, most of them quartz and trap, but all free from striation . .	2 ft.
3. A fine dark-blue clay, with occasionally small bits of quartz and other pebbles, extremely distinct in character . . .	9 in.
4. Sand, irregular in structure, very fine in places and again coarse, approaching gravel, very like river-sand . .	6 to 18 in.
5. Boulder-clay, of reddish-brown colour, very tough and unworkable, full of large boulders and smaller stones, mostly smoothed, polished, and striated; bits of coal-shale, covered with striations, not crushed .	16 ft.
6. Upper Drift, with stones, but much more open in texture, no striations .	20 ft.
7. Subsoil and surface soil.	

[1] 'On the Hist. of the last Geol. Changes in Scotland,' by T. F. Jamieson, F.R.S., p. 162.

[2] 'Transactions of the Geol. Soc. of Glasgow,' vol. iii, p. 310.

[3] "On the Occurrence of Beds in the West of Scotland beneath the Boulder Clay," by James Bryce, M.A., LL.D., F.G.S., 'Quart. Journ. Geol. Soc.,' vol. xxi, 1865, p. 213.

During this excavation no fossils were found, but *from the same quarry* a tusk of *Elephas primigenius* and a pair of horns of *Cervus tarandus* were sent some years ago to the Hunterian Museum (University of Glasgow), with a statement that they had been found at a *depth of thirty-four feet from the surface.* By washing some sandy clay in which the horns were embedded, and also the clay preserved in the cracks and crevices in the tusk, Messrs. Craig and Young have discovered (1) that the specimens came from the same bed, and (2) that this bed was of freshwater origin, and quite distinct from any bed containing marine shells.

It appears clearly proved, therefore, that there exists in this district, *beneath the old Boulder Clay*, a freshwater bed containing the remains of *E. primigenius* and *C. tarandus.*

New pits having been sunk, Messrs. Craig and Young have been able to throw fresh light on those beds beneath the Boulder Clay we are now discussing.[1]

At No. 9, Woodhill, Kilmaurs, about half a mile from the old Woodhill quarry, the following beds were pierced:

Surface-drift and Boulder-clay	50 ft.
Sand bed, containing Arctic marine shells . . .	1 ft. 3 in.
Sandy peaty clay, about	1 ft.
Coarse gravelly sand	1 ft. 6 in.
Carboniferous strata.	

Every one of the nine species of Mollusca found in this sand bed also occurs in the glacial clay, resting in hollows of the Boulder Clay (of which we shall presently speak), so that the bed is entirely different from Mr. Jamieson's Aberdeenshire "pre-glacial" sand and gravel, although it occupies the same position relatively to the Boulder Clay.

The same remark applies to a sand bed found beneath the Boulder Clay at a pit 250 yards south-east from No. 9 pit, where the section is—

Surface-drift and Boulder-clay	42 ft.
Sand bed, with Arctic shells	5 ft.
Clay-shale, the roof of the "Major Coal."	

In this pit the coarse gravelly sand and sand and peaty clay of the neighbouring pit are absent.[2]

Messrs. Craig and Young believe that the freshwater bed, containing mammalian remains, is situated beneath the Arctic shell-sand, and consequently conclude that the land has suffered a long submergence since the mammoth and the reindeer existed in the pre-glacial valley of the Carmel at Kilmaurs, but for their ingenious argument on this point we must refer to the paper already cited.

[1] 'Trans. Geol. Soc. Glasgow,' vol. iii, p. 315. [2] Ibid., p. 316.

The following Ostracoda were found:

Cythere concinna, Jones.
Cytheridea punctillata, Brady.

3. Tangy Glen, near Campbeltown.

In Tangy Glen, about six miles from Campbeltown on the road to Tarbert, about 300 yards up the little stream, at a point where it turns eastwards, and 130 feet above the sea-level, the water has cut deeply into the bank, exposing a cliff of Boulder Clay rising to the height of upwards of 100 feet.

This Boulder Clay is of the most pronounced type, stiff, compact, and full of highly striated stones of various sizes. At one part a finer or more sandy bed, gradually thinning out, is intercalated with the clay; and such lenticular beds are not uncommon in the Boulder Clays of the West of Scotland. Within this Boulder Clay, and covered by it, a stratified shell-bearing clay is seen standing up like a boss or knoll, and has doubtless been brought to this form by abrasion. At the point of greatest exposure it is thirteen feet high; and it can be traced, as it thins down along the edge of the streamlet, for a distance of sixty or seventy yards. The exact depth could not be ascertained; but, as the rock is seen at a short distance on either hand, it is probably not more than a few feet deeper than the actual exposure, and we could detect no Boulder Clay beneath it. The shell-bearing clay is dark grey in colour, and contrasts strongly with the underlying Boulder Clay, which is of a full reddish-brown.

Boulder Clay.			*Shell-bearing Clay.*		
50	per cent.	fine mud.	80	per cent.	fine mud.
27	,,	sand (21 fine, 6 coarse).	14	,,	fine sand.
23	,,	gravel.	6	,,	gravel.

The fossils in this deposit are but sparingly met with—Mollusca especially are comparatively rare—*Leda pygmæa* being the prevailing shell, with an occasional *Leda pernula*, *Venus ovata*, *Corbula gibba*. Some species, however, are of an extremely Arctic character, and while somewhat common in the glacial beds on the east coast, are very seldom met with in the west of Scotland. *Pecten Grœnlandicus, e.g.*, is common at Montrose, Errol, and Elie, but in the west we have only seen it at Tangy. It is remarkable that at Montrose it is only obtained at a great depth, seldom less than thirty or forty feet, but at Elie it is found only a few feet beneath the surface and within reach of the tide, and in neither of these cases beneath the Boulder Clay; while at Tangy it is beneath Boulder Clay, and 130 feet above the present sea-level.

Montacuta elevata, an Arctic species, very rare in the glacial clays of Britain, also occurs. The Ostracoda (of which we collected twenty-three species to be presently enumerated) have much in common with those found in the clays on the east coast of Scotland, which represent more strongly Arctic types than those generally found in the west. Amongst these are—

Cytheropteron Montrosiense, nov. sp.
Cytheridea Sorbyana, Jones.

Only one of these has yet been found in the glacial clays of the west of Scotland—*C. Montrosiense*, which we obtained at a depth of eighteen feet from a glacial clay, dipping away from the Clyde, near Govan. *C. Sorbyana* is a common species in the glacial clays of Norway.

There is little doubt, however, that these species will be at some time found in a western clay, just as we have found in a pit in Ayrshire a solitary specimen of *Leda arctica*, which is the characteristic shell of the Errol clay on the west, but the fact of their extreme rarity, to say the least, in the west and abundance in the east is full of significance.

Height above the sea 130 feet.

The following Ostracoda were found:

Cythere castanea, G. O. Sars.
— *lutea*, Müller.
— *limicola* (Norman).
— *globulifera*, Brady.
— *concinna*, Jones.
— *Dunelmensis* (Norman).
Cytheridea papillosa, Bosquet.
— *Sorbyana*, Jones.
Cytherura nigrescens (Baird).
— *undata*, G. O. Sars.
— *clathrata*, G. O. Sars.
Cytheropteron latissimum (Norman).
— *arcuatum*, nov. sp.
— *Montrosiense*, nov. sp.
Bythocythere constricta, G. O. Sars.
Sclerochilus contortus (Norman).
Paradoxostoma variabile (Baird).

4. King Edward, Aberdeenshire.

A shell-bearing silt is in this section covered by a thick mass of Boulder Clay, *which is fossiliferous in its lower portion only;* but, as its base has not been exposed, it is uncertain whether any Boulder Clay extends beneath it.

Mr. Jamieson gives the following section, and remarks that the broken shells in the lower part of the coarse upper drift appear to have been derived from the glacial marine silt below, in which the shells are *in sitû.*

	Feet.
1. Water-worn gravel and sand, stratified, often rather coarse and pebbly, and somewhat ferruginous. Contains no fossils . . .	10 to 25
2. Unstratified pebbly mud of a dark-grey tint, hard, and difficult to pierce. The stones in it are of small size, but numerous, and some of them are glacially scratched. In the upper part I could see no shells; but shell fragments occur in the lower part, increasing in numbers towards the base. Some of the shell fragments show distinct traces of glacial action	20 to 30
3. Fine brownish sand, in some places rich in shells. This sand is interstratified with the upper part of the subjacent bed . .	1 to 2
4. Fine dark-grey silt, free from stones, containing Arctic shells complete, and apparently *in sitû*. . . . . . This silt is very firm, as if much compressed, and the greater proportion of it consists of fine muddy sand. The base of this bed has not been exposed, but it has been excavated . . . . . to a depth of ten feet. No difference in the quality is to be seen to this depth; no stones. The upper surface of this silt is about 150 feet above the sea.[1]	

Mr. Jamieson classes the fossils found at King Edward with the Paisley, Kilchattan, and Gamrie groups, as being less intensely Arctic (as we shall also have occasion to remark when describing the Ostracoda) than the Errol and Elie groups.

Height above the sea 150 to 200 feet.

[1] 'Quarterly Journal Geol. Soc.,' 1866, vol. xxii, p. 275.

The following Ostracoda were found :

Cythere tuberculata (G. O. Sars).
— *Dunelmensis* (Norman).
Cytheridea papillosa, Bosquet.
— *punctillata*, Brady.
— *Sorbyana*, Jones.
Cytheropteron Montrosiense, nov. sp.

5. Thus the following classes of fossiliferous beds may be found *beneath* the Boulder Clay, and without any observed Boulder Clay for their base :

a. Marine sands and gravels more allied to the English Crag than to the glacial clays.

b. Beds of freshwater origin with the remains of *Elephas primigenius* and *Cervus tarandus.*

c. Marine beds containing the common Arctic fauna of the Clyde glacial beds.

d. Marine beds which have been broken up by some disturbing force, and some of the shells from which have been mixed with the Boulder Clay under which they were finally crushed.

It does not *necessarily* follow from the mere position of any one of these beds beneath a Boulder Clay that it must belong to an "interglacial" period; many other considerations are needed to determine this point. A Boulder Clay may have been deposited upon a shell bed during some interglacial period, or during the later part of the glacial marine period, according to the local circumstances of the case; or it may even have been thrown upon it by an accidental displacement long after its own original formation.

II. *Fossiliferous beds have been also found, situated between masses of Boulder Clay, which have been referred (together with other sand and gravels) to a series of "Interglacial deposits."*[1]

The actual occurrence of fossiliferous beds between masses of Boulder Clay does not prove that all such beds belong to the same period, or even that they were deposited in the *middle* of the Glacial Epoch itself.

It is possible (as instanced in Caithness) that drifting ice should have passed over a

[1] 'On Changes of Climate during the Glacial Epoch.' By James Geikie, F.R.S.E. Trübner and Co., 1872.—'The Great Ice Age.' By James Geikie, F.R.S.E. W. Isbister and Co., London.

shell bed of the same age, to say the least, as the later Clyde shell beds, and have deposited Boulder Clay upon it.

Whether this actually happened or not in the special cases quoted from Caithness does not affect the possibility in question.

It is equally possible that during the final recession of the ice, at points where the glacier reached the sea, Boulder Clay may have been thrown over shell beds belonging to the most recent period of the Glacial Epoch.

Regarding these intercalated beds, it has also to be determined whether they occupy their peculiar position naturally or accidentally.

The Boulder Clay (as has already been described) exists in great undulating ridges, as well as against hillsides and in the interstices of broken ground, and often rises up in hillocks and eminences, and has marine shell clay deposited in its hollows.

It is clearly within the range of possibility that it should in some instances have been undermined by the action of water or some other physical agency, and have *fallen over* a shell bed of far later date than itself.

In the series of sands, gravels, and clays claimed by Mr. J. Geikie as "interglacial," and regarded by him, in his striking argument, as proving that many changes of climate may have taken place during the accumulation of the Till and its associated deposits, few of a fossiliferous character can as yet be quoted, so that a general discussion of them does not fall within the limits of this paper.

We shall notice only those examined for Ostracoda.

1. Crofthead, near Glasgow.

In the cutting of the Crofthead and Kilmarnock railway, beds of freshwater clay were exposed which have been the subject of considerable discussion. They were described by Mr. J. Geikie as *interglacial*, in the 'Geological Magazine' (vol. v, p. 393, vi 73, vii 53), and as resting upon and covered by the "Till" (Boulder Clay). Mr. Craig in the same magazine questioned whether the upper bed overlying the stratified bed was "a deposit from land ice," and regarded the position of a large mass of Boulder Clay which covered a part of the stratified clay as owing to "a series of slips."[1]

These stratified lacustrine clays yielded the skull and horn core of *Bos primigenius*, part of the horn of *Megaceros Hibernicus*, and a few bones of *Equus caballus*.

[1] See also paper on "The Section of the Crofthead and Kilmarnock Railway." By Robert Craig. 'Trans. Geol. Soc.,' Glasgow, vol. iv, p. 17.

The following Ostracoda were found :

Cypris virens (Jurine).
— *cinerea,* Brady.
— *gibba,* Ramdohr.
Potamocypris fulva, Brady.
Candona lactea, Baird.
— *albicans,* Brady.
Limnicythere inopinata (Baird).
— *antiqua,* n. sp.
Cytheridea lacustris, G. O. Sars.
— *torosa* (Jones).

2. Paisley.

When digging a foundation on the side of Oakshaw Hill, on which part of Paisley is built, a hill which is at its summit 106 feet above the sea-level, and stretches in a gradual slope 800 yards from east to west, a bed of Boulder Clay was laid bare, beneath which was found the common Arctic shell of the district " with a bed of *Mytilus edulis* on its surface." This Arctic-shell-clay itself, throughout the whole neighbourhood, rests upon the Boulder Clay. The Rev. W. Fraser (from whose description we quote)[1] states that "this shell-bed was sixty-four feet above the mean sea-level, and the height rising over it was forty-two feet, of what in ordinary circumstances would have been accepted as genuine Till or old Boulder Clay," and attributes its position to the stranding of masses of ice-carrying portions of the Boulder Clay on the ridge.

Mr. J. Young, however, suggests that the position of this Upper Boulder Clay is due either to diggings from the Lower Boulder Clay which have been removed and laid down over more recent deposits, or to a slip of the Boulder Clay forming the crown of the hill over more recent beds.[2]

This shell-clay, although intercalated in the way described, contains precisely the same fauna as that which will be presently given from the Paisley district.

[1] 'Trans. Geol. Soc. of Glasgow,' vol. iv, p. 180. [2] Ibid., p. 214.

III. *The first great series of fossiliferous Post-Tertiary clays, sands, and gravels is characterised by a fauna of a more or less decidedly Arctic character.*

These clays, sands, and gravels are found in the following positions:

(1) They exist, in the manner already described, beneath great masses of Boulder Clay.

(2) They are intercalated, as also has been described, with masses of Boulder Clay.

(3) They either immediately overlie the fossiliferous Boulder Clay or are separated from it only by a thin seam of laminated clay, but are not covered by Boulder Clay.

(4) They are connected with a series of sands and gravels.

Examples of Arctic fossiliferous clays beneath the Boulder Clay and intercalated with Boulder Clay have already been discussed; and we proceed to consider the deposits which are Arctic in character, but are neither situated beneath the Boulder Clay nor intercalated with it.

IV. *A large class of the clays and sands, characterised by an Arctic fauna, in many cases either immediately overlie the unfossiliferous Boulder Clay, or are only separated from it by a thin seam of laminated clay, but are not covered by the Boulder Clay itself.*

These beds belong to the period or periods during which an Arctic fauna was most abundantly developed. Whether they consist of clay, sand, or gravel, is, of course, a circumstance of purely local determination, as it is with the marine deposits which are forming at the present day, but since such differences naturally influenced the fauna of which they were the habitat we shall give some details regarding them, as we notice the localities from which our specimens have been obtained.

As fossiliferous deposits they are generally remarkable for the perfect preservation of the various species they contain *in sitú.* At Paisley, *e.g.*, *Cyprina Islandica* occurs with both valves united and covered with its epidermis; and fragile bivalves like *Nucula tenuis, Axinus flexuosus,* var. *Gouldii,* as well as the most delicate Ostracoda, are in a perfect condition. From a clay bed near Blairmore, Loch Long, we have gathered numerous specimens of *Astarte,* including *A. borealis, A. sulcata, A. compressa,* evidently in their native habitat. In the banks of a freshwater stream near Loch Gilp, a whole bed of *Mya Uddevallensis* was found, each shell in its natural boring position.

Pecten Islandicus and *Saxicava* (*Panopæa*) *Norvegica* and *Mya Uddevallensis* have all been collected, in the Kyles of Bute, in the positions in which they lived and died; the

Pecten Islandicus being often covered with large *Balani*, which must have been broken had they been drifted.

In exposed situations there must have been contemporaneous beds of gravel in which the Mollusca were rolled and broken and Ostracoda could not live. An example may be seen in the railway-cutting near Drymen, Stirlingshire (140 feet above the sea), where a gravel bed has been exposed, full of hinges and fragments of the shell of *Cyprina Islandica*, fragments of *Pecten Islandicus, Astarte sulcata, Buccinum undatum,* and other bivalves, while only a few univalves, like *Trophon clathratus,* are entire, and Entomostraca are very scarce.

Very frequently these Arctic Post-tertiary clays, especially in the west of Scotland, rest upon an unfossiliferous Boulder Clay, a thin seam of laminated clay alone interposing, and are overlain by beds of sand and gravel, followed by peat and surface soil.

The Boulder Clay throughout the whole district is violently undulated; and the overlying beds of the Arctic shell clay commonly rest in the hollows of the Boulder Clay, although in some instances, as at Jordan Hill and Airdrie, they attain the heights of 63 feet and 526 feet respectively.

The laminated clay which so frequently interposes between the Boulder Clay and the clay in which an Arctic marine fauna most abundantly occurs may be clearly seen in this position at Paisley, along the shores of Gareloch and Loch Long, at Kilchattan, and throughout the Kyles of Bute. The Boulder Clay *beneath* it, in all these localities, is uniformly azoic, while the clay immediately above it is literally packed with Arctic Mollusca and swarms with Ostracoda.

This laminated clay was formerly supposed to be unfossiliferous; we have, however, detected in it several species of Foraminifera and Ostracoda. When the specimens are extremely rare, it generally happens that they consist of Foraminifera only, but when they prevail to any slight extent Ostracoda are also found.

This laminated clay was probably deposited by the cold and rapid waters of streams issuing from beneath the snow and ice of an elevated land surface, and carrying to the sea the fine mud with which they were charged.

The way in which it has happened that the laminated clay itself contains so few fossils, while the clay immediately above it abounds with Ostracoda and Mollusca, is explained by observations made in the Arctic regions by Dr. Robert Brown, of Campster.[1]

Dr. Brown has had large opportunities of examining ice-action, and draws the distinction between the "ordinary stratified azoic clay and the finer stratified fossiliferous clay," upon which we have been led by our study of the Scotch beds to insist; while he

[1] "On the Physics of Arctic Ice, as explanatory of the Glacial Remains in Scotland." By Robert Brown, of Campster, M.A., Ph.D., F.R.G.S., &c. 'Quarterly Journal of Geological Society,' 1871, vol. xxvi, p. 671.

expresses a strong opinion " regarding the identical character of the sub-glacial stream-clay, and the fossiliferous brick-clay."

" In this clayey bed the Arctic Mollusca and other marine animals find a congenial home, and burrow into it in great numbers. However, as the new deposits are thrown down, they keep near the surface to be able to get their food; so that if to-day a catastrophe were to overwhelm the whole marine life of the Arctic regions, it would be found (supposing by upheaval or otherwise we were able to verify the fact) that the animals would only be imbedded in the upper strata of clay, and that the bottom one, with the exception of a few dead shells, would be azoic; yet I need not say how erroneously we should argue, if, from this, we drew the inference that at the time the bottom layers or strata of this laminated clay were formed there was no life in the Arctic waters, and that they were formed under circumstances which prevented their being fossiliferous. The bearing of this on the subject in question need scarcely be pointed out. It ought to be noted that, supposing we were able to examine the bottom of the Arctic Sea (Davis' Straits, for instance), it would be found that this clayey deposit would not be found over the whole surface of it, but only over patches. For instance, all of the ice-fjords would be found full of it to the depth of many feet, shoaling off at the seaward end; and certain other places on the coast would be also covered with it; but the middle and mouth of Davis' Straits and Baffin's Bay, and the wide intervals between the different ice-fjords, would either be bare or but slightly covered with small patches from local glaciers; yet we should reason most grievously in error did we conclude therefrom that the other portions of the bottom covered with sand, gravel, or black mud were laid down at a different period from the other, or under other different conditions than geographical position. These ice-rivers seem, in the first place, to have taken their direction according to the nature of the country over which the inland ice lies, and latterly according to the course of the glaciers. No doubt they branch over the whole country, like a regular river-system. When the glacier reaches the sea, the stream flows out under the water, and, owing to the smaller specific gravity of the fresh water, rises to the surface, as Dr. Rink describes, 'like springs,' though I do not suppose that he considers (as some have supposed him to do) that that water was in reality spring-water, or of the nature of springs. *Here are generally swarms of Entomostraca and other marine animals, which attract flights of gulls, which are ever noisily fighting for their food in the vicinity of such places*" (p. 682-4).

It is very noticeable that the same kind of laminated clay occupies precisely the same position in the series of glacial beds exposed near Christiania.[1]

We observed the following section at the Lower Foss Clay Bank, near Christiania.

1. Unfossiliferous boulder-clay (with striated blocks, hard and compact).

[1] See 'Notes on the Post-Tertiary Geology of Norway.' By H. W. Crosskey and D. Robertson. 'Trans. Phil. Soc. of Glasgow,' 1868.

2. Laminated clay (not to be distinguished physically from the laminated clay of the Paisley and other sections).

3. Clay, charged with an Arctic fauna.

Just as the district around Paisley and other points where the laminated clay occurs would, from their natural position, receive a body of fresh water, supposing the land during the Glacial Epoch more elevated than at present; so would the district near Christiania, at which the same laminated clay is found.

Whatever its origin, it constitutes a curiously distinct deposit; and is easily distinguishable from the fine clay (sometimes itself called "fine laminated clay" or "glacial marine bed") which succeeds it, and represents the slightly more recent bed of an arctic sea, crowded with life.

The following Ostracoda have been found in the laminated clay:

Cytheridea punctillata, Brady.
Cytherura Sarsii, Brady.

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§ III. OSTRACODIFEROUS BEDS.

A.—We proceed to notice in detail *the principal beds of clay and sand, characterised by an Arctic Fauna*, from which the Ostracoda described in this Monograph have been derived.

1. Paisley.

In studying various clay-pits exposed from time to time in the neighbourhood of Paisley, we have observed the following beds, the measurements of which varied even within a few hundred yards.

The Boulder Clay is of the usual irregular character, rising up in hillocks here and there, to and above the ordinary surface-level; and in some places formed into troughs of considerable depths.

1. Surface soil.

2. Sands and gravels (probably old river-drift).

3. Littoral marine shell bed, containing *Cardium edule, Mytilus edulis,* and pieces of wood bored by *Teredo*, &c. (In one section which we measured this bed was nine inches in depth.)

4. Marine fossiliferous clay:

   a. Upper part; no Mollusca to be found, but Foraminifera and Ostracoda.

   b. Middle part; a few Mollusca, Ostracoda and Foraminifera more plentiful.

   c. Lower part; fauna abundant.

5. Laminated clay (estuarine or marine), as a rule, only containing a few Foraminifera.

6. Unfossiliferous Boulder Clay.

An instance in which the fossiliferous clay has been found between two Boulder Clays has been already noted.

We examined in detail the following section at Short Road Brickwork (south side of road).

1. Mould	3 to 4 ft.
2. Gravel (no fossils)	½ upwards to 1 ft.
3. Thick dark clay (fossiliferous, especially in the lower 6 ft.)	13 ft.
4. Laminated whitish clay (with Foraminifera) . .	1½ ft.
5. Yellowish-brown clay (with Foraminifera) . .	2 ft.
6. Muddy sand, not cut through (Foraminifera and Ostracoda).	

The Boulder Clay is met with at about the same level in a pit not more than 100 yards distant, and without doubt forms here, as throughout the district, the base of the series. The first seven feet under the gravel is brownish coloured, especially towards the top, and contains comparatively few fossils. Among these *Mytilus modiolus* is found with united valves. The next six feet run into a dark-grey clay with an abundant fauna. In the tenth and eleventh feet below the gravel is a bed of *Cyprina Islandica.*

The layer of laminated whitish clay (4) under this is more sharply defined below than above. When dry it has little cohesion and breaks down easily between the fingers like a piece of chalk. It is finely laminated, and washes almost wholly away through a sieve of ninety-six meshes to the linear inch. In washing 100 oz. of dry clay, only two drachms were left as a residue, which consisted of very fine sand and a considerable number of *Polystomella striato-punctata* and *Nonionina depressula.*

The yellowish-brown clay (5), constituting the next two feet in the section, is much more cohesive; the layers are divided from an inch to half an inch apart by fine sand; and these again into excessively thin layers by lighter and darker coloured clays. In washing, this is similar to the clay above it, and only one Foraminifer was met with. The muddy sand (6) underlying this loses 63 per cent. in washing; but the greater part of the loss is an extremely fine sand. Three Foraminifera were met with, and one valve of *Cytheridea punctillata.*

The fossils in the clay beds around Paisley are mostly confined, as in the section we have now described, to the lower half of the deposit, and generally have their chief abundance within from one to three feet of the laminated clay.

Foraminifera and Ostracoda are met with, more or less, from top to bottom of the clay, more constantly Foraminifera; but as a rule both are found most profusely where Mollusca prevail. In many cases *Mytilus edulis* occurs in considerable abundance below

Cyprina islandica, and near the bottom of the section. This is pre-eminently the case in a clay pit west of Paisley, and at Jordan Hill, about three miles north-west of Glasgow, where it is found fourteen feet below the surface.

The position of the fossils in the clay is not precisely the same in all the glacial beds of the same geological horizon.

When the Greenock New Docks were excavated the laminated clay was cut through for many feet, until the unstratified Boulder Clay was reached; and the junction was sharply marked by a thin layer of whitish-coloured clay, three or four inches thick, containing Foraminifera and Ostracoda. This thin stratum of whitish clay was followed by a darker coloured clay crowded with Mollusca, amongst which were *Cyprina Islandica*, *Pecten Islandicus*, and *Tellina calcarea*.

At Kilchattan tile-works, Buteshire, the fossils of all species are most plentiful, above the laminated clay, in a bed of sand or gravelly sand, which lies between the clays and the upper gravel.

At Elie, Fifeshire, the fossils are plentiful near the top of the clay a little under the gravel, and amongst them are *Leda arctica* and *Thracia myopsis*, with Ostracoda of an extremely arctic character.

In many other deposits of the same age an odd shell is only seen occasionally. This not unfrequently happens at different points of the Paisley beds. In a brickfield on the west side of the Cart, near the park, one or two specimens only by diligent search may be met with, although they are plentiful in cuttings close to the spot.

Before a microscopic examination of the clays was made the fossiliferous beds under discussion were described as situated between an unfossiliferous upper clay and an equally unfossiliferous laminated clay. It will be seen from the foregoing observations, however, that they occupy no such position. Foraminifera and Ostracoda of marine and estuarine character occur in the laminated clay, where the Mollusca are either absent or rare, and continue throughout the upper clay, where the Mollusca gradually disappear.

It thus appears possible to trace by these fossiliferous beds, occurring in the valley of the Clyde, (1) the pouring down of the muddy waters of an arctic river, (2) the subsidence of the land to a depth sufficient for the abode of an arctic fauna in the waters, (3) the gradual disappearance of the marine fauna owing to the re-elevation of the land, (4) the recurring of a river, with far broader boundaries than now exist.

The height above the sea of the arctic-shell-clays around Paisley (including the bed on the higher ground, covered with Boulder Clay, which has been previously described) is from twenty feet to sixty-four feet.

The following Ostracoda have been found:

Argillæcia cylindrica, G. O. Sars.
Pontocypris mytiloides (Norman).

Pontocypris trigonella, G. O. Sars.
Cythere pellucida, Baird.
— *castanea*, G. O. Sars.
— *crispata*, Brady.
— *viridis*, Müller.
— *lutea*, Müller.
— *globulifera*, Brady.
— *villosa* (G. O. Sars).
— *concinna*, Jones.
— *convexa*, Baird.
— *angulata* (G. O. Sars).
— *tuberculata* (G. O. Sars).
— *costata*, Brady.
— *Dunelmensis* (Norman).
Cytheridea papillosa, Bosquet.
— *punctillata*, Brady.
Eucythere Argus (G. O. Sars).
Loxoconcha tamarindus (Jones).
— *fragilis*, G. O. Sars.
Xestoleberis depressa, G. O. Sars.
Cytherura concentrica, n. sp.
— *undata*, G. O. Sars.
— *Sarsii*, Brady.
— *clathrata*, G. O. Sars.
Cytheropteron latissimum (Norman).
Bythocythere simplex (Norman).
Sclerochilus contortus (Norman).
Paradoxostoma variabile (Baird).
Polycope orbicularis, G. O. Sars.
Bosquetia robusta, nov. gen. et sp.

2. In and around Glasgow.

In the immediate neighbourhood of Glasgow the arctic marine clay rests upon a thick bed of sand, and is distinctly covered by a river-drift.[1]

[1] On this and other connected points, see an admirable series of papers by Mr. James Binnie, on "The Surface Geology of Glasgow," published in the 'Trans. Geol. Soc. of Glasgow,' vol. ii, parts ii and iii; vol. iii, part i.

In sections made during the formation of Windmillcroft Dock, Mr. J. Binnie discovered in the Upper Sands, extending from a few feet to a depth of twenty-two feet, numerous portions of the epidermis of *Unio margaritifera.* "A few of them," he writes, "had belonged to single valves, and in one or two instances the epidermis of both valves was flattened together; but the greater number were *lying in their natural position with the umbonal portion undermost, proving that they had lived and died in the gravel and had not been drifted down by a spate.*"[1]

A bed of clay containing marine Ostracoda, together with such arctic Mollusca as *Leda pernula* and *Tellina calcarea,* succeeded this river-drift, and was found to rest upon a bed of white sand of considerable thickness and extent (not exhausted in nineteen feet of dredging between the piles at the entrance of the dock), and containing some polished and striated boulders. Mr. J. Binnie quotes the "Journal of a Bore for an Artesian Well" made at McPhail Street, Greenhead :[2]

Surface soil	5 ft.	0 in.		
Coarse sand	1	6		
Clay mixed with sand	2	0		
Coarse sand	2	6		
River-drift			11 ft.	0 in.
Good clay	8	0		
Muddy clay	30	0		
Marine clay			38	0
Soft running sand with gravel	51	0		
Whinstone block	2	4		
Sand and gravel	7	0		
Sandstone block	0	5½		
Sand and gravel	1	0		
White sand series, probably marine			61	9½
			110 ft.	9½ in.

Over a large district, around Glasgow, and connected both with the ancient course of the Clyde and the probable flow of glacial rivers during the period of the elevation of the land, the deposition of the Boulder Clay (similar in character to that upon which the Paisley shell-beds rest, and which crowns eminences such as Garnet Hill

1 'Trans. Geol. Soc. of Glasgow,' vol. ii, part ii, p. 109. 2 Ibid., part iii, p. 265.

and the New Park) appears to have been broken under circumstances which led to the intercalation of numerous beds of sand, gravel, and clay. Two bores may be quoted as examples :[1]

Blairhardie, No. 4 Pit.

Surface soil	4 ft.	6 in.
Blue clay	9	0
Hard stony clay	69	0
Sand with a few shells	3	0
Stony clay with boulders	46	6
Mud and running sand	11	0
Hard clay, boulders, and broken rock	27	0
	170	0

Millichin, two miles east of Garscadden.

Sandy clay	5 ft.	0 in.
Brown clay and stones	17	0
Mud	15	0
Sandy mud	31	0
Sand and gravel with water	28	0
Sandy clay and gravel	17	0
Sand	5	0
Mud	6	0
Sand	14	0
Gravel	30	0
Brown sandy clay and stones	30	0
Hard red gravel	4	6
Light mud and sand	1	8
Light clay and stones	6	6
Light clay and whin block	26	0
Fine sandy mud	36	0
Brown clay, gravel, and stones	14	4
Dark clay and stones	68	0
	355	0

[1] A series of bores is given in detail by Mr. Binnie in 'Trans. Geol. Soc. of Glasgow,' p. 133, vol. iii, part i.

Mr. Binnie sums up the general results as follows :—" Between fifty and sixty bores have been obtained having sand, gravel, or clay, true water-drifted materials, interstratified with or lying beneath Boulder Clay. Twenty-five of these have one bed of sand or clay intercalated between two beds of Boulder Clay, proving that one break occurred. Ten bores have two beds of sand or clay intercalated between three beds of Boulder Clay; showing, of course, so many more breaks. One bore has three, and two bores have four beds of sand, interpolated in Boulder Clay; while one bore has no less than five beds of sand alternating with Boulder Clay,—a number sufficient to prove that the ice-sheet was not continuous throughout the Glacial Epoch, but disappeared for periods so long that great beds of water-made *débris* could be deposited in the interval. Twenty bores have sand or gravel at the bottom and Boulder Clay above. Some of these may possibly be preglacial and synchronous with the Crag period of England, but they are probably interglacial, and only apparently preglacial from accidental causes easily supposable." [1]

It must be remembered, however, that the district covered by these bores would probably be more or less directly connected with the bed of a glacial river, debouching into the sea, and be peculiarly affected, therefore, by the summer meltings of the ice. A large part of it also has undoubtedly been covered by floating ice charged with *débris* during the later portions of the Glacial Epoch.

At Windmillcroft, sixteen feet above the sea, the following Ostracoda have been found:

Sclerochilus contortus (Norman).
Cytheropteron latissimum (Norman).

3. Stobcross Railway-Cutting (Glasgow).

In this cutting a section nearly half a mile in length is exposed, between Galbraith Street on the east and Sandyford Street on the west, to a depth of forty feet from the surface.

At the west end it passes through a layer of Boulder Clay 300 yards in length and 37 feet at its highest summit. On the east, where the knoll dips more rapidly than on the west, it is overlapped by a fine yellow sand, which, after continuing a little further eastward, is replaced by gravel.

On the north side of the cutting a series of sands, clays, and gravels abuts against the Boulder Clay, and stretches over it. The sand overlies the gravel, which is covered with the clay, and the clay at some points is overlain by sand. There is no definite order, however, in which the sands, gravels, and clays of this neighbourhood fixedly

[1] Ibid., p. 136.

recur, although the bores show that in some places sand alternates with gravel to a depth of eighty or ninety feet.

The layers exposed in the railway-cutting do not maintain a horizontal line or follow a regular dip, but present false beddings with violent contortions.

The overlying shell-bearing clays conform, however, to the sand banks over which they are deposited, with depressions less or more abrupt according to their character. The shell-bearing clays of this section are therefore evidently of later date than the estuarine sands upon which they rest, as well as later than the Boulder Clay.

The clay is for the most part of a sandy character; it is finest towards the east, where it is deepest and overlapped with muddy sand, with which it is less and less mixed as it descends.

Along the north of the cutting, where the clay is seen overlying the sand, many of the layers of sand are more or less mixed with mud, showing that the deposit of mud has gone on mixing with the sand until changed circumstances permitted the mud to accumulate.

The divisions between the layers of clay are, in most instances, formed by a very fine sprinkling of fine sand, and groups of these layers are often again divided by thicker and coarser beds of sand.

These groups of thin layers are sometimes nearly of the same depth, but at other times are more irregular, and the bands of sand vary in thickness.

These very thin layers appear to have been formed by frequent and gentle undulations of the water. Winds and tides would carry over the mud only the finest particles of sand, while the thicker bands would be produced by stronger winds and storms. The lapse of time between the recurrence of these disturbing causes may be reckoned by the distance of the bands from each other, and their strength by the depth of the bands.

From the sharp lines between the bands we may infer that the causes were transient; but in the case of such deposits as those at Stobcross, where the sands and clays have been washed into each other, the conditions must have been more continuous and the water comparatively shallow.

The fauna (which has been chiefly obtained from the east bank of clay), although not abundant, furnishes ample proof of the purely marine character of the deposit. Among the shells obtained were—

Tellina calcarea,
Cyprina Islandica,
Mya truncata, &c.

In the muddy sand exposed at a lower level in the excavation for the Stobcross Docks, close by the Clyde, *brackish* water Ostracoda are found, marking the change from a sea to an estuary.

The following Ostracoda were found:

Cythere pellucida, Baird.
— *porcellanea*, Brady.
— *viridis*, Müller.
— *limicola* (Norman).
— *villosa* (G. O. Sars).
— *concinna*, Jones.
— *Dunelmensis* (Norman).
Cytheridea papillosa, Bosquet.
— *punctillata*, Brady.
Cytherura nigrescens (Baird).

4. Jordan Hill, near Glasgow.

The Crow Road, on the side of which the clay is worked, is at that point sixty-three feet above the sea-level.

The clay extends down the incline of the hill, approaching the valley of the Clyde, on the south, where it is exposed along the White Inch Railway, and also passes over its summit on the north.

Jordan Hill itself is irregularly covered with masses of Boulder Clay of variable thickness; the Boulder Clay, however, cannot be observed in any place to rest upon the shell-beds.

Our examination of one series of excavations, made to a depth of from twelve to twenty-four feet, established the existence of the following series of beds; their thicknesses, as usual, varying over very narrow areas.

1.	Surface soil	1 to 2 ft.
2.	Reddish-brown clay (unfossiliferous) . . .	7 to 8 ft.
3.	Dark grey or blue clay (arctic-shell-bed) . . .	10 to 14 ft.
4.	Laminated clay or mud (not excavated because unfit for brick unless mixed with other clays)	

The reddish-brown clay (2) is full of vertical fractures, whose sides have a bluish colour, and are generally so smooth as to present the aspect of *slickensides*.

The laminated clay is friable, marked by exceedingly thin laminations, and is the same as that which we have already described as underlying the clay more abundantly charged with the arctic fauna of the district, although itself containing evidence of its marine origin. The Boulder Clay can be traced to points at which it evidently passes under the whole series of laminated and fossiliferous clays.

At another point of the Hill two distinct fossiliferous beds can be traced, and the series runs :

1. Surface soil.
2. Littoral shell-bed a few inches (with *Littorina litorea, L. rudis, Mytilus edulis,* &c., all recent species).
3. Clay with arctic species ; chiefly confined to a band of two to three feet.
4. Laminated clay.

A similar littoral shell-bed (2) is met with on the low ground on the north of Paisley, about fifty feet lower than Jordan Hill.

The two tidal belts represented by these littoral shell-beds could not have been coexistent.

Another curious feature in this deposit is the position of the Mussel-bed. While *Mytilus edulis* certainly abounds in the youngest littoral beds, it is also found at greater depths and overlain by arctic shells.

At Paisley it is found twelve feet below the surface, at Muirhouse nineteen feet, at Stobcross twenty-four feet, and at Jordan Hill fourteen feet.

Mussel-beds undoubtedly existed, therefore, in the early periods of the deposition of the arctic clays as well as in the most recent, indicating several changes of level in the sea-bottom, and marking in the various heights at which they occur changes of elevation in the land-surface.

Height above the sea, sixty-three feet.

The following Ostracoda were found :

Cythere pellucida, Baird.
— *castanea,* G. O. Sars.
— *deflexa,* nov. sp.
— *viridis,* Müller.
— *lutea,* Müller.
— *villosa* (G. O. Sars).
— *pulchella,* Brady.

Cythere concinna, Jones.[1]
— *Dunelmensis* (Norman).
Cytheridea papillosa, Bosquet.
— *punctillata*, Brady.
Cytherura nigrescens (Baird).
— *undata*, G. O. Sars.
— *gibba* (Müller).
— *cellulosa* (Norman).
— *clathrata*, G. O. Sars.
Cytheropteron latissimum (Norman).
Bythocythere simplex (Norman).
Sclerochilus contortus (Norman).

5. Govan.

In the excavations for Messrs. Randolph and Elder's docks two beds of clay were exposed.

1. The upper bed was composed of sand, gravel, and sandy mud, and dipped towards the Clyde. The section was—

a. Mould	4 ft.
b. Black vegetable matter, crowded with leaves, fragments of twigs, &c.	1
c. Gravel and sand alternating	4
d. Muddy sand (not pierced through)	

In the muddy sand *Pecten opercularis* and *Trochus cinerarius* were met with.

2. The lower bed was not detected in the section immediately beneath the upper, but made its appearance at a little distance, dipping away from the river and then rising upwards. At a depth of eighteen feet marine shells were sparingly collected, including

Cyprina Islandica,
Tellina calcarea,
Mytilus edulis,
Buccinum undatum,
Balanus crenatus.

The Ostracoda from this lower bed proved precisely the same as those common in the

[1] The remains of the limbs are distinctly visible in some specimens of this species from this bed.

fossiliferous glacial beds of the west of Scotland, with the exception of *Loxoconcha elliptica*, a brackish water form, which was probably washed into it from the upper mud.

In the lower clay the following Ostracoda were found.

Cythere castanea, G. O. Sars.
— *viridis*, Müller.
— *Clutha*, n. sp.
— *globulifera*, Brady.
— *villosa* (G. O. Sars).
— *concinna*, Jones.
— *Dunelmensis* (Norman).
Cytheridea punctillata, Brady.
Loxoconcha elliptica, Brady.
Cytherura nigrescens (Baird).
— *undata*, G. O. Sars.
Cytheropteron latissimum (Norman).
— *Montrosiense*, n. sp.
— *elongatum*, n. sp.
Bythocythere simplex (Norman).
— *constricta*, G. O. Sars.
Sclerochilus contortus (Norman).
Paradoxostoma variabile (Baird).
Polycope orbicularis, G. O. Sars.

6. Rowan Bridge, Glasgow and Paisley Canal.

The shell-clay appears about 100 yards to the west of this bridge. The clay is of a grey colour, and when dry consists of 89 per cent. fine mud, and 11 per cent. *débris* of shells, with gravel and sand. *Mytilus edulis* is abundant, and is associated with *Tellina calcarea*, and the usual species belonging to the arctic clays.

Height above the sea forty-six feet.

The following Ostracoda were found:

Cythere pellucida, Baird.
— *viridis*, Müller.

Cythere lutea, Müller.
— *villosa* (G. O. Sars).
— *concinna*, Jones.
— *Dunelmensis* (Norman).
Cytheridea punctillata, Brady.
Cytherura nigrescens (Baird).
— *undata*, G. O. Sars.

7. Old Mains, Renfrew.

In a cutting for a tramway, between the Houston Pit No. 5 and the farm of Old Mains, a bed of shells of arctic character is exposed. The cutting is from six to seven feet at the highest point, and the bed of shells stretches along the section for about twenty yards, cropping out towards the farm and dipping towards the River Cart. The thickest part of the shell-stratum exposed is from eighteen to twenty inches; but the cutting appears only to have touched the edge of the shell-bed, as it is not seen on the opposite bank.

The deposit is made up of brown sand and earth crowded with stones, many of them covered with *Balani*. Sand predominates in the shell-stratum. *Mytilus modiolus*, *Saxicava rugosa*, *Astarte sulcata*, and *Axinus flexuosus* we found with united valves. Such species as *Pecten Islandicus*, *Tellina calcarea*, *Trochus Grœnlandicus*, *T. tumidus*, *Natica affinis*, *N. Grœnlandica*, *Velutina zonata*, *Pleurotoma violacea*, *Buccinum Grœnlandicum*, also occur.

Height above the sea thirty feet.

The following Ostracoda were found:

Cythere pellucida, Baird.
— *castanea*, G. O. Sars.
— *concinna*, Jones.
— *viridis*, Müller.
— *lutea*, Müller.
— *villosa* (G. O. Sars).
— *angulata* (G. O. Sars).
— *tuberculata* (G. O. Sars).
— *Dunelmensis* (Norman).
Cytheridea papillosa, Bosquet.

Cytheridea punctillata, Brady.
Eucythere Argus (G. O. Sars).
Cytherura nigrescens (Baird).
— *undata*, G. O. Sars.
— *clathrata*, G. O. Sars.
Cytheropteron latissimum (Norman).
Sclerochilus contortus (Norman).
Polycope orbicularis, G. O. Sars.

8. Dalmuir, Dumbartonshire.

The deposit at Dalmuir was first described by Dr. Thomas Thompson in a paper entitled "On a deposit of Recent Marine Shells at Dalmuir, Dumbartonshire," and published in the Records of General Science,' vol. i, p. 133 (1835). At that time, however, the distinction was not drawn between the recent marine shell-beds and the arctic shell-beds, to the latter of which classes the Dalmuir deposit undoubtedly belongs. Dr. Thompson describes the locality as follows :—"The locality in which the fossils are exposed is situated on the banks of the Dalmuir Burn, about 100 yards above the bridge, by which the road from Glasgow to Dumbarton crosses it, and about a mile from the Clyde. The current of the stream is not very rapid, so that the bed of shells is probably not more than twenty feet above the level of the Clyde, which at that place is sensibly salt at high water. The breadth of the channel of the stream at this place is about fourteen feet, and the depth of the banks is about two and a half feet. The sandy deposit appears to extend on both sides of the stream, upwards and downwards, without alteration; but the fossils are confined to a circular or rather elliptical face, the breadth of which (across the stream) is about twenty-five feet, while its length is only about fifteen feet. The deposit extends back from each bank only about six feet, so that more than one half the whole mass has been cut away during the change of the course of the rivulet . . . . . The depth of the bed in its original state must have been twelve or fourteen feet." Mr. Sowerby pronounced three of the species there found to differ from any known recent British species. One of them was said to be *Natica glaucinoides*, a Crag fossil (really, we believe, *N. affinis*, described as *N. clausa* by Searles Wood in 'Monograph of Crag Mollusca,' Part I, p. 147); another was called *Fusus lamellosus*, "which had only been observed about the Straits of Magellan" (a mistake for the arctic species now called *Trophon clathratum*, var. *Gunneri*); and a third, *Buccinum striatum*, "an unknown species" (now identified with *B. Grœnlandicum*, Chemnitz).

The fact, however, that these species were unknown as British, led Mr. J. Smith to imagine that the term "recent," which had been usually applied to such deposits, was not rigidly correct; and he made another excavation and published a list of shells which established the glacial character of the beds.[1]

No further examination of the Dalmuir beds was carried on until we made an excavation in the east side of the stream to the north of the bridge on the Dumbarton Road, in the immediately adjacent field, about half way down. At this point the shells are discovered in great abundance, in the position described by Dr. Thompson, beneath an overlying bed of sand and gravel. Of eleven pounds of the dry clay from this bed three pounds two ounces were lost in washing through a sieve of ninety-six cross threads to the inch, leaving seven pounds fourteen ounces of a residue. Three and a half pounds of this residue were retained in a sieve of $\frac{1}{8}$-inch mesh, and consisted chiefly of small stones of trap, quartz, and sandstone; a few were quite smooth and only rounded at the corners, others less or more irregular. Many of the polished stones were fractured, and some few finely striated. The bulk of the shelly *débris* in this portion was made up of *Mytilus edulis* and *M. modiolus*. The other portion of the residue (four pounds six ounces) consisted chiefly of sand, mixed with the plates and spines of *Echini* and many species of small Mollusca.

Besides this north patch of shell-bearing clay, there is another bed a few hundred yards to the south which was laid open by a cutting for the water-course of the Dalmuir paper-mill, and extends along the north side of the bank, about forty yards east of the burn. The shell-bearing clay rises about four feet above the water-course, when it is overlain by two feet of waterworn gravel. The upper portion of the shell-bearing clay is more sandy than the lower, which contains more stones, most of them water-worn, some rounded off at the corners, a few angular, and a few with well-marked striations. Beneath the upper clay, however, is a bed of sand about six inches in thickness, in which many of the peculiarly Arctic Mollusca are especially large and strong. *Trophon clathratum*, e. g., is very abundant, while it is scarce in the upper part of the clay. The sand is followed by a stiff blue Boulder Clay (common through the district) in which no shells occur.

The complete section is, therefore, as follows:

1. Sand and gravel	$2\frac{1}{2}$ ft. to 6 ft.
2. Shell-bearing clay	2 ft.
a. Upper part mixed with sand.	
b. Lower part not sandy.	
3. Shell-bearing sand	6 inches.
4. Boulder Clay, not pierced through.	

[1] 'Memoirs of Wernerian Soc.,' vol. viii, p. 50.

In the section on the north, the shell-bearing sandy clay was originally twelve or fourteen feet.

In both beds the deposit of shell-bearing clay appears very circumscribed. It could not be traced for more than twenty yards along the watercourse; and from the point where the shells are exposed, the overlying gravel deepens on both sides east and west.

There can be no doubt, however, that many similar patches of fossiliferous sands and clays exist beneath the surface at different points through the whole district where circumstances have permitted their preservation, and will from time to time be discovered.

Although the fauna of the two beds described is of precisely the same general character, there are local differences in the species found equivalent to those which occur in neighbouring parts of the same sea bottom at the present day. *Tellina calcarea* and *Trophon clathratum*, var. *Gunneri*, e.g., are more common in the south than in the north, but *T. truncatum* and *Lacuna divaricata*, with spines of *Echini*, are much rarer.

Height above the sea thirty-eight feet.

The following Ostracoda were found:

Potamocypris fulva, Brady.
Argillæcia cylindrica, G. O. Sars.
Cythere castanea, G. O. Sars.
— *pellucida*, Baird.
— *porcellanea*, Brady.
— *viridis*, Müller.
— *lutea*, Müller.
— *villosa* (G. O. Sars).
— *concinna*, Jones.
— *angulata* (G. O. Sars).
— *tuberculata* (G. O. Sars).
— *Dunelmensis* (Norman).
Cytheridea punctillata, Brady.
Eucythere Argus (G. O. Sars).
Loxoconcha tamarindus (Jones).
Cytherura nigrescens (Baird).
— *similis*, G. O. Sars.
— *pumila*, n. sp.
— *undata*, G. O. Sars.

Cytherura Sarsii, Brady.
— *clathrata*, G. O. Sars.
Cytheropteron latissimum (Norman).
— *nodosum*, Brady.
— *angulatum*, Brady and Robertson.
Bythocythere simplex (Norman).
Pseudocythere caudata, G. O. Sars.
Sclerochilus contortus (Norman).
Paradoxostoma tenerum, n. sp.
Polycope orbicularis, G. O. Sars.

9. Dumbarton.

A bed of glacial clay was reached in sinking the foundations of a house near the south end of the bridge crossing Leven Water. The same clay appears at half-tide-mark near Cardross, a few feet above high-tide-mark in the bay to the east of Helensburgh, and in patches all along the bay on which Helensburgh stands as far as the spit of gravel at the entrance of Gareloch.

Height above the sea fifteen to eighteen feet.

The following Ostracoda were found:

Argillæcia cylindrica, G. O. Sars.
Pontocypris mytiloides (Norman).
Cythere castanea, G. O. Sars.
— *viridis*, Müller.
— *lutea*, Müller.
— *pulchella*, Brady.
— *villosa* (G. O. Sars).
— *limicola* (Norman).
— *angulata* (G. O. Sars).
— *concinna*, Jones.
— *tuberculata* (G. O. Sars).
— *Dunelmensis* (Norman).
Cytheridea punctillata, Brady.
— *papillosa*, Bosquet.

Eucythere Argus (G. O. Sars).
Loxoconcha tamarindus (Jones).
Cytherura similis, G. O. Sars.
— *nigrescens* (Baird).
— *undata*, G. O. Sars.
— *clathrata*, G. O. Sars.
Cytheropteron latissimum (Norman).
— *angulatum*, Brady and Robertson.
Bythocythere constricta, G. O. Sars.
Sclerochilus contortus (Norman).
Paradoxostoma variabile (Baird).
— *tenerum*, n. sp.
Polycope orbicularis, G. O. Sars.

10. Loch Lomond.

On the shore of the little island of Inchlonaig, in dry seasons when the water of the lake is very low, a bed of dark grey clay is exposed, thickly interspersed with shells, amongst which are *Tellina calcarea, Pecten Islandicus, Leda pernula, L. pygmæa, Trochus Grœnlandicus,* and *Pleurotoma pyramidalis,* species which sufficiently establish the general arctic character of the deposit.

The same clay has also been found in the banks of a small burn to the north of the Pass of Balmaha.

A shell-bed of a more recent character occurs on the Loch side, in a little creek at Rossaden, near Luss, which must not be confounded with this older arctic clay. It is one to two feet under the ordinary level of the Loch. The clay is of a whitish colour, and has a strong peaty smell. It is very pure, containing only a small percentage of sand. The shells are abundant, but exceedingly friable. *Mytilus edulis* and *Hydrobia ulvæ* are the most abundant; *Littorina* is moderately common; and *Tellina Balthica* is represented by a few valves. All these species can endure a certain admixture of fresh water with the sea. A few Foraminifera occur of similar habitat, but no Ostracoda.

Height above the sea twenty feet.

In the glacial clay of Inchlonaig the following Ostracoda were found:

Cythere pellucida, Baird.
— *viridis*, Müller.

Cythere lutea, Müller.
— *limicola* (Norman).
— *villosa* (G. O. Sars).
— *angulata* (G. O. Sars).
— *concinna*, Jones.
— *tuberculata* (G. O. Sars).
— *Dunelmensis* (Norman).
Cytheridea papillosa, Bosquet.
— *punctillata*, Brady.
Loxoconcha tamarindus (Jones).
Cytherura nigrescens (Baird).
— *undata*, G. O. Sars.
— *clathrata*, G. O. Sars.
Cytheropteron angulatum, Brady and Robertson.
— *latissimum* (Norman).

11. Garvel Park New Dock, Greenock.

The dock, in the construction of which the fossiliferous deposit was found, runs very nearly parallel with the Clyde, and was cut through a slightly inclined bank of compact Boulder Clay about sixty yards from the shore. The bottom of the section is forty feet beneath the surface. The first ten or fifteen feet are crowded with large boulders, many of them striated on one or more sides. Towards the bottom boulders of large size are fewer, one only being seen here and there; but the clay is closely packed with small pebbles, few of them exceeding an inch in diameter. The great majority of the larger boulders are sandstones from the immediate neighbourhood, the remainder being of quartz, mica-schist, &c., from the Argyleshire mountains to the north-west. The blocks derived from a distance not unfrequently show much cross striation. The Boulder Clay is of such stiff consistence that gunpowder has comparatively small effect upon it.

The deep section of the dock is about 500 feet in length, and the colour of the clay varies, the junction of grey and reddish-brown clays at some points being very decidedly marked both vertically and horizontally. At one place the red clay, in the form of an obtuse inverted cone, reaches nearly to the bottom of the section; and this fact accounts for the irregular position of the red and grey clays as described in the "journal of the bores." The reddish colour of the Boulder Clay is, without doubt, due to a large admixture of the soft Old Red Sandstone of this portion of the coast.

A sample of the red Boulder Clay taken from a depth of fourteen feet consisted of 76 per cent. fine mud, 10 per cent. sand, 14 per cent. gravel or small pebbles.

A sample of the grey Boulder Clay taken from a depth of thirty feet consisted of 56 per cent. fine mud, 9 per cent. sand, 35 per cent. small gravel.

In the upper red Boulder Clay the West Highland rocks, entering into its composition, constitute less than one third, while in the lower division of the grey Boulder Clay at the depth of thirty feet they form more than half of the bulk.

The bores made preparatory to the construction of the dock extended over a radius of about 600 feet, and displayed many irregularities in the succession of the two distinctly marked Boulder Clays.

The following plan and journal of bores will illustrate the disturbed and varying nature of the old Boulder Clay base of many shell-beds.

Journal of Bores at Garvel Park.

	FT.	IN.	FT.	IN.
No. 1.				
Soil	1	0		
Light till	29	0		
			30	0
No. 2.				
Soil and sand	2	6		
Light till	38	6		
			41	0
No. 3.				
Soil	1	0		
Sand	2	0		
Sand and gravel	5	0		
Light till	32	0		
			40	0
No. 4.				
Soil	1	0		
Gravel	1	6		
Light till	5	6		
Red till	4	0		
Sandstone rock	3	0		
			15	0
No. 5 (in River).				
Sand	2	0		
Red till and stones	6	0		
Sandstone rock	1	0		
			9	0

	FT.	IN.	FT.	IN.
No. 6 (in River).				
Dark sand	3	0		
Light till	3	0		
Red till	11	0		
			17	0
No. 7 (in River).				
Dark sand and shells	3	6		
Light till	8	0		
Mud	1	6		
Red till	6	0		
			19	0
No. 8 (in River).				
Sand and shells	18	0		
Red till	2	0		
			20	0
No. 9 (in River).				
Light till	4	0		
Red till	15	0		
			19	0
No. 10 (in River).				
Sand and shells	7	6		
Light till	17	6		
			25	0
No. 11 (in River).				
Sand	9	0		
Light till	11	6		
			20	6

	FT.	IN.	FT.	IN.
No. 12 (in River).				
Sand	27	0		
Light till	9	0		
			36	0
No. 13 (in River).				
Light till	20	0		
			20	0
No. 14 (in River).				
Light till	24	0		
			24	0
No. 15 (in River).				
Dark sandy till	6	0		
Light till	14	0		
			20	0
No. 16 (in River).				
Red till	7	6		
Sandstone rock	2	6		
			10	0
No. 17 (in River).				
Sand and shells	4	0		
Dark sandy till	7	0		
Red till	9	0		
			20	0
No. 18 (in River).				
Dark sandy till	6	0		
Red till	4	0		
Sandstone rock	1	0		
			11	0
No. 19 (in River).				
Red till	6	0		
Light till	13	0		
Mud (firm)	6	6		
			25	6
No. 20.				
Soil	1	0		
Silt and shells	6	6		
Light till	26	6		
			34	0
No. 21.				
Soil	1	0		
Light till	34	0		
			35	0

	FT.	IN.	FT.	IN.
No. 22 (in River).				
Light till	30	0		
			30	0
No. 23 (in River).				
Light till	30	0		
			30	0
No. 24 (in River).				
Light till	30	0		
			30	0
No. 25.				
Soil	1	0		
Gravel	3	0		
Light till	27	0		
			31	0
No. 26.				
Soil	1	0		
Light till	33	0		
Red till	3	0		
Light till	3	0		
			40	0
No. 27.				
Soil	1	0		
Light till	1	6		
Sandstone block	1	0		
Light till	36	6		
			40	0
No. 28.				
Soil	1	0		
Light till	3	0		
Red till	15	6		
Hard white sandstone	0	7		
			20	1
No. 29.				
Red till and stones	4	0		
Light till and stones	13	0		
			17	0
No. 30.				
Red till and stones	10	6		
Light till and stones	13	8		
Red till and stones	5	2		
Red sandstone	3	2		
			32	6

No. 31.

	FT.	IN.	FT.	IN.
Red till and stones	8	3		
Light till and stones............	9	0		
Red sandstone	6	1		
			23	4

No. 32.

	FT.	IN.	FT.	IN.
Light till	14	7		
Fire-clay	1	9		
Red sandstone (soft)............	4	7		
Red sandstone (hard)	1	5		
			22	4

No. 33.

	FT.	IN.	FT.	IN.
Soil	1	0		
Light till	34	5		
Light till, with blocks	6	1		
			41	6

No. 34.

	FT.	IN.	FT.	IN.
Soil	1	0		
Light till and stones............	6	4		
Sandstone block	1	6		
Light till and stones............	2	6		
Sandstone block	2	3		
Light till and stones...........	24	4		
White sandstone	0	1		
			38	0

No. 35, Trial Pit.

	FT.	IN.	FT.	IN.
Soil	1	0		
Yellow clay	7	6		
Grey till and stones	13	6		
Red till and stones	3	0		
Grey till	2	0		
White sandstone	0	11		
			27	11

No. 4a.

	FT.	IN.	FT.	IN.
Soil	1	0		
Yellow clay	5	6		
Grey till..........................	18	0		
Red sandstone	3	6		
			28	0

No. 5a.

	FT.	IN.	FT.	IN.
Soil	0	9		
Yellow clay	4	6		
Grey till	8	3		
Red till	3	3		
Red sandstone	3	2		
			19	11

No. 6a.

	FT.	IN.	FT.	IN.
Red till and stones	3	9		
Soft white sandstone	1	6		
			5	3

No. 7a.

	FT.	IN.	FT.	IN.
Sand and stones	1	6		
Red till and stones	4	0		
Darker till and stones	6	0		
			11	6

No. 8a.

	FT.	IN.	FT.	IN.
Light grey till	1	0		
Fine red till	6	6		
			7	6

Looking at these forty bores, and confining ourselves to the clays only, which vary from nine to thirty-eight feet in thickness—in nineteen of these what is termed "light till" (*grey unstratified clay*) is only met with. In six bores what is termed red till (*reddish unstratified clay*) is only met with. In other six both occur, and the light-coloured till overlies the red. In three the red overlies the light, while in the remaining six the clays alternate variously. For example, taking them in the ascending order, in one bore, No. 26, light till, three feet; red till, three feet; light till, thirty-three feet. In another, No. 30, red till, five feet; light till, thirteen feet; red till, ten feet.

Three of the bores, lying between the dock and the highway, have the addition of what is termed yellow clay. Taking them in the same order as above, No. 35 has light till, two feet; red till, three feet; light till, thirteen feet; yellow till, seven feet.

In another, No. 4a, light till, eighteen feet; yellow clay, five feet. Again, in No. 5a, red till, three feet; grey till, five feet; yellow till, four feet.

In all these bores, some of which extend two hundred feet beyond low water, the same varieties of Boulder Clay have been met with in varying proportions.

In bore No. 8, sixty yards beyond low water, eighteen feet of sand and shells overlie the red till; but we cannot learn whether the shells belong to the glacial or recent period.

About the same distance beyond low water, No. 12, twenty-seven feet of sand overlies light till; another bore, about half-way between this and low water, No. 13, gives twenty feet light till.

The fossiliferous clay lies in a trough or oblong hollow in the Boulder Clay, crossing the longitudinal section of the dock, and shallowing at both ends. On the south it terminates near the surface about two hundred yards west of Garvel Park House, and on the north, at the embankment near the surface, close to the Clyde.

The length of the trough is about three hundred feet, its breadth twenty-four feet, and its depth, near the middle, fourteen feet. This trough is filled with a remarkable fossiliferous clay, crowded with Post-tertiary Mollusca and other marine organisms, which, like those found in other "Clyde beds," are of arctic type.

The natural character of this deposit was at first suspected because of (1) the disorderly manner in which the shells are distributed, and (2) the soft loose state of the clay in which they are embedded, which resembles material that has been roughly drifted rather than regularly deposited. We have come, however, to the conclusion that these shells lived and died where they are now found.

With regard to the apparent disorder in which they lay, it is well known that where Mollusca congregate, dead shells often preponderate largely over the living; and that a great number of the shells in this deposit were accumulated as dead shells is evident from the numerous valves having their internal surfaces grown over with marine organisms. Although, on a cursory view, they look as if tossed about, and promiscuously heaped together, yet, on closer examination, this irregular appearance seems to arise chiefly from the presence of so many large valves of dead shells; and, taking the general arrangement, they alternate very distinctly in layers.

The loose state of the soft clay may be explained in the following way:

This fossiliferous deposit unquestionably rests in a hollow or trough formed in the Boulder Clay. The open shelly clay of the deposit would take in more water from the surface than the stiff compact clay on which it reposes could withdraw, and an excess of water, accordingly, would be retained in the trough. When this was cut through at the deepest part by the excavation of the dock, and the superfluous moisture to some extent drained off, the deposit would naturally be brought much to its existing state.

Similar cases are by no means uncommon. In uncultivated moorlands, our footing is often insecure, owing to impermeable hollows filled with silt or other porous material, and grown over with turf, which may remain in this state indefinitely, while the surface continues to supply the water, and the basin to retain it. Such conditions are well known to agriculturists, whose skill is exerted in discovering how they can best draw off the imprisoned water which impedes the fertility of their lands over particular areas.

The Boulder Clay, it may be added, is softer at the bottom of the trough immediately under the laminated clay than at a greater depth, doubtless owing to contact with the moister clay above.

There are facts, moreover, which cannot be reconciled with any mere drifting agencies.

1. The large boulders embedded in the shelly deposit. Many of these had marine organisms attached to them, and were not less than half a ton in weight.

Even with modern appliances one of these large blocks could not (the contractors informed us) be removed without blasting, and not one of them when uncovered had the slightest mark of a mallet or bore of a blast upon it.

2. Had the fossiliferous material been dug up from one place and carried to another by human agency, unmistakeable tool-marks, cuts, and indentations of pike and shovel, would have been visible on the shells in their crowded condition; but not a single mark of this kind has been found.

3. Although the great mass of the shelly deposit lies in some apparent disorder, the under portions of it are distinctly laminated. Resting on the Boulder Clay there is an unevenly thin bed of reddish-brown clay, made up of very fine layers. Overlying this is a layer of whitish clay, about six inches thick, which is again covered by a layer of light grey clay, about one inch thick. These layers can be traced over the bed and up both sides of the trough, and it is impossible that sediment washed down through the loose materials above, as has been supposed, could have been accumulated in this manner. Again, had the layers been the immediate washings of the upper material, they would have been similar in colour and composition; but all three differed largely from the overlying clays, as well as amongst themselves in colour, constitution, and fossil contents.

The thin light-grey layer lying between the whitish six-inch layer and coarser shell-clay above contains one Polyzoon (*Idmonea fenestrata*, Busk) far more abundantly than we have found it elsewhere in the section. In this thin layer also occur the asbestos-like fibres of the shell of the common Mussel (*Mytilus edulis*), of which we have not found a vestige in the overlying clays. The six-inch stratum of whitish clay is, when dry, of an extremely friable character, and very like a stratum of clay met with in some of the Paisley brick-fields, and at Jordan Hill, in the same relative position; and the reddish-brown clay underlying this corresponds with the thinly laminated clays frequently found at the base of the fossiliferous clays of the Clyde district. Further, these underlying strata all contain organisms of marine and arctic character, without the least admixture of those decided brackish-water forms so common in the present neighbouring lagoons of the Clyde.

4. At the south end of the hollow, lying between the shell-clay and the upper mould, a bed of brown clay is disclosed two feet in thickness which has never been disturbed since its original deposition.

As all these circumstances are incompatible with the supposition that this deposit has been interfered with by human agency, they are equally so with the theory that it has been drifted from any near or distant locality by the action of ice. The fossils bear no trace, moreover, of having been in any way rolled or crushed, as they would infallibly have been from such a cause.

Traces of a thin irregular bed of small shells have been seen near the surface along the south-east side of the dock; and about one hundred yards from this, in an easterly direction, another shelly deposit, belonging to the same series, has been exposed on the side of a sandstone quarry, where the shells and other organisms, though fewer in number and variety of species and different in their proportions, are similar in character to those we have described.

Another shell-bed, also of Arctic type, has been brought to light in making a channel way to the west end of the dock, rather below half-tide. That these beds at one time were all connected is highly probable; but there appears no evidence that any of them were ever covered by the Boulder Clay.

At first sight the deposit in the hollow, indeed, seems to dip under the Boulder Clay, but on further examination it is clearly seen to thin out to the surface.

The whole Frith of Clyde on both sides is patched with beds of laminated fossiliferous clay, which, doubtless, at one time covered the bottom from side to side, and reached the various heights on which we find their remains above the level of the sea. The whole deposit has evidently suffered much since it was first laid down, from currents, changes of level, and other causes.

The clays are generally found cut away between low tide and high-water mark, where the abrading power of the water is greatest. Examples may be seen at Langbank, Helensburgh, Roseneath, Fairlie, Cumbrae, &c. In these localities the truncated edges of the fossiliferous clays are exposed to view here and there in the more sheltered hollows along the tidal belt.

The trough at Cartsdyke has, doubtless, been separated from the deposit existing close by, near low-water-mark, by the agencies determining the distribution of the beds through the whole Frith.

The Cartsdyke deposit is remarkable, not only for its puzzling appearance, but for the great abundance and diversity of organisms found crowded within its narrow limits.

The dry fossiliferous clay consists of 76 per cent. fine mud; 19 per cent. fine and coarse sand; 5 per cent. gravel and shell *débris.*

The gravel has chiefly been derived from the sandstones of the neighbourhood, with fragments of quartz and mica-schist, and the greater portion is less or more water-worn and striated.

In our list of Mollusca sixty-one species and seven varieties have been identified. The two prevailing shells are *Pecten Islandicus* and *Mytilus modiolus,* but perhaps the shell of most geological interest in this deposit is *Pecten maximus,* as it has been considered doubtful whether it lived at the same time in the Clyde beds with *Pecten Islandicus* or at a subsequent period. Questions have been raised regarding *P. maximus,* which show the necessity of extreme care in cataloguing supposed "glacial" fossils of any description.

It is very doubtful, indeed, whether *P. maximus* belongs to the group of shells found in the true glacial clays.

1. It is not uncommon as a living species in the Frith of Clyde, and its valves abound in the upper silts and raised beaches, and specimens really belonging to the younger beds may have been accidentally mingled with the older fossiliferous deposits beneath. From such mixtures catalogues of species from the "Clyde beds" have often been augmented.

2. There is a *Pecten maximus* bed (presently to be described) immediately in contact in some localities with the older Arctic shell-clays on which it rests.

3. *Balani* have never been found attached to *P. maximus,* yet in the glacial beds they are common on *P. Islandicus;* and as *B. porcatus* and *B. crenatus* (which are remarkably large and abundant in the Arctic clays) do not seem at all fastidious in their choice of attachment, whether to a stone or shell, we may reasonably infer that most of the shells of *P. maximus* found in the Clyde beds were not cohabitants with *P. Islandicus.*

4. With the exception of the one valve met with at Cartsdyke, *P. maximus* has only been found in beds between high and low water which have been greatly disturbed and re-arranged again and again by storm and tide.

This argument regarding *P. maximus* has been given to show the necessity of great caution in making deductions regarding the percentage and range of species generally in the whole series of glacial beds. Whether such deductions are made from the Ostracoda or the Mollusca, the same argument applies with equal force.

Height above the sea ten to twelve feet.

The following Ostracoda were found:

Argillæcia cylindrica, G. O. Sars.
Pontocypris mytiloides (Norman).
— *trigonella,* G. O. Sars.

Cythere pellucida, Baird.
— *porcellanea*, Brady.
— *viridis*, Müller.
— *lutea*, Müller.
— *clutha*, n. sp.
— *limicola* (Norman).
— *villosa* (G. O. Sars).
— *concinna*, Jones.
— *angulata* (G. O. Sars).
— *tuberculata* (G. O. Sars).
Cytheridea papillosa, Bosquet.
— *punctillata*, Brady.
Eucythere Argus, G. O. Sars.
Loxoconcha tamarindus (Jones).
— *fragilis*, G. O. Sars.
Cytherura similis, G. O. Sars.
— *pumila*, n. sp.
— *undata*, G. O. Sars.
— *striata*, G. O. Sars.
— *Sarsii*, Brady.
— *clathrata*, G. O. Sars.
Cytheropteron latissimum (Norman).
— *nodosum*, Brady.
— *angulatum*, Brady and Robertson.
Bythocythere simplex (Norman).
Sclerochilus contortus (Norman).
Paradoxostoma variabile (Baird).
— *Fischeri*, G. O. Sars.
— *tenerum*, n. sp.
Polycope orbicularis, G. O. Sars.

12. Cumbrae College.

The following succession of beds was found during the sinking of a water-tank (1867) near the College in the Isle of Cumbrae:

Earthy mould	1 ft.	6 in.
Gravel	4	0
Shell-bearing sand (not pierced through) . .	1	6

The bed occurs at a distance of 200 yards from the shore, measuring from high-tide-mark.

On parts of the flat of slightly elevated ground, on which the excavation was made, beds of Nullipore, which is not now found in the neighbouring bay, are met with forming part of an old sea-beach and covered by a few inches of mould.

The shell-bed contains a large proportion of sand. Taking seven and a half pounds of the dried material, only ten ounces washed away through a sieve of 96 threads to the inch, leaving six pounds fourteen ounces residue. Of this residue one pound is composed of gravel and broken shells, retained in a sieve of $\frac{1}{8}$-in. mesh. The fragments of rock are sandstone, quartz, trap, and mica-schist, the larger pieces being mostly water-worn, while the smaller are generally angular or partially rounded. Some of the smooth stones appear to have been broken in two, and the fractured surface is entirely unworn.

Height above the sea thirty-two feet.

The following Ostracoda were found:

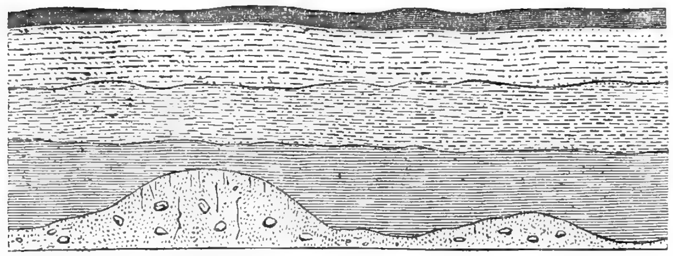
Cythere castanea, G. O. Sars.
— *porcellanea*, Brady.
— *Macallana*, Brady and Robertson.
— *viridis*, Müller.
— *lutea*, Müller.
— *albo-maculata*, Baird.
— *convexa*, Baird.
— *clutha*, n. sp.

Cythere pulchella, Brady.
— *villosa* (G. O. Sars).
— *concinna*, Jones.
— *angulata* (G. O. Sars).
— *tuberculata* (G. O. Sars).
— *limicola* (Norman).
Cytheridea punctillata, Brady.
— *papillosa*, Bosquet.
Eucythere Argus, G. O. Sars.
— *declivis* (Norman).
Loxoconcha tamarindus (Jones).
— *impressa* (Baird).
Cytherura nigrescens (Baird).
— *similis*, G. O. Sars.
— *undata*, G. O. Sars.
— *striata*, G. O. Sars.
— *Sarsii*, Brady.
— *clathrata*, G. O. Sars.
Cytheropteron latissimum (Norman).
— *nodosum*, Brady.
— *angulatum*, Brady and Robertson.
Sclerochilus contortus (Norman).
Paradoxostoma variabile (Baird).

13. Kilchattan, Isle of Bute.

The deposit lies at the north-west side of Kilchattan Bay, beyond tide-mark, and dips seaward. Taking the beds in descending order, we find—

I.—Peaty mould: about 1 foot.
II.—Gravel: 3 to 5 feet.
III.—Muddy sand: 4 to 6 feet.
IV.—Grey laminated clay: 6 to 7 feet.
V.—Reddish Boulder Clay: depth unknown.



Section showing position of shell-bearing clay at Kilchattan Tile-works, Bute.

a, Boulder clay. *b*, Laminated clay. *c*, Sandy mud, with shells, &c. *d*, Gravelly mould. *e*, Peaty mould.

Passing over *e* and *d*, it is in the stratum of muddy sand (*c*) that the shells occur; and they are more abundant towards the bottom than near the top.

The prevailing shells of this deposit are *Tellina calcarea, Axinus flexuosus, Scrobicularia prismatica, Cyprina Islandica, Mya truncata,* and *Utriculus obtusus.* Most of these reach a size rather above the average of those met with in the Clyde beds generally. They are all abundant, from the fry up to the adult forms, showing, as regards this deposit, that the conditions for all stages of growth of these various species had been exceedingly favorable.

The majority of the *Myæ* were found to have both valves preserved, together with remains of their siphons in position within the shells. This sandy material seems to be favorable for the preservation of this portion of the animal tissue. Siphons have been met with in the soft clay of other localities, but rarely.

A number of the valves of *Mya truncata* have thick patches of the muddy sand in which they are imbedded indurated on their inner surface so firmly as not to be removed even by boiling water. Similar hard clays are occasionally found in shells taken from other Post-tertiary deposits. These patches generally do not extend over the whole interior of the shell, but are confined to a particular spot. Sometimes we have met with hard nodules of clay which, when broken, disclose a cluster of small shells embedded within, much like the well-known clay nodules enclosing shells or fish-remains in other formations.

These indurated patches of sand and clay within the shells, and those enclosing shells, as well as the clay-nodules found in many of our brick-clays, that have no apparent organic nucleus, have all, so far as we have examined, a strong calcareous base, while the clays in which they are embedded have none.

The grey-coloured laminated clay (*b*) is formed into layers by thin bands of red sand, which are thicker and more distinct as they approach the bottom, where the clay between them is again divided into exceedingly thin layers. From three pounds of this laminated clay we obtained an oval plate of an *Echinus*, three valves of *Cytherura Sarsii*, twelve specimens of *Nonionina depressula*, and three of *Polystomella striato-punctata*.

A much larger portion from the same stratum had previously been examined without finding a vestige of animal remains, showing how unsafe it is to pronounce any deposit unfossiliferous from one trial, inasmuch as organisms may not be equally distributed through all parts of the same stratum.

The shell-bearing clay consists of 32 per cent. fine mud; 68 per cent. fine sand.

The laminated clay when dry is of a lightish drab colour, and consists of $96\frac{1}{2}$ per cent. fine mud, $\frac{1}{2}$ per cent. fine sand, with occasionally small pebbles less than the size of a common pea.

The Boulder Clay, which is very unevenly distributed, and at some places rises up in knolls through the grey clay and nearly reaches the muddy sand layer above, when dry consists of 51 per cent. fine mud, 28 per cent. fine and coarse sand, 21 per cent. gravel.

Height above the sea fifteen to twenty feet.

The following Ostracoda were found:

Argillæcia cylindrica, G. O. Sars.
Cythere castanea, G. O. Sars.
— *porcellanea*, Brady.
— *Macallana*, Brady and Robertson.
— *viridis*, Müller.
— *lutea*, Müller.
— *Clutha*, n. sp.
— *limicola* (Norman).
— *pulchella*, Brady.
— *villosa* (G. O. Sars).
— *concinna*, Jones.
— *angulata* (G. O. Sars).
— *tuberculata* (G. O. Sars).
— *Dunelmensis* (Norman).
Cytheridea papillosa, Bosquet.
— *punctillata*, Brady.
Eucythere Argus, G. O. Sars.
Loxoconcha tamarindus (Jones).
Cytherura nigrescens (Baird).
— *gibba* (Müller).

Cytherura similis, G. O. Sars.
— *undata*, G. O. Sars.
— *Sarsii*, Brady.
Cytheropteron latissimum (Norman).

14. Kyles of Bute.

1. *Tigh-na-bruaich.*—Walking along the shore, and proceeding from high-tide-mark to low, the following series of beds is passed over:

(1.) Boulder Clay, hard, compact, unfossiliferous. It is red in colour through the ferruginous character of the mica-schist of which the included boulders largely consist, and which constitutes the base rock on which it rests.

(2.) Laminated clay, remarkable for the decisiveness and freedom of its laminations and of the same character as that described in other beds.

(3.) Shell-clay, rich in characteristic Arctic shells. This bed is composed of clay and sand mixed in various proportions at different points. At some points a pure sand, at others a pure clay, is found, and there are all possible intermediate varieties.

To the left of the pier, covered with one to two feet of sand, is an extensive bed of *Pecten Islandicus*, the shells having both valves united, and being in their natural position.

Saxicava (*Panopœa*) *Norvegica* with *Mya truncata*, var. *Uddevallensis*, also occur in a thick clay, adjoining the sand, of large size, standing in their natural boring position. *Astarte compressa* and *A. sulcata* can be picked out from the clay also with united valves, and large valves of *A. borealis* may also be found.

To some of the boulders imbedded in the clay large specimens of *Balanus porcatus* are attached.

The true order of these beds is the reverse of the order in which they are passed over in walking from high- to low-tide-mark. The action of the sea has swept away the upper parts of the beds; and since the denudation has been most complete where the waves have broken upon the shore, the lowest bed (the Boulder Clay) is the most exposed at that point; the middle bed (the laminated clay) is still less exposed; and the upper bed (the shell-clay) is the least exposed of the whole series. This order is invariable through the whole length of the Kyles, although one or other of the beds is occasionally absent. Fossils might appear at first sight to be in the Boulder Clay when they really occur at points where the fossiliferous bed is in immediate contact with it, the laminated clay being absent.

On the Bute shore, immediately opposite Tigh-na-bruaich, the same beds are visible wherever any jutting point has saved them from denudation. In some places a bed of *Mya truncata* runs under the turf, and is above high-tide-mark, while the Boulder Clay is seen beneath it, the shell-bed having been more perfectly protected than on the opposite side of the water; *Saxicava Norvegica* of very large size is *in sitú*, and any lump of clay yields numerous examples of *Tellina calcarea.*

2. *Balnakeaile Bay.*—In this bay, which is almost directly opposite to Colintraive Pier, the glacial beds have been well preserved; they are cut through by a small stream which discharges itself into the sea in the middle of the bay, and exposes the clay with characteristic Arctic species *in sitú.* On the left of the stream the shell-bed extends under a bank of sand and gravel, rising to a height of twenty feet; and it also crops out in the wood, a quarter of a mile inland, on the same side of the stream. The nature of the matrix in which the shells are found varies from a loose sand to a tenacious clay.

Following the Rothesay Road, in a slight bend of the Kyles opposite the first farm-house, the shell-bed has been found in great perfection. It is now almost washed away, but a few years ago the remains of an Arctic fauna were multitudinous. A bed of *Pecten Islandicus* existed and many of the specimens had *Balanus porcatus* attached to their upper valves; *B. porcatus* adhered also to large boulders on the shore. In those beds we have also found *Balanus cariosus* (Darwin) and *Modiolaria nigra;* and *Saxicava Norvegica* was in great perfection. The beds occur in the same order as at Tigh-na-bruaich, and the shell-bed extends from high-tide-mark towards the sea, at about half-tide being at its thickest. Before it can be well seen a foot or more of sand and gravel must be removed. Collections made from the mere surface *débris* are worthless, since they will be found to contain Arctic, raised-beach, and recent species intermixed in inextricable confusion.

3. *Ettrick Bay.*—This bay on the Bute shore, near the westerly entrance to the Kyles, is so completely covered with sand as to obscure the separate beds. It is noteworthy, however, as the locality in which *Astarte borealis* may be found in great abundance, generally in single valves, although we have obtained a perfect specimen.

Height above the sea from half-tide to about fifteen feet.

The following Ostracoda were found:

Cythere pellucida, Baird.
— *viridis*, Müller.
— *lutea*, Müller.

Cythere limicola (Norman).
— *villosa* (G. O. Sars).
— *concinna*, Jones.
— *angulata* (G. O. Sars).
— *tuberculata* (G. O. Sars).
— *Dunelmensis* (Norman).
Cytheridea papillosa, Bosquet.
— *punctillata*, Brady.
Eucythere Argus (G. O. Sars).
Loxoconcha tamarindus (Jones).
Cytherura nigrescens (Baird).
— *similis*, G. O. Sars.
— *undata*, G. O. Sars.
— *striata*, G. O. Sars.
— *Sarsii*, Brady.
— *flavescens*, Brady.
Cytheropteron latissimum (Norman).
— *nodosum*, Brady.
— *angulatum*, Brady and Robertson.
Sclerochilus contortus (Norman).
Paradoxostoma variabile (Baird).
— *ensiforme*, Brady.

15. East Tarbert, Loch Fine.

On the north side of the Tarbert Loch, at the north-east corner, a small stream, called the Black Burn, cuts into a bed of clay containing Arctic shells, which can be traced from twelve to fifteen feet above high-water mark.

The shell-bearing clay is of a light grey colour and lies at an incline of one foot in ten. It is overlaid by five or six feet of brown stony mould washed down from the hillside. In washing through a sieve of 96 meshes to the inch, 100 parts of the dry material lost thirty, while ten parts of the residue were retained in a sieve of $\frac{1}{8}$-inch mesh and consisted of coarse gravel; the other sixty parts were composed of fine gravel and sand. The presence of water-worn specimens of species, natives of different habitats, raises a suspicion that they may have been brought after death from greater or less distances; although some specimens which have their colour and epidermis preserved are evidently on the ground on which they lived.

Trochus helicinus is remarkably prevalent, and in no one of the glacial beds we have examined has it been found so abundantly as in this locality.

Saxicava rugosa is next in abundance, and the var. *arctica* appears, although not of marked size, few specimens reaching an inch. Portions of the epidermis are preserved. A few fragments of *Mya truncata* are met with covered with fresh epidermis, and, therefore, evidently washed from a near part of the bed where they must be *in sitû*.

Littorina litorea, *L. obtusata*, and *L. limata* (which are all very scarce, especially *L. limata*) are imperfect and water-worn.

There is one curious circumstance characteristic of these local groupings, in which the facts connected with the fossils coincide with those connected with recent deposits, and which it is important for the geologist to consider when collecting palæontological evidence regarding the ages of the beds. Almost all the deposits have their peculiarly prevalent species. A rare species in one bed may be abundant in another, belonging to precisely the same age.

In the East Tarbert bed *Pseudocythere caudata*, of Sars, is moderately common. It is recorded as rare between tide marks in the Channel Islands; rare in England, Scotland, Ireland, and Norway in deep water; and it is also rare in the glacial clays.

Cythere emarginata (Sars), a still rarer species, is met with in the same bed; male and female specimens being moderately common.

This species has been found living only in one or two localities in the British seas, and there very sparingly.

Height above the sea twelve to fifteen feet.

The following Ostracoda were found:

Cythere pellucida, Baird.
— *castanea*, G. O. Sars.
— *viridis*, Müller.
— *lutea*, Müller.
— *villosa* (G. O. Sars).
— *angulata* (G. O. Sars).
— *emarginata* (G. O. Sars).
— *concinna*, Jones.
— *tuberculata* (G. O. Sars).
Cytheridea papillosa, Bosquet.
— *punctillata*, Brady.
Cytherura nigrescens (Baird).
— *undata*, G. O. Sars.

Cytherura similis, G. O. Sars.
— *Sarsii*, Brady.
— *clathrata*, G. O. Sars.
Cytheropteron latissimum (Norman).
Pseudocythere caudata, G. O. Sars.
Sclerochilus contortus (Norman).
Paradoxostoma variabile (Baird).

16. West Tarbert.

For a considerable distance along the Loch on the south side, a little beyond where the new road begins near the head of the Loch, a fossiliferous clay crops out, in some places abutting against the native rock to which *Balani* and *Serpulæ* may be seen adhering in great abundance.

A little further down the Loch, where the rocks stand out more steeply into the sea, the shell-bearing clay disappears, but it is seen again in the course of about a mile, resting against the rock on the west side of the bay. Considerable denudation has, therefore, taken place.

Many parts of the true bed are overlain by eight or ten inches of a shell *débris* thickly mixed with clay. This covering is undoubtedly a wash thrown up in heavy storms and is coated with grass. Many of the shells in the lower clay, especially *Pecten Islandicus* and *Buccinum undatum*, have attained a portly size, evidencing their growth under secure and favorable conditions.

One hundred parts of the dry clay lost 66 per cent. in washing through a sieve of 96 meshes to the inch; 16 parts of the residue were retained in a sieve of $\frac{1}{8}$th-inch mesh, consisting of small gravel and broken shells; the other 18 parts were composed of fine sand.

Height above sea, just above and beneath high-water-mark.

The following Ostracoda were found:

Cythere pellucida, Baird.
— *viridis*, Müller.
— *lutea*, Müller.
— *pulchella*, Brady.
— *villosa* (G. O. Sars).
— *concinna*, Jones.
— *angulata* (G. O. Sars).

Cythere tuberculata (G. O. Sars).
— *Dunelmensis* (Norman).
Cytheridea papillosa, Bosquet.
— *punctillata*, Brady.
Loxoconcha tamarindus (Jones).
Cytherura nigrescens (Baird).
— *undata*, G. O. Sars.
— *striata*, G. O. Sars.
Cytheropteron latissimum (Norman).
— *angulatum*, Brady and Robertson.
Bythocythere simplex (Norman).
Sclerochilus contortus (Norman).

17. Loch Gilp.

The burn in the excavated banks of which the shell-clay is found begins in the marshy ground west of Baden farm-head. When this burn was deepened shell-bearing deposits were brought to view at several points along its course, variously overlain by gravel, peat, and surface-soil, to the depth of five to ten feet.

Directly beneath the shell-clay is the Boulder Clay, with the following characteristics:

1. It is very hard and compact, and tinged with the bluish hue of the surrounding trap-rocks.
2. It is exceedingly irregular in thickness, and curves violently within a few yards.
3. The boulders are chiefly schist and greenstone, and very far-travelled; they are finely striated, smoothed, and polished.
4. It does not contain the slightest vestige of a shell.

This Boulder Clay rests upon greenstone rock, striated in horizontal or partly dipping grooves.

It is not succeeded by the usual laminated clay of the Clyde beds. A remarkable shell-bed rests immediately upon the Boulder Clay.

The line of junction between the shell-bed and Boulder Clay is sharp and well defined. There is no merging of the shell-bed into Boulder Clay, and no gradual transition. The separation is sharp, and in every way decisive.

Scarcely at any two places where the shells appear is the composition of the deposit alike. Some portions lose by washing about 10 per cent. and others about 60 per cent.

In some parts there is a thick blue clay; in others, a mixture of clay and sand, varying from a sandy clay to a clayey sand.

On the north side of the burn blue clay is overlain by about a foot of gravelly clay, with boulders of various sizes thickly interspersed, not unlike a shore shingle. In this gravelly clay *Mya truncata* is exceedingly plentiful in its natural boring position, with both valves united. It also occurs in the underlying blue clay, more than a foot and a half lower down.

The burrow of this Mollusc, however, never exceeds half that depth, and consequently the *Mya* of the upper bed could not have been contemporaneous with the *Mya* of the lower; and we have the record of successive generations.

The fauna of the shell-bed is most abundant; but the grouping of the shells, like the composition of the deposit, varies at different points. At one spot *Mya truncata* abounds, the shells being thickly packed in a sandy matrix, and in many cases having their syphons preserved. At another, this shell is absent, and *Saxicava rugosa* stands in its natural position, and *Astarte borealis* is found with united valves. The smaller shells, and even the Entomostraca, equally vary in grouping at different points. We have, in fact, all those local varieties of *habitat* characterising a sea-bottom. There is no sign of any confused sweeping of one part into another.

The occurrence of the shell-bed in patches may be due either to the irregular character of the surface over which the shell-bearing deposit is spread, or to abrasion from above.

Of the former, there are good illustrations in many of the brickfields near Paisley in which knolls of Boulder Clay rise up through the laminated clay and at some places reach the surface. Of the latter, there is a good instance on the shore at high-water mark, a little east of Helensburgh, where a patch of shell-bearing clay lies in a rent or gully of Boulder Clay and has been worn down to a level with the beach.

At one point in the Loch Gilp sections the shell-bed dips under the stream, which is literally paved with *Mya truncata* in a boring position.

A few boulders are scattered through the shell-bed; but grooved and polished specimens are not as abundant among them as they are in the clay beneath, although they occasionally occur. The change is almost as great from striated to unstriated imbedded stones, as from the absence of a fauna to its abundant development.

The boulders in the shell-bed are often covered with *Serpulæ,* and evidently, therefore, must have been stationary during a certain period. They are small in size compared with those in the clay beneath.

Above the shell-bed in one locality is a patch of fine sand (two to three feet) destitute of organic remains, and this is succeeded by a bed of about the same depth of ferruginous gravel. The whole of these deposits, however, vary in thickness at different points. In some places the sand thins out, in others the gravel disappears and a bed of mere surface-soil covers the shells.

The complete section is:

1. Surface-soil ;
2. Ferruginous gravel :
3. Fine sand (marine in one place, at which we found *Cardium edule*) ;
4. Fossiliferous clay, passing into sand ;
5. Boulder Clay.

Height above the sea fifteen to twenty feet.

The following Ostracoda were found :

Pontocypris trigonella, G. O. Sars.
Cythere pellucida, Baird.
— *viridis*, Müller.
— *lutea*, Müller.
— *Finmarchica* (G. O. Sars).
— *villosa* (G. O. Sars).
— *mirabilis*, Brady.
— *concinna*, Jones.
— *quadridentata*, Baird.
— *convexa*, Baird.
— *angulata* (G. O. Sars).
— *tuberculata* (G. O. Sars).
— *Dunelmensis* (Norman).
Cytheridea papillosa, Bosquet.
— *punctillata*, Brady.
Eucythere Argus (G. O. Sars).
Loxoconcha tamarindus (Jones).
Xestoleberis depressa, G. O. Sars.
— *aurantia* (Baird).
Cytherura nigrescens (Baird).
— *gibba* (Müller).
— *similis*, G. O. Sars.
— *undata*, G. O. Sars.
— *striata*, G. O. Sars.
— *Sarsii*, Brady.
— *clathrata*, G. O. Sars.
Cytheropteron latissimum (Norman).
Bythocythere simplex (Norman).
Sclerochilus contortus (Norman).

Paradoxostoma variabile (Baird).
— *abbreviatum*, G. O. Sars.
— *Fischeri*, G. O. Sars.
— *flexuosum*, Brady.

18. Crinan.

This bed was opened by a cutting made to lead off the water from the high level on a small plateau at the north side of No. 11 Lock on the Crinan Canal.

A few feet only of the clay are exposed, and the shell-bearing portion is a thin stratum, in which broken shells, *Balani* plates, and spines of *Echini* are seen sparsely scattered. The shells are of Arctic species, including *Astarte borealis, Tellina calcarea, Pleurotoma pyramidalis,* and *Velutina lævigata,* but so fragmentary as to be determinable with difficulty. The *Balani—B. crenatus, B. porcatus,* and *Verruca Stroemii* —are more abundant and less broken, but of small size.

The clay is reddish-brown and loses 66 per cent. in washing.

Height above the sea thirty feet.

The following Ostracoda were found:

Cythere lutea, Müller.
— *villosa* (G. O. Sars).
— *concinna*, Jones.
— *angulata* (G. O. Sars).
— *tuberculata* (G. O. Sars).
Cytheridea punctillata, Brady.
Krithe Bartonensis (Jones).
Loxoconcha impressa (Baird).
— *tamarindus* (Jones).
Cytherura undata, G. O. Sars.
— *clathrata*, G. O. Sars.
Cytheropteron latissimum (Norman).
— *nodosum*, Brady.
— *angulatum*, Brady and Robertson.
Sclerochilus contortus (Norman).

19. Duntroon.

This deposit occurs a little to the south of Duntroon Castle and comes to the surface at about high-water-mark. By clearing away a slight covering of gravelly sand a stiff brown clay is reached, containing many of the typical Arctic species of this series of beds in abundance.

Pleurotoma pyramidalis is particularly plentiful.

The clay when dry imbibes the water very slowly, pieces from three to four inches in diameter taking nearly twenty-four hours to dissolve; nevertheless, it passes easily through the sieve and washes rapidly, losing 83 per cent. in the operation.

Height above the sea, just above high-water-mark.

The following Ostracoda were found:

Argillæcia cylindrica, G. O. Sars.
Pontocypris trigonella, G. O. Sars.
Cythere castanea, G. O. Sars.
— *viridis*, Müller.
— *lutea*, Müller.
— *limicola* (Norman).
— *pulchella*, Brady.
— *villosa* (G. O. Sars).
— *concinna*, Jones.
— *angulata* (G. O. Sars).
— *tuberculata* (G. O. Sars).
— *Dunelmensis* (Norman).
Cytheridea papillosa, Bosquet.
— *punctillata*, Brady.
Eucythere Argus (G. O. Sars).
Krithe Bartonensis (Jones).
Loxoconcha impressa (Baird).
— *tamarindus* (Jones).
Cytherura nigrescens (Baird).
— *similis*, G. O. Sars.
— *pumila*, n. sp.

Cytherura undata, G. O. Sars.
— *Sarsii*, Brady.
— *cellulosa* (Norman).
— *clathrata*, G. O. Sars.
Cytheropteron latissimum (Norman).
— *nodosum*, Brady.
— *angulatum*, Brady and Robertson.
Bythocythere constricta, G. O. Sars.
Sclerochilus contortus (Norman).
Paradoxostoma variabile (Baird).
Polycope orbicularis, G. O. Sars.

20. Dyer's Burn, Fort William.

A section has been exposed by this burn, about half a mile from Fort William, a little above the bridge.

A brief account of this bed, with a complete list of its fauna, has been given by Mr. J. Gwyn Jeffreys in the 'Transactions of the British Association for the Advancement of Science' for 1862.

We observed the following particulars:

Upon the schistose rock of the locality (over which the stream pours) rests a bed of hard and stony clay.

a. The lower part of this clay is crowded with fossils, which are intermixed with stones and pebbles of schist. To some of the stones *Balani* are attached.

b. The upper part of the clay contains some angular blocks with many stones confusedly massed together, which have the appearance of having been thrown down upon the shell-bed, possibly while it was in the process of elevation.

The clay is about five to six feet deep, and in the lower foot the fossils are most abundant.

On the neighbouring hillside two beds of coarse gravel and shingle may be seen; the one, about forty feet above the sea, representing an old coast-line, the other, about twenty-five feet above the sea, representing a more recent coast-line.

Among the Mollusca included in the shell-clay are *Columbella Holbollii, Littorina limata, Margarita Grœnlandica*, &c. Mr. Jeffreys considers the whole group, however, Scandinavian rather than Arctic.

Height above the sea nine feet.

The following Ostracoda were found:

Cythere lutea, Müller.
— *concinna*, Jones.
Cytheridea punctillata, Brady.
Cytherura gibba (Müller).
Cytheropteron latissimum (Norman).
— *angulatum*, Brady and Robertson.
Sclerochilus contortus (Norman).

21. Lucknow Pit, Ardeer Iron-works, Ayrshire.

Although we could obtain no material from this pit to examine for Ostracoda, it is of importance to record the section as illustrating the existence of a younger fossiliferous bed (represented by the *Pecten maximus* bed in the Kyles of Bute and the Irvine water bed presently to be described) resting upon an older Arctic bed.

The section obtained during the sinking of the pit was the following:

Sand, about	12 ft.	0 in.
Moss	1	6
Sand	26	6
Shell-mud, or blue loamy sand	6	0
Blue clay	6	0
Sandstone rock		

The shells brought to the surface belonged to two entirely different groups. The one group was eminently Arctic, including *Leda arctica, Astarte borealis, Tellina calcarea, Natica affinis* (*clausa*).

The other group embraced a numerous collection of species precisely similar to those found in the post-glacial bed in Irvine water. In this group *Ostrea edulis* is abundant and associated with *Cardium edule, C. Norvegicum, C. echinatum, Tapes pullastra, T. decussata, Lutraria elliptica, Pecten opercularis, Trochus magnus.*

22. Cleshmahew's Tile-works, One Mile South of Stranraer.

The following section has been exposed:

1. Upper clay, mixed with sand, with polished and striated stones and worn flint pebbles	7 to 8 ft.
2. Brown clay	Very variable.
3. Blue clay rising into hummocks and occasionally intersected by lenticular beds of sand and gravel, with polished and striated stones and worn flint pebbles	7 to 8 ft.
4. Gravel, sufficiently porous to drain the water from the workings, not pierced through	

The shells are found in the brown clay (2) and the blue clay (3).

The species of Mollusca, which are not water-worn, although ill-preserved, include such an extremely Arctic type as *Leda arctica*, which is covered with its epidermis and is associated with *L. pygmæa* and *L. pernula*.

The shell-clay consists of 92 per cent. fine mud, 6 per cent. sand, 2 per cent. small gravel.

Height above the sea fifty feet.

The following Ostracoda were found:

Cythere lutea, Müller.
— *villosa* (G. O. Sars).
— *Dunelmensis* (Norman).
Cytheridea punctillata, Brady.
Loxoconcha tamarindus (Jones).

23. Terally Brick-works, Fourteen Miles from Stranraer, on the South-east of the Mull of Galloway.

This deposit is of the same general character as at Cleshmahew's except that the undermost bed retains the water instead of being porous. It is also remarkable for the prevalence of a highly Arctic fauna.

Leda arctica (Torell) is associated with *L. pygmæa.*

The shell-clay consists of 97 per cent. fine mud, 2 per cent. of sand, and 1 per cent. of gravel.

Height above the sea forty-five feet.

The following Ostracoda have been found:

Cypris gibba, Ramdohr.
Cythere limicola (Norman).
Limnicythere antiqua, n. sp.
Cytheridea papillosa, Bosquet.
— *punctillata*, Brady.
Cytherura undata, G. O. Sars.

24. Port Logan Cliffs.

Port Logan cliffs are about one mile from Terally on the opposite side of the Mull. The shell-clay rests immediately on the rock, and rises to the height of twenty feet. It is very stiff, and is overlain by a few feet of gravel.

The dry clay consists of 50 per cent. of fine mud, 46 of sand, and 4 of rounded and well polished gravel.

The shells are fragmentary and water-worn; they are scattered over the whole face of the deposit, and not confined to any particular layer in the section, as we see them in those sections where they have lived and died.

Only three species of Mollusca could be determined, viz. *Astarte sulcata*, *Leda pernula*, and *L. pygmæa*, with one of Ostracoda, viz. *Cytheridea punctillata*, Brady, which was a perfect specimen with united valves.

25. Dipple Tile-works, Three Miles East of Girvan.

The clay in this deposit is remarkable for the character of its fauna, as showing a direct passage from marine through estuarine to freshwater conditions.

Freshwater, brackish, and marine forms are not mixed up promiscuously together from bottom to top, but the fauna is nearly pure marine at the bottom, brackish in the middle, and almost entirely freshwater at the surface. Three samples of the clay were examined.

The uppermost part, between six and nine feet below the surface, is distinctly laminated, and of a dark mottled appearance. Together with some vegetable remains it contains a great abundance of the chitinous parts of Daphniadæ and Lyncæidæ, various forms of Cypridæ, and other genera and species which have a greater or less aptitude for existence in brackish water, such as *Limnicythere inopinata, Loxoconcha tamarindus,* and *Cythere tenera*.

Some shell fragments are associated with the Ostracoda,—possibly of *Mytilus edulis*, which can exist at high-water-mark, and would be lifted up with the sea-bottom when it was placed in a position to become a freshwater pool.

Under this freshwater clay we find four feet of clay of a uniform grey colour, in which the brackish water forms are very largely developed. A few freshwater species occur, such as *Sphærium corneum* and *Cypris gibba;* but brackish water forms, such as *Cythere castanea* (which is very abundant), greatly prevail. The appearance of *Utriculus obtusus* and *Homalogyra atomus* also shows that the clay is beginning to assume a more decidedly marine character.

In the succeeding three feet of clay the freshwater and brackish organisms have almost disappeared, and the Mollusca are far more numerous, both in species and individuals, than in any of the overlying strata. Taking them in the prevailing order, they are:

Homalogyra atomus	Very common.
Rissoa striata	Moderately common.
Utriculus obtusus	Moderately common.
Leda pygmæa	Moderately rare.
Axinus flexuosus	Three valves.
Skenea planorbis	One valve.

Mya truncata	Fry, one valve.
Mytilus edulis	Fragments.
Balanus crenatus . . .	One plate.
Fry of Gasteropoda.	
Claw of Crustacean.	

The following Ostracoda were found:

Cypris compressa, Baird.
— *ovum* (Jurine).
— *gibba*, Ramdohr.
Pontocypris mytiloides (Norman).
— *trigonella*, G. O. Sars.
Cythere castanea, G. O. Sars.
— *tenera*, Brady.
— *lutea*, Müller.
— *pulchella*, Brady.
— *villosa* (G. O. Sars).
— *concinna*, Jones.
— *angulata* (G. O. Sars).
— *tuberculata* (G. O. Sars).
Limnicythere inopinata (Baird).
— *antiqua*, n. sp.
Cytheridea papillosa, Bosquet.
— *punctillata*, Brady.
— *lacustris* (G. O. Sars).
Loxoconcha tamarindus (Jones).
Cytherura nigrescens (Baird).

26. Errol, Perthshire.

On the north side of the River Tay, eight miles east from Perth, a clay is exposed remarkable for the intensely Arctic character of its fossils.

1. Its surface is covered by the estuarine mud of the Tay.
2. The deposit of clay itself occupies a small oval trough about one mile in length

and a quarter of a mile in breadth, and the clay is at its extreme point twenty-five feet deep.

3. The lower part of the clay is distinctly laminated, as in the Paisley and other beds, and is far more sandy than the upper clay, becoming, indeed, the workmen informed us, a sand bed at its deepest point.

4. The trough in which the fossiliferous clay is packed is a hollow in the Boulder Clay, which crops out on neighbouring elevations.

The shells are met with at all points from the bottom to near the surface, but are most abundant (as in the Paisley beds) in the lower part of the clay.

Nothing can be more striking than the general physical conformity between the section at Errol, when fully exposed, and a good typical section in the neighbourhood of Paisley.

The Errol clay contains certain species, either absent or extremely scarce in the west, mixed with others entirely identical; and the high northern character of these peculiar species may either indicate a slight precedence in time on the part of the eastern beds and the consequent prevalence of a sterner climate; or it may (as is far more probable) be explained by local peculiarities of depth and exposure. The remarkable conformity between the two series of clays in their sequences and characteristics, unmistakeably proves, however, that they must have been formed by the exercise of the same physical forces acting under the same conditions and with similar degrees of intensity and power.

The whole of the Mollusca found, specially in the eastern fossil beds, range within the Arctic circle and off the east coast of North America, and do not live off the coast of Great Britain; and although the percentage of species collected in the several beds must always be shifting with fresh discoveries, there seems no doubt that in such glacial clays as those of Errol on the east of Scotland, as compared with those upon the west, there is a preponderance of Arctic and North-east-American forms.

The following species of an extremely Arctic character have not yet been found in the west:—*Crenella faba, Leda limatula, Mesalina erosa, Mesalia reticulata, Thracia myopsis.*

Leda arctica is a characteristic fossil at Errol; every lump of clay in some parts of the pit is crowded with them. On the west it is extremely scarce. One specimen, evidently fossil, was dredged by Mr. Jeffreys; another was obtained from a sand bed (glacial) at Stevenson; and a few specimens have been found in Cleshmahew's Tile-works and Terally Brick-works, near Stranraer.

Pecten Grœnlandicus is also far from uncommon at Errol; as yet only one young specimen has been found in the west; and that in the bed beneath the Boulder Clay at Tangy Glen.

Modiolaria discors, var. *lævigata*, is also abundant at Errol, while only rare specimens of the fry have been found in the west.

The Ostracoda yield a kindred result.

In the fossiliferous clays of Errol such species as *Cythere mirabilis*, *Cytheridea Sorbyana*, and *Cytheropteron Montrosiense*, occur with an abundance sufficient to be characteristic, while they are exceedingly rare in the western beds.

The existence of an Arctic current on the east, such as that which now sweeps over the Dogger Bank, might sufficiently account for the preponderance in question without having recourse to any larger hypothesis.

Height above the sea forty-five feet.

The following Ostracoda have been found:

Cythere viridis, Müller.
— *lutea*, Müller.
— *convexa*, Baird.
— *villosa* (G. O. Sars).
— *concinna*, Jones.
— *globulifera*, Brady.
— *emarginata* (G. O. Sars).
— *tuberculata* (G. O. Sars).
— *mirabilis*, Brady.
— *Dunelmensis* (Norman).
Cytheridea papillosa, Bosquet.
— *punctillata*, Brady.
— *Sorbyana*, Jones.
Krithe glacialis, n. sp.
Cytherura concentrica, n. sp.
— *gibba* (Müller).
Cytheropteron latissimum (Norman).
— *nodosum*, Brady.
— *arcuatum*, n. sp.
— *inflatum*, n. sp.
— *Montrosiense*, n. sp.
Sclerochilus contortus (Norman).

27. Elie, Fifeshire.

On the coast of Fife, eleven miles from St. Andrews, and on the north side of the bay in which the town of Elie is situated, there is an exposure of sandy clay, containing a fauna kindred to that at Errol, and to which the same general remarks apply.

The beds occur in the following order:

1. Drift sand.
2. Gravel, variable in thickness.
3. Sandy clay, with Arctic fauna; about four feet being exposed above high-water mark, and the bed passing under the sea.

The fossils are met with throughout the clay.

Height above the sea, from high-water mark to four feet.

The following Ostracoda were found:

Cythere globulifera, Brady.
— *concinna*, Jones.
— *emarginata* (G. O. Sars).
— *mirabilis*, Brady.
— *Dunelmensis* (Norman).
Cytheridea papillosa, Bosquet.
— *punctillata*, Brady.
— *Sorbyana*, Jones.
Eucythere Argus (G. O. Sars).
Loxoconcha tamarindus (Jones).
Cytherura concentrica, n. sp.
— *nigrescens* (Baird).
Cytheropteron arcuatum, n. sp.
— *Montrosiense*, n. sp.
— *latissimum* (Norman).
Krithe Bartonensis (Jones).
Sclerochilus contortus (Norman).

28. Dryleys, near Montrose.

In the brickworks of Dryleys, near Montrose, a thick mass of clay is exposed which reaches the height of 50 to 100 feet.

In the lower part of the mass especially fossils occur, and the presence of *Leda arctica, Pecten Grœnlandicus,* a large form of *Saxicava rugosa,* var. *arctica,* sufficiently marks the character of the deposit.

Height above the sea forty feet.

The following Ostracoda were found :

Cythere globulifera, Brady.
— *concinna,* Jones.
— *mirabilis,* Brady.
— *Dunelmensis* (Norman).
Cytheridea punctillata, Brady.
— *Sorbyana,* Jones.
Cytherura concentrica, n. sp.
Cytheropteron latissimum (Norman).
— *arcuatum,* n. sp.
— *inflatum,* n. sp.
— *Montrosiense,* n. sp.
Sclerochilus contortus (Norman).

29. Barrie, Forfarshire.

This clay bed is of the same general character as that of Dryleys. It lies along the estuary of the Tay, in a gully in the most recent of the raised sea-margins, which runs all along the east coast, nearly a mile inland.

The shells indicate a decidedly arctic character; and amongst them are *Mya truncata, Nucula tenuis, Leda pernula,* and *Leda minuta. Hoploaster gracilis* is not uncommon.

The following Ostracoda were found:

Cythere globulifera, Brady.
— *villosa* (G. O. Sars).
— *emarginata* (G. O. Sars).
— *mirabilis*, Brady.
— *Dunelmensis* (Norman).
Cytheridea punctillata, Brady.
Cytherura similis, G. O. Sars.
— *concentrica*, n. sp.
— *Sarsii*, Brady.
Cytheropteron latissimum (Norman).
— *Montrosiense*, n. sp.

30. Gamrie, Banffshire.

About seven miles east of Banff beds of fine sand and clay attain a height of upwards of 300 feet.

At an elevation of about 150 feet in a thin seam of sand, shells occur of an Arctic type, but the catalogues at present compiled do not show a group as intensely Arctic as that at Errol and Elie.

The beds at Errol and Elie, however, are at a much lower elevation, and possibly belonged to a deeper sea-bed during the period of the greatest submergence of the land.

Height above the sea 150 feet.

The following Ostracoda were found:

Cythere pellucida, Baird.
— *limicola*(Norman).
— *lutea*, Müller.
— *villosa* (G. O. Sars).
— *tuberculata* (G. O. Sars).
— *Finmarchica* (G. O. Sars).

Cytheridea papillosa, Bosquet.
Loxoconcha impressa (Baird).
Cytherura undata, G. O. Sars.
— *similis*, G. O. Sars.
— *Sarsii*, Brady.
— *cellulosa* (Norman).
— *clathrata*, G. O. Sars.
Cytheropteron latissimum (Norman).
Sclerochilus contortus (Norman).

31. Annochie, Aberdeenshire.

At Annochie, about five miles north of Peterhead, a bed of fine fossiliferous clay occurs, passing immediately from the shore under the beach, thus occupying the same position as many outcrops of clay along the Clyde. As in the corresponding Clyde beds, such species as *Axinus flexuosus*, *Leda pygmæa*, and *Nucula tenuis* are very abundant.

Height a few feet above sea-level, the bed passing under the beach.

The following Ostracoda were found:

Cythere globulifera, Brady.
— *Dunelmensis* (Norman).
Cytheridea inornata, n. sp.
Cytherura complanata, n. sp.
Cytheropteron latissimum (Norman).
— *Montrosiense*, n. sp.

B.—Arctic Shell-beds.

Although we have grouped together in one class the sands and clays characterized by an Arctic fauna, it does not necessarily follow that they belong to one period only of the great Glacial Epoch.

In many of the periods (possibly marked by fluctuations in the intensity of the climate) comprised within the epoch during which an Arctic climate prevailed and disappeared, marine clays must have been deposited and become the habitat of species now relegated to the Arctic circle.

Some of the beds must belong to the earlier, and some to the more recent portions of the epoch.

In considering the effects of fluctuations of climate upon marine animals, we must also take into account other modifying causes, such as depth of water, character of the sea-bottom, supply of food, and the abundance or otherwise of the enemies of particular species.

Without attempting to decide upon the special ages of the various Arctic deposits examined for the purposes of this paper, we must have made evident the fact that many differences exist between them.

I. The varying position of the Arctic shell-clays, with respect to the Boulder Clay, has been described.

1. Some Arctic shell-clays are covered by masses of highly glaciated Boulder Clay.

2. Other Arctic shell-clays are intercalated between masses of Boulder Clay.

3. Other Arctic shell-clays rest upon the Boulder Clay, and not only are not covered by it but are followed by a regular succession of beds, showing a very gradual change from old marine to recent estuarine conditions, and entirely free from any indications of violent breaks.

a. Beds of this class are deposited in hollows of the Boulder Clay, and have thus been formed subsequently to an extensive denudation of that material.

b. They contain large boulders, not derived from the Boulder Clay on which they rest, but which have been dropped upon existing sea-bottoms full of marine life.

c. They enable us to trace the coming and going of the Arctic fauna by the examination of the clays at the lower and upper parts of the same section, as was indicated in an account of a Paisley pit.

d. They are often immediately succeeded by a *Cardium edule* bed of a modern period, without any intervening Boulder Clay at all.

e. Sometimes the passage from marine through estuarine to freshwater beds can be followed by examining samples of one bed of clay taken from different points in the section.

An example of this was given from the tileworks near Girvan, Ayrshire.

II. Some Boulder Clays have themselves been distinguished as fossiliferous and as being Arctic shell-bearing clays, although found under special circumstances.

III. The study of the special fauna of each bed reveals also distinctions between them.

1. The shell-beds represent differences of depth, some being littoral and others deep sea.

2. They contain sometimes a mixture of deep-sea and littoral species, evidencing the action of tides and changing currents.

3. While in many beds the fossils occur *in sitú*, in others they are very much broken and fragmentary.

4. The proportion of Arctic species varies in different beds.

IV. Some of the Arctic shell-beds mark coast-lines at varying heights—coast-lines which could not have coexisted. The case of Jordan Hill, Glasgow, has been instanced, where a littoral shell-bed exists sixty-three feet above the sea; while a similar littoral shell-bed is met with on the low ground north of Paisley at about fifty feet lower level.

V. The Arctic shell-beds exist at various heights above the sea. On the west of Scotland the beds we have described range from 526 feet at Airdrie (the highest point at which Arctic shells have yet been discovered in Scotland, although there is no reason to conclude that they will not ultimately be found at higher levels) to half-tide-mark, where, in some cases, they dip beneath the sea and are entirely hidden by modern sands and gravels. At present there are blanks to be filled up between 526 feet (Airdrie) and a group of beds between forty feet and sixty feet. Tangy Glen, Campbelton, is 130 feet; and, doubtless, other beds at a corresponding elevation await discovery.

Between forty feet and sixty feet we have such beds as those at Oakshaw Hill, Paisley, Paisley and Glasgow Canal, Jordan Hill, Stranraer, &c.

Between twenty feet and forty feet such beds as those at Paisley (lower levels), Loch Lomond, Loch Gilp, Crinan, &c.

Between ten feet and twenty feet, such beds as those at Greenock, East Tarbert, Dumbarton, &c.

Between high-tide-mark and ten feet, such beds as those at Kyles of Bute and almost the whole shore of the Frith of Clyde, Fort William, &c.

On the east of Scotland, Arctic shell-beds have been found at the following heights:

Auchleuchries, Aberdeenshire (this bed we have not seen, but give it on the authority of Mr. Jamieson, *loc. cit.*, *ante*)	300 ft.
Gamrie (the beds of sand and gravel reaching to 300 feet)	150
King Edward	150 to 200
Errol	45
Belhelve, Aberdeenshire	40
Montrose	40
Annochie (passing under sea from a few feet over sea-level).	
Elie (passing under sea from a few feet over sea-level).	

VI. The position of the *Mytilus edulis* bed is also noteworthy.

The range of *Mytilus edulis* is given by Mr. J. Gwyn Jeffreys as "From high-water mark to the depth of a few fathoms."[1] The bed occurs in the lower part of some of the Arctic deposits, and in the upper part of others.

The *Mytilus edulis* bed was found resting on the surface of a glacial clay, itself covered by forty-two feet of Boulder Clay, on Oakshaw Hill, Paisley, sixty-four feet above the mean sea-level. Dr. Fraser states that he has found a similar bed "under the late steeple at the Cross of Paisley, at a height of forty feet above the sea-level; another at the head of St. Mirren Street at thirty-two feet; another in James's Street at twenty-three feet; and another in Causey-side at a height of only twelve feet; while out in the plain, and nearer the Clyde, he had found a fringe of shells, seaweed, &c., which marked the tidal limit, subsequent, of course, to the time when the lowest of these beds was formed."[2]

C.—Among the Post-tertiary fossiliferous beds of Scotland there is not only this vast series of Arctic sands and clays (in themselves possibly marking various points in the passage of a great epoch), BUT THERE IS ALSO A SERIES OF BEDS, OF LATER DATE AND NOT IN ANY WAY ARCTIC IN CHARACTER, WHICH INDICATE THE STEPS THROUGH WHICH THE PRESENT CLIMATE AND PHYSICAL GEOGRAPHY OF SCOTLAND HAVE BEEN REACHED SINCE THE FINAL RETREAT OF THE ICE.

During the complex conditions arising from the subsidence and emergence of the land, it does not seem reasonable to suppose that the climate of Scotland was ameliorated by unbroken stages. A season of less heat may have been followed by a season of greater heat than even now exists, in its turn to be modified by the changed distribution alike of the currents of the waters and the respective areas of the land and sea.

I. *Some deposits, belonging to the class now under consideration, may, indeed, be quoted as furnishing indications of a climate certainly far from Arctic, and possibly of a more genial character than now prevails in Scotland.*

1. Blair Drummond, Valley of the Forth.

The following section is given on the authority of Mr. Jamieson:[3]

1. Sandstone rock.
2. Glacial beds.

[1] 'British Conchology,' vol. ii, p. 105.
[2] 'Trans. Geol. Soc. Glasgow,' vol. iv, p. 180.
[3] 'Quart. Journal Geol. Soc.,' vol. xxi, p. 185, 1865.

3. Peat with remains of trees.
4. Carse-clay with bones of Whale.
5. Peat, with roots of oak trees at the bottom and remains of an old wooden road.

The peat (3) is described as a "land-surface of the period preceding the deposition of the old estuarine mud," and commented upon as follows—"This bed of peat, lying beneath the raised estuarine beds, is the first appearance of that substance we meet with in Scotland; indeed the period during which peat was formed so extensively from the gradual accumulation of mosses, sedges, and various other plants, is, perhaps, even a stage later; for at the bottom of many of our peat-mosses we find remains of trees and, in some cases, beds of shell-marl. These trees are all of existing species now indigenous to Scotland. The birch, hazel, and oak are amongst the most common, and hazel nuts are frequently found. Now these trees testify, I think, *to a condition more favorable to the growth of wood than what we have at present.* They evidently preceded the commencement of the peat in a multitude of instances, for their roots are spread on the hard earthy soil beneath it, and it is since the death of those trees that many of our peat-mosses date."[1]

Evidence is also brought to show that the remains of trees are now found in Scotland "at heights beyond where wood can now be got to grow."[2]

2. Colintraive, Kyles of Bute.

Following the Loch Ridden Road on the Colintraive side of the Kyles of Bute, in a small bay, about a quarter of a mile from the pier, a shell-bed is exposed at low-tide which has been confounded with the true glacial clay, but which certainly belongs to a very different age. In this deposit *Pecten maximus* and *Ostrea edulis* occur, of enormous size, associated with *Aporrhais pes-pelicani*, *Lutraria elliptica*, *Psammobia Ferroensis*, *Lucinopsis undata*, *Tellina squalida*, all British species, but constituting a group of shells which could not now be obtained in the same abundance and perfection in the immediately neighbouring waters of the Kyles.

It is true that the partial or total disappearance of shells on particular banks depends, in a large measure, on local circumstances, which may be of comparatively recent occurrence. It is not unusual when dredging to find banks, at various depths, covered with old dead shells, without a living one of the same species among them. In the bay at the head of West Tarbert Loch, a little below high-water, on digging through a foot of sand, a bed of sandy mud was reached, with large specimens of *Scrobicularia piperata*,

[1] Ibid., p. 186. [2] Ibid., p. 187.

although none are now found living in that locality, the destruction having been evidently occasioned by a bank of sand having been thrown over the haunts of that Mollusc during a violent storm. After every great storm, indeed, there is probably some change in the habitats of the Mollusca.

The *Pecten maximus* bed at Colintraive, however, contains species which would require, when living, a greater depth of water than they could have enjoyed in their present situation.

It can be traced along the shore until it can be seen resting upon an old glacial clay containing in abundance *Tellina calcarea;* and this, again, may be seen resting on the laminated clay, and the laminated clay on the Boulder Clay, in regular descending order.

It is evident that at the junction of the edge of the *Pecten maximus* bed with the Arctic clay, it will be possible for the contents of the two beds to be confused together.

We have observed this same *Pecten maximus* bed cropping out in various districts. It may be seen at dead low-water near Tigh-na-bruaich and at Kilchattan Bay, Bute.

At Fairlie (Ayrshire) it is largely developed, and, as at Colintraive, overlies the Arctic shell-clay. The ground at Fairlie has been so often dug and re-dug by collectors that the natural difficulties in the way of discriminating between the two beds have been increased, and very little, if any, reliance can be placed upon the accuracy of catalogues of so-called 'glacial fossils' based upon specimens from that locality. Not only specimens from the *P. maximus* bed, but recent specimens have been thrown together in the *débris* of the very numerous excavations which have been made, and have thence made their way into collections and catalogues as belonging to the "Clyde Beds."

The Ostracoda found are a mixture from the various beds now described, species from one deposit having been washed into another, so that it is not necessary to give a separate catalogue of them.

3. Irvine Water, Ayrshire.

On the Ayrshire coast, in the neighbourhood of Irvine, a fine sand similar to that now edging the sea has been deposited and drifted inland to a considerable distance, rising in a succession of slightly elevated knolls. Near the shore these knolls are most distinctly marked, having been recently formed, and their loose material not having been driven over the dividing gaps made by the wind. Inland their divisions have been to a great extent obliterated by perpetual driftings, but excavations show the sand rising and falling at different heights, exactly as in the line of hillocks now fronting the sea. Following the Irvine Water, at about two miles from the sea, a section of clay and sand beds was cut out by a curve of the stream. Of all sections of this character it must be noted that the looseness of the material causes them quickly to appear and disappear, so that the observations made at one season cannot often be repeated.

The section we examined was the following:

1. The base of the section was the Boulder Clay of the true normal type. The boulders, chiefly of trap and limestone, were not very far-travelled, and were beautifully striated. As usual this Boulder Clay had sharp undulations and dipped violently within short distances, rising nearly to the surface in one direction and passing down rapidly beneath the stream, a variation of one to twenty feet in its height taking place within a quarter of a mile.

The Boulder Clay was capped occasionally along the line of its outcropping by a few feet of ferruginous gravel. This gravel, as well as the Boulder Clay, has been greatly denuded, and occurs in patches only. It may be recognised in good sections of the glacial series of beds, as at Lochgilphead, where it covers the Arctic deposit, but it is not at all persistently found.

3. Here occurs a vast gap in the normal arrangement of the strata. The Boulder Clay was *not* followed by the series of glacial fossiliferous sands and gravels of the Clyde district, but was simply covered here and there by a layer of peat a few inches less or more in thickness.

4. Following the peat appeared the first great shell-bed in the section. At the point described the Boulder Clay was hollowed out and disappeared under the stream.

The old clay had evidently been disintegrated, and its boulders rolled upon a beach. The small boulders scattered about were of the same composition as those of the older bed, but their striations were gone, and they had evidently been subjected to the rolling action of the waves.

Among the shells embedded in this old sea-bottom not a single purely Arctic form could be detected, although it was twenty feet beneath the surface, and rested immediately on the Boulder Clay.

The valves of the specimens were generally loose and separate, yet several perfect examples were extracted, and from the very bed of the stream a fine example of *Mactra stultorum* was obtained *in sitú*, clearly proving that it was not a mere drift-bed, but that many of the Mollusca lived and died upon the spot. The action of the Irvine Water, often rising to great heights, would be sufficient to break up the shells and scatter them on the banks.

5. Upon this rough sea-bottom, with its stones washed out from the disintegrated Boulder Clay, rests the fine sand of the district. In this sand, fourteen feet from the surface, and about four feet above the average level of the stream, immediately before our

visit, a considerable portion of the occipital bone, with the condyles, foramen magnum, and pterygoid process of a large Cetacean had been found.

6. The same fine sand continued to the surface, and was broken by a second shell-bed, nearly two feet in depth, and extending along the section in a regular and persistent line. This shell-bed must have been deposited *after* the Cetacean stranded in the hollow of the Boulder Clay, since it is unbroken in regularity, and has not been disturbed subsequently to its deposition.

The shells have not been roughly heaped up, as a drift, by wind and tide, since many perfect specimens, fresh as when they were first interred in the sand, were obtained from the bed. *Tellina tenuis* was extracted with both valves entire, together with numerous perfect examples of *Mactra subtruncata.* This second shell-deposit indicates a less depth of water than the one preceding. Its contents consisted of such species as *M. subtruncata, Tellina tenuis,* whose special habitat is the sand in shallow water, while from the lower bed were obtained *Cyprina Islandica* and *Lutraria elliptica,* which range to greater average depths.

The rough stones of the lower bed gave place to the finer sands, and the waters becoming more shallow through the gradual elevation of the land, the nature of the characteristic fauna slightly changed during the process.

The *lowest* shell-bed is possibly of the same age as the *Pecten maximus* bed of Colintraive and other localities; but, however this may be, the fact of the occurrence of distinct beds of shells of undoubtedly post-glacial character proves the necessity for their separate description and examination, and establishes the fact that a series of gradual changes took place in comparatively recent times.

The following Ostracoda were found:

Cythere pellucida, Baird.
— *lutea,* Müller.
— *convexa,* Baird.
— *albomaculata,* Baird.
— *villosa* (G. O. Sars).
— *emaciata,* Brady.
Cytheridea elongata, Brady.
Loxoconcha impressa (Baird).
Cytherura nigrescens (Baird).
— *undata,* G. O. Sars.
Paradoxostoma variabile (Baird).

II.—*A strongly marked series of Post-glacial deposits belongs to the most recent period of the depression of the land.*

These beds when fossiliferous contain precisely the same fauna as that now occupying British waters. They are, however, sometimes distinguished (*a*) by a general grouping of species in slightly different proportions from those now prevalent in the waters of the special locality, and (*b*) by the rarity or absence in the immediately neighbouring waters of a species abundant in the fossil bed.

The deposits, which may be classed together as belonging to the close of the last period of the depression of the land, range from a little above the sea-level to a height of about forty feet, and may be described as *raised beaches* and *estuarine beds.*

A.—Estuarine muds compose the Carse Lands of Scotland, and are largely developed in the Firth of Tay and the Firth of Forth. The mud is in no way stony, but exceedingly fine and smooth, and has not been disturbed since its first deposition.

A series of bores (investigated by Mr. Croll and Mr. J. Binnie[1]) "reveal the existence of a deep trough or channel, running from the Clyde Valley, near Bowling, up to and through the haugh of Belmore, the valley of the Kelvin, and round by the south-east end of the Campsie Hills into the valley of the Forth by Grangemouth;" and one of these will clearly show the general position of the estuarine mud.[2]

Bore near Skinflats, Grangemouth, twelve feet above sea-level.[3]

1. Surface sand	6 feet.
2. Soft mud with shells [estuarine, *Ostrea edulis* very large—many recent species]	11
3. Blue mud and sand (hard)	3
4. Channel (rough gravel)	3
5. Fine sand [shell fragments]	8
6. Running sand (red and fine)	17
7. Red clay	30
8. Soft till [Boulder Clay]	36
9. Sand (pure)	2
10. Soft till [Boulder Clay and sand]	17
11. Gravel	8
12. Hard blue till [Boulder Clay]	14
	155

[1] 'Trans. Geol. Soc. of Glasgow,' vol. iii, page 141.

[2] With respect to this channel between the Forth and Clyde it must be noted that when the land stood higher the trap-dyke which crosses the Clyde near Dalmuir would have assisted in forming the deep portions of the trough into a lake such as Loch Lomond now is, with its bar at Balloch.

[3] Ibid., p. 144.

Through the Carse of Forth these beds extend to a great depth. Near Falkirk the bores show the centre of the trough to be 300 feet deep, the deposits decreasing rapidly on either side. The thickness of the different beds of the series naturally varies at different points all over the area covered by them.

Entire skeletons of the Whale (about seventy feet long) were found at Airthrey and Dunmore, twenty feet above tide-mark, imbedded in the clay,[1] and portions of Cetacean remains near Stirling, Micklewood, and Blair Drummond. The fauna is entirely modern, and many species occur in extraordinary quantities in large and well-developed beds which are scattered through the whole of the districts covered by the carse clay precisely as at the sea-bottom of the present day. Near Micklewood, five miles west of Stirling, *Cardium edule* is abundant, *Mytilus edulis* and *Ostrea edulis* common.

In a section exposed on the banks of the Allan, *Ostrea edulis* is seen in layers.

In the Montrose estuarine basin, *Scrobicularia piperata* is the most characteristic shell.

Some shells of an Arctic character, such as *Tellina calcarea* and *Trophon scalariforme*, have been reported from the Carse of Falkirk;[2] but these evidently belong to a bed of the older clay which has survived the denudation, and occupies a position beneath the estuarine mud, probably indicated by No. 5 of the Grangemouth section quoted. During the sinking of one of the Grangemouth pits at a depth of eighty feet (sixty or seventy feet below sea-level) some bones of a Seal were found.[3] From mud adhering to these bones, we obtained *Polymorphina compressa* and *Nonionina asterizans*, with one species of Ostracoda, viz. *Cytheropteron Montrosiense*, a species associated with Arctic Mollusca in the old Arctic clays. Some clay from the same pit at a depth of forty feet yielded fragments of *Tellina balthica*, a species more frequent in estuarine than in glacial beds.

1. Drip Bridge, Stirling.

A few yards above Stirling Bridge, the river exposes a fossiliferous bed of marine clay covered by later estuarine mud. By comparing one or two similar and neighbouring exposures, the following series was obtained:

1. Peat . . . . . 7 ft. to 8 ft.
   (*a*) Upper part black, useable for fuel.
   (*b*) Lower part soft and spongy not so useable.

[1] 'Edin. Phil. Journ.,' vol. i, p. 393; vol, xi, p. 220.

[2] 'Trans. Geol. Soc. of Glasgow,' vol. 3, p. 367.

[3] See a paper by Prof. Turner, "On the Bones of a Seal in the Red Clay at Grangemouth," in the 'Proceedings Roy. Soc. Edinb.,' 1869-1870.

2. Carse mud	. . . .	9 ft. to 10 ft.
3. *Ostrea edulis* bed	. . . .	2·6 „ 3 „

The sample of clay containing the shells washed quite away, leaving neither sand nor gravel, but simply shell *débris* mixed with a little vegetable matter.

Ostrea edulis is very abundant. None of the specimens, however, are as large as those we have noticed in the *Pecten maximus* bed at Colintraive, few exceeding four inches in their longest diameter, although they are generally very thick and solid.

Height above the sea thirty-four feet.

The following Ostracoda were found:

Argillæcia cylindrica, G. O. Sars.
Cythere pellucida, Baird.
— *viridis*, Müller.
— *villosa* (G. O. Sars).
— *concinna*, Jones.
— *angulata* (G. O. Sars).
— *tuberculata* (G. O. Sars).
— *Dunelmensis* (Norman).
Cytheridea torosa (Jones).
Eucythere Argus (G. O. Sars).
Loxoconcha guttata (Norman).
— *tamarindus* (Jones).
Cytherura nigrescens (Baird).
— *similis*, G. O. Sars.
— *clathrata*, G. O. Sars.
Cytheropteron nodosum, Brady.
Sclerochilus contortus (Norman).

2. Brick-work south-west of Stirling.

At McAlpin's brickwork, south-west of Stirling, there is a stiff clay of a dark colour, composed of fine mud with a small percentage of sand and gravel. Estuarine shells are exceedingly numerous, *Scrobicularia piperata* being the characteristic mollusc, and they are not associated with any Arctic forms.

The following Ostracoda were found:

Cythere pellucida, Baird.
— *lutea*, Müller.
— *villosa* (G. O. Sars).
Cytheridea punctillata, Brady.
Loxoconcha guttata (Norman).
Cytherura clathrata, G. O. Sars.
Cytheropteron nodosum, Brady.

3. Bridge of Allan.

About half a mile from the Bridge of Allan, on the north side of Allan Water, the river cuts through a bank in which the *Ostrea edulis* bed is exposed a few feet below the surface.

The following Ostracoda were found:

Potamocypris fulva, Brady.
Cythere pellucida, Baird.
— *cribosa*, nov. sp.
— *viridis*, Müller.
— *villosa* (G. O. Sars).
— *angulata* (G. O. Sars).
— *cuneiformis*, Brady.
— *tuberculuta* (G. O. Sars).
— *Dunelmensis* (Norman).
Eucythere Argus (G. O. Sars).
Loxoconcha guttata (Norman).
— *tamarindus* (Jones).
Cytherura undata, G. O. Sars.
— *nigrescens* (Baird).
Cytheropteron latissimum (Norman).
Sclerochilus contortus (Norman).

The estuarine muds at the mouth of the South Esk are typical, and the following series of deposits has been described by Dr. Howden:[1]

"1. A layer of unstratified Boulder Clay, of a red colour, lying on rocks polished and grooved in a general direction of west to east, and containing the dressings of these rocks and travelled boulders derived from rocks to the west of their present position.

"2. Laminated dull red clay, forming a terrace forty feet above the level of the sea and containing marine fossils of an Arctic type and small boulders (transported from great distances) of rocks foreign to the district.

"3. A layer of stratified sand and gravel covering the laminated and boulder clay to 100 feet above the sea-level, identical in its mineral contents with the unstratified moraine-gravels of Glen Clova.

"4. Peat found in old water-courses, resting on the marine clay or on the gravel.

"5. A great bar of boulders stretching across the estuary mouth, derived apparently from the Boulder Clay.

"6. *A deposit of estuary or Carse clay and sand, extending to about fifteen feet above the sea-level, and containing in its lower portions estuary shells.*

"7. An accumulation of blown or drifted sand, forming the links on part of which Montrose is built."

Since these old estuarine deposits and raised beaches occur at almost any point between a few feet above high-water mark and thirty feet, the amount of elevation of the land during the period they represent (as we pointed out was the case also during the glacial period) must have been very unequal.

Mr. Jamieson states that the elevation of the old estuarine deposits becomes less as we proceed from the Firth of Forth to Aberdeenshire,[2] commencing at from twenty-five to forty feet in the Carse clay of the Forth and continuing at that point to the estuary of the Tay, but at the estuary of the Ythan being eight feet and at Aberdeen only just above high-water mark.

4. Paisley, Cardium edule Bed.

The position of this bed has been previously described (p. 25). It was about nine inches in thickness and covered with four feet of surface soil. Immediately beneath it was the Arctic shell-clay, in the upper part containing few fossils, in the lower part an abundant fauna, with *Cyprina Islandica* as the characteristic species.

[1] 'Trans. Ed. Geol. Soc.,' 1867-68.

[2] 'Journal Geol. Soc.,' 1865, vol. xxi, p. 189.

The fauna of the *Cardium edule* bed was similar to the fauna of any locality on the west coast in which that species abounds. In a very small quantity of material the following Ostracoda were found:

Cythere pellucida, Baird.
Cytheridea papillosa, Bosquet.
Loxoconcha impressa (Baird).
Xestoleberis aurantia (Baird).
Cytherura gibba (Müller).

5. Isle of Cumbrae.

The village of Millport, which stretches along the shore, is built on the old twenty-five-feet sea-beach. From the pier to the west end of Kames Bay, under a thin crust of soil, is a bed of *Melobesia*, more or less thick, which, for the most part, rests on the sandstone rock of the district. It is curious to notice that, although at this stretch of the beach the *Melobesia* is lying in beds of considerable thickness, none of it is found in the sea in the bay opposite to it; but at the south-west end it is most abundant, both in the raised beach and in the sea.

The fauna is entirely recent. The shelly material is much water-worn, and loses little in washing. Mollusca are more abundant than either Foraminifera or Ostracoda.

The following Ostracoda were found:

Pontocypris mytiloides (Norman).
— *trigonella*, G. O. Sars.
— *acupunctata*, Brady.
Cythere pellucida, Baird.
— *viridis*, Müller.
— *lutea*, Müller.
— *albomaculata*, Baird.
— *convexa*, Baird.
— *pulchella*, Brady.
— *villosa* (G. O. Sars).
— *angulata* (G. O. Sars).
Cytheridea papillosa, Bosquet.

Loxoconcha impressa (Baird).
Xestoleberis aurantia (Baird).
Cytherura nigrescens (Baird).
— *angulata*, Brady.
— *acuticostata*, G. O. Sars.
Paradoxostoma Fischeri. G. O. Sars.

6. West Tarbert Silt.

A bed of estuarine silt is found at West Tarbert, younger than the glacial clay previously described, and entirely free from any remains of Arctic shells.

The following Ostracoda were found:

Pontocypris mytiloides (Norman).
Cythere pellucida, Baird.
— *castanea*, G. O. Sars.
— *porcellanea*, Brady.
— *crispata*, Brady.
— *viridis*, Müller.
— *lutea*, Müller.
— *albo-macculata*, Baird.
— *convexa*, Baird.
— *cuneiformis*, Brady.
— *villosa* (G. O. Sars).
— *tuberculata* (G. O. Sars).
Loxoconcha impressa (Baird).
— *tamarindus* (Jones).
Xestoleberis depressa, G. O. Sars.
Cytherura nigrescens (Baird).
— *undata*, G. O. Sars.
— *striata*. G. O. Sars.
— *cuneata*, Brady.
— *gibba* (Müller).
— *cellulosa* (Norman).
Paradoxostoma variabile (Baird).
— *Fischeri*, G. O. Sars.

7. Oban.

A bed composed of earthy matter, shell *débris*, and small gravel, was reached in digging the foundation of a house on the east of Oban, and also in a railway-cutting in the same vicinity. The material is more muddy and has less of a washed appearance than is usual in raised beaches.

It occurs on a small plateau at the mouth of a rivulet which might have supplied the sediment. Only one example of fluviatile Ostracoda, however, was found,—a solitary specimen of *Cytheridea lacustris*. The deposit has altogether the appearance of a recent sea-bottom, which has been uplifted to its present position, rather than of a beach. The fauna is that of the surrounding waters.

Height above the sea ten to fifteen feet.

The following Ostracoda were found:

Paracypris polita, G. O. Sars.
Pontocypris mytiloides (Norman).
— *trigonella*, G. O. Sars.
Bairdia inflata (Norman).
Cythere lutea, Müller.
— *viridis*, Müller.
— *pellucida*, Baird.
— *castanea*, G. O. Sars.
— *crispata*, Brady.
— *albo-maculata*, Baird.
— *convexa*, Baird.
— *pulchella*, Brady.
— *villosa* (G. O. Sars).
— *angulata* (G. O. Sars).
— *semipunctata*, Brady.
— *Jeffreysii*, Brady.
— *cuneiformis*, Brady.
— *laticarina*, Brady.
— *emaciata*, Brady.
— *antiquata* (Baird).
Cytheridea torosa (Jones).

Cytheridea lacustris (G. O. Sars).
Loxoconcha impressa (Baird).
— *tamarindus* (Jones).
Xestoleberis depressa, G. O. Sars.
Cytherura nigrescens (Baird).
— *similis*, G. O. Sars.
— *striata*, G. O. Sars.
— *angulata*, Brady.
— *undata*, G. O. Sars.
— *gibba* (Müller).
— *acuticostata*, G. O. Sars.
— *cellulosa* (Norman).
Cytheropteron latissimum (Norman).
Pseudocythere caudata, G. O. Sars.
Sclerochilus contortus (Norman).
Paradoxostoma variabile (Baird).
— *abbreviatum*, G. O. Sars.
— *arcuatum*, Brady.

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§ IV. GENERAL SEQUENCE OF THE POST-TERTIARY BEDS OF SCOTLAND.

While the place of several individual deposits—the precise nature of the causes by which they were produced—and the subdivisions of the periods to which they may be referred, involve geological arguments beyond the scope of the present paper, it may add to the clearness of those details, distinctive of the beds from which Ostracoda have been derived, and which have been already dwelt upon, to subjoin a reference to the General Sequence of the Post-Tertiary Beds of Scotland.

In tabulating this general sequence itself, however, we shall confine ourselves almost entirely to points illustrated by our previous descriptions of the several beds with the fauna of which this Monograph is chiefly concerned.

Without attempting to give anything approaching to a final and complete sequence we simply submit an arrangement, *in the direction of which our investigations have led us*, for the purpose of furnishing a tentative grouping of a large number of deposits which it is impossible to study when they are miscellaneously intermingled.

A. Preglacial Period.

"Crag" of Aberdeenshire.

Beds beneath Boulder Clay at Kilmaurs, with remains of *Elephas primigenius*.

B. Glacial Period.

I. *Early Glacial Period.*

Elevation of the land above its present level.

Land ice.

Formation of unfossiliferous Boulder Clay, now found:

(*a*) On the flanks, in the hollows, and on the summits of Scotch mountains, as well as beneath more recent deposits in the plains.

(*b*) Beneath the Arctic shell-clays of the Clyde.

II. *Middle Glacial Period.*

Depression of the land.

Denudation of Boulder Clay.

Formation of Arctic shell-beds in hollows of Boulder Clay at various depths, according to extent of local depression.

Floating ice over the sea increased in area by the depression.

Boulder Clay thrown over shell-beds: (*a*) by glacier reaching the sea; or (*b*) floating ice.

Earliest *Mytilus edulis* beds, formed when depression began, followed by clays with shells of deeper range as depression increased.

Period of extreme depression.

III. *Final Glacial Period.*

Re-elevation of land.

Gradual shallowing of the waters.

More littoral character of glacial shell-beds.

Later *Mytilus edulis* beds.

Floating ice; dropping glaciated Boulders into shell-beds.

Boulder Clay occasionally thrown, as before, over shell-beds.

Gradual filling up with sand and silt of great sea-channels, formed during period of greatest depression, as, *e.g.* between Firth of Forth and Firth of Clyde. During this process Boulder Clays *possibly* deposited by floating ice over sand and silt—their alternation as now found being caused by seasonal changes.

Drifting ice breaking up shell-beds and mixing their contents with Boulder Clay, especially along the newly forming coasts.

C. Post-glacial Period.

I. *Early Post-glacial Period.*

Upper Raised Beaches, formed as the land rose from the Glacial Sea, during the gradual amelioration of the climate.

Upper portions of Clyde clays, showing by absence of species common in lower portions, the disappearance of an Arctic fauna and the incoming of estuarine conditions.

Land almost at its present level.

II. *Middle Post-glacial Period.*

Possibly milder climate.

Peat with trees, showing conditions very favorable to growth.

Slight resubmergence of the land.

Pecten maximus bed at Irvine water, Colintraive, &c.

Lower estuarine mud; possibly *Scrobicularia* bed of silt of east coast.

III. *Final Post-glacial Period.*

Re-elevation of land to its present position.

Last Raised Beaches.

Upper estuarine mud.

The final *Post-glacial Period* we regard as terminating with the last elevation of the land, at however recent a date that may have taken place.

Note.—With regard to the Ostracoda which we have catalogued from the various Post-tertiary beds of Scotland the only previous notices of their occurrence known to the authors of this Monograph are the following:

1. Dr. Howden, in his paper "On the Superficial Deposits of the South Esk,"[1] catalogues among the principal fossils found at the Dryley's Brick-work, Montrose—Crustacea, *Cythere,* sp. (?)

2. Memoirs of the Geological Survey of Scotland: Explanation of—

Sheet I.—Terally Brick-works.
Entomostraca: A few single valves much worn.

Sheet II.—Monreith Tile-works.
Cythere emarginata?
— *pulchella?*

3. Mr. Peach's paper "On the Fossils from the Boulder-clay of Caithness," in 'Report of British Assoc.,' 1862, Trans. Sect., p. 83, includes—Entomostraca, some valves of *Cythere?*

V. THE POST-TERTIARY OSTRACODA.

In this Monograph we describe 133 species, of which 93 are from the Post-tertiary beds of Scotland. The species from the upper beds are the same as those inhabiting the British seas at the present day, and their distribution corresponds; but when the Ostracoda catalogued from the true glacial deposits of Scotland are studied in connection with the Mollusca, they yield the same general results both with respect to their relationship to the fauna now inhabiting British waters and also to the glacial fossil fauna of Norway and Canada.

A few of these general relationships may be indicated. The names of the fossil species to which reference is made will be given when we proceed to notice in detail the facts connected with their distribution.

[1] 'Trans. Geol. Soc. Edin.,' 1867-8, p. 6.

1. *Relation of the Scotch glacial fauna to the existing fauna of the Scotch waters.*

From the results of Mr. J. Gwyn Jeffrey's dredging expedition in the Hebrides[1] it may be concluded that—

(1) The invertebrate fauna of the district is chiefly northern, and for certain species peculiar to the Hebrides no locality has been recorded between that and the Mediterranean. The fauna of the Hebrides must have obtained this characteristic subsequently to the Glacial Epoch.

(2) The Hebrides constitute the southern limits of many northern species, such as *Lima elliptica* (not yet found fossil), *Leda pygmæa* (an abundant glacial fossil), *Trochus Groenlandicus* (also abundant as a glacial fossil).

Of the Mollusca catalogued from the Scotch glacial beds none are extinct species, but some Arctic forms are absent from the neighbouring sea, while some species ranging within the Arctic circle may be characterised as very common in glacial clays and very rare as living specimens.

Of the species of Ostracoda catalogued from the Post-tertiary beds—

18 are extinct, so far as at present known;

10 are distinctly boreal or Arctic, although living in British waters;

and none of the remainder are of southern type.

2. *Relation of the Scotch glacial fauna to the glacial fauna of the north of Europe.*

Prof. Sars gives sixty-one species of Mollusca collected from twenty beds of the old Glacial Epoch in Norway. Of these sixty-one species we have obtained forty-eight from the glacial clays of Scotland. Moreover, the characteristic species of some of the Norwegian clay beds are precisely identical with those of the Scotch beds.

At Moss, *e.g.* on the Christiania Ffiord the prevailing shell is *Leda Arctica*, which is also very characteristic of the Errol clay.

The climate of south-west Norway was undoubtedly more extreme than at present during the Glacial Epoch, and, so far as the evidence of the fauna reaches, the same severe climate extended over Scotland.

Of the forty-five fossil species of Ostracoda noted in the "Glacial and Post-glacial" beds of Norway all, except eight, are fossil in the Scotch beds, and all, except one, are living in British and Norwegian seas.

[1] 'Annals and Magazine of Natural History,' 1866, 1867, 1868.

3. *Relation of the Scotch glacial fauna to the glacial fauna of Canada.*

The fossil glacial fauna of Canada is not so widely distinct from the living fauna of the Gulf of St. Lawrence as the fossil glacial fauna of the Clyde beds is distinct from the living fauna of the Firth.

In Scotland at least sixteen species are found fossil which are extinct in British waters, together with many Arctic varieties of British species.

In Canada Dr. Dawson has described 205 species of "Post-pliocene fossils," and remarks that "the whole of these, with three or four exceptions, may be affirmed to be living Northern or Arctic species, belonging, in the case of the marine species, to moderate depths, or varying from the littoral zone to—say 200 fathoms. The assemblage is identical with that of the northern part of the Gulf of St. Lawrence and Labrador coast at present, and differs merely in the presence or absence of a few more southern forms now present in the Gulf, especially in its southern part, where the fauna is of a New England type, whereas that of the Post-pliocene may be characterised as Labradorian."[1]

This marked contrast between the Canadian and Scotch glacial fauna in relation to the fauna locally existing proves the greater completeness of the change of climate in Scotland than in Canada.

The Scotch glacial fauna has, moreover, a strong alliance with the Canadian shown by the prevalence in both of very characteristic Arctic species.

Out of thirty-three fossil species of Ostracoda collected from the Post-pliocene beds of Canada and Maine,

23 are found in Scottish glacial beds,
25 live in British waters,
6 are new.

The comparison between the Scotch and Canadian beds is of special interest, since it suggests that at the period when the glacial fauna flourished in the Scottish seas, the climate was nearly the same as that prevailing in Canada during the same epoch, *i. e.* slightly colder than that of the St. Lawrence.

The fossils, however, must not be considered as marking the extreme point of cold reached during that epoch; but rather as indicating the commencement of slightly milder conditions than had hitherto prevailed.

The question suggested by this comparison, therefore, is, What conditions would produce in the Clyde a temperature slightly colder than that of the Gulf of St. Lawrence?

[1] 'Notes on the Post-pliocene Geology of Canada,' by J. W. Dawson, LL.D.; Montreal, 1872; p. 101.

The existence of an Arctic current, the wide expanse of land in the American Arctic regions exercising its chilling influence, and other circumstances connected with the directions of the mountain-ranges and the heights of the water-shed, account to a large extent for the climate of Canada.

A corresponding series of changes would explain *not* the whole phenomena of the glacial epoch, but the existence of the fauna of the glacial clays in Scottish waters. The shiftings of level, of which there is ample evidence, would involve rearrangements in the relative proportions of land and water; while there would be vital alterations in the directions of the Arctic currents, and a deflection in the Gulf Stream.[1]

[1] See a paper "On the Reason why the Change of Climate in Canada since the Glacial Epoch has been less complete than in Scotland," by James Croll, 'Trans. Geol. Soc. Glasgow,' vol. ii, p. 138. Also a paper "On the Relation between the Glacial Deposits of Scotland and those of Canada," by H. W. Crosskey, F.G.S., ibid., p. 132.

§ VI. THE FOLLOWING IRISH AND ENGLISH POST-TERTIARY DEPOSITS HAVE BEEN EXAMINED FOR OSTRACODA.

1. Woodburn, Carrickfergus.

About a mile and a half north of Carrickfergus a bed of clay has been cut through by the stream both a little above and below Woodburn Bridge. This clay is dark-grey in colour and somewhat stony, and contains a few flint pebbles. It is irregularly overlain by from one to five feet of shingle, which appears to represent the old bed of the river. In this clay we noticed *Leda pernula*, *Leda pygmæa*, with fragments of *Balani*, &c.; and an Arctic character may be assigned to the deposit.

The following Ostracoda were found:

Cythere pellucida, Baird.
— *pulchella*, Brady.
— *concinna*, Jones.
— *tuberculata* (G. O. Sars).
— *Dunelmensis* (Norman).
Cytheridea punctillata, Brady.
Cytherura complanata, n. sp.
— *cellulosa* (Norman).
Cytheropteron nodosum, Brady.
— *arcuatum*, n. sp.
— *Montrosiense*, n. sp.
Bythocythere simplex (Norman).
Pseudocythere caudata, G. O. Sars.
Paradostoma variabile (Baird).
Polycope orbicularis, G. O. Sars.

2. Portrush.

The raised-beach at Portrush consists chiefly of shell débris. Like a large number of the raised beaches the material loses little in washing—only 4 per cent., which passes off in fine mud.

The deposit is uneven in thickness, filling up irregularities of the rock on which it rests. Its area is greatly hidden, but it is possibly 100 yards square. The fauna it contains is entirely recent.

Height above the sea fifteen feet.

The following Ostracoda were found:

Pontocypris mytiloides (Norman).
Cythere viridis, Müller.
— *tenera*, Brady.
— *pellucida*, Baird.
— *crispata*, Brady.
— *albo-maculata*, Baird.
— *gibbosa*, Brady and Robertson.
— *convexa*, Baird.
— *villosa* (G. O. Sars).
— *pulchella*, Brady.
— *angulata* (G. O. Sars).
— *emarginata* (G. O. Sars).
Cytheridea punctillata, Brady.
— *torosa* (Jones).
— *elongata*, Brady.
Eucythere Argus (G. O. Sars).
Loxoconcha impressa (Baird).
— *tamarindus* (Jones).
— *multifora* (Norman).
Cytherura nigrescens (Baird).
— *similis*, G. O. Sars.
— *angulata*, Brady.
— *gibba* (Müller).
— *undata*, G. O. Sars.

Cytherura cellulosa (Norman).
— *clathrata*, G. O. Sars.
Cytheropteron nodosum, Brady.
— *latissimum* (Norman).
Sclerochilus contortus (Norman).
Paradoxostoma ensiforme, Brady.

3. Belfast.

In digging the new docks at Belfast a fossiliferous deposit was passed through, exceedingly rich in Mollusca now living in British seas. We examined for Ostracoda samples of the material taken from the depths beneath the surface of three to four feet, eight feet, twelve to fourteen feet, and twenty feet, and found the following species :

	3 to 4 ft. below surface.	3 ft. below surface.	12 to 14 ft. below surface.	20 ft. below surface.
Pontocypris mytiloides (Norman)	×	×		
Cythere pellucida, Baird	×	×	...	×
— *viridis*, Müller	×	×	×	×
— *lutea*, Müller	×	×	...	×
— *albomaculata*, Baird	×			
— *convexa*, Baird	×	...	...	×
— *crispata*, Brady	×	×	×	×
— *pulchella*, Brady	×			
— *villosa* (G. O. Sars)	×	×	×	×
— *concinna*, Jones	...	...	...	×
— *tuberculata* (G. O. Sars)	...	×	×	×
— *Jonesii* (Baird)	...	var. ×	×	×
— *antiquata* (Baird)	×	×	×	×
— *Whitei* (Baird)	...	×		
— *Dunelmensis* (Norman)	...	...	×	
Cytheridea elongata, Brady	×			
Loxoconcha impressa (Baird)	×	×	×	×
— *tamarindus*, Jones	×	...	...	×
Xestoleberis depressa, G. O. Sars	...	×		
— *aurantia* (Baird)	...	...	×	
Cytherura nigrescens (Baird)	×	×	×	×
— *similis*, G. O. Sars	...	...	...	×
— *affinis*? G. O. Sars	...	...	×	
— *striata*, G. O. Sars	×	...	×	×
— *undata*, G. O. Sars	...	×	×	
— *gibba* (Müller)	...	...	...	×
— *acuticostata*, G. O. Sars	×			
Paradoxostoma variabile (Baird)	...	...	×	
— *ensiforme*, Brady	...	...	×	

4. Bridlington, Yorkshire.

This bed (which it is impossible now to examine) was originally described by Prof. John Phillips in the second edition of his work on the 'Geology of the Yorkshire Coast' (1836); and in the third edition of the same work is the subject of an exhaustive discussion.

In material obtained some years ago, when the beds were exposed, the following Ostracoda were found :

Cythere cribrosa, n. sp.
— *leioderma*, Norman.
— *villosa* (G. O. Sars).
— *angulata* (G. O. Sars).
— *emarginata* (G. O. Sars).
— *costata*, Brady.
— *tuberculata* (G. O. Sars).
— *concinna*, Jones.
— *globulifera*, Brady.
— *mirabilis*, Brady.
— *Dunelmensis* (Norman).
Cytheridea papillosa, Bosquet.
— *elongata*, Brady.
— *punctillata*, Brady.
— *Sorbyana*, Jones.
Cytherura clathrata, G. O. Sars.
Cytheropteron nodosum, Brady.
— *angulatum*, Brady and Robertson.
Paradoxostoma ensiforme, Brady.
— *pyriforme*, n. sp.
Sclerochilus contortus (Norman).

5. Hopton Cliff, near Yarmouth.

This deposit has been described as "Middle Glacial" by Messrs. S. V. Wood, jun., and F. W. Harmer, in the Palæontographical Society's volume for 1871, p. 22. The

Ostracoda obtained from the material submitted to us presented a general Arctic character, varied by one or two Tertiary forms, and were greatly worn.

The following Ostracoda were found:

Cythere albomaculata, Baird.
— *cicatricosa*, Reuss.
— *villosa* (G. O. Sars).
— *macropora*, Bosquet.
— *latimarginata*, Speyer.
— *tuberculata* (G. O. Sars).
— *Hoptonensis*, n. sp.
Cytheridea elongata, Brady.
Cytherura nigrescens (Baird).
Cytheropteron nodosum, Brady.
— *Montrosiense*, n. sp.
Asterope teres (Norman).

6. Hornsea.

The beds at Hornsea have been described in a paper "On the Glacial and Post-glacial Structure of Lincolnshire and South-east Yorkshire," by Searles V. Wood, jun., Esq., F.G.S., and the Rev. J. L. Rowe, F.G.S."[1]

In the material submitted to us the following Ostracoda were found:

1. In the lower freshwater bed—

Cypris compressa, Baird.
— *gibba*, Ramdohr.
— *reptans* (Baird).
Cypridopsis obesa, Brady and Robertson.
Candona albicans, Brady.
— *lactea*, Baird.
— *candida* (Müller).
Limnicythere inopinata (Baird).
Cytheridea lacustris (G. O. Sars).

[1] 'Quart. Journal of Geol. Soc.,' vol. xxiv, p. 146.

2. In the upper bed—

Cypris reptans (Baird).
— *gibba*, Ramdohr.
Cypridopsis obesa, Brady and Robertson.
Candona detecta (Müller).

7. Cardiff—New Dock Basin.

This deposit is of an estuarine character, becoming more marine in its lower portions. We examined separately portions of the clay taken from eight, fifteen, twenty, thirty, and forty feet below the surface. It varies little in composition, although it alters in colour from brownish to dark grey, but at the depth of forty feet it alternates with beds of gravel to the depth of sixty-four feet, where it reaches a red marl.

At eight feet below the surface the dry clay consists of 96 per cent. fine mud, 4 per cent. shell *débris* and fine sand.

At forty feet, 94 per cent. fine mud, 6 per cent. fine and coarse sand, with a few fragments of shells and a small portion of vegetable matter. The deposit contains some freshwater and brackish, as well as marine, forms,—a fact accounted for by its position at the mouth of the River Taff.

The prevailing species is *Scrobicularia piperata*, the characteristic shell of the Mersey and the Montrose estuarine muds. It ranges from top to bottom of the clay, and, in some places, lies in bands with little admixture of clay.

Although the whole fauna has an estuarine character, it is more diversified and more decidedly marine towards the bottom. The alternations, however, are so capricious that no lines of regular change can be drawn in the fauna. For example, at forty feet below the surface *Cythere porcellanea* prevails over *Cythere castanea;* at fifteen feet *C. castanea* prevails over *C. porcellanea;* at eight feet *C. porcellanea* prevails over *C. castanea.*

At the depth of forty feet the shells of Ostracoda and those of young Mollusca are filled with iron-pyrites. This is also the case at eight feet below the surface; but at the intermediate depths of fifteen, twenty, and thirty feet scarcely a trace of it is seen.

The following Ostracoda were found:

Candona lactea, Baird.
Cypris ovum (Jurine).
Pontocypris mytiloides (Norman).
Potamocypris fulva, Brady.
Cythere castanea, G. O. Sars.
— *porcellanea*, Brady.
— *tenera*, Brady.
— *tuberculata* (G. O. Sars).
Cytheridea torosa (Jones).
Eucythere Argus (G. O. Sars).
Loxoconcha elliptica, Brady.
Xestoleberis aurantia (Baird).
— *depressa*, G. O. Sars.
Cytherura producta, Brady.
— *angulata*, Brady.
— *striata*, G. O. Sars.
— *quadrata*, Norman.
— *cellulosa* (Norman).
Cytheropteron rectum, Brady.
Schlerochilus contortus, var. *abbreviatus*.
Paradoxostoma flexuosum, Brady.
— *abbreviatum*, G. O. Sars.
— *ensiforme*, Brady.
— *Fischeri*, G. O. Sars.

8. Mersey, Liverpool.

The following series of beds has been described:[1]

1. Surface soil	about 2 ft.
2. Sandy silt (probably fresh water) . .	at most 6 in.
3. Freshwater bed (with numerous shells) . .	4 to 18 in.

[1] "Observations on the Geology of the Cheshire Coast," by Charles Potter, 'Trans. of Liverpool Geol. Soc.,' 1868-9.

4. Sandy silt (probably fresh water) . . 9 in.
5. Peat bed.
6. Silt or bluish clay, with *Scrobicularia piperata*, *Rissoa parva*, &c. and Ostracoda . . 8 ft.
7. Peat bed.
8. Boulder-clay.

In the silt or bluish clay, with *Scrobicularia piperata* (6), the following Ostracoda were found:

Cythere pellucida, Baird.
— *tenera*, Brady.
Loxoconcha impressa (Baird).
Cytherura nigrescens (Baird).
— *similis*, G. O. Sars.
— *angulata*, Brady.
Sclerochilus contortus (Norman).
Paradoxostoma abbreviatum, G. O. Sars.

9. Branston Fen, Lincolnshire.

In some Post-tertiary clay from this fen the following species of Ostracoda were found:

Cypris compressa, Baird.
— *gibba*, Ramdohr.
Cypridopsis obesa, Brady and Robertson.
Candona detecta (Müller).
— *lactea*, Baird.
— *candida* (Müller).
Limnicythere inopinata (Baird).
Cytheridea lacustris (G. O. Sars).

10. Whittlesea.

In an old lacustrine deposit at Whittlesea (Cambridgeshire), which is overlaid by five or six feet of marl, the following Ostracoda were found:

Cypris ovum (Jurine).
— *lævis,* Müller.
— *gibba,* Ramdohr.
— *reptans* (Baird).
Cypridopsis Newtoni, Brady and Robertson.
Candona albicans, Brady.
— *lactea,* Baird.
— *compressa* (Koch).
— *candida* (Müller).
Darwinella Stevensoni, Brady and Robertson.

11. Chester.

Mr. Shone, jun., forwarded to us Ostracoda from the "Upper Boulder clay" (described by Mr. McIntosh) of Chester. They proved to belong to the following species:

Cythere tuberculata (G. O. Sars).
— *antiquata* (Baird).
— *Dunelmensis* (Norman).
— *Jonesii* (Baird).
Eucythere Argus (G. O. Sars).
Cytherura angulata, Brady.
Loxoconcha impressa (Baird).
— *tamarindus* (Jones).
Cytheropteron nodosum, Brady.
Paradoxostoma flexuosum, Brady.

§ VII. CLASSIFICATION OF THE OSTRACODA.

The remains of Entomostraca occurring in the Post-tertiary formations belong, so far as we at present know them, exclusively to the Ostracoda, nor is it likely that an extension of our knowledge will reveal the presence of any other tribes in the British area. The soft or chitinous nature of the investments of the other groups renders their speedy putrefaction almost inevitable, except, perhaps, with some of the Phyllopoda, which are for the most part confined to warmer waters than any which have existed in this region in recent times.[1]

The only satisfactory classification of these creatures being based upon the structure of those parts which most rapidly disappear after the death of the animal, it would be of little use in this place to give tables which must refer only to details altogether beyond the scrutiny of the palæontologist. We may, however, refer the reader for information on this subject to the memoir of Dr. G. O. Sars on the 'Marine Ostracoda of Norway,' and to Mr. G. S. Brady's 'Monograph of the Recent British Ostracoda,' published by the Linnean Society. But as being of more utility to the student of fossil species we have drawn up a table embracing only the characters derived from the shells without any regard to internal animal structure; this is the more feasible inasmuch as the affinities of internal anatomy are always found (as might, by a believer in the doctrine of evolution, be fully expected) to correspond more or less closely with similar affinities of shell-structnre. To make our survey of the Ostracoda more complete, and for the sake of assigning to their proper position several genera, which have hitherto been published only in a disconnected manner, we, however, here insert a synopsis of the anatomical characters of the species belonging to the families Cypridæ, Darwinellidæ, and Cytheridæ; and we give likewise a list, revised up to this date, of the families and genera of the Ostracoda, recent and fossil, so far as they are known to us.

[1] The only instance within our knowledge in which remains of Cladocera have been preserved in the Post-tertiary formations is that of the Dipple Tile-works, referred to on a previous page. Fragments of the chitinous limbs and investments of these creatures are here very abundant, and possibly, if they could be examined *in situ*, might be found tolerably perfect, but the unavoidable processes of "washing," and otherwise manipulating the matrix, reduce them to a very fragmentary condition before they can be effectively submitted to microscopic examination. We have, however, been able to recognise with certainty in the Dipple deposit, remains of *Camptocercus macrourus* (which constitute the bulk of the fragments), and *Alona elongata*, and, more doubtfully, *Chydorus sphæricus*, *Alona guttata*, and *Alona quadrangularis*. There are also in considerable abundance bodies which appear to be the ephippia of *Daphniadæ*.

Genera of Recent and Post-tertiary Ostracoda.

Class CRUSTACEA.

Subclass Entomostraca.

Order Gnathostomata.

Legion Lophyropoda.

Tribe Ostracoda.

Section Podocopa.

Family 1.—Cypridæ.

Genus Cypris.
Cypridopsis.
Paracypris.
Aglaia.
Notodromas.
Candona.
Potamocypris.
Goniocypris.
Pontocypris.
Argillœcia,
Bairdia.
Macrocypris.

Family 2.—Darwinelladæ.

Genus Darwinella.

Family 3.—Cytheridæ.

Genus Cythere.
Limnicythere.
Metacypris.
Cytheridea.
Eucythere.
Krithe.
Loxoconcha.
Xestoleberis.
Cytherura.
Sarsiella.
Cytheropteron.
Bythocythere.
Pseudocythere.
Cytherideis.
Sclerochilus.
Xiphichilus.
Paradoxostoma.

Section Myodocopa.

Family 4.—Cypridinadæ.

Genus Cypridina.
Bradycinetus.
Philomedes.
Eurypylus.
Asterope.

Family 5.—Entomoconchidæ.

Genus Heterodesmus.

Family 6.—Conchœciadæ.

Genus Conchœcia.
Halocypris.

Section Cladocopa.

Family 7.—Polycopidæ.

Genus Polycope.

Section Platycopa.

Family 8.—Cytherellidæ.

Genus Cytherella.
Bosquetia (*incertæ sedis*).

OSTRACODA—CHARACTERS OF CARAPACE.

	SHAPE AS SEEN LATERALLY.	TEXTURE AND MARKINGS OF SHELL.	HINGEMENT.
CYPRIDÆ—			
Cypris	Usually reniform or subreniform, valves equal or subequal	Fragile, usually more or less translucent, smooth, or hispid, often slightly punctate, rarely toothed at the lower angles	Consisting of feebly overlapping flanges.
Cypridopsis......	Like *Cypris*, but higher in proportion to length, and smaller	Like *Cypris*, but commonly hispid	Like *Cypris*.
Potamocypris ...	Like *Cypridopsis*, but with right valve much larger than left	Like *Cypridopsis*, but with a more robust and calcareous shell	Simple.
Paracypris	Much elongated, compressed, highest in front	Moderately robust, smooth and polished, destitute of sculpture	Simple.
Aglaia	Oblong, subreniform, compressed, nearly equal in height throughout	As in *Paracypris*	Simple.
Notodromas ...	Subquadrangular, very high in proportion to length, male and female very different in shape	Like *Cypris*	Simple, contact-margins (ventral), overlapping, that of the (female) left valve having a conspicuous flattened tooth-like plate at the posterior extremity, articulating with a fossa in the opposite valve.
Candona	Elongated, subreniform	Like *Cypris*	Simple, rarely with a prominent curved process near posterior termination of left valve.
Pontocypris......	Subtriangular or subreniform, usually higher in front than behind	Thin and fragile, with little or no sculpture, more or less hispid	Simple.
Argillœcia	Compressed, oblong, suboval	Moderately robust, smooth	Simple.
Bairdia	Subtriangular or subrhomboidal, highest near the middle, height great in proportion to length, left valve larger than right and overlapping	Moderately robust, smooth or only moderately pitted, sometimes toothed on anterior and posterior margins	Flexuous, formed by the strongly overlapping border of the left valve.

	SHAPE AS SEEN LATERALLY.	TEXTURE AND MARKINGS OF SHELL.	HINGEMENT.
CYPRIDÆ—			
Macrocypris ...	Elongated, attenuated behind, subtriangular, right valve larger than left, and overlapping	Robust, perfectly smooth	Flexuous, formed by the overlapping right valve.
Goniocypris ...	Triangular, height and length about equal, minute	Very thin and fragile, almost structureless	Simple.
DARWINELLADÆ—			
Darwinella	Compressed, oblongo-ovate or subcuneate, valves unequal, right much larger than left	Thin, quite smooth, pellucid	Simple.
CYTHERIDÆ—			
Metacypris	Subrhomboidal, supero-posterior angle produced	Moderately robust, closely punctate	On right valve, by a laminated angular process in front, behind by a strong flange with a single tooth, the flange continued round posterior margin, on left valve by a deep sulcus behind and a shallow one in front.
Limnicythere ...	Reniform or subreniform	Moderately robust, angularly pitted, prominently tuberculated or spinous	Simple, or with a very feebly marked arrangement, as in the next genus.
Cythere	Subreniform or subquadrate, mostly highest in front	Robust, often excessively thick and calcareous, smooth or variously sculptured with fine punctations or large and deep fossæ, tubercles, spines, elevated ridges, &c.	Two strong teeth on the right, with corresponding depressions on the left valve, between the teeth often a strong longitudinal bar and between the fossæ a furrow, left valve sometimes with a small tooth behind each fossa.
Cytheridea	Subtriangular or triangularly ovate, highest in front of the middle	Usually thick and strong, smooth, or more commonly foveolate; sometimes concentrically rugose, with dentate margins	Two series of terminal crenulated tubercles on right, with corresponding depressions of left valve; intermediate portions either plain or tuberculated on left and indented on right valve.
Eucythere	Subtriangular, high and rounded in front, depressed behind	Thin and pellucid, bearing conspicuous rounded papillæ	Formed on right valve by a projecting crest, on left by a corresponding depression.
Krithe	Subovate, oblong, truncate behind	Smooth, with small distant papillæ	Like *Eucythere*, but feebly developed.

	SHAPE AS SEEN LATERALLY.	TEXTURE AND MARKINGS OF SHELL.	HINGEMENT.
CYTHERIDÆ—			
Cytherideis	Elongated, subovate, depressed in front, right valve overlapping in centre of ventral margin	Smooth, more or less finely punctate	Nearly simple.
Xestoleberis......	Subtriangular, higher behind than in front	Smooth and polished, with distant round papillæ	A dentated projecting crest of the left articulating with an excavation of the right valve.
Loxoconcha......	Subrhomboidal or "peach-stone shaped"	Smooth and sparingly papillose, or concentrically pitted	Two small terminal teeth on each valve, intervening portion often finely crenulated.
Bythocythere ...	Subrhomboidal or fusiform, with hinder margin produced into a distinct beak	Smooth or ornamented with small rounded pittings and papillæ, often obscurely reticulated and having a transverse median fissure	Simple, or composed of a slight bar and furrow; no teeth.
Cytheropteron...	Subrhomboidal, more or less beaked behind, rounded in front, usually produced laterally towards ventral margin into a wing-like projection; valves unequal and dissimilar	More or less pitted; the pits usually subquadrangular and arranged in transverse rows; usually with a transverse median furrow	Two small terminal teeth on right valve with opposing fossæ and an intervening crenulated ridge on left valve.
Pseudocythere...	Obliquely quadrangular, rounded in front, obliquely truncate behind, and produced into a blunt beak at supero-posteal angle	Very thin and fragile, smooth, almost structureless	Simple.
Cytherura	Oblong or subtriangular, usually minute, produced behind into a more or less prominent beak, valves dissimilar and unequal	Smooth, or variously marked with reticulated, ribbed, or punctate ornament, usually robust	Hinge-processes obsolescent or altogether wanting.
Sarsiella	Almost circular, rostrate behind (?), much compressed	Exceedingly rugose, with circular fossæ in the interspaces	—
Sclerochilus ...	Elongated, flexuous, bean-shaped	Smooth and polished, very hard	Projecting median crest of left valve.
Xiphichilus	Valves subequal, compressed, elongated, pointed at both ends, ventral margins much compressed	Thin and fragile, smooth, polished, marked at margins with transverse hair-like lines	Simple.

	SHAPE AS SEEN LATERALLY.	TEXTURE AND MARKINGS OF SHELL.	HINGEMENT.
CYTHERIDÆ—			
Paradoxostoma	Elongated, compressed, usually higher behind than in front; usually subovate, subtriangular, or flexuous	Thin, fragile, polished, and devoid of sculpture, but often marked with arborescent coloured patches of black, olive, or violet hue	Simple.
CYPRIDINADÆ—			
Cypridina ……	Subcircular or very broad oval, with a distinct beak and notch in front and a slight projection behind	Smooth, thin, and flexible	Nearly simple.
Bradycinetus …	Similar to the foregoing, beak and notch well developed	Dense, punctate	Nearly simple.
Philomedes ……	Similar to the above, posterior extremity usually with one or two spines	Moderately strong, punctate, or foveate and ribbed	Nearly simple.
Asterope ………	Elongated, beak not at all produced, posterior extremity evenly rounded	Moderately strong, smooth	Nearly simple.
Eurypylus ……	Beak obsolete, no distinct notch; seen from above widest in front	Robust, more or less pitted	—
POLYCOPIDÆ—			
Polycope ………	Circular or nearly so, no notch or beak	Thin, calcareous, smooth, punctate, or reticulate	Formed by a slight overlapping of the valves.
CYTHERELLIDÆ—			
Cytherella ……	Usually elliptical, compressed, valves very unequal, the right much the larger	Thick and dense, smooth or variously sculptured	A groove on the right valve into which the edge of the left is received.
Bosquetia ……	Obliquely and broadly ovate, right valve much larger than left, and overlapping both above and below	Very thick and hard, smooth	Formed by an overlapping (?) of the right valve at each extremity.

Though we have thought it desirable to give these brief generic diagnoses, inserting only such characters as may be derived from the formation of the carapace (this being the only part of the animal available to the palæontologist); it should, nevertheless, be clearly understood that the really important generic distinctions are, in almost all cases, based upon the structure of the internal organs, chiefly, indeed, on the formation of the limbs, mouth-apparatus, and sexual organs. Yet, in the majority of cases, these deep-seated peculiarities coincide so remarkably with a particular form of shell that there need usually be no difficulty in assigning the fossil remains met with in the Tertiary and Post-tertiary strata to their proper genera. Amongst the Entomostraca of the Palæozoic formations, however, we meet with types of shell-structure far removed from those of recent times and can only vaguely conjecture as to their relations.

From the foregoing Table we have excluded altogether the family Conchœciadæ, the delicate valves of which have not been found (nor, indeed, are they likely ever to be found) in any geological formation. The exclusively Palæozoic genera are also omitted, as well as the recent genus *Heterodesmus*, which has not been met with except in the Chinese seas, and seems to be allied to the Carboniferous genus *Entomoconchus*.

OSTRACODA—*Synopsis of Genera based upon the anatomical characters of the animal.*

CYPRIDÆ. — Second pair of jaws.

- Possessing a branchial appendage; palp subconical, indistinctly jointed, ending in three setæ. Second joint of lower antennæ
  - bearing a brush of setæ. Setæ of the upper antennæ very long. Postabdominal rami
    - well developed, terminating in two strong curved claws . . . . *Cypris.**
    - rudimentary, setiform . . . . . . *Cypridopsis.*
  - without a brush of setæ. Setæ of the upper antennæ very short. Postabdominal rami
    - rudimentary . . . . *Potamocypris.*
    - well-developed, terminating in two strong curved claws. First and second pairs of feet
      - alike . . *Paracypris.*
      - dissimilar . *Aglaia.*
- destitute of a branchial appendage. Palp
  - subconical, indistinctly jointed. Setæ of lower antennæ
    - long, reaching beyond the apex of the terminal claws. Two eyes . . . . *Notodromas.*
    - altogether wanting. One eye . . . *Candona.*
  - distinctly jointed, subpediform
    - 3-jointed; upper antennæ
      - elongated, 7-jointed, armed with long setæ . *Pontocypris.*
      - short and robust; 5-jointed; in the female shortly setose, in the male provided with a few long setæ . . . . *Argillœcia.*
    - 4-jointed; upper antennæ shortly setose. Postabdominal rami
      - largely developed, terminating in several long setæ . . . . *Bairdia.*
      - rudimentary . . . . *Macrocypris.*
- Animal unknown . . . . *Goniocypris.*

* With this genus we incorporate *Cypria* (Zenker) and *Chlamydotheca* (Saussure).

Darwinellidæ. Antennæ destitute of swimming setæ, and of poison gland and duct. Mandible-palp 3-jointed, the basal joint large and densely setiferous. Two pairs of jaws, first with a large branchial plate, second with a smaller branchial plate and a pediform palp. Two pairs of feet external to the valves. Postabdominal lobes subconical, small . . . . *Darwinella.*

Cytheridæ. Mouth provided with a lip and labrum. Masticatory organs well developed. Mandibles toothed at the lower extremity.

- Lower antennæ 4-jointed. Upper antennæ
  - 5-jointed; last three joints
    - elongated, their united lengths more than that of the preceding joint;
      - destitute of spines; bearing only a few short slender setæ . . . . *Limnicythere.*
      - more or less strongly spiniferous. Feet in the male and female
        - alike. Internal lobe of the first pair of maxillæ
          - well developed . *Cythere.*
          - rudimentary . *Eucythere.*
        - dissimilar; right foot of first pair in the male prehensile, right of the second pair very weak and rudimentary . . . . . *Cytheridea.*
    - short and stout, their united length shorter than that of the preceding joint, bearing long curved spines. First two pairs of feet only 3-jointed. Right foot of last pair in the male prehensile. Eyes wanting . . . . *Krithe.*
    - short, their united length equal to that of preceding joint, bearing short setæ only . . . . *Cytherideis.*
  - 6-jointed; beset with simple setæ; last four joints
    - short and gradually decreasing in length . . . . . . *Xestoleberis.*
    - of moderate length, unequal, penultimate the longest . . *Metacypris.*
    - mostly much elongated and slender; unequal . . . . . *Loxoconcha.*
  - 7-jointed; first two joints very large and stout, last five slender and bearing moderately long setæ . . . . *Bythocythere.*
- Lower antennæ 5-jointed. Upper antennæ
  - 5-jointed; beset with short scattered hairs. Postabdominal lobes broad and short, bearing three setæ. No eyes . . . . *Cytheropteron.*
  - 6-jointed; last four joints
    - much narrower than the preceding, and bearing scattered short hairs, which are in part spiniform. Postabdominal lobes rudimentary, destitute of hairs. Two separate eyes . . . . . *Cytherura.*
    - not narrower than the preceding, and beset towards the apex with numerous long setæ. Postabdominal lobes larger than ordinary, bipartite, and bearing five setæ. One eye . . . . *Sclerochilus.*
  - 7-jointed, bearing numerous very long setæ, last joint very long and slender; two basal joints large and stout. Postabdominal lobes subconical, directed downwards, and bearing three hairs. Eyes wanting . . . . . . *Pseudocythere.*
- Animal unknown . . . . *Sarsiella.*

Mouth simple, tubiform; its orifice surrounded by a circular disk situated at the apex of a large subconical protuberance. Organs of mastication poorly developed and weak. Mandibles styliform; palp very narrow, destitute of a branchial appendage. First pair of jaws composed of narrow and partly imperfect lobes. Inferior antennæ, 5-jointed; upper, 6-jointed

- very slender and sparingly setose . . . *Paradoxostoma.*
- excessively slender and quite destitute of setæ . *Xiphichilus.*

§ VIII. SUMMARY OF FACTS OF DISTRIBUTION.

1. *Freshwater and Marine Species.*—Of the one hundred and thirty-two species of Ostracoda described in this Monograph, twenty-four may be considered to have been inhabitants of fresh or slightly brackish water, the remaining one hundred and eight being strictly marine species. The freshwater group is constituted as follows:

Cypris cinerea.
— compressa.
— gibba.
— ovum.
— reptans.
— salina.
— virens.
— lævis.
Cypridopsis Newtoni.
— obesa.
Candona albicans.
— candida.
Candona compressa.
— detecta.
— lactea.
Potamocypris fulva.
Darwinella Stevensoni.
Limnicythere antiqua.
— inopinata.
— monstrifica.
— Sancti-Patricii.
Cytheridea lacustris.
— torosa.
Loxoconcha elliptica.

Of these twenty-four species all except one (*Limnicythere antiqua*, respecting which we entertain some doubt as to whether it may not be a sexual variation or a stage of growth of some other species) are perfectly familiar to us as inhabiting at the present time the freshwater ponds and rivers or the brackish littoral pools of Great Britain and parts of the European continent. Two of them seem to be much restricted in their distribution, and have been found fossil only in the neighbourhood of the localities where they still live: these are *Cypridopsis Newtoni* and *Darwinella Stevensoni*. The presence of *Cytheridea torosa* or *Loxoconcha elliptica* may be taken as an almost certain indication of more or less brackish water; it is seldom that either species is found living in quite fresh or in undiluted sea-water.

The distribution of the marine species is, however, much more perfectly known: their number being so much greater, and the area over which they have been studied so much wider, we are thus better able to recognise in their distribution the effects of climate and other physical conditions. A comparison of the Ostracodal fauna of the Scottish glacial clays with that of the seas at present washing the European shores leads us to conclude that the general character of the glacial Ostracoda is of a type decidedly more boreal in character than that of the present epoch in the same latitudes. Perhaps, indeed, we should not be far wrong in saying that the species found in the clay beds of the south of Scotland correspond very closely with what we should expect to find now living on the Atlantic sea-bed between Scotland and Greenland. It is, however, only from very fragmentary observations made by private effort over the latter area that we are able to draw this conclusion; and we, therefore, the more regret that the splendid opportunities of research which were within our grasp, during the cruises of the "Lightning" and "Porcupine," seem to have been in this department almost or entirely neglected. Amongst the contents of the clay beds here referred to we are able, nevertheless, to point to the following species as extending southward, at the present day, only to latitudes corresponding to those of the Northern Hebrides, and apparently reaching their full development only towards the Arctic regions, or on the western side of the Atlantic, in the cold waters of Canada.

2. *List of Post-Tertiary Species now known as characterizing the Arctic seas and the northern coasts of Norway, Scotland, and America.*

Cythere leioderma.	Cytheridea Sorbyana.
— costata.	Cytheropteron inflatum.
— mirabilis.	— angulatum.
— latimarginata.	

Cytheridea papillosa, *C. punctillata*, and *Cythere concinna*, though extending somewhat further southward, and living even abundantly on the eastern shores of England, so far south as Yorkshire, are still conspicuously absent from more southern latitudes. These three species are, perhaps, in numbers, the most abundant of all the glacial Ostracoda. On the other hand, certain species, such as *Bairdia inflata*, *B. acanthigera*, and *Cythere emaciata*, which now are found living most abundantly on the southern shores of the British Islands, becoming rare or altogether absent from the northern shores, are likewise either entirely absent or of extreme rarity in the glacial clays; nor, indeed, have we found in these clays any species of distinctly southern type. So far, however, as our present limited knowledge of the English Post-tertiary beds extends, it would seem that their fauna indicates at least as much difference between them and the corresponding Scottish deposits, as exists at present in the seas of the two districts. Of the species comprised in this Monograph nineteen are either extinct or have not yet been seen living. They are as follows:

3. *List of Post-Tertiary Species now extinct, or unknown in the living state.*

Bairdia Cambrica.
Aglaia cylindrica.
Cythere cribrosa.
— Cluthæ.
— Logani.
— deflexa.
— macropora.
— Hoptonensis.
Limnicythere antiqua.
Cytheridea inornata.
Krithe glacialis.
Cytherura compressa.
— complanata.
Cytheropteron Montrosiense.
Bythocythere elongata.
Cytherideis subspiralis.
Paradoxostoma tenerum.
— pyriforme.
Bosquetia robusta.

Comparing the British Post-tertiary Ostracoda, so far as we at present know them, with those recorded by the late Professor Sars and Dr. G. O. Sars,[1] and by Messrs. Crosskey and Robertson,[2] as occurring in the Glacial and Post-glacial beds of Norway, we find that of the forty-five Norwegian species all, except eight (marked * in the following list), occur likewise in the British deposits of similar date; while of these eight, *Cytherura atra* is altogether unknown to us, and it is just possible that we may have included forms strictly referable to it under some other species of that difficult genus. *Cythere truncata* has not yet been described by G. O. Sars, and may very probably be identical with some other species described in this Monograph. Of these forty-five species (leaving *C. truncata* and *C. atra* as doubtful), *Krithe glacialis* is the only one which is absent from the recent marine fauna of Norway and Great Britain, and we may add that *Cythere albomaculata*, a species very abundant and characteristic of the British recent and fossil faunæ, appears to be almost or entirely absent from those of Norway.

4. *List of Ostracoda found in the Glacial and Post-Glacial deposits of Norway.*

Paracypris polita.
Pontocypris mytiloides.
Cythere viridis.
— lutea.
— pellucida.
Cythere crispata.
* — borealis.
— villosa.
— angulata.
— emarginata.

[1] 'Om de i Norge forekommende fossile Dyrelevninger fra Quartærperioden, et Bidrag til vor Faunas Historie, af Dr. phil. et med. Michael Sars.' Christiania, 1865.

[2] *See* "Notes on the Post-tertiary Geology of Norway," by Henry W. Crosskey, F.G.S., and David Robertson, F.G.S. 'Trans. Phil. Soc. Glasgow,' 1868.

Cythere Finmarchica.
— cuneiformis.
— concinna.
— tuberculata.
* — crenulata.
— Dunelmensis.
* — truncata.
Cytheridea papillosa.
— elongata.
— punctillata.
— Sorbyana.
Eucythere Argus.
Krithe Bartonensis.
— glacialis.
Loxoconcha tamarindus.
— impressa.
Xestoleberis aurantia.
— depressa.

Cytherura nigrescens.
* — affinis.
* — atra.
* — lineata.
— striata.
— undata.
— gibba.
— angulata.
— acuticostata.
— cellulosa.
Cytheropteron latissimum.
— nodosum.
* — punctatum.
* — alatum.
— Montrosiense.
Sclerochilus contortus.
Paradoxostoma variabile.

5. The glacial deposits of Canada, though imperfectly known to us, afford another opportunity of comparison, the following list comprising all that we have noted from that country:

• *Cythere leioderma.
• * — lutea.
— MacChesneyi.
• * — emarginata.
• * — concinna.
— Dawsoni.
• * — limicola.
• * — globulifera.
— Logani.
— cuspidata.
• * — Dunelmensis.
• *Cytheridea papillosa.
• * — punctillata.
* — cornea.
• * — Sorbyana.
— Williamsoniana ? (Bosquet).

• *Eucythere Argus.
*Loxoconcha granulata.
• *Xestoleberis depressa.
• *Cytherura nigrescens.
• * — Sarsii.
— cristata.
• * — striata.
— granulosa.
• * — undata.
• * — Robertsoni.
• *Cytheropteron latissimum.
• * — nodosum.
— complanatum.
• * — inflatum.
• * — angulatum.
• *Sclerochilus contortus.
• *Paradoxostoma variabile.

Species marked with an asterisk occur living in the British seas, and those marked with a dot in the British Post-tertiary clays. *Cythere Dawsoni* has occurred living in the River St. Lawrence, while *C. MacChesneyi, C. cuspidata, Cytherura cristata, C. granulosa,* and *Cytheropteron complanatum* have not been found at all in other localities, either living or fossil. So that it is evident from the very partial investigation hitherto made that a considerable admixture of species, unknown to Europe, occurs in the Post-tertiary deposits of North America, and that these correspond more or less closely with the recent fauna of the same district. This subject will, however, be found treated at greater length in a paper on "Fossil Ostracoda from the Post-Tertiary Deposits of Canada and New England," published in the 'Geological Magazine' for February, 1871.

The following works are referred to in the Synonomy of the present Monograph:

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§ IX. DESCRIPTION OF SPECIES.

Family 1.—CYPRIDÆ.

Genus 1.—Cypris, *Müller*.

Valves mostly subreniform or elongate-oval, horny in texture. Upper antennæ seven-jointed, and beset with numerous long plumose setæ, which are mostly distributed as follows,—four from the apices of the fourth, fifth, and sixth joints, and three from the apex of the terminal or seventh joint. Lower antennæ five-jointed, bearing a fascicle of five or six setæ of variable length, and on the inner side of the third joint a short bi-articulate seta; terminating in four long curved and serrated claws; a few short setæ also arise from the sides of the fourth joint, near the middle; second pair of jaws smaller than the first, in the male prehensile, and in the female consisting of a short, simple, setiferous lobe, a subconical, simple, or obscurely articulate palp, which projects backward, and terminates in three long setæ, and a small branchial plate, bearing six radiating respiratory setæ. Postabdominal rami long and slender, bearing at the apex two long and unequal curved claws, and a short seta; a short seta springs also from the inner margin of the ramus at or below the middle. The males furnished (mostly, if not always) with two mucous glands, consisting of a cylindrical axis, on which are set seven whorls of radiating filaments, the whole connected with an efferent tube or "vas deferens."

1. Cypris compressa, *Baird*. Plate I, figs. 5, 6.

1835. Cypris compressa, *Baird*. Trans. Berw. Nat. Club, vol. i, p. 100, t. iii, fig. 16; (1850) Brit. Entom., p. 154, t. xix, figs. 14, 14 *a—c*.
1853. — — *Lilljeborg*. De Crust. ex. ord. trib., p. 112, t. x, figs. 16—18.
1868. — — *Brady*. Monog. Recent Brit. Ostrac., p. 372, pl. xxiv, figs. 1—5, and pl. xxxvi, fig. 6.
1854. — (cypria) punctata, *Zenker*. Anatomisch-system. Stud. über die Krebsthiere, p. 77, taf. 3 a.

Shell much compressed, seen from the side broadly reniform, greatest height situated in the middle, and equal to more than two thirds of the length; extremities broadly rounded, superior margin excessively and evenly arched, inferior rather deeply sinuated in the middle; seen from above compressed, ovate, pointed in front, rounded off behind, greatest width situated near the middle and equal to a little more than one third of the length. Surface of the shell smooth and polished (recent specimens all usually more or less marked with distant but rather large circular impressions); colour yellowish-brown, sometimes with pellucid colourless patches.

Length, $\frac{1}{45}$th of an inch.

Distribution. *Recent.*—Great Britain, Switzerland, Germany, Bohemia, Tyrol.

Fossil.—Hornsea and Branston Fen, England; Dipple, Scotland.

2. Cypris salina, *Brady*. Plate I, figs. 17—19.

1850. Cypris strigata, *Baird*. Brit. Entom., p. 157.
1868. — salina, *Brady*. Monog. Recent Brit. Ostr., p. 368, pl. xxvi, figs. 8—13.

Shell, as seen from the side, broadly reniform, greatest height situated in the middle and equal to nearly two thirds of the length, extremities equally and broadly rounded, superior margin boldly and evenly arched, inferior rather deeply incurved; outline, as seen from above, narrowly ovate, anterior extremity much attenuated and bluntly mucronate, posterior subacuminate, greatest width considerably less than half the length, situated in the middle. Hinge- and contact-margins of the valves very flexuous, the latter thickened and prominent. Surface of the shell smooth or very slightly pubescent. Recent specimens beautifully marked with brown striæ and blotches.

Length, $\frac{1}{38}$th of an inch.

Distribution. *Recent.*—Great Britain.

Fossil.—Crofthead, Scotland.

It may perhaps be doubtful whether the specimen here described is properly referable to *C. salina*, as it differs from the recent specimens of that species not only in being considerably smaller but also to some extent in lateral outline which is more nearly reniform. The smaller size may depend upon immaturity, and the differences of shape are not sufficient to warrant its separation as a distinct species; the absence of colouring cannot be considered important in a fossil example, and, indeed, sometimes occurs in recent specimens.

3. Cypris virens (*Jurine*). Plate II, figs. 27, 28.

1820. Monoculus virens, *Jurine*. Hist. des Monocles, p. 174, pl. xviii, figs. 15, 16.
1850. Cypris tristriata, *Baird*. Brit. Entom., p. 152, t. xviii, figs. 1, 1 *a*—*i*, 2, 3.

1853. CYPRIS VIRENS, *Lilljeborg.* De Crustaceis ex ord. trib., p. 117.
1868. — — *Brady.* Monog. Recent Brit. Ostrac., p. 364, pl. xxiii, figs. 23—32, and pl. xxxvi, fig. 1.

Carapace, as seen from the side, oblong, reniform; extremities rounded and nearly equal, superior margin evenly arched, highest in the middle, height equal to more than half the length; inferior gently sinuated, seen from above oblong, ovate, pointed in front, narrowly rounded behind; greatest width situated in the middle, and equal to about half the length. Shell thin, slightly punctate or perfectly smooth; in recent specimens greenish and slightly pubescent.

Length, $\frac{1}{14}$th of an inch.

DISTRIBUTION. *Recent.*—Great Britain, Sweden, Switzerland, Bohemia.

Fossil.—Crofthead, Scotland.

Though a common species in most parts of Great Britain at the present time, we have met with very scanty traces of *C. virens* in the fossil condition; indeed, for this reason we have been compelled to give figures and description from recent specimens, our fossil examples consisting of mere fragments, which, however, we can scarcely doubt are rightly referred as above. It is remarkable that a species so abundant in the recent state should be so poorly represented in the later lacustrine and fluvial deposits; perhaps an explanation may be found in the fact that *C. virens* chiefly haunts small grassy pools and ditches, and, so far as our experience goes, is pretty much absent (except at the grassy margins) from those larger expanses of water whose deposits are most likely to come under the observation of the palæontologist. These remarks apply equally to some other species, *e.g. C. reptans* and *Candona candida.*

4. CYPRIS OVUM (*Jurine*). Plate I, figs. 29—31.

1820. MONOCULUS OVUM, *Jurine.* Histoire des Monocles, p. 179, pl. xix, figs. 18, 19.
1850. CYPRIS MINUTA, *Baird.* Brit. Entom., p. 155, tab. xviii, figs. 7, 8.
1868. — OVUM, *Brady.* Monog. Recent Brit. Ostr., p. 373, pl. xxiv, figs. 31—34, 43—45, and pl. xxxvi, fig. 8.

Carapace, as seen from the side, subovate, highest in the middle, height equal to two thirds of the length; extremities well rounded, the anterior much the wider, superior margin very boldly arched, sloping more steeply behind than in front, inferior almost straight; seen from above ovate, tapered and acuminate in front, broadly rounded behind, greatest width situated near the middle, and slightly exceeding half the length. Surface smooth, closely set with minute round punctations. Colour light brown.

Length, $\frac{1}{60}$th of an inch.

DISTRIBUTION. *Recent.*—Great Britain, Switzerland.

Fossil.—Whittlesea; Cardiff.

5. CYPRIS LÆVIS, *Müller*. Plate I, figs. 25—28.

1785. CYPRIS LÆVIS, *Müller*. Entomostraca, p. 52, tab. iii, figs. 7—9.
1851. — ? PANTHERINA, *Fischer*. Ueber das genus *Cypris*, p. 163, tab. xi, figs. 6—8.
1853. — OVUM, *Lilljeborg*. De Crustaceis, p. 113, tab. x, figs. 13—15.
1854. — (CYPRIA) —, *Zenker*. Anat.-syst. Studien, p. 70, tab. 3 B.
1856. — OVUM, *Jones*. Monog. Tert. Entom., p. 14, pl. i, figs. 4 *a*, 4 *b*.
1868. CYPRIS LÆVIS, *Brady*. Monog. Recent Brit. Ostrac., p. 374, pl. xxiv, figs. 21—26; and pl. xxxvi, fig. 5.

Shell very tumid; seen from the side forming almost three fourths of a circle, extremities broadly rounded, superior margin excessively arched, regularly curved behind, but somewhat flattened in front of the middle; inferior convex towards the extremities, straight in the middle; seen from above, ovate, widest in the middle, greatest width nearly equalling the height, anterior extremity acuminate, posterior broadly rounded. Surface of the shell perfectly smooth and polished; colour chestnut brown.

Length, $\frac{1}{40}$th of an inch.

We were at one time disposed to regard this as a new and distinct form; but, after examining specimens of *C. lævis* from many widely separated localities, it seems to be so variable in respect of size, outline, and colouring, that we can scarcely avoid the conclusion that our Whittlesea specimens belong to the same category. The form figured in the 'Monograph of Recent British Ostracoda,' though apparently common in the county of Durham in a living state, is, perhaps, more pronounced as to the tumidity of the posterior and tapering of the anterior extremity than is usual with the species.

DISTRIBUTION. *Recent.*—Great Britain, Denmark, Germany.

Fossil.—Cambridgeshire, Whittlesea, England; Dipple, Scotland.

6. CYPRIS CINEREA, *Brady*. Plate II, figs. 6, 7.

1868. CYPRIS CINEREA, *Brady*. Monog. Recent Brit. Ostrac., p. 374, pl. xxiv, figs. 39—42, and pl. xxxvi, fig. 7.

Carapace oval, tumid, higher in front than behind; greatest height equal to nearly two thirds of the length. Anterior margin broad and well rounded, posterior narrowed and rather obliquely rounded. Ventral margin straight or very slightly incurved, dorsal forming a flattened arch, and sloping more steeply behind than in front. Seen from above, rhomboidal or lozenge-shaped, greatest width in the middle, and equal to more than half the length; from the middle the sides taper evenly towards the extremities, the anterior of which is acutely, the posterior subacutely, pointed. End-view very broadly ovate, pointed above and below. The right valve considerably overlaps the left. Surface of the shell smooth or very finely punctate.

Length of fossil specimens $\frac{1}{55}$th, recent $\frac{1}{35}$th, of an inch.

Distribution. *Recent.*—Yorkshire moors.

Fossil.—Crofthead, Scotland.

Some doubt may, perhaps, attach to our identification of these specimens, none of which were quite perfect, and most merely worn and separated valves; but except in size they approach very closely to the form described by one of the present authors under the name *Cypris cinerea.* Our written description is taken from recent specimens, but will be found to agree very closely with the figure taken from a fossil carapace, and given in Plate II of this Memoir.

7. Cypris gibba, *Ramdohr.* Plate XV, figs. 5, 6.

1808. Cypris gibba, *Ramdohr.* Magaz. d. Gesellsch. naturforsch. Freunde zu Berlin, ii, p. 91, t. iii, figs. 13—17 (*fide* Jones).
1856. — — *Jones.* Mon. Entom. Tertiary Form., p. 15, pl. i, figs. 3 *a—f*, and Woodcut, fig. 1, p. 16.
1868. — — *Brady.* Monog. Recent Brit. Ostr., p. 369, pl. xxiv, figs. 47—54, and pl. xxxvi, fig. 2.
1850. ? Cytherina expansa, *Reuss.* Haidinger's Abhandl., Band iii, p. 60, taf. ix, fig. 11.

Valves, as seen from the side, oblong, subreniform, nearly equal in height throughout, marked usually by two deep transverse furrows extending from the anterior half of the dorsum to near the middle of the valve; sometimes also bearing a prominent tubercle on the posterior portion of the valve; extremities well rounded and nearly equal, the posterior often bordered below the middle with a series of small, sharp, but irregularly placed spines. Superior margin nearly straight, inferior deeply sinuated in the middle; seen from above the shape is oblong-ovate, compressed, width equal to rather more than one third of the length; obtusely pointed in front, rounded off behind, the lateral sulci showing as marginal indentations. Shell thick and strong, closely and rather coarsely punctate, usually whitish or buff coloured.

Length, $\frac{1}{28}$th of an inch.

Distribution. *Recent.*—Great Britain, Germany, Holland.

Fossil.—England: Cambridge Fens, Grays, Clacton, Reculvers, Hornsea, Whittlesea, Branston Fen. Scotland: Crofthead, Dipple, Terally.

8. CYPRIS REPTANS (*Baird*). Plate II, figs. 31—32.

1835.	CANDONA REPTANS,	*Baird.*	Trans. Berw. Nat. Club, i, p. 99, pl. iii, fig. 11; and Brit. Entom., p. 167, pl. xix, figs. 3, 3 *a* (1850).
1856.	— —	*Jones.*	Monog. Tert. Entom., p. 16, pl. i, figs. 7 *a*—7 *e*.
1853.	CYPRIS —	*Lilljeborg.*	De Crustaceis, p. 123, tab. xi, figs. 21—23, t. xii, figs. 7—9.
1868.	— —	*Brady.*	Monog. Recent Brit. Ostr., p. 370, pl. xxv, figs. 10—14, and pl. xxxvi, fig. 4.

Valves oblong, subreniform, compressed, unequal, the left being considerably the larger; seen from the side the anterior and posterior extremities are obliquely rounded, somewhat angular below and nearly equal in height, the posterior somewhat the higher; ventral margin slightly sinuated, dorsal straight or very slightly arched; seen from above the carapace is compressed, oblong-ovate, prominently keeled in front and below; surface perfectly smooth, and in recent species variously banded with shades of green, orange, and brown.

Length, $\frac{1}{11}$th of an inch.

DISTRIBUTION. *Recent.*—Great Britain and Ireland, Sweden, Bohemia, Tyrol.

Fossil.—England: Berkshire, Cambridgeshire, Essex, Hornsea, and Whittlesea.

Genus 2.—CYPRIDOPSIS, *Brady.*

Like *Cypris,* except that the post-abdominal rami are rudimentary, consisting of two slender setiform prolongations thickened below and rising together from a common base. The second feet are terminated by a short hooked claw, and two moderately long setæ.

1. CYPRIDOPSIS OBESA, *Brady* and *Robertson.* Plate I, figs. 1—4.

1869. CYPRIDOPSIS OBESA, *B. & R.* Ann. and Mag. Nat. Hist., ser. 4, vol. iii, pl. xviii, figs. 5—7, and vol. vi, p. 19.

Carapace of the female, as seen from the side, subtriangular or subreniform, highest in the middle, height equal to nearly two thirds of the length; anterior extremity well rounded, posterior also rounded, but more acutely; superior margin boldly arched, inferior slightly sinuated near the middle. Seen from above, broadly ovate, pointed in front, rounded off behind, greatest width situated in the middle, equal to nearly three fourths of the length or more than the greatest height of the shell. Surface of the valves smooth, closely set with small, round, impressed punctures; ventral surface depressed in the middle. Colour yellowish-brown. Valves subequal, the left rather the larger.

Length, $\frac{1}{35}$th of an inch.

We have expressed elsewhere ('Ann. and Mag. Nat. Hist.,' vol. vi, loc. cit.) the opinion that this may possibly be only a variety of the common *C. vidua*. To this opinion we still adhere, though without any greater certainty than previously expressed. In the state here described it is at the least a well-marked variety, which without the intervention of intermediate forms would never be suspected of any close relationship to *C. vidua*.

DISTRIBUTION. *Recent.*—Great Britain, Ireland, Holland.

Fossil.—England: Hornsea, Branston Fen.

2. CYPRIDOPSIS? NEWTONI, *Brady* and *Robertson*. Plate II, figs. 20, 21.

1870. CYPRIDOPSIS (?) NEWTONI, *B. & R.* Ann. and Mag. Nat. Hist., ser. iv, vol. iv, p. 14, pl. vii, figs. 14—16.

Carapace, as seen from the side, reniform, greatest height in the middle and equal to a little more than half the length; extremities rounded, the anterior being the broader of the two; superior margin boldly arched, inferior sinuated in the middle. Seen from above, compressed, ovate, acuminate in front, rounded behind; greatest width situated near the middle, much less than the height. Surface of the shell punctate, and (in recent specimens) covered with numerous depressed hairs.

Length, $\frac{1}{30}$th of an inch.

DISTRIBUTION. *Recent.*—East Anglian Fen District.

Fossil.—England: Whittlesea.

Genus 3—POTAMOCYPRIS, *Brady*.

Carapace compressed; seen from the side, similar to that of *Cypridopsis*, reniform; shell calcareous and rather thick, valves unequal, the right much the larger and overlapping on the dorsal and middle of the ventral margin; dorsal margin of the left valve somewhat flattened, that of the right boldly arched, hingement simple. Limbs short and stout, superior antennæ six-jointed, shortly setose, inferior altogether destitute of swimming setæ; first and second feet as in *Cypris;* abdomen rudimentary.

In the living state this genus occurs exclusively in rivers or estuaries within a very short distance of the sea; very occasionally in the sea itself, in which case it has probably been washed down from freshwater.

Potamocypris fulva, *Brady*. Plate I, figs. 20—24.

1868. Bairdia fulva, *Brady*. Monog. Recent Brit. Ostr., p. 474, pl. xxviii, fig. 21.
1869. — — *Brady* and *Robertson*. Ann. and Mag. Nat. Hist., ser. iv, vol. iii, p. 365, pl. xviii, figs. 1—4.
1870. Potamocypris fulva, *Brady*. Nat. Hist. Trans. Northumberland and Durham, vol. iii, p. 366, pl. xiv, fig. 4.

Carapace, as seen from the side, compressed, angularly reniform, higher in front than behind, greatest height situated in front of the middle and equal to more than half the length; anterior extremity well rounded, posterior narrowed, rounded below and sloping steeply above the middle; superior margin arched, almost gibbous at its highest point, whence it slopes with a gentle curve backwards, and more steeply towards the front; inferior margin distinctly sinuated in the middle. Seen from above, much compressed, ovate, extremities acutely pointed, greatest width situated in the middle, and not much exceeding one third of the length. Valves very unequal, the right being much the larger, and overlapping the left both on the dorsal and ventral margins; the left valve is thus much narrower as well as more angular in outline, having its ventral margin more deeply sinuated, and the supero-posteal angle more distinctly marked. Shell-structure rather thick. Surface more or less densely and minutely punctate. Colour (of fossil specimens) yellowish-brown.

Length, $\frac{1}{38}$th of an inch.

Distribution. *Recent.*—Great Britain and Ireland.

Fossil.—Scotland: Dalmuir.

Genus 4—Paracypris, *G. O. Sars.*

Shell smooth, compact, higher in front than behind. Upper antennæ shortly setiferous; lower strongly clawed, and bearing on the antepenultimate joint a pedicillated hyaline vesicle. Second pair of jaws provided with a branchial appendage; the palp elongated, conical, and inarticulate. Last pair of feet similar to the first, five-jointed, and terminating in a long curved claw. Post-abdominal rami large, bearing at the extremity two strong curved claws and a short seta, and on the posterior margin two long setæ. One eye.

PARACYPRIS POLITA, *G. O. Sars.* Plate XV, figs. 9, 10.

1865. PARACYPRIS POLITA, *G. O. Sars.* Oversigt af Norges marine Ostrac., p. 12.
1868. — — *Brady.* Monog. Recent Brit. Ostr., p. 378, pl. xxvii, figs. 1—4, pl. xxxviii, fig. 2.

Carapace, as seen from the side, elongated, siliquose or subtriangular, greatest height at the anterior third and equal to more than one third of the length; anterior extremity evenly rounded, posterior much attenuated; superior margin boldly arched, sloping steeply behind; ventral much sinuated in the middle. Outline, as seen from above, compressed, oval, about four times as long as broad, widest in front of the middle; extremities obtusely pointed. Shell smooth and polished, whitish.

Length, $\frac{1}{25}$th of an inch.

DISTRIBUTION. *Recent.*—Norway, Great Britain.

Fossil.—Scotland: Raised beach, Oban. Norway: Post-tertiary beds.

Genus 5—AGLAIA, *Brady.*

AGLAIA, *Brady.* Les Fonds de la Mer, tome premier, p. 90.

Shell smooth and polished, of about equal height before and behind, compressed, subcylindrical. Superior antennæ seven-jointed, beset with short setæ; inferior robust, and bearing at the apices of the joints several strong curved setæ; furnished also with a very small hyaline vesicle, as in *Pontocypris*, and on the penultimate joint with a lash of very short setæ. Mandibles slender, divided at the extremity into about five blunt teeth, and furnished with a large, narrow, branchial palp. First pair of jaws divided into four digitate segments, and having a distinct branchial appendage; second pair also provided with a branchial lamina and with a simple conical 3-setiferous palp. First pair of feet long, five-jointed, and having a very long terminal claw; second pair different from the first, flexuous, four-jointed, last joint armed with three setæ, of which one is very long and finely pectinate on the inner margin. Post-abdominal rami moderately robust, bearing two curved terminal claws, one seta on the anterior and two on the posterior margin. Testes disposed round the body of the animal; mucous gland of the male elongated and composed of seven series of verticillate filaments.

Aglaia (?) glacialis, nov. sp. Plate XI, figs. 54—56.

Carapace elongate, reniform, rather lower in front than behind, height scarcely equalling half the length. Extremities rounded, superior margin gently arched, inferior sinuated in the middle. Seen from above, ovate, pointed in front and rounded behind, greatest width somewhat less than the height, and situated near the middle. Surface perfectly smooth.

Length, $\frac{1}{55}$th of an inch.

This species was found in Bridlington, Drip Bridge.

Genus 6—Argillœcia, *G. O. Sars.*

Valves smooth, elongated, moderately robust, scarcely higher in front than behind. Superior antennæ very robust, five-jointed, first joint very large and stout, the rest beset on the lower margins with strong spines, and on the upper margins, especially in the male, with long setæ; inferior antennæ short and thick, otherwise like *Pontocypris;* the setæ of the antepenultimate joint in the female short, in the male very long and reaching much beyond the terminal claws. Mandibles almost as in *Pontocypris,* the palp, however, having only a single seta in place of a branchial appendage. Palp of the second pair of jaws indistinctly three-jointed, ending in a single straight claw. First pair of feet strong, terminating in two nearly equal claws, second pair unlike the first and almost like those of *Pontocypris,* last joint very short and bearing about three spines, of which one is very long and curved. Post-abdominal rami short, attenuated towards the apices, and with very small terminal claws. Eye wanting.

Argillœcia cylindrica, *G. O. Sars.* Plate XVI, figs. 29—31.

1865. Argillœcia cylindrica, *Sars.* Oversigt af Norges marine Ostrac., p. 18.
1868. ? Pontocypris angusta, *Brady.* Monog. Recent Brit. Ostrac., p. 387, pl. xxxiv, figs. 43, 44.

Carapace, as seen from the side, elongated, greatest height situated near the middle and equal to less than half the length, rounded in front; posterior extremity obliquely rounded off above, subangular below; superior margin arcuate, inferior gently sinuated in the middle. Seen from above, ovate, widest in the middle, extremities evenly and rather suddenly tapered, subacuminate, width rather less than the height. Shell surface smooth, without sculpture of any kind.

Length, $\frac{1}{50}$th of an inch.

DISTRIBUTION. *Recent.*—Great Britain, Norway.

Fossil.—Scotland: Duntroon, Cartsdyke, Paisley, Dalmuir, Dumbarton.

Genus 7—CANDONA, *Baird.*

Like *Cypris*, except that the lower antennæ possess no tuft of setæ, and that the second pair of jaws are destitute of a branchial appendage. The shell is usually longer and narrower than that of *Cypris*. The animals of this genus have no swimming power, and are very sluggish in their movements, living mostly at the bottom or burying themselves in the mud.

1. CANDONA ALBICANS, *Brady*. Plate I, figs. 10—13.

1864.	CANDONA ALBICANS, *Brady*.	Ann. and Mag. Nat. Hist., vol. xiii, p. 61, pl. iv, figs. 6—10; and Trans. Tyneside Nat. F. C., vol. vi, p. 107, pl. iii, figs. 6—10.
1868.	— — —	Monog. Recent Brit. Ostr., p. 381, pl. xxv, figs. 20—25, and pl. xxxvi, fig. 12.

Shell oblong, subreniform, nearly equal in height throughout, height equalling one half the length; anterior margin well and evenly, posterior less boldly and rather obliquely rounded; superior margin straight, inferior deeply sinuated in the middle. Seen from above, evenly ovate, acuminate in front, narrowly rounded behind, greatest width less than the height, situated in the middle. Surface of the shell closely and rather coarsely punctate; colour whitish, often (in the fossil state) yellow from clay stains.

Length, $\frac{1}{44}$th of an inch.

DISTRIBUTION. *Recent.*—England; *Fossil.*—England: Hornsea, Whittlesea.

2. Candona detecta (*Müller*). Plate I, figs. 7—9.

1785. Cypris detecta. *Müller*. Entomostraca, p. 49, tab. iii, figs. 1—3.
1850. Candona — *Baird*. Brit. Entom., p. 161.
1868. — — *Brady*. Monog. Recent Brit. Ostrac., p. 384, pl. xxiv, figs. 35—38, and pl. xxxvii, fig. 2.

Carapace, as seen from the side, elongated, reniform, greatest height situated in the middle, and equal to half the length; extremities nearly equally rounded, the posterior rather narrower and flatter; superior margin evenly arched, inferior sinuated in the middle; seen from above, ovate, widest in the middle, width less than the height, extremities acuminate, the anterior the more acute. Shell surface quite smooth or very faintly punctate. Colour whitish.

Length, $\frac{1}{40}$th of an inch.

C. detecta approaches very nearly the following species, *C. lactea,* and in some cases is not easily separable from it. It is, however, a smaller species, and more distinctly curved or reniform in outline when viewed laterally.

Distribution. *Recent.*—England, Germany.

Fossil.—England: Branston Fen.

3. Candona lactea, *Baird.* Plate I, figs. 14—16.

1850. Candona lactea, *Baird.* Proc. Zool. Soc. Lond., p. 255, pl. xviii (Annulosa), figs. 25—27.
1868. — — *Brady*. Monog. Recent Brit. Ostrac., p. 382, pl. xxiv, figs. 55—58.

Shell, as seen laterally, subreniform, height equal to half the length and nearly equal throughout; anterior extremity well and evenly, posterior somewhat obliquely rounded; superior margin straight in the middle and sloping towards the extremities, inferior very slightly incurved; seen from above, the outline is regularly ovate, with moderately and nearly equally acuminate extremities, greatest width situated in the middle and scarcely equalling half the length. Surface of the shell smooth, yellowish-white.

Length, $\frac{1}{33}$rd of an inch.

Distribution. *Recent.*—Holland, Great Britain, Ireland.

Fossil.—England: Hornsea, Whittlesea, Branston Fen. South Wales: Cardiff new dock basin. Ireland: Belfast new docks. Scotland: Crofthead.

4. Candona compressa (*Koch*). Plate II, figs. 10, 11.

Cypris compressa, *Koch*. Deutschland's Crustaceen, h. 21, pl. xvii (*fide* Lilljeborg).
1853. Candona — *Lilljeborg*. De Crustaceis ex ord. trib., p. 129, tab. xxvi, figs. 1—3.
1868. — — *Brady*. Monog. Recent Brit. Ostrac., p. 382, pl. xxvi, figs. 22—27.
1856. Cypris setigera, *Jones*. Tertiary Entomostraca, p. 12, pl. i, figs. 6*a*—6*d*.

Carapace, as seen from the side, compressed, subreniform, higher behind than in front, greatest height equal to more than half the length. Anterior extremity obliquely rounded, sloping steeply above to join the short and straight superior margin; posterior broad and well rounded; inferior margin very slightly sinuated, almost straight; seen from above, compressed, ovate, tapering and pointed in front, rounded behind; greatest width in the middle, and equal to less than half the length. Surface smooth (in recent specimens milk-white and thickly covered with short fine hairs), and mostly marked with a reticulated pattern.

Length, $\frac{1}{30}$th of an inch.

Distribution. *Recent.*—Great Britain, Sweden, Holland.

Fossil.—England: Whittlesea (Berkshire and Cambridgeshire, *Prof. T. Rupert Jones*).

5. Candona candida (*Müller*). Plate II, figs. 29, 30.

1785. Cypris candida, *Müller*. Entomostraca, p. 62, tab. vi, figs. 7—9.
1820. Monoculus candidus, *Jurine*. Hist. des Monocles, p. 176, pl. xix, figs. 7, 8.
1850. Candona lucens, *Baird*. Brit. Entom., p. 160, tab. xix, fig. 1.
1853. — candida, *Lilljeborg*. De Crustaceis; Jones, Tertiary Entomostraca, p. 19, pl. i, figs. 8*a*—8*f*, 5*a*, 5*b*; Brady, Monog. Recent Brit. Ostr., p. 383, pl. xxv, figs. 1—9, pl. xxxvi, fig. 13, and pl. xxxvii, fig. 1.

Carapace, as seen from the side, oblong, lower in front than behind, reniform in the male, subtriangular in the female, greatest height equal to more than half the length. Anterior extremity rounded and rather narrow; posterior obliquely rounded, and produced below into a more or less prominent angle; superior margin highest behind the middle, thence sloping with a flattened arcuate sweep to the front; inferior slightly sinuated in the young and in adult female specimens, but in old examples and in the adult male deeply sinuated in front and prominently convex behind; seen from above, oblong ovate, pointed in front and rounded behind, widest in the middle, greatest width equal to half the length. Lucid spots about six; usually arranged in two transverse lines, but sometimes (more especially in the variety *tumida* found by us living abundantly in the East Anglian Fen District) arranged in the rosette form shown in Plate II, fig. 29, of this Monograph. Such specimens often exhibit also a reticulated ornamentation on the posterior portion of the shell, which is otherwise perfectly smooth and polished.

Length, $\frac{1}{25}$th—$\frac{1}{16}$th of an inch.

DISTRIBUTION. *Recent.*—Great Britain, Ireland, Holland, Sweden, Switzerland, France, Bohemia, Tyrol.

Fossil.—England: Hornsea, Whittlesea, Branston Fen (Forfarshire, Berkshire, Cambridgeshire, Essex; Pleistocene, Essex, *Prof. T. Rupert Jones*).

Genus 8—PONTOCYPRIS, *G. O. Sars.*

Shell thin and fragile, higher in front than behind, elongated, usually subreniform or subtriangular. Antepenultimate joint of the lower antennæ bearing a brush of about five setæ, the longest of which do not much overreach the apices of the terminal claws; at the base of the joint is attached a pedicillated vesicle. Second pair of jaws destitute of a branchial appendage, palp large and subpediform, three-jointed; last joint in the female armed with two long, slightly curved claws. Second pair of feet flexuous, four-jointed; last joint short and armed at the extremity with several short setæ, one of which is conspicuously pectinated. Post-abdominal rami well developed, bearing at the apex two curved claws and a slender seta, on the inner margin three long setæ.

1. PONTOCYPRIS MYTILOIDES (*Norman*). Plate XV, figs. 7, 8.

1862. CYTHERE MYTILOIDES, *Norman.* Ann. and Mag. N. H., vol. ix, p. 50, pl. iii, figs. 1—3.
1865. — AVENA, *Norman.* Nat. Hist. Trans., Northumberland and Durham, vol. i, p. 17.
1863. CYPRIS SERRULATA, *G. O. Sars.* Zoologisk Reise i Sommeren, 1862, p. 58.
1865. PONTOCYPRIS SERRULATA, *G. O. Sars.* Oversigt af Norges marine Ostracoder, p. 15.
— — HISPIDA, *G. O. Sars.* Loc. cit., p. 16.
1868. — MYTILOIDES, *Brady.* Monograph of the Recent British Ostracoda, p. 385, pl. xxv, figs. 26—30; pl. xxxvii, fig. 4; and pl. xxxviii, fig. 1.
1858? BAIRDIA DACTYLUS and var. PUNCTATA, *Egger.* Die Ostracoden der Miocän-Schichten bei Ortenburg, p. 7, taf. i, figs. 3, 4.

Carapace, as seen from the side, elongated, triangular, high in front, tapering to a point behind ; greatest height situated in front of the middle and equal to somewhat more than one third of the length. Anterior extremity broad and well rounded, posterior obtusely pointed: superior margin obsoletely angular at its highest point, thence sloping steeply with a gentle curve backwards ; inferior distinctly sinuated in the middle. Seen from above, lanceolate with acuminate extremities ; greatest width at the anterior third, scarcely equal to one third of the length. Shell surface granular or finely punctate, thickly set with short appressed hairs, colour brownish. Right valve armed at the infero-posteal angle with eight or ten short marginal teeth.

Length, $\frac{1}{30}$th of an inch.

DISTRIBUTION. *Recent.*—Norway, Great Britain, Ireland.

Fossil.—Scotland : Dumbarton, Cartsdyke, Paisley, Dipple. Norway. Germany ?

2. PONTOCYPRIS TRIGONELLA, *G. O. Sars.* Plate XVI, figs. 26—28.

1865. PONTOCYPRIS TRIGONELLA, *Sars.* Oversigt. af Norges marine Ostracoder., p. 16.
1868. — — *Brady.* Monog. Recent British Ostracoda, p. 387, pl. xxv, figs. 31—34, and pl. xxxviii, fig. 3.

Carapace, as seen from the side, subtriangular ; greatest height situated near the middle and equal to half the length : anterior extremity well rounded, posterior narrower but rounded, superior margin boldly arched, inferior very slightly sinuated in the middle. Seen from above, elongate-ovate, widest a little in front of the middle ; width equal to more than one third of the length, acuminate in front, rounded off behind. Surface of the shell smooth or sparingly punctate.

Length, $\frac{1}{38}$th of an inch.

DISTRIBUTION. *Recent.*—Norway, Great Britain, Ireland, Mediterranean, Cape Verd.

Fossil.—Scotland : Loch Gilp, Paisley, Cartsdyke, Dipple.

3. PONTOCYPRIS ACUPUNCTATA, *Brady.* Plate II, figs. 18, 19.

1866. PONTOCYPRIS ACUPUNCTATA, *Brady.* Brit. Assoc. Report, p. 209 ; Monog. Recent Brit. Ostr., p. 386, pl. xxv, figs. 53—56.

Lateral view narrowly subreniform or subtriangular, highest in the middle, height equal to half the length. Anterior extremity rounded, posterior obtusely pointed.

Superior margin boldly arched, deeply sinuated in front of the middle. Seen from above, compressed, oval, pointed in front and rounded off behind; greatest width situated about the middle and equal to one third of the length. The surface of the shell in recent specimens appears to be very finely punctate, but a high microscopic power shows each of these markings to be an exceedingly short hair.

Length, $\frac{1}{40}$th of an inch.

DISTRIBUTION. *Recent.*—Great Britain, Ireland.

Fossil.—Scotland: Raised beach, Oban.

Genus 9.—BAIRDIA, *M'Coy.*

Valves unequal in size, the left being considerably the larger, and overlapping the right, both on the dorsal and ventral surfaces. Surface of the shell smooth or nearly so. Carapace, as seen from the side, mostly subrhomboidal or subtriangular. Eyes wanting. Antennæ robust: the upper 6-jointed, first two joints large and thick, the following joints very short and firmly united, but forming with the second joint a very mobile hinge; armed with numerous long setæ. Lower antennæ strong, 5-jointed, second joint bearing on its base a bisetose tubercle, fourth joint elongated, last very short, armed with two long and strong claws. Mandibles large, lower extremity slightly dilated, and armed with six or seven long and strongly serrulated teeth; palp strong, 4-jointed, bearing a very small trisetose branchial appendage. One pair of jaws only, terminating in three narrow subequal branches, and having a well developed branchial appendage which is separated into two parts by a distinct constriction, the basal portion beset below with several long slender setæ, the terminal portion dilated, subovate, and fringed with large ciliated setæ. Three pairs of feet, all of similar structure, directed forwards and protruding from the shell, 4-jointed, and terminating in a long claw; the first pair having attached to its basal joint a large ovate branchial lamina which is fringed with long ciliated setæ. Post-abdominal rami short but well developed, linear, bearing two elongated claws, and a few setæ of unequal length. The animal crawls slowly about amongst the mud.

The foregoing anatomical details are taken from G. O. Sars' recently published account[1] of the genus, based on an examination of *B. complanata*, Brady.

[1] Undersögelser over Hardangerfjordens Fauna. I. Crustacea af G. O. Sars (Reiseberetning), 1871.

1. Bairdia inflata (*Norman*). Plate XV, figs. 1—4.

1857. Bairdia subdeltoidea, *A. White*. Pop. Hist. Brit. Crust., p. 293.
1849. — — *Narrow* var. *Jones*. Entom. Cretaceous Formation of England, p. 23; and (1856) Tertiary Entom., p. 52.[1]
1862. Cythere inflata, *Norman*. Ann. and Mag. Nat. Hist., vol. ix, p. 49, pl. iii, figs. 6—8.
— subdeltoidea. Brit. Mus. Cat. Brit. Crust., p. 108 (*fide* Norman).
1868. Bairdia inflata, *Brady*. Monog. Recent Brit. Ostrac., p. 388, pl. xxvii, figs. 9—17, and pl. xxxviii, fig. 5.

Shell tumid; seen laterally, subrhomboidal in outline, highest in the middle; height equal to half the length. Anterior extremity obliquely rounded, flattened or somewhat sinuous, bordered occasionally with a flattened spinous lamina; posterior narrow, rounded, or almost angular, often more or less dentate or spinous; superior margin forming a flattened arch; inferior straight or slightly waved, bulging more or less at its junction with the anterior margin. Seen from above, ovate, widest in the middle, width nearly equal to the height; extremities obtusely pointed; line of junction of the valves waved; on the ventral surface the left valve much overlapping the right. Surface smooth and polished or finely punctate. Muscle-spots arranged in a rosette near the centre of the valve.

Length, $\frac{1}{23}$rd of an inch.

Recent examples of this fine species exhibit considerable variety of form and, more especially, of surface-sculpture and spinous armature, some being almost perfectly smooth at the extremities, and others strongly margined with spines or dentate lamellæ; some specimens, again, are clothed towards the extremities with numerous long, stiff bristles. Our fossil examples are, however, as yet so few that these variations have not been noticed, but should the species be found to occur in widely distant beds, we may then expect to find varieties of the kind here described.

Distribution. *Recent.*—Great Britain.

Fossil.—Scotland: Raised beach, Oban.

2. Bairdia (?) Cambrica, *nov. sp.* Plate XIII, figs. 20, 21.

Right valve, as seen from the side, rhomboidal in outline, greatest width situated in the middle and equal to more than half the length; anterior extremity gently curved in

[1] These references apply to Prof. Rupert Jones's memoranda on the *recent* shell only; not at all to his figures or description of the fossil form, which is quite distinct from the present species.

an oblique direction, looking downwards and forwards; posterior rounded and narrow, terminating in a strong sharp spine; superior margin boldly arched, gibbous in the middle, sloping steeply behind; inferior almost straight. Seen from above, ovate, tumid. Surface of the shell smooth, sparingly and minutely papillose: lucid spots about four in number, large, and disposed obliquely, as is usual in the Cypridæ.

Length, $\frac{1}{75}$th of an inch.

One valve only of this species which appears, however, to be undoubtedly distinct, occurred in the deposit met with on the site of the New Docks Basin at Cardiff.

Family 2.—DARWINELLADÆ.

Genus—DARWINELLA, *Brady* and *Robertson.*

POLYCHELES, *B.* & *R.* Ann. and Mag. N. H., 1870, vol. vi, p. 25.
DARWINELLA, *B.* & *R.* Ib., ser. iv, vol. ix, p. 50.

Shell fragile, structureless. Carapace oblong, higher behind than in front; lucid spots ten to twelve in number, linear oblong or wedge-shaped, arranged in a subradiate manner in front of the centre of the valve. Seen from the side, compressed, oblong, subovate; from above, ovate, acuminate in front, obtusely rounded behind. Valves unequal, the right much larger than the left. Antennæ very short and stout, strongly armed with curved claws and bristles. Superior antennæ six-jointed, having all the joints as broad as or broader than long, and beset with stout curved setæ; inferior four-jointed, of nearly equal thickness to the apex, which is armed with four or five strong, slightly curved claws, entirely destitute of poison-gland or urticating setæ, the place of which is occupied by a simple curved seta of moderate length. Mandible broad; truncate at the distal extremity which is provided with six or seven small and slender spiniform teeth; palp three-jointed, its basal joint very wide and fringed with a series of nine very long, curved setæ; second joint long, slender, nearly four times as long as broad, slightly curved and dilated at the distal extremity, where it bears one long and two small setæ; terminal joint more slender, about two thirds of the length of the foregoing and bearing at the truncate apex about six slender curved spines; basal joint of the palp has attached to its upper margin a small crescentic lamina which is fringed with ten branchial filaments. First jaw divided into four short setiferous segments, and bearing a very large oblong palp which is fringed above with about twenty-four long branchial filaments, and has also four deflexed setæ at its base. Second jaw simple, short and wide, truncate at the apex and divided into several slender, curved spines; bearing a large, three-jointed, pediform palp, and an ovate branchial appendage of moderate size. Two pairs of feet of moderate length, five-jointed, the second pair being much the longest, and having the last joint armed with one long and two small curved setæ; first three joints of nearly equal length, fourth and fifth respectively about one half and one third as long as the preceding. Abdomen ending in a short conical process. Copulative organs of the male of complex structure, the basal portion, on each side, consisting of a subrhomboidal acuminate lamina, the apical portion of an irregularly shaped plate produced laterally into an alæform process, and on the distal margin into a short, strong hook. Female probably viviparous.

Darwinella Stevensoni, *Brady* and *Robertson*. Plate II, figs. 13—17.

1870. Polycheles Stevensoni, *B.* & *R.* Ann. N. H., 1870, vol. vi., p. 25, plate vii, figs. 1—7, and pl. x, figs. 4—14.
1872. Darwinella — *B.* & *R.* Ib., vol. ix, p. 50.

Carapace of the *female* as seen from the side, oblong, depressed in front, height equal to more than one third of the length; extremities obliquely rounded, anterior narrowed, posterior broad and obtuse; superior margin nearly straight, curving downwards in front of the middle; inferior slightly sinuated in the middle. Seen from above, ovate, acuminate, widest near the posterior extremity; greatest width about equal to the height; posterior margin indented in the middle at the junction of the two valves; end view nearly circular. Shell of the *male* somewhat more compressed when seen from above and having the greatest width near the middle. The right valve much overlaps the left, especially in the middle of the ventral margin.

Length, $\frac{1}{32}$nd of an inch.

Distribution. *Recent.*—England, Ireland, and Holland.
Fossil.—England: Whittlesea.

Family 3.—CYTHERIDÆ.

Genus 1.—Cythere, *Müller.*

Valves unequal, mostly oblong-ovate, subreniform or subquadrangular; surface variously ornamented,—smooth, punctate, foveolate, strongly rugose, spinous, or tuberculated; usually bearing a distinct, polished, and shining tubercle over the anterior hinge-joint. Hingement formed on the right valve by two terminal teeth, on the left by one anterior tooth and a posterior fossa, between which there is frequently a more or less strongly developed bar which is received into a corresponding furrow of the opposite valve; the teeth are in some few cases crenulated, and that of the left valve is often absent. Antennæ robust; superior 5—6-jointed, armed on the anterior margin with three long curved spines, mostly one on the third and two on the fourth joint; inferior 4-jointed, the last joint short and stout, mandibular palp 3—4-jointed, bearing in place of a branchial appendage, a tuft of two to five setæ. Eyes one or two. Structure of the shell usually very dense.

The reasons which induce us to unite the two genera *Cythere* and *Cythereis* have been explained by Mr. Brady in his 'Monograph of the Recent British Ostracoda;' but as they relate entirely to the anatomy of the animal, we do not think it needful to recount them here. It must be abundantly evident to all students of the group that no permanent distinctive character can be found in the *shells* of the two genera.

1. Cythere pellucida, *Baird.* Plate III, figs. 20—24.

1850. Cythere pellucida, *Baird.* Brit. Entom., p. 173, pl. xxi, fig. 7.
1865. — — *G. O. Sars.* Oversigt af Norges marine Ostracoder, p. 31,
1868. — — *Brady.* Monograph of recent British Ostracoda, p. 397. pl. xxviii, figs. 22—26, 28.
1869. — — *Brady & Robertson.* Ann. and Mag. Nat. Hist., vol. iii, ser. 4, pl. xix, figs. 10—12.

Carapace of the *female,* as seen from the side, narrow, elongated, almost equal in height throughout, greatest height much less than half the length. Anterior extremity rounded, posterior obliquely subtruncate, angular above at its junction with the dorsal margin; superior margin straight or very slightly convex; inferior sinuated in the middle, gently convex behind. Outline, as seen from above, oblong, ovate, rounded behind, obtusely pointed in front, sides nearly parallel, greatest width situated in the middle and equal to rather more than one third of the length. End-view nearly circular. The male is narrower and more elongated. Hinge-processes distinctly developed. Surface of the shell marked with more or less closely set circular pits, and with one or more curved transverse furrows.

Length, $\frac{1}{40}$th of an inch.

The sculpture of the shell is, in this species, subject to much variation as to the closeness and size of the impressions, but this appears to depend largely upon the age and habitat of the specimens. The range of the species in our seas is very extensive: it is found in estuarine situations where the water is only slightly salt, as well as in the littoral, laminarian, and coralline zones.

DISTRIBUTION. *Recent.*—Norway, Great Britain, Ireland, Holland, Mediterranean, Gulf of St. Lawrence.

Fossil.—Common in many of the Scottish beds. Ireland: Woodburn, Belfast New Docks, Raised beach, Portrush. Norway: Post-tertiary beds.

2. CYTHERE CASTANEA, *G. O. Sars.* Plate XIII, figs. 8—11, and Plate III, fig. 25.

1865. CYTHERE CASTANEA, *G. O. Sars.* Oversigt af Norges marine Ostracoder, p. 32.
1868. — — *Brady.* Monog. Rec. Brit. Ostr., p. 398, pl. xxviii, fig. 27, and pl. xxxviii, fig. 6.
1869. — — *B. & R.* Ann. and Mag. Nat. Hist., ser. 4, vol. iii, pl. xix, figs. 15—18.

Carapace of the *female,* as seen from the side, oblong, subquadrangular, rather higher in front than behind; height equal to half the length; anterior extremity obliquely rounded; posterior rectangularly subtruncate; superior margin sinuous, sloping gently backwards from the anterior third where it is highest, and terminating behind in an obtuse angle; inferior sinuated in the middle and upcurved towards the extremity. Seen from above, ovate, acuminate in front, rounded behind, sides subparallel and more or less distinctly constricted in front of the middle. The shell of the *male* is more compressed and when seen laterally is much more tapered behind, the supero-posteal angle more pronounced, the infero-posteal entirely rounded off; superior margin quite straight and sloping rather steeply backwards. Shell-surface closely set with small rounded pittings, and marked usually with two curved transverse furrows; colour reddish brown.

Length, $\frac{1}{42}$nd of an inch.

DISTRIBUTION. *Recent.*—Great Britain, Ireland, Norway, Holland.

Fossil.—Scotland: Tangyburn, Duntroon, Kilchattan, Dipple, Cumbrae, Dumbarton, Paisley, Dalmuir, Oldmains, Govan, West Tarbert, Oban. South Wales: Cardiff New Dock Basin.

Very closely allied to this species are *C. pellucida, porcellanea, Macallana,* and *tenera.* From the first named *C. castanea* may be distinguished by its usually darker colour, its more closely punctate shell, the pittings of which are always small and round (not oblong or of any considerable size), by the almost cuneate form of the male, and its perfectly straight dorsal margin. *C. tenera* is smaller, has no transverse furrow, is more finely, or not at all, punctured, and is also sparingly papillose. *C. porcellanea* is more flexuous or reniform in outline, smooth or indistinctly sculptured; regularly ovate when seen from above, and has a much less pronounced supero-posteal angle. The same remarks apply to *C. Macal-*

lana, which differs from *porcellanea* chiefly in its straighter and more attenuated outline and more rugose sculpture.

3. CYTHERE MACALLANA, *Brady* and *Robertson*. Plate XIII, figs. 1, 2.

1869. CYTHERE MACALLANA, *B. & R.* Ann. and Mag. Nat. Hist., ser. 4, vol. iii, p. 368, pl. xix, figs. 5—9.
1869. — PROPINQUA, *G. O. Sars.* Undersögelser over Christianiafjordens Dybvandsfauna, p. 57, and note, p. 58.

Carapace of the *female*, seen from the side, subreniform; greatest height situated in front of the middle, and equal to half the length; anterior extremity evenly, posterior obliquely rounded; superior margin well arched, highest over the eyes, in front of which it is slightly excavated, ending posteriorly in an obtuse angle; inferior sinuated in the middle. Seen from above, ovate, widest in the middle, rounded behind, subacuminate in front; width less than the height. Surface of the shell vaguely and distantly punctate, the ventral surface more or less marked with sinuous grooves. Colour yellowish-brown. The shell of the *male* is longer and narrower, more tapering (as seen laterally) towards the posterior extremity, and has the dorsal margin almost straight; seen from above, the sides are subparallel, and the posterior extremity obtuse; the shell-surface is usually less sparingly punctate than in the female.

Length, $\frac{1}{65}$th of an inch.

DISTRIBUTION. *Recent.*—Great Britain, Ireland.

Fossil.—Scotland: Kilchattan, Cumbrae.

4. CYTHERE PORCELLANEA, *Brady*. Plate XIII, figs. 3—5.

1869. CYTHERE PORCELLANEA, *Brady.* Ann. and Mag. Nat. Hist., ser. 4, vol. iii, p. 47, pl. vii, figs. 1—4.
1869. — — *B. & R.* Ibid., ser. 4, vol. iii, p. 367, pl. xix, figs. 1—4.

Carapace of the *female*, as seen from the side, reniform; greatest height situated in the middle and equal to half the length; anterior extremity rounded, posterior rotundo-truncate, obscurely angulated above; superior margin arched, sloping almost in a right line behind the middle; inferior deeply sinuated in the middle. Seen from above, ovate, widest in the middle, width considerably less than the height; acuminate in front, sub-acuminate behind: surface of the shell polished, quite smooth, or more or less marked with vaguely defined rounded impressions which, towards the extremities, sometimes tend to form elongated furrows or undulations. The shell of the *male* is narrower, less deeply sinuated below and more upturned at the posterior extremity.

Length $\frac{1}{50}$th of an inch.

Distribution. *Recent.*—Great Britain, Ireland, Holland.

Fossil.—Scotland: Kilchattan, Cumbrae, Cartsdyke, Dalmuir, West Tarbert. South Wales: Cardiff New Dock basin.

5. Cythere tenera, *Brady*. Plate XIII, figs. 6, 7.

1868. Cythere tenera, *Brady*. Monog. recent Brit. Ostr., p. 399, pl. xxviii, figs. 29—32.

Carapace, as seen from the side, oblong, subquadrangular, of nearly equal height throughout; height equal to half the length; anterior extremity well rounded, posterior subtruncate, rounded off below, obscurely angulated above; superior margin straight, gently sloping from before backwards; inferior sinuated in the middle. Seen from above, ovate, widest about the middle, width less than the height; shell-surface smooth, very finely punctate, and ornamented also with a few distant small circular papillæ; no transverse sulcus.

Length of the Cardiff specimens $\frac{1}{70}$th of an inch. Usual size $\frac{1}{55}$th of an inch.

Distribution. *Recent.*—Great Britain, Ireland, Shetland, Bay of Biscay, Besika Bay.

Fossil.—Scotland: Wick, Dipple, Oban. South Wales: Cardiff New Dock basin.

5. Cythere deflexa, *nov. sp.* Plate XIII, figs. 14, 15.

Valves, as seen from the side, reniform: greatest height situated near the middle and equal to scarcely half the length; extremities well rounded; superior margin arched, almost gibbous in the middle; inferior sinuated. Seen from above, regularly ovate. Shell-surface marked with indistinct, subconcentrically arranged pittings.

Length $\frac{1}{50}$th of an inch.

The single valve on which this species is founded does not seem fairly referable to any known form, though in general appearance it approaches somewhat *C. cribrosa*, from which it is separated chiefly by its more flexuous outline and more arcuate dorsal margin.

Fossil.—Scotland: Jordan Hill.

6. Cythere cribrosa, *nov. sp.* Plate X, figs. 5—7.

Carapace compressed, oblong; seen laterally, rather higher in front than behind; greatest height equal to half the length; anterior extremity evenly, posterior obliquely, rounded and obsoletely angular about the middle; superior margin gently arched, highest in front of the middle, and terminating behind in an obtuse angle; inferior almost straight. Seen from above, compressed, ovate; anterior extremity subacuminate, posterior narrowly rounded, width less than the height; end view subcircular. Surface of the valves covered with rather closely reticulated furrows which assume a concentric arrangement toward the margins.

Length $\frac{1}{45}$th of an inch.

This is a very pretty and distinct species, its nearest relative being, perhaps, *C. Robertsoni*, Brady (see 'Ann. and Mag. Nat. Hist.,' July, 1868), from which it differs chiefly in its somewhat greater size and more compressed and elongated, as well as less angular, form.

Fossil.—England: Bridlington.

7. Cythere crispata, *Brady.* Plate X, figs. 52, 53; and Plate XIII, figs. 12, 13.

1865. Cythere cicatricosa, *G. O. Sars.* Oversigt af Norges marine Ostracoder, p. 33.
1868. Cythere badia (in part), *Brady.* Monog. Rec. Brit. Ostrac., p. 399 (not figures). (Not *C. badia* of Norman.)
1868. — — *Brady.* Les Fonds de la Mer, vol. i, p. 89.
1868. Cythere crispata, *Brady.* Ann. and Mag. Nat. Hist., ser. iv, vol. ii, p. 221, pl. xiv, figs. 14, 15.
1869. — cicatricosa, *Brady* and *Robertson.* Ann. and Mag. Nat. Hist., ser. 4, vol. iii, p. 369, pl. xix, figs. 13, 14.

Carapace, as seen from the side, subreniform, higher in front than behind; greatest height in front of the middle, equal to more than half the length; anterior extremity rounded, and often slightly crenulated below the middle; posterior truncate, with slightly rounded angles; superior margin gently arched, sloping from before backwards; supero-posteal angle somewhat produced; inferior margin nearly straight; seen from above the outline is compressed, almost clavate, narrowly rounded in front and truncate behind, with nearly parallel sides, which are sharply constricted near the posterior extremity; width considerably less than half the length. Surface of the shell marked with irregularly waved depressions, the separations between which sometimes rise into well marked ridges.

Length, $\frac{1}{62}$nd of an inch.

This species is, in many respects, not unlike *C. badia*, Norman, with which, indeed, it was confounded in the 'Monograph of the Recent British Ostracoda.' It is, however, distinctly truncate behind, and is usually conspicuously sculptured, or even rugose, with the anterior border minutely crenated. *C. badia*, on the contrary, is but vaguely pitted on the surface, and, seen from above, is pretty regularly ovate and not at all truncate. The Mediterranean form described by Mr. Brady (*op. cit.*) under the specific name *crispata*, though much more prominently rugose, seems to be essentially the same as the northern species. The name *cicatricosa* having been previously applied by Reuss to another species of the same genus, must give way to that here adopted.

Distribution. *Recent.*—Great Britain, Ireland, Norway, Mediterranean, (?) Australia, Hong Kong.

Fossil.—Scotland: Cumbrae. Ireland: Portrush. Norway: Post-tertiary beds.

8. Cythere viridis, *Müller*. Plate III, figs. 26—28.

1785. Cythere viridis, *Müller*. Entomostraca, p. 64, tab. vii, figs. 1, 2.
1865. — — *G. O. Sars*. Oversigt af Norges marine Ostracoder, p. 30.
1868. — — *Brady*. Monog. Recent Brit. Ostrac., p. 397, pl. xxviii, figs. 40, 41, 57—59, and pl. xxxviii, fig. 8.

Carapace of the *female* as seen from the side subreniform, rather higher in front than behind, greatest height equal to more than half the length. Extremities well rounded; superior margin nearly straight, inferior deeply sinuated in the middle. Outline as seen from above oblong ovate, pointed in front, greatest width situated in the middle, scarcely equal to half the length; end view ovate. Shell of the *male* more elongated. Surface smooth, marked with small distant punctures.

Length $\frac{1}{55}$th of an inch.

C. viridis is common in the recent state on our coasts, living mostly between tide-marks, but also in moderate depths of water down to 20—30 fathoms.

Distribution. *Recent.*—Norway, Great Britain, Ireland, Holland.

Fossil.—In most of the clay beds in the Clyde district, rarer in the east of Scotland; Portrush, Ireland. Norway, Post-tertiary beds.

9. Cythere lutea, *Müller*. Plate III, figs. 1—6.

1785. Cythere lutea, *Müller*. Entomostraca, p. 65, tab. vii, figs. 3, 4.
1850. — reniformis, *Baird*. Brit. Entom., p. 169, tab. xx, figs. 5, 5 *a*–*f*.
1854. — lutea, *Zenker*. Ueber die Krebsthiere, p. 83, tab. v, C.
1865. — — *G. O. Sars*. Oversigt af Norges marine Ostracoder, p. 28.
1865. — setosa, *Brady*. On new or imperfectly known Ostracoda (Trans. Zool. Soc. London), p. 372, pl. lviii, figs. 12, 13, 15 *a*.
1868. — lutea, *Brady*. Monograph of Recent British Ostracoda, p. 395, pl. xxviii, figs. 47—56; pl. xxxix, fig. 2.

Carapace of the *female*, as seen from the side, reniform, highest in the middle, greatest height equal to much more than half the length; extremities obtusely rounded, dorsal margin well arched, ventral distinctly sinuated in front of the middle. Outline, as seen from above, oblong-ovate, widest behind the middle, greatest width equal to less than half the length, obtusely pointed in front, broader behind, the hinge-line marked by a deep, sharply-cut sulcus. End view ovate, centrally emarginate above, keeled below. Valves dissimilar in shape, the right higher than the left; its extremities more obliquely truncate. Anterior and ventral borders of the carapace compressed and marked with radiating transverse hair-like lines; central portions covered with a calcareous crust which is marked with distant circular pits, and dotted in the interspaces with numerous small punctures. Hinge-teeth feebly developed, crenulated. Shell of the *male* much more elongated and more angular in outline, inferior margin more deeply sinuated, surface usually more or less waved or ribbed in a sub-radiate manner.

Length $\frac{1}{30}$th of an inch.

This species is found living abundantly in the seas of Britain and Scandinavia, mostly in the littoral and laminarian zones; it is also one of the most abundant Post-tertiary fossil species. The shell of the female sometimes nearly approaches in appearance the female *C. villosa*, but a close examination especially of the hinge-joints will always remove any doubt respecting it.

Distribution. *Recent.*—Baffin's Bay, Iceland, Gulf of St. Lawrence, North Sea, Great Britain, Ireland, Baltic, Mediterranean.

Fossil.—Common in nearly all the beds of the west of Scotland, but less frequent on the east. Ireland: Belfast New Docks, Portrush. Canada and Norway, Post-tertiary beds.

10. Cythere albomaculata, *Baird.* Plate IX, figs 1—4.

1850. Cythere albomaculata, *Baird.* Brit. Entom., p. 169, pl. xx, fig. 7.
1868. — — *Brady.* Monog. Rec. Brit. Ostrac., p. 402, pl. xxviii, figs. 33—39, and pl. xxxix, fig. 3.

Carapace, as seen from the side, subreniform, greatest height in the middle and equal to half the length. Anterior extremity obliquely rounded, posterior rounded, angular in the middle, above which it is often slightly emarginate; superior margin gently and evenly arched, almost straight in the middle; inferior deeply sinuated in front of the middle. Outline, as seen from above, oblong-ovate, widest in the middle, and nearly thrice as long as broad; extremities pointed; surface of the shell smooth, bearing a few short distantly scattered hairs and often some faintly impressed punctæ: the extremities marked with numerous radiating, hair-like lines.

Length $\frac{1}{28}$th of an inch.

This is one of the commonest of living British species, occurring abundantly both between tide-marks and in moderate depths of water. It is not recorded by G. O. Sars as a Norwegian species, but we have seen a single specimen dredged off that coast.

Distribution. *Recent.*—Great Britain, Ireland, Norway, Levant, Cape Verd.

Fossil.—Scotland: Cumbrae, West Tarbert, Dipple, Raised beaches, Oban and Cumbrae. Ireland: Belfast New Docks, Portrush.

11. Cythere leioderma, *Norman.* Plate IX, figs. 5, 6.

1868. Cythere leioderma, *Norman.* Last Shetland Dredging Report, p. 291.
1870. — — *Brady.* Ann. and Mag. N. H., 4th ser., vol. vi, p. 451, plate xix, figs. 11—13.

Carapace, as seen from the side, oblong, sub-quadrangular, highest in front of the middle, greatest height equal to nearly half the length. Anterior extremity rounded, posterior obliquely subtruncate, sinuated in the middle; superior margin highest in front of the middle, where it forms an elevated angle from which it slopes gently backwards almost in a straight line; inferior margin almost straight. Seen from above tumid, ovate, slightly narrowed in front; greatest width equal to the height and situated near the middle; extremities broadly and evenly rounded; hinge-margins somewhat depressed; hinge-teeth very strongly developed. Surface smooth, bearing numerous short scattered setæ, and marked on the anterior margin with several radiating lines.

Length, $\frac{1}{28}$th of an inch.

We have met with only one fossil valve of this species, but the characters are so well marked as to leave no doubt of its identity; we had indeed described it in MS. as a distinct species years before its discovery in the living state by the Rev. A. M. Norman. We have ourselves still more lately seen many recent specimens from the Gulf of St. Lawrence.

DISTRIBUTION. *Recent.*—Shetland, Gulf of St. Lawrence.

Fossil.—Bridlington.

12. CYTHERE GIBBOSA, *B. & R.* Plate XVI, figs. 16—18.

1869. CYTHERE GIBBOSA, *Brady* and *Robertson*. Ann. and Mag. N. H., ser. iv, vol. iii, p. 368, pl. xxi, figs. 1—3.

Carapace oblong, subtriangular or subtrapezoidal, highest in front of the middle, height fully equal to half the length, anterior extremity obliquely, posterior evenly rounded; superior margin prominent in front of the middle, thence sloping steeply to the front, more gently and almost in a right line backwards, inferior margin straight or gently convex; seen from above, subovate, widest near, or a little in front of, the middle, width considerably less than the height, extremities acuminate, end view broadly ovate. Shell rather thin and fragile, smooth and shining, slightly punctate and papillose, the ventral surface greatly depressed in the centre, forming a slight longitudinal fossa.

Length, $\frac{1}{65}$th of an inch.

DISTRIBUTION. *Recent.*—Great Britain and Ireland.

Fossil.—Portrush, Ireland.

13. CYTHERE CONVEXA, *Baird.* Plate III, figs. 14—17.

1850. CYTHERE CONVEXA, *Baird.* Brit. Entom., p. 174, pl. xxi, fig. 3.
1856. — PUNCTATA, *Jones.* Monog. Tertiary Entom., p. 24, plate ii, figs. *b—d, f—h* (not *a* and *e*).
1868. — CONVEXA, *Brady.* Monog. rec. Brit. Ostrac., p. 401, pl. xxix, figs. 19—27; pl. xxxix, fig. 4.

Carapace of the *female,* as seen from the side, almost semicircular, greatest height in the middle and equal to more than half the length. Anterior extremity broadly rounded, posterior produced below into a somewhat angular beak; superior margin very boldly arched, highest in the middle, inferior gently sinuated in the middle and convex behind. Outline, as seen from above, oblong-ovate; greatest width in the middle, and equal to less than half the length; extremities obtusely pointed; end view broadly ovate, pointed above and below. The two valves are very unequal in size and dissimilar in shape, the left being the larger and overlapping the right considerably, especially on the dorsal margin. The posterior beak of the right valve is more squamous and often two or three times emarginate. Surface of the shell covered with closely-set circular impressed puncta. The *male* does not differ much in shape from the *female*.

Length, $\frac{1}{30}$th of an inch.

Cythere convexa is in the living state widely distributed round the British coast, but nowhere occurs very abundantly; it ranges from the littoral zone to depths of about thirty fathoms, but does not appear to have been noticed either in the seas or glacial deposits of Scandinavia.

Some of the forms described and figured by Professor T. Rupert Jones under the name *Cythere punctata* are undoubtedly referable to the present species, but some of the synonyms and references given by that author do not appear to us to be applicable. We are not acquainted with the figures of *C. punctata* given by Roemer, but that of Reuss, if meant for the present species, is certainly very bad, while his *Cypridina punctatella*, which is doubtfully referred by Professor Jones to the young of the present species, evidently belongs to the group assigned in this memoir to the genus *Loxoconcha*. The same may also be said of Bosquet's *Cythere punctatella*. Lastly, it may be noted that G. O. Sars has erroneously applied Dr. Baird's name (*convexa*), having assigned it to a totally different form, the *Cytheropteron latissimum* of this Monograph.

DISTRIBUTION. *Recent.*—Great Britain and Ireland, Levant, Bay of Biscay.

Fossil.—Scotland: Raised beaches, Cumbrae and Oban; West Tarbert Silt. Ireland: Portrush; New Docks, Belfast.

14. CYTHERE CICATRICOSA, *Reuss*. Plate XIV, figs. 7—10.

1849. CYPRIDINA CICATRICOSA, *Reuss.* Die fossil. Entomostrac. Oesterreich. Tertiär-beckens, p. 27, pl. ix, figs. 21 *a*, *b*.
1852. CYTHERE CICATRICOSA, *Bosquet.* Entom. foss. terr. tertiair. France, p. 76, pl. iii, fig. 13.
1865. — ARBORESCENS, *Brady.* Ann. Mag. N. H., vol. xvi, pl. ix, figs. 5—8.

Carapace, as seen from the side, subovate, highest in the middle, greatest height equal to two thirds of the length; anterior extremity broadly rounded, posterior slightly produced below the middle; superior margin boldly arched, inferior somewhat convex and slightly sinuated in front of the middle. Seen from above, ovate, tapering evenly to the extremities, which are sharply pointed; greatest width in the middle and equal to half the length. The end view is somewhat pyramidal, being pointed at the top and widest below the middle; the base broad and rounded. Shell-surface marked with closely set rounded or subangular impressions, which on the ventral aspect coalesce so as to form beaded furrows.

Length, $\frac{1}{38}$th of an inch.

This species differs from *C. convexa*, Baird (*C. punctata ?* Münster) in its greater proportionate height, in being more tumid below the middle, and in being destitute of any very prominent beak at the postero-inferior angle. In lateral outline it approaches closely to a recent Mediterranean species, *C. Speyeri*, Brady,[1] but is smaller and very much less tumid, besides being deficient in the beak, which that species possesses in common with *C. convexa.*

Distribution. *Fossil.*—Brick-earth of the Nar; Hopton Cliff, Yarmouth. Tertiary beds of France and Germany.

15. Cythere costellata, *Römer.* Plate XVI, figs. 13—15.

1838. Cytherina costellata, *Römer.* Neues Jahrb. Mineral., &c., p. 517, pl. vi, fig. 24 (*fide* Bosquet).
1850. Cythere costellata, *Bosquet.* Entom. foss. terr. tertiair. France, p. 58, pl. ii, figs. 11 *a—d.*
1856. — — *Jones.* Monog. Tert. Entom., p. 32, pl. v, fig. 11.

Carapace, as seen from the side, oblong, somewhat cuneiform, much higher in front than behind, height equal to fully half the length, anterior extremity boldly and obliquely rounded, posterior also rounded, but narrow, and bearing in the middle one moderate-sized spine with two or three smaller ones below; superior margin somewhat angulated in front, behind which it is slightly emarginate and thence slopes backwards almost in a right line, inferior almost straight for the first two thirds of its course, then curved upwards; seen from above, somewhat lozenge-shaped, greatest width situated behind the middle and equal to half the length, obtusely pointed or almost sub-truncate in front, doubly mucronate behind. Shell dense and strong, marked longitudinally with numerous (10—12 on the lateral aspect of each valve) strong, rounded, flexuous ribs; the left valve considerably larger than the right, aud overlapping with a broad flange on the ventral surface of the shell; hinge-line on the dorsal aspect depressed so as to form a wide sulcus, and sharply bent in front.

Length $\frac{1}{40}$th of an inch.

Distribution. *Fossil.*—England: Tertiary beds of Bracklesham, and Pholas-bed of Selsey. Tertiary, France.

Our figures of this species were already lithographed before we became aware that it could not rightly be claimed as belonging to the Post-tertiary Ostracoda. The "Pholas-bed" in which our specimens were found is certainly of considerably earlier date, unless indeed the Ostracoda which it contains have been washed into it from some older deposit.

[1] Described in 'Les Fonds de la Mer,' tom. i, p. 99, pl. xii, figs. 8—10.

16. CYTHERE CLUTHÆ, *nov. sp.* Plate XIII, figs. 16, 17.

Shell, as seen from the side, subquadrate, highest in front, greatest height equal to nearly two thirds of the length; anterior extremity broad and well rounded, posterior narrow and obliquely rounded; superior margin almost straight, sloping from before backwards, inferior deeply sinuated in the middle; seen from above the outline is oblong, subrectangular, with parallel, irregularly sinuous sides, suddenly tapered off towards the front, which is truncated; posterior extremity irregularly rounded. Shell-surface irregularly mamillated, closely set with small subrotund pittings; within the ventral margin runs a broad rounded ridge, while the anterior half of the valve is occupied chiefly by one, the posterior half by two, large rounded tubercles.

Length $\frac{1}{75}$th of an inch.

DISTRIBUTION.—*Fossil.*—Scotland: Cumbrae, Cartsdyke, Govan, Lag Arran.

17. CYTHERE FINMARCHICA (*G. O. Sars*). Plate X, figs. 18—21.

1865. CYTHEREIS FINMARCHICA, *Sars.* Oversigt. Norges mar. Ostr., p. 41.
1868. CYTHERE — *Brady.* Monog. Rec. Brit. Ostrac., p. 410, pl. xxxi, figs. 9—13.

Carapace of the *female,* as seen from the side, oblong, quadrangular, higher in front than behind, greatest height equal to about half the length; anterior extremity rounded; posterior subtruncate, somewhat angulated in the middle and usually divided into four or five blunt teeth below. Superior margin sloping almost in a straight line from before backwards; inferior gently sinuated in the middle; seen from above ovate, with subparallel sides and obtuse extremities; width scarcely equalling the height. Surface of the shell marked with vaguely defined rounded pittings, and often with a median transverse sulcus, in front of which is a large rounded tubercle bearing numerous (9 to 12) irregularly disposed muscle-spots. Shell of the *male* narrower and more elongated.

Length $\frac{1}{38}$th of an inch.

Nearly allied to *Cythere tuberculata,* from which it differs, however, in having the anterior margin entire or at most only slightly crenated, and in the character of the posterior teeth, which are marginal crenulations rather than true spines; the posterior portion of the shell is also much less tumid than in the larger species, and there is only *one* large central tubercle.

DISTRIBUTION. *Recent.*—Davis's Straits, Norway, Great Britain, Ireland, Bay of Biscay, Cape Verd, St. Vincent.

Fossil.—Scotland: Gamrie, Wick, Loch Gilp. Norway: Post-tertiary beds.

18. CYTHERE CUNEIFORMIS, *Brady*. Plate X, figs. 23—26.

1865. CYTHERE VENTRICOSA, *Sars*. Op. cit., p. 34.
1868. — CUNEIFORMIS, *Brady*. Monog. Rec. Brit. Ostrac., p. 404, pl. xxxi, figs. 47—54.

Carapace of the *female* subprismoid, much depressed behind, angular on the dorsal and flattened on the ventral surface; seen from the side, the outline is subcuneiform, anterior extremity broadly rounded, posterior narrowed and produced to an obtusely mucronate point; superior margin sloping steeply and in a straight line from before backwards, inferior almost straight. Seen from above, ovate, extremities sharply mucronate, greatest width about equal to the height; end-view triangular, base and sides convex. Shell-surface marked more or less profusely with rounded depressions and tubercles, transversely sulcate in the middle, and longitudinally furrowed on the ventral surface.

Length, $\frac{1}{38}$th of an inch.

DISTRIBUTION. *Recent.*—Great Britain, Ireland, Norway.

Fossil.—Scotland: Raised beach, Oban; West Tarbert. Norway.

19. CYTHERE LIMICOLA (*Norman*). Plate X, figs. 1—4.

1865. CYTHEREIS LIMICOLA, *Norman*. Nat. Hist. Trans. Northumberland and Durham, vol. i, p. 20, pl. vi, figs. 1—4.
1865. CYTHERE NODOSA, *Sars*. Op. cit., p. 34.
1866. — COMPLEXA, *Brady*. Brit. Assoc. Report, p. 210.
1865. — AREOLATA, *Brady*. Trans. Zool. Soc., vol. v, p. 381, pl. lxii, figs. 2 *a*—*d*.
1868. — LIMICOLA, *Brady*. Monog. Rec. Brit. Ostrac., p. 405, pl. xxxi, figs. 38—41, 43—46.

Carapace of the *female*, as seen from the side, subtrapezoidal, not much higher in front than behind, greatest height situated over the anterior hinge and equal to about two thirds of the length; anterior extremity well rounded; posterior subtruncate, obtusely rounded below and slightly excavated above the middle; superior margin abruptly angular at each extremity, between which it is more or less concave; inferior slightly waved. Seen from above, the outline is broadly hastate or boat-shaped, widest near the posterior extremity, tapering gently and in a curve towards the front, but suddenly and steeply backwards; margins irregularly sinuous; greatest width about equal to the height. End-view subtriangular, base broad and flat, apex obtusely rounded, sides excavated. Shell-surface uneven, rugose, often obscurely reticulated, the interstices being finely punctate; a conspicuous polished and rounded tubercle over the anterior and two near the posterior hinge; a strongly marked longitudinal ridge running along the whole length of the valves just within the ventral margin.

Length, $\frac{1}{45}$th of an inch.

Distribution. *Recent.*—Baffin's Bay, Norway, Great Britain.

Fossil.—Scotland: Duntroon, Kyles of Bute, Kilchattan, Cumbrae, Dumbarton, Cartsdyke, Inch Lonaig, Tangy Burn, Terally. Canada: Post-tertiary beds.

20. Cythere globulifera, *Brady*. Plate IX, figs. 18—20, and (?) 21, 22; Plate XII, figs. 11, 12; and Plate XV, figs. 19, 20.

1868. Cythere globulifera, *Brady*. Monog. Rec. Brit. Ostrac., p. 406, pl. xxxi, fig. 42.

Valves, as seen from the side, subcuneiform or subquadrangular, greatest height in front, and equal to nearly two thirds of the length. Anterior extremity broadly and evenly rounded; posterior narrower and obliquely rounded; superior margin perfectly straight and terminating in an obtuse angle at each extremity; inferior straight or very slightly sinuous. Outline, as seen from above, irregularly ovate, sinuous, widest at the posterior third; width equal to half the length; surface delicately reticulated, and towards the anterior and inferior margins concentrically rugose, bearing also, near the superior margin, three large subglobular tubercles, and near the lower margin an elongated alæform projection, which extends over a large portion of the ventral surface.

Length, $\frac{1}{40}$th of an inch.

This species was first described by Mr. Brady from a single specimen found in shell-sand by Dr. Alcock at Roundstone. The specimens found by us in the Scotch glacial clays do not materially differ from the Roundstone specimen, and serve to establish the species on a more satisfactory basis than before. It is possible that the difference of outline between figs. 18 and 19 (Plate IX) may be sexual, the former representing the male, the latter the female. The valve represented in figs. 21 and 22 is, perhaps, not fairly referable to *C. globulifera;* but in the absence of further examples it seems best to place it here provisionally.

DISTRIBUTION. *Recent.*—Ireland, Spitzbergen.

Fossil.—Scotland: Paisley, Govan, Barrie, Elie, Dryleys, Annochie, Errol. England: Bridlington. Canada: Post-tertiary beds.

21. CYTHERE JEFFREYSII, *Brady.* Plate III, figs. 18, 19.

1868. CYTHERE JEFFREYSII, *Brady.* Monog. Rec. Brit. Ostr., p. 412, pl. xxix, figs. 51—55.

Carapace, as seen from the sides, oblong, subcuneiform, highest at the anterior third, greatest height equal to more than half the length. Anterior extremity broad, well rounded, fringed below with several (twelve to sixteen) small teeth, and marked with numerous radiating, hair-like lines; posterior much narrowed; superior margin somewhat angular over the eye, thence sloping steeply and almost in a straight line backwards; inferior slightly sinuated in front, then sloping upwards with a slight convexity. Outline, as seen from above, subhexagonal, sides nearly parallel, extremities tapering abruptly, obtusely pointed; width equal to about half the length. Surface of the shell finely reticulated, the lines of reticulation being made up of moniliform tubercles.

Length, $\frac{1}{40}$th of an inch.

C. Jeffreysii has been found recent on the western coasts of Ireland and Scotland, and also off the Channel Islands, but in all these localities is very rare. The surface-marking of the shell is such as is found in the young of species which in the adult stage are strongly spinous; and a similarly ornamented form, which proved to be the young of *C. echinata,* Sars, was described by Mr. Brady in the 'Zoological Transactions' under the name of *Cythere catenata.* Sars's description had not, however, been published at that time, nor had Mr. Brady seen the species in its adult state. The valve of *C. Jeffreysii* figured in our plate is, probably, a young one; but some of the recent specimens appear to be fully grown, and still exhibit similar characters. We have, therefore, but little hesitation in considering it a distinct species.

DISTRIBUTION. *Recent.*—Great Britain, Ireland.

Fossil.—Raised beach, Oban.

22. **Cythere pulchella**, *Brady*. Plate III, figs. 29—37.

1868. Cythere pulchella, *Brady*. Monog. Rec. Brit. Ostrac., p. 404; Ann. Mag. N. H., ser. iv, vol. ii, p. 32, pl. v, figs. 18—20.
1869. — — *Brady* and *Robertson*. Ann. Mag. N. H., ser, iv, vol. iii, p. 369, pl. xx, figs. 1—3.

Carapace of the *female*, as seen from the side, oblong, subquadrangular, highest at the anterior third, greatest height equal to more than half the length; anterior extremity broad and well rounded; posterior narrower and obliquely subtruncate; superior margin slightly arched, sloping from before backwards; inferior sinuated in front of the middle. Outline, as seen from above, ovate, widest in the middle, greatest width equal to less than half the length, extremities obtusely pointed. End-view broadly ovate. The shell of the *male* (fig. 33) is more elongated and angular in outline. Surface covered with closely set, small, circular impressions, and marked mostly towards the anterior and posterior margins with faintly waved grooves or rugæ. Lucid spots numerous (fig. 36), small, forming an irregular group near the centre of the valves. Hinge-processes of the right valve distinctly crenated (fig. 35).

This species is very similar in shape and general appearance to *C. villosa*, but is smaller, more delicately sculptured, and less angular in outline; the hingement and characters of the lucid spots are also widely different. In the recent state it has been found (but sparingly) in the Arctic seas, the west of Ireland, north-west of Scotland, and Holland.

Distribution. *Recent.*—Baffin's Bay, Scotland, Ireland, Holland.

Fossil.—Scotland: Duntroon, Loch Gilp, Kilchattan, Dumbarton. Ireland: Woodburn.

23. **Cythere villosa** (*G. O. Sars*). Plate III, figs. 7—13.

1865. Cythereis villosa, *G. O. Sars*. Overs. Norg. mar. Ostrac., p. 42.
1868. Cythere — *Brady*. Monog. Rec. Brit. Ostrac., p. 411, pl. xxix, figs. 28—32.

Carapace of the *female*, as seen from the side, subreniform, highest in the middle, greatest height equal to more than half the length. Anterior extremity obliquely rounded; posterior obliquely truncate and sinuated; dorsal margin evenly arched, ventral sinuated in front and forming a subangular projection behind the middle. Outline, as seen from above, oblong-ovate, widest in the middle, width less than the height. Shell of the *male* narrower, more compressed, about twice as long as high; upper margin nearly straight and sloping from before backwards, inferior also nearly straight, the post-median angular prominence more conspicuous than in the female. Hinge-teeth strongly developed; surface of the valves sculptured with deep and large fossæ, which often assume towards the margins a somewhat radiated arrangement (figs. 7 and 12); at other times, probably in old specimens, they become indistinct (fig. 8) and in the centre obsolete.

Length, $\frac{1}{40}$th of an inch.

Cythere villosa is a common recent species, occurring plentifully on the shores of Britain (except on the east coast, where it is rare) and Norway in the littoral and laminarian zones, but not often extending into great depths; it is also one of the commonest of the Glacial Ostracoda.

DISTRIBUTION. *Recent.*—Great Britain, Ireland, Norway, Bay of Biscay, Davis's Straits, Gulf of St. Lawrence.

Fossil.—Common in nearly all the Scottish Post-tertiary beds. England: Hopton Cliff, Whittlesea. Ireland: Belfast New Docks, Portrush. Norway.

24. CYTHERE LATICARINA, *Brady*. Plate IX, figs. 23—26.

1868. CYTHERE LATICARINA, *Brady*. Monog. Rec. Brit. Ostrac., p. 412, pl. xxxi, figs. 1—4.

Carapace of the *female* (?), as seen from the side, subquadrate, highest in front, greatest height equal to more than half the length. Anterior extremity broadly rounded, fringed below with numerous (about sixteen) very fine teeth; posterior rounded, narrow, emarginate above the middle; superior margin prominently angular over the anterior hinge, from which it slopes backwards in a slightly jagged line; inferior sinuated in the middle. Outline, as seen from above, subhexagonal, with parallel sides and very blunt, equally tapered extremities; greatest width in the middle and equal to about half the length. The surface of the shell is uniformly sculptured with rather large subquadrate pittings, and the eye-tubercles are large and exceedingly prominent; the margins of the valves very broad and thick, forming a wide encircling fillet or keel.

Length, $\frac{1}{33}$rd of an inch.

This is very distinct from all other species, except perhaps *C. marginata*, Norman, of which one specimen only is extant, and which must be looked upon as a somewhat doubtful form. Though bearing some resemblance to *C. tuberculata*, *C. laticarina* is easily distinguished from that species by the different proportions, and even contour of the carapace, as well as by its much thickened margins. A certain soft, woolly appearance of the surface is also characteristic. It seems to be a rare species in the recent state, having been noticed very sparingly only on the west of Scotland, in the Channel Islands, and Spitzbergen.

Distribution. *Recent.*—Great Britain, Spitzbergen.

Fossil.—Scotland: Raised beach, Oban.

25. Cythere macropora, *Bosquet.* Plate XIV, figs 1—3.

1852. Cythere macropora, *Bosquet.* Entom. foss. terr. tertiair., p. 97, pl. v, fig. 2.
1856. — — *Jones.* Monog. Tert. Entom., p. 35, pl. iii, figs. 9 *a*—9 *e*.

Carapace, as seen from the side, oblong, quadrangular, greatest height situated near the front and equal to more than half the length; anterior extremity somewhat obliquely rounded, and serrated below the middle; posterior subtruncate, its lower half somewhat produced and divided into five or six broad teeth; superior margin sloping nearly in a right line from before backwards; inferior nearly straight. Seen from above, the outline is oblong, subhexagonal, with irregularly parallel sides and broadly mucronate extremities, constricted in the middle. The surface of the shell is covered with deep, closely set angular pits, each valve bearing a large rounded central tubercle, and a strongly marked, rounded, encircling ridge just within the anterior, inferior and posterior margins; the central surface of each valve has on each side of the very prominent and largely developed contact-margins a single longitudinal series of large angular fossæ; the posterior portion of the contact-margins is ornamented in a similar manner.

Length, $\frac{1}{35}$th of an inch.

A handsome and very well characterised species, of which a few specimens only have occurred, from Hopton Cliff, Great Yarmouth. Professor Rupert Jones's measurement is double that given by M. Bosquet, with the latter of which ours closely agrees.

Distribution. *Fossil.*—England: Post-tertiary, Hopton Cliff; Pliocene, Suffolk. France: Middle Eocene.

26. Cythere concinna, *Jones*. Plate IV, figs. 1—16.

1856. Cythere concinna, *Jones*. Monog. Tert. Entom., p. 29, pl. iv, figs. 7 *a*—7 *f*.
1865. Cythereis clavata, *G. O. Sars*. Overs. Norg. mar. Ostrac., p. 39.
1868. Cythere concinna, *Brady*. Monog. Rec. Brit. Ostrac., p. 408, pl. xxvi, figs. 28—33, and pl. xxxviii, fig. 7.

Carapace of the *female*, as seen from the side, oblong, subquadrangular, highest in front of the middle, greatest height equal to more than half the length; anterior extremity broadly rounded; posterior narrowed, obliquely subtruncate, sometimes emarginate in the middle (figs. 1, 5, 12), at others simple (fig. 6) or angularly produced (fig. 7); superior margin gibbous or prominently angular in front of the middle, thence sloping backwards with an irregularly curved or sinuous line; inferior margin straight or slightly sinuous. Outline, as seen from above, oblong-ovate, greatest width in the middle and equal to half the length; extremities obtuse, broad and nearly equal; lateral margins irregularly sinuous. End-view subpentagonal; height greater than the width. The carapace of the *male* is, as usual, considerably narrower and more elongated. The surface of the shell is subject to much variation in its sculpture.

The specimens represented at figs. 9 and 11 belong to the most strongly sculptured class, and exhibit the peculiar markings of the species with great distinctness; these consist of a prominent ridge running parallel to and a little within the anterior margin, and continued along the ventral border to the hinder end of the valve, a large rounded eminence a little below and in front of the centre of the valve and a flexuous rib running from the posterior margin of this tubercle towards the supero-posteal angle; the rest of the shell-surface is marked with small closely set puncta, and with minor ribs radiating from the larger ridges and tubercles; the posterior portion of the shell is also sometimes marked with distinct angular recticulations, as in fig. 9. Sometimes, however, the shell-sculpture is very feebly developed (fig. 6), the tubercles and ridges being very faintly indicated, the general surface obscurely pitted, and bearing a few short rigid hairs. Hinge-processes strongly developed.

Length, $\frac{1}{28}$th of an inch.

Between the simplest and the most elaborately sculptured forms all shades of variation may be found, and we have not been able to detect any constant relation between the varieties of sculpture and the geological position or other conditions of life; the most ornate and the most simple forms are found living in our own seas almost side by side, and have apparently existed in a similar manner in the seas of the Glacial Epoch. Various stages of growth are represented in figs. 13—16. *C. concinna* has been found in the recent state in the Arctic Sea, and on the coasts of Norway, Canada, Scotland, and north of England; its range of depth appears to be from ten to sixty fathoms.

Distribution. *Recent.*—Great Britain, Ireland, Norway, Gulf of St. Lawrence, Spitzbergen, Davis's Straits.

Fossil.—England: Bridlington. Scotland: in nearly all the Post-tertiary beds. Ireland: Woodburn, and New Docks, Belfast. Canada and Norway. Post-tertiary beds.

27. Cythere emaciata, *Brady*. Plate IX, figs. 14—17.

1866. Cythere emaciata, *Brady*. Brit. Assoc. Report, p. 210.
1868. — — *Brady*. Monog. Rec. Brit. Ostrac., p. 414, pl. xxxi, figs. 31—37.

Carapace (of the *male?*), as seen from the side, oblong, subquadrangular, greatest height situated in front and not equalling half the length. Anterior extremity forming a somewhat flattened curve and faintly toothed below; posterior rather narrower, obliquely concave above the middle and produced below into four or five short blunt teeth; superior margin sloping backwards almost in a straight line; inferior very slightly sinuated. Outline, as seen from above, compressed ovate, nearly thrice as long as broad; sides nearly parallel; anterior extremity obtuse and centrally emarginate; posterior broadly emarginate in the middle and produced on each side into a more or less conspicuous spinous lobe. Surface of the valves marked with two or three prominent longitudinal ribs, which towards the anterior extremity anastomose, forming a network of large polygonal areolæ; the remainder of the shell is covered with large and deep subcircular excavations, which are arranged chiefly in longitudinal rows. The dorsal aspect shows a deep sulcus in the line of the hinge-margins, and the contact-margins on the ventral surface are considerably introverted and bordered by a wide smooth band.

Length, $\frac{1}{33}$rd of an inch.

Cythere emaciata occurs in the living state in depths of ten to thirty fathoms on the southern shore of England, and the west of Ireland and Scotland; the Scottish specimens, however, being few and stunted in growth.

Distribution. *Recent.*—Great Britain and Ireland.

Fossil.—Raised beaches, Oban and Portrush.

28. Cythere quadridentata, *Baird*. Plate XIII, fig. 22.

1850. Cythere quadridentata, *Baird*. Brit. Entom., p. 173, pl. xxi, fig. 2.
1868. — — *Brady*. Monog. Rec. Brit. Ostrac., p. 413, pl. xxxi, figs. 19—30.

Carapace, as seen from the side, oblong, quadrangular, or subcuneate, highest in front, height equal to about half the length. Anterior extremity obliquely rounded, often bearing a row of from eight to twelve small teeth; posterior extremity narrowed, angular, excavated above and considerably produced below, where it is generally armed with about four sharp spines: inferior margin straight or slightly convex; superior elevated over the anterior hinge, thence sloping backwards. Seen from above, oblong-ovate or hastate, greatest width situated behind the middle and equal to less than half the length, the junction of the hinge-margins marked behind the middle by a deep, sharply defined sulcus; ventral surface depressed along the whole length of the contact-margins, which are bordered by a broad, well defined, smooth band. Surface of the shell marked with oblong punctures, which are arranged chiefly in longitudinal rows, but around the anterior border in curved lines. The valves are usually swollen behind, forming an abrupt angular elevation, from which a longitudinal rib runs directly forwards, and two others in an oblique direction towards the upper and lower margins. Left valve considerably smaller than the right.

Length, $\frac{1}{33}$rd of an inch.

We have met with only one fossil specimen of this species, and from it our figure is taken; but, as this carapace is by no means well characterized, our description is taken from recent specimens.

Distribution. *Recent.*—Great Britain, Ireland, Bay of Biscay.

Fossil.—Scotland: Loch Gilp.

29. Cythere angulata (*G. O. Sars*). Plate IV, figs. 17—24; and Plate X, fig. 22.

1865. Cythereis angulata, *G. O. Sars.* Overs. Norg. mar. Ostrac., p. 40.
1865. Cythere clathrata, *var.* nuda, *Brady.* Zool. Trans., vol. v, p. 377, pl. lix, figs. 9, 10.
1868. — angulata, *Brady.* Monog. Rec. Brit. Ostrac., p. 409, pl. xxvi, figs. 39—42.

Carapace of the *female*, as seen from the side, oblong, subquadrangular, greatest height over the anterior hinge and equal to more than half the length. Anterior extremity broadly and somewhat obliquely rounded, traversed by numerous radiating hair-like lines; posterior subtruncate, projecting angularly in the middle, its lower half produced backwards and often divided into four or five small teeth; upper margin highest over the anterior hinge, thence sloping with a slight convexity to the posterior extremity, where it ends in an obtuse angle; inferior straight or only slightly sinuated. Outline, as seen from above, oblong, subhexagonal; sides nearly parallel and more or less constricted in the middle; extremities abruptly tapered, obtuse; margins irregularly sinuous; twice as long as broad; hinge-line marked on the dorsal aspect by a deep, sharply cut sulcus. Shell-surface bearing a few distant, short, rigid hairs, and ornamented with large, deep, angular excavations, mostly arranged in irregularly waved or radiating lines; there is usually a conspicuous rounded tubercle a little below and in front of the centre of the valve, and two broad, rounded, and elevated ridges, one running parallel with the ventral, the other with the dorsal margin, on the posterior half of the valve; these are confluent behind, ending abruptly and thus forming a well-marked transverse ridge or declivity; there is also a narrow elevated ridge running parallel to and within the anterior margin.

Length, $\frac{1}{40}$th of an inch.

This species, like *C. concinna,* varies much in the amount of sculpture visible on its valves, some specimens, as shown in fig. 17, being poorly marked, while others, of which fig. 21 is a fair example, are very highly ornamented. In the British seas, at the present day, it seems to be of rare occurrence, and confined to the northern and western shores of Scotland, where it lives in considerable depths of water. It has been found also by G. O. Sars on the coast of Norway.

Distribution. *Recent.*—Baffin's Bay, Norway, Great Britain, Davis's Straits.

Fossil.—England: Bridlington. Scotland: nearly all the clay beds of the Clyde district; Raised beach, Oban; Drip Bridge. Ireland: Portrush. Norway.

30. Cythere latimarginata, *Speyer.* Plate XVI, fig. 6.

1863. Cythere latimarginata, *Speyer.* Die Ostrac. der Casseler Tertiärbild., p. 22, pl. iii, figs. 3 *a—d.*
1865. — abyssicola, *G. O. Sars.* Overs. Norg. mar. Ostrac., p. 43.

Shell of the *female,* as seen from the side, elongated, subquadrangular, much higher in front than behind, greatest height not more than half the length; anterior extremity obliquely rounded; posterior truncate; superior margin very prominent and angulated above the eyes, slightly concave in the middle, then convex, and steeply sloping towards the hinder end; inferior distinctly sinuated in the middle. Seen from above, of irregular form, showing on each lateral margin two subangular protuberances separated by a deep furrow, both extremities being a little produced and truncate. Valves very hard in structure, indistinctly areolated in the middle, surrounded by a wide and much thickened margin, which forms two lips, the innermost of which is at each extremity minutely dentate, and especially towards the posterior extremity is beset with rather long hairs. Hinge-teeth of the left valve obsolete.

Length, $\frac{1}{30}$th of an inch.

One valve only of this species has come under our notice, from Hopton Cliff, near Yarmouth, and, this being imperfect we have had recourse for our description to the original account given by G. O. Sars. Our figure, however, is copied accurately from the Hopton Cliff specimen.

Judging from the carefully drawn figures of Dr. Speyer, which, though too small, offer a delightful contrast to the almost useless illustrations of fossil *Ostracoda* usually produced in Germany, we have no doubt that his *Cythere latimarginata* really refers to the species better known to us by the more recent description (from the living animal) of Sars under the name *abyssicola*. On the ground of priority, however, we here adopt Speyer's specific name.

DISTRIBUTION. *Recent.*—Norway and Shetland.

Fossil.—England: Hopton Cliff. Germany: Middle Tertiary, Cassel.

31. CYTHERE TUBERCULATA (*G. O. Sars*). Plate V, figs 7—12.

1865. CYTHEREIS TUBERCULATA, *G. O. Sars*. Overs. Norg. mar. Ostrac., p. 37.
1865. CYTHERE MUTABILIS, CLATHRATA, *var.* LYRATA, et ? *var.* LATIMARGINATA, *Brady*. Trans. Zool. Soc., p. 377, pl. lix, figs. 12, 13, 14.
1868. — TUBERCULATA, *Brady*. Monog. Rec. Brit. Ostrac., p. 406, pl. xxx, figs. 25—41 (not *Cytherideis tuberculata* of Jones, Monog. Tert. Entom., p. 47).

Carapace of the *female*, as seen from the side, oblong, subquadrangular or subovate, highest over the anterior hinge; greatest height equal to rather more than half the length. Anterior extremity broad, obliquely rounded, and fringed on its lower half with a series of (12—20) short equal teeth; posterior extremity narrower, evenly rounded and bearing usually near the lower angle four, five, or six teeth rather larger than, but of similar character to, those on the anterior margin. Superior margin sinuated behind the anterior hinge, thence sloping backwards with an irregularly sinuous (or sometimes twice or thrice sharply emarginate) curve; inferior margin gently sinuated in the middle. Outline, as seen from above, ovate, widest in the middle, extremities evenly and somewhat obtusely pointed, margins irregularly sinuous, width scarcely equalling half the length. End-view irregularly and broadly ovate, height not much exceeding the width. Carapace of the *male* (fig. 11) much narrower and more elongated, dorsal margin more conspicuously angulated at each extremity, ventral margin more deeply sinuated. Surface of the shell marked throughout with large, deep, irregularly shaped pittings, the interspaces of which often bear a few scattered setiferous papillæ, bearing also three more or less conspicuous eminences, one rounded and situated near the middle, the others elongated and occupying the posterior third of the valve; these, especially the two posterior, are often almost obsolete.

Length, $\frac{1}{28}$th of an inch.

Cythere tuberculata is one of the commonest and most widely distributed of living British Ostracoda, occurring chiefly in depths of 10—30 fathoms. Like its near allies, *C. concinna, angulata, quadridentata*, &c., it exhibits much variation in outline and in surface-marking, and, as also in those species, the tubercular elevations are much more conspicuous in very young than in old specimens, though the contrary holds good with regard to the pitting or excavation of the shell.

DISTRIBUTION. *Recent.*—Baffin's Bay, Great Britain, Ireland, Norway, Spitzbergen, Bay of Biscay, West Indies, Gulf of St. Lawrence.

Fossil.—Occurring in nearly all the Post-tertiary beds in the Clyde district; on the east of Scotland, Gamrie, Annochie, King Edward, Wick, Drip Bridge. England: Bridlington, Hopton Cliff, Branston Fen. South Wales: Cardiff New Dock Basin. Ireland: Woodburn, Belfast New Docks. Norway, Post-tertiary beds.

32. CYTHERE LOGANI, *Brady* and *Crosskey*. Plate XV, figs. 17, 18.

1871. CYTHERE LOGANI, *Brady* and *Crosskey*. Geol. Mag., vol. viii, p. 63, pl. ii, figs. 8—9.

Shell, seen laterally, subquadrate, highest in front, greatest height equal to more than half the length; anterior extremity broadly and well rounded; posterior narrower and obliquely rounded; superior margin straight in its general direction, but much jagged and emarginate throughout, terminating in an obtuse angle behind; inferior slightly sinuated, curved upwards towards the posterior extremity. Seen from above, the outline is irregularly ovate, with obtusely rounded extremities. Surface of the valves marked with large and deep angular fossæ, near the middle bearing a rounded tubercle and near the posterior extremity two large tubercular elevations.

Length, $\frac{1}{26}$th of an inch.

It is not without hesitation that we identify the single valve on which the foregoing description is founded with *C. Logani*; yet, though the contour of the shell differs in some not unimportant particulars from the types of that species, its general aspect and style of sculpture are so nearly similar that we think it best, for the present at least, to consider it as belonging to the same species.

DISTRIBUTION. *Fossil.*—Scotland: Elie. Canada: Montreal.

33. Cythere emarginata (*G. O. Sars*). Plate V, figs. 1—6.

1865. Cythereis emarginata, *G. O. Sars*. Overs. Norg. mar. Ostrac., p. 38.
1868. Cythere — *Brady*. Monog. Rec. Brit. Ostrac., p. 475.

Carapace of the *female*, as seen from the side, subreniform, highest in the middle, greatest height equal to considerably more than half the length. Anterior extremity obliquely rounded; posterior produced below into a prominent angular lobe; superior margin boldly arched, highest in the middle; inferior slightly sinuated in front of the middle and curved upwards behind. Outline, as seen from above, compressed, ovate, extremities obtusely mucronate. The right valve very different from the left, higher and more boldly arched, sinuated in front of the anterior hinge; posterior extremity more deeply emarginate, and more prominent below. The carapace of the *male* is distinctly quadrangular, its greatest height little exceeding half the length and situated over the anterior hinge; superior margin only slightly curved; posterior obliquely truncate. Surface of the valves irregularly sculptured with large angular excavations, which behind terminate abruptly in a transverse ridge a little in front of the posterior margin, and below in a sharply defined ventral rib, which is most strongly developed posteriorly. Hinge-line on the dorsal surface marked by a deep, sharply cut sulcus; hinge-teeth strongly developed.

Length, $\frac{1}{30}$th of an inch.

Distribution. *Recent.*—Arctic Seas, Norway, Shetland, Iceland, Spitzbergen, Gulf of St. Lawrence.

Fossil.—England: Bridlington. Scotland: Barrie, Elie, Errol. Ireland: Portrush. Norway and Canada.

34. Cythere costata, *Brady*. Plate V, figs. 21—24.

1865. Cythere costata, *Brady*. Trans. Zool. Soc. vol. v, p. 375, pl. lx, figs. 5 *a—f*.
1869. — — *Norman*. Brit. Assoc. Report, 1868, p. 290.

Carapace of the *female*, as seen from the side, subquadrangular, highest in front of the middle, greatest height equal to somewhat more than half the length. Anterior extremity subtruncate, emarginate above, produced below, and divided into four or five short obtuse teeth; superior margin arched, gently sinuated in front. Outline, as seen from above, ovate, widest in the middle; extremities obtusely mucronate, margins irregular. The carapace of the *male* is longer, narrower, and distinctly quadrangular, its greatest height situated in front and equal to less than half the length; superior margin distinctly angular over the anterior hinge, behind which it is slightly excavated, and then slopes backwards almost in a straight line; posterior margin obliquely truncate. Shell-surface deeply marked with irregular angular excavations, and with three or more prominent obliquely transverse ribs. Hinge-teeth strongly developed.

Length, $\frac{1}{25}$th of an inch.

C. costata has been found living amongst the Shetland Islands and in Baffin's Bay, at a depth of 60—70 fathoms. It is very nearly allied to *C. emarginata*, being distinguished from that species chiefly by its greater size and narrower proportions, as well as by its prominent oblique ridges, and the dentation of its infero-posterior angle.

DISTRIBUTION. *Recent.*—Arctic Seas, Shetland, Gulf of St. Lawrence.

Fossil.—England: Bridlington, Hopton Cliff. Scotland: Paisley.

35. CYTHERE MIRABILIS, *Brady*. Plate VII, figs. 22—26; Plate XV, figs. 13—16.

1868. CYTHERE MIRABILIS, *Brady*. Monog. Rec. Brit. Ostrac., p. 415, pl. xxix, figs. 7, 8.

Carapace of the *female*, as seen from the side, subtrapezoidal, highest at the anterior third, greatest height equal to two thirds of the length. Anterior extremity broad, boldly rounded, and bordered below with a series of ten to twenty short, blunt spines; posterior narrow, truncate, bearing about four blunt spines at its inferior angle. Superior margin prominently angular over the anterior hinge, behind which it is two or three times deeply and abruptly excavated, thence sloping with a steep, irregularly jagged curve to the posterior extremity, where it ends in an obtuse angle; inferior margin gently and evenly convex. Outline, as seen from above, ovate, with flattened sides, width equal to more than half the length: posterior extremity rounded, prominent in the middle, and bearing numerous sharp, irregularly placed spines; anterior margin obtuse, irregularly denticulate or spinous. Surface of the shell sculptured on the central and centro-dorsal portions with large, deep, and sharply cut polygonal excavations, and round the margins with wide, concentric furrows, which are separated from each other by sharp ribs, sparingly anastomosing, and especially strong and prominent on the ventral surface. Hinge-joint formed on the left valve by a very strong central bar, terminating anteriorly in a prominent tooth, and posteriorly in a sharply defined sulcus; on the right valve by two very large terminal teeth, the anterior of which is triangular and fang-like; the posterior broad and obliquely truncate. The shell of the *male* is, as usual, more compressed and elongated.

Length, $\frac{1}{22}$nd of an inch.

DISTRIBUTION. *Recent.*—Scotland, Spitzbergen.

Fossil.—England: Bridlington. Scotland: Barrie, Elie, Dryleys, Errol, Wick.

36. CYTHERE HOPTONENSIS, *nov. sp.* Plate XIV, figs. 4—6.

Left valve, as seen from the side, subquadrangular, oblong, greatest height situated over the anterior hinge-tubercle, and equal to nearly two thirds of the length; anterior extremity obliquely rounded; posterior subtruncate, prominent and rounded below the middle; superior margin sloping from before backwards and distinctly excavated towards each extremity; inferior nearly straight; seen from above, the outline is irregularly ovate, with broadly and obtusely mucronate extremities. The outline of the right valve presents an evenly arched, though flattened dorsal margin, the lower angle of the posterior margin being also much more distinctly produced. The surface of the shell is covered with rather sharp and irregularly convoluted ridges, and with distinct crests running parallel to the anterior and lower borders.

Length, $\frac{1}{33}$rd of an inch.

DISTRIBUTION, *fossil.*—England: Hopton Cliff.

37. CYTHERE DUNELMENSIS (*Norman*). Plate V, figs. 13—20; Plate XI, figs. 36, 37.

1865. CYTHEREIS DUNELMENSIS, *Norman.* Nat. Hist. Trans. Northumberland and Durham, vol. i, p. 22, pl. vii, figs. 1—4.
1865. — HORRIDA, *G. O. Sars.* Overs. Norg. mar. Ostrac., p. 45.
1868. CYTHERE DUNELMENSIS, *Brady.* Monog. Rec. Brit. Ostrac., p. 416, pl. xxx, figs. 1—12.

Carapace of the *female*, as seen from the side, subquadrangular, greatest height equal to more than half the length, and situated over the arterior hinge. Anterior extremity broadly rounded; posterior somewhat narrower and rectangularly truncate; superior margin nearly straight, highest in front; inferior slightly sinuated, the whole circumference being much jagged and spinous. Outline, as seen from above, ovate, extremities obtuse. The shell of the *male* is longer, narrower, and distinctly quadrangular, and its infero-posteal angle is produced into a more or less conspicuous squamous and spinous plate. The surface of the shell is marked by large subhexagonal excavations, the intervals between which are beset with several strong spines of irregular shape and size, which are much larger in the male than in the female; there is also a row of spinous tubercles parallel to and a little within the anterior margin, the series being continued with less regularity along the greater part of the ventral margin. Hinge-tubercles large, shining, and prominent, especially in the male. Hinge-teeth very strongly developed, shell very thich and strong.

Length, $\frac{1}{28}$th of an inch.

Cythere Dunelmensis is not very rare in the living state in the seas of Norway, Scotland, and Northern England, mostly inhabiting depths of fifteen fathoms and upwards. The reticulation of the surface is often obscure, and its spinous armature is very variable in strength and general development. Young specimens (fig. 19) are subovate in form, with the margins arched and the angles well rounded off. The form figured in Plate XI, figs. 36, 37, which we at one time supposed to belong to a distinct species, is without doubt the young stage of *C. Dunelmensis;* between this and the adult form almost all gradations of growth have been observed.

DISTRIBUTION. *Recent.*—Great Britain and Ireland, Gulf of St. Lawrence, Arctic Seas, Spitzbergen.

Fossil.—England: Bridlington. Scotland: nearly all the Post-tertiary beds. Ireland: Belfast and Woodburn.

38. CYTHERE WHITEII (*Baird*). Plate XII, figs. 1—3.

1850. CYTHEREIS WHITEII, *Baird.* Brit. Entom., p. 175, pl. xx, figs. 3, 3 *a.*
1868. CYTHERE — *Brady.* Monog. Rec. Brit. Ostrac., p. 416, pl. xxx, figs. 21—24.

Carapace, as seen from the side, oblong, quadrangular, nearly equal in height throughout, height equal to half the length; anterior margin rounded and more or less spinous, conspicuously elevated over the anterior hinge-joint; posterior almost rectangularly truncate, and mostly bearing two or more large backward-pointing spines at its lower termination; superior and inferior margins almost straight, but more or less bluntly toothed behind the middle. Seen from above, the outline is ovate, widest behind the middle, the greatest width being somewhat less than the height, only slightly tapering towards the broadly mucronate or subtruncate extremities. The valves are ornamented with three or four longitudinal rows (more or less interrupted) of blunt rounded spines, and between the rows are a few smaller scattered tubercles of similar character.

Length, $\frac{1}{28}$th of an inch.

In the recent state this is, perhaps, almost the rarest of the strongly spinous species of *Cythere*, which are represented more commonly by *C. Dunelmensis*, *Jonesii*, and *antiquata*. In those localities where it has been noticed the number of examples found has been extremely small, and the same remark applies to the fossil specimens.

DISTRIBUTION. *Recent.*—Great Britain, Levant, Gulf of St. Lawrence.

Fossil.—Belfast New Docks.

39. CYTHERE ANTIQUATA (*Baird*). Plate XII, figs. 8—10.

1850. CYTHEREIS ANTIQUATA, *Baird*. Brit. Entom., p. 176, pl. xx, fig. 2.
1868. CYTHERE ANTIQUATA, *Brady*. Monog. Rec. Brit. Ostr., p. 417, pl. xxx, figs. 17—20.

Carapace, as seen from the side, rectangular, quadrilateral, about equal in height throughout, length equal to nearly twice the height; anterior extremity broadly rounded; posterior rectangularly truncate, both extremities spinous below the middle, the spines of the posterior much longer and stronger than those of the anterior margin; superior and inferior margins parallel, the latter almost straight, the former cleft into three or four angular segments with intervening sulci and forming an angular elevation over the anterior hinge. Seen from below, oblong with projecting lateral alæ, which taper towards the front, but terminate abruptly behind, giving to the whole a somewhat arrow-headed outline. From above the outline is more irregular. Surface of the shell more or less tuberculated, bearing two conspicuous longitudinal crests, which terminate abruptly in angular elevations near the posterior extremity of the valves; these ribs are mostly perforated at the base, the rows of apertures thus produced being very conspicuous on the ventral aspect of the shell. The "eye-tubercle" is very large and prominent.

Length, $\frac{1}{30}$th of an inch.

The characters which chiefly distinguish this from the much rarer species *C. Whiteii* are the more marked rectangular outline, the sharply cut, knife-like, and perforated longitudinal ridges, and the much laciniated or jagged dorsal margin.

DISTRIBUTION. *Recent.*—Great Britain, Ireland, Bay of Biscay, Levant.

Fossil.—Scotland: Raised beach, Oban. Ireland: Belfast New Docks.

40. Cythere Jonesii (*Baird*). Plate XII, figs. 4—7.

1850. Cythereis Jonesii, *Baird.* Brit. Entom., p. 175, pl. xx, fig. 1; Norman (1865), Nat. Hist. Trans. Northumberland and Durham, vol. i, p. 21, pl. vii, figs. 5—8.

1852. Cythere ceratoptera, *Bosquet.* Entom. foss. terr. tert. France, p. 114, pl. vi, fig. 2; Jones (1856), Monog. Tert. Entom., p. 39, pl. iv, fig. 1.

1856. ? Cythereis cornuta (young), *Jones.* Monog. Tert. Entom., p. 39, pl. iv, fig. 19.

1862. — fimbriata, *Norman.* Ann. Mag. N. H., ser. iii, vol. ix, pl. iii, fig. 9.

1865. — spectabilis, *Sars.* Overs. Norg. mar. Ostrac., p. 46.

1865. — subcoronata, *Brady.* Trans. Zool. Soc., vol. v, p. 384, pl. lx, figs. 9 *a—e*, and (?) Speyer (1863), Ostrac. Casseler Tertiärbild., p. 38, pl. iv, figs. 9, 10.

1868. Cythere Jonesii, *Brady.* Monog. Rec. Brit. Ostrac., p. 418, pl. xxx, figs. 13—16.

Carapace, as seen from the side, ear-shaped or subquadrangular, higher in front than behind, greatest height considerably more than half the length; anterior margin rounded, fringed with blunt spines below the middle; posterior subtruncate, armed with a series of strong spines which are largest towards the ventral angle; inferior margin gently convex; superior much shorter than the inferior, sloping gently from before backwards, its anterior extremity forming a conspicuous angular elevation: Outline, as seen from below, irregularly lozenge-shaped or subrhomboidal, bordered with strong spinous projections, which gradually increase in size from the front to the posterior third, where they terminate abruptly; greatest width equal to two thirds of the length, situated behind the middle. End-view triangular, equilateral; the base perfectly straight. The surface of the shell is quite smooth and rises gradually from the front to near the posterior extremity of the valves, there forming an abrupt spinous declivity. A strongly developed ridge commences at the anterior hinge or "eye-tubercle," running a little within and parallel to the anterior and inferior margins, as far as the transverse declivity just described; this ridge is in the first portion of its course smooth and rounded, but near the middle of the anterior margin becomes spinous and retains that character to the end, the spines of which it is composed being about ten in number, very large and strong, rounded at the tips; a little below and behind the middle of the superior margin is a shorter row of similar strong processes, three or four in number and arranged longitudinally.

Length, $\frac{1}{28}$th of an inch.

Var. CERATOPTERA (Plate XII, fig. 7).

This differs from the typical form of the species, only in the greater delicacy of its shell-structure and the more attenuated condition of its spinous armature. Our fossil specimens, of which fig. 7 gives a correct idea, do not exhibit these peculiarities so conspicuously as do recent carapaces dredged in the west of Ireland, or more especially in the Mediterranean and Bay of Biscay; but between the extreme forms of these latter localities and the robust strongly armed carapaces of the Dogger bank and still more northern habitats—which we look upon as constituting the typical *C. Jonesii*—every grade of development may be met with.

DISTRIBUTION. *Recent.*—Norway, Great Britain.—(var. *ceratoptera*), Ireland, Bay of Biscay, Levant.

Fossil.—Ireland: Post-tertiary, Belfast New Docks (var.). England: Pliocene, Suffolk. Belgium and France: Eocene.

41. CYTHERE (?) SEMIPUNCTATA, *Brady.* Plate XVI, figs. 11, 12.

1868. CYTHERE (?) SEMIPUNCTATA, *Brady.* Monog. Rec. Brit. Ostrac., p. 411, pl. xxix, figs. 33—38.

Carapace, as seen from the side, subreniform, nearly equal in height throughout, height equal to fully half the length, extremities well and evenly rounded; superior margin very slightly arched; inferior gently sinuated in the middle. Seen from above, compressed, oblong, width equal to one third of the length, lateral margins nearly parallel, extremities produced and broadly truncate. Shell thick, smooth in front, but behind the middle covered with rounded and rather large impressed puncta. Within the anterior and inferior margins the valves are hollowed out so as to form a wide channel, the margins themselves being thickened and everted.

Length, $\frac{1}{50}$th of an inch.

DISTRIBUTION. *Recent.*—Bay of Biscay, England, and Ireland.

Fossil.—Scotland: Raised-beach, Oban.

Genus 2.—Limnicythere, *Brady*.

Shell irregularly tuberculated or spinous, rather thin and horny in texture. Animal like that of *Cythere*, except that the antennæ are armed with short setæ, instead of spines. Upper antennæ five-jointed, slender, the last joint much elongated, the antepenultimate excessively short. Post-abdomen terminating in two rather stout setæ.

Freshwater habitat.

1. Limnicythere inopinata (*Baird*). Plate X, figs. 8—11.

1850. Cythere inopinata, *Baird.* Brit. Entom., p. 172, pl. xx, figs. 1, 1 *a—e*.
1868. Limnicythere — *Brady.* Monog. Rec. Brit. Ostrac., p. 419, pl. xxix, figs. 15—18; pl. xxxviii, fig. 9; pl. xxxix, fig. 1.

Carapace, as seen from the side, reniform, greatest height near the middle and somewhat exceeding half the length; anterior extremity evenly, posterior obliquely rounded, and fringed below the middle with a series of from six to twelve small sharp teeth; superior margin forming a flattened arch, inferior deeply sinuated in the middle. Seen from above, the outline is irregularly ovate, conspicuously and sharply mucronate in front and more obscurely behind; greatest width behind the middle, and scarcely equal to half the length. Surface of the valves finely punctate, once or twice transversely sulcate, and usually bearing from one to three tubercles; margins produced into a compressed encircling flange. Colour yellowish.

Length, $\frac{1}{45}$th of an inch.

The tuberculation and general surface-sculpture of this species vary very much; sometimes, as in the specimen here figured, there is scarcely any tuberculation; in other cases there may be one, two, or three tubercles, which of course very much modify the outline of the shell when viewed from above. Our fossil specimens, however, are as a general rule less uneven than the recent ones.

Distribution. *Recent.*—Great Britain, Ireland.

Fossil.—Scotland: Crofthead, Dipple. England: Hornsea, Branston Fen.

2. Limnicythere? antiqua, *nov. sp.* Plate XVI, figs. 4, 5.

Carapace, as seen from the side, oblong, subreniform, higher in front than behind, height equal to half the length. Extremities well and evenly rounded, the posterior much the smaller; superior margin sloping almost in a right line from before backwards, inferior deeply and suddenly sinuated in the middle; seen from above, compressed ovate, with slender acuminate extremities, greatest width a little in front of the middle, and equal to one third of the length. Shells marked with a faintly striato-reticulate pattern and with a bicurvate transverse furrow near the middle of the valve.

Length, $\frac{1}{60}$th of an inch.

It may perhaps be doubted whether this form be not referable to the young or some local variety of the foregoing species; its chief distinctive characters are the narrowed posterior extremity, straight dorsal margin, and faint surface-sculpture, just such as are usually presented by young shells, but we have not as yet seen any distinctly intermediate forms, nor are we sure as to the young of the recent *L. inopinata.*

Distribution. *Fossil.*—Scotland: Crofthead, Terally, Dipple.

3. Limnicythere Sancti-Patricii, *Brady* and *Robertson.* Plate II, figs. 1—3.

1869. Limnicythere Sancti-Patricii, *B.* and *R.* Ann. Mag. N. H., ser. iii, vol. iv, pl. xviii, figs. 8—11; pl. xxi, fig. 4.

Carapace (of the *male?*), as seen from the side, reniform, nearly equal in height throughout, height equal to half the length; extremities well rounded, the anterior slightly the broader; superior margin almost straight, inferior deeply sinuated in the middle. Seen from above, the outline is irregularly rhomboidal, widest somewhat behind the middle; extremities acuminate; greatest width rather less than the height. Seen from the front, the outline is widest at the base, with gradually converging sides and broadly arched apex; ventral margin convex, and prominently keeled in the middle. Surface of the valves sculptured with small, closely set, polygonal excavations, and marked across the middle with a conspicuous broad and deep curved furrow, in front of which is another, of similar character, but smaller; behind the posterior furrow the shell rises towards the ventral surface into a prominent rounded eminence: the ventral surface is furrowed in a longitudinal direction, and also marked more or less with cross striæ.

Distribution. *Recent.*—Great Britain, Ireland.

Fossil.—England: Branston Fen, Lincolnshire.

4. Liminicythere monstrifica (*Norman*). Plate II, figs. 8 *a—d*.

1862. Cypris monstrifica, *Norman.* Ann. Mag. N. H., vol. ix, p. 45, pl. iii, figs. 4, 5.
1868. Limnicythere — *Brady.* Monog. Rec. Brit. Ostrac., p. 420, pl. xxix, figs. 9—12.

Valves, as seen from the side, oblong, subreniform, strongly spinous and tuberculated, greatest height near the middle, and equal to about half the length. Extremities boldly rounded, the anterior bearing on each valve a marginal row of about twelve small sharp spines. Superior margin straight, angulated at its anterior extremity, whence it slopes gently downwards and backwards; inferior margin deeply sinuated. Seen from above, compressed, irregularly ovate, lateral margins having two large spinous processes, and several smaller spines and ridges; extremities prominently mucronate. End-view subquadrate, irregularly angulated. Valves closely punctate, furrowed across the middle; one strong spinous tubercle on the anterior, and two on the posterior half of each valve; posterior portion also beset with numerous small spines.

Length, $\frac{1}{33}$rd of an inch.

Distribution. *Recent.*—England.

Fossil.—England: Branston Fen, Lincolnshire.

Genus 3.—Cytheridea, *Bosquet.*

Valves unequal, the left mostly larger than the right, ovate or subtriangular, highest at the anterior third. Surface smooth, or marked with scattered circular tubercles, impressed puncta, or concentric furrows, anterior extremity rarely spinous, posterior sometimes bearing a single spine at its inferior angle. Lucid spots arranged in a transverse row of three or four, with two detached, sometimes coalescent, spots in front. Hinge composed of two crenated or "knurled" crests on the left (sometimes the right) valve which articulate with corresponding depressions of the opposite valve. Upper antennæ very robust, mostly five-jointed, and bearing strong spines; the last joint narrow and elongated; lower antennæ four-jointed; urticating setæ long and slender, biarticulate. Mandibles large and numerously toothed; palp three-jointed, and bearing a distinct branchial appendage. The right foot of the first and second pairs in the male different from the rest, that of the first pair very strong and prehensile; of the second very feeble, the apical portion rudimentary and destitute of a terminal claw. Eyes distinct.

We include in this genus the species referred by Prof. T. Rupert Jones and G. O. Sars to *Cyprideis*, as we are unable to find any sufficient character to distinguish these from the typical *Cytheridea* of M. Bosquet. Sars proposes to confine the generic term *Cytheridea* to the form typified by his *C. dentata;* but the animal structure of this species is quite unknown, and the shell does not appear to exhibit any marked differentiating character; the difference seems to us to be one of degree merely.

Certain species of *Cytheridea* are very abundant and widely distributed in the seas of the present day, but the number of species is comparatively few. Most of the forms described in this Monograph are, however, still flourishing in the British areaa.

1. Cytheridea papillosa, *Bosquet.* Plate VI, figs. 12—15.

1852. Cytheridea papillosa, ***Bosquet.*** Entom. foss. terr. tertiair. France, p. 42, pl. ii, fig. 5.
1865. Cythere Bradii, ***Norman.*** Nat. Hist. Trans. Northumb. and Durham, vol. i, p. 15, pl. v, figs. 5—8; see also note, p. 28.
1865. Cyprideis Bairdii, ***G. O. Sars.*** Oversigt af Norges marine Ostracoder, p. 52.
1865. Cytheridea papillosa, ***Brady.*** On new or imperfectly known species of Marine Ostracoda; Trans. Zool. Soc., vol. v, p. 370, pl. lviii, figs. 8 *a—g*.
1868. — — ***Brady.*** Monog. Rec. Brit. Ostrac., Trans Lin. Soc., vol. xxvi, p. 423, pl. xxviii, figs. 1—6, pl. xl, fig. 1.

Carapace of the *female*, as seen from the side, subovate, highest near the middle; greatest height equal to rather more than half the length. Anterior extremity evenly, posterior obliquely rounded. Superior margin well arched, forming a continuous curve as far as the infero-posteal angle of the carapace, inferior margin slightly sinuated in the middle, the infero-posteal angle more exserted. Outline, as seen from above, ovate, widest behind the middle, greatest width equal to half the length; end-view nearly circular; surface of the shell smooth and polished, bearing numerous scattered circular tubercles or papillæ, and sometimes slightly punctate. Lucid spots large and conspicuous.

The shell of the *male* is narrower and more elongated, and its dorsal margin is much flattened and nearly parallel with the ventral.

Length, $\frac{1}{30}$th of an inch.

This species has been already identified by one of us with M. Bosquet's *Cytheridea* *papillosa;* and though the British specimens, both recent and fossil, are considerably larger than those obligingly sent to us from France by M. Bosquet, they so perfectly agree in every other respect that we can scarcely do otherwise than adopt the name *papillosa* already applied to them by Mr. Brady. In habitat it ranges from extreme low-water-mark to twenty or thirty fathoms, and is also found, but much less abundantly, in greater depths of water.

Distribution. *Recent.*—Baffin's Bay, Gulf of St. Lawrence, Norway, Spitzbergen, Great Britain.

Fossil.—England: Bridlington. Scotland: nearly all the Post-tertiary beds. Norway and Canada: Post-tertiary beds. France: Tertiary.

2. Cytheridea punctillata, *Brady.* Plate VI, figs. 1—11.

1865. Cytheridea punctillata, *Brady.* Ann. Mag. Nat. Hist., ser. iii, vol. xvi, p. 189, pl. ix, figs. 9—11. 1868, Monog. Brit. Ostrac., p. 424, pl. xxvi, figs. 35—38; pl. xxviii, figs. 17—20.

1865. Cyprideis proxima, *G. O. Sars.* Overs. Norg. mar. Ostrac., p. 54.

Carapace of the *female*, as seen from the side, subovate, highest in front of the middle, greatest height equal to more than half the length. Anterior extremity broadly and evenly, posterior somewhat obliquely rounded; superior margin highest over the anterior hinge, where it is obscurely angular, thence sloping backwards with a gentle convexity; inferior straight or very slightly sinuated in the middle. Outline, as seen from above, ovate, greatest width in the middle, and equal to half the length; extremities obtusely pointed; end-view nearly circular. The carapace of the *male* (fig. 4) is much longer, narrower, and more angular, the posterior margin of the right valve sloping abruptly in a subtruncate manner. Surface of the shell thickly covered with impressed puncta, which have a tendency to coalesce or to form faintly-marked grooves. Specimens from certain localities (Jordan Hill, &c.) bear also numerous small circular elevated papillæ; in young specimens these constitute the only markings, but are displaced by the pitted sculpture as age advances. Many examples are profusely marked with both species of sculpture. Colour yellowish-brown.

Length, $\frac{1}{35}$th of an inch.

Cytheridea punctillata occurs in the living state on the shores of Britain and Norway in company with the preceding species, but is not nearly so common, nor is its range of habitat so great; it does not seem to approach nearer to the shore than depths of 15—20 fathoms. In the Glacial clays, however, it is much more abundant, being, perhaps, the commonest of all the Ostracoda in those formations. It may readily be distinguished from *C. papillosa* by its dull, unpolished surface, distinct punctation, and less conspicuous papillæ, as well as by the anterior elevation of the dorsal margin and the less exserted infero-posteal angle; it is also a considerably smaller species. The young forms of the two sexes are represented at figs. 6 and 7. *C. punctillata* approaches closely Bosquet's "*Bairdia*" (*Cytheridea*) *punctatella*, and *B. Hebertiana*, as also (*fide* Bosquet) to *C. Muelleri*, Münster; but it is not strictly referable to any of these forms. M. Bosquet himself considers it a distinct species.

Distribution. *Recent.*—Baffin's Bay, Gulf of St. Lawrence, Spitzbergen, Norway, Britain.

Fossil.—Occurring in nearly all the Scottish beds. Ireland: Woodburn and Portrush. England: Bridlington.

3. Cytheridea torosa (*Jones*). Plate XV, figs. 11, 12. *Var.* teres, Plate VII, figs. 1, 2.

1850. Candona torosa, *Jones*. Ann. Mag. Nat. Hist., ser. ii, vol. vi, p. 27, pl. iii, fig. 6.
1856. Cyprideis —, *Jones*. Monog. Tertiary Entom., p. 21, pl. ii, figs. 1 *a*—1 *i*, and Woodcut, fig. 2, p. 16.
1870. Cytheridea torosa, *Brady* and *Robertson*. Ann. Mag. N. H., ser. iv, vol. vi, p. 21, pl. viii, figs. 6, 7.

Carapace of the *female*, as seen from the side, oblong, subelliptical, greatest height in the middle, and equal to rather more than half the length. Extremities rounded, the posterior narrower and rather oblique. Dorsal margin gently and evenly arched, ventral straight or very slightly sinuated in front; at the infero-posteal angle there is often a short thick spine. Outline, as seen from above, oblong ovate, having on each lateral margin several (usually three) equidistant nodular projections with intervening sulci. The right valve is smaller than the left and slopes away much more steeply behind. The shell of the *male* is as usual much narrower, longer, and more angular. Shell very thick and strong, marked with closely set, rounded pittings, and bearing on each valve several (usually four) large, rounded, prominent tubercles. Colour yellowish or greenish-brown.

Length, $\frac{1}{28}$th of an inch.

Var. teres. Plate VII, figs. 1, 2.

1864. Cyprideis torosa, *Brady*. Trans. Tyneside Nat. Field Club, vol. vi, p. 108, pl. iii, figs. 11—23, and Ann. Mag. N. H., ser. iii, vol. xiii, p. 62, pl. iv, figs. 11—23.
1865. Cyprideis torosa, *G. O. Sars*. Overs. Norg. mar. Ostrac., p. 51.

1868. CYTHERIDEA TOROSA, *Brady*. Monog. Rec. Brit. Ostrac., p. 425, pl. xxviii, figs. 7—12; pl. xxxix, fig. 5.
1868. — LITTORALIS, *Brady*. Nat. Hist. Trans. Northumb. and Durham, vol. iii, p. 125.
1870. — TOROSA, *var.* TERES, *Brady* and *Robertson*. Ann. and Mag. N. H., ser. 4, vol. vii, p. 21.

This differs from the typical form in being altogether destitute of tubercular prominences, which are replaced in most cases by a shallow transverse median sulcus on the lateral aspect of the valves.

C. torosa is usually an inhabitant of brackish water, where it is often found living in immense numbers, the situations which it haunts being chiefly salt marshes and muddy estuaries. It has, however, though very rarely, been found in quite fresh water, and more frequently in shallow littoral situations exposed to purely marine influences; but in neither of these latter cases does it ever occur very abundantly.

We have not ourselves met with the typical tuberculated form of this species amongst Post-tertiary fossils, except in one locality, our examples being otherwise referable to the smooth variety (*teres,* Brady and Robertson).

DISTRIBUTION. *Recent.*—Norway, Great Britain, Ireland, Levant, Sea of Azoff.

Fossil.—England: Grays Thurrock. Scotland: Drip Bridge, Raised beach at Oban. South Wales: New Dock basin at Cardiff. Ireland: Portrush.

4. CYTHERIDEA LACUSTRIS (*G. O. Sars*). Plate VI, figs. 16—20.

1863. CYTHERE LACUSTRIS, *G. O. Sars*. Om en i Sommeren 1862 foretagen zoologisk Reise, p. 30.
1868. CYTHERIDEA — *Brady*. Monog. Rec. Brit. Ostrac., p. 427, pl. xxvi, figs. 18—21; pl. xl, fig. 2.

Carapace of the *female,* as seen from the side, subquadrangular, highest at the anterior third, greatest height equal to considerably more than half the length; anterior extremity broad and well rounded; posterior narrow and not so boldly rounded; superior margin highest over the anterior hinge, thence sloping rather steeply and in a more or less undulating line backwards; inferior margin deeply sinuated in the middle, thence sloping upwards and backwards with a gentle curve. Outline, as seen from above, ovate, the lateral margins subparallel, irregularly sulcate and tuberculate, extremities obtusely pointed, greatest width equal to half the length. End-view broadly and irregularly ovate. Surface of the shell marked with closely set angular pittings, and bearing on the lateral aspect several (2—5) large rounded tubercles. Hinge-processes (fig. 20) not crenulated, consisting of two not very prominent terminal projections of the right which articulate with corresponding sulci of the left valve. *Male* unknown.

Length, $\frac{1}{30}$th of an inch.

Cytheridea lacustris is an inhabitant of fresh water. It appears to be of rare occurrence in the living state, having been noticed only in two localities in Scotland and one in England and in some Norwegian lakes. The tubercular eminences of the shell are very variable in number and degree of elevation, sometimes being almost obsolete, and at others forming a very conspicuous feature. The generic position of the species must be looked upon as provisional until the male has been seen and examined in the recent state.

DISTRIBUTION. *Recent.*—Norway, Scotland, England.

Fossil.—England : Hornsea, Branston Fen. Scotland : Crofthead, Dipple.

5. CYTHERIDEA SORBYANA, *Jones*. Plate VII, figs. 7—12.

1856. CYTHERIDEA SORBYANA, *Jones*. Monog. Tert. Entom., p. 44, pl. iv, figs. 6 *a*—6 *e*.
1865. — DENTATA, *G. O. Sars*. Overs. Norg. mar. Ostrac. (right valve), p. 56.
1865. — INERMIS, *G. O. Sars*. Overs. Norg. mar. Ostrac. (left valve), p. 56.
1868. — SORBYANA, *Brady*. Monog. Rec. Brit. Ostrac., p. 428, pl. xxix, figs. 1—6.

Carapace, as seen from the side, broadly subtriangular, greatest height situated in front of the middle and equal to about two thirds of the length ; anterior extremity broadly rounded and bearing several (6—8) triangular spines, which point obliquely downwards and forwards ; posterior extremity narrow and somewhat exserted below ; superior margin much elevated and almost gibbous over the anterior hinge, thence sloping in a continuous and bold curve to the postero-ventral angle ; inferior margin almost straight, terminated behind by a single stout pointed spine, which projects obliquely downwards and backwards from the extremity of the right valve. The left valve is higher than the right, the spines on its anterior margin are often almost obsolete, and its posterior angle is rounded off and bears no spine. Outline, as seen from above, broadly oval, greatest width in the middle and equal to more than half the length, mucronate in front. Surface of the shell marked, except toward the centre, with coarse, irregularly sinuous, concentric furrows, and pitted, usually in the interspaces, with numerous minute punctures.

Length, $\frac{1}{30}$th of an inch.

We have seen only one perfect specimen of this species, which was found by Mr. Robertson amongst some clay from Norway. Detached valves, however, are not uncommon in some of our British clay beds, and a few examples, also separated valves, have been dredged in Shetland, and off the north-western shores of Scotland, in considerable depths (60 fathoms and upwards) of water.

DISTRIBUTION. *Recent.*—Norway, Scotland, Gulf of St. Lawrence, Spitzbergen.

Fossil.—England: Bridlington. Scotland: Elie, Dryleys, Errol, King Edward's, Tangyburn. Norway and Canada: Post-tertiary beds.

6. CYTHERIDEA (?) INORNATA, *n. sp.* Plate VII, figs. 3—6.

Carapace, as seen from the side, oblong, subreniform, highest behind the middle, greatest height equal to more than half the length. Anterior extremity obtusely, posterior boldly and obliquely rounded; superior margin forming a flattened curve, highest at the posterior third, inferior rather deeply sinuated in the middle. Outline as seen from above compressed, ovate, width considerably less than half the length. Surface perfectly smooth.

Length, $\frac{1}{33}$rd of an inch.

Except for its occurrence in company with distinctly marine species, we should almost have placed this in the genus *Candona*, to which it bears a very strong resemblance. Some undoubtedly marine forms have, however, been described (*Cytheridea Zetlandica*, Brady, and *C. nobilis*, Brady), which present very similar characters; but in none of these cases have the recent animals been procured in a state fit for anatomical examination. Their present generic position must consequently be looked upon as merely provisional.

DISTRIBUTION, *fossil.*—Scotland: Annochie.

7. CYTHERIDEA ELONGATA, *Brady.* Plate IX, figs. 10—13.

1850. CYTHERE ANGUSTATA, *Baird* (not of Münster). Brit. Entom., p. 172, pl. xxi, fig. 6.

1868. CYTHERIDEA ELONGATA, *Brady.* Monog. Rec. Brit. Ostrac., p. 421, pl. xxviii, figs. 13—16; pl. xl, fig. 6.

Carapace, as seen from the side, elongated, subreniform, higher behind than in front, greatest height situated near the middle and equal to considerably less than half the length; anterior extremity evenly, posterior obliquely rounded; superior margin forming a somewhat flattened arch, inferior distinctly sinuated in front of the middle and slightly protuberant behind. Outline as seen from above elongato-ovate, widest behind the middle, where the width is equal to little more than one third of the length, obtusely pointed in front, posterior extremity rounded and slightly indented in the middle. Hinge-processes feebly developed (fig. 13), consisting of two slightly elevated angular crests on the right, and two slightly crenated sinuations on the left valve. Surface of the shell smooth, ornamented with numerous, small, distantly scattered, circular papillæ, and frequently marked towards the extremities and along the ventral surface with more or less distinct longitudinal furrows.

Length, $\frac{1}{26}$th of an inch.

This species, which is of frequent occurrence round the British shores at the present day, seems to occupy, in some of its characters, especially in those of the hinge-joint, a position intermediate between the genera *Cythere* and *Cytheridea*. The animal structure is, however, very distinct from that of the former genus, and, so far as we at present know, does not differ from that observed in *Cytheridea*.

DISTRIBUTION. *Recent.*—Great Britain, Ireland, Bay of Biscay, Gulf of St. Lawrence.

Fossil.—England: Hopton Cliff. Scotland: Irvine. Ireland: New Docks at Belfast, Portrush.

Genus 4—EUCYTHERE, *Brady*.

Carapace high and compressed in front, lower and more tumid behind. Shell thin, pellucid, and marked with conspicuous round white papillæ. Hinge-joint formed on the left valve by a projecting flange or crest, which is received into a corresponding depression of the left valve. "Superior antennæ five-jointed, and in structure almost like those of *Cythere;* inferior much more robust, four-jointed; flagellum (urticating seta) long. Mandibular palp three-jointed; branchial appendage very small. Cutting portion of the first maxillæ weaker than usual; internal segment rudimentary. Second pair of maxillæ very large, dilated in an extraordinary manner at the apex, flabelliform, and beset with numerous apical setæ. Feet weak and slender, subequal; terminal claws long and almost straight, alike in the male and female. Copulative organs of the male unusually small. One eye."

EUCYTHERE ARGUS (*G. O. Sars*). Plate X, figs. 12—15.

1865. CYTHEROPSIS ARGUS, *Sars*. Overs. Norg. mar. Ostrac., p. 58.
1868. EUCYTHERE — *Brady*. Monog. Rec. Brit. Ostrac., p. 431, pl. xxvii, figs. 49—51.

Carapace of the *female*, as seen from the side, oblong, subreniform, higher in front than behind, greatest height in the middle and slightly exceeding half the length; anterior extremity broadly, posterior narrowly rounded; superior margin boldly arched; inferior sinuated in the middle. Seen from above, ovate, widest behind the middle, greatest width equal to half the length, obtusely pointed in front, rounded behind. Shell-surface smooth and polished, thickly set with large circular white papillæ or tubercles, which are often dotted in the centre. Shell of the *male* more compressed; seen from the side, subcuneiform, superior margin highest in front of the middle, thence sloping steeply and almost in a right line backwards; inferior margin perfectly straight.

Length, $\frac{1}{45}$th of an inch.

DISTRIBUTION. *Recent.*—Norway, Great Britain, Ireland, Gulf of St. Lawrence.

Fossil.—Scotland: Duntroon, Loch Gilp, Kyles of Bute, Kilchattan, Cumbrae, Dumbarton, Cartsdyke, Paisley, Dalmuir, Old Mains, Elie, Drip Bridge. South Wales: new Dock Basin at Cardiff. Ireland: Portrush. Norway and Canada: Post-tertiary beds.

Genus 5—KRITHE, *Brady, Crosskey, and Robertson.*[1]

Valves thin and pellucid, subovate, truncate behind; smooth and shining, and set with very small distant papillæ. Hinge-joint simple, formed by a slight projection of the left valve, which is received into a corresponding depression of the right. Upper antennæ very stout, five-jointed, the first two joints much thickened, the last three short and bearing long curved spines; lower antennæ four-jointed. Mandibles small, with

[1] κριθή, a barley-corn. The name *Ilyobates* was applied by G. O. Sars in 1865 to this genus; but, as the same term had been used by Kraatz ('Naturgeschichte der Insecten Deutschlands') in 1858 to designate a genus of Coleoptera, it has become necessary to adopt a fresh name.

unusually long slender teeth; palp three-jointed, the second joint elongated, "branchial appendage having two long ciliated setæ and one rudimentary." Maxillæ of the usual form. Feet very short; the first two pairs three-jointed, the last pair four-jointed. "Right foot of the last pair, in the male, prehensile and only three-jointed, terminal claw very large and strong. Abdomen of the female very convex above, the postabdominal lobes bearing two short hairs." Eyes wanting.

1. Krithe glacialis, *nov. sp.* Plate VI, figs. 21—26.

Carapace of the *female*, as seen from the side, subrhomboidal, almost equal in height throughout, height equal to nearly two thirds of the length; anterior extremity evenly rounded; posterior obliquely truncate; superior margin gently arched and forming a rounded obtuse angle posteriorly; inferior convex. Outline, as seen from above, ovate, widest in the middle, acutely pointed in front, rectangularly truncate behind, greatest width slightly exceeding half the length, posterior extremity slightly emarginate at each side of the median line. End-view nearly circular. Carapace of the *male* narrower and longer, dorsal and ventral margins nearly straight, infero-posteal angle more pronounced. Shell-surface smooth, bearing several scattered circular papillæ and a few rather short thick hairs. Lucid spots large, oblong, four in a transverse row a little below and in front of the centre of the valve and one or two a little in advance of the main group.

Length, $\frac{1}{34}$th of an inch.

This species differs little from *Krithe Bartonensis,* except in the greater size and wider proportions of the carapace, and in the rectangularly truncate posterior extremity. It has not yet been seen in the recent state.

Fossil.—Scotland: Errol. Norway.

2. Krithe Bartonensis (*Jones*). Plate II, figs. 22—26.

1856. Cytherideis Bartonensis, *Jones.* Monog. Tert. Entom., p. 50, pl. v, figs. 2 *a*, 2 *b*, 3 *a*, 3 *b*.
1865. Ilyobates prætexta, *G. O. Sars.* Overs. Norg. mar. Ostrac., p. 60.
1868. — Bartonensis, *Brady.* Monog. Rec. Brit. Ostrac., p. 432, pl. xxxiv, figs. 11—14, and pl. xl, fig. 5.

Carapace of the *female,* as seen from the side, oblong, highest near the middle, height equal to at least half the length; anterior extremity rounded; posterior scarcely rounded, rather oblique, subangular below and sloping steeply above to the dorsal margin; superior margin arcuate; inferior nearly straight, and forming almost a right angle with the hinder extremity. Seen from above, ovate, tapering in front to an obtuse point; posterior extremity narrow and deeply emarginate, greatest width less than half the length. The shell of the *male* is longer and narrower, with an almost flat superior margin. Surface perfectly smooth, whitish, or pellucid brown.

Length, $\frac{1}{35}$th of an inch.

DISTRIBUTION. *Recent.*—Great Britain, Norway.

Fossil.—England : Tertiary, Barton. Scotland: Post-tertiary, Duntroon, Crinan. Norway.

Genus 6—LOXOCONCHA, *G. O. Sars.*

Valves nearly equal, subrhomboidal, and mostly flexuous in outline, evenly convex. Surface smooth or marked with concentrically arranged impressed puncta or with polygonal fossæ, often also with minute circular papillæ. Ventral margin forming a prominent compressed keel behind the middle; postero-superior angle obliquely truncate. Hinge-joint formed by two small teeth at the extremities of the hinge-line of each valve. Limbs of the animal slender and colourless. Upper antennæ very slender, six-jointed, the last joint very long, linear, and bearing long simple setæ; lower antennæ four-jointed, the third joint long and narrow; flagellum long and biarticulate. Mandibular palp three-jointed, bearing a distinct branchial appendage. Lowest seta of the branchial plate of the first pair of jaws deflexed. Feet long and slender, alike in male and female. Abdomen terminated by a hairy conical process; postabdominal lobes bearing two moderately long subequal setæ.

The members of this genus are easily recognised by their obliquely quadrangular or "peach-stone-shaped" outline. They occur in considerable abundance in our seas as well as in the Glacial clays, but the number of species is comparatively small. The females in this genus are very much more common than the males.

1. LOXOCONCHA IMPRESSA (*Baird*). Plate VIII, figs. 1—4.

1850. CYTHERE IMPRESSA, *Baird.* Brit. Entom., p. 173, pl. xxi, fig. 9.
1854. — FLAVIDA, *Zenker.* Anatomisch.-System: Studien über die Krebsthiere, p. 86, pl v B.

1851. CYTHERE RHOMBOIDEA, *Fischer*. Abhandl. Bayerischen Akad. Wissensch., vol. vii, p. 656.
1853. — VIRIDIS, *Lilljeborg*. De Crustaceis ex ordinibus tribus, p. 168, pl. xviii, figs. 4—6; pl. xix, figs. 3—5.
1865. — CARINATA, *Brady*. Ann. Mag. N. H., ser. iii, vol. xvi, p. 190, pl. ix, figs. 1—4.
1865. LOXOCONCHA RHOMBOIDEA, *G. O. Sars*. Overs. Norg. mar. Ostrac., p. 62.
1868. — IMPRESSA, *Brady*. Monog. Rec. Brit. Ostrac., p. 433, pl. xxv, figs. 35—40; pl. xl, fig. 4.

Carapace of the *female*, as seen from the side, subrhomboidal, flexuous, greatest height near the middle, equal to fully two thirds of the length; extremities obliquely rounded, the posterior somewhat prominent above the middle; superior margin well arched, its posterior angle sinuated and obliquely truncate; inferior convex, distinctly sinuated in front. Outline, as seen from above, ovate, widest in the middle, extremities equally tapering and pointed, greatest width equal to half the length. End-view very broadly ovate, keeled. The shell of the *male* is unlike that of the female, much lower in front than behind, the upper margin straight and abruptly angulated at each extremity (see figure of male, *L. guttata*, Pl. VIII, fig. 7). Surface marked with closely set concentric circular punctures, which on the ventral surface run into somewhat moniliform furrows; in the interspaces are a few distant circular papillæ. The shell is dense in structure, and in old specimens is covered with a thick calcareous crust, which almost obliterates the surface-markings.

Length, $\frac{1}{38}$th of an inch.

L. impressa is very abundant on most parts of the British coast at the present day, ranging from the littoral zone to depths of about twenty-five fathoms; it occurs also in the more recent Glacial and Post-tertiary formations, but not in those of old date. Its characters are well marked and not likely to be confounded with those of any other fossil species.

DISTRIBUTION. *Recent.*—Norway, Great Britain, Ireland, Bay of Biscay.

Fossil.—Scotland: Duntroon, Crinan, West Tarbert, Raised beaches at Oban and Cumbrae. Ireland: New Docks at Belfast, Portrush. Norway.

2. LOXOCONCHA GUTTATA (*Norman*). Plate VIII, figs. 5—7.

1865. CYTHERE GUTTATA, *Norman*. Nat. Hist. Trans. Northumberland and Durham, vol. i, p. 19, pl. vi, figs. 9—12.
1868. LOXOCONCHA GUTTATA, *Brady*. Monog. Rec. Brit. Ostrac., p. 436, pl. 27, figs. 40—44.

Carapace of the *female,* as seen from the side, subrhomboidal; greatest height in the middle, equal to more than half the length, rounded obliquely in front, produced behind into an obtuse median projection; superior margin almost straight, inferior sinuated in front, convex behind. Outline, as seen from above, broadly ovate, extremities mucronate. The carapace of the *male* is much more elongated, height equal to half the length; dorsal margin quite straight and angular at its extremities; posterior margin rounded. Surface of the shell marked with large and deep, polygonal, concentrically arranged excavations, which, however, are mostly absent from the margins of the valves.

Length, $\frac{1}{43}$rd of an inch.

L. guttata occurs in a recent state in our seas, in depths of 10—30 fathoms.

Distribution. *Recent.*—Great Britain, Ireland, Bay of Biscay, Levant.

Fossil.—Scotland: Drip Bridge.

3. Loxoconcha multifora (*Norman*). Plate XIV, figs. 11, 12, *a*, *b*.

1858. ? Cythere hastata, *Egger*. Ostrak. Miocän-Schicht. Ortenburg, p. 32, pl. ii, fig. 6.

1864. — multifora, *Norman.* Brit. Assoc. Rep., p. 192; Nat. Hist. Trans. Northumberland and Durham (1865), vol. i, p. 18, pl. vi, figs. 13—16.

1868. Cytheropteron multiforum, *Brady.* Monog. Rec. Brit. Ostrac., p. 449, pl. xxix, figs. 38—42.

Carapace, as seen from the side, compressed, rhomboidal; height equal to about half the length and nearly equal throughout; extremities oblique and slightly rounded; superior margin straight, slightly sinuated in the middle; inferior almost straight; seen from above, ovate, widest behind the middle; width and height equal; acuminate in front, more obtuse behind. Shell marked over its entire lateral aspect, with large and rather distant angular fossæ, and behind the middle, just within the inferior margin, raised into an irregularly curved alæform ridge.

Length, $\frac{1}{60}$th of an inch.

The almost obsolete alæform projection of the shell induced the author of the 'Monograph of the Recent British Ostracoda' to place this species in the genus *Cytheropteron.* We have, however, since that period become acquainted with some even more distinctly alate forms which undoubtedly belong to *Loxoconcha,* and, as the present species is in general appearance quite in accord with that genus, we have no hesitation in removing it from its former position.

Distribution. *Recent.*—Great Britain.

Fossil.—Ireland: Portrush.

4. Loxoconcha tamarindus (*Jones*). Plate VIII, figs. 8—11.

1856. Cytherideis tamarindus, *Jones.* Monog. Entom. Tert. Form. England, p. 49, pl. iii, figs. 4 *a*, 4 *b*.
1865. Cythere lævata, *Norman.* Nat. Hist. Trans. Northumberland and Durham, vol. i, p. 18, pl. v, figs. 13—16.
1865. Loxoconcha longipes, *G. O. Sars.* Overs. Norg. mar. Ostrac., p. 63.
1868. — tamarindus, *Brady.* Monog. Rec. Brit. Ostrac., p. 435, pl. xxv, figs. 45—48.

Carapace of the *female,* as seen from the side, elongate, subrhomboidal, height nearly equal throughout, and equal to about half the length. Extremities obliquely rounded; superior margin nearly straight, obtusely angular behind; inferior slightly sinuated in front, then convex. Outline, as seen from above, elongate-ovate, its greatest width in the middle, and equal to less than half the length. End-view broadly ovate, keeled. Shell of the *male* narrower and more elongated (fig. 11). Surface of the valves smooth, minutely and closely punctate and bearing a few very small scattered papillæ.

Length, $\frac{1}{50}$th of an inch.

This species is found abundantly in the living state in the British Seas and on the coast of Norway, ranging from 2 to 40 fathoms.

Distribution. *Recent.*—Norway, Great Britain, Ireland, Bay of Biscay.

Fossil.—Scotland: in nearly all the Post-tertiary beds on the west, and on the east at Elie and Drip Bridge. Ireland: New Docks at Belfast, Portrush. England: Crag, Suffolk. Norway; Post-tertiary.

5. Loxoconcha elliptica, *Brady.* Plate XIV, figs. 23—25.

Loxoconcha elliptica, *Brady.* Monog. Rec. Brit. Ostrac., p. 435, pl. xxvii, figs. 38, 39, 45—48; pl. xl, fig. 3.

Carapace of the *male*, oblong, compressed; seen from the side, subrhomboidal, nearly equal in height throughout; height equal to somewhat more than half the length; anterior extremity obliquely, posterior well and evenly rounded; superior margin straight, inferior slightly sinuated in the middle; seen from above, compressed, ovate, pointed in front, narrowly rounded or submucronate behind, width equalling nearly half the length. The shell of the *female* is shorter, more tumid, and has the dorsal margin distinctly arched. Surface of the valves smooth, bearing several small scattered circular papillæ.

Length (of the male), $\frac{1}{40}$th of an inch.

This very well-marked species is a characteristic inhabitant of brackish water, being seldom or never found living in purely marine situations. In the water of salt marshes, estuaries, and at the heads of contracted bays where there is much influx of fresh water, it often occurs in great abundance, and in such situations it appears to be generally distributed round the coasts of Europe.

DISTRIBUTION. *Recent.*—Great Britain and Europe.

Fossil.—Scotland: Govan. South Wales: New Dock-basin at Cardiff.

6. LOXOCONCHA FRAGILIS, *G. O. Sars.* Plate XIV, figs. 30—32.

LOXOCONCHA FRAGILIS, *G. O. Sars.* Overs. Norg. mar. Ostrac., p. 65.

Carapace of the *male* oblong, subrhomboidal, somewhat higher behind than in front, surrounded, except on the superior margin, by a broad laminar fillet, which is most developed behind and on the posterior portion of the ventral margin; height fully equal to half the length; anterior extremity well rounded, posterior rather broader, oblique and produced above the middle into a short obtusely rounded beak; superior margin straight, inferior sinuated in the middle, seen from above, ovate, with pointed extremities. Shell smooth, fragile, bearing usually a few scattered circular papillæ, the marginal belt marked with radiating hairlike lines. Carapace of the *female*, differing from that of the male in the same way as in the foregoing species.

Length, $\frac{1}{60}$th of an inch.

DISTRIBUTION. *Recent.*—Great Britain and Norway.

Fossil.—Scotland: Cartsdyke, Paisley.

Genus 7—XESTOLEBERIS, *G. O. Sars.*

Shell very smooth and polished, ornamented with small round distant papillæ, much lower in front than behind; in the *female* very tumid behind. Hinge-joint formed by a dentated projecting crest of the left, which is received into an excavation of the right valve. Ventral margin of both valves incurved in front of the middle. Upper antennæ six-jointed, the last four joints successively decreasing in length, and bearing very short simple setæ; lower antennæ short, four-jointed, flagellum of moderate length. Mandibular palp four-jointed, " branchial appendage small and bearing only two setæ." Maxillæ as in the preceding genus. Feet short. Postabdominal lobes bearing two setæ. Eyes distinct. Ova and immature young borne within the shell of the female.

This genus is chiefly distinguished by the peculiar form of the carapace, which is very low and pointed in front, elevated and tumid behind, in these respects offering a direct contrast to the genus *Eucythere*, with which, however, in the character of the hinge-joint and of the surface-markings, it to a great extent agrees.

1. Xestoleberis depressa, *G. O. Sars.* Plate VII, figs. 13—19.

1865. Xestoleberis depressa, *G. O. Sars.* Overs. Norg. mar. Ostrac., p. 68.
1868. — — *Brady.* Monog. Rec. Brit. Ostrac., p. 438, pl. xxvii, figs. 27—33.
1850. ? Cytherina tumida, *Reuss.* Foss. Entom. Oesterr. Tert. Beckens, p. 57, pl. viii, fig. 29.
1858. ? Cytheridea tumida, *Egger.* Ostrak. Miocän-Schicht. Ortenburg, p. 17, pl. ii, fig. 11.

Carapace of the *female*, as seen from the side, subsemicircular, highest in the middle; greatest height equal to more than half the length. Anterior extremity depressed, obliquely rounded, narrowed, and somewhat exserted at its inferior angle, posterior broader and evenly rounded. Superior margin boldly arched, highest in the middle, sloping with a steep curve towards the anterior, and with a bold convexity towards the posterior extremity; inferior gently sinuated in front of the middle. Outline, as seen from above, broadly ovate, greatest width behind the middle and equal to two thirds of the length; anterior extremity acutely pointed, posterior broadly rounded. End-view subtriangular, the width considerably greater than the height, lateral and ventral margins all gently convex. The shell of the *male* is longer in proportion to its height and more depressed in front; seen from above it is narrower, and has the greatest width in the middle; the width is greater than the height and the ventral surface is nearly flat. Surface of the shell smooth, polished and often iridescent, bearing numerous very small circular papillæ.

Length, $\frac{1}{45}$th of an inch.

This is one of the most abundant and widely distributed of recent marine species, being found all round the British Islands and on the Scandinavian coast, mostly in depths of 2—30 fathoms.

Distribution. *Recent.*—Great Britain, Ireland, Norway, Spitzbergen, Gulf of St. Lawrence.

Fossil.—Scotland: Loch Gilp, Paisley, Wick, West Tarbert, Raised beach at Oban. Ireland: New Docks at Belfast. Norway and Canada.

2. Xestoleberis aurantia (*Baird*). Plate XVI, figs. 32, 33.

1835. Cythere aurantia, *Baird.* Mag. Zool. Bot., ii, 143, pl. v, fig. 26; and (1850) Brit. Entom., p. 171, pl. xxi, fig. 8.
1853. — nitida, *Lilljeborg.* De Crustaceis, p. 169, pl. xix, figs. 6, 7.
1854. — viridis, *Zenker.* Anat. Syst. Studien über die Krebst., p. 86, pl. v A.
1865. Xestoleberis nitida, *G. O. Sars.* Overs. Norg. mar. Ostrac., p. 67.
1868. — aurantia, *Brady.* Monog. Brit. Ostrac., p. 437, pl. xxvii, figs. 34—37; pl. xxxix, fig. 6.

Shell of the *female*, seen from the side, subtriangular, greatest height situated behind the middle and equal to nearly two thirds of the length. Anterior extremity much narrowed, rounded, posterior very broadly rounded; superior strongly arched, inferior very slightly sinuated in front of the middle. Seen from above, ovate, acuminate in front, broadly rounded behind, greatest width behind the middle, and equal to half the length. The shell of the *male* is more elongated, and scarcely so tumid behind. Shell smooth and ornamented with minute and distant circula papillæ; there is usually (even in fossil specimens) a dark-coloured spot on each valve near the position of the eyes.

Length, $\frac{1}{48}$th of an inch.

Distribution. *Recent.*—Holland, Great Britain, Ireland.

Fossil.—Scotland: Raised beach at Cumbrae. South Wales: New Dock-basin at Cardiff. Ireland: New Docks at Belfast. Norway.

Genus 8—Cytherura, *G. O. Sars.*

Valves unequal and dissimilar in form, the right more or less overlapping the left on the dorsal margin; surface reticulated, punctated, deeply excavated, or bearing irregularly disposed ribs or protuberances, mostly marked with a central areola of darker colour than the rest of the shell. Carapace oblong or subtriangular, the posterior extremity produced into a more or less prominent beak. Hinge-processes mostly obsolete. Superior antennæ shortly setose, six-jointed, gradually tapering; second joint bearing a rather long seta on the middle of the posterior margin; inferior antennæ five-jointed, terminal claws short; flagellum long, triarticulate. Mandibles robust, with very blunt teeth, "palp three-jointed, branchial appendage small, and bearing only two recurved setæ." Terminal lobes of the first pair of maxillæ long and narrow, "branchial plate bearing on its external margin two non-ciliated setæ, which are directed downwards, and arise from a separate lobe." Feet small, the terminal claws short and curved. Eyes distinct. Copulative organs of the male very complex, provided with several irregular processes and a very long spirally convoluted tube.

The species belonging to this genus are the smallest of the *Cytheridæ;* they occur in considerable numbers, and various species are so closely related one to the other that it is often by no means easy to identify them with certainty. The species we have now to describe are to a large extent identical with those now living in the British seas.

1. Cytherura nigrescens (*Baird*). Plate XI, figs. 28—32; and Plate XII, fig. 13.

1838.	Cythere nigrescens,	*Baird.*	Mag. Zool. Bot., vol. ii, p. 143, pl. v, fig. 27.
1850.	— —	*Baird.*	Brit. Entom., p. 171, pl. xxi, figs. 4, 4 *a*.
1865.	Cytherura —	*G. O. Sars.*	Overs. Norg. mar. Ostrac., p. 71.
1868	— —	*Brady.*	Monog. Rec. Brit. Ostrac., p. 440, pl. xxxii, figs. 50—55; pl. xxxix, fig. 7.

Carapace of *female*, as seen from the side, subrhomboidal, highest in the middle, greatest height equal to quite half the length; anterior extremity rounded, posterior produced above the middle into a short obtuse beak; superior margin evenly and boldly arched, inferior slightly sinuated. Outline, as seen from above, compressed, ovate, pointed at each extremity, widest in the middle, width equal to rather more than one third of the length. End-view broadly ovate. Surface of the shell smooth, often slightly punctate.

Length, $\frac{1}{62}$nd of an inch.

Distribution. *Recent.*—Norway, Great Britain, Ireland.

Fossil.—England: Hopton Cliff. Scotland: nearly all the Post-tertiary beds on the west, and at Drip Bridge. Ireland: New Dock at Belfast, Portrush. Norway and Canada.

2. Cytherura similis, *G. O. Sars.* Plate XI, figs. 16—18; Plate XII, fig. 16.

1865.	Cytherura similis,	*G. O. Sars.*	Overs. Norg. mar. Ostrac., p. 72.
1868.	— —	*Brady.*	Monog. Rec. Brit. Ostrac., p. 442, pl. xxxii, figs. 56—59.

Carapace, as seen from the side, subovate, highest in the middle, greatest height equal to rather more than half the length; anterior extremity rounded, posterior produced in the middle, but scarcely beaked; superior margin boldly and evenly arched, inferior nearly straight. Outline, seen from above, ovate, widest in the middle, width equalling half the length. End-view ovate, tumid, widest towards the base, width and height equal. Shell smooth, obscurely reticulated. Very similar to the preceding, but larger, more ventricose, and less distinctly beaked posteriorly.

Length, $\frac{1}{53}$rd of an inch.

DISTRIBUTION. *Recent.*—Norway, Great Britain, Holland, Spitzbergen.

Fossil.—Scotland: Duntroon, Loch Gilp, Kyles of Bute, Kilchattan, Cumbrae, Dumbarton, Cartsdyke, Dalmuir, Barrie. Ireland: New Docks at Belfast, Portrush. Norway.

3. CYTHERURA FLAVESCENS, *Brady.* Plate XVI, figs. 7, 8.

1869. CYTHERURA FLAVESCENS, *Brady.* Ann. Mag. N. H., ser. 4, vol. iii, p. 49, pl. viii, figs. 13—15.

Carapace, seen from the side, subquadrangular, nearly equal in height throughout, height equal to half the length; anterior extremity imperfectly rounded and somewhat oblique; posterior produced in the middle into a broad rounded beak; superior margin flattened, slightly sinuated in the middle; inferior with a distinct median sinuation. Seen from above, ovate, widest near the middle, subacuminate in front, mucronate behind, width rather less than the height. Surface of the shell marked longitudinally with numerous flexuous, anastomosing, but not very prominent, ribs.

Length, $\frac{1}{62}$nd of an inch.

DISTRIBUTION. *Recent.*—Britain, Holland.

Fossil.—Scotland: Kyles of Bute.

4. CYTHERURA PUMILA, *nov. sp.* Plate XI, figs. 33—35.

Carapace of the *female*, seen from the side, subovate, highest in the middle, height equal to more than half the length; rounded in front, produced in the middle behind, but not beaked; superior margin arched; inferior nearly straight. Outline, seen from above, compressed, ovate, widest near the middle, nearly thrice as long as broad, extremities pointed. Shell of the *male* (fig. 35) long and narrow. Surface of the valves obscurely undulated and finely punctate.

Length, $\frac{1}{50}$th of an inch.

DISTRIBUTION. *Recent.*—Shetland. Gulf of St. Lawrence.

Fossil.—Scotland: Duntroon, Cartsdyke, Dalmuir.

5. CYTHERURA CONCENTRICA, *nov. sp.* Plate XI, figs. 7, 8; Plate XV, fig. 21.

Carapace somewhat peach-stone-shaped, highest in the middle, height equal to half the length; anterior extremity obliquely rounded; posterior oblique, produced in the middle into a short, obtuse beak; superior margin boldly arched; inferior slightly sinuated in front of the middle. Seen from above, compressed, acuminate in front, sharply and strongly mucronate behind; width less than half the length. Shell-surface concentrically striated and finely punctate.

Length, $\frac{1}{50}$th of an inch.

DISTRIBUTION. *Recent.*—Shetland, Gulf of St. Lawrence.

Fossil.—Scotland: Paisley, Barrie, Elie, Dryleys, Errol.

6. CYTHERURA (?) COMPLANATA, *nov. sp.* Plate XI, figs. 19, 20.

Carapace reniform, highest in the middle, height equal to more than half the length; extremities rounded; superior margin boldly and evenly arched; inferior sinuated in the middle. Seen from above, compressed, oblong, with parallel sides. Surface of the valves slightly punctate, marked with a strong elevated ridge round the greater part of the circumference, and with a few shallow rounded pits or areolæ on the posterior portion of the valves.

Length, $\frac{1}{50}$th of an inch.

DISTRIBUTION. *Fossil.*—Scotland: Annochie. Ireland: Woodburn.

7. CYTHERURA UNDATA, *G. O. Sars.* Plate XI, figs. 9—15; and Plate XII, fig. 17.

1865. CYTHERURA UNDATA, *Sars.* Overs. Norg. mar. Ostrac., p. 75.
1868. — — *Brady.* Monog. Rec. Brit. Ostrac., p. 443, pl. xxxii, figs. 43—49, 66.

Carapace of *female* subrhomboidal, greatest height in the middle and equal to rather more than half the length; anterior extremity obscurely rounded; posterior obliquely subtruncate, somewhat angulated above the middle; superior margin forming a flattened arch; inferior nearly straight. Outline, as seen from above, elongated, subpentagonal, with nearly parallel sides, width considerably less than the height, pointed in front, truncate and centrally mucronate behind. Surface of the shell marked with two longitudinal and three or more irregularly curved transverse ribs, the intervals between which are sometimes angularly areolated. Shell of the *male* more compressed and more angular in outline.

Length, $\frac{1}{62}$nd of an inch.

There is much diversity in the development of the surface-ornament in this species, some specimens showing scarcely more than a mere undulation of the surface (fig. 12), while others (fig. 9) are very distinctly ridged and occasionally even areolated in the interspaces. It is, perhaps, next to *C. nigrescens*, the commonest fossil species of the genus.

Distribution. *Recent.*—Baffin's Bay, Gulf of St. Lawrence, Spitzbergen, Norway, Great Britain, Ireland.

Fossil.—Scotland: nearly all the Post-tertiary beds. Ireland: New Docks at Belfast, Portrush. Norway. Canada.

8. Cytherura compressa, *nov. sp.* Plate XI, figs. 21—23.

Carapace subrhomboidal, higher in front than behind, greatest height more than equal to half the length, situated in front of the middle; anterior extremity obliquely rounded; posterior angularly produced in the middle; superior margin arched; inferior almost straight. Seen from above, subpentagonal, acuminate in front, mucronate behind, width less than the height. End-view pentagonal, widest in the middle, the base concave, with a central keel. Surface of the shell obsoletely striated.

Length, $\frac{1}{55}$th of an inch.

Distribution. *Fossil.*—Scotland: Gamrie.

9. Cytherura striata, *G. O. Sars.* Plate XI, figs. 38—41.

1865. Cytherura striata, *G. O. Sars.* Overs. Norg. mar. Ostrac., p. 74.
1868. — — *Brady.* Monog. Rec. Brit. Ostrac., p. 441, pl, xxxii, figs. 26—29, 62, 64, 65.

Carapace, as seen from the side, compressed, oblong, of nearly equal height throughout, height equal to less than half the length; anterior extremity rounded, posterior produced in the middle into a long beak; superior margin forming a flattened arch, inferior sinuated in the middle. Seen from above, the outline is subpentagonal, with parallel sides, pointed in front and strongly mucronate behind, width about equal to the height. End-view subtriangular, widest at the base, which is centrally keeled. Surface marked with distinct longitudinal grooves, each of which is mostly impressed with a single series of round punctures.

Length, $\frac{1}{55}$th of an inch.

C. striata also is very variable in the amount of its shell-sculpture.

DISTRIBUTION. *Recent.*—Norway, Great Britain, Ireland.

Fossil.—Scotland: Loch Gilp, West Tarbert, Kyles of Bute, Cumbrae, Cartsdyke, West Tarbert. South Wales: New Dock basin at Cardiff. Ireland: New Docks at Belfast. Norway and Canada.

10. CYTHERURA QUADRATA, *Norman.* Plate XIII, figs. 34, 35.

1868. CYTHERURA QUADRATA, *Norman.* Last Report on Dredging amongst the Shetland Islands, p. 292.

Shell, seen from the side, subquadrangular, of nearly equal height throughout, height equal to half the length, rounded in front, produced behind into a sharp median beak; superior margin forming a flattened arch; inferior almost straight; seen from above, the greatest width is situated rather in front of the middle, the outline being subhexagonal. The surface-sculpture is very similar to that of *C. striata,* consisting of flexuous longitudinal striæ, the hollows of which are marked with more or less circular pittings; just within the ventral margin is a ridge, terminating in front in a small angular alæform projection.

Length, $\frac{1}{60}$th of an inch.

This species differs from *C. striata* in its greater proportionate height and width, and in having its greatest width, when viewed from above, situated towards the anterior extremity, a peculiarity which it shares, so far as we know, only with *C. affinis.* We have seen only a very few detached valves.

DISTRIBUTION. *Recent.*—Shetland, South Wales.

Fossil.—South Wales: Cardiff New Dock basin. Ireland: Belfast New Docks.

11. CYTHERURA CUNEATA, *Brady.* Plate XIII, figs. 36, 37; Plate XI, figs. 42 and 47.

1868. CYTHERURA CUNEATA, *Brady.* Monog. Rec. Brit. Ostrac., p. 442, pl. xxxii, figs. 35—38, 63.

Carapace of *female,* seen from the side, elongated, subquadrangular, nearly equal in height throughout, height scarcely equal to one half the length; rounded in front, produced behind into a short and obtuse, obliquely truncate, median beak; superior margin nearly straight; inferior slightly sinuated; seen from above, cuneate, greatest width about equal to the height, and situated near the posterior extremity; acuminate in front, mucronate behind. Shell longitudinally striated and marked, more particularly over the protruberant posterior portion, with a delicately reticulated and punctate pattern; within the ventral margin on the posterior half of the valve is a sinuous ridge, which terminates behind in an obtusely rounded alæform projection. The *male* is rather longer and narrower than the female.

Length, $\frac{1}{65}$th of an inch.

Distribution. *Recent.*—Great Britain, Ireland, Levant.

Fossil.—Scotland: West Tarbert.

12. Cytherura Sarsii, *Brady*. Plate XI, figs. 24—27; Plate XIII, figs. 18, 19.

1868. Cytherura Sarsii, *Brady*. Monog. Rec. Brit. Ostrac., p. 442, pl. xxxii, figs. 39—42.

Carapace, seen from the side, oblong, subquadrangular, nearly equal in height throughout, height scarcely equalling half the length; anterior extremity rounded; posterior scarcely produced in the middle; superior margin nearly straight; inferior sinuated in the middle; outline, seen from above, compressed, ovate, widest behind the middle, width considerably less than the height, pointed in front, mucronate behind. End-view broadly ovate, widest in the middle. Surface of the shell smooth or obscurely striated and punctate.

Length, $\frac{1}{52}$nd of an inch.

Distribution. *Recent.*—Scotland.

Fossil.—Scotland: Duntroon, Loch Gilp, Kyles of Bute, Cumbrae, Cartsdyke, Paisley, Dalmuir, Barrie. Canada.

13. Cytherura angulata, *Brady*. Plate XI, figs. 48—51; Plate XII, fig. 14.

1868. Cytherura angulata, *Brady*. Monog. Rec. Brit. Ostrac., p. 440, pl. xxxii, figs. 22—25.

Carapace, as seen from the side, compressed, oblong, greatest height near the middle and equal to about one half of the length; anterior extremity rounded; posterior almost rectangular below, and produced above the middle into a large and prominent beak;

superior margin arched, inferior nearly straight. Seen from above, the outline is much compressed, widest in the middle, pointed in front, and strongly mucronate behind, width equal to scarcely more than one third of the length. End-view ovate, pointed above, height much greater than the width. Shell-surface distinctly punctate; central areola black, saddle-shaped. Colour, golden yellow.

Length, $\frac{1}{58}$th of an inch.

DISTRIBUTION. *Recent.*—Great Britain.

Fossil.—Scotland: Raised beach at Oban. South Wales: Cardiff New Dock-basin. Ireland: Belfast New Docks, Portrush. Norway.

14. CYTHERURA PRODUCTA, *Brady*. Plate XIII, figs. 30—33.

1868. CYTHERURA PRODUCTA, *Brady*. Monog. Rec. Brit. Ostrac., p. 443, pl. xxxii, figs. 60, 61.

Carapace, seen from the side, elongated, anterior margin rounded above, obliquely truncate below; posterior produced into a long and sharp central beak; superior margin well arched and forming a continuous curve (steeper, however, in front than behind) from the middle of the anterior margin to the extremity of the posterior beak; inferior margin nearly straight, subrectangular behind; height equal to less than half the length. Seen from above, the outline is subhexagonal, with produced strongly mucronate extremities and nearly parallel sides, width equal to about half the length. Surface of the shell more or less irregularly striated or vaguely reticulate, the ventral surface longitudinally striated. Central areola broad, somewhat crescentic. The *female* is more tumid and usually smoother than the *male*.

Length, $\frac{1}{60}$th of an inch.

DISTRIBUTION. *Recent.*—Great Britain, Ireland.

Fossil.—South Wales: Cardiff New Dock-basin.

15. CYTHERURA GIBBA (*Müller*). Plate XIII, figs. 26—29.

1785. CYTHERE GIBBA, *Muller*. Entomostraca, p. 24, pl. vii, figs. 10—12.
— GIBBERA, idem. ibidem (*Mas*); Lilljeborg, De Crustaceis, (1853), p. 167, pl. xix, figs. 1, 2.
1854. — GIBBA, *Zenker*. Anat. Studien über die Krebsth., p. 84, pl. v, D.
1865. CYTHERURA GIBBA, *G. O. Sars*. Overs. Norg. mar. Ostrac., p. 70.
1868. — — *Brady*. Monog. Rec. Brit. Ostr., p. 444, pl. xxxii, figs. 68—70.

Carapace of the *female*, as seen from the side, elongated, subquadrangular, of nearly equal height throughout, height equal to about half the length, rounded in front; posterior margin produced above the middle into an obtuse obliquely truncate beak; superior margin almost straight; inferior gently sinuated. Outline, as seen from above, constricted in the middle, the posterior half forming on each side a rounded protuberance, greatest width situated near the posterior extremity and equal to at least half the length; anterior extremity suddenly tapering, acuminate; posterior broadly rounded, with a prominent central mucro. End-view pentagonal, width greater than the height. The *male* more elongated, with the upper margin slightly, the lower deeply, sinuated. The shell is marked, more or less distinctly, with large polygonal reticulations; ventral surface longitudinally striated.

Length, $\frac{1}{45}$th of an inch.

Distribution. *Recent.*—Britain, Baltic Sea, North Sea.

Fossil.—Scotland: West Tarbert, Raised beach at Oban. Ireland: Belfast New Docks, Portrush.

16. Cytherura cornuta, *Brady*. Plate XIII, figs. 23—25.

1868. Cytherura cornuta, *Brady*. Monog. Rec. Brit. Ostrac., p. 445, pl. xxxii, figs. 12—15.

This species differs from the foregoing (*C. gibba*) chiefly in having an arcuate dorsal margin, a sharper posterior beak, and when viewed from above in being less tumid posteriorly and without any central constriction. The end-view is triangular instead of pentagonal. The shell-sculpture is much the same in both species. It must be admitted, however, that it is not always easy to determine to which of the two forms a given specimen should be referred.

Distribution. *Recent.*—Britain, Dardanelles, Levant.

Fossil.—Scotland: West Tarbert Silt. Norway.

17. Cytherura acuticostata, *G. O. Sars*. Plate XVI, figs. 1—3.

1865. Cytherura acuticostata, *G. O. Sars*. Overs. Norg. mar. Ostrac., p. 76.
1868. — — *Brady*. Mon. Rec. Brit. Ostr., p. 445, pl. xxxii, figs. 1—11.

Carapace, as seen from the side, quadrate, subrectangular, height equal to half the length and nearly uniform throughout; anterior extremity moderately and evenly rounded; posterior produced above the middle into a long and narrow beak; superior margin straight or very slightly sinuated, curved downwards towards the posterior extremity; inferior straight in front, but behind the middle forming a convex curve, which terminates in an acute angle behind. Seen from above, broadly ovate, greatest width situate in the middle and equal to considerably more than half the length; anterior extremity rounded and minutely mucronate; posterior subtruncate, strongly mucronate in the middle. End-view triangular, with irregularly emarginate sides and broadly rounded angles. Surface of the shell sculptured with very prominent and sharply cut flexuous longitudinal ribs.

Length, $\frac{1}{55}$th of an inch.

Distribution *Recent.*—Norway, Great Britain, Ireland. Holland.

Fossil.—Scotland: Raised beach at Oban. Ireland: Belfast New Docks. Norway.

18. Cytherura cellulosa (*Norman*). Plate XI, figs. 5, 6.

1865. Cythere cellulosa, *Norman.* Nat. Hist. Trans. Northumberland and Durham, vol. i, p. 22, pl. v, figs. 17—20; pl. vi, fig. 17.

1865. Cytherura nana, *Sars.* Overs. Norg. mar. Ostrac., p. 78.

1868. — cellulosa, *Brady.* Monog. Rec. Brit. Ostrac., p. 446, pl. xxix, figs. 47—50, 60.

Carapace of the *female*, as seen from the side, almost semicircular, except that the postero-inferior angle is obliquely truncate, greatest height in the middle, equal to about two thirds of the length; anterior extremity rounded; posterior obliquely truncate below the middle, where it is produced into a broadly rounded beak; superior margin boldly arched; inferior nearly straight, sinuated in the middle. Seen from above, the outline is lozenge-shaped, compressed, with broadly pointed extremities and nearly parallel sides, width much less than the height. The shell of the *male* (figs. 5, 6) is obliquely ovate, much more elongated and less strongly arcuate on the dorsal margin, the infero-posteal angle rounded off. Surface of the shell marked with very large, irregularly angular pits, in the centre of each of which is a small elevated tubercle.

Length, $\frac{1}{70}$th of an inch.

Distribution. *Recent.*—Norway, Great Britain, Ireland, Holland.

Fossil.—Scotland: Gamrie, Duntroon, West Tarbert, Raised-beach at Oban. South Wales: Cardiff New Dock basin. Ireland: Woodburn, Raised-beach at Portrush. Norway.

19. CYTHERURA CLATHRATA, *G. O. Sars.* Plate XI, figs. 1—4.

1865. CYTHERURA CLATHRATA, *G. O. Sars.* Overs. Norg. mar. Ostrac., p. 77.
1868. — — *Brady.* Monog. Rec. Brit. Ostrac., p. 446, pl. xxix, figs. 43—46.

Carapace, as seen from the side, triangular, highest in the middle, greatest height almost equal to three fourths of the length; anterior extremity narrowed, subangular, divided into three or four short, broad teeth; posterior also narrow, produced into an almost obsolete rounded beak; superior margin much elevated in the middle, sloping very steeply and with a scarcely perceptible curve to each extremity, inferior distinctly convex, more or less sinuous. Outline, seen from above, ovate, widest in the middle, greatest width equal to more than half the length, extremities mucronate. End-view triangular, with arcuate sides and flattened base; height much greater than the width. Each valve is traversed by one conspicuous central longitudinal rib, from which several other more or less distinct curved ridges diverge laterally, the interspaces excavated into numerous large fossæ; ventral surface longitudinally striated.

Length, $\frac{1}{47}$th of an inch.

This is the largest of the genus, and in general appearance bears considerable resemblance to the preceding species. In the Post-tertiary formations it is apparently of much more frequent occurrence than *C. cellulosa*, though comparatively rare in our seas at the present day.

DISTRIBUTION. *Recent.*—Baffin's Bay, Norway, Great Britain, Ireland.

Fossil.—Scotland: Tangyburn, Duntroon, Crinan, Loch Gilp, Blackburn, Cumbrae, Dumbarton, Cartsdyke, Paisley, Dalmuir, Old Mains, Inch Lonaig, Drip Bridge. Ireland: Portrush. England: Bridlington. Norway.

Genus 9—CYTHEROPTERON, *G. O. Sars.*

Valves mostly subrhomboidal, tumid, unequal, and different in shape, the right valve more or less overlapping the left on the dorsal margin; surface of the shell variously sculptured, punctate, papillose, reticulated, or transversely rugose, ventral surface produced laterally into a prominent rounded or spinous ala; posterior margin produced into a more or less distinct but obtuse beak. Hinge formed by two small terminal teeth on the right and by a minutely crenated median bar on the left valve. Lucid spots usually four, linear oblong, arranged in an obliquely transverse row just above the middle of the ventral margin. Upper antennæ shortly setose and composed of five joints, penultimate joint elongated and bearing on the middle of the anterior margin two hairs; lower antennæ distinctly five-jointed, flagellum long. Mandibles of moderate size; palp three-jointed, branchial appendage bearing two very small setæ. Jaws as in the preceding genus. Feet long and slender, terminal claw slender. Abdomen ending in a long, narrow process, post-abdominal lobes bearing three short hairs. Copulative organs of the male armed behind with three spiniform processes, one of which is trifurcate. Eyes wanting.

1. Cytheropteron latissimum (*Norman*). Plate VIII, figs. 19—23.

1865. Cythere latissima, *Norman*. Nat. Hist. Trans. Northumberland and Durham, vol. i, p. 19, pl. vi, figs. 5—8. Brady, Trans. Zool. Soc., 1866, vol. v, p. 381, pl. lxii, figs. 4 *a—e*.

1865. Cytheropteron convexum, *G. O. Sars*. Overs. Norg. mar. Ostrac., p. 80.

1868. Cytheropteron latissimum, *Brady*. Monog. Rec. Brit. Ostrac., p. 448, pl. xxxiv, figs. 26—30.

Carapace of the *female*, seen from the side, subrhomboidal, highest in the middle, greatest height equal to two thirds of the length. Anterior margin broadly rounded, posterior produced into a short obtusely rounded median beak; dorsal margin boldly arched, sloping steeply behind, more gently and with a slight sinuation in front; ventral somewhat convex, sinuated in front; alæform protuberance rounded off in front, obtusely angular behind. Outline, as seen from above, subovate; greatest width situated behind the middle and equal to two thirds of the length; extremities acuminate. End-view equilaterally triangular, the sides all convex. Shell of the *male* somewhat more elongated, the posterior beak obsolete. Surface marked with more or less distinct, subquadrangular pits arranged transversely, and often coalescing, so as to form well-marked sulci; ventral surface longitudinally furrowed.

Length, $\frac{1}{43}$rd of an inch.

There is much variety in the surface-marking of this species, some specimens being distinctly reticulated while others are obscurely rugose, owing to the coalescence of the fossæ; in others, again, as in fig. 23, the transverse furrows become exceedingly deep and well marked. It may be distinguished from *C. nodosum* (with which alone, amongst fossil species, it is likely to be confounded) by the less angular outline, and the absence of any conspicuous tubercles on the dorsal aspect. In the living state *C. latissimum* is met with abundantly round the shores of Britain and Norway, in a depth of 10—60 fathoms, and has also been found in dredgings from Spitzbergen and Baffin's Bay. G. O. Sars notices its occurrence in a fossil state in the Glacial formations of Norway.

Distribution. *Recent.*—Baffin's Bay, Norway, Great Britain, Ireland, Spitzbergen.

Fossil.—Scotland: in nearly all the Post-tertiary beds. England: Bridlington. Norway and Canada.

2. Cytheropteron nodosum, *Brady.* Plate VIII, figs. 12—15.

Cytheropteron nodosum, *Brady.* Monog. Rec. Brit. Ostrac., p. 448, pl. xxxiv, figs. 31—34.

Carapace of the *female* (?), seen from the side, subtriangular or subrhomboidal; greatest height in the middle, equal to two thirds of the length. Anterior margin obtusely rounded: posterior obliquely subtruncate; dorsal margin boldly arched, sloping steeply before and behind; ventral nearly straight: edge of the alæform process crested and sharp. Outline, seen from above, ovate, widest in the middle, extremities pointed, width equal to more than half the length; end-view trapezoidal; height greater than the width, angles acute. Surface less distinctly furrowed than in the preceding species, but having two large, rounded tubercles below the dorsal margin, from each of which there runs a more or less distinct elevated rib towards the ventral margin.

Length, $\frac{1}{44}$th of an inch.

Distribution. *Recent.*—Britain, Ireland, Gulf of St. Lawrence.

Fossil.—Scotland: Lag Arran, Duntroon, Crinan, Kyles of Bute, Cumbrae, Cartsdyke, Dalmuir, Old Mains, Errol, Drip Bridge. England: Bridlington, Hopton Cliff. Ireland: Woodburn, Portrush. Canada and Norway.

3. Cytheropteron arcuatum, *nov. sp.* Plate VIII, figs. 16—18; and Plate XIV, figs. 19—22.

1868. Cytheropteron vespertilio, *Brady.* Ann. Mag. N. H., ser. iv, vol. ii, p. 33, pl. v, figs. 6, 7.

Carapace, seen from the side, subsemicircular, highest in the middle; height equal to nearly three fourths of the length; anterior extremity rounded; posterior produced in the middle, but in most cases scarcely beaked; superior margin very boldly and evenly arched; inferior very slightly sinuated in the middle, bending upwards behind. Outline, as seen from above, subsagittate, widest behind the middle, width equal to nearly two thirds of the length; anterior extremity pointed, lateral margins sloping in a curved line outwards to near the posterior third, where they sink suddenly, forming a rectangular projection, the hinder third of the shell constituting a large triangular process. End-view triangular, the angles all acute. Surface of the shell smooth, bearing more or less numerous scattered circular papillæ, and usually with indistinct transverse striato-reticulate sculpture; the lateral alæ prominent, rounded off gradually in front, rectangular behind, and in old specimens bearing at the angle a strong, awl-shaped mucro or spine.

Length, $\frac{1}{50}$th of an inch.

At one time we supposed this interesting species to be identical with the *Cypridina vespertilio* of Reuss and of Egger, but further acquaintance with it and other allied forms convinces us that we were mistaken in that supposition, and that the *C. vespertilio* of those authors is really referable to an immature stage of *Cytheropteron alatum*, G. O. Sars.[1] Young specimens of *C. arcuatum* have the lateral alæ, as a rule, well rounded, and are destitute of the angular spine; the shell is also more fully papillated, but the reticulated surface-ornament, on the contrary, seems to become more distinct with age. *C. hamatum*, of G. O. Sars, is very nearly allied to the present species, but that author himself, from actual examination, considers it to be distinct, an opinion in which we entirely agree with him. The difference is chiefly that of outline, *C. arcuatum* being more boldly arched, and with blunter, wider, and less produced extremities; in these particulars (though in no others) *C. hamatum* more resembles the *C. inflatum* of the present Monograph.

Distribution. *Recent.*—Baffin's Bay.

Fossil.—Scotland: Tangyburn, Elie, Dryleys, Errol. Ireland: Woodburn.

4. Cytheropteron inflatum, *nov. sp.* Plate VIII, figs. 24—27; Plate XIV, figs. 26—29.

1868. Cytheropteron inflatum, *B.*, *C.*, and *R.* Ann. Mag. N. H., ser. iv, vol. ii, p. 33, pl. v, figs. 8—10 (figured but not described).

Carapace, as seen from the side, subrhomboidal, highest in the middle, height equal to two thirds of the length; anterior extremity somewhat produced, rounded; posterior produced into an obtusely rounded median beak; superior margin boldly arched, gibbous; inferior convex in the middle along the line of the alæform process, slightly

[1] *Cytheropteron inornatum*, B. and R. (see Ann. and Mag. N. H. (1872), ser. iv, vol. ix, p. 61, pl. ii, figs. 1—3), is likewise only a stage of development of *C. alatum*. We therefore take this opportunity of withdrawing the name.

sinuated towards each extremity. Seen from above, broadly ovate or lozenge-shaped, with equally tapering and sharply mucronate extremities; greatest width situate in the middle and equal to rather more than half the length. End-view almost quadrate, scarcely at all tapering to the apex. Shell-surface densely and minutely punctate, on the ventral surface longitudinally striated; alæform processes evenly and boldly rounded and but slightly prominent.

Length, $\frac{1}{40}$th of an inch.

DISTRIBUTION. *Recent.*—Baffin's Bay, North Atlantic.

Fossil.—Scotland: Dryleys, Errol. Canada.

5. CYTHEROPTERON MONTROSIENSE, *nov. sp.* Plate VIII, figs. 28—36; Plate XIV, figs. 13—16.

1868. CYTHEROPTERON MONTROSIENSE, *C.*, *B.*, and *R.* Ann. Mag. N. H., ser. iv, vol. ii, p. 33, pl. v, figs. 1—5 (figured but not described).

Valves of the *female* (?), as seen from the side, oblong, subrhomboidal, nearly equal in height throughout, height equal to more than half the length; anterior margin broadly rounded; posterior obliquely truncate below, produced above into a broad laminar projection or beak; dorsal margin slightly convex, deeply sulcate behind and at its junction with the laminar process; ventral straight in front, convex behind; lateral protuberance very prominent, forming a large irregularly rounded projection behind the middle of the ventral margin. Outline, as seen from above, rhomboidal, widest behind the middle, extremities pointed, the posterior strongly mucronate. End-view broadly triangular, the sides very convex; lateral surfaces marked with large polygonal excavations, ventral surface longitudinally rugose. Shell of the *male* (?) higher in front, the dorsal margin sloping steeply backwards, lateral and posterior protuberances poorly developed, surface-markings smaller.

Length, $\frac{1}{50}$th of an inch.

It will be seen by reference to the figures that the two forms included in the foregoing description differ considerably in appearance, but it will also be observed that the smaller, which we suppose to be the male, would by a larger development of the posterior and lateral protuberances assume a shape almost identical with that of the larger form; and as the two occur in the same localities we think it best to regard them as varieties of the same species dependent probably upon sex or age. *C. Montrosiense* has been found in the recent state in company with *C. inflatum.*

The form figured in Plate XIV we at one time supposed to belong to a distinct species, characterised by the tapering and acutely pointed posterior extremity, and by the absence of lateral alar projections, and of any surface-ornament except the very slightest punctation. More extended researches have, however, supplied us with numerous specimens in stages intermediate between this and the fully developed *C. Montrosiense*, showing the extremity becoming gradually more obtuse and upturned, the shell-surface putting on its characteristic sculpture, and the lateral processes in progress of development.

Distribution. *Recent.*—Baffin's Bay.

Fossil.—Scotland: Tangyburn, Govan, Barrie, Elie, Dryleys, Errol, Annochie, King Edward's. England: Hopton Cliff. Ireland: Woodburn. Norway.

6. Cytheropteron rectum, *Brady*. Plate XIV, figs. 17, 18.

1868. Cytheropteron rectum, *Brady*. Monog. Rec. Brit. Ostrac., p. 476.
1869. — — *Brady* and *Robertson*. Ann. Mag. N. H., ser. iv, vol. iii, p. 372, pl. xx, figs. 6—8.

Carapace, seen laterally, oblong, quadrangular, very slightly higher in front than behind; height not equal to half the length; anterior extremity well rounded; posterior rounded off below, but only slightly above the middle; superior margin straight, terminated at each extremity by a distinct angular elevation, inferior slightly sinuated in front of the middle; seen from above, ovate, widest behind the middle, where the lateral alæ project slightly, forming an obtuse angle, rounded behind, acuminate in front; width equal to nearly half the length. Surface of the shell closely and minutely punctate, lateral alæ almost obsolete.

Length, $\frac{1}{66}$th of an inch.

Our single fossil specimen of this species was unfortunately lost when only one figure of it had been drawn. The lateral view given in our plate was, therefore, taken from a recent carapace.

Distribution. *Recent.*—Shetland and West of Ireland.

Fossil.—Scotland: Crofthead.

7. Cytheropteron angulatum, *B.* and *R.* Plate VIII, figs. 37—40.

1872. Cytheropteron angulatum, *Brady* and *Robertson*. Ann. Mag. N. H., ser. iv, vol. vi, p. 62, pl. ii, figs. 7, 8.

Carapace, as seen from the side, oblong, subrhomboidal, highest in front of the middle, greatest height equal to more than half the length; anterior margin rounded, posterior subtruncate, slightly beaked above; dorsal margin highest in front of the middle, thence sloping steeply in front and more gently behind, slightly sinuated near the posterior extremity; ventral margin somewhat convex. Outline, seen from above, oblong-pentagonal, widest in front of the middle, thence tapering suddenly to the anterior extremity, which is acuminate, more gradually to the posterior, which is broad and truncate; sides irregularly waved and emarginate. Surface irregularly waved and rugose in a transverse direction; alæform process not very prominent, forming an irregularly excavated angular line just within the ventral margin.

Length, $\frac{1}{55}$th of an inch.

Distribution. *Recent.*—Scotland.

Fossil.—Scotland: Duntroon, Crinan, West Tarbert, Kyles of Bute, Kilchattan, Cumbrae, Dumbarton, Dalmuir, Inch Lonaig. England: Bridlington. Canada.

Genus 10—Bythocythere, *G. O. Sars.*

Valves subequal, smooth or very sparingly sculptured, almost destitute of hairs; thin and fragile. Hinge-joint quite simple or composed of a slight bar and furrow; no teeth. Upper antennæ elongated, seven-jointed; the second joint large and thick and bearing a seta on its anterior and posterior margins; the other joints suddenly much narrower, forming a long slender lash, which bears several setæ; penultimate joint linear and destitute of setæ. Lower antennæ tolerably robust, four-jointed; second joint large; flagellum long, biarticulate, its last joint long and setiform. Mandibles constricted above the distal extremity, strongly toothed; palp four-jointed, bearing a well-developed branchial plate, which is set with numerous ciliated setæ. Terminal lobes of the first pair of jaws very short and thick; branchial plate large, ovate, bearing numerous marginal ciliated setæ, and at the base four long and deflexed simple setæ. Feet elongated, terminal claw very long and slender, second and third joints bearing each a short apical seta; basal joint of the first pair furnished at the base with a small lobe, which bears two very large and densely ciliated, and two smaller and simple setæ. Abdomen ending in a very large and acuminated process; postabdominal lobes narrow and bearing three hairs. Eyes mostly absent.

The species grouped under this genus present two very distinct types, so far as the characters of the shell are concerned; but according to the investigations of G. O. Sars, the structure of the animal itself is the same in both types.

1. Bythocythere simplex (*Norman*). Plate VII, figs. 20, 21.

1865. Cythere simplex, *Norman*. Nat. Hist. Trans. Northumberland and Durham, vol. i, p. 17, pl. v, figs. 1—4.
1865. Bythocythere acuminata, *G. O. Sars*. Overs. Norg. mar. Ostrac., p. 86.
1865. Jonesia simplex, *Brady*. Zool. Trans., vol. v, p. 363, pl. lvii, figs. 11 *a—e*.
1868. Bythocythere simplex, *Brady*. Monog. Rec. Brit. Ostrac., p. 450, pl. xxxiii, figs. 23—27, pl. xl, fig. 8.

Carapace, as seen from the side, elongated, fusiform, nearly equal in height throughout, greatest height equal to considerably less than half the length. Anterior extremity evenly rounded, posterior tapering abruptly, and conspicuously acuminate below the middle; superior margin nearly straight, inferior gently convex in front, produced along the posterior two thirds into a much compressed convex keel, sloping steeply upwards behind. Outline, seen from above, acutely ovate, extremities acuminate; widest in the middle, where the width is equal to one third of the length. Surface perfectly smooth. Lucid spots about five, parallel, linear, oblong, forming an oval, obliquely set patch near the middle of the valve.

Length, $\frac{1}{22}$nd of an inch.

This remarkable species is known in a living state in Baffin's Bay, on the coasts of Norway, Scotland, and the north of England, and has a range of depth varying from low-water-mark to about sixty fathoms.

Distribution. *Recent.*—Baffin's Bay, Norway, Great Britain.

Fossil.—Scotland: Duntroon, Loch Gilp, West Tarbert, Cartsdyke, Paisley, Dalmuir, Govan, Jordan Hill. Ireland: Woodburn.

2. Bythocythere constricta, *G. O. Sars*. Plate XVI, figs. 9, 10.

1865. Bythocythere constricta, *G. O. Sars*. Overs. Norg. Mar. Ostrac., p. 85.
— — *Brady*. Monog. Rec. Brit. Ostrac., p. 451, pl. xxxv, figs. 47—52.

Carapace, as seen from the side, rhomboidal, height nearly equal throughout and exceeding half the length; anterior extremity obliquely rounded; posterior obliquely truncate, rounded off at its upper angle; superior margin straight; inferior slightly sinuated near the middle, convex and inclined upwards behind. Outline, as seen from above, lozenge-shaped, distinctly constricted in the middle. Surface of the shell marked with delicate grooves mostly running in a subconcentric manner, but frequently anastomosing, so as to form an irregular reticulation; lateral protuberance rounded and not very prominent; centre of the valves marked by a deep and wide transverse sulcus.

Length, $\frac{1}{36}$th of an inch.

Distribution. *Recent.*—Great Britain, Ireland, Channel Islands.

Fossil.—Scotland: Tangy Burn, Duntroon, Dumbarton, Govan.

3. Bythocythere elongata, *nov. sp.* Plate II, figs. 4, 5.

Carapace, seen laterally, oblong, subelliptical, somewhat higher behind than in front, height equal to less than one half of the length; extremities rather obliquely rounded off; superior margin almost straight for the greater part of its course, but sloping gently towards the front; inferior nearly straight. Seen from above, compressed, ovate, somewhat suddenly tapered and obtusely pointed in front, prominently mucronate behind; greatest width less than the height and situated rather behind the middle of the shell. Shell transversely rugose in a waved manner, with a central transverse sulcus, such as is frequently observed in this and the preceding genus. Lower surface of the shell marked with longitudinal furrows.

Length, $\frac{1}{50}$th of an inch.

This species, in general appearance, bears some resemblance to *Cytheropteron rectum*, especially in its rugose sculpture and rounded angles.

Distribution.—One specimen only was found at Girvan.

Genus 11—Pseudocythere, *G. O. Sars.*

Shell thin and pellucid, having no distinct structure, rounded in front, produced behind. Hinge-joint simple. Upper antennæ bearing long setæ, 7-jointed; second joint thick and armed with a single seta on the middle of the anterior margin; last joint very long and narrow, linear, terminating in very long setæ; lower antennæ very slender, 5-jointed; flagellum long and slender. Mandibles small, with slender, curved, unguiform, teeth; palp narrow, 4-jointed; branchial appendage bearing long setæ. Terminal lobes of the first pair of jaws narrow; branchial plate large, elongate-ovate, armed towards the base with three curved and deflexed simple setæ. Feet very long and slender. Abdomen ending in a long, slender process ; postabdominal lobes almost as in the preceding genus. No eye.

PSEUDOCYTHERE CAUDATA, *G. O. Sars.* Plate II, fig. 9.

PSEUDOCYTHERE CAUDATA, *G. O. Sars.* Overs. Norg. mar. Ostrac., p. 88.
— — *Brady.* Monog. Rec. Brit. Ostrac., p. 453, pl. xxxiv, figs. 49—52 ; pl. xli, fig. 6.

Carapace of the *male*, as seen from the side, quadrilateral, highest in front ; greatest height equal to more than half the length. Anterior margin broad and well rounded ; posterior obliquely truncate, produced above into an obtusely conical beak ; superior margin sloping in a somewhat sinuous line from before backwards ; inferior slightly sinuated in front, terminating behind in one or two small sharp teeth. The anterior and ventral margins form a thin flattened lamina, which (in recent specimens) is marked with radiating transverse lines, and is most strongly developed behind. Shell of the *female* rather more tumid. Outline, as seen from above, compressed, tapering to the extremities, which are slightly mucronate ; greatest width in the middle and equal to one third of the length. Shell smooth, thin, and fragile ; pellucid. Lucid spots four, linear, parallel, situated obliquely a little in front of the middle.

Length, $\frac{1}{50}$th of an inch.

DISTRIBUTION. *Recent.*—Norway, Great Britain and Ireland.

Fossil.—Scotland : Blackburn, Dalmuir, Raised-beach, Oban. Ireland : Woodburn.

Genus 12—CYTHERIDEIS, *Jones.*

Carapace elongated, subovate, depressed in front ; hinge-margins nearly simple. Shell smooth, punctate, sometimes grooved ; right valve overlapping the left in the centre of the ventral aspect. Superior antennæ slender, sparingly setose ; last joint short and bearing six short terminal setæ ; penultimate and antepenultimate joints each bearing a single apical seta. Mandible slender and curved, divided below into about four very small indistinct teeth ; palp four-jointed, its first joint bearing on the inferior margin a conical tooth-like process ; third joint set along its entire length with a comb-like series of straight equal setæ ; in other respects like that of *Cythere.* First segment of the maxillæ much stouter and larger than the rest.

Cytherideis subspiralis, *nov. sp.* Plate X, figs. 16, 17.

Valves, as seen from the side, oblong, depressed in front, height equal to not much more than one third of the length; extremities rounded; the anterior much narrowed; superior margin straight, but suddenly sloping forwards with a gentle declivity from about the anterior third; inferior margin almost straight. Seen from above, compressed, ovate. Shell-surface marked with several curved or transversely spiral furrows, and on the anterior half with distant circular pittings.

Length, $\frac{1}{36}$th of an inch.

Except the British *C. subulata,* the only near relative of this curious species, with which we are acquainted, is a still more compressed and elongated form found living in the Mediterranean and amongst the Cape de Verd Islands, and described by Mr. Brady, in 'Les Fonds de la Mer,' under the name *Cytherideis cylindrica.* One valve only of *C. subspiralis* has been discovered.

Distribution. *Fossil.*—Scotland: Wick.

Genus 13—Sclerochilus, *G. O. Sars.*

Valves elongated, very hard, especially towards the margins; surface smooth and shining, ornamented with very minute scattered papillæ. Hinge-joint formed by a projecting median crest of the left valve. Lucid spots linear, subparallel, forming an oblique oval patch below the centre of the valve. Antennæ robust; second joint of the upper bearing a seta on the anterior and posterior margins, the last five joints quickly decreasing in size and bearing numerous long setæ; lower antennæ larger than the upper, 5-jointed; flagellum long and very slender. Poison-glands very large, and divided into many lobes. Mouth produced, conical; labrum strongly toothed. Mandibles small; teeth numerous and acuminate; palp narrow, indistinctly 3-jointed, with a distinct branchial appendage. Terminal lobes of the first pair of jaws partly wanting; branchial plate narrow, almost lanceolate, and beset with numerous setæ on the outer and inner margins. Feet short and robust; second and third joints armed in front with a sharp seta; first pair armed with a single strong spine at the apex of the basal joint. Post-abdominal lobes larger than usual, forming broad bilobed laminæ, and bearing five setæ. Eye single.

Sclerochilus contortus (*Norman*). Plate X, figs. 33—35.

1862. Cythere contorta, *Norman*. Ann. Mag. N. H., vol. ix, p. 48, pl. ii, fig. 15; Trans. Tyneside Nat. F. C., vol. v, p. 150, pl. iii, fig. 15.
1865. Schlerochilus contortus, *Sars*. Overs. Norg. mar. Ostrac., p. 90.
1868. — — *Brady*. Monog. Rec. Brit. Ostrac., p. 455, pl. xxxiv, figs. 5—10; pl. xli, fig. 7.

Shell of the *female*, as seen from the side, elongated, bean-shaped, higher behind than in front, greatest height less than one half of the length, situated behind the middle. Extremities well rounded; superior boldly arched; inferior deeply sinuated in front of the middle. Seen from above, compressed, ovate, extremities acutely pointed, width scarcely equal to one third of the length. End-view ovate, rounded above, pointed below. Surface perfectly smooth. Colour yellowish.

Length, $\frac{1}{34}$th of an inch.

Distribution. *Recent.*—Britain, Norway, Bay of Biscay, Spitzbergen.

Fossil.—Scotland: in nearly all the Post-tertiary beds. South Wales: Cardiff New Dock-basin. Ireland: Belfast New Dock, Portrush. Norway and Canada.

Genus 14—Paradoxostoma, *Fischer*.

Shell thin and fragile, smooth, shining, and having no definite structure; valves subequal, mostly much higher behind than in front, usually elongate-ovate. Lucid spots as in the preceding genus. Hinge-joint simple. Ventral margins emarginate in front, so that when the valves are closed there is still an elongated orifice through which the suctorial mouth can be protruded. Upper antennæ exceedingly slender, 6-jointed, and bearing short setæ; lower shorter and more robust, 5-jointed; flagellum large and almost as thick as the antenna itself. Poison-glands large and mostly lobulated. Mouth suctorial. Labrum and labium forming together a large and stout subconical process projecting downwards, and terminating in a disk with elevated margins, in the middle of which the orifice of the mouth is situated. Mandibles very slender, protractile, styliform, subulate at the apex; palp very slender and elongated, indistinctly jointed and without a branchial appendage. Terminal lobes of the first pair of jaws very narrow; branchial plate elongate-ovate, and bearing at the base two deflexed setæ. Feet short and robust, last joint elongated, terminal claw very short and curved; basal joint of the first pair armed at the apex with a single strong spine. Postabdominal lobes bearing two short hairs. One eye.

1. Paradoxostoma variabile (*Baird*). Plate X, figs. 29—32.

1792. ? Cythere flavida, *Müller*. Entomostraca, p. 66, pl. vii, figs. 5, 6.
1835. — variabilis, *Baird*. Trans. Berwickshire Nat. Club, vol. i, p. 98, pl. iii, figs. 7 *a*—*b*; vol. ii, p. 153; (1850) Brit. Entom., p. 170, pl. xxi, figs. 10, 11.
1865. Paradoxostoma variabile, *Sars*. Overs. Norg. mar. Ostrac., p. 93.
1868. — — *Brady*. Monog. Rec. Brit. Ostrac., p. 457, pl. xxxv, figs. 1—7, 12—17; pl. xli, fig. 8.

Carapace, as seen from the side, pear-shaped, much higher behind than in front; greatest height equal to half the length, situated behind the middle; anterior extremity narrowly, posterior broadly rounded; superior margin well arched, sloping more steeply in front than behind; inferior convex behind the middle. Outline, as seen from above, compressed, ovate, tapering gradually to the acuminate extremities; greatest width behind the middle, slightly exceeding one third of the length. End-view obovate, widest above the middle. Shell-surface perfectly smooth.

Length, $\frac{1}{40}$th of an inch.

We do not remember to have seen any fossil shells of this species marked with the dark-coloured maculæ, which are so constant in recent littoral examples. This may arise either from their having inhabited water of considerable depth or possibly from loss of the original colouring during the ages which have elapsed since their death.

Distribution. *Recent.*—Baffin's Bay, Spitzbergen, Great Britain, Norway, Holland.

Fossil.—Scotland: Tangy Burn, Duntroon, Loch Gilp, Blackburn, Kyles of Bute, Cumbrae, Dumbarton, Cartsdyke, Paisley, Govan, West Tarbert, Raised Beach at Oban. Ireland: Woodburn, Belfast New Docks. Norway and Canada.

2. Paradoxostoma abbreviatum, *G. O. Sars.*

1865. Paradoxostoma abbreviatum, *G. O. Sars.* Overs. Norg. mar. Ostrac. p. 94.
1868. — — *Brady.* Monog. Rec. Brit. Ostrac., p. 458, pl. xxxv, figs. 22—25.

Carapace of the *female,* as seen from the side, much shorter and higher than the preceding; greatest height behind the middle and equal to about two thirds of the length; extremities rounded; anterior narrow; posterior excessively broad; superior margin boldly arched; inferior deeply sinuated in front, very convex behind. Outline, as seen from above, compressed, ovate, about three times as long as broad. Shell of the *male* and *young females* lower; inferior margin less convex behind.

Length, $\frac{1}{45}$th of an inch.

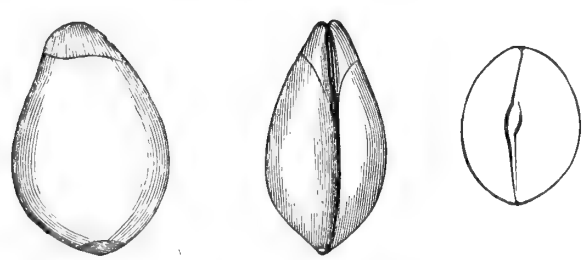
Distribution. *Recent.*—Great Britain, Ireland, Norway.

Fossil.—Scotland: Loch Gilp, Oban. South Wales: Cardiff.

3. Paradoxostoma (?) pyriforme, *nov. sp.* Woodcut, figs. 1—3.

Carapace, as seen from the side, broadly pear-shaped, narrowed at the anterior and broadly rounded at the posterior extremity; superior and inferior margins nearly alike, gently sinuated in front and boldly convex at and behind the middle; greatest height

Fig. 1. Fig. 2. Fig. 3.



Side view. Edge view. End view.

equal to more than two thirds of the length and situated near the middle; seen from above the outline is subovate, suddenly tapered and acuminate behind, more gently tapering and subacuminate in front, greatest width a little behind the middle and equal to about one half the length; end view broadly oval. Shell smooth and polished, milk-white, tipped with a small pellucid areola at each extremity.

Length, $\frac{1}{60}$th of an inch.

Three or four examples of this very distinct species were found in the Bridlington deposit, but too late to be figured in our lithographic plates. It has the general aspect of a *Paradoxostoma,* but we have failed to find the mandibular aperture characteristic of that species; neither are the lucid spots visible. Moreover, there is an indistinct appearance of overlapping of the left valve on the dorsal surface, so that we cannot but consider the position here assigned to it somewhat doubtful. In lateral outline it is extremely like *P. abbreviatum* (which species we have by some oversight omitted to include in our plates), but when viewed from above is much more tumid.

4. Paradoxostoma ensiforme, *Brady.* Plate 10, figs. 27, 28.

1868. Paradoxostoma ensiforme, *Brady.* Monog. Rec. Brit. Ostrac., p. 460, pl. xxxv, figs. 8—11.

Valves, as seen from the side, somewhat scimitar-shaped, much higher behind than in front, greatest height scarcely equal to half the length, situated behind the middle; anterior extremity obtusely pointed; posterior obliquely rounded, slightly produced above the middle; superior margin boldly arched; inferior gently sinuated in the middle. Seen from above, compressed, ovate, with pointed extremities. Shell smooth, yellowish.

Length, $\frac{1}{35}$th of an inch.

Our fossil specimens differ somewhat in shape from the recent form as found in the British islands, and are, perhaps, more exactly similar to specimens taken in the Mediterranean, and referred by Mr. Brady to the same species.

Distribution. *Recent.*—Great Britain, Ireland, Levant.

Fossil.—Scotland: Kyles of Bute. South Wales: Cardiff New Dock basin. England: Bridlington. Ireland: Belfast New Docks, Portrush.

5. Paradoxostoma Fischeri, *G. O. Sars.* Plate XVI, figs. 23, 24.

1865. Paradoxostoma Fischeri, *G. O. Sars.* Overs. Norg. mar. Ostrac., p. 96.
1870. — — *Brady.* Nat. Hist. Trans. Northumberland and Durham, vol. iii, p. 362, pl. xii, figs. 1—3.

1869. SCLEROCHILUS (?) GRACILIS, *Brady* and *Robertson*. Ann. Mag. N. H., ser. iv, vol. iii, pl. xx, figs. 11, 12.

Carapace, seen laterally, elongated, subtriangular, greatest height situated in the middle, and equal to less than half the length; extremities nearly equal, narrowed, and sharply rounded, superior margin very boldly and evenly arched, inferior gently sinuated in the middle. Seen from above, ovate, with equal obtusely pointed extremities; greatest width situated in the middle, rather less than the height. Shell-surface smooth, destitute of ornament of any kind, but in recent specimens often beautifully banded with dark olive or black.

Length, $\frac{1}{55}$th of an inch.

DISTRIBUTION. *Recent.*—Britain, Ireland, Norway.

Fossil.—Scotland: Loch Gilp, Cartsdyke, West Tarbert. South Wales: Cardiff New Dock-basin. Ireland: Belfast New Dock.

6. PARADOXOSTOMA FLEXUOSUM, *Brady*. Plate XVI, figs. 19, 20.

1866. BYTHOCYTHERE (?) FLEXUOSA, *Brady*. Brit. Assoc. Report, 1866, p. 211.
1868. PARADOXOSTOMA FLEXUOSUM, *Brady*. Monog. Rec. Brit. Ostrac., p. 461, pl. xxxv, figs. 30—34.
1872. — — *Brady* and *Robertson*. Ann. Mag. N. H., ser. iv, vol. ix, p. 55, pl. i, figs. 8, 9.

Carapace, seen laterally, elongated, flexuous, greatest height situated near the middle, and equal to rather more than one third of the length; extremities sharply rounded, the anterior being the narrower and more acute, superior margin boldly and equally arched, inferior distinctly sinuated in front of the middle, gently convex behind. Seen from above, much compressed, ovate, extremities acuminate, greatest width in the middle, and equal to about one fourth of the length. Surface of the shell smooth, marked usually with very faint and delicate longitudinal striæ.

Length, $\frac{1}{55}$th of an inch.

The longitudinal striations referred to in this description are imperceptible except with a tolerably high microscopic power, and they exist probably in all—certainly in many others—of the genus.

DISTRIBUTION. *Recent.*—Britain.

Fossil.—Scotland: Loch Gilp. South Wales: Cardiff New Dock-basin.

7. Paradoxostoma tenerum, *nov. sp.* Plate XVI, figs. 21, 22.

Almost exactly like *P. flexuosum*, except that, when seen laterally, the anterior extremity is more widely rounded, and the superior margin more boldly arched in the middle; the dorsal aspect presents also a more compressed outline, while the surface of the shell is slightly papillose, with hair-like markings along the ventral margin. The length is also greater, being about $\frac{1}{38}$th of an inch. Yet notwithstanding these differences we have still some misgivings as to its title to rank as a distinct species.

Distribution. *Fossil.*—Scotland: Dumbarton, Cartsdyke, Dalmuir.

8. Paradoxostoma arcuatum, *Brady.* Plate XVI, fig. 25.

1868. Paradoxostoma arcuatum, *Brady.* Monog. Rec. Brit. Ostrac., p. 461, pl. xxxv, figs. 37, 38.

Carapace, seen from the side, oblong, subtriangular, highest in the middle, height equal to a little more than one third of the length, extremities moderately rounded, superior margin well and evenly arched, inferior almost straight. Seen from above, compressed, ovate, widest behind the middle, width equal to one fourth of the length. Shell quite smooth.

Length, $\frac{1}{45}$th of an inch.

Distribution. *Recent.*—West of Ireland, Shetland.

Fossil.—Scotland: Raised-beach at Oban.

Family 4—CYPRIDINADÆ.

Genus 1—Asterope, *Philippi.*

Shell subcylindrical, beak not at all produced. Upper antennæ six-jointed; in the *female* short and thick, and bearing several subequal terminal setæ of moderate length; in the *male* more elongated, two of the terminal setæ of excessive length, the antepenultimate joint bearing a stout and densely setose auditory filament. Second joint of the natatory branch of the lower antennæ in the *male* elongated, in the *female* scarcely longer than the succeeding joints; secondary branch in the *male* robust, subchelate; terminal joint slender, curved upwards; in the *female* simple, triarticulate, last joint setiform. First jaw consisting of a broad, subquadrate, or crescentic lamina densely clothed on its distal margin with long bristles; second jaw swollen at the base, narrowed at the apex, where it bears six plumose setæ, basal portion setose along its convex margin; third jaw narrow, elongated, setose along the inner margin. Post-abdominal laminæ short and broad, subtruncate at the apex.

In external appearance this genus is chiefly distinguished from others of its family by the cylindrical form of the shell and the absence of a projecting beak.

Asterope teres (*Norman*). Plate II, figs. 33, 34.

1861. Cypridina teres, ***Norman.*** **Ann. Mag. N. H., vol. viii, pl. xiv, fig. 10.**
1868. Cylindroleberis teres, ***Brady.*** **Monog. Rec. Brit. Ostrac., p. 465, pl. xxxiii, figs. 6—9, and pl. xli, fig. 2.**
1871. Asterope — ***Brady.*** **Proc. Zool. Soc. Lond., 1871, p. 295.**

Shell, seen laterally, almost elliptical, wider behind than in front, the greatest height behind the middle and equal to at least two thirds of the length. Anterior extremity slightly narrowed and somewhat flattened, with a wide, but shallow, notch below the middle; obtusely subangular below, rounded off above; posterior extremity broad, boldly and evenly rounded; superior margin evenly and well arched; inferior almost straight for the first half of its course, but curved posteriorly. Seen from above, oblong-ovate, anterior extremity narrowly, posterior rather broadly, rounded; greatest width situated near the middle, and equal to nearly half the length. Surface of the shell smooth, dense and calcareous in structure.

Length, $\frac{1}{18}$th of an inch.

It is extremely probable that this is only the female of the much more commonly seen *Asterope Mariæ*, which differs, however, very considerably in external appearance, being much longer and more compressed, more delicate in shell structure and variously coloured. The anatomy of the two animals is, however, essentially the same, and the points of difference are such as might be expected to accompany difference of sex, though, doubtless, very strongly developed in this instance. The male, being provided with swimming filaments, is usually taken near the surface of the water, while the female is never met with except in the dredge. Under these circumstances we need scarcely expect to find the male in the fossil state.

Distribution. *Recent.*—North Sea, West Coasts of Scotland and Ireland, Scilly, and Channel Islands.

Fossil.—Scotland: Jordan Hill.

Family 5—POLYCOPIDÆ.

Genus 1—Polycope, *G. O. Sars.*

Valves rounded, ventricose, thin, and fragile, corneo-calcareous. Forehead having no tentacle, but in its place two ciliated setæ. Upper antennæ three-jointed, last joint short, terminal setæ long and slender; terminal rami of the lower antennæ unequal, one many-jointed, of structure very similar to that of *Cypridina*, the other shorter and three-jointed. Lower extremity of mandibles strongly inflexed, armed with a few small acute teeth; palp biarticulate, first joint stout, bearing externally a short, bisetose, branchial appendage; last narrow, beset with long plumose setæ. Incisive portion of the first pair of jaws small, forming a simple setiferous lobe; palp very large, four-jointed, two-branched, second joint bearing externally a long, narrow, and obsoletely biarticulate branch, which is terminated by long setæ. Second pair of jaws membranaceous, three-jointed; penultimate joint bearing externally a small branch which terminates in a single seta; furnished at the base with a large branchial plate. Postabdominal plates short, posterior margin shortly digitate and armed between the segments with acuminate claws. Animal swimming actively like the Lynceidæ.

Polycope orbicularis, *G. O. Sars.* Plate XII, figs. 22, 23.

1865. Polycope orbicularis, *G. O. Sars.* Overs. Norg. mar. Ostrac., p. 122.
1868. — — *Brady.* Monog. Rec. Brit. Ostrac., p. 471, pl. xxxv, figs. 53—57.

Shell subspheroidal; as seen from the side, almost circular, somewhat flattened on the dorsal margin. Seen from above, ovate, tapering evenly to each extremity, greatest width situated in the middle, equal to more than half the length. Surface of the shell finely and closely punctate, and mostly divided by delicate raised ridges into numerous polygonal areolæ.

Diameter, $\frac{1}{72}$nd of an inch.

There is a good deal of diversity in the surface-ornament of this species. The specimens from Dalmuir, one of which is figured in our plate, are distinctly areolated, but the puncta are small and faint; the Paisley specimens, on the contrary, are much more strongly punctate, and others are almost entirely destitute of sculpture of any kind.

Distribution. *Recent.*—Norway, Great Britain, Ireland, Spitzbergen.

Fossil.—Scotland: Duntroon, Dumbarton, Cartsdyke, Paisley, Old Mains, Govan, Dalmuir.

Family 6—CYTHERELLIDÆ?

Genus 1—Bosquetia, *nov. gen.*

Shell dense and thick, the right valve much larger than the left and overlapping both on the dorsal and ventral margins; valves obliquely ovate, higher in front than behind; greatest width in the middle; hinge-joints formed apparently by an overlapping of the dorsal margin of the right valve at each extremity.

One specimen only of this new genus having occurred to us, we are unable to give its characters with the certainty and minuteness which we could have wished, but an examination of this single example leaves us unable to assign it to any known genus. It differs from the *Cypridinadæ* in the absence of any antennal notch, and from the *Cytherellidæ* in the structure of the hinge-joint, in the general contour of the shell, and probably also in the character of the muscle-spots; but of this latter point we cannot speak confidently.

Bosquetia robusta, *nov. sp.* Plate XII, figs. 18—21.

Carapace, as seen from the side, higher in front than behind; greatest height equal to nearly three fourths of the length; anterior extremity broadly rounded; posterior rounded, somewhat narrowed and prominent in the middle; superior margin arched, flattened in the middle; inferior boldly convex, forming with the anterior margin one continuous sweep. Seen from above, ovate, widest near the middle; width fully equal to half the length, extremities broadly acuminate, tapering more abruptly behind than in front. Surface of the shell perfectly smooth.

Length, $\frac{1}{30}$th of an inch.

Distribution. *Fossil.*—Scotland: Paisley.

§ X. SUPPLEMENTARY.

[The following have been accidentally omitted from their proper positions in the descriptive portion of this Memoir.]

42. Cythere Robertsoni, *Brady*.

1868. Cythere Robertsoni, *Brady*. Ann. Mag. N. H., ser. iv, vol. ii, p. 33, pl. iv, figs. 5, 8—10.

Shell of the *female* compressed, subcuneiform, much higher in front than behind; greatest height situated in front and equal to somewhat more than half the length; extremities obliquely rounded; anterior broad, posterior narrowed; superior margin straight, sloping steeply from before backwards; inferior sinuated in the middle, curved upwards behind. Seen from above, compressed, oblong, with nearly parallel sides; anterior extremity acuminate, posterior suddenly tapered and obtusely pointed; width much less than the height. End-view ovate, widest in the middle. Shell of the *male* much narrower; surface of the shell covered with closely set angular pittings.

Length, $\frac{1}{52}$nd of an inch.

Distribution. *Recent.*—Great Britain, Ireland, Norway.

Fossil.—Scotland: Loch Gilp. Norway.

20. Cytherura Robertsoni, *Brady*.

1868. Cytherura Robertsoni, *Brady*. Monog. Rec. Brit. Ostrac., p. 444, pl. xxxii, figs. 16—18.

Carapace of the *female*, as seen from the side, subovate, produced into a lateral ala behind the middle of the ventral margin; height equal to more than half the length; anterior extremity rounded, posterior slightly produced in a rounded manner above the middle. Superior margin gently and evenly arched, inferior slightly sinuated. Seen from above, subrhomboidal, widest behind the middle, extremities slightly mucronate; width equal to about two thirds of the length. End-view broadly triangular, with much produced basal angles; width greater than the height. The shell of the *male* is more elongated, more sinuated below, and has less prominent lateral alæ. Shell-surface very distinctly and regularly marked with a raised reticulation; ventral surface longitudinally striated.

Length, $\frac{1}{52}$nd of an inch.

Distribution. *Recent.*—Great Britain.

Fossil.—Scotland: West Tarbert Silt. Canada: Saxicava Sand, Montreal.

§ XI. TABLE ILLUSTRATING THE DISTRIBUTION OF

The asterisk denotes the comparative rarity of the species. × × × Represent abundance, × × moderate frequency,

	Boulder Clay, Wick.	Lag Arran.	Tangy Burn, Campbelton.	King Edward's, near Banff.	Crofthead, Renfrewshire.	Paisley.	Stobcross, Glasgow.	Jordan Hill, near Glasgow.	Govan, near Glasgow.	Rowan Bridge, near Glasgow.	Old Mains, Renfrewshire.	Dalmuir.	Dumbarton.	Inch Lonaig, Loch Lomond.	Cartsdyke, Greenock.	Cumbrae, College-bed, Buteshire.	Kilchattan, Bute.	Kyles of Bute.	East Tarbert, Argyleshire.	West Tarbert, Argyleshire.	Loch Gilp, Argyleshire.
Cypris, *Müller*—																					
compressa, *Baird*	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
salina, *Brady*	...	...	...	...	×																
virens (*Jurine*)	...	...	...	...	×																
ovum (*Jurine*)	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
lævis, *Müller*	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
cinerea, *Brady*	...	...	...	...	×																
gibba, *Ramdohr*	...	...	...	...	× ×	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
reptans (*Baird*)	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Cypridopsis, *Brady*—																					
obesa, *B. & R.*	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Newtoni, *B. & R.*	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Potamocypris, *Brady*—																					
fulva, *Brady*	...	...	...	...	×	...	...	...	...	...	...	×	...	...	...	...	...	...	...	...	...
Paracypris, *G. O. Sars*—																					
polita, *G. O. Sars*	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Argilloecia, *G. O. Sars*—																					
cylindrica, *G. O. Sars*	...	...	...	...	...	× ×	...	...	...	...	...	× ×	×	...	×	...	× ×	...	...	...	...
Candona, *Baird*—																					
albicans, *Brady*	...	...	...	...	×	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
detecta (*Müller*)	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
lactea, *Baird*	...	...	...	...	× ×	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
compressa (*Koch.*)	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
candida (*Müller*)	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Pontocypris, *G. O. Sars*—																					
mytiloides, *Norman*	...	...	...	...	...	× ×	...	...	...	...	...	×	×	...	×	...	...	...	...	...	...
trigonella, *G. O. Sars*	...	...	...	...	...	× ×	...	...	...	...	...	...	...	...	×	...	...	...	...	...	...
acupunctata, *Brady*	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Aglaia, *Brady*—																					
glacialis, *n. sp.*	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Bairdia, *M'Coy*—																					
inflata, *Norman*	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Cambrica, *n. sp.*	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Darwinella, *B. & R.*—																					
Stevensoni, *B. & R.*	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Cythere, *Müller*—																					
pellucida, *Baird*	...	×	...	...	...	× ×	× × ×	× ×	...	× ×	× ×	× ×	...	× ×	× ×	× ×	...	× ×	×	× ×	×
castanea, *G. O. Sars*	...	...	× ×	...	...	× ×	...	×	× ×	...	×	× ×	× ×	...	...	×	× ×	...	...	...	...
porcellanea, *Brady*	...	...	...	...	...	...	×	...	...	...	...	× ×	...	...	×	×	× ×	...	...	...	×
Macallana, *B. & R.*	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	×	×				
tenera, *Brady*	×	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
deflexa, *n. sp.*	...	...	...	...	...	...	...	×													
cribrosa, *n. sp.*	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
crispata, *Brady*	...	...	...	...	...	×	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
viridis, *Müller*	×	...	...	...	...	× ×	×	×	× ×	× ×	× ×	× ×	× ×	×	× ×	× ×	×	× ×	×	×	×
lutea, *Müller*	×	...	× ×	...	...	× ×	...	×	...	× ×	×	× ×	×	× ×	× ×	× ×	× ×	×	×	×	×
albomaculata, *Baird*	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	×	...	...	...	...	...
leioderma, *Norman*	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
gibbosa, *B. & R.*	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
convexa, *Baird*	...	...	...	...	...	×	...	...	...	...	...	...	...	...	...	×	...	...	...	...	...
cicatricosa (*Reuss*)	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...

OSTRACODA OVER POST-TERTIARY LOCALITIES.

and × rarity. Localities additional to those given in the text are assigned in this Table to some species.

Duntroon, Argyleshire.	Fort William.	Clashmahew, Wigtonshire.	Terally Tile-works, Wigtonshire.	Dipple Tile-works, Girvan, Ayrshire.	Errol, Perthshire.	Elie, Fifeshire.	Dryleys, Montrose.	Barrie, Forfarshire.	Gamrie, Banffshire.	Annochie, Aberdeenshire.	Raised beach, Irvine, Ayrshire.	Drip Bridge, near Stirling.	Bridge of Allan.	Raised beach, Cumbrae, Buteshire.	West Tarbert Silt, Argyleshire.	Raised beach, Oban.	Woodburn, near Carrickfergus.	Raised beach, Portrush.	Belfast New Docks.	Bridlington, Yorkshire.	Hopton Cliff, near Yarmouth.	Hornsea, Yorkshire.	Cardiff New Docks basin.	Mersey, near Liverpool.	Branston Fen, Lincolnshire.	Whittlesea.	Upper Boulder Clay, Newton, nr. Chester.
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	Boulder Clay, Wick.	Lag Arran.	Tangy Burn, Campbelton.	King Edward's, near Banff.	Crofthead, Renfrewshire.	Paisley.	Stobcross, Glasgow.	Jordan Hill, near Glasgow.	Govan, near Glasgow.	Rowan Bridge, near Glasgow.	Old Mains, Renfrewshire.	Dalmuir.	Dumbarton.	Inch Lonaig, Loch Lomond.	Cartsdyke, Greenock.	Cumbrae, College-bed, Buteshire.	Kilchattan, Bute.	Kyles of Bute.	East Tarbert, Argyleshire.	West Tarbert, Argyleshire.	Loch Gilp, Argyleshire.
Cythere, *Müller* (*cont.*)—																					
Clutha, *n. sp.*	...	×	...	...	...	...	...	...	×	...	...	...	...	...	×	...	×				
Finmarchica (*G. O. Sars*)	×	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	×
cuneiformis, *Brady*	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
limicola (*Norman*)	...	...	× ×	...	...	...	×	...	...	...	...	...	×	×	×	×	× ×	× ×	...	...	...
globulifera, *Brady*	...	...	×	...	...	× ×	...	×	× ×	...	...	...	...	...	...	...	...	...	...	...	...
Jeffreysii, *Brady*	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
pulchella, *Brady*	...	...	...	...	...	...	...	×	...	...	...	...	×	...	...	× ×	× ×	...	...	×	×
villosa (*G. O. Sars*)	×	...	...	...	...	×	× ×	× ×	×	× ×	× ×	× ×	×	×	× ×	× ×	× ×	× ×	×	× ×	× ×
laticarina, *Brady*	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
macropora, *Bosq.*	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
concinna, *Jones*	×	× ×	× ×	...	...	× ×	×	× ×	× ×	× ×	×	× ×	× ×	× × ×	× ×	× ×	× ×	× × ×	×	× ×	×
emaciata, *Brady*	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
quadridentata, *Baird*	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	×
angulata (*G. O. Sars*)	...	...	...	...	...	× ×	...	...	...	...	× ×	× ×	× ×	×	× ×	× ×	× ×	× ×	× ×	× ×	×
latimarginata, *Speyer*	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
tuberculata (*G. O. Sars*)	×	...	...	×	...	×	...	...	...	...	× ×	× ×	× ×	× ×	× ×	× ×	× ×	× × ×	× ×	× ×	×
Logani, *B. & C.*	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
emarginata (*G. O. Sars*)	...	×	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	×	...	...
costata, *Brady*	...	...	...	...	...	×	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
mirabilis, *Brady*	×	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	×
Hoptonensis, *n. sp.*	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Dunelmensis (*Norman*)	×	×	× ×	× ×	...	× ×	× ×	×	× ×	× ×	×	×	×	×	...	×	× ×	× ×	...	× ×	×
Whiteii (*Baird*)	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
antiquata (*Baird*)	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Jonesii (*Baird*)	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
— *var.* ceratoptera, *Bosq.*	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
? semipunctata, *Brady*	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Robertsoni, *Brady*	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	×
Limnicythere, *Brady*—																					
inopinata (*Baird*)	...	...	...	...	× ×	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Sancti Patricii, *B. & R.*	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
antiqua, *n. sp.*	...	...	...	...	× ×	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
monstrifica (*Norman*)	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Cytheridea, *Bosquet*—																					
papillosa, *Bosquet*	× ×	× ×	×	×	...	×	× ×	×	...	...	×	...	×	× ×	× ×	×	× ×	× ×	× ×	× ×	×
punctillata, *Brady*	×	×	...	×	...	×	× ×	×	× ×	× ×	× ×	× × ×	× ×	× ×	×	× ×	× × ×	× ×	× ×	× ×	× ×
torosa (*Jones*)	...	...	...	...	×	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
— *var.* teres, *B. & R.*	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
lacustris (*G. O. Sars*)	...	...	...	...	× ×	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Sorbyana, *Jones*	...	...	×	× ×	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
inornata, *n. sp.*	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
elongata, *Brady*	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Eucythere, *Brady*—																					
Argus (*G. O. Sars*)	...	...	...	...	...	×	...	...	...	...	× ×	× ×	× ×	...	×	×	× ×	× ×	...	...	×
declivis (*Norman*)	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	×					
Krithe, *B., C., & R.*—																					
glacialis, *n. sp.*	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Bartonensis (*Jones*)	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Loxoconcha, *G. O. Sars*—																					
impressa (*Baird*)	× ×	...	...	...	...	...	...	×	...	...	...	...	...	...	...	...	...	...	...	...	...
guttata (*Norman*)	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
multifora (*Norman*)	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
tamarindus (*Jones*)	...	...	...	...	...	× ×	...	×	...	...	...	× ×	× ×	× ×	× ×	× ×	× ×	×	...	× ×	×
elliptica, *Brady*	...	...	...	...	...	...	...	...	× ×	...	...	...	...	...	...	...	...	...	...	...	...
fragilis, *G. O. Sars*	...	...	...	...	...	× ×	...	...	...	...	...	...	...	...	×						
Xestoleberis, *G. O. Sars*—																					
depressa, *G. O. Sars*	×	...	...	...	...	×	...	×	...	...	...	...	...	...	...	...	...	...	...	...	×
aurantia (*Baird*)	×	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	×

Duntroon, Argyleshire.	Fort William.	Clashmahew, Wigtonshire.	Terally Tile-works, Wigtonshire.	Dipple Tile-works, Girvan, Ayrshire.	Errol, Perthshire.	Elie, Fifeshire.	Dryleys, Montrose.	Barrie, Forfarshire.	Gamrie, Banffshire.	Annochie, Aberdeenshire.	Raised beach, Irvine, Ayrshire.	Drip Bridge, near Stirling.	Bridge of Allan.	Raised beach, Cumbrae, Buteshire.	West Tarbert Silt, Argyleshire.	Raised beach, Oban.	Woodburn, near Carrickfergus.	Raised beach, Portrush.	Belfast New Docks.	Bridlington, Yorkshire.	Hopton Cliff, near Yarmouth.	Hornsea, Yorkshire.	Cardiff New Docks basin.	Mersey, near Liverpool.	Branston Fen, Lincolnshire.	Whittlesea.	Upper Boulder Clay, Newton, nr. Chester.
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CYTHERURA, *G. O. Sars*—																					
nigrescens (*Baird*)	...	×	× ×	...	...	...	×	×	× ×	× ×	× ×	× ×	× ×	× ×	...	× ×	× ×	× ×	×	× ×	×
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complanata, *n. sp.*	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
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compressa, *n. sp.*	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
striata, *G. O. Sars*	...	...	...	...	...	...	...	...	...	...	...	...	...	...	× ×	×	. .	× ×	...	× ×	×
quadrata, *Norman*	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
cuneata, *Brady*	..	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Sarsii, *Brady*	...	...	...	...	...	× ×	...	...	...	...	...	× ×	...	...	× ×	× ×	×	×	× ×	...	×
angulata, *Brady*	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
producta, *Brady*	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
cornuta, *Brady*	..	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Robertsoni, *Brady*	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
gibba (*Müller*)	...	...	...	...	...	...	...	×	...	...	...	...	...	...	...	...	×	...	...	...	×
flavescens, *Brady*	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	×	...	...	...
acuticostata, *G. O. Sars*	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
cellulosa (*Norman*)	...	...	...	...	...	...	...	×	...	...	...	...	...	...	...	...	...	...	...	...	...
clathrata, *G. O. Sars*	...	...	× ×	...	...	× ×	...	×	...	...	×	× ×	×	×	× ×	×	...	...	×	...	×
CYTHEROPTERON, *G. O. Sars*—																					
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nodosum, *Brady*	...	×	...	...	...	...	...	×	×	...	...	× ×	...	...	×	×	...	×	...	...	...
arcuatum, *n. sp.*	...	...	×	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
inflatum, *n. sp.*	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Montrosiense, *n. sp.*	...	...	× ×	×	...	...	...	...	× ×	...	...	...	...	...	...	...	...	...	...	...	...
rectum, *Brady*	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
angulatum, *B. & R.*	...	...	...	...	...	...	. .	...	...	...	...	× ×	× ×	× ×	× ×	×	...	×	...	×	...
BYTHOCYTHERE, *G. O. Sars*—																					
simplex (*Norman*)	...	...	..	...	...	× ×	...	×	×	...	...	×	...	...	×	...	...	...	...	×	×
constricta, *G. O. Sars*	...	...	×	...	...	...	...	...	×	...	...	...	×	...	...	...	...	...	...	...	...
elongata, *n. sp.*	...	...	...	...	...	...	...	...	×												
PSEUDOCYTHERE, *G. O. Sars*—																					
caudata, *G. O. Sars*	...	...	...	...	...	...	...	...	...	...	...	×	...	...	...	...	...	...	× ×	...	...
CYTHERIDEIS, *Jones*—																					
subspiralis, *n. sp.*	×																				
SCLEROCHILUS, *G. O. Sars*—																					
contortus, *Norman*	...	...	×	...	...	× ×	...	×	×	...	×	× ×	× ×	...	× ×	×	...	×	× ×	× ×	×
PARADOXOSTOMA, *Fischer*—																					
variabile (*Baird*)	...	...	×	...	...	× ×	...	...	×	...	...	...	×	...	× ×	× ×	...	×	× ×	...	×
abbreviatum, *G. O. Sars*	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	×
pyriforme, *n. sp.*	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
ensiforme, *Brady*	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	×	...	...	...
Fischeri, *G. O. Sars*	...	...	...	...	...	...	...	...	...	...	...	...	...	...	×	...	...	...	...	...	×
flexuosum, *Brady*	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	×
tenerum, *n. sp.*	...	...	...	...	...	...	...	...	...	...	...	×	× ×	...	× ×						
arcuatum, *Brady*	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
ASTEROPE, *Philippi*—																					
teres (*Norman*)	...	...	...	...	...	...	...	×													
POLYCOPE, *G. O. Sars*—																					
orbicularis, *G. O. Sars*	...	...	...	...	...	× ×	...	...	× ×	...	×	× ×	× ×	...	× ×	...	...	...	...	...	...
BOSQUETIA, *gen. nov.*—																					
robusta, *n. sp.*	...	...	...	...	...	×															

Duntroon, Argyleshire.	Fort William.	Clashmahew, Wigtonshire.	Terally Tile-works, Wigtonshire.	Dipple Tile-works, Girvan, Ayrshire.	Errol, Perthshire.	Elie, Fifeshire.	Dryleys, Montrose.	Barrie, Forfarshire.	Gamrie, Banffshire.	Annochie, Aberdeenshire.	Raised beach, Irvine, Ayrshire.	Drip Bridge, near Stirling.	Bridge of Allan.	Raised beach, Cumbrae, Buteshire.	West Tarbert Silt, Argyleshire.	Raised beach, Oban.	Woodburn, near Carrickfergus.	Raised beach, Portrush.	Belfast New Docks.	Bridlington, Yorkshire.	Hopton Cliff, near Yarmouth.	Hornsea, Yorkshire.	Cardiff New Docks basin.	Mersey, near Liverpool.	Branston Fen, Lincolnshire.	Whittlesea.	Upper Boulder Clay, Newton, nr. Chester.
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INDEX

OF

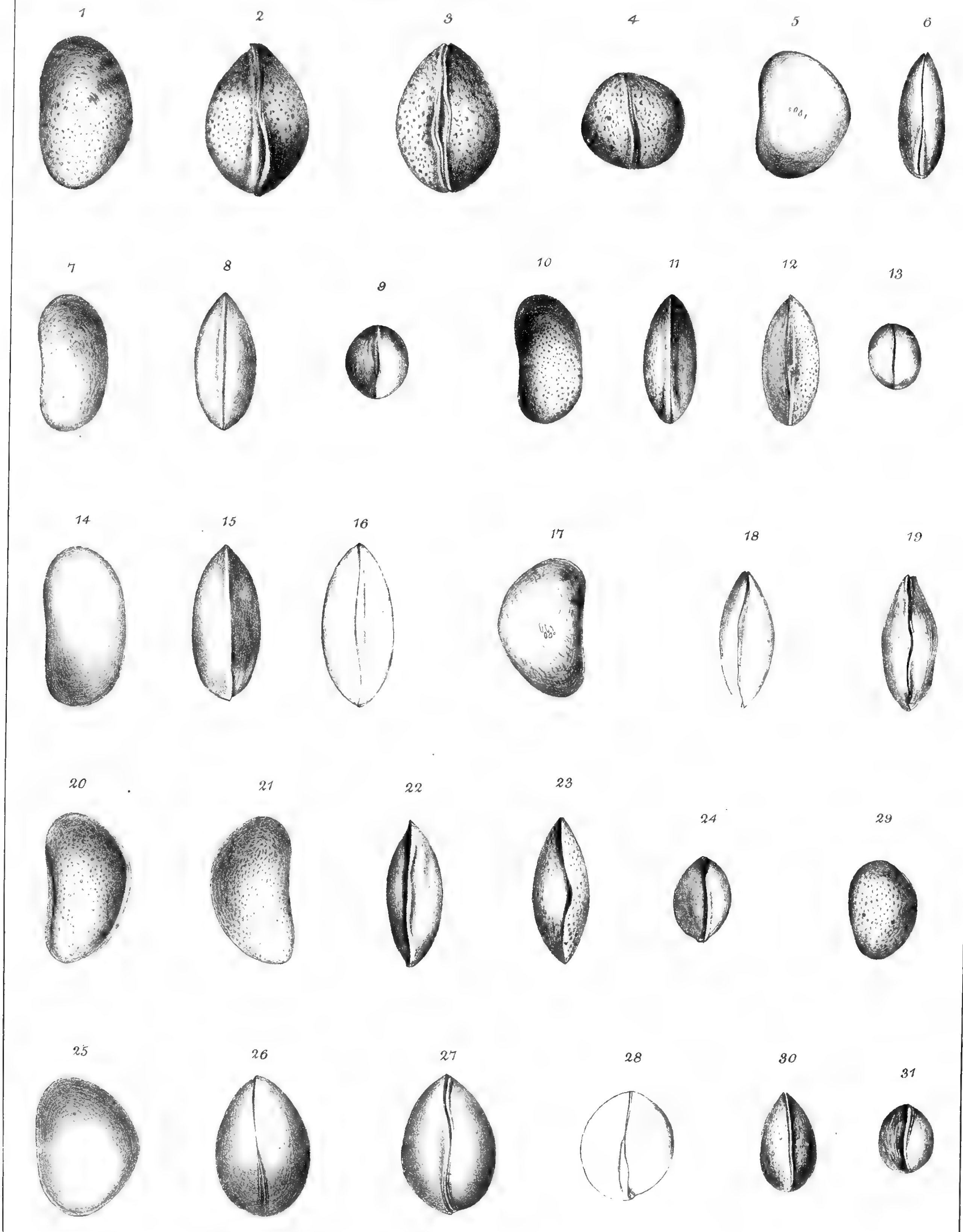
GENERIC AND SPECIFIC NAMES.

*** *The Synonyms are printed in italics.*

PLATE I.

Fig.			
1.	*Cypridopsis obesa.*	Carapace, seen from left side.	(Hornsea.)
2.	— —	,, ,, above.	
3.	— —	,, ,, below.	
4.	— —	,, ,, front.	
5.	*Cypris compressa.*	Carapace, seen from left side.	(Hornsea.)
6.	— —	,, ,, above.	
7.	*Candona detecta.*	Carapace, seen from left side.	(Hornsea.)
8.	— —	,, ,, above.	
9.	— —	,, ,, front.	
10.	*Candona albicans.*	Carapace, seen from left side.	(Hornsea.)
11.	— —	,, ,, above.	
12.	— —	,, ,, below.	
13.	— —	,, ,, front.	
14.	*Candona lactea.*	Carapace, seen from left side.	(Mersey beds.)
15.	— —	,, ,, above.	
16.	— —	,, ,, below.	
17.	*Cypris salina.*	Carapace, seen from right side.	(Crofthead.)
18.	— —	,, ,, above.	
19.	— —	,, ,, below.	
20.	*Potamocypris fulva.*	Carapace, seen from left side.	(Dalmuir.)
21.	— —	Right valve, seen from outside.	
22.	— —	Carapace, seen from above.	
23.	— —	,, ,, below.	
24.	— —	,, ,, front.	
25.	*Cypris lævis.*	Carapace, seen from left side.	(Whittlesea.)
26.	— —	,, ,, above.	
27.	— —	,, ,, below.	
28.	— —	,, ,, front.	
29.	*Cypris ovum.*	Carapace, seen from left side.	(Hornsea.)
30.	— —	,, ,, above.	
31.	— —	,, ,, front.	

(All magnified 40 diameters.)



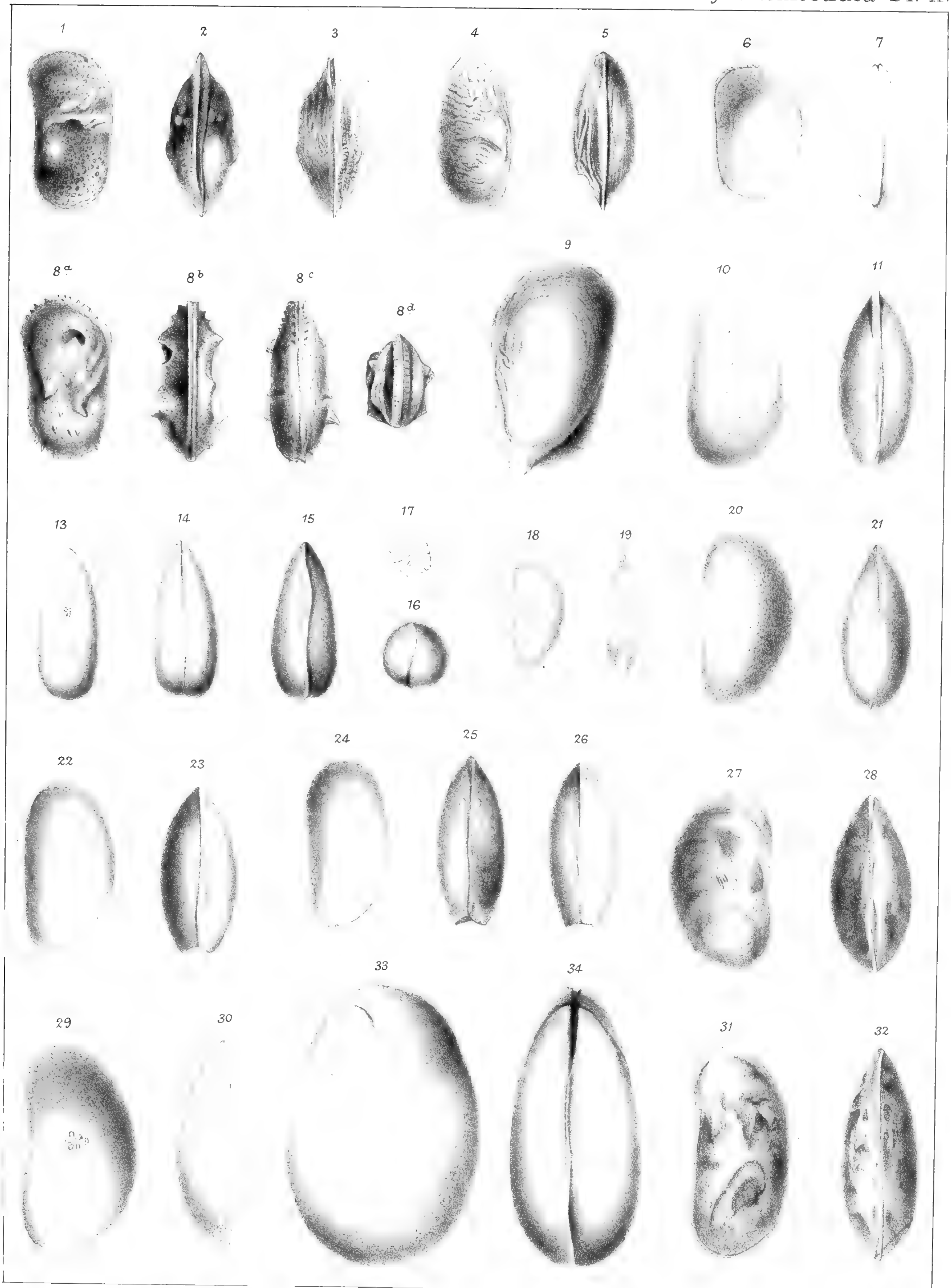
G. S. Brady del. Tuffen West lith.

W. West imp.

PLATE II.

Fig.		
1.	*Limnicythere Sancti-Patricii.* Carapace, seen from left side.	× 30 (Recent.)
2.	— — ,, ,, above	
3.	— — ,, ,, below.	
4.	*Bythocythere elongata.* Carapace, seen from right side.	× 60 (Girvan.)
5.	— — ,, ,, above.	
6.	*Cypris cinerea.* Carapace (slightly imperfect), seen from left side.	× 60 (Crofthead.)
7.	,, ,, ,, above.	
8 *a.*	*Limnicythere monstrifica.* Carapace, seen from left side.	× 40 (Recent.)
8 *b.*	— — ,, ,, above.	
8 *c.*	— — ,, ,, below.	
8 *d.*	— — ,, ,, front.	
9.	*Pseudocythere caudata.* Right valve, seen from outside.	× 85 (Dalmuir.)
10.	*Candona compressa.* Carapace, seen from left side.	× 40 (Recent.)
11.	— — ,, ,, above.	
13.	*Darwinella Stevensoni.* Carapace, seen from left side (female).	× 40 (Recent.)
14.	— — ,, ,, above.	
15.	— — ,, ,, below.	
16.	— — ,, ,, front.	
17.	— — Lucid spots × 100.	
18.	*Pontocypris acupunctata.* Carapace, seen from left side.	× 40 (Recent.)
19.	— — ,, ,, above.	
20.	*Cypridopsis Newtoni.* Carapace, seen from left side.	× 40 (Recent.)
21.	— — — ,, above.	
22.	*Krithe Bartonensis.* Carapace of female, seen from left side.	× 55 (Duntroon.)
23.	— — ,, ,, below.	
24.	— — Carapace of male, seen from left side.	
25.	— — ,, ,, above.	
26.	— — ,, ,, below.	
27.	*Cypris virens.* Carapace, seen from right side.	× 16 (Recent.)
28.	— — ,, ,, above.	
29.	*Candona candida.* Left valve of male, seen from outside.	× 40 (Dalmuir, south bed.)
30.	— — ,, ,, above.	
31.	*Cypris reptans.* Carapace, seen from left side.	× 16 (Recent.)
32.	— — — ,, above.	
33.	*Asterope teres.* Carapace of female, seen from left side.	× 40 (Jordan Hill.)
34.	— — ,, ,, below.	

NOTE.—The figures of *Cypridopsis Newtoni, Candona compressa, Darwinella Stevensoni, Limnicythere monstrifica, L. Sancti-Patricii, Pontocypris acupunctata, Cypris virens, and Cypris reptans,* are all taken from recent specimens, no fossil examples having been found sufficiently perfect to illustrate the species satisfactorily.



G. S Brady delt T. West lith.

W West & Co. imp.

PLATE III.

Fig.			
1.	*Cythere lutea.*	Carapace of female, seen from left side.	(Loch Gilp.)
2.	— —	,, ,, above.	
3.	— —	,, ,, below.	
4.	— —	,, ,, front.	
5.	— —	Carapace of male, ,, right side.	
6.	— —	,, separated valves showing hinge-margins.	
7.	*Cythere villosa.*	Carapace of female, seen from left side.	(Jordan Hill.)
8.	— —	,, male, ,, ,,	
9.	— —	,, ,, ,, above.	
10.	— —	,, ,, ,, below.	
11.	— —	,, ,, ,, front.	
11 *a*.	— —	Separated valves.	
12.	— —	,, female (variety).	
13.	— —	Carapace of male, radiate variety.	(Greenock.)
14.	*Cythere convexa.*	Carapace of female, seen from left side.	(Oban, raised-beach.)
15.	— —	,, ,, above.	
16.	— —	,, ,, below.	
17.	— —	,, ,, front.	
18.	*Cythere Jeffreysii.*	Left valve, seen from outside.	(Oban, raised-beach.)
19.	— —	,, ,, above.	
20.	*Cythere pellucida.*	Carapace of female, seen from left side.	(Loch Gilp.)
21.	— —	,, ,, above.	
22.	— —	,, ,, below.	
23.	— —	,, ,, front.	
24.	— —	Right valve, ,, above.	
25.	*Cythere castanea.*	Right valve of female.	(Paisley, brick-field.)
26.	*Cythere viridis.*	Carapace of female, seen from left side.	(Paisley.)
27.	— —	,, ,, above.	
28.	— —	,, ,, front.	
29.	*Cythere pulchella.*	Carapace of female, seen from left side.	(Loch Gilp.)
30.	— —	,, ,, above.	
31.	— —	,, ,, below.	
32.	— —	,, ,, front.	
33.	— —	Carapace of male, ,, left side.	(Jordan Hill.)
34.	— —	,, separated valves, seen from above.	
35.	— —	Hinge-processes of right valve × 84.	
36.	— —	Lucid spots × 84.	
37.	— —	Outline of young carapace.	

(All × 40 except where otherwise stated.)

G S Brady del. T West lith.

W. West imp.

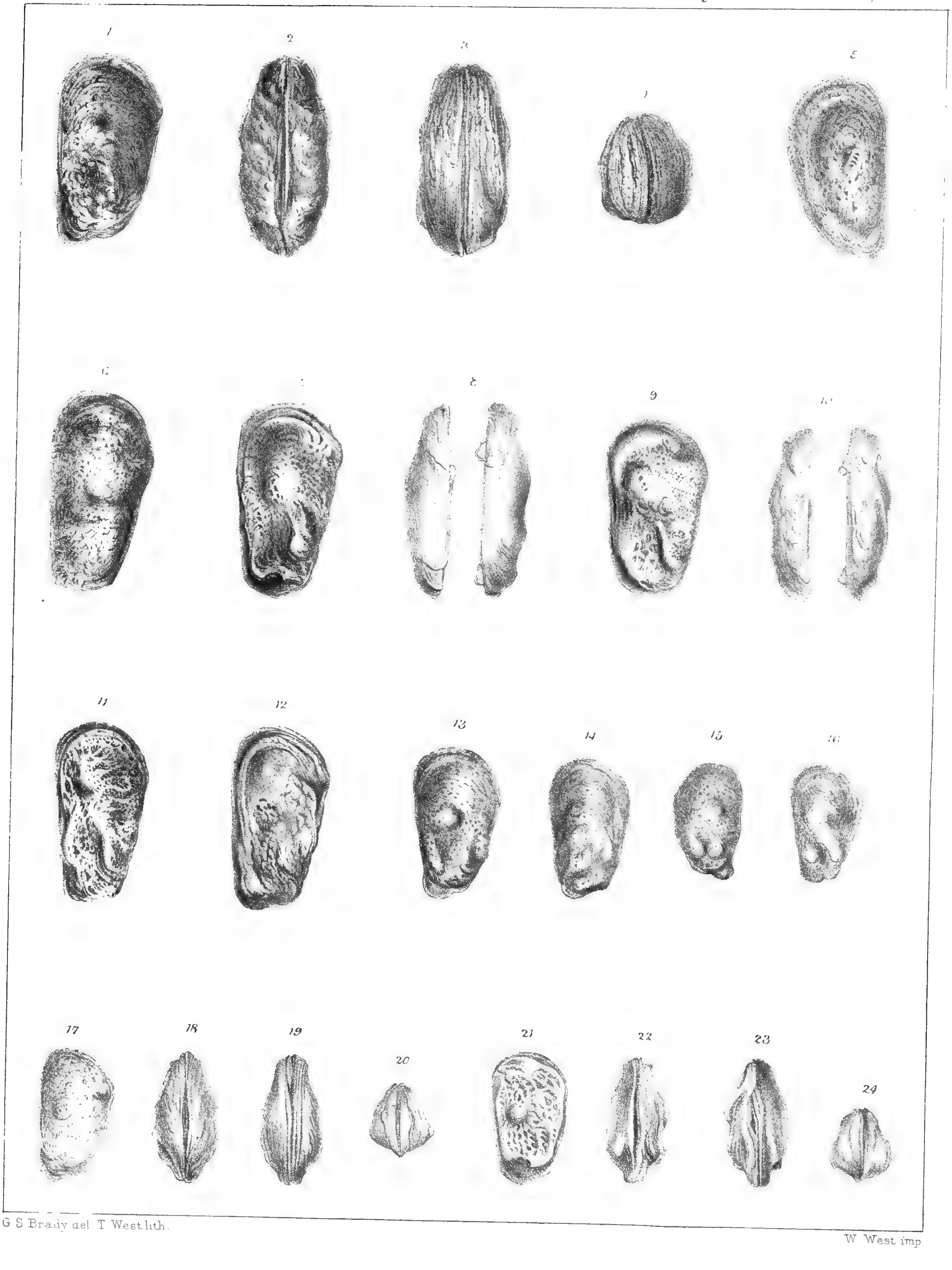
PLATE IV.

Fig.			
1.	*Cythere concinna.*[1]		Carapace of female (variety) seen from left side.
2.	—	—	„ „ above.
3.	—	—	„ „ below.
4.	—	—	„ „ front.
5.	—	—	Right valve of female carapace, seen from outside.
6.	—	—	Left valve of male carapace, seen from outside.
7.	—	—	Carapace of male (variety), seen from left side.
8.	—	—	„ valves separated and seen from above.
9.	—	—	Carapace of female, seen from left side.
10.	—	—	„ valves separated and seen from above.
11.	—	—	Carapace, seen from left side, male; normal form.
12.	—	—	„ „ „ variety.
13—16.		—	Carapace in different stages of growth.
17.	—	—	Young carapace, seen from left side.
18.	—	—	„ „ above.
19.	—	—	„ „ below.
20.	—	—	„ „ front.
21.	*Cythere angulata.*[2]		Carapace of female, seen from left side.
22.	—	—	„ „ above.
23.	—	—	„ „ below.
24.	—	—	„ „ front.

(All magnified 40 diameters.)

[1] At page 160, 1st line, *for* Figs. 1—16, *read* figs. 1—20.

[2] „ 162, 22nd „ *for* „ 17—24, *read* „ 21—24.



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W West imp

PLATE V.

Fig.				
1.	*Cythere emarginata.*	Carapace of male, seen from left side.		(Loch Gilp.)
2.	— —	,, ,, ,, above.		
3.	— —	,, ,, ,, below.		
4.	— —	,, ,, ,, front.		
5.	— —	,, female, ,, right side.		
6.	— —	,, ,, separated valves.		
7.	*Cythere tuberculata.*	Carapace of female, seen from left side.		(Dalmuir.)
8.	— —	,, ,, ,, above.		
9.	— —	,, ,, ,, below.		
10.	— —	,, ,, ,, front.		
11.	— —	,, male, ,, left side.		(Greenock new Dock.)
12.	— —	,, ,, hinge-margins.		
13.	*Cythere Dunelmensis.*	Left valve of male, lateral view.		(Jordan Hill.)
14.	— —	,, ,, seen from above.		
15.	— —	,, ,, ,, below.		
16.	— —	,, ,, ,, front.		
17.	— —	,, ,, ,, inside.		
18.	— —	Right valve of female.		
19.	— —	,, young.		
20.	— —	Hinge-margins.		
21.	*Cythere costata.*	Right valve of female, seen from outside.		(Bridlington.)
22.	— —	,, ,, above.		
23.	— —	Left valve of male, seen from outside.		(Bridlington.)
24.	— —	,, ,, inside.		

(All magnified 40 diameters.)

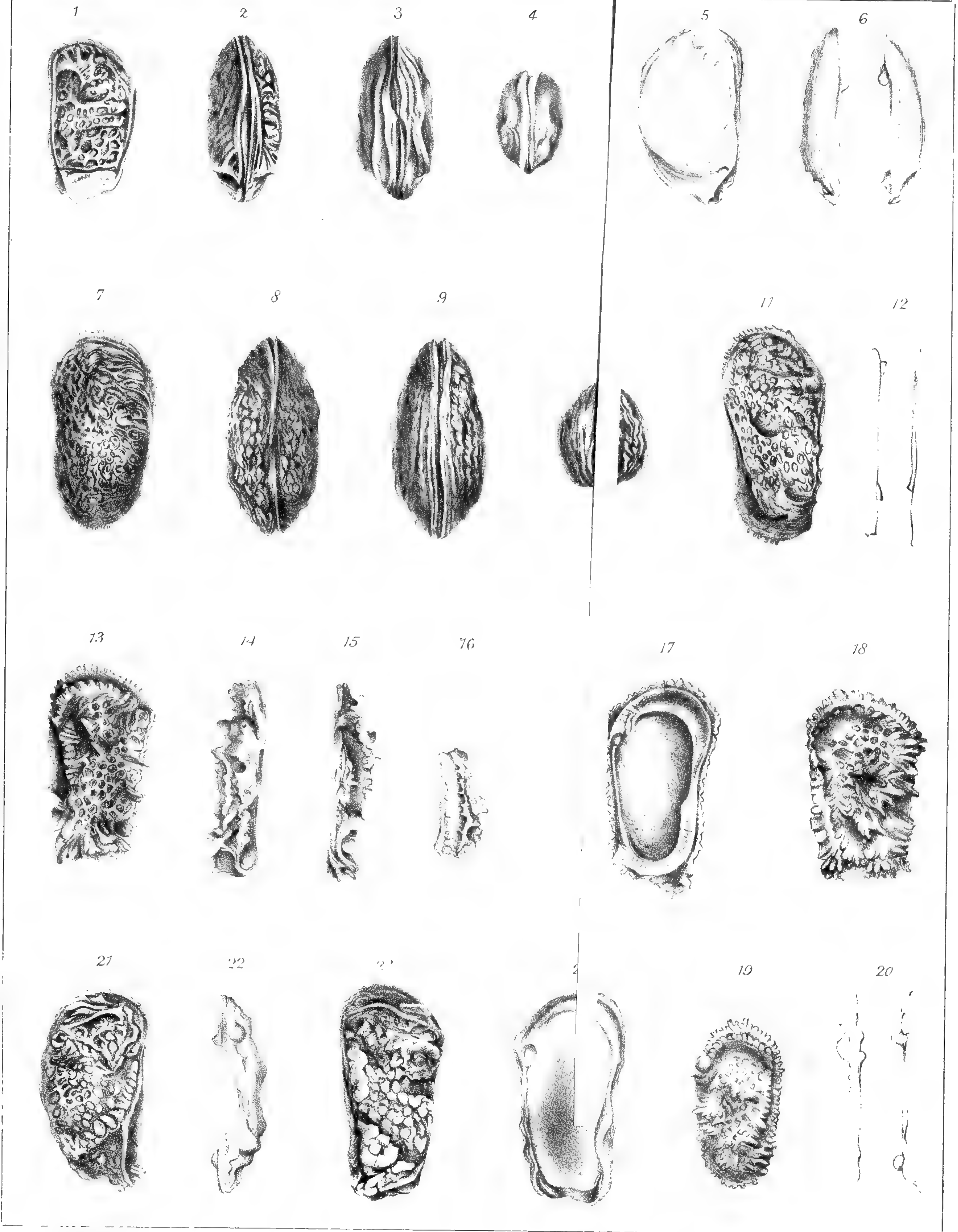

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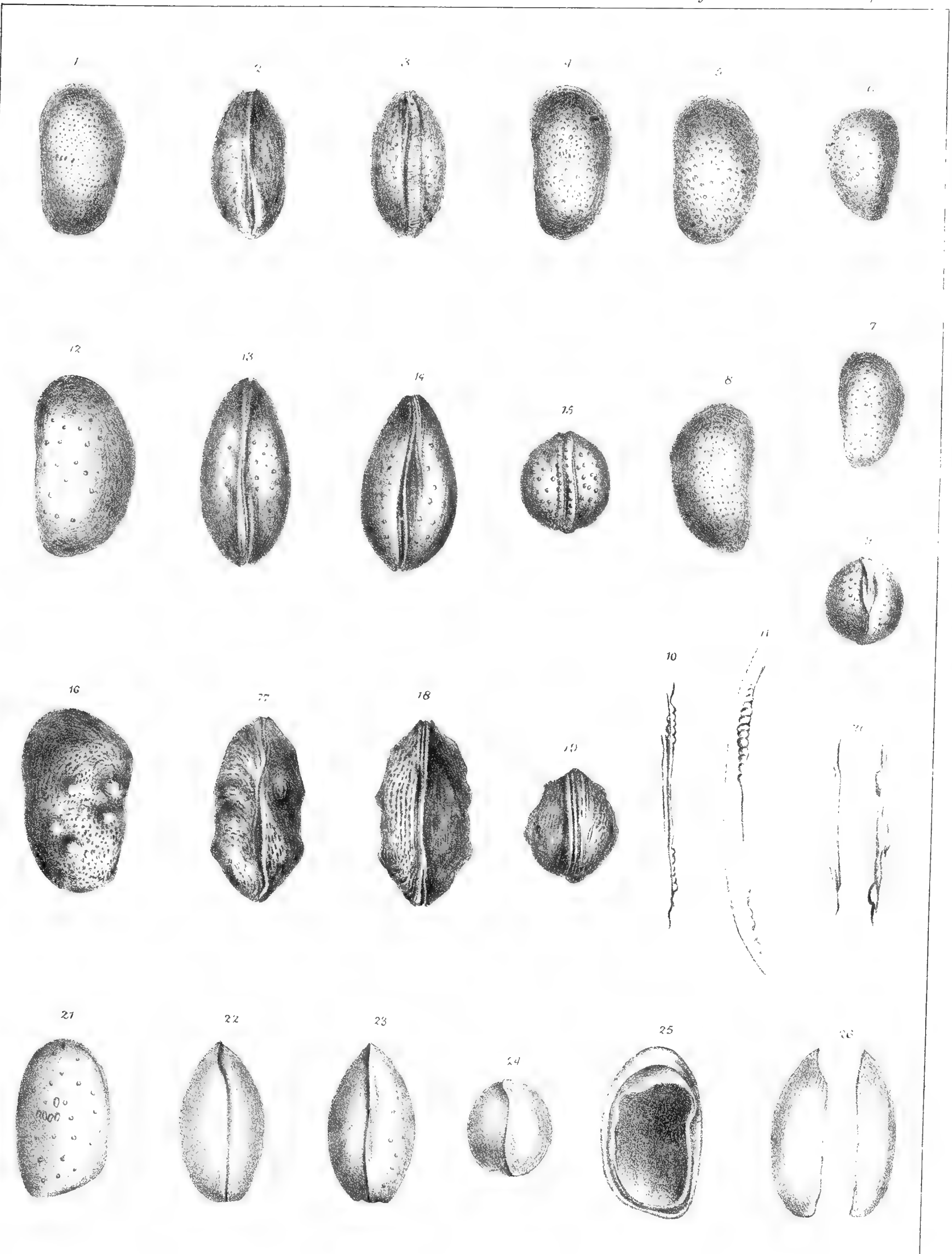
PLATE VI.

Fig.		
1.	*Cytheridea punctillata.*	Carapace of female, seen from left side.
2.	— —	,, ,, above.
3.	— —	,, ,, below.
4.	— —	Carapace of male, seen from left side.
5.	— —	,, female (variety).
6, 7.	— —	Carapaces in early stages of growth.
8.	— —	Right valve, seen from outside.
9.	— —	End-view of adult carapace.
10.	— —	Hinge-margin of left valve, seen from above.
11.	— —	,, ,, ,, inside.
12.	*Cytheridea papillosa.*	Carapace of female, seen from left side.
13.	— —	,, ,, above.
14.	— —	,, ,, below.
15.	— —	,, ,, front.
16.	*Cytheridea lacustris.*	Carapace, seen from left side.
17.	— —	,, ,, above.
18.	— —	,, ,, below.
19.	— —	,, ,, front.
20.	— —	Hinge-margins, seen from above.
21.	*Krithe glacialis.*	Carapace, seen from left side.
22.	— —	,, ,, above.
23.	— —	,, ,, below.
24.	— —	,, ,, front.
25.	— —	Left valve, seen from inside.
26.	— —	Right and left valves, separated, and seen from above.

(All magnified 40 diameters, except 10, 11, and 20, which are on a larger scale.)



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W West imp

PLATE VII.

Fig.			
1.	*Cytheridea torosa*, var. *teres*.	Carapace of female, seen from left side.	(Paisley.)
2.	— —	,, ,, above.	
3.	*Cytheridea* (?) *inornata*.	Carapace, seen from left side.	(Annochie.)
4.	— —	,, ,, above.	
5.	— —	,, ,, below.	
6.	— —	,, ,, front.	
7.	*Cytheridea Sorbyana*.	Left valve of female, seen from side.	(Errol.)
8.	— —	Right ,, ,, ,,	
9.	— —	Left ,, ,, above.	
10.	— —	Right ,, ,, ,,	
11.	— —	Carapace of female, seen from below.	(Norway.)
12.	— —	Right valve of male, seen from side.	(Errol.)
13.	*Xestoleberis depressa*.	Carapace of female, seen from left side.	(Loch Gilp.)
14.	— —	,, ,, above.	
15.	— —	,, ,, below.	
16.	— —	,, ,, front.	
17.	— —	Carapace of male, ,, left side.	
18.	— —	,, ,, above.	
19.	— —	,, ,, front.	
20.	*Bythocythere simplex*.	Left valve of ? , seen from side.	(Paisley.)
21.	— —	,, ,, above.	
22.	*Cythere mirabilis* (female).	Left valve, seen from side.	(Errol.)
23.	— — —	,, ,, above.	
24.	— — —	Right valve ,, ,,	
25.	— — —	Left valve ,, front.	
26.	— — —	Lucid spots.	

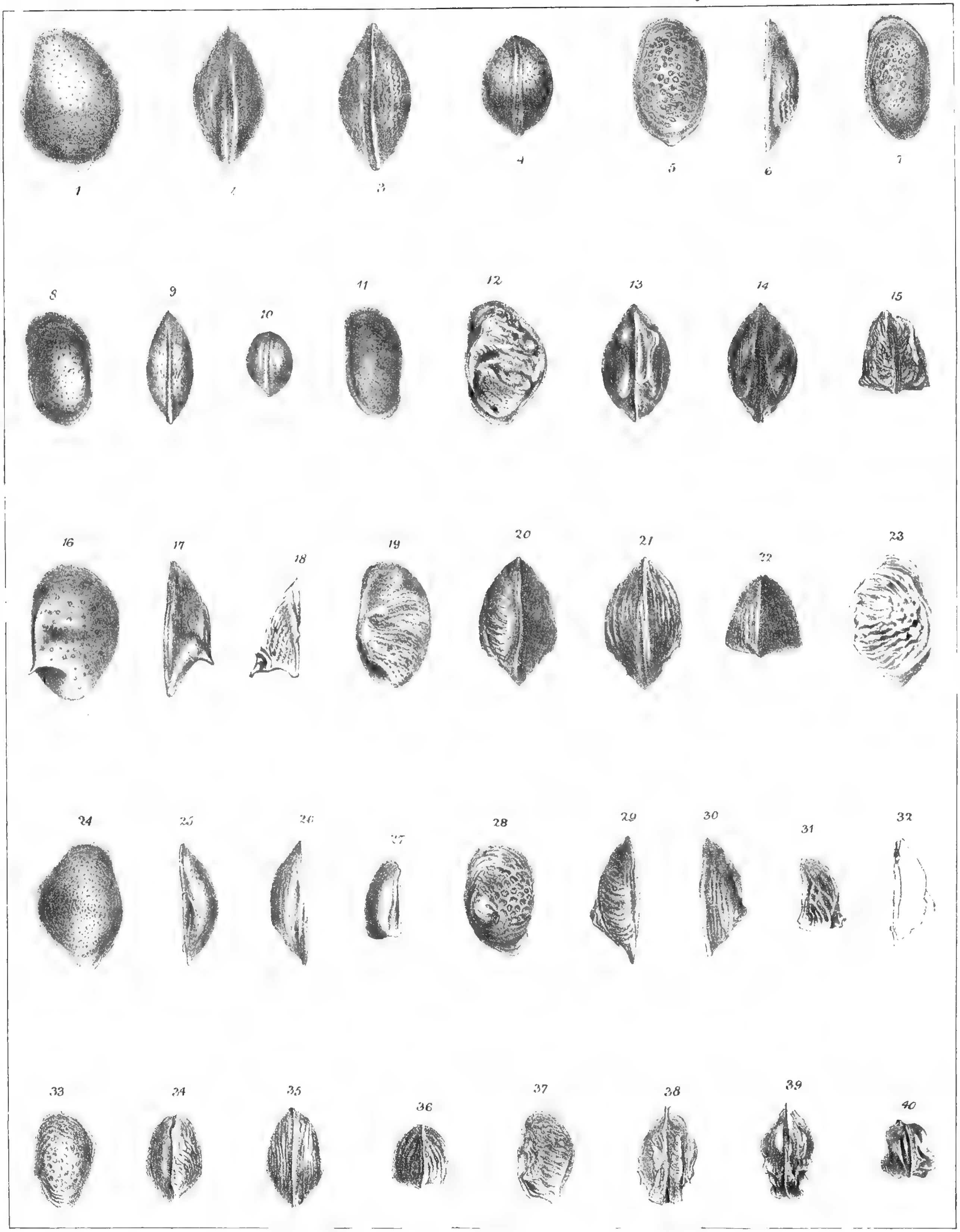
(All the figures × 40, except fig. 26, which is × 96.)

G. S. Brady del. T. West lith.

PLATE VIII.

Fig.			
1.	*Loxoconcha impressa.*	Carapace of female, seen from left side.	(Oban, Raised-beach.)
2.	— —	,, ,, above.	
3.	— —	,, ,, below.	
4.	— —	,, ,, front.	
5.	*Loxoconcha guttata.*	Left valve of female, seen from side.	(Drip Bridge, Stirling.)
6.	— —	,, ,, above.	
7.	— —	Left valve of male, ,, side.	
8.	*Loxoconcha tamarindus.*	Carapace of female, seen from left side.	(Dalmuir.)
9.	— —	,, ,, above.	
10.	— —	,, ,, front.	
11.	— —	Carapace of male, ,, left side.	(Greenock new Dock.)
12.	*Cytheropteron nodosum.*	Carapace, seen from left side.	(Dumbarton.)
13.	— —	,, ,, above.	
14.	— —	,, ,, below.	
15.	— —	,, ,, front.	
16.	*Cytheropteron arcuatum.*	Left valve, seen from side.	(Errol.)
17.	— —	,, ,, below.	
18.	— —	,, ,, front.	
19.	*Cytheropteron latissimum.*	Carapace of male, seen from left side.	(Kilchattan.)
20.	— —	,, ,, above.	
21.	— —	,, ,, below.	
22.	— —	,, ,, front.	
23.	— —	Carapace of female, seen from right side.	(Montrose.)
24.	*Cytheropteron inflatum.*	Right valve, seen from side.	(Errol.)
25.	— —	,, ,, above.	
26.	— —	,, ,, below.	
27.	— —	,, ,, front.	
28.	*Cytheropteron Montrosiense.*	Left valve of female, seen from outside.	(Montrose.)
29.	— —	,, above.	
30.	— —	,, below.	
31.	— —	,, front.	
32.	— —	Right valve of female, seen from above.	
33.	— —	Carapace of male (?), seen from left side.	(Annochie Brick-works.)
34.	— —	,, above.	
35.	— —	,, below.	
36.	— —	,, front.	
37.	*Cytheropteron angulatum.*	Carapace, seen from left side.	(Dumbarton.)
38.	— —	,, ,, above.	
39.	— —	,, ,, below.	
40.	— —	,, ,, front.	

(All × 40, except *C. arcuatum*, which is × 50.)



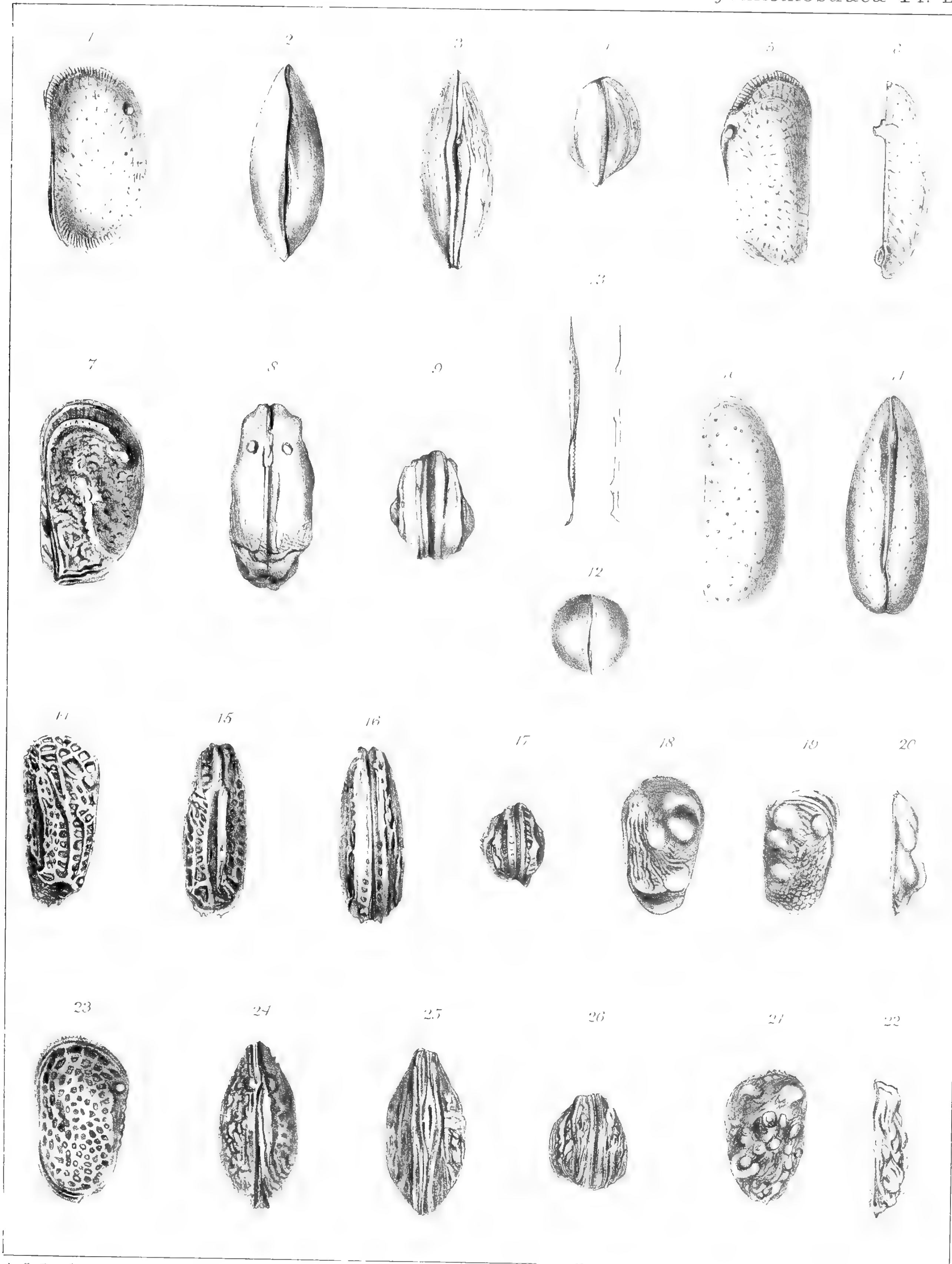
G S Brady del. T West lith.

W West imp.

PLATE IX.

Fig.			
1.	*Cythere albomaculata.*	Carapace of female, seen from left side.	(Raised beach, Irvine.)
2.	— —	,, ,, above.	
3.	— —	,, ,, below.	
4.	— —	,, ,, front.	
5.	*Cythere leioderma.*	Right valve, seen from outside.	(Bridlington.)
6.	— —	,, ,, above.	
7.	*Cythere concinna.*	Carapace of female, seen from left side.	(Bridlington.)
8.	— —	,, ,, above.	
9.	— —	,, ,, front.	
10.	*Cytheridea elongata.*	Carapace, seen from left side.	(Raised beach, Irvine.)
11.	— —	,, ,, above.	
12.	— —	,, ,, behind.	
13.	— —	Hinge-margins.	
14.	*Cythere emaciata.*	Carapace of male, seen from left side.	(Raised beach, Oban.)
15.	— —	,, ,, above.	
16.	— —	,, ,, below.	
17.	— —	,, ,, front.	
18.	*Cythere globulifera.*	Left valve (of male?), seen from outside.	(Errol.)
19.	— —	Right valve (of female?), seen from outside.	× 50 (Annochie.)
20.	— —	,, ,, above.	
21.	— —	Right valve, seen from outside.	(Bridlington.)
22.	— —	,, ,, above.	
23.	*Cythere laticarina.*	Carapace, seen from the left side.	(Raised beach, Oban.)
24.	— —	,, ,, above.	
25.	— —	,, ,, below.	
26.	— —	,, ,, front.	

(All × 40, except where otherwise stated.)



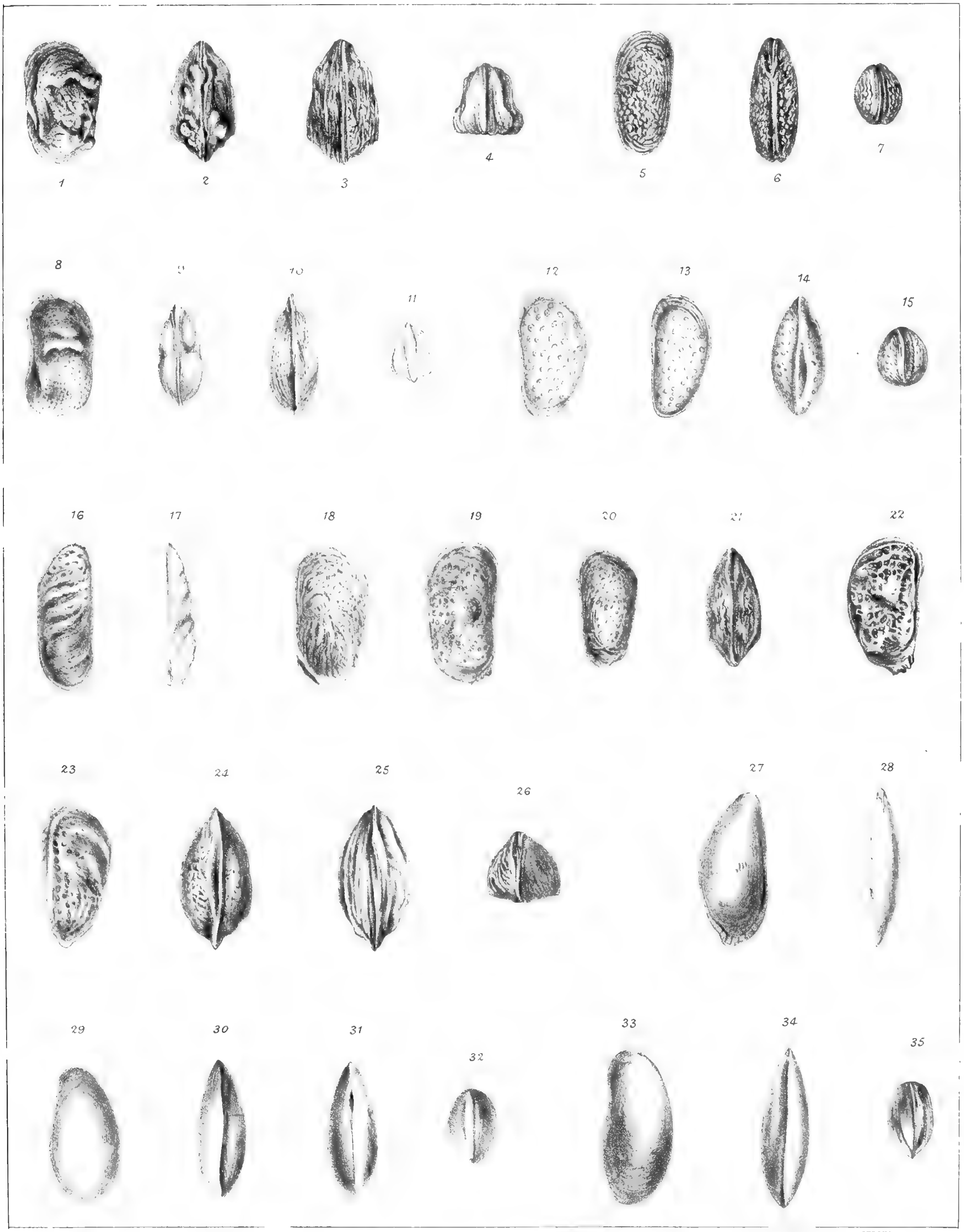
G. S. Brady del. T. West lith.

W. West imp.

PLATE X.

Fig.			
1.	*Cythere limicola.*	Carapace of female, seen from left side.	(Kilchattan.)
2.	— —	,, ,, above.	
3.	— —	,, ,, below.	
4.	— —	,, ,, front.	
5.	*Cythere cribrosa.*	Carapace, seen from right side.	(Bridlington.)
6.	— —	,, ,, above.	
7.	— —	,, ,, front.	
8.	*Limnicythere inopinata.*	Carapace, seen from left side.	(Hornsea.)
9.	— —	,, ,, above.	
10.	— —	,, ,, below.	
11.	— —	,, ,, front.	
12.	*Eucythere Argus.*	Carapace of female, seen from left side.	(Dumbarton.)
13.	— —	,, male, ,, ,,	
14.	— —	,, ,, ,, above.	
15.	— —	,, ,, ,, front.	
16.	*Cytherideis subspiralis.*	Right valve, seen from outside.	(Burn of Haster, Caithness.)
17.	— —	,, ,, above.	
18.	*Cythere Finmarchica.*	Carapace, seen from left side.	(Loch Gilp.)
19.	— —	,, ,, right side.	(Burn of Haster.)
20.	— —	,, (young), left side.	(Gamrie.)
21.	— —	,, ,, above.	
22.	*Cythere angulata*, var.	Carapace, seen from right side.	(Dalmuir.)
23.	*Cythere cuneiformis.*	Carapace of female, seen from left side.	(Bridge of Allan.)
24.	— —	,, ,, above.	
25.	— —	,, ,, below.	
26.	— —	,, ,, front.	
27.	*Paradoxostoma ensiforme.*	Right valve, from outside.	(Bridlington.)
28.	— —	,, ,, above.	
29.	*Paradoxostoma variabile.*	Carapace, seen from left side.	(Cumbrae, College-bed.)
30.	— —	,, ,, above.	
31.	— —	,, ,, below.	
32.	— —	,, ,, front.	
33.	*Sclerochilus contortus.*	Carapace, seen from left side.	(Cumbrae, College-bed.)
34.	— —	,, ,, below.	
35.	— —	,, ,, front.	

(All magnified 40 diameters.)



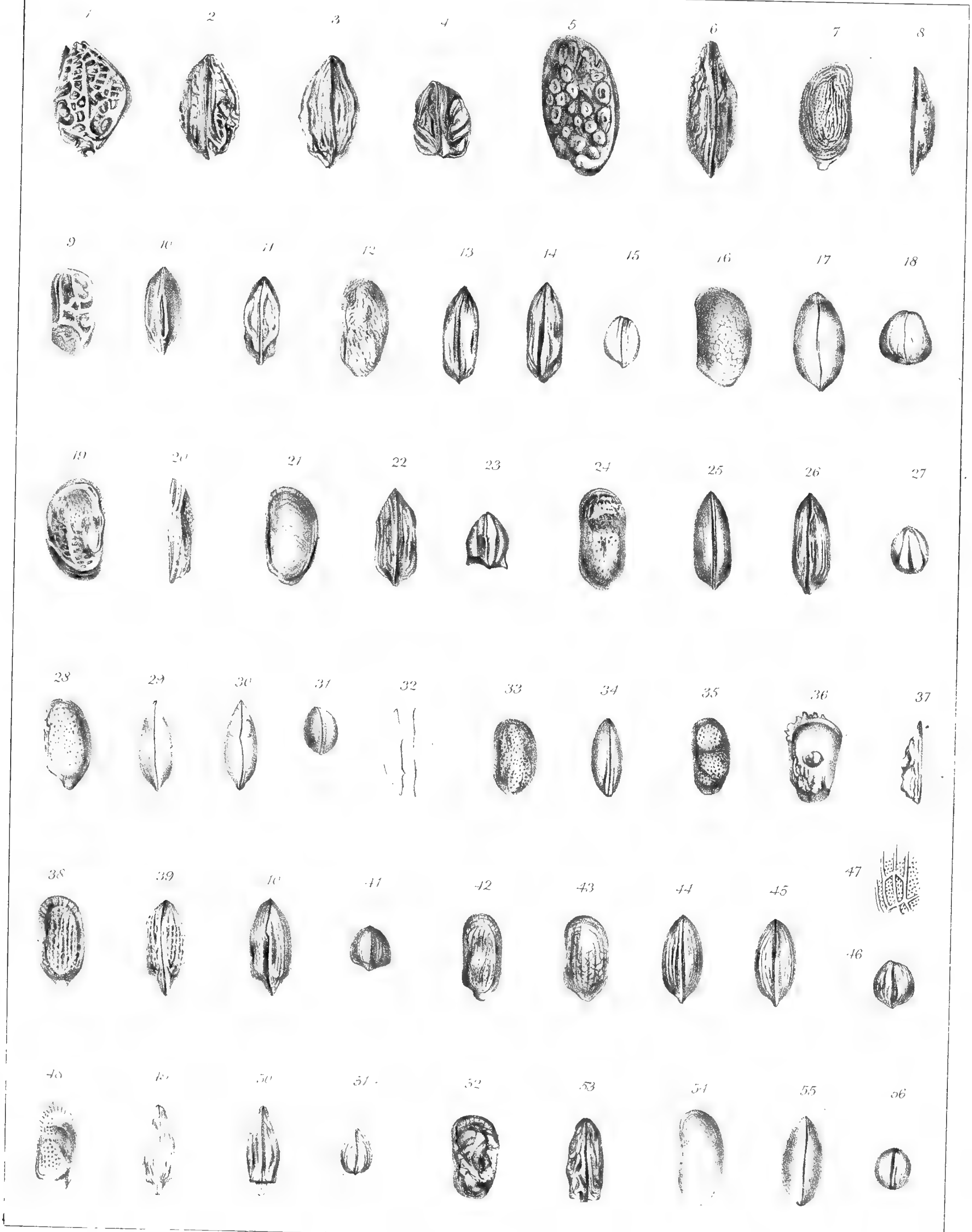
G. S. Brady del^{t} T. West lith

W. West & C^{o} imp.

PLATE XI.

Fig.			
1.	*Cytherura clathrata.*	Carapace, seen from left side.	× 40 (Raised beach, Oban.)
2.	— —	,, ,, above.	
3.	— —	,, ,, below.	
4.	— —	,, ,, front.	
5.	*Cytherura cellulosa.*	Carapace of male, seen from left side.	× 84 (Gamrie.)
6.	— —	,, ,, above.	
7.	*Cytherura concentrica.*	Right valve, seen from side.	× 40 (Errol.)
8.	— —	,, ,, above.	
9.	*Cytherura undata.*	Carapace of female, seen from left side.	× 40 (Paisley.)
10.	— —	,, ,, above.	
11.	— —	,, ,, below.	
12.	— —	Carapace of male (variety).	× 40 (Loch Gilp.)
13.	— —	,, seen from above.	
14.	— —	,, ,, below.	
15.	— —	,, ,, front.	
16.	*Cytherura similis.*	Carapace, seen from left side.	× 40 (Loch Gilp.)
17.	— —	,, ,, below.	
18.	— —	,, ,, front.	
19.	*Cytherura* (?) *complanata.*	Right valve, seen from side.	× 50 (Annochie.)
20.	— —	,, ,, above.	
21.	*Cytherura compressa.*	Carapace, seen from left side.	× 40 (Gamrie.)
22.	— —	,, ,, above.	
23.	— —	,, ,, front.	
24.	*Cytherura Sarsii.*	Carapace, seen from left side.	× 40 (College-bed, Cumbrae.)
25.	— —	,, ,, above.	
26.	— —	,, ,, below.	
27.	— —	,, ,, front.	
28.	*Cytherura nigrescens.*	Carapace, seen from left side.	× 40 (Jordan Hill.)
29.	— —	,, ,, above.	
30.	— —	,, ,, below.	
31.	— —	,, ,, front.	
32.	— —	,, ,, separate valves.	
33.	*Cytherura pumila.*	Carapace of female, seen from left side.	× 40 (Greenock Dock.)
34.	— —	,, ,, above.	
35.	— —	Carapace of male, ,, left side.	
36.	*Cythere Dunelmensis* (young).	Left valve, lateral view.	× 40 (Errol.)
37.	— —	,, ,, seen from above.	
38.	*Cytherura striata.*	Carapace, seen from left side.	× 40 (College-bed, Cumbrae.)
39.	— —	,, ,, above.	
40.	— —	,, ,, below.	
41.	— —	,, ,, front.	
42.	*Cytherura cuneata.*	Carapace of male, seen from left side.	× 40 (Dalmuir.)
43.	*Cytherura flavescens.*	Carapace, seen from left side.	× 40
44.	— —	,, ,, above.	
45.	— —	,, ,, below.	
46.	— —	,, ,, front.	
47.	— *cuneata.*	Sculpture of male carapace.	× 84
48.	*Cytherura angulata.*	Carapace, seen from left side.	× 40 (Oban, raised beach.)
49.	— —	,, ,, above.	
50.	— —	,, ,, below.	
51.	— —	,, ,, front.	
52.	*Cythere crispata.*[1]	Carapace of female, seen from left side.	× 40 (Oban.)
53.	— —	,, ,, above.	
54.	*Aglaia* (?) *glacialis.*	Carapace, seen from left side.	(Drip Bridge.)
55.	— —	,, ,, above.	
56.	— —	,, ,, front.	

[1] At page 146, printed Plate X in error.

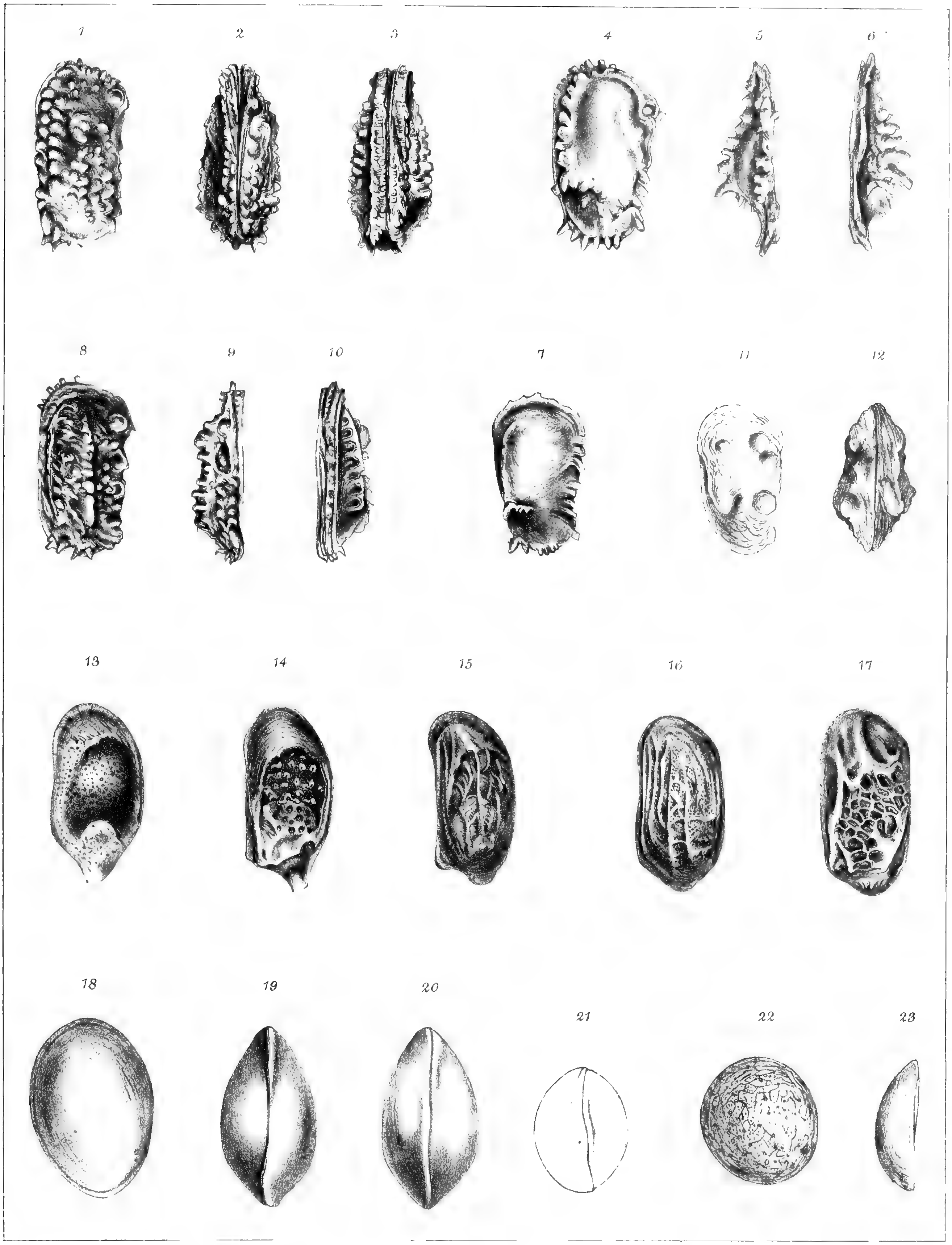


G. S. Brady del. T. West lith.

W. West imp.

PLATE XII.

Fig.		
1. *Cythere Whiteii.* Carapace, seen from left side. 2. — — „ „ above. 3. — — „ „ below.	× 40 (Belfast New Dock.)
4. *Cythere Jonesii.* Left valve, seen from outside. 5. — — „ „ above. 6. — — „ „ below. 7. — — var. *ceratoptera.* Left valve, seen from outside.	× 40 (Belfast New Dock.)
8. *Cythere antiquata.* Left valve, seen from outside. 9. — — „ „ above. 10. — — „ „ below.	× 40 (Belfast New Dock.)
11. *Cythere globulifera.* Carapace, seen from left side. 12. — — „ „ above.	× 60 (Barrie.)
13. *Cytherura nigrescens.* Carapace of female, seen from left side.	× 84 (Irvine.)
14. *Cytherura angulata.* Carapace, seen from left side.	× 84 (Oban.)
15. *Cytherura cuneata.* Carapace of male, seen from left side.	× 84 (Loch Gilp.)
16. *Cytherura* (*similis*?). Carapace, seen from left side.	× 84 (Loch Gilp.)
17. *Cytherura undata.* Carapace of male, seen from left side.	× 84 (Paisley.)
18. *Bosquetia robusta.* Carapace, seen from left side. 19. — — „ „ above. 20. — — „ „ below. 21. — — „ „ front.	× 40 (Paisley.)
22. *Polycope orbicularis.* Left valve, seen from outside. 23. — — „ „ above.	× 60 (Dalmuir.)



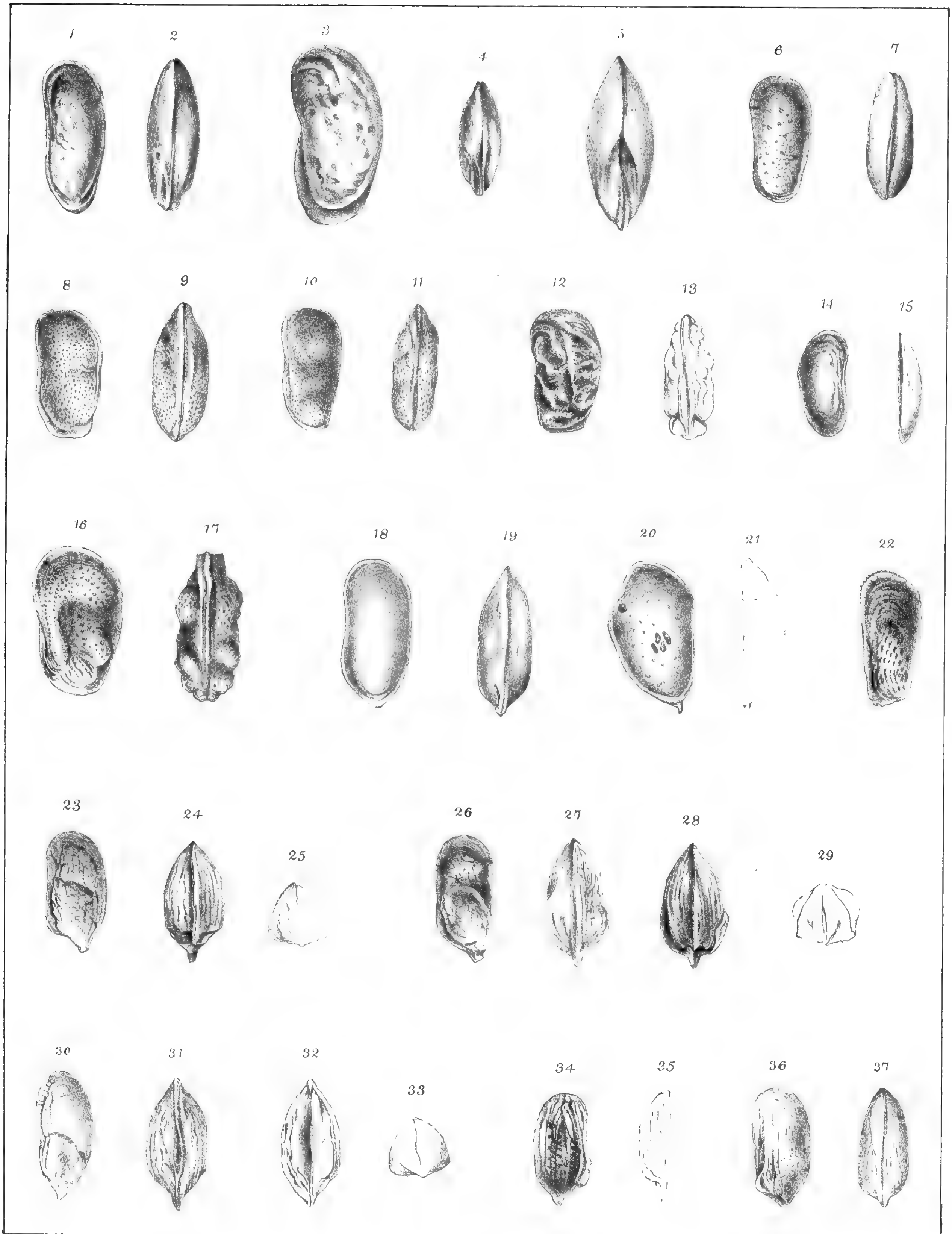
G S Brady del Tuffen West lith.

W West imp

PLATE XIII.

Fig.			
1.	*Cythere Macallana.*	Carapace, seen from left side.	× 60 (Kilchattan.)
2.	— —	,, ,, above.	
3.	*Cythere porcellanea.*	Carapace, seen from left side.	× 60 (West Tarbert.)
4.	— —	,, ,, above.	
5.	— —	,, ,, below.	
6.	*Cythere tenera.*	Carapace, seen from left side.	× 60 (Cardiff New Dock.)
7.	— —	,, ,, above.	
8.	*Cythere castanea.*	Carapace (of female), seen from left side.	× 40 (Cardiff New Dock.)
9.	— —	,, ,, ,, above.	
10.	— —	,, (of male), ,, left side.	
11.	— —	,, ,, ,, above.	
12.	*Cythere crispata.*	Carapace, seen from left side.	× 60 (West Tarbert, silt.)
13.	— —	,, ,, above.	
14.	*Cythere deflexa.*	Right valve, seen from side.	× 40 (Jordan Hill.)
15.	— —	,, ,, above.	
16.	*Cythere Cluthæ.*	Carapace, seen from left side.	× 84 (Kilchattan.)
17.	— —	,, ,, above.	
18.	*Cytherura Sarsii.*	Carapace, seen from left side.	× 60 (Kames Bay, Cumbrae.)
19.	— —	,, ,, above.	
20.	*Bairdia* (?) *Cambrica.*	Right valve, seen from side.	× 84 (Cardiff New Dock.)
21.	— —	,, ,, above.	
22.	*Cythere quadridentata.*	Carapace, seen from left side.	× 40 (Loch Gilp.)
23.	*Cytherura cornuta.*	Carapace (of female), seen from left side.	× 40 (West Tarbert, silt.)
24.	— —	,, ,, below.	
25.	— —	,, ,, front.	
26.	*Cytherura gibba.*	Carapace (of female), seen from left side.	× 40 (West Tarbert, silt.)
27.	— —	,, ,, above.	
28.	— —	,, ,, below.	
29.	— —	,, ,, front.	
30.	*Cytherura producta.*	Carapace, seen from left side.	× 50 (Cardiff New Dock.)
31.	— —	,, ,, above.	
32.	— —	,, ,, below.	
33.	— —	,, ,, front.	
34.	*Cytherura quadrata.*	Right valve, seen from side.	× 40 (Belfast.)
35.	— —	,, ,, above.	
36.	*Cytherura cuneata.*	Carapace, seen from left side.	× 50 (West Tarbert, silt.)
37.	— —	,, ,, above.	

(Note.—By a mistake of the lithographer fig. 4 has been made of a smaller size than the others.)

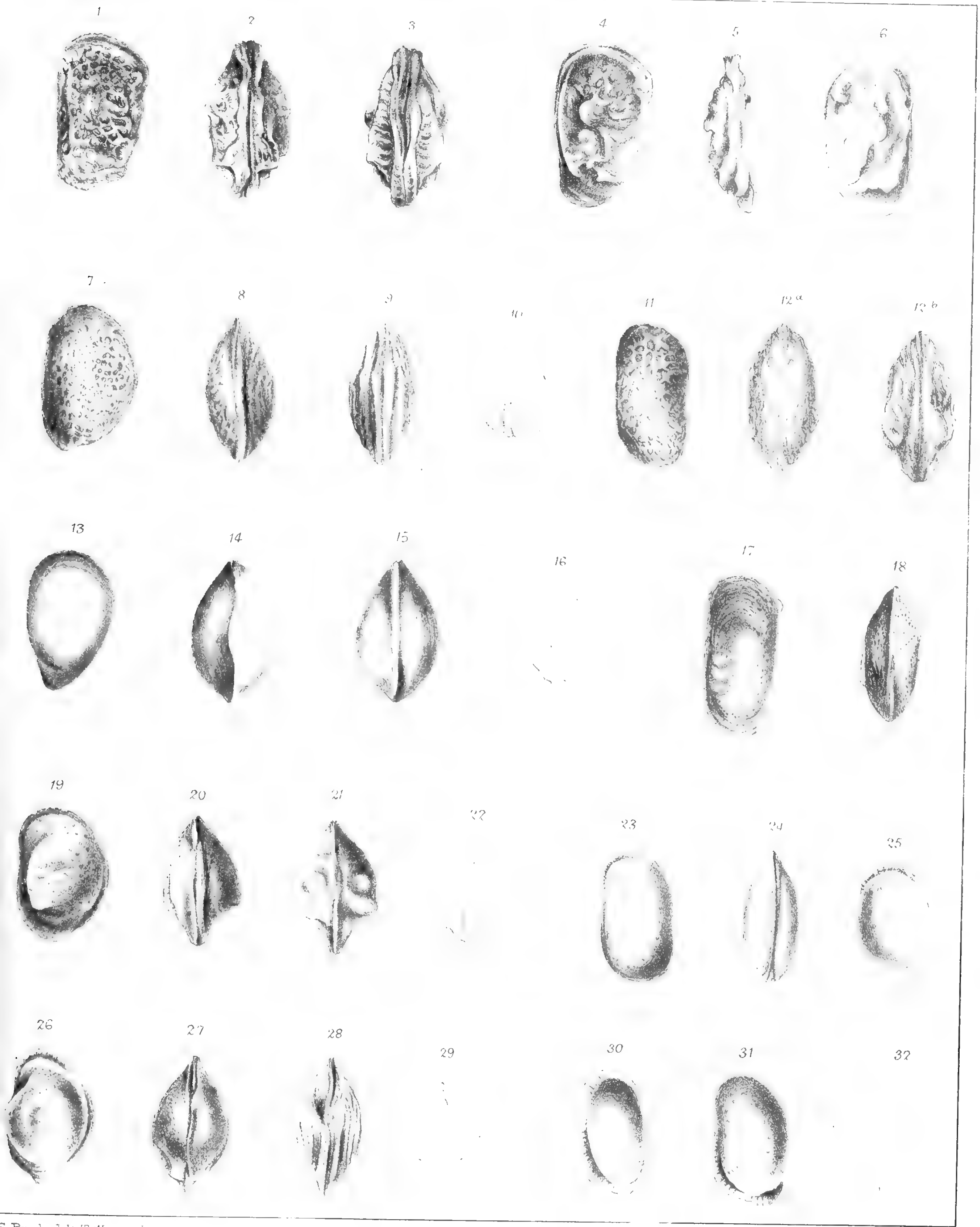


G. S. Brady del.' T. West lith.

W. West & Co. imp.

PLATE XIV.

Fig.			
1. *Cythere macropora.*	Carapace, seen from left side.		× 40 (Hopton Cliff.)
2. — —	,, ,, above.		
3. — —	,, ,, below.		
4. *Cythere Hoptonensis.*	Left valve, seen from outside.		× 40 (Hopton Cliff.)
5. — —	,, ,, above.		
6. — —	Right valve, seen from outside.		
7. *Cythere cicatricosa.*	Carapace, seen from left side.		× 40 (Hopton Cliff.)
8. — —	,, ,, above.		
9. — —	,, ,, below.		
10. — —	,, ,, front.		
11. *Loxoconcha multifora.*	Carapace, seen from left side.		× 60 (Bristol.)
12 *a*. — —	,, ,, above.		
12 *b*. — —	,, ,, below.		
13. *Cytheropteron Montrosiense* (junius).	Carapace, seen from left side.		× 50 (Errol.)
14. — —	,, above.		
15. — —	,, below.		
16. — —	,, front.		
17. *Cytheropteron rectum.*	Carapace, seen from left side.		×60 (Recent: Westport.)
18. — —	,, ,, above.		× 60 (Cardiff Dock.)
19. *Cytheropteron arcuatum.*	Carapace, seen from left side.		× 50 (Dryleys.)
20. — —	,, ,, above.		
21. — —	,, ,, below.		
22. — —	,, ,, front.		
23. *Loxoconcha elliptica.*	Carapace of male, seen from left side.		× 40 (Govan New Dock.)
24. — —	,, ,, above.		
25. — —	,, female, seen from left side.		× 40 (Cardiff Dock.)
26. *Cytheropteron inflatum.*	Carapace, seen from left side.		× 40 (Dryleys.)
27. — —	,, ,, above.		
28. — —	,, ,, below.		
29. — —	,, ,, front.		
30. *Loxoconcha fragilis.*	Carapace of male, seen from left side.		× 60 (Paisley.)
31. — —	Left valve of female, seen from outside.		
32. — —	,, ,, (outline), seen from above.		

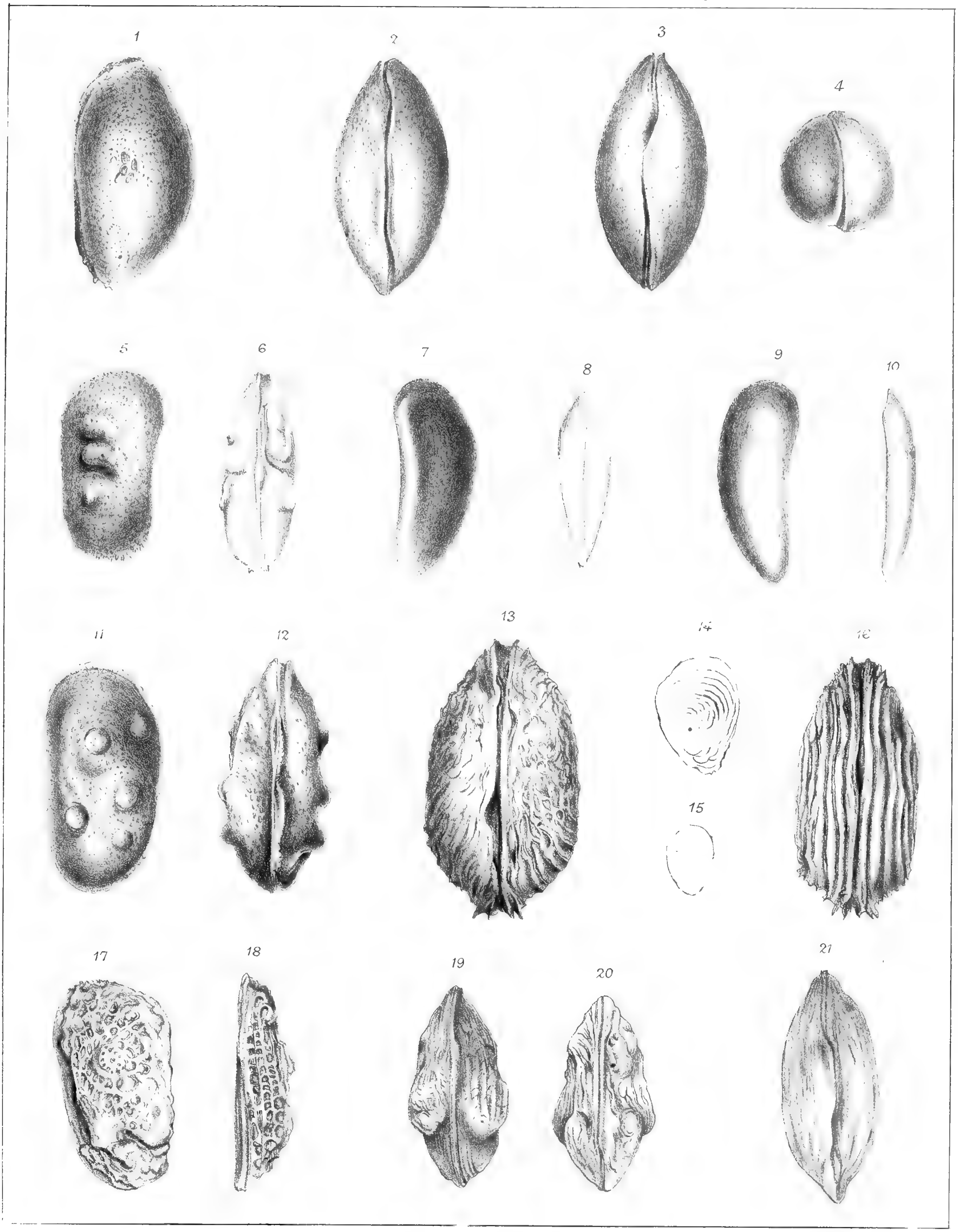


S Brady del T West lith

W West & Co imp

PLATE XV.

Fig.			
1.	*Bairdia inflata.*	Carapace, seen from left side.	× 40 (Oban, Raised-beach.)
2.	— —	,, ,, above.	
3.	— —	,, ,, below.	
4.	— —	,, ,, front.	
5.	*Cypris gibba.*	Carapace, seen from right side.	× 40 (Hornsea.)
6.	— —	,, ,, above.	
7.	*Pontocypris mytiloides.*	Carapace, seen from left side.	× 40 (Oban, Raised-beach.)
8.	— —	,, ,, above.	
9.	*Paracypris polita.*	Right valve, seen from outside.	× 40 (Oban, Raised-beach.)
10.	— —	,, ,, above.	
11.	*Cytheridea torosa.*	Carapace, seen from left side.	× 40 (Mundesly, Crag.)
12.	— —	— ,, above.	
13.	*Cythere mirabilis.*	Carapace of male, seen from above.	× 40 (Dryleys.)
14, 15.	— —	Outlines of the young shell.	
16.	— —	Carapace of male, seen from below.	
17.	*Cythere Logani.*	Left valve of female, seen from outside.	× 40 (Elie.)
18.	— —	,, ,, below.	
19.	*Cythere globulifera.*	Carapace, seen from below.	× 84 (Dryleys.)
20.	— —	,, ,, above.	
21.	*Cytherura concentrica.*	Carapace, seen from below.	× 84



G. S. Brady delt T. West lith.

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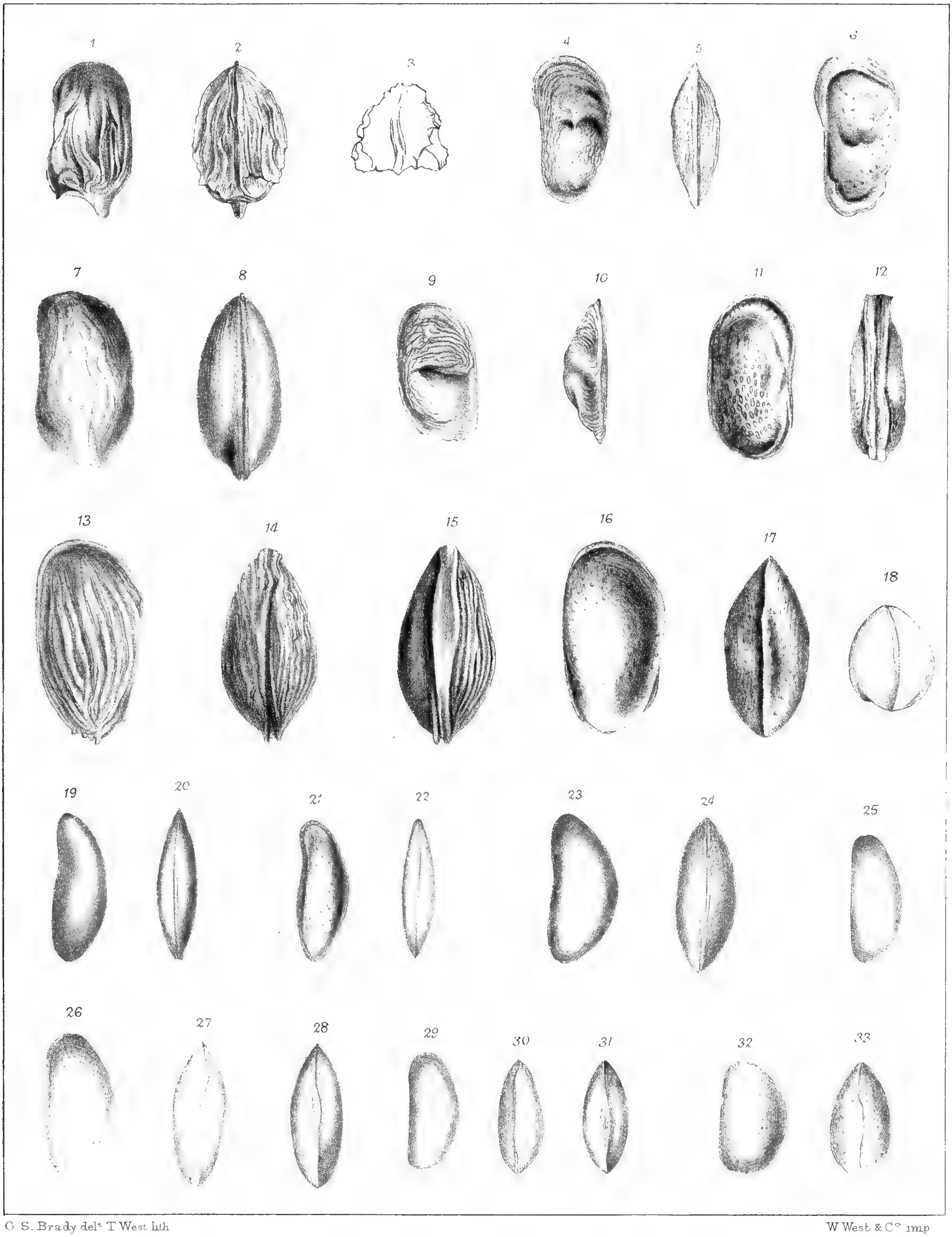
PLATE XVI.

Fig.			
1.	*Cytherura acuticostata.*	Carapace, seen from left side.	× 60 (Oban, Raised-beach.)
2.	— —	,, ,, below.	
3.	— —	,, ,, behind.	
4.	*Limnicythere antiqua.*	Carapace, seen from left side.	× 60 (Crofthead and Dipple.)
5.	— —	,, ,, above.	
6.	*Cythere latimarginata.*	Left valve (imperfect), seen from outside.	× 60 (Hopton Cliff.)
7.	*Cytherura flavescens.*	Carapace, seen from left side.	× 84 (Colintraive.)
8.	— —	,, ,, above.	
9.	*Bythocythere constricta.*	Left valve, seen from outside.	× 40 (Helensburgh.)
10.	— —	,, ,, above.	
11.	*Cythere* (?) *semipunctata.*	Carapace, seen from right side.	× 60 (Oban, Raised-beach.)
12.	— —	,, ,, below.	
13.	*Cythere costellata.*	Carapace, seen from left side.	× 60 (Selsey, Pholas-bed.)
14.	— —	,, ,, above.	
15.	— —	,, ,, below.	
16.	*Cythere gibbosa.*	Carapace, seen from left side.	× 84 (Portrush.)
17.	— —	,, ,, below.	
18.	— —	,, ,, front.	
19.	*Paradoxostoma flexuosum.*	Carapace, seen from left side.	× 60 (Cardiff Dock.)
20.	— —	,, ,, above.	
21.	*Paradoxostoma tenerum.*	Carapace, seen from left side.	× 40 (Dumbarton.)
22.	— —	,, ,, above.	
23.	*Paradoxostoma Fischeri.*	Carapace, seen from left side.	× 60 (West Tarbert, silt.)
24.	— —	,, ,, above.	
25.	*Paradoxostoma arcuatum.*	Carapace, seen from left side.	× 40 (Oban, Raised-beach.)
26.	*Pontocypris trigonella.*	Carapace, seen from left side.	× 40 (Duntroon.)
27.	— —	,, ,, above.	
28.	— —	,, ,, below.	
29.	*Argillœcia cylindrica.*	Carapace, seen from left side.	× 40 (Duntroon.)
30.	— —	,, ,, above.	
31.	— —	,, ,, below.	
32.	*Xestoleberis aurantia.*	Carapace of female, seen from left side.	× 40 (Belfast.)
33.	— —	,, ,, above.	



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THE

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MDCCCLXXIV.

A MONOGRAPH

OF THE

BRITISH FOSSIL

BIVALVED ENTOMOSTRACA

FROM THE

CARBONIFEROUS FORMATIONS.

BY

PROFESSOR T. RUPERT JONES, F.R.S., G.S., &c. &c.;

JAMES W. KIRKBY, ESQ., &c. &c.;

AND

GEORGE S. BRADY, ESQ., C.M.Z.S., &c. &c.

PART I.

THE CYPRIDINADÆ AND THEIR ALLIES.

BY PROF. T. RUPERT JONES, F.R.S., G.S., AND J. W. KIRKBY, ESQ., &c. &c.

CONTAINING

PAGES 1—56; PLATES I—V.

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A MONOGRAPH

OF

THE CARBONIFEROUS BIVALVE ENTOMOSTRACA

OF

GREAT BRITAIN AND IRELAND.

PART I.—THE CYPRIDINADÆ AND ALLIED GROUPS.

INTRODUCTION.

The classification of the very numerous Bivalved Entomostraca found in the Carboniferous Limestones, Shales, and Ironstones, and submitted to our examination by numerous friends and correspondents, has been no easy task. Much as, at first sight, the fossil oval carapace-valves, notched on the anterior edge, may resemble some of the existing *Cypridinadæ*, we have to recollect that, even among the latter, generic discrimination by means of the shell (test or bivalved carapace) is almost impossible. So great is the modification of the shape of valves in any one group, and so little is the persistency among them of any one feature or character, or any set of features, that, except in a very general manner, we may not even take either the "notch" or the contour as a guide, not knowing the soft parts of the animal, remarkable as the similarity may sometimes be between the old and the modern shells.

It is impossible to group many even of the recent "notched" forms under the genus *Cypridina*, in accordance with the requirements of natural classification, by regarding only one character; for from the limbs and other organs are taken the main features of distinction between *Cypridina, Philomedes, Bradycinetus,* and *Asterope,* all formerly grouped as *Cypridinæ.* Evidently, therefore, we cannot say for certain that the extremely old *Cypridinadæ* of the Carboniferous Period, which preceded those of our day by countless generations, susceptible of numberless variations, are generically the same as those now living.

To escape this difficulty, and not to fall into error, we once thought of adopting such a term as "Cypridinopsis" for all these Cypridina-like forms, whether really allied to one more than to another of the genera above alluded to—relationships which the absence of the limbs prevents us from defining with exactness. But several subgeneric terms would have been required, indicating apparent approximations to existing forms; and no advantage in the saving of names would have accrued.

Making the most, then, of the carapace-characters among the fossil Cypridina-like species, and referring them on that basis to their apparent congeners among the published existing forms, we find several which appear to be related to *Cypridina* (both oval and pyriform), and a few to *Bradycinetus* and *Philomedes*. *Rhombina* is a related Cypridinad. Five kinds of Cypridinal carapace among the Carboniferous specimens have additional features, constituting distinctive characters not known among recent Cypridinads; and thus give grounds for *Cypridinella, Cypridellina, Cypridella, Cyprella,* and *Sulcuna.* Two well-marked mutual allies, *Entomoconchus* and *Offa,* are neighbours of the *Cypridinadæ;* and the recent *Polycope* is represented. Others of more obscure relationship occur, such as *Entomis,* with its deep dorsal sulcus.

We need not hesitate in carefully referring these recent and fossil Entomostraca to the same zoological groups, inasmuch as *Cythere* and *Bairdia* are represented by even Silurian carapace-valves; and we may add that *Cypridinadæ* (not yet described) occur in the Upper Silurian strata of the Pentland Hills in Scotland, and in the old pebbles of Silurian or Devonian quartzite in the Conglomerate of Budleigh-Salterton in Devonshire.

Taking, then, the simply notched, oval, oblong, and pyriform specimens as *Cypridinæ,* we find a peculiarly notched and oval species representing *Bradycinetus,* and some oblong impressed specimens equal to *Philomedes.* A modification of the pyriform *Cypridinæ* by the projection of the antero-ventral region marks *Cypridinella;* intervention of a subcentral tubercle gives us *Cypridellina;* and the superadded nuchal furrow, with augmented tuberculation, characterizes *Cypridella.* The tubercle is foreshadowed in an occasional specimen of *Cypridina,* and we see the nuchal impression faintly in the *Philomedes;* but, with the high probability that the limbs differed, we take these slight links in their broadest developmental sense, and not as indicating direct alliance.

The addition of an external annulated ornament brings us from *Cypridella* to *Cyprella;* and *Sulcuna* differs from *Cypridella* in its peculiar sulcus.

Returning to *Cypridina* we trace modifications of the antero-inferior region, beneath the "notch," either by a lessening (as in our *C. brevimentum*), such as obtains in most of the recent forms, or by increased projection, faintly exhibited in the living *C. Zelandica,* Baird, and *C. luteola,* Dana, but in many of the fossils so extremely produced that the antero-ventral quarter stands out like the prow of such an armoured ship as the modern "Ram," typified by the American "Merrimac" and "Monitor." This modification characterizes our *Cypridinella.*

In another direction the Cypridinal carapace, becoming very gibbous and subquadrate or globose, has a faint "notch," but a long vertical "gape," and is recognized as *Entomoconchus;* further, in this kind of subglobose carapace, with the "sinus" present, but the "gape" reduced to a minimum, we have *Offa.*

The recent *Polycope*, characterized by its limbs as belonging to a different family to that of the *Cypridinadæ*, has a globose shell, with no notch, only an obsolete sinus; and among the Carboniferous fossils there are several to match this kind of carapace. There are also some oblong forms, with oblique ends, which we name *Rhombina*, and believe to be related both to *Cypridina* and to some older genera known in the Silurian rocks of Bohemia.

To render the recognition and classification of the recent and fossil *Cypridinadæ* and their allied groups more clear, we here indicate what is known of the existing forms, especially as far as the features of the *Carapace* are concerned.

The Ostracoda are divided by G. O. Sars and G. S. Brady into four great groups.

I. Podocopa, comprising the *Cypridæ* and the *Cytheridæ*.—"This is by far the most extensive of the four sections, including all the freshwater and a vast majority of the marine Ostracoda, and embracing all the forms classed by the earlier writers under the two great genera *Cypris* and *Cythere*" (Brady, p. 355). The characters based on limbs and other organs are enumerated at p. 355, &c., of Mr. G. S. Brady's memoir "On the Recent British Ostracoda," in the 'Trans. Lin. Soc.,' vol. xxvi (1868).

1. *Cypridæ*.—"Valves mostly thin and smooth, more or less sinuate below" (Brady, *op. cit.*, p. 359).
2. *Cytheridæ*.—"Shell mostly hard and compact, calcareous; surface generally more or less rough and uneven, occasionally quite smooth" (Brady, *op. cit.*, p. 393).

II. Myodocopa, embracing the *Cypridinadæ* and *Conchœciadæ* [and the *Entomoconchidæ*.]—"This group comprises the forms of which the genus *Cypridina* is the type, the characters indicating a higher organization and presenting well-marked differences, which show an approach to the higher order Branchiopoda" (Brady, *op. cit.*, 355).

1. *Cypridinadæ*.—"Shell mostly hard and compact in structure, smooth or punctate, and sometimes beset with short hairs, notched at the antero-inferior angle, so that when the valves are closed there remains still a large aperture for the protrusion of the lower antennæ" (Brady, *op. cit.*, p. 462).

1. Cypridina, *Milne-Edwards*.

"Carapace produced in front into a more or less prominent beak, with a subjacent hollow or notch facing the ventral margin" (Brady, 'Trans. Zool. Soc.,' vol. v, p. 386).

"Shell smooth, thin, and flexible; notch shallow; its posterior extremity only slightly exserted" (Brady, 'Proc. Zool. Soc.,' 1871, p. 291). Looking at the series of recognized *Cypridinæ,* we are inclined to think that there are two leading forms of carapace: 1. The elongate-pyriform, such as *C. Reynaudii, C. elongata,* and *C. Bairdii;* and, 2, the oval-oblong, such as *C. Norvegica* and *C. Japonica.*

2. Philomedes, *Lilljeborg.*

"Valves elongated, thin; notch broad; anterior extremity obtuse" (Brady, p. 462). "Shell of moderate strength and density" (Brady, 'Proc. Zool. Soc.,' 1871, p. 291).

3. Asterope,[1] *Philippi.*

"Shell elongated, fusiform, or subcylindrical; beak rounded, not at all produced" (Brady, 'Trans. Lin. Soc.,' vol. xxvi, p. 464; *Cylindroleberis* and *Asterope,* 'Proc. Zool. Soc.,' 1871, p. 292). This genus appears to be one of the most consistent in form and structure of carapace.

4. Bradycinetus, *G. O. Sars.*

"Shell thicker and more compact than in the preceding genera (*Asterope* and *Philomedes*); notch deep, with setose margins" (Brady, 'Trans. Lin. Soc.,' xxvi, p. 466). "Shell much denser than in *Cypridinæ,* punctate; notch deep" (Brady, 'Proc. Zool. Soc.,' 1871, p. 291).

5. Eurypylus, *G. S. Brady.*

"Valves hard, calcareous; closely pitted on the surface, without a notch. Carapace rounded (oval) on side view; anterior end slightly produced, with a short blunt beak; posterior rounded; seen from above clavate, broadly rounded in front, and attenuate behind" (Brady, 'Les Fonds de la Mer,' 1869, p. 141). Though little is known of the soft parts, Mr. Brady is satisfied that *Eurypylus* is a Cypridinad.

[1] Mr. Brady thinks that this genus might with propriety be made the type of a distinct family.

2. *Conchœciadæ.*—" Shell very thin and flexible, neither horny nor calcareous, but almost membranaceous, more or less distinctly notched and emarginate in front, forming an orifice, through which, as in the preceding family, the lower antennæ are protruded whilst swimming " (Brady, *op. cit.*, p. 468).

1. CONCHŒCIA, *Dana.*

" Valves elongated [subrectangular in outline], produced in front into a beaked process; shell finely reticulated, or marked with concentric striæ; very slightly pilose. Dorsal surface of the carapace flattened in front, sometimes slightly excavated and keeled " (Brady, *op. cit.*, p. 469).

2. HALOCYPRIS, *Dana.*

Valves thin, subquadrate, saddle-shaped; more or less beaked in front at the upper angle.

3. *Entomoconchidæ.*[1]

Carapace strong and large, gibbous, subquadrate or suborbicular in side-view.

1. ENTOMOCONCHUS, *M'Coy.* [Known only in the fossil state.]

Carapace subglobose, hinged by overlap; notched in front with a slight beak, and long, vertical, interrupted gape.

2. HETERODESMUS, *G. S. Brady.*

" Carapace subglobose. Dorsal margin slightly arched, forming at its extremities two largely developed hinge-processes; the anterior process somewhat waved and scroll-like; the posterior a truncate cone, projecting directly upwards. Ventral margin strongly arched " (Brady, 'Trans. Zool. Soc.,' vol. v, p. 387). Mr. Brady regards *Heterodesmus* as closely related to the *Cypridinadæ,* though not yet wholly elucidated; and he has suggested the alliance with *Entomoconchus* as above.

[1] G. S. Brady, 'Trans. Linn. Soc.,' vol. xxvi, 1868, p. 358.

III. Cladocopa, having the *Polycopidæ* only.—" The type of this group is *Polycope*, a genus recently described by G. O. Sars, which occurs on some parts of the coasts of the British Islands and Norway, and in the Mediterranean " (Brady, 'Trans. Lin. Soc.,' xxvi, p. 356).

1. *Polycopidæ*.—" Valves subequal, thin, not notched in front " (Brady, *op. cit.*, p. 470).

Polycope, *G. O. Sars*.

" Valves rounded, ventricose, thin, and fragile, corneo-calcareous " (Brady, *op. cit.*, p. 470).

IV. Platycopa, having the *Cytherellidæ* only.—" This group is typified by the genus *Cytherella*, known, before Sars's researches, only from fossil specimens " (Brady, *op. cit.*, p. 317).

1. *Cytherellidæ*.—" Valves unequal, very thick and calcareous, not notched in front " (Brady, *op. cit.*, p. 472).

Cytherella (*Jones*), *Bosquet*.

" Valves elongated, flattened, thick and hard, very unequal; the right much larger than the left, and overlapping throughout the whole circumference, presenting round the entire inner margin a distinct groove, into which the valve of the opposite side is received " (Brady, *op. cit.*, p. 472).

The following Synopsis of existing Genera and Species will aid the student in his search through the somewhat scattered bibliography of those recent *Ostracoda* which are concerned with the present Part of our Monograph.

I. CYPRIDINADÆ, *Baird*, 1850.

1. Cypridina, *Milne-Edwards*, 1837.

Cypridina* Reynaudii, *Milne-Edwards*, 1837. Hist. Nat. Crust., vol. iii, p. 409, pl. xxxvi, figs. 5, 5*a*, 5*b*; and Annotations de l'Hist. des Anim. s. Vert. de Lamarck, vol. v, 1838, p. 178. Indian Ocean.

— * Zelandica, *Baird*, 1850. Proc. Zool. Soc., 1850, p. 102, p. 257, Annulosa, pl. xvii, figs. 11—13. New Zealand.

— luteola, *Dana*, 1855. U. S. Expl. Exped. Crust., p. 1291, pl. xci, figs. 1 *a*—*n*. Sooloo Sea.

— * punctata, *Dana*, 1855. Ibid, p. 1293, pl. xci, figs. 2 *a*, *b*. Sooloo Sea.

— * gibbosa, *Dana*, 1856. Ibid., p. 1295, pl. xci, figs. 4 *a*—*e*. Pacific.

— * formosa, *Dana*, 1855. Ibid., p. 1296, pl. xci, figs. 5 *a*—*h*. Samoan Islands.

— Norvegica, *Baird*, 1860. Proc. Zool. Soc., 1860, p. 200, Annulosa, pl. lxxi, figs. 4, 4 *a*—*d*; Brady, Proc. Zool. Soc., 1871, p. 292. North Atlantic.

— * ovum, *Baird*, 1860. Proc. Zool. Soc., 1860, p. 201, Annulosa, pl. lxxi, figs. 3, 3 *a*, *b*. Chinese Sea.

— * albomaculata, *Baird*, 1860. Ibid., figs. 1, 1 *a*, *b*. Swan River, W. Australia.

— * Godehavi, *Baird*, 1860. Ibid., figs. 2, 2 *a*—*c*. Madras.

— Messinensis, *Claus*, 1865. Ueber die Organization der Cypridinen, Zeitsch. f. wissensch. Zool., vol. xv, Heft 2, p. 143, &c., pl. x. Mediterranean.

— Japonica, *Brady*, 1866. Trans. Zool. Soc., vol. v, p. 386, pl. lxii, figs. 8 *a*—*d*. Japan.

— elongata, *Brady*, 1866. Ibid., figs. 9 *a*—*d*. Chinese Sea.

— Bairdii, *Brady*, 1866. Ibid., figs. 7 *a*—*m*. Chinese Sea.

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* Further knowledge of the soft parts of these species, and a full comparison with what is known of the others, is wanted for the exact determination of their generic relationship. G. O. Sars assigns *Cypridina messinensis,* Claus, and *C. luteola,* Dana, to *Cypridina;* Grube's species probably to *Asterope;* Costa's species and Baird's *C. Adamsii* probably to a distinct genus, or else to *Asterope;* and *C. olivacea,* Dana, to *Philomedes* (as suggested by Dr. Baird previously).—G. S. B.

2. ASTEROPE, *Philippi*, 1840.

ASTEROPE ELLIPTICA, *Philippi*, 1840. Archiv für Naturgeschicht., 1840, p. 188, pl. iii, figs. 9—11; Annals Nat. Hist., vol. vi, p. 94, pl. iii, figs. 9—11. Mediterranean.

— * ? MEDITERRANEA (*Costa*), 1845. Illustraz. Cypridina, &c., Dono Accad. Pontan. agli Sc. Ital., p. 57, &c., pl. i. Mediterranean.

— * ? ADAMSII (*Baird*), 1848. Ann. N. H., ser. 2, vol. i, p. 22, pl. vii, fig. 1. South Atlantic.

— MARIÆ (*Baird*), 1850. Proc. Zool. Soc., 1850, p. 257, Annulosa, pl. xvii, figs. 5—7; Brady (*Cylindroleberis*), Trans. Linn. Soc., vol. xxvi, p. 465, pl. xxxiii, figs. 18—22, pl. xli, fig. 1; Proc. Zool. Soc., 1871, p. 295. North Atlantic, Channel Islands, and Bay of Biscay.

— * ? OBLONGA (*Grube*), 1859. Archiv Naturgesch., 35 Jahrg., vol. i, pp. 330—335, pl. xii, figs. 2—5. Adriatic.

— TERES (*Norman*), 1861. Ann. N. Hist., ser. 3, vol. viii, p. 280, pl. xiv, fig. 10; Brady (*Cylindrolebris*), Tr. Linn. Soc., vol. xxvi, p. 465, pl. xxxiii, figs. 6—9, pl. xli, fig. 2; Proc. Zool. Soc., 1871, p. 295. North Atlantic.

— ABYSSICOLA, *G. O. Sars*, 1869. Nye Dybvandscrustaceer fra Lofoten, p. 26. Norway.

— NORVEGICA, *G. O. Sars*, 1869. Undersögelser over Christianifiordens Dybvandsfauna anstillede paa en i Som. 1868, p. 53. Norway.

3. PHILOMEDES, *Lilljeborg*, 1853.

PHILOMEDES ? * ALBIMACULATA (*Nicolet*[1]), 1849. In Cl. Gay's Hist. fisica y politica de Chile, vol. iii, p. 294, Atlas, Crustaceos, pl. iv, fig. 6. Marshes of Chile.

— ? * CŒRULEA *vel* VIOLACEA (*Nicolet*), 1849. Ibid., fig. 6*b*. Marshes of Chile.

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[1] As to Nicolet's species, it would seem impossible, without information as to the limbs, to say anything definite; the antennæ do not look like *Philomedes*, unless they be those of the female, which is not usually got on the surface.—G. S. B.

PHILOMEDES INTERPUNCTA (*Baird*), 1850. Proc. Zool. Soc., 1850, p. 257, Annulosa, pl. xvii, figs. 8—10; Brady, Tr. Linn. Soc., vol. xxvi, p. 463, pl. xxxiii, figs. 10—13, pl. xli, fig. 3; Proc. Zool. Soc., 1871, p. 293, pl. xxvi, figs. 1—5 (=*Philomedes longicornis*, Lilljeborg, Norman, and G. O. Sars). North Atlantic, English Channel, and Bay of Biscay.

— OLIVACEA (*Dana*), 1855. Expl. Exped. Crust., p. 1294, pl. xci, figs. 3 *a*, *b*. Sooloo Sea.

— FOLINII, *Brady*, 1871. Proc. Zool. Soc., 1871, p. 294, pl. xxvii, figs. 1—3. Bay of Biscay.

4. BRADYCINETUS, *G. O. Sars*, 1865.

BRADYCINETUS MACANDREI (*Baird*), 1850. Brit. Entom., p. 179, pl. xxii, figs. 1 *a*—*g*; Brady, Tr. Lin. Soc., vol. xxvi; p. 468, pl. xxxiii, figs. 14—17, pl. xli; fig. 4. North Atlantic.

— BRENDA (*Baird*), 1850. Brit. Entom., p. 181, pl. xxiii, figs. 1 *a*—*g*; Brady, Tr. Lin. Soc., 1868, vol. xxvi, p. 466, pl. xxxiii, figs. 1—5, pl. xli, fig. 5; Proc. Zool. Soc., 1871, p. 292 (=*Cypridina globosa*, Lilljeborg; *Bradycinetus globosus*, Sars; *Asterope groenlandica*, Fischer; *Cypridina excisa*, Stimpson). North Atlantic, Bay of Fundy, and Bay of Biscay.

— LILLJEBORGII, *G. O. Sars*, 1865. Oversigt af Norges marine Ostracoder, p. 112. Norway and North Atlantic.

5. EURYPYLUS, *G. S. Brady*, 1869.

EURYPYLUS PETROSUS, *Brady*, 1869. Les Fonds de la Mer, livr. 9, p. 141, pl. xviii, fig. 12. St. Vincent Roads, Cape Verde.

II. CONCHŒCIADÆ, *G. O. Sars*, 1865.

1. CONCHŒCIA, *Dana*, 1855.

CONCHŒCIA AGILIS, *Dana*, 1855. Expl. Exped. Crust., p. 1299, pl. xci, figs. 6 *a*—*e*. Atlantic.

— ROSTRATA, *Dana*, 1855. Ibid., p. 1300, pl. xci, figs. 7 *a*—*f*. Pacific.

— OBTUSATA, *Sars*, 1865. Oversigt, &c., p. 118; Brady, Trans. Lin. Soc., vol. xxvi, p. 470, pl. xli, fig. 9. North Atlantic.

2. Halocypris, *Dana,* 1855.

Halocypris inflata, *Dana,* 1855. Expl. Exped. Crust., p. 1301, pl. xci, figs. 8 *a—k.* Atlantic.
— brevirostris, *Dana,* 1855. Ibid., p. 1303, pl. xci, figs. 9 *a—c.* Atlantic.
— Atlantica, *Lubbock,* 1856. Tr. Entom. Soc., new ser., vol. iv, p. 34, pl. xii, figs. 1—8. North Atlantic.
— messinensis, *Claus,* 1865. Zeitsch. wiss. Zool., vol. xv, p. 399, pl. xxx. Mediterranean.

III. ENTOMOCONCHIDÆ, *G. S. Brady,* 1868.

1. Heterodesmus, *Brady,* 1866.

Heterodesmus Adamsii, *Brady,* 1866. Trans. Zool. Soc., vol. v, p. 387, pl. lxii, figs. 6 *a—h.* Japan.

IV. POLYCOPIDÆ, *G. O. Sars,* 1865.

1. Polycope, *Sars,* 1865.

Polycope orbicularis, *G. O. Sars,* 1865. Oversigt af Norges marine Ostracoder, p. 122; Brady, Tr. Linn. Soc., vol. xxvi, p. 471, pl. xxxv, figs. 53—57. Norway and North Atlantic.
— ? dentata, *Brady,* 1868. Ibid., p. 472, pl. xxxv, figs. 58, 59. Shetland.
— punctata, *G. O. Sars,* 1869. Nye Dybvandscrustaceer fra Lofoten, p. 27. Norway.
— sp. indet., *Brady,* 1869. Ann. N. H., ser. 4, vol. iii, p. 47, pl. vii, figs. 15, 16. Crete.
— compressa, *Brady* and *Robertson,* 1869. Ibid., p. 372, pl. xxi, figs. 5—8. Atlantic and Mediterranean.

V. CYTHERELLIDÆ, *G. O. Sars,* 1865.

1. Cytherella (*Jones*), *Bosquet.*

The Synopsis of Species for this Genus will be given in a subsequent portion of this Monograph.

DESCRIPTION OF THE CARBONIFEROUS GENERA AND SPECIES.

I.—CYPRIDINA, *Milne-Edwards.*

CYPRIDINA, *Milne-Edwards*, 1837.
— *Baird*, 1840, 1848, 1850, 1860.
DAPHNIA, *M'Coy*, 1844.
CYPRIDINA, *Costa*, 1845.
CYPRELLA, *Bosquet*, 1847, 1852, 1854.
CYPRIDINA, *Jones*, 1849, 1854, 1856, 1869.
— *Adam White*, 1850.
— *Dana*, 1855.
— *Grube*, 1859.
— *Claus*, 1865.
— *G. S. Brady*, 1866, 1868.
— *Jones* and *Kirkby*, 1866, 1867, 1871.
— *G. O. Sars*, 1868, 1869.

Carapace-valves rather thin and horny in the recent specimens, more solid and calcareous when fossil; ovate, oblong-oval, elongate-oval, or pyriform; apiculate behind; notch distinct in front. The fossil are thicker than the recent shells; partly, at least, from mineralization. Muscle-spot frequently apparent.

The 'Monograph of the Tertiary Entomostraca of England' (Palæontogr. Soc.), 1856, p. 9, where treating of the Family *Cypridæ,* contains the following paragraph:—"I may here mention that *Cyprella* and *Cypridella,* of M. De Koninck, probably belong to a different group of the Entomostraca; that M. Bosquet's 'Cyprellæ' of the Cretaceous and Tertiary deposits are true *Cypridinæ;* and that De Koninck's 'Cypridina' (of the Carboniferous Limestone) is not the *Cypridina* of Milne-Edwards. In a courteous reply to an inquiry with which I lately troubled M. Milne-Edwards, he kindly informed me that the *Cypridina* described in the 'Hist. Nat. des Crust.' has really the antero-ventral notch so characteristic of the genus." With regard to this important point in the history of the genus, it is evident that, for want of the early indication of the presence of this character, several fossil forms have been wrongly allocated by palæontologists. Thus, besides noticing[1] that M'Coy's *Daphnia primæva* is a *Cypridina,* and that M. De

[1] See also 'Monog. Cretac. Entom., England' (Palæontogr. Soc.), 1849, pp. 3, 5, and 36.

Koninck's *Cypridina Edwardsiana* is a *Cypridella,* his *Cypridina annulata* a *Cyprella,* and his *Cypridina concentrica* an *Entomis,* and that numerous *Cytheræ* (Tertiary and Cretaceous) were formerly called "Cypridinæ," we must draw attention (as we have elsewhere) to the fact that none of the Devonian "Cypridinæ" which have given a name to a formation ("Cypridinen-Schiefer," &c.) are *Cypridinæ,* but for the most part *Entomides,* &c. See also "Palæoz. Biv. Entom.," Geol. Assoc., 1869, p. 4.

On the other hand, M. Bosquet's *Cyprella ovulata* and *C. Koninckiana,* from the Chalk of Maestricht ('Mém. Soc. Roy. Sciences Liége,' vol. iv, 1847, p. 373, pl. iv, figs. 4 and 5; and 'Mém. Commission Carte Géol. Neerlande,' vol. ii, 1854, pp, 124, 125), and his *Cyprella Edwardsiana,* from the Lower Tertiaries of France ('Mém. Cour. Acad. Roy. Belgique,' vol. xxiv, 1852, p. 132, pl. 6, fig. 14), are true *Cypridinæ,* as now understood by a wider knowledge of the genus, and especially the recognition of the notch and beak in M. Milne-Edwards's typical species. Among known recent species *Cypridina Bairdii,* G. S. Brady, is, perhaps, the nearest to the above-mentioned *Cypridinæ ovulata, Koninckiana,* and *Edwardsiana* (Bosquet).

For a list of the known recent species of *Cypridina* and their more important synonyms, see page 7.

1. Cypridina primæva (M'Coy). Plate II, figs. 24, 25, 26, 27 *a—c,* 28.

Daphnia primæva, *M'Coy,*[1] 1844. Synops. Char. Carb. Foss. Ireland, p. 164, pl. xxiii, fig. 5.

Cypridina — *Jones,* 1854. In Morris's Catal. Brit. Foss., 2nd ed., p. 104.

— — *Jones* and *Kirkby,* 1866. Annals Nat. Hist., ser. 3, vol. xviii, p. 41; 1867, Trans. Geol. Soc. Glasgow, vol. ii, p. 218, and vol. iii, Suppl., 1871, p. 27.

Carapace subequivalve, subglobose, or of a compressed egg-shape; oval in outline, nearly equilateral; notched anteriorly, at the middle, with a deep sinus and wide triangular gape (fig. 27 *b*). End-view compressed-oval. Edge view narrow-oval.

This much resembles *Cypridina Japonica,* Brady ('Trans. Zool. Soc.,' vol. v, pl. 62, fig. 8) in shape, but wants the posterior prickle or spur, and differs somewhat in the gape, which is cruciform in *C. Japonica.* It is still more like *C. Norvegica,* Baird ('Proc. Zool. Soc.' Annulosa, pl. 71, fig. 4); but in the latter the notch is smaller and the gape cordiform.

Fig. 27 *a* matches Prof. M'Coy's *Daphnia primæva* in shape and size (according

[1] Prof. M'Coy quoted the *Daphnoidia* of Hibbert ('Trans. Roy. Soc. Edin.,' 1834, vol. xiii, p. 180; *D. Hibberti,* Morris, 1843), as a synonym, but we do not see any relationship. Indeed, "*Daphnoidia*" appears to be indeterminable ('Annals N. H.,' *l. c.,* p. 34), or it may be a crushed specimen of *Leperditia Scotoburdigalensis.* M'Coy mentions no special locality for *C. primæva.*

to the figure and description in the 'Syn. Char. Carb. Foss.'), being $1\frac{3}{4}$ by $\frac{3}{4}$ line (a line $= \frac{1}{10}$ inch).

Figs. 24—27 are brown bivalved carapaces from Braidwood, Carluke, Lanarkshire. They were found by Mr. John Young, amongst about 300, in a fish Coprolite,[1] collected by Dr. D. R. Rankin in an old "Opencast" at Braidwood Gill, Carluke, from a stratum containing *Beyrichia multilobata,* in the Lower Limestone Shale, and on or below the horizon of the First Calmy Limestone, 343 fathoms below the Ell Coal of the Carluke series. The Coprolite was about two inches by one in size and thickly charged throughout with the bivalve tests.

Smallest.—Length $\frac{1}{14}$; height $\frac{1}{24}$; thickness ? . Proportions $3\frac{1}{2} : 2$.

Largest.— „ $\frac{1}{5}$; „ $\frac{1}{8}$; „ $\frac{1}{12}$. „ $9 : 6 : 4$.

Fig. 28 is from a cast in the Permian Limestone of Sunderland; there are two specimens in Mr. Kirkby's Collection. It closely resembles *C. primæva* in outline and contour, and is about $\frac{1}{10}$ inch in length.

We have also met with this species in the Poolvash Limestone of the Isle of Man (see p. 22).

So many of our fossil Entomostraca have been derived from the Carboniferous Formations of Scotland, particularly of Lanarkshire, by the energy and kind care of Dr. Rankin, Messrs. Grossart, Young, Armstrong, Thomson, Hunter, Robertson, and other friends, that we will here refer to sources of information on the stratigraphy of the Scotch Coal-fields.

At pages 33 and 34 of the 'Monograph of the Fossil Estheriæ" (Pal. Soc.), 1862, is a stratigraphical list of the Coal-measures of Lanarkshire, indicating the range of *Beyrichia, Estheria,* and *Leperditia* (there termed "Cytheropsis"). Mr. Grossart's *Cypridina* (350 fathoms below the Ell Coal) is also referred to at p. 34, and Dr. Rankin's specimen (239 fathoms) at p. 35.

A Synoptical Table or "Vertical Section of the Carboniferous Rocks in the neighbourhood of Glasgow, showing the distribution of the Bivalve Entomostraca," was published in the 'Trans. Geol. Soc. Glasgow,' vol. ii (1867), p. 225; and it was re-issued in an improved form in the Supplement of vol. iii, 1871, by Messrs. John Young and James Armstrong, descriptive of the vertical range and distribution of the Carboniferous Fossils of the West of Scotland.

A Tabular View of the Carboniferous System of Lanarkshire was given by Mr. T. Davidson, F.R.S., in the 'Geologist,' vol. ii, 1859, p. 466; and of the Lothians in the 'Geologist,' vol. iii, 1860, p. 239; and a still later conspectus of these Carboniferous Formations of East Scotland, by Mr. Geikie, was published in Murchison's 'Siluria,' 1867, p. 292, &c. See also the publications of the Geological Survey of Scotland.

[1] Mentioned also in the "Report of the Glasgow Geological Society's Meeting of January 25, 1866," in the 'Geological Magazine,' vol. iii, p. 133.

2. Cypridina radiata. Sp. nov. Plate V, figs. 6 *a*—6 *f*.

Mr. John Young, of Glasgow, has found in a black shale of the Airdrie Blackband Ironstone of the "Upper Coal-measures" of the Glasgow district numerous rusty longitudinally oval *Cypridinæ*, much resembling *C. primæva* (especially figs. 25 and 27) in shape, but larger, with deeper and lower notch, and characterized by a beautiful radiate shell-structure. Being mostly squeezed in the shale, they vary in outline, in relative size, and in depth of notch.

The exterior bears a rough, blebby, reticulate surface, with minute subconvex meshes; and these are often broken away, leaving subhexagonal linear meshes. The inner laminæ of the shell (brown) exhibit groups of vascular radii, consisting of about fifteen delicate furrows (and their casts), some bifurcate, radiating from a small round space (a pit, as seen from within), less distinct in some specimens and most apparent in the scaled interior of others. Where the furrows are coarse there are about seven or eight of these vascular stars across the valve, and nine or ten along its length, irregular and alternate, the ends of one set of rays just touching those of the neighbouring groups. The stars vary in size, and in the length, tenuity, straightness, and number of their rays, even in one specimen.

Length $\frac{1}{4}$, height $\frac{1}{6}$, thickness $\frac{1}{12}$. Proportions 12 : 8 : 3.[1]

In this bituminous shale of the so-called "Freshwater Series" of the local Carboniferous group, thirty-three fathoms below the Ell Coal, besides *C. radiata*, are other smaller *Cypridinæ* (?) and *Beyrichia arcuata*, also *Anthracosiæ* and remains of Fishes and Reptiles.

Similar *Cypridinæ* with radiate structure have been discovered by Mr. W. Molyneux, F.G.S., of Burton-on-Trent, in laminated and rusty bituminous shales (of the "Hæmatite" series) belonging to the English Coal-measures, at Ipstones, North Staffordshire. In some soft, drab-coloured concretions in similar shales from Lowndes' Pit, Ipstones, Mr. Molyneux has also found a subglobular pitted *Cypridina* (imperfect), which may be of the same species.

3. Cypridina Wrightiana. Sp. nov. Plate II, figs. 14 *a, b, c*.

Carapace-valve oval-oblong, somewhat compressed, boldly curved above and behind, straight below; though indented with a large open sinus in front, the valves had but a very small gape. End view of carapace acute-obovate; edge-view narrow-oval.

[1] These measurements and proportions are taken from one of the best preserved specimens; but owing to the carapace-valves having been much pressed they may not be quite accurate.

Length $\frac{5}{24}$; height $\frac{1}{7}$; thickness $\frac{1}{12}$ inch. Proportions 10 : 7 : 4.

A grey shell in grey Carboniferous Limestone, Cork, Ireland; collected by Mr. Joseph Wright, F.G.S. It differs from *C. primæva* in its straight ventral edge, large open sinus, and small gape; and it is dedicated to its discoverer, one of the most enthusiastic of collectors and students of the Carboniferous and other fossils of Ireland. To Mr. Wright's energy and liberality we owe a very considerable portion of the large number of the Carboniferous Cypridinads, besides other Entomostraca, that have come under our examination.

4. Cypridina Bradyana. Sp. nov. Plate II, figs. 13 *a, b, c.*

Carapace-valve gently gibbous, subovate in outline, truncate in front, where the sinus cuts away, as it were, the lower portion of a semicircular curve, leaving a strong triangular beak and a perpendicular margin beneath it. Yet the gape or fissure does not seem to have been large (fig. 13 *b*). A slight local elevation or faint knob is expressed in the antero-dorsal region, somewhat modifying the otherwise symmetrically convex outline of that part of the valve. This slight tubercle is not without its meaning in relation to the far more extensively tuberculate and swollen *Cypridellæ* and *Cypridellinæ* hereafter to be noticed. End-view of carapace suboval; edge-view acute-ovate.

Length $\frac{1}{5}$; height $\frac{1}{8}$; thickness $\frac{1}{12}$. Proportions $9\frac{1}{2}$: 6 : 4.

This species, represented by a grey shell in grey limestone, differs markedly in contour and in form of "notch" from *C. Wrightiana* and its other associates in the Carboniferous Limestone of Little Island, Cork. It was also collected by Mr. Joseph Wright, F.G.S.; and it is named after our accomplished friend, Mr. G. S. Brady of Sunderland, who has favoured us with much help in the study of these and other fossil Entomostraca.

5. Cypridina brevimentum. Sp. nov. Plate II, figs. 15—19.

Carapace compressed egg-shaped; valves varying in outline from oval (figs. 15 and 16) to oval-oblong (figs. 17—19); arched or curved on each margin, though sometimes nearly straight below; elliptically and often obliquely curved behind; broadly convex on the dorsal line; deeply cut by a sinus in front, with the lower (antero-ventral) region sloping away downwards and backwards with a curved outline. The smaller (younger) and most oval specimens (fig. 16, &c.) have the greatest loss in this region, and the relatively most projecting beak; and thus present an even more chinless outline than the larger individuals (figs. 19, &c.). A gape of moderate proportions (indicated in the outlines, figs. 16 *b* and 19 *b*) accompanies this deep sinus. Some valves (fig. 18) have a slight marginal rim on the ventral edge. End-view obovate; edge view compressed ovate, and nearly oblong-oval in the fine old specimen, fig. 19 *c*, which has its surface somewhat depressed across the middle.

In the males of *Philomedes interpuncta* (Baird), and in *Cypridina Reynaudi*, M.-Edwards, and *C. Bairdii*, Brady, the antero-ventral region of the carapace slopes away rapidly backwards, as in *C. brevimentum;* but there are no other mutual characters of similarity.

This species, gregarious like many other Cypridinads, is evidently of common occurrence in the Mountain-limestone of Ireland, England, and Belgium. Taken according to gradations in shape—

Fig. 16 (the smallest) is a grey shell in grey limestone from Cork (Mr. Joseph Wright, F.G.S.). It is a fifth too large to be M'Coy's *Daphnia primæva*, and differs from it essentially in shape. We have a similar specimen from Visé (Belgium), thanks to our friend M. J. Bosquet, F.C.G.S. of Maestricht.

Fig. 15 is a grey shell, roughened by partial solution and weathering, and cracked (as shown in the figure), in grey limestone from Little Island, Cork; Mr. Joseph Wright, F.G.S.

Fig. 18 is a whitish weathered shell in grey Mountain-limestone from Parkhill, near Longnor, Derbyshire, associated with a small *Aviculopecten* and small bivalves. The specimen is in the Museum of the Geological Survey, Jermyn Street (Tablet $\frac{38}{11}$), where there are two others similar, one a cast and one with a film of shell remaining (fig. 19), from the same place.

Fig. 17 is a grey shell in the grey limestone of Cork, collected by Mr. Joseph Wright, F.G.S. This species is plentiful at Little Island.

Fig. 19 (the largest) is a black cast, retaining some straggling films and broken reticulations of shell-matter, in dark grey encrinital limestone, in which the constituent fossils are partially darkened with bitumen, from Parkhill, Longnor, Derbyshire. It is on Tablet $\frac{38}{11}$ in the Museum of the Geological Survey, London. [The beak over the notch is rather sharper in the specimen than in the figure.]

Fig. 16	length	$\frac{1}{5}$;	height $\frac{1}{9}$;	thickness	$\frac{1}{12}$ inch.	Proportions	9 : $5\frac{1}{2}$: 4.
Fig. 17	,,	$\frac{2}{7}$;	,, $\frac{1}{6}$;	,,	?	,,	$6\frac{1}{2}$: 4.
Fig. 15	,,	$\frac{1}{3}$;	,, $\frac{1}{5}$;	,,	$\frac{1}{7}$	,,	8 : $4\frac{1}{2}$: $3\frac{1}{2}$.
Fig. 18	,,	$\frac{1}{3}$;	,, $\frac{5}{24}$;	,,	$\frac{1}{6}$	,,	$7\frac{3}{4}$: 5 : 4.
Fig. 19	,,	$\frac{5}{12}$;	,, $\frac{1}{4}$;	,,	$\frac{1}{6}$	,,	10 : 6 : $4\frac{1}{4}$.

In the Carboniferous Limestone of Caldy Island, South Wales, the late Mr. J. W. Salter observed a gregarious Cypridinad, either of this species or possibly *Polycope simplex*.

6. Cypridina Grossartiana, *J. and K.* Plate II, figs. 20 *a, b, c.*

Cypridina grossartiana, *J. and K.*, 1867. Trans. Geol. Soc. Glasgow, vol. ii, p. 218; and vol. iii, Suppl., p. 27, 1871.

Carapace ovate-oblong; moderately gibbous, but compressed along the margins, especially anteriorly; broadest (deepest) in the front half; but the antero-dorsal or nuchal region suddenly sinks in before it curves off into the beak or penthouse over the strongly marked notch. The gape seems to have been small. End-view acute-oval; edge-view long-acute-ovate.

Length $\frac{7}{24}$; height $\frac{1}{5}$; thickness $\frac{1}{9}$ inch. Proportions $14\frac{1}{2} : 9 : 5$.

The nuchal depression, giving a somewhat hump-backed appearance to the carapace, is present also to a great or less extent in some recent Cypridinads. We know of no species like *C. Grossartina* in form of valve and shape of beak.

We name this species after Mr. W. Grossart, Surgeon, of Salsburg, Lanarkshire, who collected it near Blackburn, a mile and a half south-east of Bathgate, Linlithgowshire, from ironstone-shale six feet above the "Eurypterus Limestone,"[1] and 345 fathoms under the Ell Coal.

7. Cypridina Youngiana. Sp. nov. Plate II, figs. 11 *a—c.*

Carapace-valve broadly oblong; subcompressed, semicircular behind; curved below; nearly straight on the back; posterior broader and fuller than the anterior, where a neat median notch (the projection is slightly lessened by injury in this specimen) forms a large gape (fig. 11 *b*).

The specimen consists of a cast of the interior, retaining a small fragment of the shell posteriorly, and showing a distinct, large, radiate Muscle-spot in the antero-ventral region. The radii are longer on the hinder than on the front half of the spot, the centre of convergence being towards the front. End-view of the carapace acute-oval; edge-view compressed ovate, broadest behind.

Length $\frac{2}{7}$; height $\frac{1}{5}$; thickness $\frac{1}{8}$ inch. Proportions $13 : 9\frac{1}{2} : 6$.

This was found by Mr. James Thomson, of Glasgow, at Gare, Carluke, in the Upper Limestone-shale, 202 fathoms below the Ell Coal. It is named after Mr. John Young, the energetic Assistant-curator of the Hunterian Museum, Glasgow, who has worked assiduously in collecting, classifying, and elaborating the Carboniferous Entomostraca of the Glasgow District.

[1] This is a local limestone, found at Kirkton, near Bathgate, and appears to be associated with the limestones at the bottom of the Scotch Coal-measures. It was noticed by Dr. Hibbert, in 'Trans. Roy. Soc. Edinb.,' vol. xii.

8. Cypridina Phillipsiana, *Jones*. Plate II, figs. 4, 5, 9.

Cypridina Phillipsiana, *Jones*, 1870. Monthly Microsc. Journ., vol. iv, p. 185, pl. lxi, fig. 8 *a*, *b*.
— — *J. and K.*, 1871. Trans. Geol. Soc. Glasgow, vol. iii, Suppl., p. 27.

Carapace subglobose, symmetrically convex (or nearly so), the amount of convexity somewhat variable; broadly oval in outline, with nearly equal ends, except that one (anterior) is notched, above the middle line, with a long, curved, shallow sinus, accompanied by a decided, though small, gape of the valves. Surface smooth. Muscle-spot oval, radiate, strong on the casts, and visible on the shell; like that in Baird's *Cypridina albomaculata* and *C. Adamsii.*

Fig. 4.	Length $\frac{1}{4}$;	height $\frac{1}{5}$;	thickness $\frac{1}{8}$ inch.	Proportions 11 : 9 : 6.
Fig. 5.	„ $\frac{1}{6}$;	„ $\frac{1}{7}$;	„	„ $8\frac{1}{2}$: 7.
Fig. 9.	„ $\frac{1}{5}$;	„ $\frac{1}{7}$;	„ $\frac{1}{7}$ „	„ 9 : 7 : 7.

Shells and casts of this species (dedicated to Prof. John Phillips, F.R.S., whose name is so intimately connected with Carboniferous fossils and Geology in general) are not uncommon in the Carboniferous Limestone near Glasgow, and it occurs also in that of Middleton, Co. Cork, Ireland (Mr. Joseph Wright), and of Visé, in Belgium (British Museum).

Fig. 5. This specimen (small) retains a part of the shell (white and showing reticulate structure), in grey Carboniferous Limestone, with pieces of Trilobite and a Coral, from Gare, Carluke (Dr. Rankin). This specimen has a minute circular depression, on the junction of the valves, at the postero-ventral curve, probably representing the place of a spine or prickle.

Fig. 9. From a dark-grey limestone at Carluke (Dr. Rankin), retaining part of the whitened shell, and showing a faint, vertical, ventral depression [not visible in the figure].

Fig. 4, the largest, is a cast with filmy remnants of white shell at the muscle-spot and edges; also in a dark-grey limestone from Carluke (Mr. J. R. S. Hunter).

To this species we refer a small subquadrate bivalved specimen in ironstone from the Upper Limestone-shale, 290 fathoms below the Ell Coal, at Robroystone, near Glasgow, in Mr. John Young's collection, and formerly catalogued by us as "*Entomoconchus*," 'Glasgow List,' 1871, p. 28; see also 'Geol. Mag.,' vol. ii, p. 277.

9. Cypridina Hunteriana. Sp. nov. Plate V, figs. 3 *a*, 3 *b*, 3 *c*.

Mr. John Young has obtained from the Main Post Limestone (366 fathoms below the Ell Coal) of Braidwood, Carluke, a relatively large specimen (cast) subquadrate in outline, somewhat compressed, being less convex than *C. Phillipsiana*, and notched with a deeper sinus in the middle of the front edge. It bears a large, circular, radiate Muscle-spot rather higher up than in figs. 5 and 9 of Pl. II. There is also present a considerable depression or nuchal furrow, in the anterior third of the dorsum, above the muscle-spot.

Size—$\frac{1}{6}$ inch long.

We name this species after Mr. J. R. S. Hunter, of Beaushields, near Carluke, who, with Dr. Selkirk, has successfully worked the Braidwood Limestone, and added much to our knowledge of its palæontology. Mr. Hunter has obtained numerous *Entomostraca* from the débris of decomposed limestone in the large crevices traversing the rock. These once formed subterranean watercourses, and the limestone has been extensively disintegrated by the solvent and mechanical action of the water, the organic particles resisting destruction more successfully than the matrix.

10. Cypridina Thomsoniana, *J. and K.* Plate II, figs. 8 *a*—*c*; Plate V, fig. 4.

Cypridina Thomsoniana, *J. and K.*, 1867. Trans. Geol. Soc. Glasgow, vol. ii, p. 218; and vol. iii, Suppl., 1871, p. 27.

Carapace-valve subquadrate in outline; convex, especially below and behind; semi-circular below (ventral); broadest and elliptical above, with a slight angle at the small notch in the upper portion of the front edge (slightly modified by pressure in the specimen).

Posterior half fuller than the anterior, therefore the antero-dorsal region of the carapace is somewhat compressed. End-view and edge-view both ovate, but the latter the longer.

Surface reticulated all over (not partially as in fig. 8 *a*), with circular spots (Pl. V, fig. 4), somewhat like those of *Polycope simplex* from Braidwood.

Length $\frac{1}{4}$; height $\frac{1}{5}$; thickness $\frac{1}{6}$ inch. Proportions 11 : 9 : 8.

This species is named after Mr. James Thomson, of Glasgow, who found the specimen in a small ironstone nodule from the Upper Limestone-shale, 202 fathoms below the Ell Coal, at Gare, Carluke.

11. Cypridina pruniformis. Sp. nov. Pl. V, figs. 9 *a*, 9 *b*, 9 *c*.

Carapace plum-shaped; very similar to *C. Thomsoniana* (Pl. II, figs. 8 *a*, *b*, *c*), but larger, not truncated behind, less oblong and more elliptical in side-view, and notched lower down in front, with a somewhat larger beak and gape. Muscle-spot radiate, large.

Length $\frac{1}{3}$; height $\frac{1}{4}$; thickness $\frac{5}{24}$ inch. Proportions 15 : 12 : 10.

From the Carboniferous Limestone; Limerick (?). Visé, Belgium; Brit. Mus.

12. CYPRIDINA SCORIACEA, *J. and K.* Plate II, figs. 3 *a—d.*

CYPRIDINA SCORIACEA, *J. and K.*, 1871. Trans. Geol. Soc. Glasgow, vol. iii, Suppl., p. 27.

Carapace-valve oblong, compressed; ends rounded; one is broader than the other, and has a very slight but decided notch and projection near the top. Surface reticulate, with irregular hollow meshes, coarser towards the centre, which give the valve a rough scoriaceous appearance. (The lines traversing the surface in the fig. 3 *a* are cracks in the shell.)

Length $\frac{1}{4}$; height $\frac{1}{6}$; thickness $\frac{1}{12}$ inch. Proportions 11 : 8 : 4.

This is a somewhat crushed dark-brown specimen in a small ironstone concretion from the "Upper Limestone-shale," 202 fathoms below the Ell Coal, at Gare, near Carluke. In Dr. Rankin's collection.

Cypridina scoriacea and *C. Thomsoniana* in the high position of the notch resemble *C.* (?) *luteola,* Dana, but not in other respects.

13. CYPRIDINA OBLONGA. Sp. nov. Plate V, figs. 12 *a—c.*

Carapace subquadrate, compressed; valve oblong, slightly convex above and below, broader and flatter in front, narrower and more convex behind. A faintly marked and almost closed notch is apparent high up on the anterior margin. A very faint tubercle marks the middle of the valve. End-view acute-ovate; edge-view blunt and narrow-lanceolate.

Length $\frac{12}{48}$; height $\frac{7}{48}$; thickness $\frac{5}{48}$ inch. Proportions 12 : 7 : 5.

Collected by Mr. J. Wright, F.G.S., in the Carboniferous Limestone of Little Island, Cork.

On account of its general form this specimen was at first associated with *Rhombina,* but it wants the antero-dorsal projection and the retiring antero-ventral line, and its obscure notch was ultimately discerned. *Cypridina scoriacea* (*supra*) is one of the few compressed *Cypridinæ* that offer any features for comparison.

II. CYPRIDINELLA. Genus novum.

The foregoing oval-oblong *Cypridinæ* (Nos. 1—13) have rounded hind quarters, with occasional evidences of a posterior spine; and their antero-ventral margin is rarely produced as far as the vertical line of the beak. Several recent analogues for the members of this group have been pointed out above. We now have to treat of another group in which the carapaces are not oblong; they have always a more or less produced hinder margin, either apiculate and indented, or spined at the postero-ventral margin of each valve; and their front margin is produced, often to a considerable extent, as a prow. Excepting that the oval-oblong *Cypridina Zelandica*, Baird, and *C. luteola*, Dana, have the lower front margin rather more prominent than other known living forms, we are without a recent analogue for these smooth, ovate, apiculate *Cypridinæ;* the long, sharp-tailed, recent forms, such as *C. Reynaudii*, *elongata*, *Bairdii*, &c., having no chin-like projection under the notch.

There is a closer alliance in form between the group under notice and the next two groups than between it and the foregoing group of *Cypridina* proper.

Judging, therefore, by the features of the carapace, which alone remains for our examination, we determine to separate the group in question as a genus, under the name CYPRIDINELLA, knowing that the differences of the soft parts of the Cypridinads are so great among the various forms as to be an additional basis of probability for a real generic distinction.

The following seven species are arranged according to the increasing projection of the lower front margin. *Cypridinella clausa* and *C. Maccoyiana* are apiculate and indented behind; the others elliptically rounded, and probably once spined.

1. CYPRIDINELLA CUMMINGII. Sp. nov. Plate II, figs. 23 *a*—*c*.

Carapace-valves highly convex, broad-ovate, attenuated posteriorly, deeply notched at the middle of the broad front. The carapace was egg-shaped, as thick as it was broad (high). Edge-view long-ovate; end-view broad-obvate.

This is somewhat like the recent *Cypridina Zelandica*, Baird, in shape; but the notch is too large, and the shell too convex and too narrow behind.

Length $\frac{5}{24}$; height $\frac{1}{6}$; thickness $\frac{1}{6}$ inch. Proportions 10 : 8 : 8.

Of the ovate *Cypridinadæ*, more or less distinctly apiculate behind, and produced to a greater or less extent at the antero-ventral region, *Cypridina Zelandica* is the nearest recent type, and *Cypridinella Cummingii* is one of the most symmetrical and least exaggerated at the lower portion of the front, among the fossils; thus it more closely approximates to the said recent species than several of its associates in the Carboniferous Limestone, which become almost grotesque in the prow-like character of the front, as in naval rams, like the "Merrimac" and "Monitor." Thus they belong to a peculiar group, separate from *Cypridina* proper; indeed, the exact generic place of the recent type above mentioned has not been determined, for it was characterised by its carapace alone, before the study of the limbs had been carried to as great a nicety as naturalists now find necessary.

Two casts, somewhat ferruginous (one rather smaller than the figured specimen), occur in dark grey limestone, with Encrinites and small Shells, from Poolvash, Isle of Man, collected by the late Rev. J. G. Cumming, and presented by him to the Museum of the Geological Survey, London (Tablet $\frac{38}{5}$).

The late Mr. Cumming courteously informed us by letter (January 27th, 1864) that he regarded his *Cypridina ovalis*, from the Upper or Poolvash Limestone[1] (see 'The Isle of Man,' 1848, p. 355), found with other Entomostraca, referred to as *Cythere Phillipsiana*, De Koninck, *Cypridina annulata*, De Kon., and *Daphnia primæva* (?), M'Coy, in the same work, at pp. xxiv, 355, as being most probably the same as *C. primæva* (M'Coy).

In specimens of this same limestone, kindly sent to us by Mr. E. W. Binney, F.R.S., we have met with a valve, not well exposed, of *Cypridina primæva* (?), and an imperfectly preserved valve of a small compressed *Entomoconchus*.

2. Cypridinella superciliosa. Sp. nov. Plate II, figs. 7 *a—c*; Plate V, figs. 7 *a—d*.

Carapace-valves convex, broad-oval or subovate; indented in front, above the middle, with a deep, narrow notch, slanting upwards, and bordered by a distinct marginal rim. The lower portion of the front of the figured specimen is partly imbedded and not fully exhibited in fig. 7*a*; but it stands out with a bold though variable curve in specimens from Settle and Bathgate. The ventral margin is bordered by a furrow and a rim in a large valve from Bathgate (Pl. V, fig. 7). Edge- and end-view are both sharp-ovate, the former the longer.

From Cork. Length $\frac{1}{4}$; height $\frac{1}{6}$; thickness $\frac{1}{7}$ inch. Proportions 11 : $8\frac{1}{2}$: 7.

From Bathgate. Length $\frac{1}{4}$; height $\frac{5}{24}$; thickness $\frac{1}{6}$ inch. Proportions 12 : 10 : 8.

Cypridinella superciliosa is less convex and rounder in side-view than *C. ovalis;* and its deep-cut and neatly bordered or rimmed notch is a good distinction. It has been

[1] Equivalent to the lower portion of the Mountain-limestone.

collected at Little Island, Cork, by Mr. Joseph Wright, F.G.S.; and Mr. W. Grossart, of Salsburg, has been so fortunate as to meet with several good specimens, and, indeed, gregarious masses, of this species in the light-grey Lower Carboniferous Limestone at Bathgate, Linlithgowshire. Like many other Bivalve Entomostraca, this species evidently constitutes a large proportion of its limestone mass. Mr. Burrow has also found this specimen in the Great Scar Limestone at Settle, Yorkshire.

The shells of some specimens in the Bathgate Limestone are marked with numerous minute, round, and vermicular white spots (fig. 7 *d*), beneath the smooth surface originally, both wearing away into roughness. Whether this be due to decay of structure or to parasitical borings we have not determined.

3. Cypridinella clausa. Sp. nov. Plate III, figs. 3 *a*—*c*.

Carapace ovato-globose, indented in front with a broad shallow sinus and a very narrow notch, retreating obliquely upwards; bluntly pointed behind, with a slightly upturned apex, somewhat like the posterior angle of Dana's *Cypridina punctata* and others. Side-view subovate; edge-view acute-ovate; end-view broad-obovate.

Length $\frac{1}{3}$; height $\frac{1}{4}$; thickness $\frac{5}{24}$ inch. Proportions 8 : $5\frac{1}{2}$: 5.

A grey cast in the limestone of Little Island, Cork; collected by Mr. J. Wright, F.G.S. *C. clausa* occurs also at Middleton, Co. Cork.

4. Cypridinella Bosqueti. Sp. nov. Plate III, figs. 6 *a*, *b*, *c*.

Carapace egg-like, very gibbose, almost equal-ended, but the front is excavated, high up, with well-marked sinus and notch, overhung by a small, neatly curved beak. Side-view ovate; edge-view broad-oval; end-view suborbicular, slightly flattened at the top.

Length $\frac{1}{4}$; height $\frac{1}{7}$; thickness $\frac{1}{8}$ inch. Proportions 11 : 7 : 8.

Somewhat like *Cypridina Norvegica* and *C. Zelandica* in general style, but more egg-shaped, too gibbose, with too much prow, and too small a gape, to resemble either closely.

This very neatly egg-shaped *Cypridinella*, represented by a cast from the white Upper Mountain-limestone of Visé, Belgium, sent to us by M. J. Bosquet, F.C.G.S., of Maestricht, we dedicate to him. By his liberality and friendly co-operation M. Bosquet has enabled us to study a large series of the typical Belgian Entomostraca, and bring them, as in this case, into direct comparison with our British specimens.

C. ovalis, *superciliosa*, *clausa*, and *Bosqueti*, have the ventral border semicircular or elliptical, with the anterior edge curved boldly upwards. The next group we have to describe, namely, *C. Maccoyiana, Burrovii, Monitor,* and *vomer,* have the ventral margin, for the most part, less convex, and sometimes nearly flat, with a strongly projecting prow.

5. CYPRIDINELLA MACCOYIANA. Sp. nov. Plate III, figs. 13 *a, b.*

Carapace subglobose; suboblong in side-view; curved on the dorsal margin; bluntly apiculate, with a curved indentation, at the posterior angle; notched high up in front, with the lower portion of the anterior margin curving boldly outwards and downwards to meet the nearly straight, but somewhat sinuous, ventral border. Neither valve has an elevated tubercle, but the right valve is slightly more convex than the other in the specimen.

Length $\frac{1}{5}$; height $\frac{1}{8}$; thickness $\frac{1}{12}$ inch. Proportions 9 : 6 : 4.

This smaller species imitates *C. clausa* in some features, but not nearly enough to be taken for its young state. In the notch and front margin also they differ considerably. *C. Maccoyiana* is known by several shells and casts in the grey limestone of Little Island, Cork; collected by J. Wright, Esq., F.G.S.

We name this species after Prof. F. M'Coy, F.G.S., of Melbourne, who has brought very many genera and species of the Carboniferous Fossils of Ireland to notice, besides working extensively in other fields of Palæontology.

6. CYPRIDINELLA MONITOR. Sp. nov. Plate III, figs. 1 *a, b.*

Carapace subpyriform, boldly curved above and below, but most convex above; bluntly apiculate low down behind; sharply pointed in the prow-like antero-inferior projection; front sloping downwards and outwards from the dorsum to the prow, with a hollow curve, and having a small notch and beak above the middle line. At the posterior angle, in some specimens from Settle, there is the indication of the base of a posterior spine; and in some casts a small fissure exists between the valves, with a subtriangular stone core, which has reference to the former existence at this spot of a hollow projecting angle of the carapace-valves, such as occurs in several Bivalve Entomostraca, and among the *Cypridinæ* especially noticeable in the recent *C. Bairdii,* Brady, and the fossil *C. Koninckiana* (Bosquet).

Length $\frac{1}{3}$; height $\frac{1}{4}$; thickness $\frac{2}{7}$ inch. Proportions 15 : 11 : 13.

The prow of this compact carapace forcibly reminds us of the modern iron-clad mastless men-of-war typified by the American "Monitor."

Our figured specimen is from Visé, Belgium, thanks to our friend M. J. Bosquet, of Maestricht. It is a white cast, with a film of white shell here and there. Similar casts accompany it, of grey limestone, smaller and less globose; and in Mr. Burrow's collection from Settle is another, also less globose than our fine Belgian specimen.

7. CYPRIDINELLA VOMER. Sp. nov. Plate III, figs. 11 *a—c.*

Carapace-valve obliquely subpyriform in outline; moderately convex; depressed and produced antero-ventrally, so that the front slopes down to the straight ventral edge, making a sharp prow like a ploughshare. A narrow, distinct, almost horizontal notch, cuts deeply into the upper half of the front; the edges of the notch are slightly rimmed or thickened. Edge-view of carapace acute-ovate; end-view oval.

Length $\frac{1}{4}$; height $\frac{1}{7}$; thickness $\frac{1}{9}$ inch. Proportions 11 : 7 : 5.

A grey shell, much weathered, from the limestone of Little Island, near Cork. Collected by Mr. J. Wright, F.G.S.

III. CYPRIDELLINA. Genus novum.

Carapace suboviform; notched in front; produced in the antero-ventral region; the valves locally swollen into a tubercle or circular subcentral hump above the median line.

Prof. De Koninck in 1844 founded a genus under the name of *Cypridella,* typified by his *C. cruciata,* which is a subquadrate Cypridinad with tubercular swellings on its valves and a strong nuchal furrow. His *Cypridina Edwardsiana* also has the furrow and tubercles, although associated with the same general shape as that of the smooth *Cypridinellæ* above described. Thus we are led to associate the two species in one genus, distinct from both *Cypridina* and *Cypridinella,* which, either among the recent species of the one or those described above of both genera, very occasionally show any feature analogous to the furrow or the tubercle (see *Cypridina Hunteriana,* Pl. V, fig. 3; and *C. Bradyana,* Pl. II, fig. 13).

We find, however, a set of Cypridinal forms corresponding in general features with the smooth suboviform *Cypridinellæ* (of which we take *Cypridina Zelandica,* Baird, to be an approximate existing type), but with the tubercle only, and without the nuchal furrow, present. These want, then, an important feature present in *Cypridella* of De Koninck; and we now divide them off as a group under the cognate name of CYPRIDELLINA, intermediate to *Cypridinella* (see above) and *Cypridella,* De Koninck, and, at the same time, to some extent related to *Cypridina,* Milne-Edwards.

We are aware that this distinction is in some degree artificial, and that (as before intimated) the presence of either nuchal furrow or subcentral hump, in faint degree, is to be recognized among some of the foregoing genera and species. But, knowing how greatly these may have differed one from the other in the arrangement and details of limbs, and believing that tubercle and furrow were not without their meaning in the economy of the living animal, we prefer to seize on them as characteristics in these unknown organisms.

At the same time, if, besides relative size, the tubercles, and even the dorsal furrows, are the consequences of luxuriant growth, or of age, or of sex, we shall avoid error by giving similar trivial names to the seeming analogues in the three different series (1, smooth; 2, tubercled; and 3, tubercled, with furrow), taking care to be guided by the shape and general habit in making specific distinctions.

We have to add that some of the smaller individuals are tubercled, whilst their smooth analogue is of larger size; for example, Pl. III, figs. 7 and 10, compared with fig. 11. Hence the tubercles are not the result of mere growth; and the differences in other features should have the more weight.

There is evidently a great temptation to the condensing palæontologist to group together the three sections that we have here indicated, seeing that the tubercle is very slightly developed in Pl. III, fig. 5, that the extremely tuberculate *Cypridella Edwardsiana* (Pl. IV, fig. 4) approximates in shape to the smooth *Cypridinella Cummingii* (Pl. II, fig. 23), and that the furrow is almost obsolete in Pl. III, fig. 12. This last form, too, may be compared with *Cypridina Bradyana* (Pl. II, fig. 13) and Pl. IV, fig. 1, with Pl. III, figs. 9, 18, and 19; but, nevertheless, important differences, as to notch and prow, are evident, besides the presence of tubercles; and none of the *Cypridinæ* nor *Cypridinellæ* are really comparable with a *Cypridellina* except in the case of *Cypridellina clausa* (Pl. II, figs. 2 and 3), and even there the notch differs, and the specimens are not good enough for a perfect decision.

Further, if these proposed *generic* distinctions fail, there is but a very narrow basis indeed for the separation of *species* in this extensive group of empty carapace-valves; the differences of form being, for the most part, susceptible of a graduated arrangement, which, the tubercles and furrows being ignored, and the high probability of great variation in the soft parts being forgotten, would lead to an exceedingly artificial grouping, of but little use in reality. After all, it would be found necessary to recognize some subordinate divisions of long and short, thin or thick, oval or pyriform individuals, which would have still to stand for types of genera or sub-genera; and, as we have stated already in alluding to the Cypridinads generally (pages 1 and 2), no saving in nomenclature would be made.

The following species are arranged according to the development of their lower front margin in projection and depth. *C. clausa, Burrovii,* and *galea* are more or less apiculate, with posterior indentation; the others appear to have been spined on their rounded ends.

1. Cypridellina clausa. Sp. nov. Plate III, figs. 2 *a*, *b*, *c*.

Carapace roughly egg-shaped; suboblong in side-view; sloping in front, obscurely notched (broken below in the specimen); hinder margin apiculate and strongly indented. Tubercle large, but not prominent. Edge-view subacute-ovate. Fig. 2 *b* shows the ventral aspect of this injured specimen; its dorsal aspect would be much like fig. 18 *b*, but more pointed behind, and showing the posterior depression. End-view sub-pentagonal.

In some respects this resembles *Cypridinella clausa*, Plate III, fig. 3, p. 23; but without the swelling of the tubercles its end-profile would have been orbicular instead of oval; and its notch is higher and more horizontal.

Length $\frac{1}{3}$ (probably more); height $\frac{5}{24}$; thickness $\frac{5}{24}$ inch. Proportions $7\frac{1}{2}$: 5 : 5.

A grey limestone cast from Little Island, Cork. Collected by Mr. J. Wright, F.G.S.

2. Cypridellina Burrovii. Sp. nov. Plate III, figs. 4 *a—e;* figs. 5 *a—c;* figs. 21 *a—e*.

We have here individuals of one species at three stages of growth, well preserved as far as internal casts can serve, and well illustrated for comparison; fig. 5 retaining portions of the shell. The smallest (youngest?) form, fig. 4, is subovate in profile; the largest (fig. 21) is ovate-oblong; less boldly curved above and below, more apiculate behind, and with a relatively smaller notch and gape than the other. Both are sub-oviform, with subhexagonal end-view, and pyriform edge-view; and each had posterior spines, as they retain the cast of their united base, which, however, in fig. 4 *d*, is rather higher up than in fig. 21 *e*. The prow, also, of fig. 4 *c* projects somewhat further beyond the beak than in fig. 21 *c*, and the hind-quarters of fig. 21 *e* (the largest specimen) are rounder than those of fig. 4 *d*.

None of these differences, however, in the presence of the many similarities, can be of specific importance. Moreover, there is the intermediate form presently to be described; and we have, besides, an individual, still smaller than fig. 4, of the same form from Ireland, which is rather more apiculate behind, and two middle-sized specimens (smaller than fig. 5) from Settle, whence the three figured fossils came. From M. Bosquet's Belgian collection, also, we have been favoured with two casts, one in the grey and one in the white limestone of Visé, similar to fig. 4.

The specimen of intermediate size, fig. 5, has a subglobose, nearly egg-shaped carapace, semicircular above in outline, elliptical behind, almost straight below, and flat enough to stand on its ventral face. Its antero-ventral margin is produced, prow-like; the sinus is broadly curved, but the beak has been much reduced by fracture in fig. 5 *a*. Rather above the middle of the posterior margin is the round spot, formed by a small indentation in the edge of each valve, with its central core of stone, and corresponding with the base of a hollow conical process, formed of two more or less terete and approximate spines, such as we see in several Cypridinads; for instance, *Philomedes interpuncta.* Edge-view pyriform; end-view suborbicular, with a tendency towards hexagonal.

Portions of the eroded shell remain on the dorsal and ventral regions (fig. 5 *a*), and we can see evidence of a small inturned flange on the ventral edges, with a minutely crenulate parallel edging or border (not clearly shown in the figures). There is also clearly discernible a low hump in each antero-dorsal region, affecting the end-profile of the carapace, and somewhat below it is a roughness at about the usual position of the muscle-spot.

This specimen has the same proportions as fig. 4; it is more rotund than fig. 21: excepting that its tubercle is not so strongly pronounced, and its posterior spine was higher up than in fig. 21, and lower than in fig. 4, we see no essential difference between them.

Fig. 4.	Length $\frac{1}{4}$;	height $\frac{1}{6}$;	thickness $\frac{1}{6}$ inch.	Proportions	11 : 8 : 8.
Fig. 5.	„ $\frac{2}{7}$;	„ $\frac{1}{4}$;	„ $\frac{1}{4}$	„	14 : 11 : 11.
Fig. 21.	„ $\frac{1}{3}$;	„ $\frac{2}{9}$;	„ $\frac{1}{4}$	„	17 : $10\frac{1}{2}$: 11.

The figured specimens of *Cypridellina Burrovii* are from the Lower Scar Limestone of Settle, Yorkshire; collected by Mr. J. H. Burrow, M.A., who has worked the district geologically with great success, and has favoured us with the use of his extensive collection. We have, therefore, adopted his name for this characteristic and wide-spread species.

2.* Cypridellina Burrovii, Var. *Longnoriensis*, nov. Plate III, fig. 8.

Carapace gibbose, suborbicular, varying in the curve of back and hind quarters; notched and produced in front with somewhat variable contours, fig. 8 being an average form. Tubercle small, low down, and forward; sometimes scarcely perceptible.

Length $\frac{1}{6}$; height $\frac{1}{7}$; thickness $\frac{1}{9}$ inch. Proportions 8 : $6\frac{1}{2}$: 5.

This small and weak *Cypridellina*, gregarious in the Derbyshire limestone, presents strong characters of alliance with the large *C. Burrovii* above described, and must be taken for a local variety of the species.

Accompanied by *Aviculopecten* and some small shells, it constitutes a mass of grey Carboniferous Limestone, from Longnor, Derbyshire: Tablet $\frac{38}{10}$ in the Museum of the Geological Survey, London (Geol. Survey Map, Sheet 81, S.E.).

3. CYPRIDELLINA INTERMEDIA. Sp. nov. Plate V, figs. 8 *a*, *b*, *c*.

This relatively small form seems at first sight to be the tubercled analogue of *Cypridinella superciliosa* (Pl. II, figs. 7 *a*, *b c*); it differs, however, from it in all its profiles, without reference to the local swelling or tubercle, being more elliptical in side-view and more compressed in edge-view. It much resembles *Cypridellina Burrovii* in side-view, but it is much thinner, and its tubercle is placed farther back.

Length $\frac{1}{8}$; height $\frac{1}{9}$; thickness $\frac{1}{16}$ inch. Proportions 6 : 5 : 3.

From the grey Carboniferous Limestone of Bathgate, Linlithgowshire. In Mr. W. Grossart's collection.

4. CYPRIDELLINA ELONGATA. Sp. nov. Plate III, figs. 18 *a*, *b*; 19 *a*, *b*.

Carapace elongate, suboviform, somewhat variable in outline; narrow-elliptical behind, bearing evidence of a posterior apex or spine. Notched in front, and sloping below the hood or beak into a prow, at an angle of about 60°. Tubercles strong, rather high up. Edge-view pyriform; end-view pentagonal.

Length $\frac{2}{7}$; height $\frac{1}{7}$; thickness $\frac{1}{5}$ inch. Proportions 13 : 7 : 9.

Several casts in the grey limestone of Visé have been kindly communicated to us by M. Bosquet, of Maestricht; some retain portions of shell (white), and we see the beak and tubercles more thoroughly expressed in the carapace than in the cast.

4.* CYPRIDELLINA ELONGATA, Var. *Hibernica*, nov. Plate III, figs. 9 *a*—*c*.

Smaller, feebler, less pronounced in thickness and tubercles, but not otherwise dissimilar, this must be taken for a local variety of the Belgian *C. elongata* above noticed.

Length $\frac{1}{5}$; height $\frac{1}{8}$; thickness $\frac{1}{9}$ inch. Proportions $9\frac{1}{2}$: 6 : $5\frac{1}{2}$.

This is an abundant and variable form, as shells and casts, in the Carboniferous Limestone of Little Island, Cork. The tubercle is in some high up, in others lower down and further back; occasionally it is very faintly expressed.

Collected by Mr. J. Wright, F.G.S., of Belfast.

5. Cypridellina galea. Sp. nov. Plate IV, figs. 3 *a—c.*

Carapace round-egg-shaped, very gibbose; apiculate and indented behind; strongly notched high up on the front, which slopes downwards and outwards, forming a strong prominent prow with the upward and outward curve of the antero-ventral margin. Edges of notch thickened. Tubercle large, just above the centre. Edge-view broad-ovate; end-view suborbicular, somewhat pentagonal.

Length $\frac{2}{7}$; height $\frac{5}{24}$; thickness $\frac{1}{4}$ inch. Proportions 13 : 10 : 12.

Cypridellina galea stands alone; distinct by shape, gape, and other features. The specimen is a shell in the Carboniferous Limestone of Little Island, Cork. Collected by Mr. J. Wright, F.G.S.

6. Cypridellina vomer. Sp. nov. Plate III, figs. 7 *a—c;* 10 *a—c.*

6.* Var. *cultrata* (fig. 10).

6.* Var. *uncinata* (not figured).

Carapace-valves ovate-oblong, with suboval outline posteriorly; sloping, notched, and produced in front, with somewhat variable contours, either like a ploughshare with small notch (fig. 10 *a*, much resembling fig. 11), with a hatchet-like curve and large notch (var. *cultrata*, fig. 7 *a*), or curved still more suddenly downwards with a narrow, blunt, backward bending angle and a broad shallow sinus (var. *uncinata,* not figured).

The valves are rather compressed, with a variable convexity, and are faintly tubercled high up; the tubercle is almost obsolete in some more convex specimens. Edge-view of carapace long acute-ovate. End-view acute-oval.

Cypridellina vomer, fig. 10.	Length $\frac{1}{5}$;	height $\frac{1}{9}$;	thickness $\frac{1}{12}$ inch.	Prop.	9 : 5 : 4.
C. vomer, var. *cultrata,* fig. 7.	,, $\frac{5}{24}$;	,, $\frac{1}{7}$;	,, $\frac{1}{12}$,,	,,	10 : 7 : 4.
C. vomer, var. *uncinata* (not fig.)	,, $\frac{1}{5}$;	,, $\frac{1}{8}$;	,, $\frac{1}{8}$,,	,,	9 : 6 : 5.

The feebleness of the tubercle reminds us of a weak local elevation on the valves of *Cypridina Bradyana*, p. 15; but the shape of *Cypridellina vomer* is far more closely analogous to that of *Cypridinella vomer*, p. 25, without in any case being exactly the same. We have here rather the touchings of isomorphs than the coalescence of congeneric forms.

Cypridellina vomer, in its varieties, is common in the Carboniferous Limestone of Little Island, Cork, both as casts and shells, more or less weathered. Collected by Mr. Joseph Wright, F.G.S.

7. Cypridellina alta. Sp. nov. Plate III, figs. 15 *a, b.*

Carapace globose, ovate-triangular, short; rounded behind; truncate in front, with a long sloping broad face, sinuous in profile, impressed with deep transverse sinus and distinct beak, and angular below with an axe-like edge. The tubercle, not very strong, is high up and forward. The posterior curve is marked low down by the base of a hollow double spine.

Deep, short, and broad, this species has neither smooth *Cypridinella* nor furrowed *Cypridella* to match it.

Length $\frac{1}{6}$; height $\frac{1}{5}$; thickness $\frac{1}{7}$ inch. Proportions 8 : 9 : 7.

A grey shell, one of several, from Little Island, Cork, collected by Mr. J. Wright, F.G.S. Similar forms, as casts in white, yellowish, and grey Carboniferous Limestone from Visé, some with remnants of the shell, have been received from our friend, M. Bosquet, of Maestricht, For. Cor. Geol. Soc.

8. Cypridellina Bosqueti. Sp. nov. Plate III, figs. 20 *a, b.*

This is a cast, imperfect at the notch and hood (not indicated in the sketch), of a *Cypridinella* with an extreme condition of the antero-ventral margin, which slopes downwards and *backwards* from the hood at an angle of 65°, to form a sharp, coulter-like, vertical prow (too prominent in fig. 20 *b*); the ventral margin rises rapidly backwards from it, with an oval outline, to the narrow, rounded, posterior extremity, which was once probably spined. As the dorsal line is nearly straight, the side profile of the carapace is ovate-triangular. The tubercle is strong and rather forward.

Length $\frac{1}{4}$; height $\frac{1}{5}$; thickness $\frac{1}{6}$ inch. Proportions 12 : 9 : 8.

From the Upper Carboniferous Limestone, Visé, Belgium. We dedicate this well-featured species, with really large beak,[1] peculiar prow, and triangular outline, to M. J. Bosquet, For. Cor. Geol. Soc., one of the most earnest students of Belgian fossils, and to whom we are indebted for a large and choice collection of the fossil *Cypridinadæ* of Belgium.

[1] Broken in the specimen and not shown in the figure.

IV. CYPRIDELLA, *De Koninck*, 1844.

CYPRIDINA, *De Koninck*, 1841, 1844.
CYPRIDELLA, *De Koninck*, 1844.
— *Jones and Kirkby*, 1863.

Carapace subovate, with either attenuate or subquadrate hind quarters; notched in front, with different degrees of beak or hood; tuberculate in various degrees, and impressed with a transverse dorsal sulcus behind the main pair of tubercles. Both the original subquadrate *Cypridella cruciata* of De Koninck, with one large tubercle on either valve, and his ovate *Cypridina Edwardsiana*, with more tubercles, are comprehended in this revised genus on account of intermediate alliances.

In the following arrangement of species we pass from the ovate to the subquadrate forms (Nos. 1—5), and then take a somewhat abnormal species that looks towards the next group (*Cyprellæ*).

Of these *Cypridella Koninckiana* and *C. obsoleta* are apiculate and indented behind; the others had posterior spines.

1. CYPRIDELLA EDWARDSIANA (*De Koninck*). Plate IV, figs. 4 *a—c*; Pl. V, figs. 11 *a—c*.

CYPRIDINA EDWARDSIANA, *De Kon.*, 1841. Mém. Acad. Roy. Belg., vol. xiv, p. 17, fig. 9.
— — — 1843. In D'Omalius' Précis élém. Géol., p. 515.
— — — 1844. Descript. Anim. foss. Terr. Carb. Belgique, p. 287, pl. lii, fig. 2 *a—d*.
CYTHERE — *Dupont*, 1863. Bullet. Acad. Roy. Belg., sér. 2me, vol. xv, p. 110.
CYPRIDELLA — *Jones and Kirkby*, 1864. Canad. N. Geol., June, 1864, p. 237; N. Jahrb., f. 1864, p. 54.

Carapace-valves gibbose, tuberculate; subovate in profile, nearly subtrigonal; acute behind, broad, and notched in front. Raised into a large subcentral tubercle (in the antero-dorsal region), with two or more smaller knobs, above and below. Impressed with a dorsal or nuchal sulcus, passing from the back with an oblique curve across the centre, and dying out below.

The notch is obscure within the broad sinus of the front in the few specimens we have seen. The antero-ventral margin rarely projects beyond the vertical line of the notch; it is sharper in our best specimen than in Prof. De Koninck's fig. 2 *c*, which has it rounded in a left valve placed with the anterior edge upwards; otherwise the outline agrees with that in our fig. 4 *a*. The main tubercle appears rather higher up in the Belgian figure than in ours; and the ventral tubercle is not so low down, nor so large, as in our figured specimen; indeed it seems to be linear and subdivided. The sulcus is not defined by Prof. De Koninck, and the edge-views of his specimen (fig. 2 *a*, ventral; 2 *b*, dorsal) indicate only a slight transverse depression.

Cypridella Edwardsiana has a profile much resembling that of *Cypridina Cummingii* (Pl. II, fig. 23); but it is sharper behind, less deeply notched in front, sometimes more produced antero-ventrally, and is not so convex, although tuberculate.

The small specimen of *Cypridella Edwardsiana*, var. *septentrionalis*, drawn in Pl. V, figs. 11 *a—d*, is from the grey Carboniferous Limestone of West Broadstone, Beith, Ayrshire; collected by Mr. John Young. It is relatively thicker and shorter, with a more angular edge-view, than figs. 4 *a—c*, Pl. IV. The "chin" is less developed; the dorsal tubercle is wanting, but the ventral swelling is considerable, and the central tubercle, quite as strong as in the Irish specimen, is truncate, as is that also; perhaps it was originally produced as a lateral spine or prickle. The posterior margin is acuminate. The worn surface shows numerous, minute, scattered pits, almost quincuncially arranged.

We have no doubt of the specific identity of the specimens alluded to. The differences can be only varietal at most. The features are more strongly expressed in the Irish and Scotch specimens than in the Belgian figured specimen; and the British form may be recorded as *Cypridella Edwardsiana*, Var. SEPTENTRIONALIS.

From Cork. Length $\frac{1}{4}$; height $\frac{1}{6}$; thickness $\frac{1}{7}$ inch. Proportions 11 : 8 : 7.

From West Broadstone. Length $\frac{1}{9}$; height $\frac{1}{12}$; thickness $\frac{1}{14}$ inch. Proportions 5 : 4 : $3\frac{1}{2}$.

The Belgian specimen is 5 millimètres in length. Proportions $9\frac{1}{2}$: 8 : $5\frac{1}{2}$.

The species is stated to be rare at Visé, Belgium. We have it from the Carboniferous Limestone of Cork, Ireland (Mr. J. Wright, F.G.S.), and of Bathgate and West Broadstone, Scotland (Mr. W. Grossart and Mr. J. Young), and at neither place is it common. The shell is preserved, but not perfectly, being minutely honeycombed by the action of water, giving rise sometimes to a deceptive appearance of granulations under the microscope.

2. Cypridella Koninckiana, *Jones.* Plate III, figs. 14 *a—c;* figs. 16 *a, b;* and figs. 17 *a—d.*

Cypridella Koninckiana, *Jones,* 1870. Month. Micr. Journ., vol. iv, p. 185, pl. lxi, fig. 9.

Carapace-valves ovato-triangular; convex; some with less vertical diameter than others, the ventral region being protruded into a blunt angle (fig. 14 *a*) in the latter. Dorsal line slightly convex, with a median depression, due to the nuchal furrow; posterior strongly apiculate and indented; anterior edge nasute, being deeply notched, produced above into a hook and almost vertical below, with a slight swelling or sigmoid curve not projecting out so far as the hood and beak. Tubercle usually strong, but variable; furrow distinct.

Fig. 16.	Length $\frac{1}{4}$;	height $\frac{1}{7}$;	thickness $\frac{1}{9}$ inch.	Proportions	$11\frac{1}{2}$: 7 : $5\frac{1}{2}$.
Fig. 17.	" $\frac{2}{7}$;	" $\frac{1}{6}$;	" $\frac{1}{7}$ "	"	$12\frac{1}{2}$: $8\frac{1}{2}$: 7.
Fig. 14.	" $\frac{1}{4}$;	" $\frac{5}{24}$;	" $\frac{1}{6}$ "	"	$11\frac{1}{2}$: 10 : 8.

Figs. 17 *d, e* are three-quarter views of this species partly imbedded, to compare with Pl. IV, figs. 5, 6, 7, 8, which belong to different animals.

This is a well marked species, very common and well preserved in the Carboniferous Limestone of Little Island and the neighbourhood of Cork, Ireland. Collected by Mr. J. Wright, F.G.S., and dedicated to the veteran palæontologist of Belgium—Prof. Dr. L. de Koninck, of Liége, to whom we owe an early acquaintance with some of the most interesting of the fossil *Cypridinadæ,* and of the present genus in particular.

3. Cypridella obsoleta. Sp. nov. Plate III, figs. 12 *a—c.*

Carapace bean-shaped; ovate-oblong in side-view; apiculate behind at the middle; strongly notched and hooded in front. Tubercles and sulcus both faint, but much stronger on the left than on the right valve (figured).

Length $\frac{1}{5}$; height $\frac{1}{8}$; thickness $\frac{1}{9}$ inch. Proportions 9 : 6 : 5.

The specimen, retaining a film of much-weathered shell, was collected by Mr. J. Wright, F.G.S., from the Carboniferous Limestone of Little Island, near Cork; and we know of none like it among our Cypridinads. The slight expression of its generic characters (tubercle and furrow) gives rise to its proposed name.

4. Cypridella Wrightii. Sp. nov. Plate IV, figs. 1 *a—c.*

Carapace oviform, but truncate and broadly notched anteriorly, and locally thickened by two very large hemispherical tubercles, one on either side of the antero-dorsal region. The rounded hinder end is marked by the circular base of a spinous apex.

Length $\frac{1}{6}$; height $\frac{1}{9}$; thickness $\frac{1}{8}$inch. Proportions 11 : 8 : 9.

In this little dark-coloured shell from the limestone of Little Island, Cork (Mr. J. Wright), and in a white cast from Visé (Bosquet), we have a near approach to *Cypridella cruciata*, De Koninck ('Mém. Acad. Roy. Belg.,' vol. xiv, 1841, p. 20, fig. 11, and 'Descr. Crust. foss. Terr. Carb. Belg.,' 1844, p. 590, pl. 52, figs. 7 *a—e*) from Visé. Our specimens, however, are smaller, longer in proportion, more egg-shaped and tapering, have much larger tubercles, less hood, and more gape apparently, and have decidedly far less of the furrow across the back, which gives the cross-mark to Prof. De Koninck's species.

To the energy and discrimination of Mr. Joseph Wright, F.G.S., of Belfast, we owe the perfect specimen from Cork, and many other of the Entomostraca here described; and we record our appreciation of his love of geology and his scientific liberality by giving his name to this exquisite little fossil Cypridinad.

M. de Koninck's *C. cruciata* is represented (*loc. cit.*, fig. 7 *a*) by a right-hand valve, with its front face upwards; *b* is the anterior face, comparable with our fig. 1 *c*; the fig. 7 *d* shows the posterior extremity with the base of a spine, and *e* is the dorsal surface, cross-marked by the hinge-line and transverse furrow. It is a rare species. Length 4 millimètres. M. E. Dupont found it very rare in French Hainault, 'Bull. Acad. Belg.,' sér. 2, vol. xv, 1863, p. 110.

5. Cypridella quadrata. Sp. nov. Plate IV, figs. 2 *a*, *b*, *c*.

Carapace quadrate in each profile, bearing a very prominent, globose, nearly central tubercle on either side; the front strongly hooded, and projecting below in a coarsely trifid prow; somewhat convex on the back; almost straight and flat below; rounded behind, and bearing a mark of a spine at the postero-ventral angle; transverse sulcus (not shown in the figures) distinct on the back, and especially on the sides behind the tubercles. There is a trace of a muscle-spot below the tubercle and rather forwards.

C. quadrata.	Length $\frac{1}{5}$;	height $\frac{1}{7}$;	thickness $\frac{1}{6}$ inch.	Proportions	19 : 14 : 15.
C. Wrightii.	„ $\frac{1}{6}$;	„ $\frac{1}{9}$;	„ $\frac{1}{8}$ „	„	22 : 16 : 18.
C. cruciata.	Length 4 millimètres.			„	18 : 18 : 20.

C. quadrata is longer and squarer than *Cypridella cruciata*, De Kon.; its tubercles are more free and globose; its hood and prow far more knobly, and its posterior spine was low down instead of being on the middle line.

Two strongly featured casts in the light-coloured Carboniferous Limestone of Visé, from M. Bosquet's collection, form the basis for the above specific determination.

6. Cypridella cyprelloides. Sp. nov. Plate IV, figs. 9 *a—c*.

Carapace-valve acute-ovate; pointed behind; indented in front with a shallow open sinus, leaving a blunt beak and retreating breast. Large, long, prominent tubercle, placed forwards and pointing backwards; and a strong sulcus behind it. Edge-view of carapace acute-irregular-oval; end-view rhombic.

This much resembles *Cyprella chrysalidea*, De Kon., in form; but it is quite smooth, having no annulation. It may be regarded either as a link or an isomorph. It is a light-grey shell from the Carboniferous Limestone of Cork, Ireland. Collected by Mr. J. Wright, F.G.S.

Length $\frac{1}{6}$; height $\frac{1}{9}$; thickness $\frac{1}{9}$ inch. Proportions 8 : 5 : 5.

V. SULCUNA. Gen. nov.

The carapace-valves are much like those of *Cypridella Wrightii* (Pl. IV, fig. 1) in lateral outline, being ovate-oblong, elliptical behind, and truncate and more or less indented, with sinus and notch, in front; but the nuchal sulcus is much more definitely and deeply marked. It passes obliquely downwards and forwards, undercutting the antero-dorsal region, and raising it into a slanting hump or even a backward-pointing process.

There is a tendency to point backwards in the subcentral tubercle of some *Cypridellæ*; and were the high position of the tubercle (as in Pl. IV, fig. 1) accompanied by a more backward development than even in Fig. 9, and associated with a strong and oblique furrow under the tubercle, we should have the main characters of our new genus.

1. Sulcuna lepus. Sp. nov. Plate IV, figs. 6 *a, b*; 7 *a, b, c*.

Valves ovate-oblong, truncate in front, rounded behind; antero-dorsal region formed into an oblique hump by the slanting nuchal furrow. Front margin indented; the sinus appears shallow in fig. 7 *a*, but deeper in fig. 6 *a*. The end-view of the carapace would present an acute-oval outline, with two suboval projections above.

Fig. 6. Length $\frac{1}{6}$; height $\frac{1}{9}$; thickness $\frac{1}{16}$. Proportions 8 : 5 : 3.
Fig. 7. „ $\frac{1}{4}$; „ $\frac{1}{6}$; „ $\frac{1}{9}$. „ 12 : 8 : 5.

Rare in the Carboniferous Limestone of Little Island, Cork. Mr. Joseph Wright, F.G.S.

2. Sulcuna cuniculus. Sp. nov. Plate IV, figs; *5 a, b, c; 8 a, b, c.*

Smaller than *S. lepus,* and, in one specimen at least, more convex, strongly notched and hooded anteriorly (in a well-preserved specimen, fig. 8), and far more strongly indented by the dorsal furrow, whereby the antero-dorsal region of each valve is divided off as a pointed process, tending backwards and outwards. This curious species has a distant resemblance in outline to a couchant rabbit, with distinct pointed ears. In the end-view, fig. 8 *b,* these processes diverge more than in fig. 5 *b.* In fig. 5 *a* the anterior margin, its dorsal angle being obscured by matrix, is not perfectly shown, and a little tubercle, which is merely a local irregularity of the convex surface, is figured too strongly.

Fig. 5. Length $\frac{1}{5}$; height $\frac{1}{8}$; thickness $\frac{1}{16}$. Proportions 9 : 6 : 3.

Fig. 8. „ $\frac{5}{24}$; „ $\frac{1}{7}$; „ $\frac{1}{9}$. „ 10 : 7 : 5.

Mr. J. Wright, F.G.S., has found well-preserved but rather rare specimens in the Carboniferous Limestone of Little Island, Cork.

VI. CYPRELLA, *De Koninck.*

Cyprella et cypridina, *De Koninck,*[1] 1841, 1844.
Cyprella, *Dupont,* 1863.
— *Jones and Kirkby,* 1863.

The generic characters of this peculiar form are best understood from the description of the two species known to us. The general form is that of *Cypridinella* and *Cypridellina,* with apiculate and indented end and a truncate front; the latter notched, sloping downwards, and with either a nearly vertical or a receding antero-ventral margin. There are also present tubercle and dorsal sulcus, of varying intensities; but the chief character is a vertical and necessarily annular striation, furrowing, or step-like marking on the carapace. These parallel lines are more distinct, wider apart, and more step-like in *Cyprella chrysalidea* than in *C. annulata. C. chrysalidea* also has a more hood-like construction of the antero-dorsal region, over the sinus and notch, than either its fellow species, or any of the Cypridinads we know of. None of our figures, some of the best of our specimens being crushed casts, express quite so much as we can see in them; and M. De

[1] M. Cantraine, in reporting, together with M. Dumont, on Prof. De Koninck's "Memoir on the Carboniferous Crustacea of Belgium," in 'Bullet. Acad. Belg.,' viii, partie 1ère, p. 801 (1841), expressed the opinion that *Cyprella* might be *Cypridina,* and that *Cyprella chrysalidea,* De Kon., and *Cypridina annulata,* De Kon., might belong to one genus. In the latter opinion we fully coincide.

Koninck's somewhat exaggerated curve (in his fig. 6 *c*) is not without meaning in the representation of the curious Daphnioid hood, as shown also in his fig. 6 *a*. The structure of sinus and gape there clearly shown appears to be unique, and waits for elucidation.

1. Cyprella chrysalidea, *De Koninck*. Plate IV, figs. 10 *a—c*; 11 *a—c*; 14 *a, b*, 15, 16 *a—c*; 18 *a, b*. Including Var. *subannulata*.

Cyprella chrysalidea, *De Koninck*, 1844. Mém. Acad. Roy. Belgique, vol. xiv, p. 19, fig. 7; 1843, in D'Omalius' Précis élém. Géol., p. 515; 1844, Desc. Anim. foss. Terr. Carb. Belg., p. 589, pl. lii, fig. 6 *a—e*.
— — *Dupont*, 1863. Bull. Acad. Roy. Belg., sér. 2e, vol. xv, p. 110.
— — *Jones and Kirkby*, 1864. N. Jahrb. f., 1864, p. 54; Can. Nat. Geol., June, 1864, p. 237.
— subannulata, *Jones*, 1870. M. Microsc. Journ., vol. iv, p. 185, pl. 61, fig. 10.

Carapace compressed-egg-shaped; subovate in outline, sharp behind; truncate and notched, or somewhat rounded and notched, in front; bearing subcentral tubercles of greater or less extent and elevation; surface marked with numerous vertically transverse, parallel striæ or furrows, or rather step-like graduated rings, like the body-rings of a chrysalis. These vary in number in our specimens; fig. 10 has only seven from behind up to the tubercle, and none beyond, over the anterior quarters of the shell; fig. 11 has ten or more on the posterior, and none on the anterior half of the shell; fig. 16 shows about fourteen over the whole length of the valve, and they are strongly marked as in fig. 10; fig. 18 also has about fourteen, as in fig 16, whilst figs. 14 and 15 have about fifteen or sixteen; and the still more perfect Belgian specimen, figured by Prof. De Koninck, has eighteen or more clearly indicated from tail to hood.

The Belgian casts with which M. Bosquet has favoured us are sketched in figs. 14, 15, and 18, and though somewhat crushed and imperfect, they show the general features clearly enough [fig. 18 *a* ought to indicate a trace of the tubercle]. Like them, though not quite so large, is a well-preserved grey shell (fig. 16) in grey limestone from Settle, Yorkshire (Mr. J. H. Burrow), fully satisfying palæontologists of the existence of the Belgian species in the British area during the Lower Carboniferous Period. It has a rounded hood, low-set notch, and feeble tubercle, but we hesitate to regard these differences as of specific value.

In fig. 10 we exhibit another but smaller specimen; a grey shell, in grey limestone, from Settle (Mr. Burrow). It is like the others, except that the beak is relatively stronger in profile, the breast more retreating, and the rings fewer in number, and investing only the hinder half of the valve. This is our Var. SUBANNULATA (*C. subannulata*, Jones, 1870).

In fig. 11 we see a similar shell, dark grey, from Little Island, Cork (Mr. J. Wright, F.G.S.), rather more convex than the last, with a somewhat stronger tubercle, and marked by a few more rings on its posterior moiety. This has the definitely apiculate and indented posterior margin that we see in M. De Koninck's fig. 6 *c*.

Fig. 16 and fig. 10 agree in the symmetrically elliptical shape of the hinder extremity, whilst fig. 11 is indented and apiculate posteriorly, like De Koninck's original specimen (his fig. 6 *c*); but figs. 11 and 10 agree as to the form of the beak or hood, and fig. 16 differs in that point from all. So also figs. 10 and 16 agree as to general convexity with each other, and with all the Belgian specimens, and their tubercles are low; whilst fig. 11 has an unusual convexity of the hinder half, and its tubercle also is strong. We see an extra large tubercle in fig. 15, but this cast (Belgian) is not well preserved; and the tubercle is very feeble in fig. 18, also a Belgian cast (compressed).

Looking at all the slight differences above detailed, and weighing them against the features of mutual resemblance, we must still regard all these specimens as belonging to one species; suggesting, however, that fig. 10 (from Settle) and fig. 11 (Cork) are varietal (Var. *subannulata*), if not male or young specimens, and that possibly fig. 16 may also be a local variety.

	Length.	Height.	Thickness.	Proportions. Length.	Height.	Thickness.
De Koninck's figs. 6 *a*—*e*	$\frac{11}{24}$	$\frac{1}{4}$	$\frac{1}{6}$ inch.	11	6	4.
Fig. 10, from Settle (Var.)	$\frac{5}{24}$	$\frac{1}{8}$	$\frac{1}{9}$	10	6	5.
Fig. 11, from Cork (Var.)	$\frac{1}{4}$	$\frac{1}{7}$	$\frac{1}{8}$	11	7	6.
Fig. 14, poor cast, Belgium	$\frac{2}{7}$	$\frac{1}{6}$	$\frac{1}{7}$	14	8	7.
Fig. 16, from Settle	$\frac{1}{4}$	$\frac{1}{6}$	$\frac{1}{9}$	12	8	5.
Fig. 18, compressed cast,[1] Belgium	$\frac{1}{3}$	$\frac{1}{5}$	$\frac{1}{9}$	15	$9\frac{1}{2}$	5.

Cyprella chrysalidea is represented in Prof. De Koninck's plate 52 by the right valve (fig. 6 *c*) with its front upwards, by the dorsal (*e*) and ventral (*a*) views of the carapace, and by two views of natural size (*b* and *d*). It appears to us that the artist made too strong a line and too free a curve between the hood and the tubercle, as also in fig. 7 *a* of the same plate. The curve in fig. 3 we interpret somewhat differently. See further on, p. 40.

C. chrysalidea is stated by De Koninck to be ten millimètres in length, and to be very rare at Visé; so also M. E. Dupont refers to it as being very rare in French Hainault ('Bull. Acad. Belg.,' sér. 2e, vol. xv, p. 110). M. Bosquet has kindly sent us some Belgian casts of this interesting little fossil.

[1] This has been somewhat compressed; hence a greater height and less thickness, perhaps, than in the original carapace.

It is not common either at Little Island or Settle, whence Messrs. Wright and Burrow obtained their specimens respectively. The late Rev. J. G. Cumming found it in the Poolvash Limestone, Isle of Man, and presented a specimen to the Geol. Mus. Survey, London, Tablet $\frac{38}{1}$. Another specimen on the same Tablet came from Longnor, Derbyshire. We have also seen a specimen in the Carboniferous Limestone of Bathgate, Linlithgowshire, collected by Mr. Grossart, Surgeon, of Salsburg, Lanarkshire.

2. Cyprella annulata (*De Koninck*). Plate IV, figs. 12 *a*, *b*; 13 *a*, *b*; 17 *a*, *b*, *c*.

Cypridina annulata, *De Koninck*, 1841. Mém. Acad. Roy. Belg., vol. xiv, p. 18, fig. 8; 1843, in D'Omalius' Précis élém. Géol., p. 515; 1844, Desc. Anim. foss. Terr. Carbonif. Belg., p. 588, pl. lii, figs. 3 *a*, *b*.

Cythere — *Dupont*, 1863. Bullet. Acad. Roy. Belg., sér. 2e, vol. xv, p. 110.

Cyprella — *Jones and Kirkby*, 1864. N. Jahrb. f., 1864, p. 54; Canad. Nat. Geol., June, 1864, p. 237.

Carapace short oviform, truncate and notched in front; bluntly apiculate and indented behind; the subcentral tubercle large; the nuchal furrow variable, stronger in some individuals than in others; vertical across the valve in fig. 12 *a*; strongest behind and below the tubercle in fig. 13 *a*; merely intensifying the back of the tubercle in fig. 17 *a*; deeply notching the back in Prof. De Koninck's figured specimen. Surface vertically scored throughout, with about eighteen parallel, sometimes sinuous, lines, with weaker and partial lines between; and in one interesting case we find a distinct reticulate ornament of minute, polygonal, raised meshes on the shell, traversed by the small parallel furrows above mentioned (fig. 12 *b*, magnified twenty diameters).

	Length.	Height.	Thickness.	Proportions. Length.	Height.	Thickness.
C. annulata (De Kon.), plate 52, fig. 3 *a*, *b* (about seven millimètres long) . . .	$\frac{1}{3}$.	$\frac{1}{4}$.	? .	12 :	9 :	?.
Fig. 13, from Settle . . .	$\frac{1}{4}$.	$\frac{5}{24}$.	$\frac{1}{4}$.	12 :	10 :	11.
Fig. 17, from Cork . . .	$\frac{1}{4}$.	$\frac{1}{6}$.	$\frac{1}{5}$.	12 :	$8\frac{1}{2}$:	9.

Prof. De Koninck has figured a left valve (fig. 3 *a*, *b*), comparable with our fig. 13 *a*, with its front upwards; and the artist has introduced an artificial curve, involving the antero-dorsal region and the tubercle, and following the line of the strong nuchal furrow, where it has depressed the dorsal edge. The front margin (upwards) is imperfect, and therefore rounded, as in our fig. 12 *a*. The convex ventral margin (on the left hand of the reader), and the apiculate and indented hinder margin (downwards in fig. 3 *a, b*), are very characteristic.

Fig. 12 is a grey valve (showing reticulate sculpture under the microscope, 12 *b*) in grey limestone from Cork (Mr. J. Wright, F.G.S.). It seems to be rounded in front, but is really imbedded in the matrix; it has a low tubercle, and a strong, broad, transverse furrow across the surface, the hinder moiety of the valve being very convex.

Fig. 13 is a larger valve, grey, with a suborbicular outline; from the grey limestone of Settle; collected by Mr. J. H. Burrow, M.A., who has enriched our list with many Carboniferous species.

Fig. 17, a grey shell in grey limestone, is more ovate than either of the foregoing, being narrower in vertical diameter; perhaps a male. It was collected, with a few others, at Little Island, Cork, by Mr. J. Wright, F.G.S., who has been so successful in his search in the Carboniferous Limestone of Cork, Ireland.

We have also seen a specimen of this species in Mr. W. Grossart's collection from the Carboniferous Limestone of Bathgate, Linlithgowshire.

Our specimens are much less depressed at the nuchal furrow than Prof. De Koninck's original seems to have been; but evidently that is a variable feature.

Cyprella annulata is said to be very rare at Visé, Belgium (De Koninck), and in French Hainault (Dupont).

We now return to some forms closely related to *Cypridina,* and well known in the recent state, namely, *Bradycinetus* and *Philomedes.* Of the former we have certainly a good representative in the Carboniferous Formation at Carluke, Scotland; of the latter a less decided, but very probable, representative has been sent to us from the Carboniferous Limestone of Cork, Ireland. After having treated of some other fossil forms, which, however, have no closely allied existing representative, but are evidently Cypridinads (*Entomoconchus* and *Offa*), we shall treat of some fossil forms of *Polycope* and *Cytherella,* and then take up some extinct Entomostraca (*Entomis*), whose relationship with the Ostracoda is obscure, and in which the absence of the anterior notch and the presence of a strong nuchal furrow are distinguishing features.

VII. BRADYCINETUS, *G. O. Sars.*

CYPRIDINA, *Baird,* 1850.
— *Liljeborg,* 1853.
ASTEROPE, *Fischer,* 1854.
CYPRIDINA, *Stimpson,* 1854.
BRADYCINETUS, *G. O. Sars,* 1865.
— *G. S. Brady,* 1867, 1868, 1871.

Carapace strong, ovato-globose; deeply notched; edge of the beak sinuous, or even produced into small horn-like processes. See page 9.

1. BRADYCINETUS RANKINIANUS, *J. and K.* Plate II, figs. 21, 22 *a—c.* Plate V, fig. 5.

CYPRIDINA RANKINIANA, *J. and K.*, 1867. Trans. Geol. Soc. Glasgow, vol. ii, p. 218; and vol. iii, Suppl., 1871, p. 27.

Carapace globose; compressed anteriorly, round-oval or broad-ovate in outline; deeply notched in front, beneath a broad beak, which has a jagged or sinuous edge (fig. 5, Pl. V).

The surface is smooth and finely reticulate (fig. 22, *c*), with irregularly quadrangular meshes, slightly sunken at the centre. The Muscle-spot, distinct on the cast (fig 21), is almost central.

Two specimens of this interesting species occur in the half of a small round ironstone nodule from Gare, Carluke: from the same stratum that yielded the Coprolite with *Polycope simplex* (p. 53), equivalent to the "First Calmy Limestone of Braidwood," 340 fathoms below the Ell Coal. In Dr. Rankin's Collection.

The nodule is seven eighths of an inch in greatest diameter; beneath its external coat (one sixth of an inch) is a thin layer of calc-spar, next a film of ironstone, and the inside consists of a blue argillaceous septarium, one fissure of which passes through one of the specimens.

Bradycinetus Rankinianus is like *B. Macandrei* (Baird), Brady, 'Trans. Lin. Soc.,' vol. xxvi, plate 37, figs. 14—17, in general aspect, but is more gibbose and more oval in outline; but it is not truncate behind, nor is there evidence of its having been spined at the postero-ventral region. It has a notch and beak closely resembling those of *B. Macandrei;* and, though *B. Brenda* has a somewhat different structure of these parts we refer our fossil to this genus, guided by the peculiarity of beak, general contour, and ornament. It is dedicated to the indefatigable explorer of Carluke fossils, Dr. D. R. Rankin, who has aided us kindly with many specimens.

Length $\frac{1}{4}$; height $\frac{1}{5}$; thickness $\frac{1}{8}$ inch. Proportions 12 : 9 : 6.

VIII. PHILOMEDES, *Lilljeborg*.

? Cypris, *Nicolet*, 1849.
Cypridina, *Baird*, 1850.
Philomedes, *Lilljeborg*, 1853.
Cypridina, *Dana*, 1855.
Philomedes, *Norman*, 1861.
— *G. O. Sars*, 1865.
— *G. S. Brady*, 1867, 1868, 1871.

Carapace subcylindrical ♂, or ovate ♀; frequently spined or apiculate posteriorly; notch deep and large. One known form (*Ph. Folinii*, Brady) has a coarsely ridged and deeply pitted carapace. See page 8.

1. Philomedes Bairdiana. Sp. nov. Plate II, figs. 30, 31 *a, b, c.*

Carapace-valves suboblong, compressed; excised by a broad antero-inferior sinus; and impressed by a medio-dorsal furrow. Edge-view of carapace narrow-oblong, with elliptical ends; end-view obovate.

This resembles some published figures of *Philomedes interpuncta* ♂; but the specimens, not being free of the matrix, are apparently without the usual posterior spine or process; the notch, also, is too broadly rounded, though the gape is smaller; and the nuchal furrow is rather too strong for *Ph. interpuncta.*

Length $\frac{5}{24}$; height $\frac{1}{9}$; thickness $\frac{1}{14}$ inch. Proportions 10 : 5 : $3\frac{1}{2}$.

We dedicate this interesting Cypridinad to the memory of our deceased friend Dr. W. Baird, by whom the knowledge of Entomostraca was so greatly advanced.

Ph. Bairdiana occurs as grey shells (two) in the grey Carboniferous Limestone of Little Island, Cork. Collected by Mr. Joseph Wright, F.G.S.

IX. RHOMBINA. Gen. nov.

Belonging possibly to the *Cypridinadæ*, but differing in shape from any of the foregoing genera, there are some rare specimens of carapace-valves obliquely oblong or rhomboidal in profile, and rather compressed, which have a slight sinus and a mere trace of the Cypridinal notch on the sloping anterior margin under the projecting antero-dorsal angle. The nearest approach to this structure among the species described in the previous pages is seen in figs. 15—19, Pl. II, *Cypridina brevimentum*, and in figs. 30 and 31, Pl. II, which we have doubtingly referred to *Philomedes* (p. 43). In both cases, however, a large sinus and definite notch give a considerable gape to the closed valves. In *Polycope*, which is known to differ considerably from *Cypridina* in its organs, the sinus is reduced to a minimum, and the notch is quite wanting, so that there is no gape at all. The above-mentioned specimens, having still some amount of sinus, notch, and gape, differ essentially from *Polycope;* and they differ in degree, to a large extent, from the above quoted Cypridinads. And as the features here referred to were doubtless in strict relation with the capability and appliance of the internal organs and the extruded swimming feet, we propose to group these few specimens under a new genus, Rhombina. A marginal rim on the ventral edge of the valves may also be mentioned as a noticeable feature, on account of its much greater development than in any other of the allied forms.

There is some resemblance between *Rhombina* and certain forms of *Aristozoe,* one of M. Barrande's Silurian genera from Bohemia, but the latter has usually antero-dorsal tubercles and sometimes a nuchal sulcus.

1. Rhombina Hibernica. Sp. nov. Plate II, figs. 32 *a—c;* Plate V, figs. 13 *a—c.*

Carapace subcylindrical, with slanting ends; somewhat pod-shaped; compressed anteriorly. Carapace-valve almost a rhomb in outline, obliquely truncate at both extremities, with nearly parallel lines, but more acutely (60°) at the anterior end than at the other (70°). The most prominent angle is at the antero-dorsal region, under which a slight sinus notches each valve, making a small gape.

The dorsal line is straight; the lower margin is slightly convex, and is bordered by a distinct raised rim. End-view of the carapace is acute-oval; edge-view long compressed ovate.

Length $\frac{1}{4}$; height $\frac{1}{8}$; thickness $\frac{1}{9}$ inch. Proportions 12 : 6 : 5.

This species is represented by a well-preserved dark-coloured shell from the Carboniferous Limestone of Little Island, Cork, and was brought to our notice by its discoverer, Mr. J. Wright, F.G.S.

[The figure 32 *a*, in Pl. II, represents the valve upside down; it is therefore refigured in Pl. V, fig. 13 *a*.]

2. Rhombina Belgica. Sp. nov. Plate V, figs. 14 *a—d.*

Carapace oblong-ovate, subcylindrical, truncated obliquely at the extremities, and somewhat compressed posteriorly. Anterior slope 70°; hinder slope 80°. Dorsal and ventral margins slightly convex, the latter bordered by a raised rim. End-view acute-oval; edge-view long-pyriform.

Length $\frac{14}{48}$; height $\frac{7}{48}$; thickness $\frac{6}{48}$ inch. Proportions 14 : 7 : 6.

This rare form occurs to us as a single valve from the Upper Carboniferous Limestone at Visé, Belgium, and we are indebted to M. J. Bosquet, F.C.G.S., for this and other interesting specimens.

X. ENTOMOCONCHUS, *M'Coy*, 1839.

The bibliographical history of *Entomoconchus* is that of its best-known species, *E. Scouleri*. In 1839 Professor F. M'Coy figured and described as *Entomoconchus Scouleri*, in the 'Journal of the Geological Society of Dublin' (vol. ii, p. 91, pl. 5, figs. *a—e*), some large globose Entomostracan specimens which had been obtained by himself and Dr. Scouler from the Mountain-limestone of Clane, Co. Kildare, Ireland. This form had already been recognised as occurring in the Mountain-limestone of Bolland (Bowland Forest), Yorkshire, by Prof. John Phillips, and was referred to by him in his 'Geology of the Mountain-limestone District of Yorkshire' (1836), pages 240 and 251, as a "Cypridiform Shell," in the Gilbertson Collection;[1] but he did not describe it, though he gave sketches of it in pl. 22, figs. 23 and 24, of that work.

In 1841 five species of Bivalved Entomostraca from the Carboniferous Limestone of Belgium were figured and described by Prof. Dr. L. De Koninck, of Liége, in his 'Mémoire sur les Crustacés fossiles de Belgique,' in the 'Mémoires Acad. Royale Belg.,' vol. xiv. At page 16, under the name *Cytherina Phillipsiana* (fig. 13), we have the peculiar gibbose form common in some of the beds of the European Mountain-limestone, and above referred to as *Entomoconchus Scouleri*. The foregoing five species, together with one other, were more fully treated and illustrated in his 'Description des Animaux fossiles qui se trouvent dans le Terrain Carbonifère de Belgique' (4to, Liége, 1842–44). Among them De Koninck described his *Cypridina Edwardsiana, C. concentrica, C. annulata, Cyprella chrysalidea*, and *Cypridella cruciata*. The generic affinities, however, were not well determined, owing to the fact of the peculiar antero-ventral notch in the valves of *Cypridina* having been omitted in the engraving of Milne-Edwards's typical species (as explained in the 'Monograph of Tertiary Entomostraca of England,' Pal. Soc., 1856, page 9), and the palæontologist having been thereby misled in collocating the fossil carapaces with their recent analogues. See above, p. 11.

In 1844 Prof. M'Coy enlarged our knowledge of the Entomostraca of the

[1] Now in the British Museum.

Carboniferous rocks by the description and illustration of twenty-two forms (including *Entomoconchus Scouleri*) from the Lower Carboniferous strata of Ireland, in his 'Synopsis of the Characters of the Carboniferous Fossils of Ireland' (4to, Dublin, 1844). Having been enabled, through the courtesy of Sir Richard Griffith, Bart., to examine the original specimens, we communicated to the 'Annals Nat. Hist.' for July, 1866, a critical notice of the whole, and arrived at the following conclusions as to the specimens of *E. Scouleri*:[1]

"1. *Entomoconchus Scouleri.* Lower Carboniferous Limestone; Little Island, Cork. 'Synops. Carb. Foss. Ireland,' p. 164. Griffith, "List of Localities" ('Journ. Geol. Soc. Dublin,' vol. ix), p. 68. A weathered shell [not "cast"] in grey crystalline fossiliferous limestone.

"1*. Another shell, in similar limestone; Millicent, Clane, Co. Kildare.

"1**. Another specimen (labelled '*E. Scouleri,* Upper Carboniferous Limestone; Black Lion, Enniskillen, Co. Leitrim,' 'Localities,' p. 80) is a dark-coloured crystalline shelly limestone with a *Cyclus*."[2]

In Prof. M'Coy's figures and descriptions of *E. Scouleri* the hinge-line is by mistake referred to the anterior extremity, and the relations of the other margins are consequently misconstrued. His figures published in 1839 are large and carefully drawn, but those of 1844, also those by Phillips and De Koninck, are not of sufficient size, nor exact enough, to serve the purposes of the naturalist.

The characteristic feature in *Entomoconchus*, namely, the anterior peak, with a fissure beneath, formed by a sudden, though slight, inward curve of the edge of each valve, just below the antero-dorsal region, and analogous to the Cypridinal beak and notch, was not noticed until 1863, when we pointed out that *Entomoconchus* is one of the *Cypridinadæ* in a provisional notice of the Entomostraca of the Carboniferous Period read before the British Association.[3]

Generic Description.—The carapace of *Entomoconchus* is bivalved and subglobose; valves subequal, smooth, thick ($\frac{1}{30}$th inch and more). In some instances, where large individuals are crowded together (Kildare and Bolland), the middle portions of some valves appear to be $\frac{1}{16}$th inch thick, but this may possibly be due to the close approximation of valve within valve. Sometimes a very faint reticulate structure is recognisable in well-preserved shells. The left valve strongly overlaps the right valve in the antero-dorsal region, less so posteally, and slightly at the ventral border. This kind of overlap exists in two of Dr. Baird's *Cypridinæ, C. Zelandica* and *C. albomaculata* ('Proc. Zool. Soc.,'

[1] See 'Annals Nat. Hist.,' ser. 3, vol. xviii, p. 41.

[2] For a full account of all that is known of this curious little fossil Crustacean and its allies see Mr. Henry Woodward's exhaustive memoir in the 'Geol. Mag.,' 1870, vol. vii, pp. 554—560, pl. 23.

[3] See 'Report Brit. Assoc.,' Newcastle-on-Tyne, for 1863, Trans. Sect., p. 80; also 'Canadian Naturalist and Geologist,' new ser., vol. i, 1864, p. 236; 'Neues Jahrbuch für Min. Geol.,' &c., 1864, p. 54; and 'Geologist,' vol. vi, p. 460, 1863.

"Annulosa.") The hinge-line is simple, the thin edge of the right valve being received under the overlap of the opposite valve.

The posterior portion of the carapace is rounded, the curve varying with individuals. The anterior is truncate, usually obliquely, and with a more or less sinuous outline, due to a depression accompanying the slight notch that is cut out (or rather indented) below the well-marked antero-dorsal angle. These correspond with the hood and notch of most of the *Cypridinadæ*.[1] The gape or opening at the notch is narrow and vertical (not transverse, as in *Cypridina* and many of its allies). It is widest above, and closes at about the middle of the vertical line, but reopens, with a smaller vertical fissure, at the antero-ventral angle of the carapace, which is rounded and subcarinate, being impressed on either side by a marginal furrow continued downwards from the depressed area. In old individuals a short oblique furrow passes off on each side from the great sinus or depressed area of the front of the carapace; it is directed backwards and downwards, from below the hood-like notch, and above the antero-ventral dehiscence of the valves. There is also a small round or oval space left between the valves, sometimes accompanied by a slight prominence at the postero-ventral angle, or at the corresponding curve. This probably had relation to a marginal spike on each valve, such as is met with in many bivalved Entomostraca. Near the middle of the inside of each valve, but rather nearer the antero-ventral angle, a relatively large " Muscle-spot " is strongly marked in old individuals of *E. Scouleri* by a suboval patch of short radiating furrows within a much larger sunken circular area.

A local cloudiness of discoloration only is sometimes seen at this point on the outside of the perfect valves, but by the loss of the exterior coating, from solution of the carbonate of lime (a result of weathering), the radiate lines of the Muscle-mark are frequently brought to view. These vascular rays of the Muscle-spot are transverse in the middle, longitudinal at the extremities above and below, and at graduated angles between on either side.[2]

The Muscle-spot was distinctly indicated by Prof. M'Coy in 1839. Somewhat similar radiating groups of linear " lucid spots " are observable in several published figures of *Cypridinæ* (Baird and others).

A difference of outline and of the number of radiating canals occurs in the figured Muscle-spots of our specimens (figs. 3 *d*, 4 *d*, 5 *d*); but we do not see how to assign these differences as characters of sex, age, or variety. Fig. 3 *d*, showing the coarsest radii, is a perfect cast of the Muscle-spot; the others are seen by partial loss of the outer crust of the valve.

[1] *Cypridina*, *Philomedes*, *Asterope* and *Bradycinetus* possess the anterior or antero-ventral notch *Eurypylus* and *Heterodesmus* have it far less developed or barely present. *Polycope*, a member of an allied group, has no notch. See above, pages 3 *et seq.*

[2] A curiously similar pattern is seen on the dorsum of *Cryptonota citrina*, Stimpson, 'Invertebr. Grand Manon,' p. 36, pl. 2, fig. 27.

Relationship of the Genus.—The carapace of *Entomoconchus* differs from that of any of the known species of *Cypridina, Philomedes, Asterope,* or *Bradycinetus,* in its subquadrilateral outline, the hood and notch being only slightly developed, and usually much higher up than in the oval *Cypridinadæ.* Its greater globosity and the thickness of its valves distinguish it from the majority of the Cypridinal species, though the overlap of the larger (left) valve is the same as in *Cypridina? Zelandica,* Baird ('Proc. Zool. Soc.,' Annulosa, pl. 17, figs. 11—13), and *C.? albomaculata,* Baird (ibid., pl. 71, figs. 1 *a—d*). The Muscle-spot of the latter has a somewhat similar character to that of *Entomoconchus.*

There is a superficial likeness between some of the smaller specimens of *Entomoconchus* and the carapace of *Limnetis Gouldii,* Baird ('Proceed. Zool. Soc.,' 1862, p. 149, Annulosa, pl. 15, fig. 7); but the Cypridinal notch is absent in the latter, and the Muscle-spot is very different.

Figs. 1 and 7 of our Plate I have outlines somewhat similar to that of *Polycope orbicularis,* Brady ('Lin. Soc. Trans.,' vol. xxvi, pl. 35, fig. 53); but with this the resemblance ends, for in *Polycope* the Cypridinal notch is quite obsolete.

With the similarly globose, but strongly hinged, *Heterodesmus,*[1] an imperfectly known Cypridinad from the Sea of Japan, *Entomoconchus* has shape and gibbosity in common, but the hingements differ, as well as the form and amount of notch or sinus.

Judging by the carapace-valves, all of the animal that remains to us, *Entomoconchus* was a marine gregarious Bivalved Entomostracan (as indicated by M'Coy in 1839), closely allied to the existing *Cypridinadæ;* but the high position and the feeble development of its "notch" and "hood," and the vertical, narrow, interrupted anterior "gape" of the valves, are distinctive features, connected with the extrusion of the antennæ (swimming limbs) and other organs, which were doubtlessly planned somewhat differently to those of the existing genera.

For the better understanding of the illustrations referred to we note that—

In Prof. M'Coy's figures (1839)—

Fig. *a* is the anterior aspect of a carapace, the dorsal border being to the right hand of the reader, and the right valve upwards. Compare our Pl. I, fig. 2 *d,* &c.

Fig. *b* is the ventral aspect, with the anterior end upward. Compare our fig. 6 *c,* &c.

Fig. *c* is the side view of a carapace, showing the right valve and its muscle-spot; the anterior end is upwards, and the dorsal border to the left of the reader. Compare our fig. 4 *a,* &c.

Fig. *d* (natural size) is an outline view of the last-mentioned aspect (or of a left

[1] G. S. Brady, 'Trans. Zool. Soc.,' 1866, vol. v, p. 387, pl. 72, figs. *a—h*.

valve); the dorsal border is to the left of the reader, and the front end upwards.

Fig. *e* is a diagrammatic plan of the rays of the Muscle-spot. Compare our figs. 3 *d* and 4 *d*.

In Prof. M'Coy's figures (1844)—

Fig. 4 *a*, carapace showing right valve; anterior upwards.

Fig. 4 *b*, ventral aspect.

In Prof. Phillips's figures (1836)—

Fig. 23, carapace, side-view, showing left valve; anterior end upwards.

Fig. 24, carapace, ventral view; anterior upwards.

In Prof. De Koninck's figures (1841, 1844)—

Fig. 1 *a*, side-view of carapace, showing the left valve; anterior end upwards.

Fig. 1 *b*, ventral aspect of carapace; anterior upwards.

1. Entomoconchus Scouleri, *M'Coy*. Plate I, figs. 1—6. Var. ovalis, fig. 1.

"Cypridiform Shell," *J. Phillips*, 1836. Illust. Geol. Yorkshire, part. 2, p. 240 and p. 251, pl. xxii, figs. 23, 24.

Entomoconchus Scouleri, *M'Coy*, 1839. Journ. Geol. Soc. Dublin, vol. ii, p. 91, pl. v, figs. *a*—*e*.

Cytherina Phillipsiana, *De Koninck*, 1841. Mém. Acad. Roy. Belgique, vol. xiv, p. 16, fig. 13; 1843, in *D'Omalius's* Précis élém. Géol., p. 515.

— — *Morris*, 1843. Catal. Brit. Foss., p. 73.

— — *De Koninck*, 1844. Descript. Anim. foss. Terr. Carb. Belg., p. 585, pl. lii, fig. 1 *a*, *b*.

Entomoconchus Scouleri, *M'Coy*, 1844. Synops. Char. Carb. Foss. Ireland, p. 164, pl. xxiii, fig. 4.

Cytherina Phillipsiana, *Cumming*, 1846. Quart. Journ. Geol. Soc., vol. ii, p. 322.

Cythere — — 1848. The Isle of Man, Appendix Q, p. 355.

Entomoconchus Scouleri, *Morris*, 1854. Catal. Brit. Foss., 2nd edit., p. 108.

Cythere Phillipsiana, *Dupont*, 1863. Bull. Acad. Roy. Belg., ser. 2, vol. xv, p. 110.

Entomoconchus Scouleri, *Jones & Kirkby*,[1] 1863. Geologist, vol. vi, p. 460; 1864, Rep. Brit. Assoc. for 1863, Trans. Sect., p. 80; Neues Jahrb., 1864, p. 54; Canad. Nat. Geol., 1864, new ser., vol. i, p. 236; 1866, Ann. Nat. Hist., ser. 3, vol. xviii, pp. 41, 46, 48.

[1] The references in 'Trans. Geol. Soc. Glasgow,' 1867, vol. ii, p. 218, and 'Trans. Geol. Soc. Glasgow,' vol. iii, Supplement (Young and Armstrong's 'Carb. Foss. W. Scotland,' 1871), p. 28, were by our mistake made to specimens of *Cypridina Phillipsiana*.

ENTOMOCONCHUS SCOULERI, *Jones*, 1870. Monthly Microsc. Journ., vol. iv, p. 185, pl. lxi, fig. 17.

Carapace subglobose, with a subquadrilateral profile; more strongly arched on the dorsal than on the ventral border; truncate in front, with slight notch, depressed area, and narrow interrupted gape, as described above (p. 46).

Individuals differ one from another in the profiles of their several aspects, as side-view, end-view, and edge-view, and when some agree in one profile they differ in others. Some (as figs. 2, 3, and 5), which are fuller in the postero-dorsal region than others (figs. 4 and 6), may have been females.

The diversity of outlines leads us to treat of the selected specimens separately, thus:

Pl. I, figs. 1 *a—c.*—The cast of a varietal form, and probably a small male, from the Carboniferous Limestone of Clonalvy, near Naul, Co. Meath, Ireland.[1] It is $\frac{7}{24}$ths of an inch long. Side-view obliquely ovate; truncated obliquely in front, having its longest diameter from the antero-dorsal angle to the postero-ventral curve. End-view ovate, broadest downwards. Edge-view long-ovate, broadest anteriorly. The transverse (through the valves), vertical, and longitudinal diameters are as 5 : 6 : 7.

This specimen indicates a carapace proportionately longer, more convex below, and more depressed in the postero-dorsal region (the last being probably a masculine feature), than the other oblique-ovate specimens (figs. 4 and 6), and it differs also from them somewhat in the profiles both of end and edge. Hence we regard it as a variety—*Var.* OVALIS.

Figs. 2 *a—d.*—This is a yellowish-grey shell of probably a young female *E. Scouleri*, one third of an inch long. It is from the Lower Scar Limestone of Settle, Yorkshire (Mr. J. H. Burrow, M.A.). Side-view subquadrate, with the postero-ventral region rather prominent and the dorsal wall rounded. End-view ovate, broadest below. Edge-view long-ovate, broadest in front.

The diameters have the following proportions:—Transverse (thickness of the whole carapace) as 8; vertical as 11; longitudinal as 13.

We have the same form from the Carboniferous Limestone of Bolland,[2] Yorkshire (Prof. Morris, F.G.S.), and of Visé, Belgium (M. Bosquet, C.M.G.S.).

Figs. 3 *a—d.*—This is a rather large specimen, consisting of a light-grey limestone cast and a piece of cream-coloured shell, from Visé, Belgium; the gift of M. J. Bosquet, For. Cor. G. S., of Maestricht. It corresponds with De Koninck's figured specimen in size, but slightly differs in outline. It is $\frac{7}{12}$ths inch in length. Side-view

[1] Geol. Survey Ireland Museum, Tablet 211 N. Referred to in 'Ann. Nat. Hist.,' ser. 3, vol. xviii, p. 48.

[2] This is the "Bowland Forest" of some maps, &c.—J. P.

subquadrate, with the antero-ventral and postero-dorsal regions slightly prominent. End-view ovate, broadest below. Edge-view long-ovate, broadest behind.

The transverse, vertical, and longitudinal diameters are as $6\frac{1}{2} : 7 : 8$. That of the circular depression around the Muscle-spot is as $4\frac{1}{2}$.

Muscle-spot (seen on the internal cast where the shell is wanting) oval, with about thirty-six radii; it is near the centre of a slightly raised circular area on the cast, corresponding with a depression on the inside of the shell, and the edge of which is indicated on the outside of the remaining portion of the shell by a faint curved furrow.

[These features are not shown on the figure.]

Figs. 4 *a—d.*—The shell (grey) of a very large and old individual from Bolland, Yorkshire (Prof. Morris, F.G.S.); $\frac{9}{12}$ths inch in length. Side-view obliquely subovate; that is, obliquely truncate in front, with antero-dorsal prominence; and obliquely elliptical behind, the postero-dorsal region being depressed. End-view slightly ovate, nearly round. Edge-view oval.

Transverse, vertical, and longitudinal diameters as $8 : 9 : 10$.

Similar specimens abound in the Carboniferous Limestone of Kildare, Ireland.

Figs. 5 *a—d.*—A large dark-grey shell, slightly roughened by weathering, from Bolland (Prof. J. Morris, F.G.S.). It is $\frac{2}{3}$rds inch in length. Similar occur in Kildare. Side-view suboval, truncate anteriorly, broadly elliptical behind. End-view broadly ovate, almost round. Edge-view subovate, truncate anteriorly.

Transverse diameter almost equal to the height, and nearly $\frac{6}{7}$ths of the length.

Muscle-spot (shown by slight loss of surface) nearly round, with about fifty-two radii.

Figs. 6 *a—c.*—A neat little shell of a small, probably young male, specimen, from Bolland (Prof. Morris, F.G.S.). It is $\frac{11}{24}$ths inch long; like fig. 4 in shape, but smaller and less globose.

Diameters—Transverse as 9; vertical as 11; longitudinal as 13.

Entomoconchus Scouleri is known to us by specimens from the Carboniferous Limestone of Cork,[1] Kildare (see above), Meath,[2] and Limerick (collections of Sir R. Griffith, the late Mr. D. Sharpe, Mr. Joseph Wright, British Museum, and Geological Survey, Dublin and London); Bolland, Yorkshire (Profs. Phillips and Morris); Park Hill, near Longnor, Derbyshire (Geol. Survey, London); and Lower Scar Limestone, Settle, Yorkshire (Mr. J. H. Burrow).

The late Rev. J. G. Cumming quotes it from both the lower and middle stages of the

1 "It is common in the limestone of Little Island, near Cork, but can rarely be got out perfect."—*J. Wright.* It is also found at Ballyvodock, about two miles south-west of Middleton, Co. Cork, 'Ann. Nat. Hist.,' ser. 3, vol. xviii, p. 48, and 'Explanation of Sheets 187, 195, and 196, &c., Geol. Survey, Ireland,' 1864, p. 18 and p. 54.

2 'Annals Nat. Hist.,' ser. 3, vol. xviii, p. 48.

Carboniferous Limestone of the Isle of Man ('Quart. Journ. Geol. Soc.,' vol. ii, pp. 322; and 'Isle of Man,' p. 355).

At Visé, in Belgium, it is not rare in the white Carboniferous Limestone (De Koninck, Bosquet, Dupont[1]).

2. Entomoconchus orbicularis. Sp. nov. Plate I, figs. 7 *a—c*.

Carapace suborbicular and compressed, one half inch long; vertical and longitudinal diameters nearly equal; transverse diameter (through both valves) rather more than half of either of the former; notch faint; antero-ventral keel strong. Side-view almost orbicular; truncate in front, and slightly contracted in the postero-ventral region. End-view acute oval, lenticular. Edge-view acute oval, lenticular.

Transverse, vertical, and longitudinal diameters as $8 : 14\frac{1}{2} : 15$.

One shell, much eaten away by weathering, collected by Mr. Joseph Wright, F.G.S., at Little Island, Cork; and in a specimen of the grey Carboniferous Limestone of Poolvash, sent to us from the Isle of Man by Mr. E. W. Binney, F.R.S., we find the cast of a small compressed *Entomoconchus* probably referable to this species.

3. Entomoconchus globosus. Sp. nov. Plate V, figs. 10 *a—g*.

Carapace globular, its length slightly exceeding its height or thickness, which are equal. Profiles nearly orbicular. Side-view faintly elliptical. Edge-view suboval. End-view round, with a slight ventral flattening.

The "beak" is more distinct than in either *Entomoconchus Scouleri* or *E. orbicularis*, and the lower portion of the "gape" is continued much further into the ventral region than in either of the other two species. The breast-angle is wanting in *E. globosus*; the hinder margin is well rounded, and bears a trace of a submedian spine.

The Muscle-spot is of the usual type and very distinct. The surface of the valve exhibits also some traces of reticular structure or ornament.

Length $\frac{1}{3}$; height $\frac{2}{7}$; thickness $\frac{2}{7}$ inch. Proportions 16 : 13 : 13.

Only one valve is known; from the Lower Limestone Series of West Broadstone, Beith, Ayrshire. Collected by Mr. John Young.

4. Entomoconchus. Sp. nov. ?

In the British Museum is a rather small Belgian *Entomoconchus* from the Carboniferous Limestone of Visé, which has the general characters of *E. globosus*, with the

[1] 'Bullet. Acad. Roy. Belgique,' sér. 2, vol. xv, p. 110.

rounded front and low-placed gape, but it is longer and much narrower anteriorly, having an oval or elliptical profile. This may be a new species.

XI. OFFA.[1] Genus novum.

Carapace equivalve (?), subglobose, nearly equilateral, truncate in front, and impressed by a subcentral inturning of the anterior edge of each valve, representing the Cypridinal notch and equivalent to the upper gape in *Entomoconchus.*

M. Barrande figures two species of *Elpe* from the Upper Silurian rocks (" Fauna III, F, fig. 2") of Bohemia, one of which, *E. inchoata,* Bar., is globular, and in profile somewhat resembles our Carboniferous species; but the sinuated margin is the hinge-line in the Bohemian species. ('Syst. Sil. Bohême,' vol. i, Suppl., 1872, p. 511, pl. 26, figs. 10 *a—e*). *E. pinguis* is subreniform (*op. cit.*, p. 512, pl. 26, figs. 15 *a—e*).

1. Offa Barrandiana. Sp. nov. Plate II, figs. 6 *a—c*.

Carapace-valve subquadrilateral, boldly curved above, nearly flat below, semicircular behind; truncate in front, with a small sinus or infolding of the edges in the upper third, sufficient to leave a slight fissure between the valves, as in *Entomoconchus,* though in a less degree.

Surface of valve smooth; impressed by the lateral extension of the sinus obliquely downwards for a short distance, and raised in a low boss a little above and in advance of the centre.

End and edge profiles long-compressed-obovate.

Offa Barrandiana is named after the eminent geologist of Bohemia, who has elucidated very many fossil Entomostraca. It is somewhat like *Entomoconchus Scouleri junior* in shape, but is less convex and the gape is very different. Its valves have a slight central boss, affecting the profiles of edge and end, which would otherwise be scarcely gibbose.

Length $\frac{1}{6}$; height $\frac{1}{7}$; thickness $\frac{1}{8}$ inch. Proportions $8\frac{1}{2} : 6\frac{1}{2} : 6$.

A grey shell in grey limestone from Middleton, Co. Cork, Ireland. On the same horizon as that of Little Island, and only a few miles distant. Collected by Mr. Joseph Wright, F.G.S.

[1] *Offa*, a pellet.

XII. POLYCOPE, *G. O. Sars.*

Polycope, the only known type of the *Polycopidæ* (see p. 10), and belonging to the distinct section Cladocopa (see p. 6), has a bivalved carapace, recognisable by its circular or oval form, its obsolete sinus, and want of beak.[1]

In the *Polycope* the notch is obsolete or absent, a faint indentation or sinus in some species indicating its place; in others it is not at all marked. In this group the antero-inferior region, if truncated, falls inwards or slopes obliquely downwards and backwards from the greatest prominence in front. This corresponds to some extent with the shape of those Cypridinads that have more beak than ventral keel, seeming to have a short chin, in strong contradistinction to those which have the "notch" high up, with or without a deep sinus, and with more or less projecting antero-ventral quarters.

1. Polycope Burrovii. Sp. nov. Plate II, figs. 2 *a—c.*

Carapace equivalve (?), equilateral, subglobular, smooth. Side-view short-broad-ovate, slightly smaller anteriorly. End-view obovate, being broadest at the top. Edge-view long-ovate, broadest in front.

Muscle-spot obscurely visible. No indication of a notch or sinus.

Length $\frac{1}{8}$ inch. Proportions—length 7; height 6; thickness 5.

A few gregarious casts of *P. Burrovii,* some ferruginous, in grey Carboniferous Limestone, have been collected at Settle, Yorkshire, by Mr. J. H. Burrow, M.A., after whom the species is here named.

2. Polycope simplex, *J. and K.* Plate II, figs. 1 *a—c;* 10; 12. Plate V, figs. 1 *a—d.*

Cypridinopsis simplex, *J. & K.*, 1871. Trans. Geol. Soc. Glasgow, vol. iii, Suppl., p. 26.

Carapace oval, compressed, smooth. A delicate marginal rim is seen on the ventral

[1] We do not know of any other fossil specimens besides these from the Carboniferous Limestone; but it appears to us possible that M. Barrande's *Primitia socialis* from the Silurian of Bohemia ('Sil. Syst. Bohême,' vol. i, Suppl., p. 551, pl. 26, figs. 11 *a—e*), which is globose, about $\frac{1}{10}$th of an inch long, with oval outline and profile, circular end-view, and no notch, may be an ancient *Polycope.*

edge of some valves. The curvature of outline and the amount of gibbosity are variable. Side-view oval (sometimes ovate by increased ventral convexity); obliquely truncate at the antero-ventral region, and hence a slight angular anterior prominence. End-view narrow-obovate. Edge-view narrow-acute-oval.

A faint trace of the Muscle-spot occurs on some specimens.

No indication appears of a notch at or under the projecting angle. In this feature our little fossil resembles the very small existing *Polycope orbicularis*, Brady ('Trans. Lin. Soc.,' vol. xxvii, p. 471, pl. 35, figs. 53—57), which, however, is rounder and thicker, has an irregular reticulate ornament, and is indented with the very shallow and nearly obsolete sinus rather higher up on the front.

The fossil specimens (in a nodule) from Braidwood, Lanarkshire, show a neat reticulate structure of oblong meshes and scattered superficial pits. One small specimen is very much more ovate than the others, but this may be a character of age or of sex.

Carluke (Plate II, fig. 1).	Length $\frac{1}{10}$ inch.	Proportions—Length 10;	height 7;	thickness 5.
Meath (fig. 12) . .	„ $\frac{2}{3}$ „	„ „	9;	„ 6.
Cork (fig. 10) . .	„ $\frac{1}{5}$ „	„ „	10;	„ 7.

Polycope simplex is not rare. We have it from the Carboniferous Limestone of Little Island, Cork (Mr. Joseph Wright, F.G.S.); from Duleek, Co. Meath (a cast[1] in the Museum of the Geological Survey of Ireland); and a large specimen from limestone of the same age at Limerick. Probably of the same species, but not well exposed, are some imbedded specimens in the same limestone from the Isle of Man (Mr. E. W. Binney, F.R.S.).

A nodule of ironstone from Braidwood, near Carluke, Scotland, contained seventeen specimens (including impressions) of *P. simplex*, having brownish-grey shells, smooth, translucent, showing reticulate structure, and with a neat little ventral rim to some of the valves (Dr. Rankin's collection). We also refer to this species two small, smooth, compressed casts[2] from the Hosie Limestone series, South Hill, Campsie, near Glasgow, 660 fathoms below the Ell Coal (Mr. J. Young[3]).

Figs. 1 *a—c*.—Shell; magnified eight diameters; from Braidwood, Carluke.

Fig. 10.—A smooth grey shell; Cork.

Fig. 12.—A cast in limestone; Duleek, Meath, Ireland (Geol. Surv. Map, Sheet $\frac{27}{1}$).

This specimen from Duleek is one of some gregarious casts in a light-grey Carboniferous Limestone, and is restored in the figure from a wax impression. It shows obscurely

[1] Referred to as "*Cypridina primæva*" in the 'Annals Nat. Hist.,' ser. 3, vol. xviii, p. 48.

[2] These were associated with "*Cypridina primæva*" in the 'Glasgow List' of 1871, p. 27.

[3] Mr. Young informs me that "this *Polycope* is found, with many marine shells, in dark-grey shale, lying upon the Hosie Limestone at Campsie and Kilbride. The beds are in the 'Lower Limestone series.' Craigenglen, which has yielded a great many species of the smaller Entomostraca, is on the same South Hill of Campsie. The beds lie under the 'Main Limestone,' and are therefore lower in position than the Hosie Limestone, which is 22 fathoms above the Main Limestone."

the Muscle-spot in the normal position, that is, in the antero-inferior region and towards the sloping margin.

Plate V, figs. 1 *a—d.*—Shells; magnified eight diameters, and ornament more highly magnified; from Braidwood, Carluke.

3. POLYCOPE YOUNGIANA, *J. and K.* Plate V, figs. 2 *a—f.*

CYTHERE? YOUNGIANA, *J. & K.*, 1867. Trans. Geol. Soc. Glasgow, vol. ii, p. 223.
CYPRIDINOPSIS — — 1871. Ib., vol. iii, Suppl., p. 26.

Carapace ovate, somewhat narrower in front, and slightly pinched in or incurved at the anterior third of the ventral edge, without any definite notch being produced. End-view acute-oval. Edge-view long-acute-oval. Surface ornamented with long, concentric, interlacing or anastomosing and mesh-like striæ, very much like the ornament of *Cypris striolata,* Brady ('Annals Nat. Hist.,' ser. 3, vol. xiii, pl. 3, fig. 15). The ventral edge of at least the right valve has a marginal rim.

Length $\frac{1}{12}$; height $\frac{1}{15}$; thickness $\frac{1}{19}$ inch. Proportions 9 : $6\frac{1}{2}$: 5.

The specimens are pyritous, and were collected by Mr. John Young, Assistant-Curator of the Hunterian Museum in the University of Glasgow, in a marine shale of the Carboniferous series at South Hill Pit, Campsie. "Rather rare. A very local species. Lower Limestone, South Hill, Campsie; in dark-blue shale above the Hosie Limestone, with *Goniatites, Bellerophon, Nuculæ,* and *Spirifera Urei;* Carluke; in an ironstone nodule, in shale, First Kingshaw Limestone" (Suppl. *supra cit.,* p. 26).

The species is named after Mr. John Young, of Glasgow, one of the energetic palæontologists of Western Scotland who are successfully working out the natural history, geology, and fossils of Lanarkshire and the neighbouring districts.

PLATE I.

Fig.

1 *a—c*. *Entomoconchus Scouleri*, M'Coy, *var.* ovalis, nov. A cast from Meath, Ireland. (Page 49.)

a, Side-view of the left valve; *b*, hinder view; *c*, back-view. Magnified 4 diameters.

2 *a—e*. *Entomoconchus Scouleri*. Small female (?) shell. From Settle, Yorkshire. (Page 50.)

a, Profile, showing right valve; *b*, dorsal view; *c*, posterior; *d*, anterior; *e*, ventral. Magnified 4 diameters.

3 *a—d*. *Entomoconchus Scouleri*. Cast with portion of the shell. From Visé, Belgium. (Page 50.)

a, Profile, showing left valve; *b*, hinder end of the valve; *c*, ventral edge; magnified $2\frac{1}{2}$ diameters. *d*, Muscle-spot as shown on the cast; magnified 12 diameters.

4 *a—d*. *Entomoconchus Scouleri*. Large specimen from Bolland, Yorkshire. (Page 51).

a, Profile, showing right valve; *b*, anterior; *c*, ventral; magnified $2\frac{1}{2}$ diameters. *d*, Muscle-spot; magnified 5 diameters.

5 *a—d*. *Entomoconchus Scouleri*. Large specimen from Bolland. (Page 51.)

a, Profile, showing left valve; *b*, anterior; *c*, ventral; magnified $2\frac{1}{2}$ diameters. *d*, Muscle-spot; magnified 5 diameters.

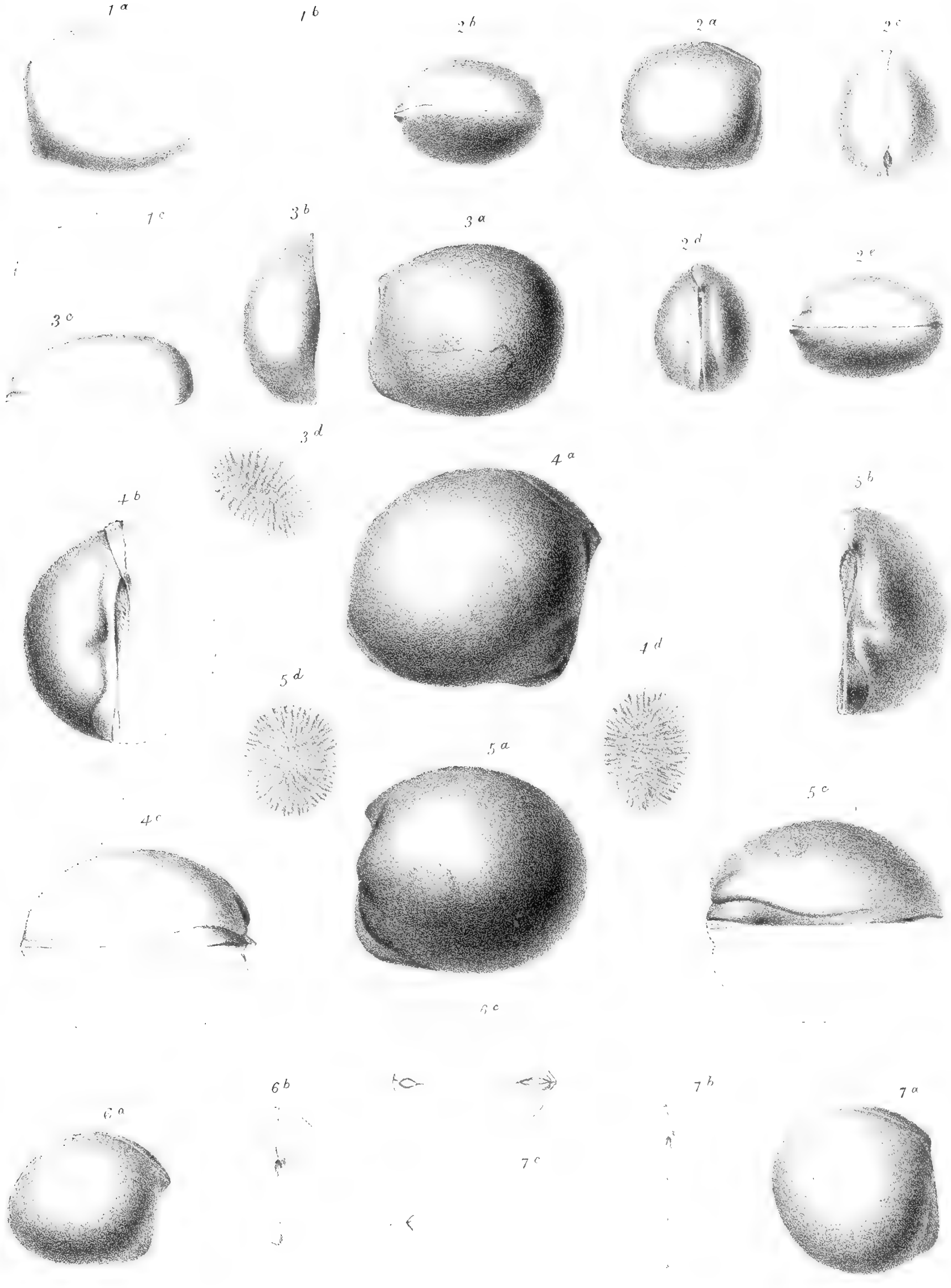
6 *a—c*. *Entomoconchus Scouleri*. Small male (?) shell. From Bolland. (Page 51.)

a, Profile, showing right valve; *b*, front-view; *c*, ventral. Magnified $2\frac{1}{2}$ diameters.

7 *a—c*. *Entomoconchus orbicularis*, sp. nov. From Little Island, Cork. (Page 52.)

a, Profile, showing right valve; *b*, front-view; *c*, dorsal view. Magnified $2\frac{1}{2}$ diameters.

Pl. I



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CARBONIFEROUS ENTOMOSTRACA

PLATE II.

FIG.

1 *a—c.* *Polycope simplex*, Jones & Kirkby. Magnified 8 diameters. (Page 54.)
a, Left valve; *b*, end-view; *c*, edge-view. Retaining a film of shell. Carluke.

2 *a—c.* *Polycope Burrovii*, sp. nov. Magnified 4 diameters. (Page 54.)
a, Left valve; *b*, end-view; *c*, edge-view. Cast. Settle.

3 *a—e.* *Cypridina scoriacea*, J. & K. Shell. Carluke. (Page 20.)
a, Left valve; *b*, end-view; *c*, edge-view; magnified 4 diameters. *d*, Reticulated ornament near the centre; *e*, reticulated ornament near the margin; both magnified 18 diameters.

4 *a—c.* *Cypridina Phillipsiana*, Jones. With filmy remnant of shell. Carluke. (Page 18.)
a, Right valve; *b*, end-view; *c*, edge-view. Magnified 4 diameters.

5. *Cypridina Phillipsiana*, Jones. Part of the shell on a cast. Left valve. Magnified 4 diameters, Carluke. (Page 18.)

6 *a—c.* *Offa Barrandiana*, sp. nov. Shell. Cork. (Page 53.)
a, Left valve; *b*, front end-view; *c*, edge-view. Magnified 4 diameters.

7 *a—c.* *Cypridinella superciliosa*, sp. nov. Shell. Cork. (P. 22.)
a, Right valve; *b*, end-view; *c*, edge-view. Magnified 4 diameters. [The breast, or antero-ventral border, is imperfect.]

8 *a—c.* *Cypridina Thomsoniana*, J. & K. Shell. Gare. (Page 19.)
a, Right valve [slightly crushed at the notch]; *b*, hinder end-view; *c*, edge-view. Magnified 4 diameters. N.B.—The pitted ornament should have been continued all over the surface.

9 *a—c.* *Cypridina Phillipsiana*, Jones. Partly shell on cast. Carluke. (Page 18.)
a, Right valve; *b*, front end; *c*, ventral edge. Magnified 4 diameters.

10. *Polycope simplex*, J. & K. Shell. Cork. Right valve. Magnified 4 diameters. (Page 54.)

11 *a—c.* *Cypridina Youngiana*, J. & K. Cast. Gare. (Page 17.)
a, Left valve; *b*, front end; *c*, edge-view. Magnified 4 diameters.

12. *Polycope simplex*, J. & K. Cast. Meath. Right valve. Magnified 4 diameters. (Page 54.)

13 *a—c.* *Cypridina Bradyana*, sp. nov. Shell. Cork. (Page 15.)
a, Right valve; *b*, front end; *c*, edge-view. Magnified 4 diameters.

14 *a—c.* *Cypridina Wrightiana*, sp. nov. Shell. Cork. (Page 14.)
a, Left valve; *b*, front end; *c*, edge-view. Magnified 4 diameters.

15 *a—c.* *Cypridina brevimentum*, sp. nov. Shell. Cork. (Page 16.)
a, Left valve; *b*, end-view; *c*, edge-view. Magnified 4 diameters.

16 *a—c.* *Cypridina brevimentum*, sp. nov. Shell. Cork. (Page 16.)
a, Left valve; *b*, front end; *c*, edge-view. Magnified 4 diameters.

17. *Cypridina brevimentum*, sp. nov. Shell. Cork. Left valve. Magnified 4 diameters. (Page 16.)

18 *a—c.* *Cypridina brevimentum*, sp. nov. Shell. Park Hill, Longnor. (Page 16.)
a, Left valve; *b*, end view; *c*, ventral edge. Magnified 4 diameters.

19 *a—c.* *Cypridina brevimentum*, sp. nov. Film of shell on cast. Park Hill, Longnor. (Page 16.)
a, Right valve (the beak is rather sharper than in the drawing); *b*, front edge; *c*, edge-view.

20 *a—c.* *Cypridina Grossartiana*, J. & K. Carapace. Carluke. (Page 17.)
a, Showing the left valve; *b*, end-view; *c*, ventral aspect. Magnified 4 diameters.

21. *Bradycinetus Rankinianus*, J. & K. Shell on cast. Gare. Right valve. Magnified 4 diameters. (Page 42.)

22 *a—c.* *Bradycinetus Rankinianus*, J. & K. Carapace. Gare. (Page 42).
a, Right valve shown; *b*, ventral aspect (*a* & *b*, magnified 4 diameters); *c*, reticulate surface ornament; magnified 18 diameters.

23 *a—c.* *Cypridinella Cummingii*, sp. nov. Cast. Isle of Man. (Page 21.)
a, Left valve; *b*, end-view; *c*, edge-view. Magnified 4 diameters.

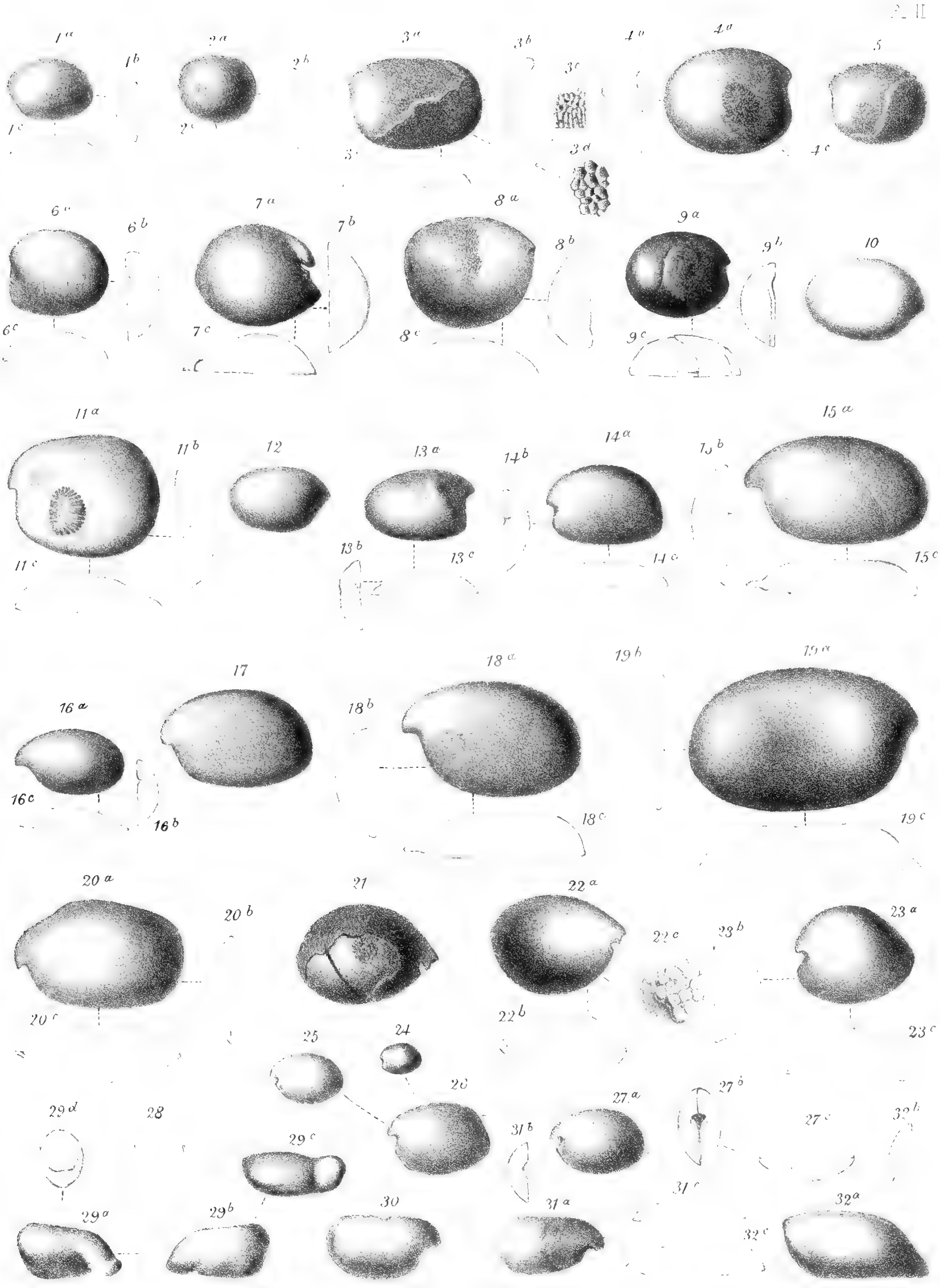
24—27 *a—c.* *Cypridina primæva*, M'Coy. Shells. Braidwood. Left valves and profiles. Magnified 4 diameters. (Page 12.)

28. *Cypridina primæva*, M'Coy. Cast. Permian limestone; Sunderland. Right valve. Magnified 4 diameters. (Page 13.)

29. Rolled fragment, figured by mistake. Cork. Magnified 4 diameters.

30, 31 *a—c.* *Philomedes* (?) *Bairdiana*, sp. nov. Shells. Cork. Right valves and profiles. Magnified 4 diameters. (Page 43.)

32 *a—c.* *Rhombina Hibernica*, sp. nov. Shell. Cork. (Page 44.)
a, Left valve (figured with the ventral edge upwards); *b*, end-view; *c*, ventral aspect. Magnified 4 diameters.



J.W.K., T.R.J., & G.W. del.

George West lith.

CARBONIFEROUS ENTOMOSTRACA

PLATE III.

FIG.

1 *a, b.* *Cypridinella monitor,* sp. nov. Cast. Visé. (Page 24.)
a, Left valve seen; *b,* dorsal aspect. Magnified 4 diameters.

2 *a—c.* *Cypridellina clausa,* sp. nov. Cast of carapace; imperfect at anterior extremity. Cork. (Page 27.)
a, Right valve; *b,* ventral aspect; *c,* posterior aspect. Magnified 4 diameters.

3 *a—c.* *Cypridinella clausa,* sp. nov. Cast of carapace, somewhat broken at both ends. Cork. (Page 23.)
a, Right valve shown; *b,* ventral aspect; *c,* anterior aspect. Magnified 4 diameters.

4 *a—e.* *Cypridellina Burrovii,* sp. nov. Cast of carapace. Settle. (Page 27.)
a, Right valve shown (the beak should be rather more definite); *b,* ventral aspect; *c,* dorsal aspect; *d,* posterior view; *e,* anterior aspect. Magnified 4 diameters.

5 *a—c.* *Cypridellina Burrovii,* sp. nov. Shell partially preserved on cast of carapace. Settle. (Page 28.)
a, Left valve shown (the beak is broken); *b,* ventral aspect; *c,* hinder end. Magnified 4 diameters.

6 *a—c.* *Cypridinella Bosqueti,* sp. nov. Cast of carapace. Visé. (Page 23.)
a, Left valve seen; *b,* dorsal aspect; *c,* front-view. Magnified 4 diameters.

7 *a—c.* *Cypridellina vomer,* sp. nov. Shell. Cork. (Page 25.)
a, Right valve; *b,* front-view; *c,* edge-view. Magnified 4 diameters.

8. *Cypridellina Burrovii* var. *Longnoriensis,* nov. Shell. Longnor, Derbyshire. Outline of the right valve. (Page 28.)

9 *a—c.* *Cypridellina elongata,* sp. nov., var. *Hibernica,* nov. Carapace. Cork. (Page 29.)
a, Left valve shown; *b,* ventral aspect; *c,* front aspect. Magnified 4 diameters.

10 *a—c.* *Cypridellina vomer,* var. *cultrata,* nov. Shell. Cork. (Page 30.)
a, Right valve; *b,* end-view; *c,* edge-view. Magnified 4 diameters.

11 *a—c.* *Cypridinella vomer,* sp. nov. Cast with remnant of shell. Cork. (Page 25.)
a, Right valve; *b,* front-view; *c,* edge-view. Magnified 4 diameters.

12 *a—c.* *Cypridella obsoleta,* sp. nov. Carapace, with shell reduced by weathering. Cork. (Page 34.)
a, Right valve shown; *b,* ventral aspect; *c,* front-view. Magnified 4 diameters.

13 *a, b.* *Cypridinella Maccoyiana,* sp. nov. Carapace. Cork. (Page 24.)
a, Right valve shown; *b,* front-view. Magnified 4 diameters.

14 *a—c.* *Cypridella Koninckiana,* Jones. Shell. Cork. (Page 34.)
a, Right valve; *b,* ventral aspect; *c,* front-view. Magnified 4 diameters.

15 *a, b.* *Cypridellina alta,* sp. nov. Carapace. Cork. (Page 31.)
a, Right valve shown; *b,* front-view. Magnified 4 diameters.

16 *a, b.* *Cypridella Koninckiana,* Jones. Shell. Cork. (Page 34.)
a, Right valve; *b,* ventral view. Magnified 4 diameters.

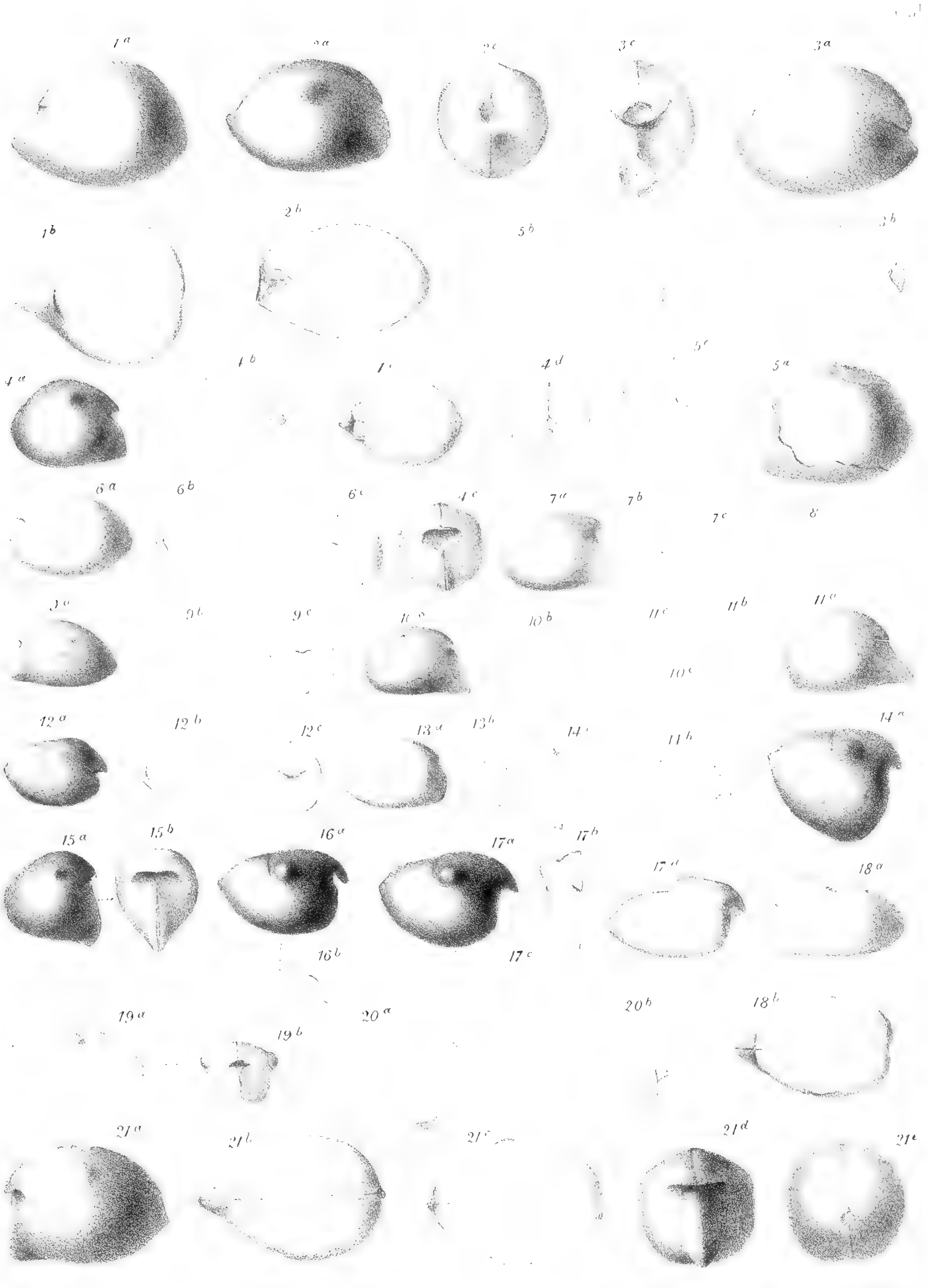
17 *a—d.* *Cypridella Koninckiana,* Jones. Shell. Cork. (Page 34.)
a, Right valve; *b,* end-view; *c,* ventral aspect; *d,* three-quarters view of valve obliquely placed, for comparison with other figures, as Pl. IV, fig. 6 *a.* Magnified 4 diameters.

18 *a, b.* *Cypridellina elongata,* sp. nov. Cast of carapace. Visé. (Page 29.)
a, Showing left valve; *b,* dorsal aspect. Magnified 4 diameters.

19 *a, b.* *Cypridellina elongata,* sp. nov. Cast of carapace. Visé. (Page 29).
a, Showing left valve; *b,* front-view. Magnified 4 diameters.

20 *a, b.* *Cypridellina Bosqueti,* sp. nov. Cast of carapace. Visé. (Page 31.)
a, Showing right valve (the beak should be distinct, in a line with the tubercle); *b,* dorsal view (the anterior protuberance is an error). Magnified 4 diameters.

21 *a—e.* *Cypridellina Burrovii,* sp. nov. Cast of carapace. Settle. (Page 27.)
a, Showing left valve; *b,* ventral aspect; *c,* dorsal aspect; *d,* front-view; *e,* back-view. Magnified 4 diameters.



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CARBONIFEROUS ENTOMOSTRACA

PLATE IV.

FIG.

1 *a—c.* *Cypridella Wrightii*, sp. nov. Carapace. Cork. (Page 34.)
a, Left valve shown; *b*, dorsal aspect; *c*, front-view. Magnified 8 diameters.

2 *a—c.* *Cypridella quadrata*, sp. nov. Cast of carapace. Visé. (Page 35.)
a, Right valve seen (the transverse furrow is not well shown, nor the lateral indentation under the beak); *b*, front-view; *c*, dorsal-view (dorsal furrow not shown). Magnified 4 diameters.

3 *a—c.* *Cypridellina galea*, sp. nov. Shell. Cork. (Page 30.)
a, Left valve; *b*, front edge; *c*, ventral edge. Magnified 4 diameters.

4 *a—c.* *Cypridella Edwardsiana*, De Koninck, var. *septentrionalis*, nov. Shell. Cork. (Page 32.)
a, Right valve; *b*, front-view; *c*, dorsal edge. Magnified 4 diameters.

5 *a—c.* *Sulcuna cuniculus*, sp. nov. Shell. Cork. (Page 37.)
a, Left valve (antero-dorsal region is buried in the stone); *b*, end-view; *c*, edge-view. Magnified 4 diameters.

6 *a, b.* *Sulcuna lepus*, sp. nov. Shell. Cork. (Page 36.)
a, Right valve; *b*, end-view. Magnified 4 diameters.

7 *a—c.* *Sulcuna lepus*, sp. nov. Shell. Cork. (Page 36.)
a, Right valve (anterior end partially imbedded); *b*, end-view; *c*, edge-view. Magnified 4 diameters.

8 *a—c.* *Sulcuna cuniculus*, sp. nov. Shell. Cork. (Page 37.)
a, Right valve; *b*, end-view; *c*, edge-view. Magnified 4 diameters.

9 *a—c.* *Cypridellina cyprelloides*, sp. nov. Shell. Cork. (Page 36.)
a, Left valve; *b*, front end; *c*, edge-view. Magnified 4 diameters.

10 *a—c.* *Cyprella chrysalidea*, De Koninck, var. *subannulata*, nov. Shell. Settle. (Page 38.)
a, Left valve; *b*, ventral view; *c*, front edge. Magnified 4 diameters.

11 *a—c.* *Cyprella chrysalidea*, De Koninck, var. *subannulata*, nov. Shell. Cork. (Page 39.)
a, Right valve; *b*, front aspect; *c*, ventral aspect. Magnified 4 diameters.

12 *a, b.* *Cyprella annulata* (De Koninck). Shell. Cork. (Page 40.)
a, Right valve, magnified 4 diameters. *b*, Reticulate ornament, magnified 20 diameters).

13 *a, b.* *Cyprella annulata* (De Koninck). Shell. Settle. (Page 41.)
a, Left valve; *b*, front-view. Magnified 4 diameters.

14 *a, b.* *Cyprella chrysalidea*, De Koninck. Cast of carapace. Visé. (Page 38.)
a, Showing left valve; *b*, dorsal view of both valves, open. Magnified 4 diameters.

15. *Cyprella chrysalidea*, De Koninck. Cast of the left valve; imperfect. Visé. Magnified 4 diameters. (Page 38.)

16 *a—c.* *Cyprella chrysalidea*, De Koninck. Shell. Settle. (Page 39.)
a, Right valve; *b*, front-view; *c*, edge-view. Magnified 4 diameters.

17 *a—c.* *Cyprella annulata* (De Koninck). Shell. Cork. (Page 40.)
a, Left valve; *b*, front edge; *c*, ventral edge. Magnified 4 diameters.

18 *a, b.* *Cyprella chrysalidea*, De Koninck. Compressed cast of carapace. Visé. (Page 38.)
a, Right valve (the outline of hood and tubercle not indicated); *b*, front-view.

19 *a—d.* *Entomis obscura*, sp. nov. Worn shell. Cork.
a, Right valve, magnified 4 diameters. *b*, The same, magnified 8 diameters. *c & d*, end-view and edge-view, magnified 8 diameters.

20 *a—c.* *Entomis Koninckiana*, sp. nov. Shell. Settle.
a, Right valve, somewhat imperfect at the antero-dorsal corner; *b*, end-view; *c*, ventral aspect. Magnified 4 diameters.

21 *a—c.* *Entomis Burrovii*, sp. nov. Shell. Settle.
a, Left valve; *b*, dorsal view; *c*, end-view. Magnified 4 diameters.

22. *Entomis concentrica* (De Koninck). Carapace. Visé. Dorsal aspect in outline. Magnified 4 diameters.

23 *a, b.* *Entomis biconcentrica*, Jones. Carapace. Cork.
a, Dorsal aspect, in outline; *b*, end-view of the same open carapace, in outline. Magnified 4 diameters.

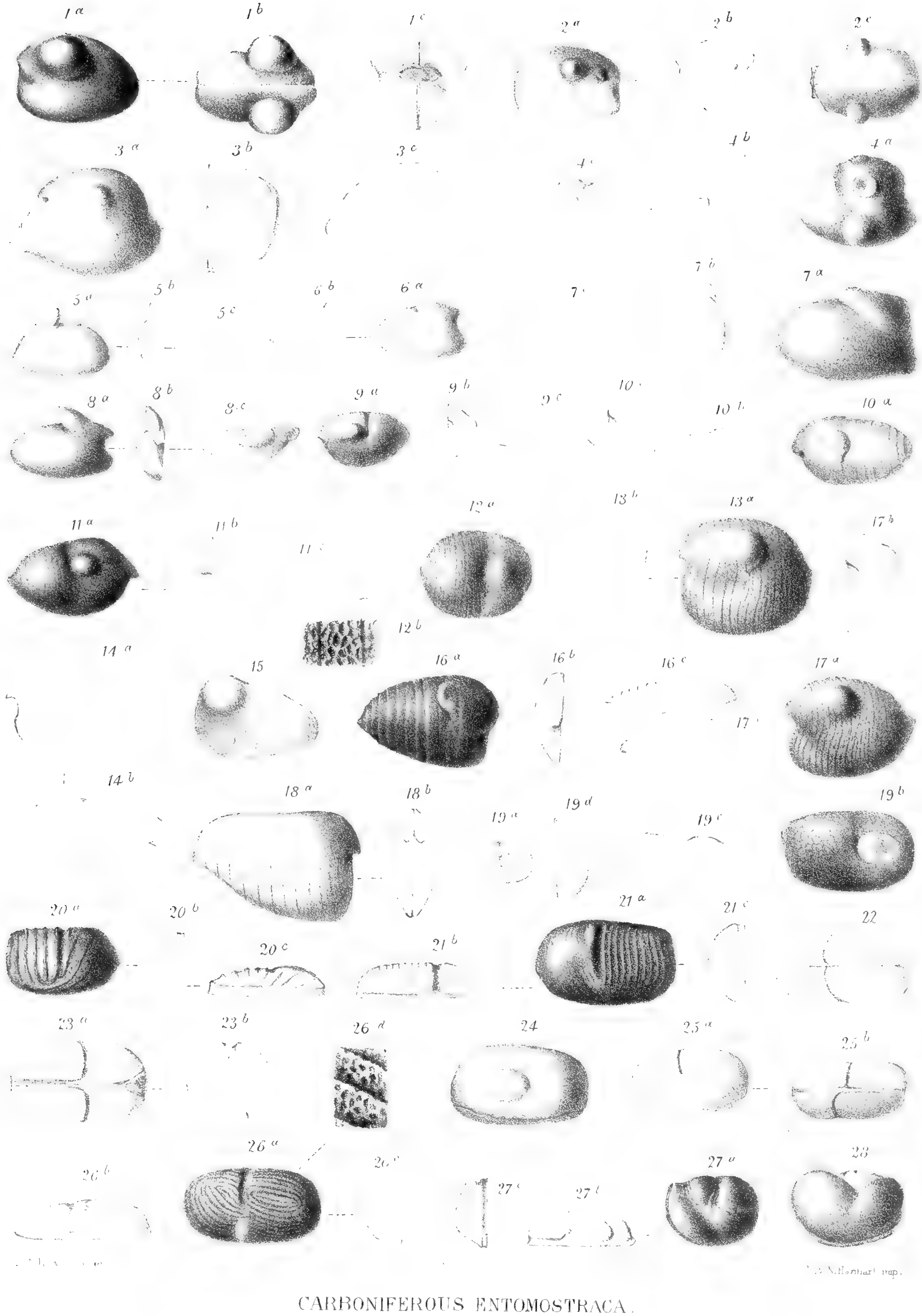
24. *Entomis obscura*, sp. nov. Cast. Settle. Right valve. Magnified 4 diameters.

25 *a, b.* *Entomis concentrica* (De Koninck). Cast of carapace. Visé.
a, Left side; *b*, dorsal view. Magnified 4 diameters.

26 *a—d.* *Entomis biconcentrica*, Jones. Shell. Cork.
a, Left valve; *b*, edge-view; *c*, end-view; *a, b, c*, magnified 4 diameters. *d*, Reticulate and ridged surface; magnified 25 diameters.

27 *a—c.* *Beyrichia gigantea*, sp. nov. Shell partly preserved on cast. Longnor, Derbyshire.
a, Left valve; *b*, edge-view; *c*, end-view. Magnified 4 diameters.

28. *Beyrichia gigantea*, sp. nov. Shell. Cork. Right valve. Magnified 4 diameters.



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CARBONIFEROUS ENTOMOSTRACA.

PLATE V.

1 *a—d.* *Polycope simplex*, Jones & Kirkby. Shells. Braidwood. Carluke. (Page 55).
a, Left valve; *b*, edge-view; *c*, left valve of a smaller specimen; magnified 8 diameters. *d*, Part of surface; magnified 40 diameters.

2 *a—f.* *Polycope Youngiana*, sp. nov. Shell represented by pyrites. Campsie. (Page 56.)
a, Left valve; *b*, edge-view of carapace; *c*, end-view; magnified 8 diameters. *d, e, f*, Portions of the surface; magnified 40 diameters.

3 *a—c.* *Cypridina Hunteriana*, sp. nov. Cast. Braidwood. (Page 18.)
a, Left valve; *b*, front end of carapace; *c*, edge-view,

4\. *Cypridina Thompsoniana*, sp. nov. Gare. Portion of the surface, highly magnified. (Page 19.)

5\. *Bradycinetus Rankinianus*, J. & K. Gare. The beak, magnified. (Page 42.)

6 *a—f.* *Cypridina radiata*, sp. nov. Shells. Airdrie. (Page 14.)
a, Left valve; *b*, edge-view; *c*, end-view; magnified 4 diameters. *d* & *e*, Portions of shell; magnified 40 diameters. *f*, A right valve, misshapen by pressure, and showing the layers of shell; magnified 8 diameters.

7 *a—d.* *Cypridinella superciliosa*, sp. nov. Shell. Bathgate. (Page 22.)
a, Right valve; *b*, ventral edge of valve; *c*, front view of carapace; magnified 4 diameters. *d*, Superficial markings; magnified 40 diameters.

8 *a—c.* *Cypridellina intermedia*, sp. nov. Shell. Bathgate. (Page 29.)
a, Left valve; *b*, edge-view; *c*, end-view. Magnified 4 diameters.

9 *a—c.* *Cypridina pruniformis*, sp. nov. Cast. Limerick? (Page 19.)
a, Right valve; *b*, ventral; *c*, front. Magnified 4 diameters.

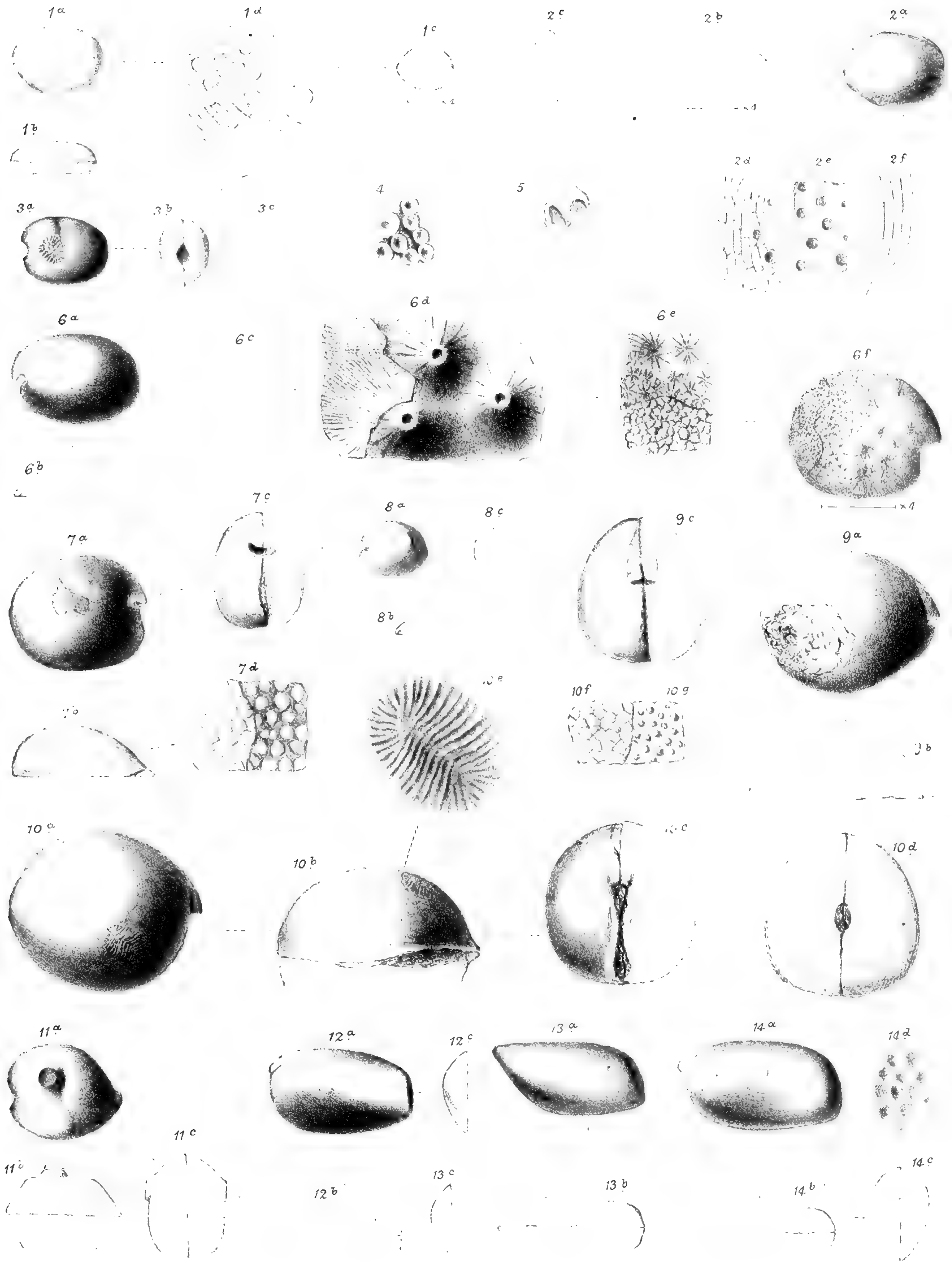
10 *a—g.* *Entomoconchus globosus*, sp. nov. Shell. West Broadstone, Beith, Ayrshire. (Page 52.)
a, Right valve; *b*, ventral aspect; *c*, front-view; *d*, posterior; magnified 4 diameters. *e*, Muscle-spot; magnified $2\frac{1}{2}$ diameters. *f* & *g*, Parts of surface; magnified 40 diameters.

11 *a—c.* *Cypridella Edwardsiana* (De Koninck), var. *septentrionalis*, nov. Shell. Beith, Ayrshire. (Page 33.)
a, Left valve; *b*, edge-view; *c*, end-view. Magnified 8 diameters.

12 *a—c.* *Cypridina oblonga*, sp. nov. Shell. Cork. (Page 20.)
a, Left valve; *b*, edge-view; *c*, end-view. Magnified 4 diameters.

13 *a—c.* *Rhombina Hibernica*, sp. nov. Shell. Cork. (Page 44.)
a, Left valve; *b*, edge-view; *c*, end-view. Magnified 4 diameters.

14 *a—d.* *Rhombina Belgica*, sp. nov. Shell. Visé, Belgium. (Page 44.)
a, Left valve; *b*, edge-view; *c*, end-view; magnified 4 diameters. *d*, Superficial markings; magnified 40 diameters.



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Carboniferous Entomostraca

THE

PALÆONTOGRAPHICAL SOCIETY.

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LONDON:

MDCCCLXXIV.

A MONOGRAPH

OF THE

BRITISH FOSSIL TRIGONIÆ.

BY

JOHN LYCETT, L.R.C.P.E., &c.

No. II.

Pages 53—92; Plates X—XIX.

LONDON:

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1874.

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Trigonia Williamsoni, *Lycett*, sp. nov. Plate XVI, fig. 8.

Shell ovately oblong, lengthened, depressed; umbones sub-anterior, not much elevated, obtuse, not recurved; anterior side short, its border somewhat truncated, curved elliptically at its base with the lengthened lower border; superior border nearly straight, or slightly convex, sloping downwards, its extremity rounded with the posteal termination of the lower border. Area narrow and flattened, bounded by two faintly traced, minutely tuberculated carinæ; there is also a similar, rather obscure, line of tubercles indicating the position of a median carina; there are also delicately marked, transverse, plications of growth, which become more prominent posteally. The escutcheon is flattened or slightly excavated, and has great length; it is narrow, in conformity with the area. The other portion of the valve has about ten or eleven oblique, or slightly curved rows of large depressed, nodose varices; the first-formed three or four rows form separate nodes, but with some irregularity and inequality in their arrangement; the succeeding rows have the nodes very large, confluent, and depressed near to the angle of the valve, becoming rapidly small, attenuated, and irregular, near to the pallial border. The lines of growth are strongly defined over the whole of the valve.

This is one of the most depressed forms of the *Clavellatæ;* it possesses some general resemblance to *T. triquetra,* but is more depressed, and more lengthened; the posteal portion is wider and more rounded; its rows of nodose varices are also much more oblique. From *T. clavellata* it is distinguished by the very short anterior side, by the narrower area and escutcheon, by the general depression of the valves, and by the few broad, irregular, confluent nodes at the carinal extremities of the rows.

The name is intended as a trifling tribute to reminiscences of the earlier geological researches of Professor W. C. Williamson, F.R.S., of Owen's College, Manchester, and of his description of the locality whence the examples of this Trigonia have been obtained.[1]

Stratigraphical position and Localities. The Kelloway Rock, of Cayton Bay, near Scarborough. The matrix is a very hard, variable, grey, or sometimes whitish, siliceous rock in the lower portion of that stage; the valves of conchifera occur in abundance, but owing to the very intractable kind of rock, few are separated in good condition; associated with it are numerous valves of *Trigonia Rupellensis. T. Williamsoni* appears to be rare, only two examples have come under my notice; it is intended to figure a more perfect specimen upon the last plate of this Monograph.

[1] "On the Distribution of Organic Remains upon the Yorkshire Coast." 'Trans. Geol. Soc.,' 2 ser., vol. vi, p. 143; 1838.

§ III. Undulatæ.

Trigonia angulata, *Sow.* Plate XIV, figs. 5, 6.

Trigonia angulata, *Sowerby.* Mineral Conchology, 1826, pl. 508, fig. 1.
— angulosa, *Agassiz.* Trigonies, 1840, p. 9.
— angulata, *Ib.* Trigonies, 1840, p. 50.
— — *Roemer,* Versteinerungen, Oolith, 1836, p. 96.
— — *Morris.* Catal., 1854, p. 228.
— — *D'Orbigny.* Prodrome de Paléont., 1850, i, p. 308, No. 223.
— — *Lycett.* Inf. Ool. Trigonias, Ann. and Mag. Nat. Hist., 1850, p. 427.

Taking the figure in the 'Mineral Conchology' as representing the typical form, obtained from the Upper Ragstones of the Inferior Oolite at Nunney, near Frome, the following will serve for its description:

Shell sub-ovately elongated, convex; umbones obtuse, antero-mesial, much incurved and slightly recurved; anterior side much produced and rounded with considerable convexity; lower border lengthened, nearly straight, but with a slight undulation or excavation posteally; hinge-border lengthened, concave, sloping towards the more produced and narrow posteal extremity of the area, with which it forms a considerable angle. Escutcheon moderately wide, depressed, and concave. Area narrow and flattened, with two very small, but well-defined, bounding carinæ, and in some specimens there is an obscure line of minute tubercles bordering upon the median furrow, which is usually distinct; the bounding carinæ are also minutely tuberculated upon their upper portions, they have always much curvature; the area has transverse irregular plications, near to the apices these become distinct, regular costellæ. The sides of the valves have upon their anteal portions a few narrow, inconspicuous, sub-tuberculated costæ, which are directed obliquely downwards to the middle of the valve, but not in the direction of the lines of growth; they form a curve or undulation, the convex border of which is directed towards the marginal carina; for the most part their posteal extremities are bent suddenly upwards or united to a larger nodulous series of costæ or varices, which approach the carina at a considerable angle, and the few lower costæ approach it almost perpendicularly; these are scarcely so numerous as the anteal series. The first-formed five or six costæ are without undulation, or are nearly concentric; all are slightly nodulous. The larger example figured has some variability in its costæ, which, however, does not entitle it to be considered as a distinct variety. The few last-formed costæ are irregular or confusedly nodulous, and the larger or posteal costæ disappear in their course upwards, leaving a smooth, plain, and depressed space separating them from the carina.

The first of the two figures of *T. undulata*, From., given by Agassiz ('Trigonies,' pl. 6, fig. 1), has been quoted by D'Orbigny and by Oppel as a synonym of *T. angulata;* in this opinion I cannot concur, the large varices upon the marginal and inner carinæ, together with the considerable breadth of the area, appear clearly to separate the Swiss Great Oolite fossil. The second example of *T. undulata* ('Trigonies,' pl. 10, fig. 14) is another equally distinct species, and still more removed from *T. angulata.*

The authors above quoted appear to have had little confidence in the figure of *T. angulata* given in the 'Mineral Conchology,' which, although rudely engraved, is really a good drawing and faithfully renders the characters of the species in a small specimen.

T. angulata has more or less affinities with all the species of the *Undulatæ:* for distinctive differences the reader is referred to the descriptions of the numerous forms depicted upon Plates X to XVI inclusive.

Stratigraphical position and Localities. *T. angulata* has occurred in the Inferior Oolite of Nunney, near Frome, whence the type-specimen, associated with *Astarte elegans,* was obtained; Dundry, in the same county, is another locality. I have obtained it at various Gloucestershire localities in the Oolite-marl and in the Upper Grit-stones of the same formation in the Cotteswold Hills, but the entire number of examples which have come under my notice are inconsiderable, and no evidence has been obtained connecting the species with the southern portion of Somersetshire, or of Dorsetshire; it also appears to be absent throughout the long course of the Inferior Oolite in Oxfordshire, Northamptonshire, Bedfordshire, Lincolnshire, and Yorkshire. Upon the whole, therefore, it may be regarded as a rare species.

In France *T. angulata* has been described by Oppel ('Juraformation,' p. 485) as a species of the Cornbrash at Marquise, near Boulogne; some fine specimens from that formation and locality attributed to our species have been found upon examination to be *T. flecta.* D'Orbigny ('Prodrome,' 1, p. 308) places our species in his Étage 11, Bathonien. Rœmer ('Nordd. Oolith.,' p. 96) records the occurrence of *T. angulata* in the Dogger of Porta Westphalica.

Trigonia flecta, *Mor.* and *Lyc.* Plate XIV, figs. 7, 8, 9, 10.

Trigonia angulata, *D'Orbigny.* Prodrome de Paléont., 1850, vol. i, p. 308.
— plecta, *Mor.* and *Lyc.* Monogr. Gr. Ool., Pal. Soc., 1853, p. 60, pl. v, fig. 20.
— — *Morris.* Catal., 1854, p. 228.
— angulata, *Oppel.* Juraformation, 1857, p. 485, No. 45.

Shell sub-ovate, or ovately oblong, somewhat depressed; umbones antero-mesial, with little prominence, erect, or in other examples slightly recurved; anterior side moderately produced, its border curved elliptically with the lower border; hinge-border lengthened with some concavity, or in other instances nearly straight, sloping obliquely downwards; its length is nearly equal to twice that of the posteal border of the area, with which it forms a considerable angle. Escutcheon lengthened, much excavated, but having its superior border raised. Area of moderate breadth, concave immediately beneath the apex, but expanded and flattened posteally; it has regular, transverse, prominent plications, which become costellæ near to the apex; there is a well-marked mesial furrow; the bounding carinæ are small, but elevated and distinct; they have small, closely arranged, ovate tubercles or varices throughout their entire length; there is no median carina. The other portion of the valve has the rows of costæ rather numerous (about sixteen) anteally; they are plain, narrow, depressed, and horizontal, or are directed slightly downwards to about the middle of the valve, where they enlarge, form two or three nodose varices, and, curving gracefully upwards, become again suddenly attenuated, and meet the marginal carina at a considerable angle; in some instances, as in fig. 9, the costæ become broken mesially, and form an imperfect angle with their posteal portions. In adult specimens two or three of the last-formed anteal costæ coincide in their direction with the lines of growth; they therefore take the direction of the lower border, which is without any undulation, as in *T. angulata;* the anteal costæ are always somewhat more numerous than the others.

Affinities. The nearest ally is *T. angulata,* compared with which it is more depressed both anteally and mesially; its posteal portion is more expanded, and its lower border is destitute of the posteal undulation of that species; its costæ are also more numerous anteally, and do not form a distinct undulation or double curvature upon the middle of the valve, so that their general direction accords more nearly with the lines of growth; their posteal portions are also larger and broader.

T. Painei, another species of the Great Oolite, has also considerable affinities with our species; the latter has the form more lengthened posteally, the umbones are less produced, and are more anteal; the costæ are more numerous; its area more especially differs in having delicately tuberculated carinæ and a rugose plicated surface.

T. paucicosta, of the Kelloway Rock, has greater general convexity, and its area, with the peculiarity of its few, large, widely separated tubercles upon its carinæ, will readily be distinguished.

The young shells of *T. flecta* offer little that is distinctive from specimens of similar size pertaining to *T. angulata* and *T. Painei;* the transverse costellæ upon the area are, however, smaller than in the last-named species; compared with *T. paucicosta* their general ornamentation is much less conspicuous, more especially upon their carinæ.

The largest of our specimens has the length of 23 lines, height $19\frac{1}{2}$ lines, diameter through the united valves 10 lines.

Stratigraphical position and Localities. *T. flecta* appears to be a somewhat rare species;

when figured and described in the 'Monograph of the Great Oolite Mollusca,' published by the Palæontographical Society in 1853, it was only known as a British species from a single specimen indifferently preserved, and not sufficiently exhibiting the characteristic features; it was obtained at Trewsbury Quarry, in Forest Marble, near to the Tetbury Road Station of the Great Western Railway, near to Cirencester. More recently the Rev. J. E. Cross has obtained fine examples in the upper subdivision of the Great Oolite at Thornholm, near to the Village of Appleby, Lincolnshire; to the liberality of that gentleman I am indebted for the specimens now figured. Mr. Cunnington has also kindly forwarded to me four specimens from the Cornbrash of Hilperton, near Trowbridge; Hinton, in the same county, is another locality.

Fine examples of *T. flecta* have also been obtained in the Great Oolite of Marquise, near to Boulogne; they constitute the *T. angulata* of D'Orbigny and of Oppel.

Trigonia paucicosta, *Lycett*, sp. nov. Plate XI, figs. 8, 9; Plate XVI, fig. 7.

Shell ovately oblong, convex; umbones moderately elevated, antero-mesial, and recurved; anterior side rather short, its border curved; lower border much more lengthened, with a lesser curvature; superior border lengthened, somewhat concave, sloping obliquely, forming a conspicuous angle with the posteal border of the area. Escutcheon narrow, slightly depressed, its superior border somewhat raised. Area narrow, flattened, divided by a mesial furrow, bordered by a minute row of tubercles, bounded by two small distinct carinæ, which have each a row of tubercles; those of the marginal carina are large, regular, widely separated, and somewhat compressed by the lines of growth, they become evanescent upon the posteal half of the valve in specimens of advanced growth, upon which portion the surface has conspicuous irregular transverse plications; in the young shell the area has a few plain transverse costellæ. The costæ upon the other portion of the surface consist at first, of three or four narrow, elevated, plain, somewhat angulated ridges, which become, near to the carina, sub-tuberculated; subsequently they form two series, the anteal series are narrow, distinctly ridged, irregularly knotted or sub-tuberculated, they are nearly straight, and pass obliquely downwards to the middle of the valve, when they meet with a much larger, less numerous, posteal series of nodose varices; this posteal series turns upwards suddenly at a considerable angle to the anteal series, towards the carina, from which the varices are well separated, and with which they form right angles. In adult forms the lower portion of the valve has the anteal costæ more irregular, and the junction of the two series is less angulated or more obscure; the whole aspect becomes influenced by the folds of growth which are conspicuous. Some specimens which scarcely constitute a distinct variety have the costæ, both anteal and posteal, plain; the posteal series, however, are usually slightly nodulous.

T. paucicosta is nearly allied to *T. angulata*, Sow., but has a much shorter anteal, and more lengthened posteal side; the ornamentation of the area is much larger, especially the tubercles upon the marginal carina, the few larger nodes upon the posteal series of varices are different to the small tubercular rows of *T. angulata;* the angles which the rows form at the middle of the valves are also distinct from the curvature or undulation of *T. angulata.* Another allied form is *T. undulata*, Fromherz (Agassiz, 'Trigonies,' pl. x, fig. 4), also a specimen figured under the same name (pl. vi, fig. 1); the description refers only to the former of the two specimens, which has the varices, both anteal and posteal, equal in size, and united mesially; the marginal carina has unusual prominence. The specimen, pl. vi, fig. 1, may possibly be identical with our *T. paucicosta*, but it appears to have undergone compression, and is therefore scarcely to be relied upon; should its identity with our species be eventually established, the name I have chosen may remain, as it is sufficiently distinct from the typical form figured by Agassiz, which may be regarded as the true *T. undulata* ('Trig.,' pl. 10, fig. 4).

For comparison with *T. flecta*, another allied species, the reader is referred to that shell.

The specimens selected for our figures sufficiently exemplify the general variability of the species, and also the changes of aspect produced by advance of growth; usually examples of very advanced growth are more imperfectly preserved, and are therefore less fitted to exemplify the species.

There is so much variability, both in the figure and ornamentation, that measurements of proportions have but little utility, descriptions also must, to some extent, be subordinate to figures in conveying correct or sufficient ideas of its several aspects.

Stratigraphical position and Localities. Hitherto *T. paucicosta* has been obtained only in the Kelloway Rock, of Cayton Bay, three miles to the southward of Scarborough. Numerous specimens in various stages of growth occur in the higher beds of the formation at that locality, in hard, brownish, sub-siliceous rock, occupying a thickness of eight feet, and associated with a multitude of the characteristic Ammonites of the formation. Other beds, six feet or more, separate it from certain lower hard beds, mostly of pale grey colour, which yield *Trigonia Rupellensis* in considerable numbers, even down to the dark clay which separates it from the Cornbrash. (The discovery of numerous examples of the latter species having occurred since page 28 was printed, I take the present opportunity of mentioning that it is intended to give additional illustrations of it upon the last plate of the present Monograph.) The entire thickness of Kelloway Rock at Cayton Bay, and beneath the adjacent Red Cliff does not exceed twenty-five feet, the section of the same formation to the northward of Scarborough Castle is upwards of three times that thickness, including a portion of the highest beds removed for foundations of houses. These excavations produced the finest

Ammonites of the formation in the collection made by Mr. Leckenby, now in the Woodwardian Museum, Cambridge, including the specimens figured in the plates accompanying his memoir on the Kelloway Rock of Yorkshire (' Quart. Jour. Geol. Soc.,' 1858, vol. xv); but no example of *Trigonia paucicosta* has occurred at that locality.

TRIGONIA PAINEI, *Lyc.* Pl. XII, figs. 2, 3, 4, 5.

TRIGONIA GOLDFUSSII, *Morris* and *Lycett.* Monog. Moll. Gr. Ool., Pal. Soc., 1853, Bivalves, pl. v, figs. 18, 18 *a*; not *Lyrodon literatum*, Goldfuss.
— — *Morris.* Catalogue, 1854, p. 228.

Shell depressed, ovately trigonal; umbones antero-mesial, large, elevated, and slightly recurved; anterior border moderately produced, and elliptically curved with the lower border; hinge-border nearly straight, sloping obliquely, and terminating in an oblique truncation of the posteal extremity of the area. Escutcheon narrow, depressed, and lengthened; its superior border is much raised: the area is narrow and flattened, divided by an oblique mesial furrow, and bounded by two inconspicuous slightly knotted carinæ, which disappear altogether posteally; near to the apex the area has a few transverse plications, but the surface generally is nearly smooth. The lines of growth are only faintly marked. The other portion of the shell has the first-formed six or seven rows of costæ entire and smooth, they pass obliquely downwards from the anterior border, and curve to the carina at a right angle; the subsequently formed costæ consist of two portions, the anteal series consist of a few narrow and depressed subnodulous costæ, which pass obliquely downwards to the middle of the valve, where their extremities are contiguous to the extremities of a few, much larger, nodose varices which pass upwards almost perpendicularly to the carina.

Much variability in the costæ is observable in different specimens, and not unfrequently the ornamentation over the greater portion of the valve is effaced; the later-formed costæ are usually disunited and very irregular. Our largest example has thirteen costæ. The species was at first mistaken for *T. Goldfussii,* Ag. (*Lyrodon literatum* Goldf.), which is more lengthened, and has a more prominent kind of ornamentation; it occurs in the Upper Oolites, but has not been discovered in Britain.

The smallest of our figures exemplifies a young shell with the costæ prominent, smooth, and ridge-like; they are united to the carina, where they form a projecting angle, and pass undivided across the area as somewhat smaller costellæ. Some doubt may exist whether the minute figure of *T. cuspidata,* Sow., given in the ' Mineral Conchology,' pl. cvii, figs. 4, 5, is intended for a dwarfed example of this form, or for the young state of *T. Moretoni,* as there is no very clear distinction between them; but as the first-formed costæ of *T. Moretoni* are usually smaller and more closely arranged than in *T. Painei,* and as the latter species has not been obtained at Ancliff, which was the locality of Sowerby's little specimen, it is more probable that *T. cuspidata* is the young of *T. Moretoni* in a more dwarfed condition than has been obtained at Minchinhampton.

Adult examples of *T. Painei* are most nearly allied to *T. flecta,* to which the reader is referred.

A shell figured by Messrs. Rigaux and Sauvage as a variety of *T. Arduenna,* Buv., in their interesting Memoir on new species from the Bathonian formation of Boulogne ('Mém. de la Soc. Acad. de Boulogne,' 1868, vol. iii, pl. vi, fig. 4), appears nearly allied to, and perhaps is not really distinct from, *T. Painei.* Our Plate XII, fig. 3, which presents an approximation to the Boulogne shell, represents the most common aspect of the species in the Great Oolite of Minchinhampton, or perhaps with the costæ more than usually prominent; not unfrequently, however, the posteal varices are more imperfectly developed, or more nearly resembling the figure of Messrs. Rigaux and Sauvage.

T. Arduenna, Buv., a much smaller species, is less short in its general figure, with much more numerous and more closely placed costæ and varices; the rugose area is another distinctive feature.

Dimensions.—Our largest specimen has the length upon the marginal carina of $2\frac{1}{4}$ inches; the opposite measurement is 2 inches; the convexity of a single valve 7 lines; the length of the escutcheon 18 lines.

The name is intended as a slight recognition of the success which has attended the exertions of Dr. Paine, of Stroud, as Honorary Secretary of the Cotteswold Naturalists' Field-Club during a long period, and also of his acquirements in the cultitivation of the natural Sciences.

Stratigraphical position and Localities. In the Great Oolite of Minchinhampton Common, in the beds called "planking," where the species occurs of every stage of growth, and is not infrequent, the valves are always disunited, and are often abraded, or have the ornamentation scarcely perceptible. It has also been obtained in the Great Oolite of South Lincolnshire. The specimen figured by Messrs. Rigaux and Sauvage, from Boulogne, is stated to have been procured in the zone with *Clypeus Plotii.* The British Museum has fine examples from the Great Oolite of Normandy.

TRIGONIA PRODUCTA, *Lyc.* Pl. XIII, figs. 1, 2, 3, 4.

TRIGONIA PRODUCTA, *Lycett.* Note in Wright's Memoir on the Inferior Oolite, Quart. Jour. Geol. Soc., 1859, vol. xvi, p. 45.

Shell ovately trigonal, somewhat depressed, elongated posteally, short but curved anteally; superior border lengthened, straight, or slightly concave; lower border slightly curved elliptically; umbones antero-mesial, elevated, obtuse, and but little recurved. Area narrow, flattened, somewhat raised, with numerous very irregular, rugose, transverse plications; it has a well-defined median furrow, bordering upon which, on each side, is a row of minute tubercles; the inner and marginal carinæ are each represented by a small row of inconspicuous tubercles or knotted terminations of the transverse plications of the area. The escutcheon is depressed and flattened, its length is considerable, or nearly equal to the measurement across the valves; its posteal extremity forms an obtuse angle with that of the area. The costæ upon the sides of the valves have but little prominence, the first-formed three or four rows are horizontal or slightly oblique, with small, regular, cord-like tubercles, the succeeding rows form two distinct series; the anteal series are few, oblique, and very irregularly sub-tuberculated; for the most part the rows have but little prominence and sometimes become nearly evanescent towards the middle of the valve; the few last-formed or lower ones are commonly more or less confused or imperfect; about the middle of the valve this anteal series is replaced by a more numerous posteal series, whose lower extremities form nearly right angles with the other series; they are regular, narrow, closely arranged, straight, imperfectly tuberculated, and are somewhat more prominent than the anteal series; they pass upwards nearly perpendicularly to the marginal carina; there are about fifteen rows, and their size continues nearly equal even to the posteal extremity of the valve.

The test is thick, the borders of the valves smooth, and the hinge is remarkable for the great breadth and flattening of the central tooth in the left valve. The larger of our specimens has the length, upon the marginal carina, of $3\frac{1}{2}$ inches; the opposite measurement is $2\frac{1}{2}$ inches; the diameter through the united valves is inconsiderable. *T. producta* has occurred only in single valves; the internal mould is unknown: it is one of the largest and least known of the *Undulatæ;* several young examples have been obtained, these are but little distinguished from similar examples of *T. signata.* The costæ supply the distinguishing features of *T. producta,* the few widely separated and rather obscure anteal series, and the more closely arranged, but separate, straight, and narrow posteal rows, serve to remove it from *T. signata,* which has moreover the umbones more mesial and recurved; the anterior side and border is more produced and rounded; this arrangement of the costæ is very distinct from *T. V-costata,* which has the anteal series much more numerous, and of a different figure, and does not form rows of separate tubercles. It has also some affinity with *Lyrodon literatum,* Goldf., in the characters of the costæ; but the latter species has the general figure more lengthened and oblong, and the posteal portion of the area has much greater breadth; the marginal carina also has a row of large rounded tubercles; the umbones are smaller and less elevated; the anterior side is also more produced. In *T. producta* the whole of the ornamentation has but little prominence, and in some examples it is partially obscured by the plications of growth, which become large and rugose over the lower portion of the valve.

Messieurs Terquem and Jourdy have figured, under the name of *T. producta,* a small species of the *Clavellatæ* from the Great Oolite of the Department of the Moselle ('Mém. Soc. Géol. Fr.,' 2 sér., tom. ix, 1869, pl. xi, figs. 29, 30), this is allied to, and perhaps is not really distinct from, *T. impressa,* Sow.

Stratigraphical position and Localities. T. producta is one of the rarer fossils of the Trigonia-grit of the Inferior Oolite, near to Cheltenham and to Stroud; fine examples have also been obtained in Northamptonshire by the officers of the National Geological Survey. Specimens from the Inferior Oolite of Normandy are in the British Museum.

TRIGONIA CONJUNGENS, *Phil.* Pl. X, figs. 5, 7, 8; Pl. XIII, fig. 6.

TRIGONIA CONJUNGENS, *Phillips.* Geol. Yorks., 1829, vol. i, p. 156.
— — *Morris.* Catal., 1854, p. 228.

Shell ovately oblong, moderately convex mesially, somewhat depressed near to the anterior and posterior borders; umbones elevated, obtuse, erect, or slightly recurved, placed within, or in other specimens upon, the line of the anterior third of the valves; anterior border produced, curved elliptically with the lower border; hinge-border straight, lengthened, sloping obliquely, and terminating posteally in the wide, rounded, posteal border of the area. Escutcheon large, lengthened, depressed, excepting its superior border, which is raised. Area very wide, occupying about one third of the surface of the valve; it is somewhat raised, expanded, and flattened posteally; it has a well-marked mesial oblique furrow, and is traversed transversely by numerous large plications, which increase in size posteally, and become irregular, prominent, and wrinkled (see Plate XIII, fig. 6); the bounding carinæ are small and distinct; the marginal carina is minutely plicated, excepting its posteal portion, which is occupied by the large transverse plications of the area; these form small varices upon the inner carina; there is no median carina. The costated portion of the valve has numerous rows (eighteen or nineteen in adult forms) of tuberculated or sub-tuberculated costæ, the first-formed six or seven rows are very closely arranged, regular, plain, nearly horizontal, and slightly curved at their two extremities: those which succeed form two series; the anteal series are somewhat irregular in their arrangement, but are always small and inconspicuous; they are directed somewhat obliquely downwards to the middle of the valve, and are occasionally distinctly tuberculated, but commonly are irregularly sub-tuberculated; their posteal extremities are united about the middle of the valve to another, less numerous, and somewhat larger posteal series of costæ, which are also either distinctly tuberculated or sub-tuberculated; they approach the carina at a considerable angle, and the last-formed three or four rows pass perpendicularly down to the lower border; their anteal or lower extremities are for the most part united to the extremities of the more numerous anteal series, with which they form a considerable undulation or angle, which is always less than a right angle; not unfrequently, however, the few last-formed anteal costæ are altogether irregular, presenting only small confused tubercles.

This appears to be the shell indicated by the author of the 'Geology of Yorkshire,' who gave a short notice of it at page 156 of the first edition of that work, but without any figure. It is nearly allied to *T. angulata*, Sow., in the general arrangement of its ornamentation; but it differs from that species constantly and materially in the general figure, which is much more broad and expanded posteally,—so different from the narrow, concave, and delicately plicated area of *T. angulata;* it is also without the undulation upon the lower borders of the latter species, and its rows of anteal costæ are more numerous; but usually the outline of the two forms will at once show their distinctness. It is also somewhat allied to *T. Moretoni*, M. and L., but is more oblong, with a much wider and more rugose area; the marginal carina is much smaller, the costæ are also more disunited mesially, and have the tubercles smaller, and the costæ less ridge-like.

The two small lower figures of plate lxxxvii 'Mineral Conchology,' represented as a variety of *T. clavellata,* have some affinities with our species in the general figure, and the characters of the costæ; but the area is destitute of the large transverse rugose costellæ; there are also indications of a small median carina, it is probably therefore distinct.

T. compta, Lyc., of the Collyweston Slate, is also nearly allied to it, both in the general outline and the ornamentation. The flattened condition of the slate species prevents any comparison of the convexity, but the costæ in adult specimens are fewer; the area is smooth, and has three distinct tuberculated carinæ,—characters which are so different from that portion of *T. conjungens* as to compel their separation as species.

Stratigraphical position and Localities. During many years *T. conjungens* remained one of the more obscure and doubtful forms of Trigonia, and was usually omitted, even in the lists of Yorkshire fossils; this arose from the very few words of description allotted to it by Professor Phillips in his 'Geology of Yorkshire,' and not less so to the very intractable stone of the Millepore-bed, a hard, rough, semi-ferruginous stratum at Cloughton Cliffs, to the northward of Scarborough. A considerable number of examples of *T. conjungens* have been obtained from that locality, but only a few have been separated well preserved. Brandsby, Yorkshire, was the locality given by Proféssor Phillips, at which place the beds are not now accessible: it has also been obtained in the White Oolite of Whitwell, in the same county. The Cloughton specimens are associated with *T. recticosta,* and a considerable number of Inferior Oolite Conchifera. It also occurs in the same stratum exposed at Cayton Bay, to the southward of Scarborough. Specimens are in the Museum of the Yorkshire Philosophical Society at York, also in the collection of Mr. Reed, of the same place; in the collection of Mr. Leckenby, now forming part of the Woodwardian Museum, Cambridge; also in the author's cabinet. It is now for the first time figured.

TRIGONIA LITERATA, *Young* and *Bird*. Pl. XIV, figs. 1, 1*a*, 2, 3, 4.

TRIGONIA LITERATA, *Young* and *Bird*. Geological Survey of the Yorkshire Coast, 2nd ed., 1828, p. 225, pl. viii, fig. 23.
— — *Phillips*. Geol. of Yorkshire, 1829—1835, vol. i, pl. xiv, fig. 11.
— — *Williamson*. Distribution of Fossil Remains on the Yorkshire Coast, Tr. Geol. Soc., 2nd series, 1836, vol. v, p. 243.
— — *Pusch*. Polens Palæont., 1837, p. 60.
— LITTERATA, *Agassiz*. Trigonies, 1840, pp. 8 and 50.
— — *Brown*. Foss. Conchol. of Great Britain, 1845.
— LYRATA. *D'Orbigny*. Prodr. de Paléont., 1850, vol. i, p. 218.
— LITTERATA, *Morris*. Catal. 1854, p. 229.
— LITTERATA, *Simpson*. Fossils of Lias, 1855, p. 116.
— LITTERATA, *Quenstedt*. Der Jura., 1856, p. 442.
— — *Oppel*. Juraformation, 1856, p. 260.
— LITTERATA, *Tate*. Geol. Mag., 1872, vol. ix, p. 306.

Shell sub-ovate or ovately oblong, convex; umbones large, moderately elevated, obtuse, nearly erect, placed within the anterior third of the valves; anterior side moderately produced, its border curved elliptically with the lower border; superior border lengthened, nearly straight, sloping obliquely downwards, and forming posteally nearly a right angle with the posterior border of the area. Escutcheon wide and somewhat concave, its superior border is moderately raised. Area narrow, slightly convex, with a well-defined mesial furrow. Young examples have two distinct bounding carinæ; the inner carina is characterised by transverse narrow irregular varices; the marginal carina has irregular widely separated tubercles; in examples of more advanced growth the carinæ have small varices which are united to the transverse plications upon the area; much variability exists in the prominence of the plications, but usually specimens of full development have the posteal portions of their areas characterised only by delicate lines of growth, and are altogether without ornamentation. The other portion of the surface has two distinct series of tuberculated costæ, this distinctness commences at the apices even of the youngest specimens; the anteal series has the rows very numerous, small, and extremely irregular; in young specimens they approach the anterior borders horizontally, as smooth attenuated lines; with the curvature of the valve they become sub-tuberculated, and are usually deflected slightly downwards, but their direction is scarcely alike in any two specimens; they are always small and unsymmetrical, one row with another, unequal, and either prominent or obscure, sometimes partially united to the extremities of the larger posteal series, or altogether separated from them and excentric. Well-preserved adult forms have the few lower costæ of the anteal series more or less wrinkled and obscure, these take the direction of the lines of growth, and therefore curve upwards to the anterior border; other examples have the whole of the anteal series forming smooth, irregular and unequal, oblique, wrinkled costæ, but in all instances this series occupies only the smaller portion of the costated surface, their junction with the other series is always anteal to the middle of the costated surface; the posteal series are fewer, much larger, and more regular; they form prominent nodose ridges, which descend almost perpendicularly from the carina, enlarging downwards, and forming acute angles with the anteal series; about a moiety of the posteal series attain the lower border: our largest specimen has twelve of these costæ. Few examples of the genus have the lines of growth so strongly marked as in the adult examples of *T. literata,* they impress the costæ very conspicuously.

Young specimens from nine to twelve lines across the valves are remarkable for the prominence, delicacy, and beauty of their ornamentation; they are slightly more lengthened, than the adult form, but are less oblong and quadrate than the little *Trigonia pulchella,* of Agassiz, to which their ornamentation approximates considerably.

Dimensions of a large specimen.

Length	$2\frac{1}{4}$ inches.
Opposite measurement	$1\frac{6}{10}$,,
Diameter through the united valves . . .	$1\frac{6}{10}$,,

Several Jurassic species approximate to *T. literata* in the general plan of their ornamentation. *Lyrodon literatum,* Goldf., a larger species, has the general figure more lengthened, and the area much larger in proportion. *T. subglobosa,* Mor. and Lyc., is distinguished by the more globose form, by the large tuberculated carinal, and by the few very large posteal varices. *T. Painei,* Lyc., on the other hand is much more depressed, and the costæ fewer. *T. V-costata,* Lyc., has not the two series of costæ broken and separated as in the present form, it is also much less convex: other of the *Undulatæ* are more remotely allied to it.

History, Stratigraphical position, and Locality. Messrs. Young and Bird, in their Geological Survey of the Coast of Yorkshire (1822), first described *T. literata:* they assigned it to the Lower Lias Shale, but without any locality: the figure of it given upon plate viii of their work is very indifferently executed. In the year 1829, Professor Phillips, in his 'Illustrations of the Geology of Yorkshire,' gave a much better figure: he assigned the species to the Lower Lias Shale of Robin Hood's Bay, and figured it with the fossils of that stage; he also noticed its occurrence in Upper Lias Shale upon the authority of Mr. Williamson (p. 161). In 1850, D'Orbigny in his 'Prodrome,' also erroneously placed it (printed *T. lyrata*) in his Étage Sinemurien, and gave the vicinity of Metz (Moselle) as a locality. In addition to *T. literata,* Agassiz placed the five following species in the

Upper Lias: *T. navis*, Lam., *T. pulchella*, Ag., *T. tuberculata*, Ag. (*T. spinulosa*, Y. and B.), *T. similis*, Bronn, and *T. costellata*, Ag. Subsequent researches have shown that the latter five species are associated more or less one with another in a single geological position, and that two or more of them occur together at several localities in Southern Germany. Professor Quenstedt ('Der Jura.') has established *T. navis* and *T. pulchella* as species of the lower portion of the Inferior Oolite.

In Britain *T. spinulosa* pertains both to the Supra-Liassic Sands and to the lower portion of the Inferior Oolite; and, as the two remaining species are associated in Southern Germany with the three former, it may be inferred that all of them belong to a higher position than *T. literata*, and that the latter therefore occupies the lowest position of any known species of the Upper Lias.

In Britain *T. literata* has occurred only at a single locality; namely, a little higher than the middle of the Upper Lias Shale at the Peak, Robin Hood's Bay, in scars accessible only at low water; there are no Ammonites in this stratum, but it immediately overlies a bed with *Ammonites crassus*, Y. and B.; it is lower than the beds worked for alum upon the same coast. Specimens occur of every stage of growth, with the valves both united and separated; but, as the greater number have the characters of the surface ill-preserved, good specimens are somewhat rare.

TRIGONIA V-COSTATA, *Lyc.* Plate XIII, fig. 5; Plate XV, figs. 1, 2, 3, 4.

TRIGONIA ANGULATA, *Phil.* Geol. York., 1829, vol. i, p. 156 (not Sow.).
— — *Williamson.* On Distribution of Fossils, Yorkshire Coast, Trans. Geol. Soc., 1836, 2 ser., iii, p. 229.
— V-COSTATA, *Lycett.* Ann. and Mag. Nat. Hist., 1850, p. 422.
— — *Morris.* Catalogue, 1854, p. 228.
— — *Lycett.* Cotteswold Hills Handbook, 1857, pl. vi, fig. 5.

Shell ovately trigonial, moderately convex; umbones nearly mesial, produced, obtuse, and usually somewhat recurved; anterior side produced, its border curved elliptically with the lower border; hinge-border slightly concave, sloping obliquely, its extremity forming an obtuse angle with the extremity of the area. Area narrow, concave beneath the apices, but flattened posteally; it is traversed transversely by delicate plications, which near to the apices form a few regular, smooth costellæ; it has a mesial longitudinal furrow, and in the young condition three closely tuberculated carinæ, which become evanescent posteally with advance of growth. The escutcheon is much depressed compared with the inner carina; it is lengthened, of moderate breadth, and perflectly flat. The other portion of the surface has the rows of costæ numerous (twenty to twenty-four) and narrow; they are but little raised, and are rather inconstant in their characters; sometimes they are plain, but more frequently they are subtuberculated; all of them commence at the anterior border and curve obliquely downwards; the first few rows are simply curved upwards at their posteal extremities to the carina; those which succeed are more straight and oblique; their posteal portions form with the anteal portions a more decided angle, which increases with every succeeding costa, until they form acute angles upon the middle of the valve, the posteal portions passing upwards perpendicularly to the carina, but without any increase in their size. In adult forms the last three or four posteal costæ pass downwards perpendicularly to the pallial border.

Three Jurassic Trigoniæ are allied to *T. V-costata*. *T. tripartita*, Forbes, a much smaller species, differs in having a few large posteal, straight, oblique costæ, which are distinct from the far more numerous and smaller anteal costæ. The figure of *T. angulata*, Sow., is much more produced, and attenuated posteally; the hinge-border is more lengthened and concave; the umbones are more prominent and recurved; the costæ are very much fewer, and posteally they form an undulation rather than an angle; it is very correctly represented by the coarse figure in the 'Mineral Conchology.' *T. producta*, Lycett, is somewhat allied to it in the characters of the costæ, but has the anteal series few and distinctly tuberculated; the general figure also is essentially different; the anteal not recurved apices, the lengthened and flattened area, together with the greater general length of the shell, separate them very clearly.

Adult specimens of *T. V-costata* have the length one sixth greater than the height; of small specimens the number is far more considerable; these latter have been obtained at numerous localities in beds of very different mineral character; usually they have a more lengthened figure transversely; they differ materially one from another in the closeness or wider separation of the costæ.

Stratigraphical position and Localities. The figure given in the 'Annals of Natural History' was from a large example obtained in the Upper Trigonia-grit of Rodborough Hill, near Stroud; a few specimens have also occurred in a similar position at several localities near to Cheltenham; it is, however, rare throughout the Cotteswold Hills. In Northamptonshire it occurs more commonly in the ferruginous beds, and is of smaller dimensions. Numerous specimens (apparently dwarfed) also occur in the very fossiliferous bed of the Dogger at Blue Wyke, near Robin Hood's Bay, Yorkshire; they are of various stages of growth; three are depicted upon Plate XV. A considerable number of small, imperfectly preserved Trigoniæ also occur in the layers of oolitic slate at Collyweston; they are deprived of the test, and have probably undergone vertical compression; their condition, therefore, does not admit of a rigid comparison; they also differ much one with another in the general figure, and in the prominence or indistinctiveness of the costæ; all have the appearance of young shells, and occasionally specimens have the figure more lengthened transversely than is observed even in young examples of *T. V-costata;* there does not, however, occur any constant characters which will justify their separation from that species, to which, therefore, they are provisionally united; two examples are figured on Plate XI, figs. 6, 7. In the absence of better illustrative specimens it is therefore necessary to cancel "*T. minor*," as this obscure form was designated in the list of Inferior Oolite Trigoniæ, page 12 of this Monograph.

The internal mould is not known; impressions occur in the Ferruginous Oolite of Glaizedale, North Yorkshire. All the localities are in Inferior Oolite.

TRIGONIA SUBGLOBOSA, *Lyc.* Plate XII, figs. 8, 9, 10.

TRIGONIA SUBGLOBOSA, *Lycett.* Ann. and Mag. Nat. Hist., 1850, p. 421.
— — *Morris* and *Lycett.* Gr. Ool. Monog., Pal. Soc., 1853, p. 55, pl. v, fig. 21.
— — *Morris.* Catal., 1854, p. 229.

An inflated shell with prominent ornamentation and nodose angulated costæ.

Shell ovately globose; umbones antero-mesial, large, produced, much incurved, and slightly recurved; anterior and inferior borders curved elliptically; posterior or superior border short, concave, its posteal extremity forming an obtuse angle with the posteal border of the area. Escutcheon wide, depressed, and rather short. Area wide, flattened, slightly excavated, its surface forming a considerable angle with the other portion of the shell; it is conspicuously bi-partite, the lower constituting the larger portion; it is traversed transversely by irregular rugose plications, which near to the apex are replaced by a few, narrow, regular, plain costellæ; it is bounded by tuberculated carinæ; the tubercles upon the marginal carina are unusually large and nodose; the median carina is also represented by a similar, but smaller row of tubercles. The other portion of the shell has upon its anteal side thirteen or more, narrow, depressed, subtuberculated costæ, which are rather irregular in their course, but, for the most part, curve obliquely downwards to within a short distance of the carina, when they meet with a much larger and more prominent nodose posteal series, fewer in number (about eight or nine), which pass upwards perpendicularly to the carina, their point of junction with each of the anteal series having a large tubercle; the angles thus formed are more considerable than right angles. Upon the lower third of the adult valves the plications of growth become strongly marked anteally, and all other ornamentation then ceases; this change is also accompanied by a sub-concentric sulcation which crosses the valve longitudinally.

Affinities. It is allied to a larger species, *T. Painei*, Lyc., in the general features of its ornamentation, but is greatly more inflated; the area is much wider and more ornamented, and more especially by the presence of the prominent marginal carina with its few large tubercles; this latter feature, together with the absence of large transverse plications upon the area, and its sub-globose figure, serve also to separate it from *T. conjungens.* The valves are separate, or spread open and held in contact by their ligament.

Stratigraphical position and Localities. Near to Stroud and Nailsworth, Gloucestershire, in the middle portion of the Inferior Oolite; in a bed of pale, tough, cream-coloured limestone (Coralline mud), associated with *Trigonia costatula,* Lyc., *T. angulata,* Sow., *T. Phillipsi,* Mor. and Lyc., a crowd of small, sub-cylindrical Nerinææ, sub-acicular Chemnitziæ, and a numerous group of Molluscan forms, both of Gasteropoda and Conchifera: but all the Trigoniæ are rare.

TRIGONIA GEOGRAPHICA, *Ag.* Plate X, fig. 6.

TRIGONIA GEOGRAPHICA, *Agassiz.* Mém. sur les Trigonies, 1840, p. 25, tab. 10, fig. 7 (Excl. tab. 6, figs. 2, 3).
— — *D'Orbigny.* Prodr. de Paléont., 1850, vol. ii, p. 17, No. 267.
— — *De Loriol, E. Royer,* and *H. Tombeck.* Descr. Géol. et Paléont. des Étages Jurassiques Supérieurs de la Haut Marne, 1872. Mém. Soc. Linn. de Normandie, tom. 13, pl. 17, fig. 7.

Shell ovately trigonal, moderately convex; umbones submesial, not much produced, and only slightly recurved; anterior side produced, its border curved elliptically with the lower border; hinge-border straight, sloping obliquely downwards. Area narrow, somewhat concave, divided into two portions by a considerable depression of the upper half; the whole is transversely striated; the bounding carinæ are very small, without any distinct tubercles. Escutcheon narrow, depressed, and moderately lengthened. The other portion of the shell has numerous rows of narrow, plain, closely arranged costæ, all of which originate at the anterior border and pass over the middle of the shell obliquely downwards with a slight curvature; they enlarge somewhat posteally, and curve upwards towards the carina; about twelve or thirteen of the costæ first-formed are plain, those which follow gradually become tuberculated and enlarge at their posteal portions; each succeeding row becomes more tuberculated, so that the rows last-formed have only a short portion plain anteally; they thus gradually form two series of costæ, of which the posteal or tuberculated series is the larger and less numerous in consequence of the intercalation of three or four rows of short anteal costæ, which impart much irregularity to the few last-formed rows; the tubercles are neither regular nor symmetrical, some are distinct and oval, others are united in the rows which all curve upwards to the carina.

Our specimen resembles only the second figure of Agassiz ('Trigonies,' tab. 10, fig. 7), but is a smaller example with less prominent posteal tubercles; the area is also nearly destitute of ornamentation, which is probably due to defective preservation. The figure given by De Loriol, Royer, and Tombeck is more lengthened, and the costæ have less posteal curvature towards the carina; the tubercles also appear small for a specimen of such advanced growth, differences which indicate a variety.

Stratigraphical position and Locality. Our specimen was obtained in the Trigonia-bed of the Coralline Oolite at Pickering; no second specimen has come under my observation.

Trigonia compta, *Lyc.* Plate XV, figs. 5, 6, 7.

Trigonia compta, *Lycett.* Suppl. Mon. Gr. Ool. Mollusca, Pal. Soc., 1863, p. 50, pl. xl, fig. 1.

Shell ovately trigonal, somewhat depressed; umbones moderately elevated, antero-mesial, not recurved, obtuse; anterior side produced, curved elliptically with the lower border; posterior border truncated at its extremity. Escutcheon narrow and inconspicuous. Area rather wide, flattened, with a mesial furrow and three small tuberculated carinæ; its general surface is smooth, with faintly traced lines of growth. In other specimens the carinæ are evanescent, and the area is altogether smooth; its entire surface is raised, so that the marginal carina, although so little conspicuous, forms a prominent ridge compared with the more depressed, adjacent costated portion of the valve.

The other portion of the surface has about twelve rows of costæ, which pass from the anterior border obliquely downwards; they are very narrow, elevated, and sub-tuberculated, or occasionally plain; posteally they increase in size, become partially disunited, and form two distinct, large, depressed nodes or varices, which curve upwards and meet the marginal carina at a right angle; each row of varices corresponds to every alternate row of the narrow anteal costæ.

The general ornamentation has but little prominence, and not unfrequently it is rather obscure.

Young specimens, when only three lines across, have narrow, horizontal, plain costæ, which are slightly curved upwards at their posteal extremities; the marginal carina is then prominent.

T. compta is a small species not uncommon in the slate of Collyweston; the specimens are usually more or less compressed; it also occurs more rarely in the sand of Northampton, in which it retains its original convexity. It differs from *T. Moretoni* in having much fewer costæ, which do not form continuous curves as in that species, but are disunited posteally, forming a less numerous series of short large varices; the area destitute of large transverse rugose folds, is another distinctive feature.

From *T. costatula* it is separated by the more lengthened form, less convexity, larger area, and the presence of the short, curved, large posteal varices. The same general features, together with the larger ornamentation, also separate it from *T. impressa.*

Compared with *T. conjungens,* its ornamentation is much less prominent; its posteal varices are larger and more depressed; the area is less expanded posteally, and is destitute of the large rugose plications which are so conspicuous on that species.

Locality. The finely laminated, slaty sandstone has preserved the ornamentation in a very perfect manner, although the test has wholly disappeared. It has only been recognised in the vicinity of Collyweston, and in an apparently similar geological position in the Inferior Oolite of Northamptonshire.

Trigonia Leckenbyi, *Lycett,* sp. nov. Plate XVI, figs. 1, 2.

Shell ovately oblong, lengthened and attenuated posteally, much depressed; umbones sub-anterior, obtuse, not conspicuous; anterior side short and rounded; lower border lengthened, curved elliptically; superior border lengthened, slightly concave, and having a gentle curvature downwards posteally to the lower extremity of the area, which is somewhat pointed. Area narrow and flattened with some obscure transverse plications; the bounding carinæ are scarcely elevated, the marginal carina has a row of small tubercles, which disappear posteally; there is no distinct mesial furrow. The escutcheon is lengthened, very narrow, and depressed. The other portion of the valve has the rows of costæ in two series; the posteal series consists of depressed, curved, rounded, sub-tuberculated costæ, which pass downwards almost perpendicularly from the carina to the middle of the valve; their number is from fourteen to sixteen, they are cord-like, and become attenuated near to the carina; the anteal series is much smaller and more numerous, the rows are sub-tuberculated, and, for the most part, nearly horizontal in their direction; they are not distinctly united to the extremities of the posteal series, but become broken into small, irregular, isolated tubercles, which occupy the middle of the valve, even to the lower border; the general direction of the rows of posteal costæ is therefore not conformable with that of the anteal series. The lines of growth appear to have but little prominence; no portion of the test has been preserved in the larger example, and only partially so in the smaller.

This remarkable example of the *Undulatæ,* conspicuous for its very much depressed, lengthened figure, and the delicate, but composite, character of its ornamentation, possesses some general resemblance to *T. angulata,* from which it will readily be distinguished by its large obtuse umbo and depressed figure; or, when the costæ are preserved, the very numerous and minutely knotted anteal series is a characteristic feature. The lengthened depressed form equally removes it from *T. literata,* Phil., to which it approximates in the general character of its costæ. Other species more remotely allied are *T. v.-costata* and *T. paucicosta,* to the descriptions of which the reader is referred. *T. Ramsayi,* from nearly the same geological horizon in Gloucestershire, with a more lengthened form and cord-like costæ, is without the small anteal series. In the general lengthened outline it is also not without some resemblance to *T. Pellati;* but they differs in all the essential features of ornamentation.

Stratigraphical position and Locality. *T. Leckenbyi* ranks as one of the most rare of the Trigoniæ. I am not aware that more than four entire examples of single valves have been procured, and fragments of a few others; all are more or less flattened from vertical pressure, and only portions of the test remain; but the characters of the surface are sufficiently well preserved. The rock is a dark grey, highly micaceous, thin-bedded, shaley sandstone, a member of the stage which may be provisionally termed Supra-liassic, and according in position with the *Jurensis*-beds of the Cotteswold Hills; it is associated with some of the characteristic fossils of that stage, and more especially with *Terebratula trilineata,* Y. and B. It has been procured only over a small area in shore-beds covered by the tide at high water, between Blue Wyke and the Peak, near Robin Hood's Bay, upon the coast of Yorkshire. The geological position is therefore higher than the Alum Shale or the zone of *Ammonites communis,* and lower than the stratum with *Lingula Beanii.*

Trigonia Carrei, *Mun.-Chal.* Pl. XII, fig. 1.

Trigonia Carrei, *Munier-Chalmas.* Note sur quel. esp. nouv. du genre Trigonia, Bull. Soc. Linn. de Normandie, 1865, vol. ix.
— — *De Loriol* et *Pellat.* Mon. Paléont. et Géol. de l'étage Portlandien des env. de Boulogne, 1866, pl. viii, fig. 5.
— — *Hébert.* Terr. jurass. du Boulonnais, Bull. de la Soc. Géol. France, 1866, 2 sér., t. xxiii, p. 216.

Shell ovately trigonal, moderately convex; umbones sub-anterior, elevated, obtuse, and erect; anterior side short, its border somewhat truncated, but having its lower portion curved elliptically with the lower border; cardinal border moderately lengthened, straight, sloping obliquely, and curved suddenly with the posterior extremity of the area. Escutcheon excavated, its superior border raised. Area narrow, flattened, conspicuously bi-partite; the plane of its surface forms a considerable angle with the other portion of the shell; it is bounded by two well-defined tuberculated carinæ; the tubercles upon the marginal carina are more especially large and distantly arranged; there is also a line of small tubercles bordering upon the mesial furrow; the transverse plications upon the area are irregular and not conspicuous. The other portion of the surface has a series of large elevated varices, about twelve in number, which curve downwards from the carina, occupying more than half the costated surface; each row has about nine depressed nodes; the lower extremities of these varices meet the posteal extremities of a much smaller anteal series, which are nodose, short, and nearly horizontal in their direction, but with some irregularity. The lines of growth are conspicuous over the greater portion of the shell. Portions of the epidermal granulated tegument are preserved, and have the lines of granules larger than is usual in the *Undulatæ* or the *Clavellatæ*. Our figure exemplifies a specimen, the posteal extremity of which is somewhat defective from disappearance of the test.

Locality and History. Our specimen is from the Portland Oolite of Tisbury; Mr. Cunnington has also obtained the species in the same formation near to Devizes; at both localities it ranks as one of the most rare Testacea in the formation. Allusion may here be made to *T. radiata*, Benett, the absence of which in this Monograph as a recognised species requires some explanation.

In the year 1831, Miss Etherelda Benett, of Warminster, published a small folio volume, intended as an illustrated catalogue of Wiltshire fossils; plate xviii, fig. 3, of that work, represents *Trigonia radiata* from the Portland Limestone of Tisbury; the figures generally in Miss Benett's work are carefully drawn, it may therefore be assumed that the deficiencies in the Trigonia represent the defective condition of the specimen. The general aspect seems to indicate flattening or compression; the area has no clearly defined features; the marginal carina has some indistinct tubercles; the rows of varices which pass downwards from the carina are more clearly expressed, and appear to be obtusely nodose; there are also some partially preserved tubercles upon the pallial portion of the valve near to the lower border; all else is left to the imagination. The type specimen was removed to the Philadelphian Museum, with the whole of Miss Benett's collection, at the decease of that lady; but, judging from the figure, the possession of the specimen would have added but little to our knowledge of the species, and no second British example recognised as *T. radiata* is known.

In the year 1865 M. Munier-Chalmas figured and described under the name of *T. Ferryi* ('Bull. Soc. Linn. de Normandie,' vol. ix), a Trigonia which in the general characters of its varices possesses a considerable resemblance to the figure given by Miss Benett; the anteal portion of the valve is represented as devoid of ornamentation, but as this, in common with the other figures upon the same plate, is reduced in size, we are the less able to judge of the actual condition of the specimen; he also described in the memoir accompanying the plate an allied Trigonia from the same formation, in the vicinity of Boulogne, under the name of *T. Carrei*, but of this no figure was given.

In the following year appeared the almost simultaneous publication of Memoirs on the Portland formation of Boulogne by Professor Hébert, and Messieurs de Loriol and Pellat, each of these palæontologists discovered the apparent identity of *T. Ferryi* with *T. radiata*, and the last-named authors figured a very perfect example of *T. Carrei*, and another of *T. radiata;* the latter form is, however, apparently defective, the anteal half of the valve being separated from the other portion with varices by a line of fracture, which apparently indicates the absence of the test upon the anteal portion of the valve, the varices of which end abruptly at the line of fracture. Several large clavellated

Trigoniæ, or portions of them from the Portland formation of Oxfordshire and Wiltshire, which have come under my notice, are too imperfect in their general condition to admit of any satisfactory comparison with other known forms; at present, therefore, I can only allude to *T. radiata* as a British species with much hesitation, as being represented possibly by examples which are too defective to be submitted to the artist as illustrations of Miss Benett's species. It may also be remarked that an entire absence of ornamentation upon the anteal portion of the shell, such as appears to be indicated by the specimen of Miss Benett, by that of Munier-Chalmas, and also by the defective figure of De Loriol, represents a feature to which we discover nothing analogous throughout the entire series of the genus Trigonia. In the absence of any more satisfactory example it is intended to figure an imperfect specimen in the Oxford University Museum, obtained in the Portland Limestone of Shotover Hill, and kindly brought under my notice by Professor Phillips.

TRIGONIA TRIPARTITA, *Forbes.* Pl. XII, fig. 7.

TRIGONIA TRIPARTITA, *Forbes.* Quart. Jour. Geol. Soc., 1851, vol. vii, p. 111, pl v, fig. 11.
— — *Morris.* Catal., 1854, p. 229.
— — *Lycett.* Pal. Soc. Suppl. Gr. Ool. Monogr., 1863, p. 51, p. xl, fig. 4.

Shell ovately trigonal, short, rather depressed; umbones elevated, obtuse, and scarcely recurved; anterior and lower borders curved elliptically; hinge-border short, sloping obliquely. Area of moderate breadth, flattened, distinctly bipartite, the inner or superior half being the more depressed; it is traversed transversely by delicate lines of growth, and near to the umbones by a few small costellæ; the bounding carinæ are distinct, but have little prominence, and are only imperfectly tuberculated; the posteal border of the area forms only a slight angle with the superior border of the escutcheon, which is small and depressed. The costated portion forms a considerable angle with the plane of the area; the costæ form two distinct series; the more numerous or anteal series has the rows very small, plain, and closely arranged; their direction is uniform, passing from the anteal border obliquely downwards to the middle of the valve, where they are cut off by a much larger, less numerous, posteal series of costæ, seven or eight in number, which are slightly tuberculated, and pass downwards from the carina almost perpendicularly, forming right angles with the anteal series. The comparative size and direction of the two species of costæ will serve to distinguish this little shell from *T. v.-costata,* from *T. undulata,* and from *T. detrita;* others of the *Undulatæ* are more remotely allied. The anteal ribbing in Fig. 7 is more minute than in the specimen figured by Professor E. Forbes, and this is the sole difference observable.

Stratigraphical position and Localities. Our specimen was obtained by Mr. Walton, of Bath, in the Cornbrash of Chippenham; the type specimen was found by the late Professor Edmund Forbes in a stratum of soft crumbling yellowish limestone and shale beneath the Oxford Clay at Loch Staffin, Isle of Skye, associated with Testacea, which are for the most part estuarine or fluviatile forms; the geological position is probably not very different from that of the Chippenham Cornbrash, but modified by peculiar local conditions.[1]

TRIGONIA DETRITA, *Terq.* and *Jour.* Pl. X, figs. 3, 3 *a*, 4.

TRIGOIA DEETTRITA, *Terquem* et *Jourdy.* Monog. de l' Étage Bathonien dans le Département de la Moselle; Mém. Soc. Géol. de France, deux. sér., tom. neuv., 1869, pl. xii, figs. 1 and 2.

Shell ovately trigonal, moderately convex; umbones placed within the anterior third of the valves, moderately elevated, only slightly recurved; anterior side very short, its border curved elliptically with the lower border; superior border straight, sloping obliquely downwards and forming an obtuse angle with the posteal border of the area. Escutcheon lengthened, concave, its superior border somewhat raised. Area of moderate breadth, flattened, having a well-defined mesial furrow; it is transversely rugosely plicated and bounded by two small elevated, tuberculated, or rather closely arranged, plicated carinæ, which are formed by enlarged continuations of the transverse rugæ upon the area. The other portion of the shell has numerous, very closely arranged, plain, rounded costæ; the few first-formed are regular and almost horizontal, succeeded by rows more oblique or directed obliquely downwards from the anterior border; posteally they form a sudden flexure somewhat downwards and then turn upwards perpendicularly to the carina; at first the posteal angle is but small, but it regularly increases with the succeeding costæ, so that the few last formed have their posteal portions somewhat disunited; they become slightly nodulous and, forming each a right angle, pass per-

[1] The association of the generic forms of Testacea in the Hebridean deposit described in the Memoir quoted and depicted upon the plate which accompanies it, is curious and instructive, especially when compared with the habitats of two of the living Australian *Trigoniæ*. *T. tripartita* was found in the Loch Staffin shale with a Perna and an Ostrea, and with ten other species, belonging to the fluviatile genera, Cyrena, Potamomya, Unio, Neritina, and Hydrobia. That this association was not accidental may be inferred from the following analogous facts. The recent *Trigonia Lamarckii* occurs in Sydney Harbour, partially buried in black mud, and also in the Paramatta River, within reach of the tide; in like manner the larger *T. pectinata* is found in Launceston River, Tasmania, in similar black mud, exposed to the alternating influences of fresh and of tidal brackish water. Any section of these Australian deposits may, therefore, be expected to expose the *Trigoniæ* associated, as at Loch Staffin, with the fluviatile or estuarine testacea with which they lived and were buried.

pendicularly upwards; the last-formed two or three anteal costæ become slightly waved or irregular, and their direction accords nearly with the lines of growth, which become conspicuous near the lower border; they also form, near the middle of the valve, an horizontal sulcation or arrest of growth.

Localities. The materials upon which the foregoing description is founded are somewhat scanty, consisting of three British and as many foreign examples. The larger of the specimens figured, with the valves united, is in a very perfect condition, and was obtained by the Rev. P. B. Brodie, in Forest Marble, near to the Tetbury Road Station of the Great Western Railway, North Wilts; the small example is from the Cornbrash of Hilperton, which has also produced other specimens. There are several in the British Museum, of medium sizefrom the Great Oolite of Ranville, Normandy. This appears to have affinity much larger and imperfect fossil figured by Goldfuss ('Petrefac.,' pl. 136, fig. 5 *c*) from the Lower Oolite of Pegnitz, forming one of a group which he attributed to *T. literata.* Its nearest ally probably is *T. undulata,* which is obtained in a similar geological position; compared with the latter species it has greater convexity, more especially at the umbonal portion of the valves, which has also the costæ much more closely arranged, more horizontal, more numerous, and more rounded; the slight posteal flexure downwards and the considerable angles which they form with the short, nodulous, perpendicular series is also distinctive. In *T. undulata* the angle or curvature is situated nearly at the middle of the valve.

Messrs. Terquem and Jourdy have figured a large example of *T. detrita* in their 'Monograph on the Great Oolite of the Department of the Moselle.'

Trigonia Clytia, *D'Orb.* Pl. XI, figs. 4, 5; Pl. XVII, fig. 7.

Trigonia Clytia, *D'Orbigny.* Prodrome de Paléont., 1850, vol. i, p. 309.
— — *Lycett.* Gr. Ool. Suppl. Monog., Pal. Soc., 1863, p. 48, pl. xl, fig. 5.
— — *Rigaux* et *Sauvage.* Descr. de quelq. esp. nouv. de l'Étage Bathonien du Bas-Boulon., 1868, p. 19.

Shell small, sub-trigonal, moderately convex; umbones elevated, sub-mesial, pointed, and recurved; anterior side produced and curved elliptically with the lower border; superior border short, somewhat convex, passing abruptly downwards to the pointed posteal extremity. Escutcheon small and depressed. Area narrow; the plane of its surface forms nearly a right angle with the other portion of the shell; it is traversed transversely by a few large depressed costellæ, which are waved as they pass the mesial furrow; there are also three slightly nodulous carinæ, of which the inner and median carinæ are very small, the marginal carina is much larger. The other portion of the shell has the costæ plain, numerous, small, and very closely arranged, convex upon their lower and concave upon their upper sides; their direction has a slight curvature obliquely downwards towards the carina; the first-formed four costæ are simply horizontal, the succeeding costæ are bent suddenly upwards at their posteal extremities, forming a series of right angles, one of which proceeds from every second costa. The entire number of costæ in adult shells is nineteen or twenty in a specimen eight lines in height. In aged specimens the few last-formed costæ are small, or indistinct, broken, or undulating, and their posteal extremities become somewhat nodulous when the whole of the ornamentation becomes nearly effaced.

The height and lateral diameter are nearly equal; the diameter through both the valves is one fifth less. The size varies from three to ten lines across the valves.

Stratigraphical positions and Localities. The Great Oolite of Box, near Bath, has produced numerous examples of varying dimensions and stages of growth. Mr. Cunnington has also obtained it in the Cornbrash of Westbrook and Trowbridge. Specimens are in the British Museum; in the Museum of Practical Geology, Jermyn Street; the Woodwardian Museum, Cambridge; in the Cabinet of Mr. Walton, of Bath; Mr. Cunnington, of Devizes; and in my own collection. France Luc, Calvados, in the Great Oolite.

TRIGONIA UNDULATA, *Fromherz.* Pl. XVI, figs. 9, 10, 11; Pl. XVII, figs. 5, 6.

TRIGONIA UNDULATA, *Fromherz.* Agassiz, Trigonies, 1840, p. 34, tab. x, figs. 14, 16, exclude tab. vi, fig. 1.
— ARATA, *Lycett.* Suppl. Monogr. Gr. Ool. Moll., Pal. Soc., 1863, p. 52, tab. xl, fig. 2 (variety).

Shell sub-ovate or ovately trigonal, moderately convex; umbones little produced, obtuse, nearly erect, antero-mesial; anterior border moderately produced, curved elliptically with the lower border; hinge-border lengthened, nearly straight, sloping obliquely, forming a considerable angle with the posteal extremity of the area. Area flattened but slightly convex, the plane of its surface differing only slightly from that of the other portion of the valve; its breadth is equal to one third of the costated surface; it is traversed by large transverse plications which become prominent costella upon the upper third of its length; the marginal carina has little prominence; the median furrow is well defined, but there is no median carina; the posteal extremities of the costellæ form a tuberculated inner carina. The escutcheon is narrow and much excavated, its superior border is raised; one of our specimens has several oblique varices across its surface, but this appears to be an abnormal feature. The rows of costæ are numerous, small, and not quite regular in their arrangement, the first-formed six rows are plain, slightly curved and acute; the succeeding rows descend obliquely from the anterior side, and about the middle of the valve form a sudden curvature or an imperfect angle; their posteal portions curve upwards towards the marginal carina, which they meet at a considerable angle. The rows are nearly equal in size throughout their length, but become somewhat attenuated towards their two extremities. Some specimens have the costæ almost entirely plain, or only sparingly and slightly knotted (Pl. XVI, fig. 11), others have the tubercles small, numerous, and irregular; usually the anteal portions of such have the tubercles more or less lamellated, their posteal portions more frequently form rounded tubercles; in other instances they are only sub-tuberculated or cord-like (Pl. XVI, fig. 9; Pl. XVII, fig. 5); each row extends to the marginal carina, the tubercles of which form the terminations of the rows of costæ, but towards the middle and lower portion of the carina its tubercles become somewhat compressed, and are more numerous than the rows of costæ. An examination of numerous specimens in various conditions of preservation and in different stages of growth prove that the costæ have great variability, both in their figure and in the presence or absence of tubercles. Occasionally a specimen will occur with the costæ plain and oblique, forming a considerable angle with the posteal portion, which, over the lower half of the valve, rise upwards almost at a right angle with their anteal portions, but even such specimens are never altogether destitute of small depressed nodose elevations upon the costæ; others are irregularly tuberculated or nodose over two thirds of the height of the valve, and are more or less angulated; again, other specimens have the few last-formed costæ altogether variable both in their direction and in the size and arrangement of their nodose tubercles which meander across the valve (Pl. XVI, figs. 9, 10), but their posteal portions are invariably nodose and curve suddenly upwards to the carina. Without exception fully developed forms have one or occasionally two supplementary anteal costæ.

The example figured under the name of *T. arata* in the 'Supplementary Monograph of the Great Oolite Mollusca,' above cited, was one of several very indifferently preserved specimens obtained by Mr. Walton in the Forest Marble of Farleigh, near Bath; the specimen is not of fully developed growth, the costæ are plain or have only slight indications of tubercles, and there is no distinct carina; other examples forwarded to me by the same gentleman were of more advanced growth and tuberculated, but so imperfect as to be unfit for purposes of illustration. The portions of their surface preserved agree with the larger and more irregular of our Lincolnshire examples.

Affinities and differences. From *T. v.-costata* it differs in the figures of the costæ, which are not **V**-like; the area is also much more rugose, and it is without the median carina.

It is more nearly allied to some forms of that very variable species, *T. Moretoni;* unlike the latter, the posteal portions of the costæ do not enlarge, but become somewhat attenuated near to the carina, to which, in the best preserved examples, they are united, each small tubercle upon the carina forming the terminal tubercle of one of the rows of costæ; the median carina in *T. Moretoni* has no counterpart in *T. undulata;* the latter-formed costæ in our species have also much greater irregularity than is seen in *T. Moretoni.* Upon the whole the enlargement of the posteal portions of the costæ in the latter species appears to be the most reliable distinctive feature, as it is always present. The remarkable variability above described will account for our having failed to identify with the second figure of Agassiz the very imperfect examples from the Forest Marble of Farleigh; and it has only been after comparison with examples from several localities that I have become convinced of the necessity of merging *T. arata* in *T. undulata.* By this latter species is intended only the specimen upon table x of the work of Agassiz, excluding table 6, figure 1, which appears to be a different species with a few large, widely-separated varices upon the angle of the valves or marginal carina.

In no British specimen examined, is the marginal carina and its row of tubercles so large, as in the figure of Agassiz, table x, which appears to constitute the extreme limit of its variability in one direction; other examples with the marginal carina nearly plain constituting the opposite limit of variability.

Stratigraphical position and Localities. *T. undulata* has been obtained only in the upper subdivision of the Great Oolite. Mr. Walton procured specimens in the Forest Marble of Farleigh; Mr. Cunnington in the Cornbrash of Hilperton, near Trowbridge. The officers of the National Geological Survey have also obtained it in Northamptonshire and Southern Lincolnshire; our figured examples are from Edenham, near Bourne, Lincolnshire. The specimen figured by Agassiz was from Piedmont.

TRIGONIA SHARPIANA, *Lycett,* sp. nov. Pl. XV, fig. 11; Pl. XVI, figs. 3, 4, 5, 6.

.... *Morton.* **Natural History of Northamptonshire, 1712, tab. vi, fig. 9.**

Shell ovately trigonal, convex; umbones elevated, and slightly recurved; anterior side short, its border curved elliptically with the lower border; hinge-border short, nearly horizontal, terminating posteally in the wide, rounded, and produced posteal border of the area. Escutcheon depressed, wide, and short; its upper border is somewhat raised. Area very wide, flattened, but occasionally with some convexity, bipartite, and bounded by two regular, small, delicately, and closely tuberculated carinæ; it is traversed transversely by narrow, sparingly arranged, regular costellæ, which become evanescent posteally in specimens of advanced growth; each costella has for its carinal termination one of the small carinal varices; the area occupies fully one third the surface of the valve. The other portion of the surface has numerous (16—17) rows of minutely tuberculated costæ; the first-formed four or five rows are nearly concentric, narrow, elevated, and only slightly tuberculated; the succeeding rows are closely arranged posteally; they descend from the carina almost perpendicularly to the middle of the valve, where they are suddenly bent horizontally forwards, and form a slight undulation nearly to the anterior border; the last-formed three or four rows descend perpendicularly to the lower border; all the rows have great regularity in their arrangement, and are nearly of equal size throughout their course.

The internal mould is unknown.

Stratigraphical position.—A specimen unusually large but without name as a species was figured by Morton in his 'Natural History' of Northamptonshire. The figure gives the characteristic features with truthfulness and minuteness, and is the only notice of it which I have discovered. Our smaller figures represent the usual size of specimens preserved in the form of external casts upon slabs of the sandy iron oolite of Northamptonshire. These preserve the more minute features of the Trigonia with great delicacy; for examples I am indebted to the kindness of Mr. S. Sharp, of Dallington Hall, Northampton, who has investigated the geology and palæontology of his district with long-continued perseverance and success. His collection has the only few Northamptonshire specimens with the tests preserved which I am acquainted with; my own cabinet has a single much larger example, but of less mature growth, from the shelly bed of the Dogger at Blue Wyke, near Robin Hood Bay, Yorkshire. The coarse ferruginous Oolite of Glaizedale in the same county also very commonly contains external casts of this Trigonia under circumstances of lithological character closely resembling the beds in Northamptonshire, and in like manner associated with *Astarte elegans*, Sow., *A. rhomboidalis*, Phil., and other well-known testacea of the Inferior Oolite. The Glaizedale casts of the Trigonia are much larger than those of Northamptonshire. It, therefore, appears to be a characteristic shell of the lower portion of the Inferior Oolite in the midland and northern counties of England.

Affinities. It is allied to *T. compta*, from which it is distinguished by having the area more expanded, by the absence of the few large isolated varices at the posteal extremities of the costæ, by their greater upward posteal curvature, and by their anteal undulation. From *T. Phillipsi* it is separated by the great breadth of the area with its distantly arranged transverse costellæ, together with the undulation and occasional angularity in the curvature of the rows of costæ.

T. Sharpiana has also considerable affinities with a still smaller species, viz. the *T. pulchella*, of Agassiz ('Trig.,' pl. xxv, t. 2, figs. 1—7), from strata, which he assigns to Upper Lias, at Urweilar and Mühlhausen (Haut-Rhin). Subsequently Quenstedt figured this little species in his 'Handbuche der Petrefacten' (tab. 43, fig. 14), and assigned it to the lowest zone of the Inferior Oolite. Compared with the British species all these forms are more oblong or sub-quadrate; their umbones are therefore more anterior, and are scarcely raised above the superior border. In *T. Sharpiana* the umbones are much raised, and have so much prominence that the general figure is ovately trigonal; the number of tuberculated costæ are variable, and differ much in their mesial angularity or undulation, but they are always more numerous, and never assume the broken and irregular aspect exhibited in all the specimens figured by Agassiz. The figures of Quenstedt have the ornamentation approximating more nearly to our species, but the general figure coincides with the shell of Agassiz, and cannot be identified with *T. Sharpiana.* Various specimens from Normandy in the British Museum from the Inferior Oolite at St. Vigor and Montiers have an absolute specific identity with the British examples, and serve materially to establish their distinctness from *T. pulchella.*

TRIGONIA COSTATULA, *Lyc.* Pl. XV, figs. 8, 9, 10; Pl. XII, fig. 6, 6*a*.

TRIGONIA COSTATULA, *Lycett.* Ann. and Mag. Nat. Hist., 1850, p. 421, tab. xi, fig. 5.
— EXIGUA, *Lycett.* Ann. and Mag. Nat. Hist., 1850, tab. xi, fig. 3 (young example dwarfed).
— COSTATULA and T. EXIGUA, *Morris.* Catal., 1854, p. 228.

Shell convex, ovately trigonal, or sub-quadrate; umbones elevated, obtuse, submesial, scarcely recurved; anterior side produced, its border, together with the lower border, curved elliptically. Escutcheon narrow, short, and depressed; only slightly more lengthened than the posterior border of the area, with which it forms an obtuse angle. Area wide, flattened, divided by an oblique mesial furrow, and bounded by two inconspicuous, knotted, small carinæ; the knots upon the inner carina assume the form of small varices, which are occasionally somewhat extended upon the escutcheon; the intercarinal space is occupied by small, irregular, transverse plications, which are sometimes only faintly traced. The other portion of the shell has a numerous series (21—22) of smooth, narrow, horizontal, or somewhat concentrically curved costæ, which near to the lower border become less elevated, and have also less regularity; a large specimen of the left valve has the last-formed two or three costæ more or less broken posteally; other specimens have their last-formed four or five costæ attenuated posteally, and bent slightly upwards with some irregularity to the marginal carina.

Trigonia exigua was founded upon very perfect examples of the young shell of the present species, obtained with numerous other dwarfed and immature testacea in the shelly freestone of Leckhampton Hill, near Cheltenham. In this young condition the first-formed costæ, to the number of thirteen or fourteen, are united almost uninterruptedly to the knotted elevations which constitute the marginal carina; they then pass across the area in the form of smaller costellæ, each of which terminates at the slight nodosities which form the inner carina; occasionally an intercalated costella is formed upon the area, which also possesses only slight indications of a median furrow; the uniformity, close arrangement, elevation, and acute edges of these first-formed costæ are remarkable, and differ greatly from the condition of specimens of more-developed growth, obtained in a bed of hard cream-coloured limestone (coralline mud), in which specimens have been cleared with great difficulty with the help of cutting instruments. Due allowance being made for these adverse circumstances, it will readily be understood that the specific identity of the two forms, apparently dissimilar, was not at first discovered, and that they were believed to represent different species; the cream-coloured rock, which also abounds with the genus *Nerinæa* in the vicinity of Stroud and Nailsworth, is little used for economical purposes, and the Trigonia therefore has very rarely been obtained.

Trigonia costatula appears to occupy in its sectional characters a position between the *costatæ* and the *undulatæ*, or to connect these groups, but as the area and escutcheon agree with those parts of the *undulatæ*, and are altogether distinct from the *costatæ*, I have preferred to place it with the former section, notwithstanding the presence of a series of plain horizontal costæ upon the other portion of the shell.

Specimens of this rare species are in the Museum of the Royal School of Mines; in the Woodwardian Museum, Cambridge; also in the collections of Dr. Wright, Cheltenham; Mr. Witchell, Stroud; Rev. P. B. Brodie, Rowington, near Warwick; and in my own cabinet; all from the middle portion of the Inferior Oolite in the vicinity of Cheltenham and of Stroud.

Trigonia Joassi, *Lycett*, sp. nov. Pl. XX, figs. 2, 3, 4.

Shell ovately oblong, convex; umbones placed within the anterior third of the valves, moderately elevated; anterior side short, curved elliptically with the lower border; posterior side much produced and somewhat depressed, pointed at the extremity of the marginal carina. Area of considerable breadth, flattened, rugosely plicated transversely. Escutcheon lengthened, narrow and flattened; marginal carina slightly elevated, transversely knotted. The other portion of the surface has the rows of costæ very numerous, each row having a double undulation resembling in figure the radii upon the Ammonites of the group of *Falciferi*, but with less regularity. The nodes in the rows are usually small, with much inequality in size and variability in figure, but for the most part they are either rounded or ovate; anteally they become much attenuated or cord-like; they are curved upwards obliquely from the anterior border, and at the end of about two fifths of their course form a sudden flexure directed obliquely downwards and become more distinctly nodulous. The nodes are irregular in the rows, and about the middle of the valve some of the anteal rows terminate; the remainder of the rows form another undulation, curving upwards to the marginal carina at a considerable angle, becoming more ridge-like and attenuated at their extremities. The nodes upon the middle portion of the valve are commonly confused, unequal in size, and irregular in figure; but this does not appear to be an invariable feature, as a specimen in the collection of Mr. Grant, of Lossimouth, has the rows of nodes regularly falciform and nearly equal. This specimen, although imperfect, shows that the rows near to the umbones become simply transverse and lose the falciform aspect. The materials upon which the foregoing description is founded are all more or less imperfect, but in the aggregate they exemplify nearly the whole of the more important features. The specimen with the ornamentation preserved over the greater part of the costated surface is in two portions, exhibiting only a moiety of the marginal carina, and is destitute of the area. The internal mould gives the general outline and proportions; the large striated hinge teeth, the muscular scars, and pallial lines; fortunately also, owing to the thinness of the test, the exterior ornamentation is obscurely visible, and even the posteal portion of the area has delicate, faintly-marked, transverse striations. The mould and also the specimen belonging to Mr. Grant have the few last-formed posteal portions of the costæ almost effaced, a condition which appears to be a concomitant of the last stage of growth. The specimen figured with the surface preserved retains its costæ at that portion of the valve.

The third specimen, which exhibits the greater portion of the area, is slightly defective near to the pallial border, and also at the apex; it is a gutta-percha pressing taken from a well-preserved external cast, kindly forwarded by the Rev. Mr. Joass; the compact siliceous rock has retained the impression of the surface of the shell with minuteness and delicacy. In the aggregate the examples figured upon our Plate appear sufficiently to elucidate the species.

Affinities. No one of the British *Undulata* presents any near approximation to *T. Joassi*; there is, however, one foreign *Trigonia* from the Oxford Clay of Gundershofen, which might possibly be mistaken for it, the *Lyrodon litteratum* of Goldfuss ('Petref.,' vol. ii, p. 200, tab. 136, fig. 5 *b*); the largest figure is the nearest ally; excluding other testacea upon the same plate, also named *litteratum*, which belong to two other species; the broken specimen pertains to the Inferior Oolite, the other to the Neocomian formation. Limiting the *litteratum* of Goldfuss in this manner, it will be found to have the area larger than in our species, which is also without the row of distinct rounded tubercles upon the marginal carina; upon the other portion of the valve the species of Gundershofen possesses in its ornamentation a certain amount of resemblance to *T. Joassi*, differing from the latter in the posteal portions of the costæ, which are larger and for the most part almost perpendicular and disunited from the other portions; the anteal costæ are also larger and less numerous. For examples of this fine species of the *Undulatæ* I am indebted to the kindness of Mr. J. W. Judd, who obtained them at Brora, in the far north of Scotland, during long and persevering researches in the Jurassic rocks of that little-known region. The imperfect specimen in two portions, but having the surface preserved, is from plaster casts of originals in the British Museum, obtained by Mr. Charles Peach in the Brora region. The species is dedicated to the Rev. J. M. Joass, of Golspie, at the suggestion of Mr. Judd, as a fitting recognition of his own obligations to that gentleman, for untiring efforts in his assistance, during the survey of a region heretofore but little explored by geologists.

Stratigraphical position and Localities. The Brora specimens are in a pale whitish argillaceous grit, which Mr. Judd believes to be upon the horizon of the Lower Calcareous Grit of Yorkshire; they are associated with *Pecten vimineus*, Sow.

§ IV. GLABRÆ.

TRIGONIA GIBBOSA, *Sow.* Plate XVIII, figs. 1, 2, 2 *a*, 3, 4, 5, 6; Plate XIX, figs. 1, 1 *a*, 1 *b*, 2.

TRIGONIA GIBBOSA, *Sowerby.* Min. Conch., tabs. 235, 236, p. 61, vol. iii.
— — *Benett.* Catal. Org. Rem. County of Wilts, 1831.
— — *Deshayes.* Coq. Carac., 1831, pl. xi, fig. 8, p. 37, 1831.
— — *De la Beche.* Manual of Geology, 1833.
— — *Fitton.* Géol. Trans., 2 sér., 4, p. 356, 1835.
— — *Pusch.* Potens Paléont., 1837, p. 60.
— — *Fitton.* Bull. Soc. Géol. de France, 1839, 1 sér., tom. x, p. 445.
— — *Agassiz.* Trigoniés, 1840, p. 10.
— — *Bronn.* Index Paléont., 1848, p. 686.
— — *D'Orbigny.* Prodrome de Paléont., 1850, vol. ii, No. 42, p. 60.
— — *Buvigier.* Statist. Minér. et Géol. Meuse, pp. 370, 401, 1852.
— — *Morris.* Catalogue, 1854, p. 228.
— — *Pictet.* Traité de Paléont., t. iii, p. 539, 1855.
— — *Hébert.* Terr. Jurass de la Bassin de Paris, p. 73, 1857.
— — *Oppel.* Juraformation, p. 722, No. 144, 1856.
— — *Contejean.* Étage Kimmeridgien de Mont Belliard, pp. 60 et 217, 1859.
— — *Coquand.* Synopsis des Foss. de la Charent., 1860, p. 36.
— — *Rigeaux.* Notice Stat. sur le Bas Boulonnais, 1865, p. 26.
— — *Pellat.* Bull. Soc. Géol. de Fr., 2 sér., tom. xxiii, pp. 208, 209, 1866.
— — *Hébert.* Note sur le terrain Jurassique du Boulonnais, Bull. Soc. Géol. Fr., 1866, 2 sér., tom. xxiii, p. 21.
— — *De Loriol* and *Pellat.* Monog. Paléont. et Géol. de l'étage Portlandien des env. de Boulogne, 1866, pl. iii, figs. 1, 2, 3.
— — *Wright.* Correlation of Jurassic Rocks, Proceedings of Cotteswold Nat. Club, 1869, p. 88.

Shell somewhat inflated, sub-ovate, or ovately oblong; umbones large, obtuse, elevated, antero-mesial and erect; anterior and inferior borders elliptically curved, hinge-border concave, its posteal extremity curved gently with the posteal border of the area.

The area is narrow, slightly convex, having a mesial oblique furrow; there are no distinct bounding carinæ, but near to the umbo the area forms a distinct angle with the more depressed ante-carinal space. The escutcheon is of moderate breadth, smooth and depressed. The ante-carinal space is much depressed near to the umbo; downwards it becomes more flattened and widens regularly towards the lower border, where its breadth exceeds that of the area. The entire valve in the adult state is divided into four or more zones by large, deeply-indented, transverse sulcations which are always conspicuous; they curve upwards at their extremities in accordance with the lines of growth. The costated portion occupies more than half the valve; the costæ in their prominence, number, and general aspects possess so much variability that, without the possession of numerous connecting specimens, other species may possibly be united with it; whenever the costæ are distinct upon the first or umbonal zone they are moderately numerous, plain, and oblique; upon the next and the succeeding zones they have greater curvature; anteally the extremities of the costæ in each zone curve upwards, external to the extremities of the costæ in the preceding zones, so that anteally the costæ appear to be unsymmetrical; upon the last zone the costæ become smaller and less distinct, or are confused irregularly with the lines of growth. *T. gibbosa* may be arranged under three varieties as follows:

Var. a.—Figure, Unio like or produced posteally; longitudinal sulcations large and deep, irregular and unequal near the pallial border; ante-carinal space narrow and not well defined, excepting near the apex; surface generally destitute of ornamentation, occasionally with some indications of costæ. Plate XVIII, figs. 5, 6.

Var. b.—Costæ prominent and numerous, covering the greater portion of the valve; narrow, ridge-like, small, and plain anteally, forming large, oblong, or sub-ovate nodes posteally; ante-carinal space much larger and more defined than in *Var. a;* the area also more distinctly marked, sometimes with slightly knotted elevations at the positions of the marginal and inner carinæ. Longitudinal sulcations distinct, but smaller than in *Var. a.* Plate XVIII, figs. 1, 2, 2 *a*, 4; Plate XIX, fig. 2.

Var. c.—Ante-carinal space very large and depressed; sulcations only slightly defined; rows of costæ very numerous and irregular, with small, crowded, but prominent nodes, producing a roughened surface; area narrow, strongly defined, transversely coarsely plicated, its bounding carinæ knotted anteally, plicated posteally. Plate XXI, fig. 1.

The figures in Sowerby's 'Mineral Conchology' represent the varieties *a* and *b*.

T. gibbosa in the work of De Loriol and Pellat is exemplified only by the variety *a*.

The *T. gibbosa* of Seebach ('Der Hannoversche Jura,' tab. 2, fig. 6 *a*, 6), from the Pterocera Beds of Tongesberge (a lower zone of the Jura formation), is evidently a distinct species characterised by a more trigonal form; by the absence of the large longitudinal sulcations and of the wide ante-carinal space, the costæ are also different.

Stratigraphical postion and Localities. In Britain *T. gibbosa* is the most well-known Trigonia of the Portland Oolite, and is limited to that rock and the subjacent sands; at Chilmark and at Tisbury all its varieties are exemplified throughout beds, the entire thickness of which is not less than sixty feet. Other reputed localities are the Isle of Portland, Devizes, Brill, Hartwell, and Swindon, but the examination of a multitude of examples of the *Glabræ* from those places demonstrate that *T. Dasmoniana* is their prevailing Trigonia.

Chicksgrove Quarry, Tisbury, has disunited valves of *T. gibbosa* in great profusion, sometimes covering large slabs of the bed called *Troughstone*, to the exclusion of all other testacea. The Portland formation in Britain is well characterised by the presence of its *Trigoniæ*, all of which appear to be special to it; those of the oolites and sands are *T. Damoniana, T. Manseli, T. Micheloti, T. tenuitexta, T. muricata, T. incurva*, and *T. Carrei;* those of the lower or Kimmeridge Clay are *T. Voltzii, T. Juddiana, T. Pellati, T. Woodwardi*, also another lengthened form, somewhat doubtful, which I have provisionally placed as a variety of *T. incurva* (Pl. IX, fig. 2).

In the vicinity of Boulogne *T. gibbosa* is also an abundant species at numerous localities, and in various beds of the upper portion of the Portland Formation. For ample details the reader is referred to the important memoirs by M. Hébert and by De Loriol and Pellat above cited.

Trigonia Manseli, *Lycett*, sp. nov. Pl. XIX, figs. 3, 4, 4 *a, b*.

Shell subovate or ovately oblong, inflated mesially, compressed near to the pallial border; umbones antero-mesial, prominent, large, and obtuse, much incurved and nearly erect; anterior and lower borders curved elliptically; hinge-border rather convex, curved gently with the posteal extremity of the area and terminating in an extremity which is somewhat produced and pointed. Escutcheon smooth and concave, but having its upper border somewhat raised. Area narrow, convex, and raised, divided conspicuously by a deep mesial furrow, which has bordering upon it, immediately upon either side, a slightly defined row of small tubercles, or in other specimens they are evanescent; there is also a well-defined line of small tubercles or varices which forms an inner carina; these varices are extended somewhat upon the escutcheon. The position of the marginal carina is indicated near to the umbones by a well-marked obtuse ridge, but this soon disappears with advance of growth, and the carina is then represented only by the rounded elevation which the border of the area forms, adjoining to the wide and very depressed smooth or ante-carinal space; the plications of growth are well defined over the whole of the area. The other portion of the surface has a very numerous and well-marked series of obliquely directed tuberculated costæ; upon the umbones the costæ are different; they there form a densely-arranged minute or linear series which pass horizontally across the whole of the valve uninterruptedly; they are plain and the breadth of the series does not exceed three lines (this feature, unfortunately, is not depicted upon our figures 4 *a* and 4 *b*); the costæ then change abruptly to oblique tuberculated rows which continue with only slight irregularity even to the lower border; the costæ (about twenty-four in number) are narrow, closely arranged, curved, and somewhat attenuated near to the pallial border; they pass upwards in a manner sometimes somewhat waved and meet the depressed ante-carinal space at a considerable angle, the tubercles in the rows (about twenty) are rounded or ovate and closely arranged, but upon the anteal attenuated portions of the costæ they are indistinct or cord-like; the costal terminations, posteally, are abrupt but do not form a regular line, so that the anteal boundary of the ante-carinal space is irregular. The arrangement of the rows is so close that it is sometimes difficult to discover the real direction of the lines of tubercles; in such instances the attenuated pallial extremities of the rows of costæ afford the real guide. The ante-carinal space is less wide than in *T. Micheloti* and *T. gibbosa,* but it is always conspicuously depressed longitudinally, which imparts an additional apparent convexity to the area. The valve has three transverse sulcations or arrests of growth; these are not very conspicuous and do not appear materially to have interfered with the direction of the rows of costæ which pass across them.

This pretty species constitutes one of the most clearly defined examples of the *Glabræ,* the direction and arrangements of the rows of tubercles immediately suffice to determine the species; perhaps it may be the shell of which a fragment of the anteal side was figured by Agassiz, 'Trigonies,' tab. 6, fig. 11, under the name of *T. picta,* from the White Coral Crag of Hoggerwald (Canton of Soleure), the general direction of the lines of tubercles and their attenuation towards the border agree with *T. Manseli,* but in the absence of the greater and more important portion of the valve I prefer only to allude to their possible specific identity.

Upon the whole there is much variability in the characters of the tuberculated costæ; occasionally the anteal portions of the umbonal rows are somewhat angulated or are curved concentrically, or the anteal portions of the latter-formed series have an occasional intercalated costa. The varying size of the tubercles in different specimens, and their more close or distant arrangement in the rows, impart much variability to the aspect of the species, but in every instance the tubercles are rounded and have much prominence.

The size is usually smaller than *T. Damoniana.*

Dimensions of a specimen rather smaller than usual:

Length 22 lines, height 18 lines, diameter through the united valves $14\frac{1}{2}$ lines.

The name is intended as a slight recognition of most welcome assistance rendered to the author by the loan of some interesting *Trigoniæ* from the Kimmeridge Clay of the Cliffs of Dorsetshire, one of the results of extensive explorations made by J. C. Mansel-Pleydell, Esq., of Longthorns, near Blandford, Dorset, upon his property in the Kimmeridge Clay, a formation which has been but little exposed in England.

Stratigraphical position and Localities.—*T. Manseli* has occurred somewhat rarely in the Limestone of the Isle of Portland and Tisbury. Specimens are in the Museum of Practical Geology, Jermyn Street; in the collection of Dr. Wright, of Cheltenham; in the collection of Mr. Cunnington, of Devizes; also in my own cabinet.

TRIGONIA DAMONIANA, *de Lor.* Pl. XVIII, fig. 3; Pl. XX, figs. 1, 2, 2 *a*, 2 *b*; Pl. XIX, figs. 1, 1 *a*, 1 *b*.

TRIGONIA GIBBOSA, a new variety, *Etherelda Benett.* Catal. Org. Rem. County of Wilts, 1830, pl. xviii, fig. 1.
— — *Damon.* Geol. Weymouth, Suppl., 1860, pl. vii, fig. 2.
— DAMONIANA, *de Loriol* and *Pellat.* Monog. Paléont. et Géol. de l'étage Portlandien des envir. de Boulogne, 1866, pl. xvii, figs. 4, 5.

Shell sub-ovate, lengthened obliquely, convex, umbones large, erect, very prominent and somewhat pointed, much incurved and rendered bipartite by the narrow deep sulcation produced by the apical termination of the ante-carinal space; borders of the valves elliptically rounded, excepting the hinge-border, which is straight and lengthened, sloping obliquely; the anterior face of the valves has also a large, rounded, depressed space or lunule, which gives a slightly truncated aspect to that portion when viewed laterally. The escutcheon is depressed, cordiform, and strongly marked by the lines of growth; the area is narrow, slightly elevated or convex, traversed transversely by irregular folds of growth; it has a well-marked mesial furrow, and is bounded at its upper or umbonal portion by two rows of minute, sparsely-arranged tubercles; some specimens have also a median line of minute tubercles bordering upon the groove; more frequently these three lines of carinal tubercles cannot be traced or only partially so even upon well-preserved specimens. The anti-carinal space or sulcation is narrow, smooth, and only slightly depressed, excepting near to the umbones, where it forms a deep sulcation; more frequently in adult forms its slight depression is the only feature which separates it from the area. The costated portion is divided into three or four zones by as many elliptical horizontal furrows; these are much less conspicuous than in *T. gibbosa;* like to that species the direction of the rows of costa are not conformable with the sulcations; they are more horizontal, thus rendering their aspect rather excentric; upon the anterior face of the shell they are entire, much attenuated, and form a slight angle or undulation; the costæ upon the umbo form a very numerous, plain, minute, closely-arranged, horizontal series, which pass also across the ante-carinal sulcation and area with slightly diminished prominence; subsequently the rows have their middle and posteal portions closely arranged and very unequal in size; they are usually slightly knotted or nodose, becoming larger posteally, and terminate abruptly at the smooth ante-carinal space, but occasionally over the lowest zone they are confusedly crowded, and minute or even continued across the ante-carinal space. Our example, Pl. XVIII, fig. 3, represents a well-marked variety, with few prominent costæ, each of which has about seven, large, widely separated tubercles; a specimen of more advanced growth has the last zone crowded with minute tubercles, which afford a remarkable contrast to the other rows of costæ, but the umbones have their costæ plain, minute, and dense, as in the typical form.

Compared with *T. gibbosa* the general figure differs considerably. It is shorter transversely, or more obliquely lengthened or ovate; the concentric sulcations are smaller, the umbones are more elevated, the costæ are smaller, more numerous, and more minutely nodose; the very numerous linear series which occupies the first zone of the shell and passes across the whole of the valves transversely is also another remarkable and distinctive feature. As there is much variability in the obliquity of the valves, measurements of proportions would have but little utility.

The first notice of *T. Damoniana* as distinguished from *T. gibbosa* occurs in a thin quarto volume published by Miss Etherelda Benett, of Warminster, in the year 1831; intended as an illustrated catalogue of organic remains in the County of Wilts, it is therein mentioned as a distinct variety of *T. gibbosa;* the drawing is characteristic and satisfactory, but the extreme scarceness of the work in question, together perhaps with some supineness or absence of sufficient investigation by British palæontologists, rendered it altogether neglected as a species.

Stratigraphical position and Localities. T. Damoniana is an abundant fossil at several localities, more especially in the white limestone of the Isle of Portland; at Brill, Bucks, and at Swindon, at the latter place the reddish ferruginous sandy beds at Dayhouse Farm have produced very numerous separate valves of *T. Damoniana,* having the ornamentation for the most part very well preserved; the specimens are of every stage of growth, but are frequently distorted by vertical pressure; they are spread out laterally and slightly flattened; specimens are in the Museum of Practical Geology and in the collection of Mr. Cunnington, of Devizes. Internal moulds are abundant at Swindon. They are shorter and more oblique than those of *T. gibbosa.*

A very large majority of examples of *T. Damoniana* obtained in the Isle of Portland coincide with the foregoing description; rarely, however, certain features become prominent, indicative of an additional variety, characterised by the great breadth of the smooth ante-carinal space. Apparently this is the form figured by De Loriol and Pellat for the *T. variegata* of Credner ('Monog. de la Portland. de Boulogne,' 1865, pl. 7, figs. 6, 7); the latter species, which is from the Kimmeridge strata of Fritzow, has large oblong nodes upon the posteal portions of the costæ; these are much fewer, and the ante-carinal space is much smaller than in our variety. In the expectation that examples of *T. variegata* might occur in the Portland formation of England I have attentively examined a multitude of examples of the *Glabræ* from its beds, but have failed to ascertain its presence; perhaps, considering the general very limited stratigraphical range of the *Trigoniæ*, we should scarcely expect to discover one of its Kimmeridge Clay species in the Portland Oolite; our British examples from the upper and lower stages of the formation indicate this distinctness very conclusively. The figures in the little work of Credner ('Ueber die Gliederung der Obern Juraformation und der Wealden Bildung in Nordwestlichen Deutschland, &c.,' Prag, 1863) are, upon the whole, coarsely engraved, and the drawings of the *Trigoniæ* are apparently not very reliable for correctness; in them we observe only a remote resemblance to the two figures of *T. variegata* given by De Loriol and Pellat from Boulogne.

For the most part the size and general aspect of the ante-carinal space affords a good distinctive feature for the *Glabræ*, and aids materially in the separation of its species, but in the present, as in some other instances, it assumes an amount of variability indicative of its subordination to some other specific characters. Other variable examples of this feature are seen in the smooth or typical form of *T. gibbosa*, in which the space is smaller and less distinct than in the other varieties; the same remark will also apply to certain examples of *T. Juddiana* and of *T. irregularis* in the *Clavellatæ* and to *T. angulata* in the *Undulatæ*; but it is only in the *Glabræ* that this feature, from its constancy and prominence, becomes of sectional importance.

TRIGONIA TENUITEXTA, *Lycett*, sp. nov. Plate XX, figs. 1, 1 *a*.

Shell with the general outline of *T. Damoniana*, but with less convexity; the most striking peculiarity is afforded by the ante-carinal space, which is nearly absent; there is only a narrow slight depression indicating its position; the knotted costæ upon the side of the valve are remarkable for their minuteness, close arrangement, and irregularity or undulations, so that they appear partially confused; they are also continued more or less obscurely even across the ante-carinal space; upon the umbonal portion the minute tubercles with which the costæ are crowded, disappear, and they there form a very numerous, minute, plain, or almost linear series. Upon the specimen figured the escutcheon has a few regular oblique plications; as this feature is one altogether foreign to the *Glabræ*, and occurs only in the *Quadratæ*, the *Scabræ*, and the *Costatæ*, its occurrence in the present instance may be regarded as only an abnormal or individual peculiarity.

Affinities. Compared with the allied form, *T. Damoniana,* the partial disappearance of the ante-carinal space, the smaller, much more numerous and crowded, meandering costæ, serve sufficiently to distinguish it. These characters also separate it from other *Trigoniæ* of the same section.

The magnified figure 1 *a* represents the umbonal costæ constituting a very numerous, minute series, directed horizontally, without interruption, across both the ante-carinal space and the area.

Stratigraphical position. The specimen figured is from the limestone of the Isle of Portland. A series of specimens more or less imperfect, kindly forwarded to me by Mr. Cunnington, proves that the species also occurs in the Portland Oolite at Devizes, Crookwood, and Tisbury.

TRIGONIA BEESLEYANA, *Lycett,* sp. nov. Plate XVII, figs. 2, 3, 4.

Shell ovately oblong, depressed, transverse, thin; umbones antero-mesial, small, depressed, only slightly raised above the superior border; anterior side moderately produced; its border rounded; lower border lengthened and curved elliptically, its posteal extremity pointed; superior border moderately lengthened, nearly horizontal, curved downwards posteally. Each valve is divided into two unequal portions by a plain oblique angle. The escutcheon is of moderate breadth, flattened, but somewhat concave, traversed by very numerous, rounded, regular, depressed, delicate costellæ, which pass across its surface horizontally, and are slightly indented transversely by the lines of growth; a few of the costellæ are bifurcated near to the superior border. There is no marginal carina, but a distinct oblique divisional angle, such as occurs in a portion of the *Scabræ;* to this latter group it is also allied by the entire absence of an area and by the ornamentation of the escutcheon, the costellæ upon which are similar in character or slightly scabrous. The middle portion of the valve comprising nearly the half of the whole surface is plain, and its surface is traversed only by the very delicate lines of growth; it is also without the oblique depression which usually is characteristic of the *Glabræ.* The anteal portion of the valve has numerous delicate, narrow, smooth, small costæ, which are conspicuous at the anteal border; they pass towards the middle of the valve obliquely downwards; they are slightly waved, and become evanescent ere they have traversed little more than one fourth of the length of the valve; towards the umbo they are scarcely perceptible. The lines of growth are numerous, unequal, and delicate.

The internal mould is well preserved, it exhibits very wide-spreading, coarsely striated, dental processes, and owing to the general depression of the valves, there is little convexity excepting near to the umbones; the muscular scars have but little prominence, and there are no traces of the external ornamentation. I have also succeeded in exposing the dental characters in a specimen of the right valve; the processes are narrow, widely divergent, and have little prominence, corresponding with the internal mould.

Dimensions.—Height 20 lines, length 27 lines, diameter through the united valves 6 lines.

My attention was first directed to this remarkable form by my friend Mr. J. W. Judd, who during his labours in the geological survey of Oxfordshire saw this Trigonia in the collection of Mr. Beesley, of Banbury, and was much struck with its novel aspect. So singular is the combination of characters which it presents, that the term *paradoxa* might be fitly applied to it were it not already employed in the genus. Its analogues belong altogether to the Cretaceous rocks; the general outline and also the ornamentation of the anterior side much resembles *T. excentrica,* Park. The posteal angle and slope with the characters of that portion of its surface assimilate it to some of the cretaceous *Scabræ,* and more especially to *T. Hondeana,* Coq., *T. tenuisulcata,* Duj., and *T. Archiaciana,* D'Orb., and this remarkable combination of sectional characters, so foreign to the Jurassic species, occurs in a Trigonia from almost the base of the Lower Oolites associated with a numerous series of Conchifera special to that stage.

Stratigraphical position and Locality. The two fine examples herewith figured, several others less well preserved, and a few internal moulds, constitute all the materials known; Mr. Beesley, to whom we owe their discovery, informs me that the locality of the quarry is Tynehill, in the parish of Adderbury, between that place and Great Barford, Oxfordshire. The rock is coarse, brown, shelly Oolite; amongst the Inferior Oolite Testacea found with it are *Cricopora straminea,* Phil., sp., *Serpula socialis,* Goldf., *Natica Leckhamptonensis,* Lyc. *Lima bellula,* Mor. and Lyc., *Nerinæa Jonesi,* Lyc., &c. The specimens figured are from the collection of Mr. Beesley; the University Museum, Oxford, also possesses a specimen.

TRIGONIA MICHELOTTI, *De Lor.* et *Pellat* (*variety*). Plate XX, fig. 7.

LYRODON EXCENTRICUM, *Goldfuss* and *Munster.* Petrefacta, 1836, vol. ii, page 203, plate 137, fig. 8. (Not *Trigonia excentrica,* Park.)

TRIGONIA MICHELOTTI, *T. de Loriol* et *E. Pellat.* Monog. Paléont. et Géol. de l'étage Portlandien des env. de Boulogne-sur-Mer, 1866, plate 7, fig. 9.

— MUNIERI, *Hébert.* Note sur le terr. jurass. der Boulonnois, Bull. de la Soc. Géol. de France, 2 sér., 1866, tom. 23, page 216.

[1] I am unable to determine to which of the eminent French geologists above cited priority should be given, as their publications are dated in the same year. Some consideration is perhaps due to the fact that the beautiful Monograph by De Loriol and Pellat gives the only figure of the species which has appeared since the great work of Goldfuss and Munster, in 1836.

PLATE X.

Fig.

1, 2. *Trigonia Voltzii,* Ag. (*T. Thurmanni,* Cont.). Kimmeridge Clay, near Weymouth. (Page 20.)

3, 3, *a*. ,, *detrita,* Terq. and Jour. Forest Marble, near Cirencester, Gloucestershire. (Page 75.)

4. ,, ,, Cornbrash, Hilperton. (Page 75.)

5, 7, 8. ,, *conjungens,* Phil. Inferior Oolite (Millepore bed), Cloughton, near Scarborough. (Page 62.)

6. ,, *geographica,* Ag. Coral Rag, Pickering. (Page 69.)

Fig. 3ª

Fig. 3.

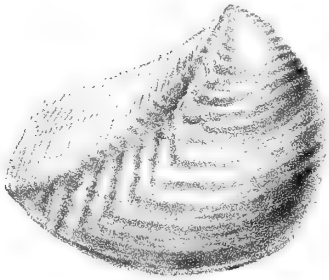


Fig. 4.

Fig. 1.

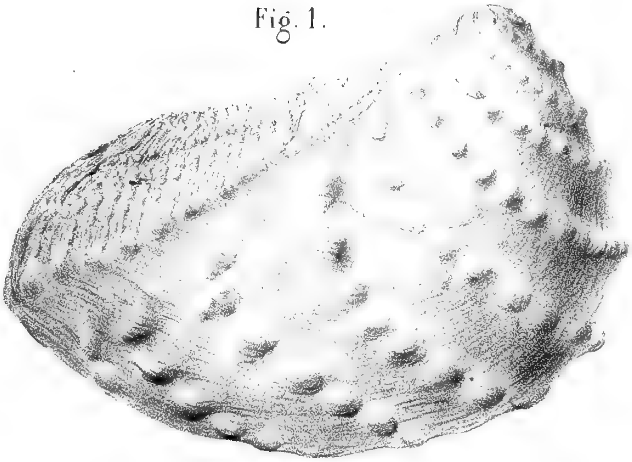


Fig. 5.

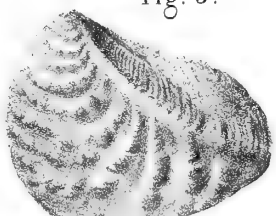


Fig. 6.

Fig. 2.

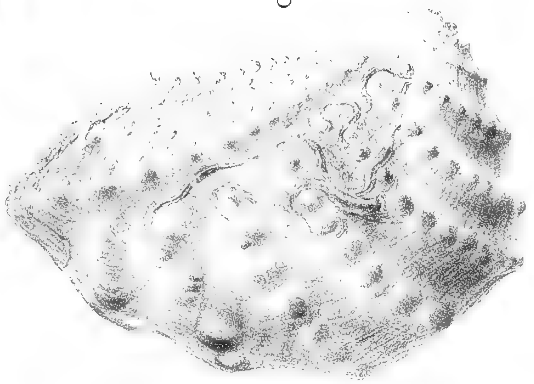
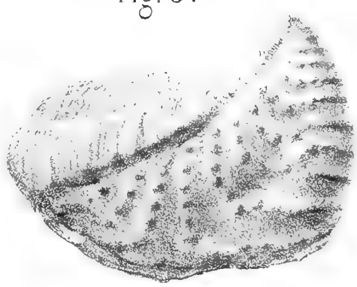


Fig. 7.

Fig. 8.



P. Lackerbauer ad nat in lap del.

Imp Becquet à Paris.

PLATE XI.

FIG.

1. *Trigonia Pellati,* Mun. Chal. Kimmeridge Clay, near St. Ives. (Page 41.)

2. ,, *formosa*, Lyc. Inferior Oolite, Rodborough Hill, near Stroud; specimen with the costæ deformed. (Page 35.)

3. ,, *perlata,* Ag. Coral Rag, Pickering; specimen with the pallial portions of the costæ irregular. (Page 22.)

4, 5. ,, *clytia,* D'Orb. Great Oolite, Box near Bath. (Page 76.)

6, 7. ,, ,, Impressions of small Trigoniæ, probably young examples of *T. v.-costata,* Collyweston Slate. (Page 66.)

8. ,, *paucicosta,* Lyc. Kelloway Rock, Cayton Bay, near Scarborough. (Page 57.)

9. ,, ,, Young example of the same species, from the same locality and formation.

Fig. 4.

Fig. 2.

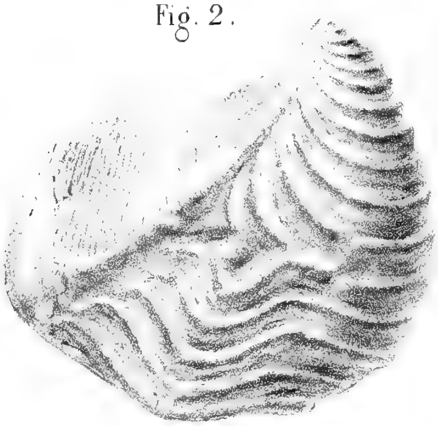


Fig. 5.

Fig. 6.

Fig. 7.

Fig. 1.

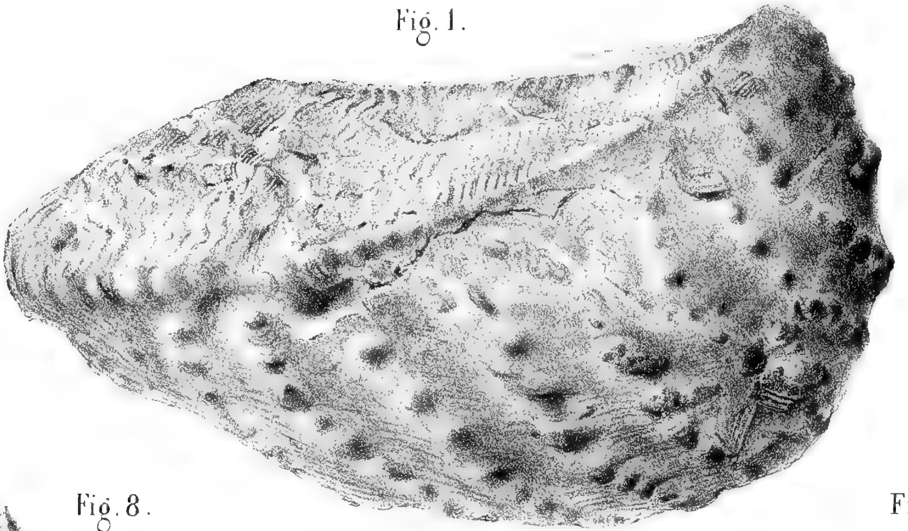


Fig. 8.

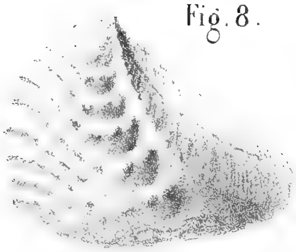


Fig. 9.

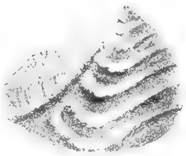
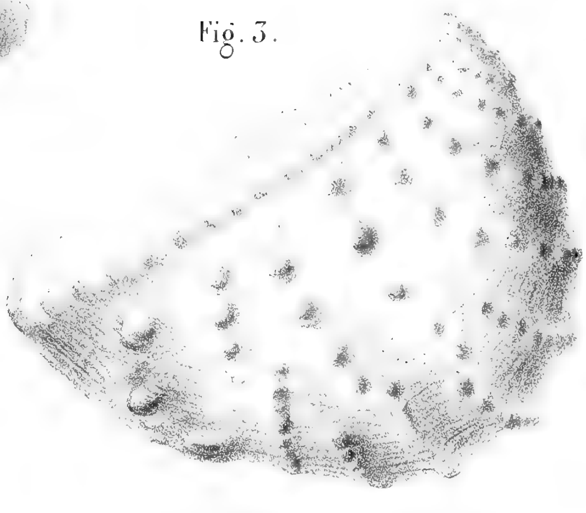


Fig. 3.



P. Lackerbauer ad nat. in lap. del.

Imp. Becquet à Paris.

PLATE XII.

FIG.

1. *Trigonia Carrei*, Mun. Chal. Portland Limestone, Tisbury, Wilts. (Page 72.)

2, 3. „ *Painei*, Lyc. Great Oolite, Minchinhampton. (Page 59.)

4. „ „ Specimen from the Great Oolite of South Lincolnshire.

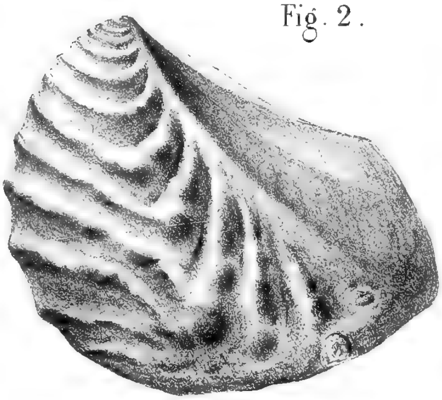
5. „ „ Young example from the same locality.

6, 6, *a*. „ *costatula*, Lyc. Young example. Inferior Oolite, Leckhampton Hill, Cheltenham. (Page 81.) 6, *a*, enlarged.

7. „ *tripartita*, Forbes. Cornbrash, Chippenham. (Page 74.)

8. „ *subglobosa*, Lyc. Inferior Oolite, near Stroud. (Page 68.)

9, 10. „ „ Large specimens of the same species, from the same formation and locality. Coll. Royal School of Mines.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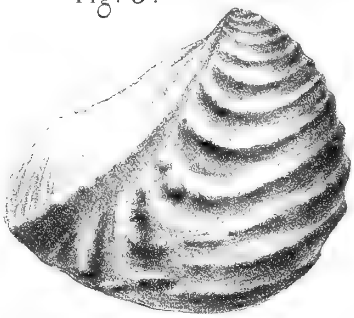
Fig. 3.


Fig. 4.

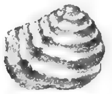
Fig. 5.

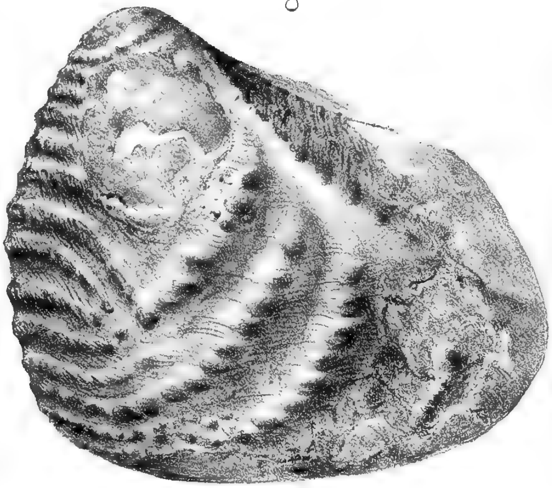
Fig. 1.


Fig. 6.

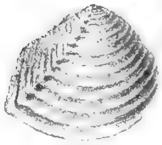
Fig. 6ª.

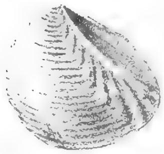
Fig. 7.


Fig. 8.


Fig. 9.


Fig. 10.

P. Lackerbauer ad nat in lap del.

Imp Becquet à Paris.

PLATE XIII.

Fig.

1, 2. *Trigonia producta*, Lyc. Inferior Oolite, Rodborough Hill, near Stroud. (Page 60.)

3, 4. „ „ Valves of the same species, exhibiting the hinge. Inferior Oolite, Oxfordshire. Coll. Royal School of Mines.

5. „ *v.-costata*, Lyc. Inferior Oolite, Cold Comfort, near Cheltenham; specimen with the costæ deformed. (Page 66.)

6. „ *conjungens*, Phil. Inferior Oolite, Millepore bed, near Scarborough. Also Plate X, figs. 5, 7, 8. (Page 62.)

Fig. 6.

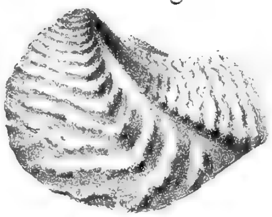

Fig. 2.

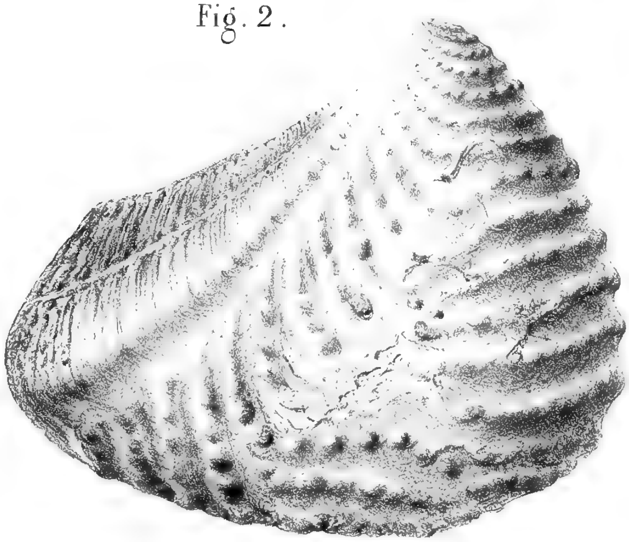

Fig. 1.

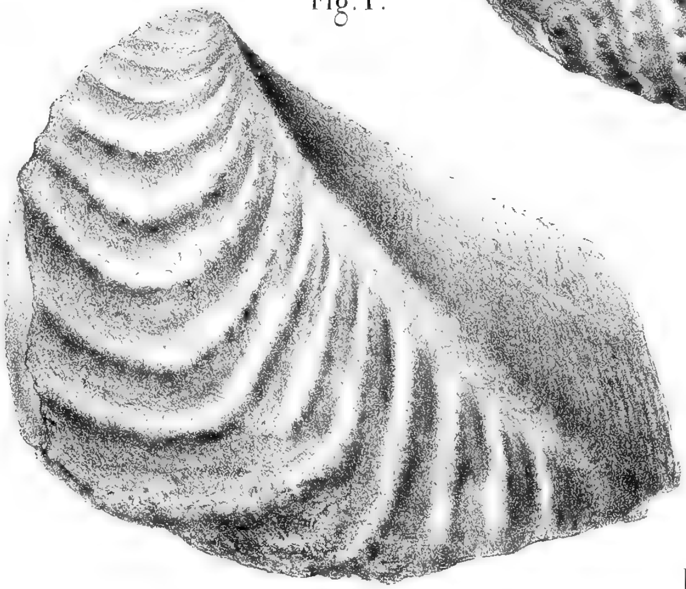

Fig. 3.

Fig. 4.

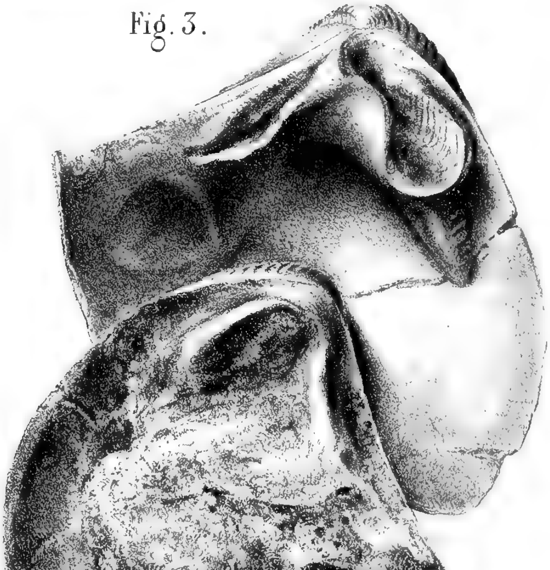

Fig. 5.

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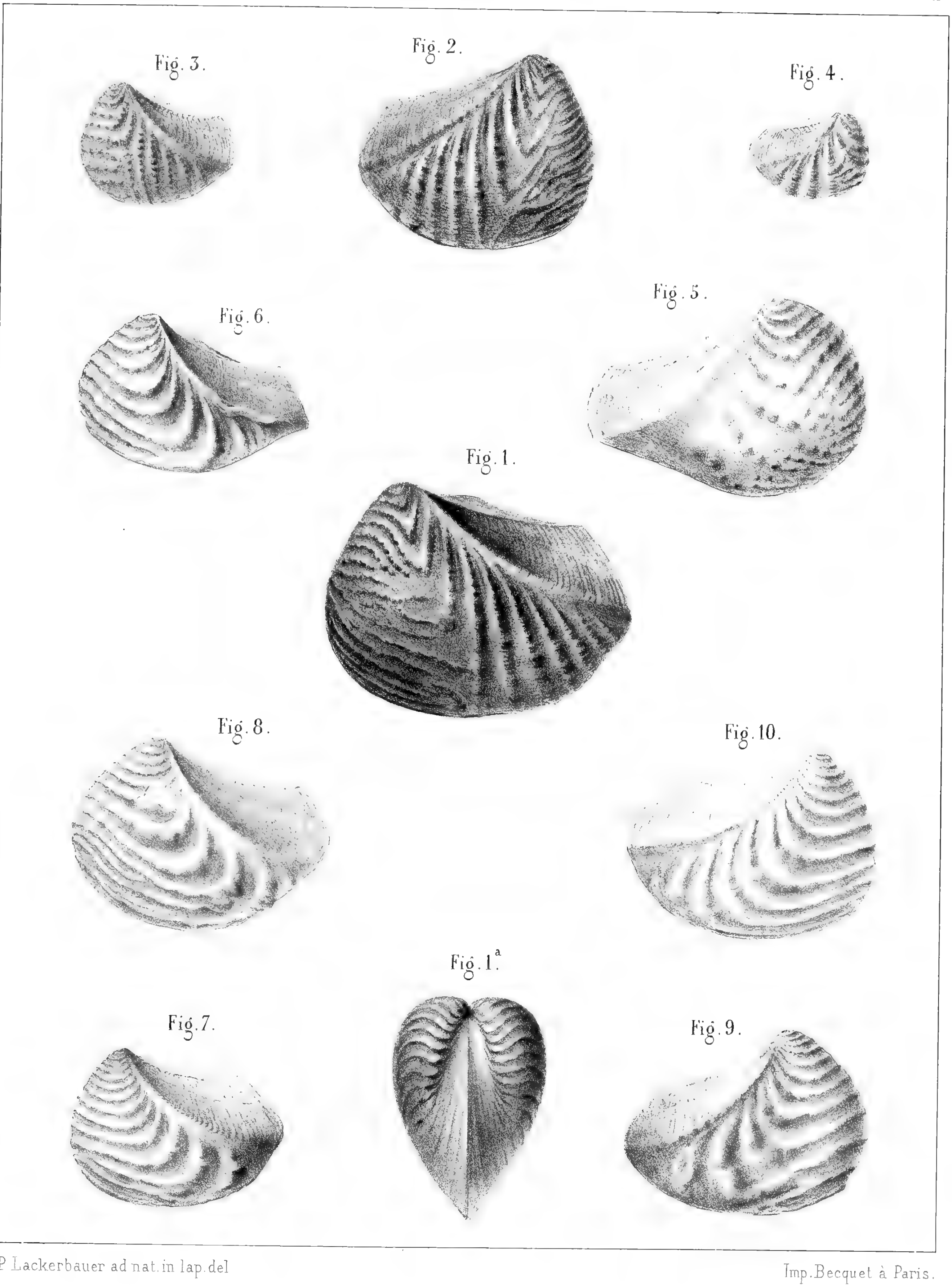
PLATE XIV.

FIG.

1, 1, *a*, 2, 3, 4. *Trigonia literata*, Young and Bird. Upper Lias, Robin Hood's Bay, Yorkshire. (Page 64.)

5, 6. " *angulata*, Sow. Inferior Oolite, Rodborough Hill, Stroud. (Page 54.)

7, 8, 9, 10. " *flecta*, Lyc. Cornbrash or Forest Marble, Thornholme, Appleby, Lincolnshire. (Page 55.)



P. Lackerbauer ad nat. in lap. del

Imp. Becquet à Paris.

PLATE XV.

Fig.

1. *Trigonia v.-costata*, Lyc. Inferior Oolite, Rodborough Hill, Stroud. (Page 66.) Coll. Royal School of Mines.

2, 3, 4. ,, ,, Smaller examples, Inferior Oolite, Dogger, Blue Wyke, Yorkshire.

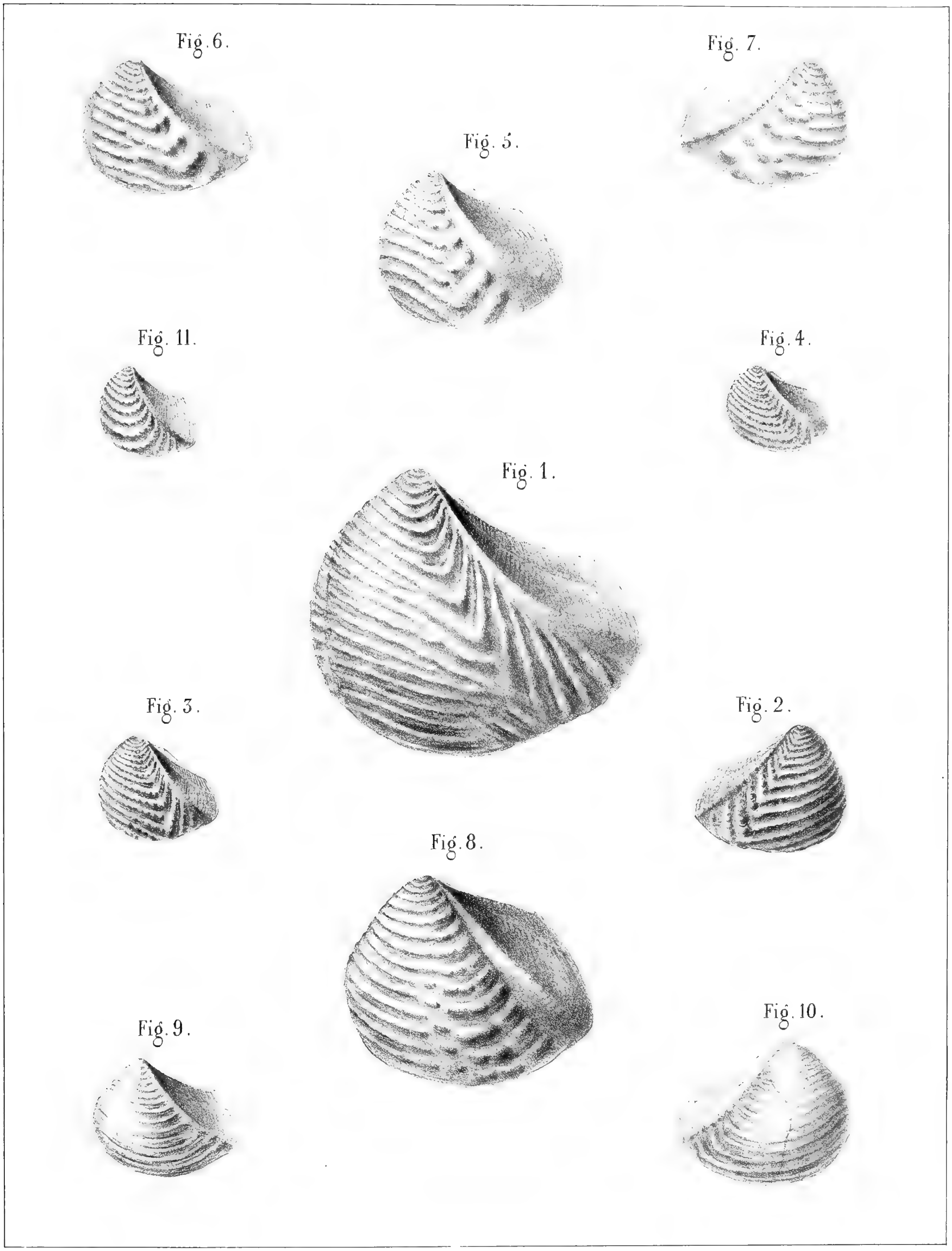
5, 6, 7. ,, *compta*, Lyc. Inferior Oolite, Collyweston slate. (Page 70.)

8, 10. ,, *costatula*, Lyc. Inferior Oolite, near Stroud. (Page 81.) Coll. Royal School of Mines.

9. ,, ,, A smaller specimen, from the same formation and locality.

11. ,, *Sharpiana*, Lyc. Inferior Oolite (ferruginous), near Northampton. (Page 79.)

Pl. 15.



P. Lackerbauer ad nat. in lap. del

Imp. Becquet à Paris.

PLATE XV.

FIG.

1. *Trigonia v.-costata*, Lyc. Inferior Oolite, Rodborough Hill, Stroud. (Page 66.) Coll. Royal School of Mines.

2, 3, 4. ,, ,, Smaller examples, Inferior Oolite, Dogger, Blue Wyke, Yorkshire.

5, 6, 7. ,, *compta*, Lyc. Inferior Oolite, Collyweston slate. (Page 70.)

8, 10. ,, *costatula*, Lyc. Inferior Oolite, near Stroud. (Page 81.) Coll. Royal School of Mines.

9. ,, ,, A smaller specimen, from the same formation and locality.

11. ,, *Sharpiana*, Lyc. Inferior Oolite (ferruginous), near Northampton. (Page 79.)

Fig. 6.

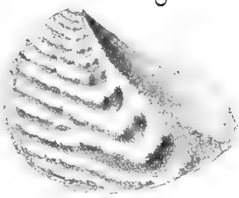


Fig. 7.

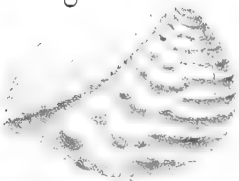


Fig. 5.

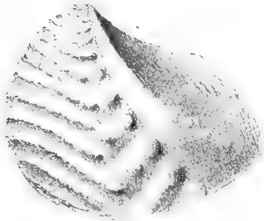


Fig. 11.

Fig. 4.

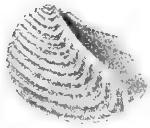


Fig. 1.

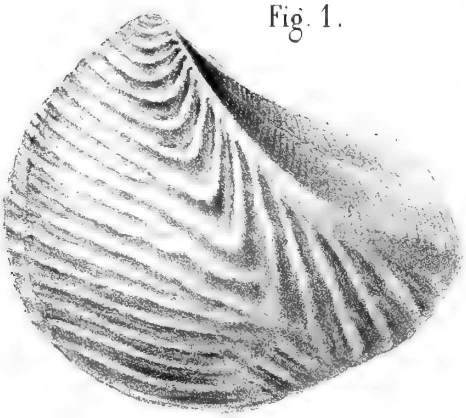


Fig. 3.

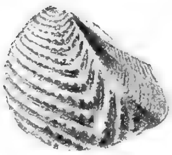


Fig. 2.

Fig. 8.

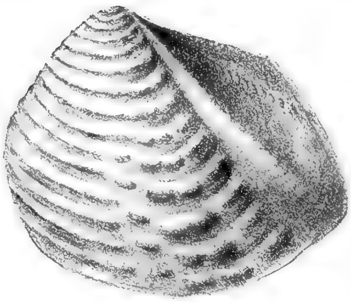


Fig. 9.

Fig. 10.

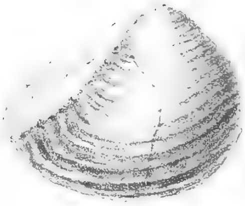


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PLATE XVI.

Fig.

1\. *Trigonia Leckenbyi*, Lyc. Supra-Liassic Sandstone, Robin Hood's Bay, Yorkshire. (Page 71.) Coll. Woodwardian Museum, Cambridge.

2\. ,, ,, A smaller specimen, from the same formation and locality.

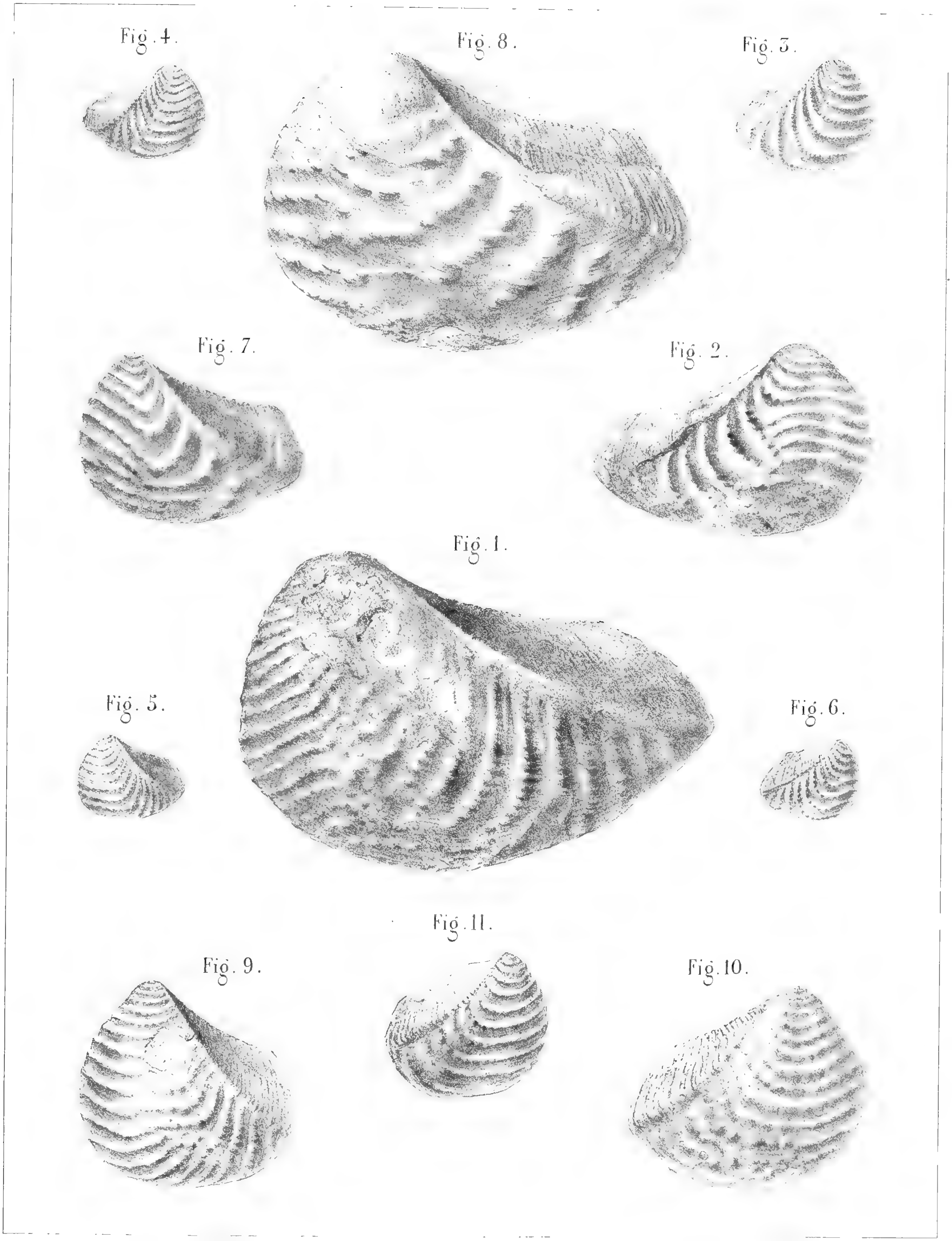
3\. ,, *Sharpiana*. Dogger, Blue Wyke. (Page 79.)

4, 5, 6. ,, ,, Same species (ferruginous). Inferior Oolite, Northamptonshire.

7\. ,, *paucicosta*, Lyc. Kelloway Rock, Cayton Bay, near Scarborough. (Page 57.)

8\. ,, *Williamsoni*, Lyc. Kelloway Rock, Cayton Bay, near Scarborough. (Page 53.)

9, 10, 11. *undulata*, From. Great Oolite, near Bourn, Lincolnshire. (Page 77.)



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Imp Becquet a Paris.

PLATE XVII.

Fig.

1. *Trigonia Woodwardi*, Lyc. Kimmeridge Clay, Dorsetshire. (Page 40.)

2. 3, 4. ,, *Beesleyana*, Lyc. Inferior Oolite, Combe Hill, Oxfordshire. (Page 90.)

5, 6. ,, *undulata*, From. Great Oolite, South Lincolnshire. (Page 77.)

7. ,, *clytia*, D'Orb. Great Oolite, Box, near Bath. (Page 76.)

Fig. 2.

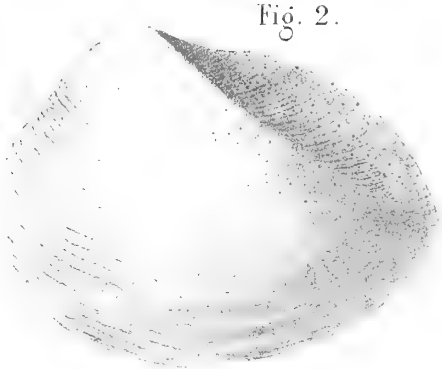


Fig. 3.

Fig. 1.

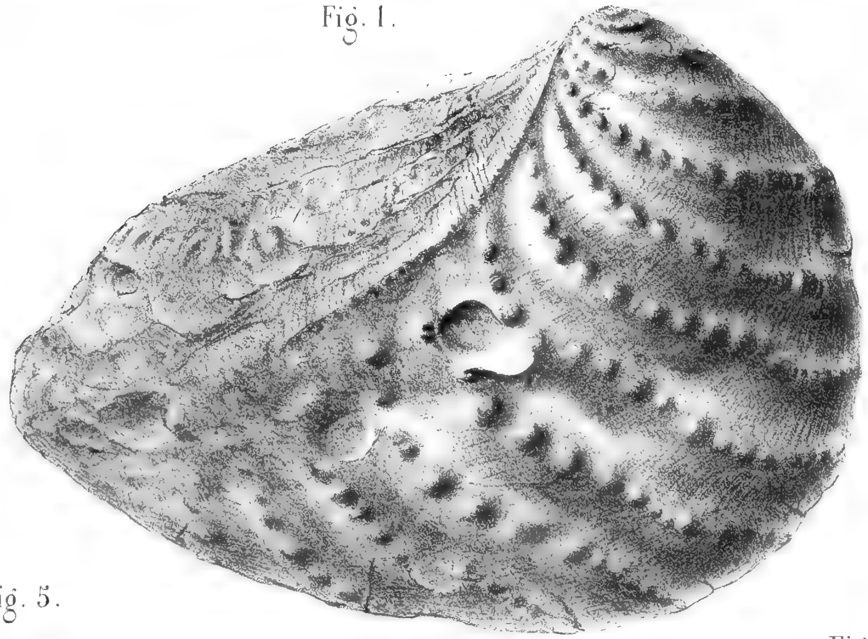


Fig. 5.

Fig. 7.

Fig. 6.

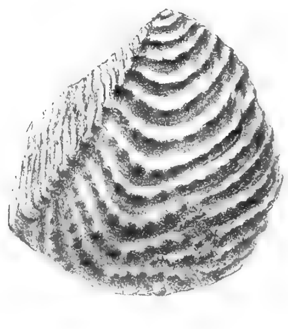


Fig. 4.

P. Lackerbauer ad nat in lap del

Imp. Becquet à Paris

PLATE XVIII.

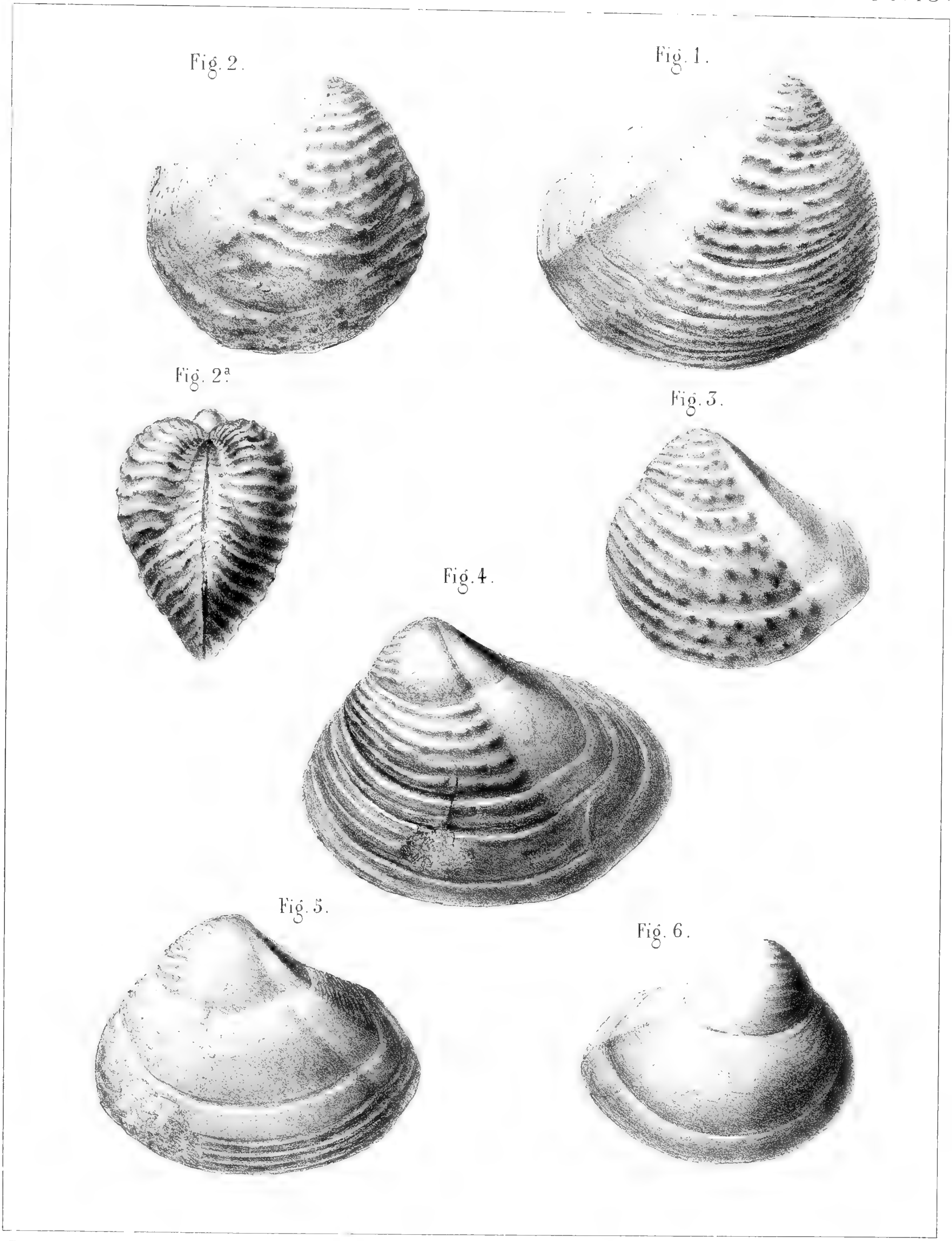
Fig.

1, 2, 2, *a*. *Trigonia gibbosa*, Sow. Variety with prominent nodose costæ and wide ante-carinal space. Portland Oolite, Tisbury. Also Plate XXI, fig. 1. (Page 84.)

3. „ *Damoniana*, De Lor. Variety with few large nodes upon the costæ; see also Plate XXI, figs. 2, 3, 4, 5. Portland Limestone, Portland. (Page 88.)

4. „ *gibbosa*. Variety with the costæ small, partially plain or subtuberculated; see also Plate XIX, fig. 2. Portland Oolite, Tisbury. (Page 84.)

5, 6. „ *gibbosa*. The typical form, longitudinal sulcations strongly defined. Portland Oolite, Tisbury. (Page 84.)



P. Lackerbauer ad nat. in lap. del.

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PLATE XIX.

FIG.

1, 1, *a*, *b*. *Trigonia Damoniana*, De Lor. Internal moulds. Portland Oolite, Swindon, Wilts. (Page 88.)

2. ,, *gibbosa*, Sow. Variety; see also fig. 4, Plate XVIII. Portland Oolite, Tisbury. (Page 84.)

3, 4, 4, *a*, *b*. ,, *Manseli*, Lyc. Portland Oolite, Isle of Portland. (Page 86.)

Fig. 1a.

Fig. 1.

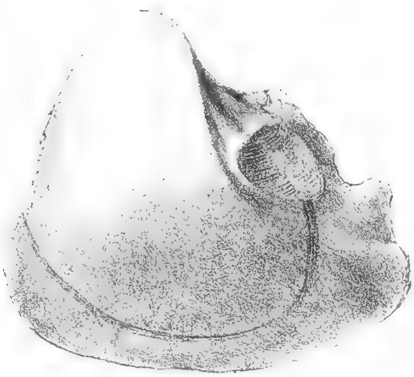

Fig. 1b.

Fig. 4a.

Fig. 4b.

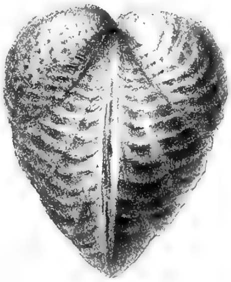

Fig. 2.

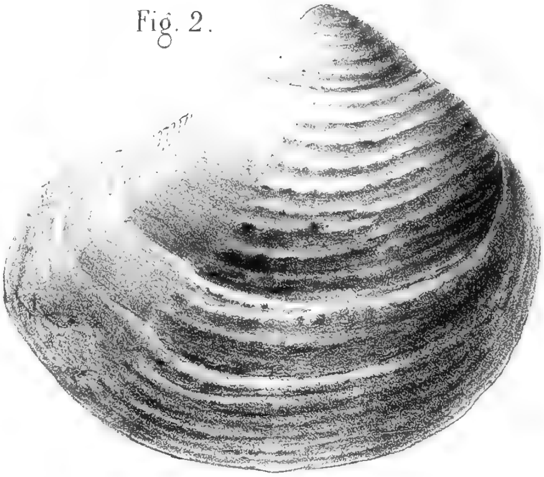

Fig. 4.

Fig. 3.

P. Lackerbauer ad nat. in lap del.

Imp. Becquet à Paris.