

PALEONTOGRAPHICAL SOCIETY.

VOL. LIII.

PALÆOZOIC PHYLLOPODA.

PART IV (CONCLUSION).

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CRETACEOUS LAMELLIBRANCHIA.

PART I.

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CARBONIFEROUS LAMELLIBRANCHATA.

PART IV.

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INFERIOR OOLITE AMMONITES.

PART XI (SUPPLEMENT NO. 2).

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PALÆONTOGRAPHICAL SOCIETY.

VOLUME LIII.

CONTAINING

- THE PALÆOZOIC PHYLLOPODA. Part IV (*Conclusion*). By Prof. T. RUPERT JONES and Dr. H. WOODWARD. Six Plates.
- THE CRETACEOUS LAMELLIBRANCHIA. Part I. By Mr. H. WOODS. Fourteen Plates.
- THE CARBONIFEROUS LAMELLIBRANCHIATA. Part IV. By Dr. WHEELTON HIND. Fourteen Plates.
- THE INFERIOR OOLITE AMMONITES. Part XI. By Mr. S. S. BUCKMAN. Ten Plates.

ISSUED FOR 1899.

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OF

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- I. A CATALOGUE OF THE WORKS ALREADY PUBLISHED ;
- II. A CLASSIFIED LIST OF THE MONOGRAPHS COMPLETED, IN COURSE OF PUBLICATION,
AND IN PREPARATION, WITH THE NAMES OF THEIR RESPECTIVE AUTHORS ;
- III. THE DATES OF ISSUE OF THE ANNUAL VOLUMES ;
- IV. A GENERAL SUMMARY, SHOWING THE NUMBER OF THE PAGES, PLATES, FIGURES,
AND SPECIES IN EACH MONOGRAPH ;
- V. A STRATIGRAPHICAL LIST OF THE BRITISH FOSSILS FIGURED AND DESCRIBED IN THE
YEARLY VOLUMES.

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§ I. CATALOGUE OF WORKS

ALREADY PUBLISHED BY

THE PALÆONTOGRAPHICAL SOCIETY:

Showing the ORDER of publication; the YEARS during which the Society has been in operation; and the CONTENTS of each yearly Volume.

Vol. I.	Issued for the Year 1847	The Crag Mollusca, Part I, Univalves, by Mr. S. V. Wood, 21 plates.
„ II.	„	1848 { The Reptilia of the London Clay, Vol. I, Part I, Chelonia, &c., by Profs. Owen and Bell, 38 plates. The Eocene Mollusca, Part I, Cephalopoda, by Mr. F. E. Edwards, 9 plates.
„ III.*	„	1849 { The Entomostraca of the Cretaceous Formations, by Mr. T. R. Jones, 7 plates. The Permian Fossils, by Prof. Wm. King, 29 plates. The Reptilia of the London Clay, Vol. I, Part II, Crocodilia and Ophidia, &c., by Prof. Owen, 18 plates. The Fossil Corals, Part I, Crag, London Clay, Cretaceous, by Messrs. Milne Edwards and Jules Haime, 11 plates.
„ IV.	„	1850 { The Crag Mollusca, Part II, No. 1, by Mr. S. V. Wood, 12 plates. The Mollusca of the Great Oolite, Part I, Univalves, by Messrs. Morris and Lycett, 15 plates. The Fossil Brachiopoda, Vol. I, Part III, No. 1, Oolitic and Liassic, by Mr. Davidson, 13 plates.
„ V.	„	1851 { The Reptilia of the Cretaceous Formations, by Prof. Owen, 39 plates. The Fossil Corals, Part II, Oolitic, by Messrs. Milne Edwards and Jules Haime, 19 plates. The Fossil Lepadidæ, by Mr. Charles Darwin, 5-plates.
„ VI.	„	1852 { The Fossil Corals, Part III, Permian and Mountain-limestone, by Messrs. Milne Edwards and Jules Haime, 16 plates. The Fossil Brachiopoda, Vol. I, Part I, Tertiary, by Mr. Davidson, 2 plates. The Fossil Brachiopoda, Vol. I, Part II, No. 1, Cretaceous, by Mr. Davidson, 5 plates. The Fossil Brachiopoda, Vol. I, Part III, No. 2, Oolitic, by Mr. Davidson, 5 plates. The Eocene Mollusca, Part II, Pulmonata, by Mr. F. E. Edwards, 6 plates. The Radiaria of the Crag, London Clay, &c., by Prof. E. Forbes, 4 plates.

* The Volume for the year 1849 consists of two separate portions, each of which is stitched in a paper cover, on which are printed the dates 1848, 1849, and 1850. The one portion contains 'Cretaceous Entomostraca' and 'Permian Fossils;' the other, 'London Clay Reptilia,' Part II, and 'Fossil Corals,' Part I

CATALOGUE OF WORKS—Continued.

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| Vol. VII. | Issued for the
Year 1853 | <ul style="list-style-type: none"> { The Fossil Corals, Part IV, Devonian, by Messrs. Milne Edwards and Jules Haime, 10 plates. { The Fossil Brachiopoda, Introduction to Vol. I, by Mr. Davidson, 9 plates. { The Mollusca of the Chalk, Part I, Cephalopoda, by Mr. D. Sharpe, 10 plates. { The Mollusca of the Great Oolite, Part II, Bivalves, by Messrs. Morris and Lycett, 8 plates. { The Mollusca of the Crag, Part II, No. 2, Bivalves, by Mr. S. V. Wood, 8 plates. { The Reptilia of the Wealden Formations, Part I, Chelonia, by Prof. Owen, 9 plates. |
| ,, VIII.* | ,, 1854 | <ul style="list-style-type: none"> { The Fossil Brachiopoda, Vol. I, Part II, No. 2, Cretaceous, with Appendix and Index to Vol. I, by Mr. Davidson, 8 plates. { The Reptilia of the Wealden Formations, Part II, Dinosauria, by Prof. Owen, 20 plates. { The Mollusca of the Great Oolite, Part III, Bivalves, by Messrs. Morris and Lycett, 7 plates. { The Fossil Corals, Part V, Silurian, by Messrs. Milne Edwards and Jules Haime, 16 plates. { The Fossil Balanidæ and Verrucidæ, by Mr. Charles Darwin, 2 plates. { The Mollusca of the Chalk, Part II, Cephalopoda, by Mr. D. Sharpe, 6 plates. { The Eocene Mollusca, Part III, No. 1, Prosobranchiata, by Mr. F. E. Edwards, 3 plates. |
| ,, IX.† | ,, 1855 | <ul style="list-style-type: none"> { The Mollusca of the Crag, Part II, No. 3, Bivalves, by Mr. S. V. Wood, 11 plates. { The Reptilia of the Wealden Formations, Part III, by Prof. Owen, 12 plates. { The Eocene Mollusca, Part III, No. 2, Prosobranchiata, continued, by Mr. F. E. Edwards, 4 plates. { The Mollusca of the Chalk, Part III, Cephalopoda, by Mr. D. Sharpe, 11 plates. { The Tertiary Entomotraca, by Mr. T. R. Jones, 6 plates. { The Fossil Echinodermata, Oolitic, Vol. I, Part I, by Dr. Wright, 10 plates. |
| ,, X. | ,, 1856 | <ul style="list-style-type: none"> { The Fossil Echinodermata, Oolitic, Vol. I, Part II, by Dr. Wright, 12 plates. { The Fossil Crustacea, Part I, London Clay, by Prof. Bell, 11 plates. { The Fossil Brachiopoda, Vol. II, Part IV, Permian, by Mr. Davidson, 4 plates. { The Fossil Brachiopoda, Vol. II, Part V, No. 1, Carboniferous, by Mr. Davidson, 8 plates. { The Reptilia of the Wealden Formations, Part IV (Supplement No. 1), by Prof. Owen, 11 plates. { The Reptilia of the London Clay, Vol. I (Supplement), by Prof. Owen, 2 plates. |
| ,, XI. | ,, 1857 | <ul style="list-style-type: none"> { The Fossil Echinodermata, Oolitic, Vol. I, Part III, by Dr. Wright, 14 plates. { The Fossil Brachiopoda, Vol. II, Part V, No. 2, Carboniferous, by Mr. Davidson, 8 plates. { The Reptilia of the Cretaceous Formations (Supplement No. 1), by Prof. Owen, 4 plates. { The Reptilia of the Wealden Formations (Supplement No. 2), by Prof. Owen, 8 plates. { The Polyzoa of the Crag, by Prof. Busk, 22 plates. |
| ,, XII. | ,, 1858 | <ul style="list-style-type: none"> { The Fossil Echinodermata, Oolitic, Vol. I, Part IV, by Dr. Wright, 7 plates. { The Eocene Mollusca, Part III, No. 3, Prosobranchiata continued, by Mr. F. E. Edwards, 6 plates. { The Reptilia of the Cretaceous Formations (Supplements No. 2, No. 3), by Prof. Owen, 7 plates. { The Reptilia of the Purbeck Limestones, by Prof. Owen, 1 plate. { The Fossil Brachiopoda, Vol. II, Part V, No. 3, Carboniferous, by Mr. Davidson, 10 plates. |
| ,, XIII. | ,, 1859 | <ul style="list-style-type: none"> { The Fossil Brachiopoda, Part V, No. 4, Carboniferous, by Mr. Davidson, 20 plates. { The Reptilia of the Oolitic Formations, No. 1, Lower Lias, by Prof. Owen, 6 plates. { The Reptilia of the Kimmeridge Clay, No. 1, by Prof. Owen, 1 plate. { The Eocene Mollusca, Part IV, No. 1, Bivalves, by Mr. S. V. Wood, 13 plates. |
| ,, XIV. | ,, 1860 | <ul style="list-style-type: none"> { The Fossil Brachiopoda, Vol. II, Part V, No. 5, Carboniferous, by Mr. Davidson, 8 plates. { The Reptilia of the Oolitic Formations, No. 2, Lower Lias, by Prof. Owen, 11 plates. { The Reptilia of the Kimmeridge Clay, No. 2, by Prof. Owen, 1 plate. { The Fossil Estheria, by Prof. Rupert Jones, 5 plates. { The Fossil Crustacea, Part II, Gault and Greensand, by Prof. Bell, 11 plates. |
| ,, XV. | ,, 1861 | <ul style="list-style-type: none"> { The Fossil Echinodermata, Oolitic, Vol. II, Part I (Asteroidea), by Dr. Wright, 13 plates. { Supplement to the Great Oolite Mollusca, by Dr. Lycett, 15 plates. |

* This Vol. is marked on the outside 1855.

† This Vol. is marked on the outside 1856.

CATALOGUE OF WORKS—Continued.

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| Vol. XVI. | Issued for the Year 1862 | <ul style="list-style-type: none"> { The Fossil Echinodermata, Cretaceous, Vol. I, Part I, by Dr. Wright, 11 plates. { The Trilobites of the Silurian, Devonian, &c., Formations, Part I (Devonian and Silurian), by Mr. J. W. Salter, 6 plates. { The Fossil Brachiopoda, Vol. III, Part VI, No. 1, Devonian, by Mr. Davidson, 9 plates. { The Eocene Mollusca, Part IV, No. 2, Bivalves, by Mr. S. V. Wood, 7 plates. { The Reptilia of the Cretaceous and Wealden Formations (Supplements), by Prof. Owen, 10 plates. |
| „ XVII. | „ 1863 | <ul style="list-style-type: none"> { The Trilobites of the Silurian, Devonian, &c., Formations, Part II, by Mr. J. W. Salter, 8 plates. { The Fossil Brachiopoda, Vol. III, Part VI, No. 2, Devonian, by Mr. Davidson, 11 plates. { The Belemnitidae, Part I, Introduction, by Prof. Phillips. { The Reptilia of the Liassic Formations, Part I, by Prof. Owen, 16 plates. |
| „ XVIII. | „ 1864 | <ul style="list-style-type: none"> { The Fossil Echinodermata, Oolitic, 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 Belemnitidae, 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 | <ul style="list-style-type: none"> { The Crag Foraminifera, Part I, 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, Vol. III, Part VII, No. 1, Silurian, by Mr. Davidson, 12 plates. |
| „ XX.* | „ 1866 | <ul style="list-style-type: none"> { 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, Vol. III, Part VII, No. 2, Silurian, by Mr. Davidson, 10 plates. { The Belemnitidae, Part III, Liassic Belemnites, by Prof. Phillips, 13 plates. |
| „ XXI.* | „ 1867 | <ul style="list-style-type: none"> { Flora of the 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. |
| „ XXII.* | „ 1868 | <ul style="list-style-type: none"> { 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, Vol. III, Part VII, No. 3, Silurian, by Mr. Davidson, 15 plates. { The Belemnitidae, 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 | <ul style="list-style-type: none"> { 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 Belemnitidae, 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 | <ul style="list-style-type: none"> { 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, Vol. III, 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. |

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| Vol. XXV.* | Issued for the
Year 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.
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to the Tertiary and Secondary Species, 7 plates.
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Woodward, 10 plates.
The Fossil Trigonie, No. I, by Dr. Lycett, 9 plates. |
| „ XXVII.* | „ 1873 | { The Fossil Echinodermata, Cretaceous, Vol. I, Part VI, by Dr. Wright, 8 plates.
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Mr. Davidson, 8 plates.
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Supplement to the Reptilia of the Wealden (Hylæochamps) 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 (Cyprinidæ), by Prof. T. Rupert Jones
and Messrs. J. W. Kirkby and G. S. Brady, 5 plates.
The Fossil Trigonie, No. II, by Dr. Lycett, 10 plates. |
| „ XXIX.* | „ 1875 | { The Flora of the Carboniferous Strata, Part IV, by Mr. E. W. Binney, 6 plates.
The Fossil Echinodermata, Cretaceous, Vol. I, Part VII, by Dr. Wright, 10 plates.
The Fossil Trigonie, No. III, by Dr. Lycett, 8 plates.
The Fossil Reptilia of the Mesozoic Formations, Part II, by Prof. Owen, 20 plates. |
| „ XXX.* | „ 1876 | { The Carboniferous and Permian Foraminifera (the genus Fusulina excepted), by Mr.
H. B. Brady, 12 plates.
Supplement to the Fossil Brachiopoda, Vol. IV, Part II, No. 1 (Jurassic and Triassic)
by Mr. Davidson, 8 plates.
Supplement to the Reptilia of the Wealden (Poikilopleuron and Chondrosteosaurus)
No. VII, by Prof. Owen, 6 plates. |
| „ XXXI.* | „ 1877 | { Supplement to the Eocene Mollusca (Bivalves), by Mr. S. V. Wood, 2 plates.
The Fossil Trigonie, No. IV, by Dr. Lycett, 13 plates.
The Eocene Mollusca (Univalves), Part IV, by Mr. S. V. Wood, 1 plate.
The Carboniferous Ganoid Fishes, Part I (Paleoniscidæ), by Dr. Traquair, 7 plates.
The Fossil Reptilia of the Mesozoic Formations, Part III, by Prof. Owen, 2 plates.
The Fossil Elephants (E. antiquus), Part I, by Prof. Leith Adams, 5 plates. |
| „ XXXII.* | „ 1878 | { The Fossil Echinodermata, Cretaceous, Vol. I, Part VIII, by Dr. Wright, 8 plates.
Index and Title Page to the Fossil Echinodermata, Oolitic, Vol. I (Echinoidea), by Dr.
Wright.
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by Mr. Davidson, 13 plates.
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The Sirenoid and Crossopterygian Ganoids, Part I, by Prof. Miall, 6 plates.
Supplement to the Reptilia of the Wealden (Goniopholis, Petrosuchus, and Sucho-
saurus), No. VIII, by Prof. Owen, 6 plates.
The Pleistocene Mammalia, Part A (Preliminary Treatise), by Prof. Boyd Dawkins. |

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CATALOGUE OF WORKS—Continued.

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| Vol. XXXIII.* | Issued for the Year 1879 | { | The Eocene Flora, Vol. I, Part I, by Mr. J. S. Gardner and Baron Ettingshausen, 5 plates. |
| | | | Second Supplement to the Crag Mollusca (Univalves and Bivalves), by Mr. S. V. Wood, 6 plates. |
| | | | The Fossil Trigonina, No. V (<i>Conclusion</i>), by Dr. Lycett, 1 plate. |
| ,, XXXIV.* | ,, | 1880 | { |
| | | | The Lias Ammonites, Part II, by Dr. Wright, 10 plates. |
| | | | Supplement to the Reptilia of the Wealden (Goniopholis, Brachydectes, Nannosuchus, Theriosuchus, and Nuthetes), No. IX, by Prof. Owen, 4 plates. |
| ,, XXXV.* | ,, | 1881 | { |
| | | | The Fossil Elephants (E. primigenius), Part II, by Prof. Leith Adams, 10 plates. |
| | | | The Eocene Flora, Vol. I, Part II, by Mr. J. S. Gardner and Baron Ettingshausen, 6 plates. |
| ,, XXXVI.* | ,, | 1882 | { |
| | | | The Fossil Echinodermata, Oolitic, Vol. II, Part III (Asteroidea and Ophiuroidea), by Dr. Wright, 3 plates. |
| | | | Supplement to the Fossil Brachiopoda, Vol. IV, Part III (Permian and Carboniferous), by Mr. Davidson, 8 plates. |
| ,, XXXVII.* | ,, | 1883 | { |
| | | | The Lias Ammonites, Part III, by Dr. Wright, 22 plates. |
| | | | The Reptilia of the London Clay, Vol. II, Part I (Chelone) by Prof. Owen, 2 plates. |
| ,, XXXVIII.* | ,, | 1884 | { |
| | | | The Fossil Echinodermata, Cretaceous, Vol. I, Part IX, by Dr. Wright, 6 plates. |
| | | | Supplement to the Fossil Brachiopoda, Vol. IV, Part IV (Devonian and Silurian, from Budleigh-Salterton Pebble Bed), by Mr. Davidson, 5 plates. |
| ,, XXXIX.* | ,, | 1885 | { |
| | | | The Fossil Trigonina (Supplement No. 1), by Dr. Lycett, 10 plates. |
| | | | The Reptilia of the Liassic Formations, Part III (<i>Conclusion</i>), by Prof. Owen, 13 plates. |
| ,, XL.* | ,, | 1886 | { |
| | | | The Fossil Elephants (E. primigenius and E. meridionalis), Part III (<i>Conclusion</i>), by Prof. Leith Adams, 13 plates. |
| | | | The Eocene Flora, Vol. I, Part III (<i>Conclusion</i>), by Mr. J. S. Gardner and Baron Ettingshausen, 2 plates. |
| ,, XLI.* | ,, | 1887 | { |
| | | | Third Supplement to the Crag Mollusca, by the late Mr. S. V. Wood, 1 plate. |
| | | | The Fossil Echinodermata, Cret., Vol. I, Part X (<i>Conclusion</i>), by Dr. Wright, 5 plates. |
| ,, XLII.* | ,, | 1888 | { |
| | | | Supplement to the Fossil Brachiopoda, Vol. IV, Part V (<i>Conclusion</i>), by Dr. Davidson, Do., Vol. V, Part I (Devonian and Silurian), by Dr. Davidson, 7 plates. |
| | | | The Lias Ammonites, Part V, by Dr. Wright, 22 plates. |
| ,, XLIII.* | ,, | 1889 | { |
| | | | The Eocene Flora, Vol. II, Part I, by Mr. J. S. Gardner, 9 plates. |
| | | | The Trilobites of the Silurian, Devonian, &c., Formations, Part V (<i>Conclusion</i>), by the late Mr. J. W. Salter. |
| ,, XLIV.* | ,, | 1890 | { |
| | | | The Carboniferous Trilobites, Part I, by Dr. H. Woodward, 6 plates. |
| | | | Supplement to the Fossil Brachiopoda, Vol. V, Part II (Silurian), by Dr. Davidson, 10 plates. |
| ,, XLV.* | ,, | 1891 | { |
| | | | The Fossil Trigonina (Supplement No. 2), by the late Dr. Lycett, 4 plates. |
| | | | The Lias Ammonites, Part VI, by Dr. Wright, 8 plates. |
| ,, XLVI.* | ,, | 1892 | { |
| | | | The Eocene Flora, Vol. II, Part II, by Mr. J. S. Gardner, 11 plates. |
| | | | The Carboniferous Entomostraca, Part I, No. 2 (<i>Conclusion</i>), by Prof. T. Rupert Jones, Mr. J. W. Kirkby, and Prof. G. S. Brady, 2 plates. |
| ,, XLVII.* | ,, | 1893 | { |
| | | | The Carboniferous Trilobites, Part II, by Dr. H. Woodward, 4 plates. |
| | | | Supplement to the Fossil Brachiopoda, Vol. V, Part III (<i>Conclusion</i>), by Dr. Davidson, 4 plates. |
| ,, XLVIII.* | ,, | 1894 | { |
| | | | The Lias Ammonites, Part VII, by Dr. Wright, 10 plates. |
| | | | The Eocene Flora, Vol. II, Part III (<i>Conclusion</i>), by Mr. J. S. Gardner, 7 plates. |
| ,, XLIX.* | ,, | 1895 | { |
| | | | The Stromatoporoids, Part I, by Prof. Alleyne Nicholson, 11 plates. |
| | | | The Fossil Brachiopoda (Bibliography), Vol. VI (<i>Conclusion</i>), by the late Dr. Davidson and Mr. W. H. Dalton. |
| ,, L.* | ,, | 1896 | { |
| | | | The Lias Ammonites, Part VIII (<i>Conclusion</i>), by the late Dr. Wright, 1 plate. |
| | | | The Morphology and Histology of Stigmaria Ficoides, by Prof. W. C. Williamson, 15 plates. |
| ,, LI.* | ,, | 1897 | { |
| | | | The Fossil Sponges, Part I, by Dr. G. J. Hinde, 8 plates. |
| | | | The Jurassic Gasteropoda, Part I, No. 1, by Mr. W. H. Hudleston. |
| ,, LII.* | ,, | 1898 | { |
| | | | The Inferior Oolite Ammonites, Part I, by Mr. S. S. Buckman, 6 plates. |
| | | | The Pleistocene Mammalia, Part VI, by Prof. Boyd Dawkins, 7 plates. |
| ,, LIII.* | ,, | 1899 | { |
| | | | The Fossil Sponges, Part II, by Dr. G. J. Hinde, 1 plate. |
| | | | The Palaeozoic Phyllopora, Part I, by Prof. T. R. Jones and Dr. Woodward, 12 plates. |
| ,, LIV.* | ,, | 1900 | { |
| | | | The Jurassic Gasteropoda, Part I, No. 2, by Mr. W. H. Hudleston, 6 plates. |
| | | | The Inferior Oolite Ammonites, Part II, by Mr. S. S. Buckman, 8 plates. |

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CATALOGUE OF WORKS—Continued.

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| Vol. XLII.* | Issued for the
Year 1888 | } | The Stromatopoids, Part II, by Prof. Alleyne Nicholson, 8 plates. |
| | | | The Tertiary Entomostraca (Supplement), by Prof. T. Rupert Jones and Mr. C. D. Sherborn, 3 plates. |
| | | | The Jurassic Gasteropoda, Part I, No. 3, by Mr. W. H. Hudleston, 5 plates. |
| | | | The Inferior Oolite Ammonites, Part III, by Mr. S. S. Buckman, 10 plates. |
| „ XLIII.* | „ 1889 | } | The Devonian Fauna of the South of England, Part I, by the Rev. G. F. Whidborne, 4 plates. |
| | | | Title-pages to the Monographs on the Reptilia of the Wealden and Purbeck (Supplements), Kimmeridge Clay, and Mesozoic Formations, and on the Cetacea of the Red Crag. |
| | | | The Cretaceous Entomostraca (Supplement), by Prof. T. Rupert Jones and Dr. G. J. Hinde, 4 plates. |
| | | | The Jurassic Gasteropoda, Part I, No. 4, by Mr. W. H. Hudleston, 5 plates. |
| „ XLIV.* | „ 1890 | } | The Inferior Oolite Ammonites, Part IV, by Mr. S. S. Buckman, 13 plates. |
| | | | The Devonian Fauna of the South of England, Part II, by the Rev. G. F. Whidborne, 12 plates. |
| | | | The Stromatopoids, Part III, by Prof. Alleyne Nicholson, 6 plates. |
| | | | The Fossil Echinodermata, Cretaceous, Vol. II, Part I (Asteroidea), by Mr. W. Percy Sladen, 8 plates. |
| „ XLV.* | „ 1891 | } | The Inferior Oolite Ammonites, Part V, by Mr. S. S. Buckman, 8 plates. |
| | | | The Devonian Fauna of the South of England, Part III, by the Rev. G. F. Whidborne, 9 plates. |
| | | | Title-pages to the Supplement to the Fossil Corals, by Prof. Duncan. |
| | | | The Jurassic Gasteropoda, Part I, No. 5, by Mr. W. H. Hudleston, 4 plates. |
| „ XLVI.* | „ 1892 | } | The Inferior Oolite Ammonites, Part VI, by Mr. S. S. Buckman, 12 plates. |
| | | | The Devonian Fauna of the South of England, Part IV (Conclusion of Vol. I), 7 plates. |
| | | | „ „ Vol. II, Part I, by the Rev. G. F. Whidborne, 5 plates. |
| | | | The Stromatopoids, Part IV (Conclusion), by Prof. Alleyne Nicholson, 4 plates. |
| „ XLVII.* | „ 1893 | } | The Palaeozoic Phyllopora, Part II, by Prof. T. R. Jones and Dr. Woodward, 5 plates. |
| | | | The Jurassic Gasteropoda, Part I, No. 6, by Mr. W. H. Hudleston, 6 plates. |
| | | | The Inferior Oolite Ammonites, Part VII, by Mr. S. S. Buckman, 20 plates. |
| | | | The Devonian Fauna of the South of England, Vol. II, Part II, by the Rev. G. F. Whidborne, 5 plates. |
| „ XLVIII.* | „ 1894 | } | The Fossil Sponges, Part III, by Dr. G. J. Hinde, 10 plates. |
| | | | The Fossil Echinodermata, Cretaceous, Vol. II, Part II (Asteroidea), by Mr. W. Percy Sladen, 8 plates. |
| | | | The Inferior Oolite Ammonites, Part VIII, by Mr. S. S. Buckman, 16 plates. |
| | | | The Devonian Fauna of the South of England, Vol. II, Part III, by the Rev. G. F. Whidborne, 7 plates. |
| „ XLIX.* | „ 1895 | } | The Jurassic Gasteropoda, Part I, No. 7, by Mr. W. H. Hudleston, 6 plates. |
| | | | Carbonicola, Anthracomya, and Naiadites, Part I, by Dr. W. Hind, 11 plates. |
| | | | The Inferior Oolite Ammonites, Part IX, by Mr. S. S. Buckman, 11 plates. |
| | | | The Fishes of the Old Red Sandstone, Part II, No. 1, by Dr. R. H. Traquair, 4 plates. |
| „ L.* | „ 1896 | } | The Crag Foraminifera, Part II, by Prof. T. R. Jones, 3 plates. |
| | | | The Jurassic Gasteropoda, Part I, No. 8, by Mr. W. H. Hudleston, 8 plates. |
| | | | Carbonicola, Anthracomya, and Naiadites, Part II, by Dr. W. Hind, 9 plates. |
| | | | The Devonian Fauna of the South of England, Vol. II, Part IV, by the Rev. G. F. Whidborne, 7 plates. |
| „ L.* | „ 1896 | } | The Crag Foraminifera, Part III, by Prof. T. R. Jones. |
| | | | The Jurassic Gasteropoda, Part I, No. 9 (Conclusion), by Mr. W. H. Hudleston, 4 plates. |
| | | | Carbonicola, Anthracomya, and Naiadites, Part III (Conclusion), by Dr. W. Hind, 1 plate. |
| | | | The Carboniferous Lamellibranchiata, Part I, by Dr. W. Hind, 4 plates. |
| | | | The Devonian Fauna of the South of England, Vol. III, Part I, by the Rev. G. F. Whidborne, 16 plates. |

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CATALOGUE OF WORKS—Continued.

Vol. LI.*	Issued for the Year 1897	{	The Crag Foraminifera, Part IV (<i>Conclusion</i>), by Prof. T. R. Jones.
			The Carboniferous Lamellibranchiata, Part II, by Dr. W. Hind, 13 plates.
			The Carboniferous Cephalopoda of Ireland, Part I, by Dr. A. H. Foord, 7 plates.
			The Devonian Fauna of the South of England, Vol. III, Part II, by the Rev. G. F. Whidborne, 5 plates.
„ LII.*	„ 1898	{	The Palæozoic Phyllopora, Part III, by Prof. T. R. Jones and Dr. Woodward, 8 plates.
			The Carboniferous Lamellibranchiata, Part III, by Dr. W. Hind, 10 plates.
			The Inferior Oolite Ammonites, Part X, by Mr. S. S. Buckman, 4 plates.
			The Carboniferous Cephalopoda of Ireland, Part II, by Dr. A. H. Foord, 10 plates.
			The Devonian Fauna of the South of England, Vol. III, Part II, by the Rev. G. F. Whidborne, 17 plates.
„ LIII.*	„ 1899	{	The Palæozoic Phyllopora, Part IV (<i>Conclusion</i>), by Prof. T. R. Jones and Dr. Woodward, 6 plates.
			The Cretaceous Lamellibranchia, Part I, by Mr. H. Woods, 14 plates.
			The Carboniferous Lamellibranchiata, Part IV, by Dr. W. Hind, 14 plates.
			The Inferior Oolite Ammonites, Part XI, by Mr. S. S. Buckman, 10 plates.

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§ II. LIST OF MONOGRAPHS

Completed, in course of Publication, and in Preparation.

1. MONOGRAPHS which have been COMPLETED, and which may be bound as separate Volumes, with directions for the BINDING:—

- The Morphology and Histology of *Stigmaria ficoides* by Prof. W. C. Williamson. (*Complete with Title-page and Index in the Volume for the year 1886.*)
- The Eocene Flora, Vol. I (Filices), by Mr. J. S. Gardner and Baron Ettingshausen. (*Complete in the Volumes for the years 1879, 1880, and 1882. Title-page, Index, and directions for the binding, will be found in the Volume for 1882.*)
- The Eocene Flora, Vol. II (Gymnospermæ), by Mr. J. S. Gardner. (*Complete in the Volumes for the years 1883, 1884, and 1885. Title-page, Index, and directions for the binding, will be found in the Volume for 1885.*)
- The Crag Foraminifera, by Prof. T. Rupert Jones, W. K. Parker, and H. B. Brady, assisted by H. W. Burrows, C. D. Sherborn, F. W. Millett, R. Holland, and F. Chapman. (*Complete in the Volumes for the years 1865, 1895, 1896, and 1897. Title-page, Index, and directions for the binding, will be found in the Volume for 1897.*)
- The Carboniferous and Permian Foraminifera (the genus *Fusulina* excepted), by Mr. H. B. Brady. (*Complete in the Volume for the year 1876.*)
- The Stromatoporoids, by Prof. Alleyne Nicholson. (*Complete in the Volumes for the years 1885, 1888, 1890, and 1892. The Title-page, Index, and directions for binding will be found in the Volume for the year 1892.*)
- The Tertiary, Cretaceous, Oolitic, Devonian, and Silurian Corals, by MM. Milne-Edwards and J. Haime. (*Complete in the Volumes for the years 1849, 1851, 1852, 1853, and 1854. The Title-page and Index, with corrected explanations of Plates XVII and XVIII, will be found in the Volume for the year 1854.*)
- Supplement to the Tertiary, Cretaceous, Liassic, and Oolitic Corals, by Prof. Martin Duncan. (*Complete in the Volumes for the years 1865, 1866, 1867, 1868, 1869, 1872, and 1890. The Title-page, with directions for binding, will be found in the Volume for the year 1890.*)
- The Polyzoa of the Crag, by Mr. G. Busk. (*Complete with Title-page and Index in the Volume for the year 1857.*)
- The Tertiary Echinodermata, by Professor Forbes. (*Complete with Title-page in the Volume for the year 1852.*)
- The Fossil Cirripedes, by Mr. C. Darwin. (*Complete in the Volumes for the years 1851, 1854, and 1858. The Title-page will be found in the Volume for the year 1854, and the Index in the Volume for the year 1858.*)
- The Post-Tertiary Entomostraca, by Mr. G. S. Brady, the Rev. H. W. Crosskey, and Mr. D. Robertson. (*Complete, with Title-page and Index, in the Volume for the year 1874.*)
- The Tertiary Entomostraca, by Prof. T. Rupert Jones. (*Complete, with Title-page and Index, in the Volume for the year 1855.*)
- Supplement to the Tertiary Entomostraca, by Prof. T. Rupert Jones. (*Complete, with Title-page and Index, in the Volume for the year 1888.*)
- The Cretaceous Entomostraca, by Prof. T. Rupert Jones. (*Complete, with Title-page and Index, in the Volume for the year 1849.*)
- Supplement to the Cretaceous Entomostraca, by Prof. T. Rupert Jones and Dr. G. J. Hinde. (*Complete, with Title-page and Index, in the Volume for the year 1889.*)
- The Carboniferous Entomostraca, Part I (Cypridinadæ and their allies), by Prof. T. Rupert Jones, Mr. J. W. Kirkby, and Prof. G. S. Brady. (*Complete in the volumes for the years 1874 and 1884. The Title-page and Index will be found in the Volume for the year 1884.*)

- The Fossil Estheriæ, by Prof. T. Rupert Jones. (*Complete, with Title-page and Index, in the Volume for the year 1860.*)
- The Palæozoic Phyllopora, by Prof. T. Rupert Jones and Dr. H. Woodward. (*Complete, in the Volumes for the years 1887, 1892, 1898, and 1899. The Title-page and Index, with directions for the binding, will be found in the Volume for the year 1899.*)
- The Trilobites of the Cambrian, Silurian, and Devonian Formations, by Mr. J. W. Salter. (*Complete in the Volumes for the years 1862, 1863, 1864, 1866, and 1883. The Title-page and Index, with directions for the binding, will be found in the Volume for the year 1883.*)
- The Fossil Merostomata, by Dr. H. Woodward. (*Complete in the Volumes for the years 1865, 1868, 1871, 1872, and 1878. The Title-page and Index, with directions for the binding, will be found in the Volume for the year 1878.*)
- The Fossil Brachiopoda (Tertiary, Cretaceous, Oolitic, and Liassic), Vol. I, by Mr. T. Davidson. (*Complete in the Volumes for the years 1850, 1852, 1853, and 1854. The Index will be found in the Volume for the year 1854, and corrected Title-page in that for 1870.*)
- The Fossil Brachiopoda (Permian and Carboniferous), Vol. II, by Mr. T. Davidson. (*Complete in the Volumes for the years 1856, 1857, 1858, 1859, and 1860. The Index will be found in the Volume for the year 1860, and corrected Title-page in that for 1870.*)
- The Fossil Brachiopoda (Devonian and Silurian), Vol. III, by Mr. T. Davidson. (*Complete in the Volumes for the years 1862, 1863, 1865, 1866, 1868, and 1870. The Title-page and Index will be found in the Volume for the year 1870.*)
- The Fossil Brachiopoda, Vol. IV, by Dr. T. Davidson. Supplements: Tertiary, Cretaceous, Jurassic, Triassic, Permian, and Carboniferous. (*Complete in the Volumes for the years 1873, 1876, 1878, 1880, 1881, and 1882. The Title-page and Index, with directions for the binding will be found in the Volume for the year 1882.*)
- The Fossil Brachiopoda, Vol. V, by Dr. T. Davidson. Supplements: Devonian and Silurian. Appendix to Supplements, General Summary, Catalogue and Index of the British Species. (*Complete in the Volumes for the years 1882, 1883, and 1884. The Title-page, with directions for the binding will be found in the Volume for the year 1884.*)
- The Fossil Brachiopoda, Vol. VI, by Dr. T. Davidson and Mr. W. H. Dalton. Bibliography. (*Complete in the Volume for the year 1885.*)
- The Eocene Bivalves, Vol. I, by Mr. S. V. Wood. (*Complete, with Title-page and Index, in the Volumes for the years 1859, 1862, and 1870. The directions for the binding will be found in the Volume for the year 1870.*)
- Supplement to the Eocene Bivalves, by Mr. S. V. Wood. (*Complete, with Title-page and Index, in the Volume for the year 1877.*)
- The Eocene Cephalopoda and Univalves, Vol. I, by Mr. F. E. Edwards and Mr. S. V. Wood. (*Complete in the Volumes for the years 1848, 1852, 1854, 1855, 1858, and 1877. The Title-page, Index, and directions for the binding, will be found in the Volume for the year 1877.*)
- The Mollusca of the Crag, Vol. I, Univalves, by Mr. S. V. Wood. (*The Text, Plates, and Index, will be found in the Volume for the year 1847, and the Title-page will be found in the Volume for the year 1855.*)
- The Mollusca of the Crag, Vol. II, Bivalves, by Mr. S. V. Wood. (*Complete in the Volumes for the years 1850, 1853, 1855, 1858, and 1873. The Title-page will be found in the Volume for the year 1873, and the Index will be found in the Volume for the year 1855, and a Note in the Volume for the year 1858.*)
- The Mollusca of the Crag, Vol. III, Supplement, by Mr. S. V. Wood. (*Complete in the Volumes for the years 1871 and 1873. The Title-page and Index will be found in the Volume for the year 1873.*)
- Second Supplement to the Crag Mollusca, by Mr. S. V. Wood. (*Complete, with Title-page and Index, in the Volume for the year 1879.*)

- Third Supplement to the Crag Mollusca, by Mr. S. V. Wood. (*Complete, with Title-page and Index, in the Volume for the year 1882.*)
- The Great Oolite Mollusca, by Professor Morris and Dr. Lycett. (*Complete in the Volumes for the years 1850, 1853, and 1854. The Title-page and Index will be found in the Volume for the year 1854.*)
- The Gasteropoda of the Inferior Oolite, by Mr. W. H. Hudleston. (*Complete in the Volumes for the years 1886, 1887, 1889, 1891, 1892, 1894, 1895, and 1895. The Title-page, Index, and directions for the binding will be found in the Volume for the year 1896.*)
- The Fossil Trigoniæ, by Dr. Lycett. (*Complete in the Volumes for the years 1872, 1874, 1875, 1877, and 1879. The directions for the binding will be found in the Volume for the year 1879.*)
- Supplement to the Fossil Trigoniæ, by Dr. Lycett. (*Complete in the Volumes for the years 1881 and 1883. The Title-page, Index, with directions for the binding, will be found in the Volume for the year 1883.*)
- Carbonicola, Anthracomya, and Naaidites, by Dr. Wheelton Hind. (*Complete in the Volumes for the years 1894, 1895, and 1896. The Title-page and Index will be found in the Volume for the year 1896.*)
- The Oolitic Echinodermata, Vol. I, Echinoidea, by Dr. Wright. (*Complete in the Volumes for the years 1855, 1856, 1857, 1858, and 1878. Title-page, Index, and directions for the binding, will be found in the Volume for the year 1878.*)
- The Oolitic Echinodermata, Vol. II, Asteroidea, by Dr. Wright. (*Complete in the Volumes for the years 1861, 1864, and 1880. Title-page, Index, and directions for the binding, will be found in the Volume for the year 1880.*)
- The Cretaceous Echinodermata, Vol. I, Echinoidea, by Dr. Wright. (*Complete in the Volumes for the years 1862, 1867, 1869, 1870, 1872, 1873, 1875, 1878, 1881, and 1882. The Title-page and Index, with directions for the binding, will be found in the Volume for the year 1882.*)
- The Cretaceous (Upper) Cephalopoda, by Mr. D. Sharpe. (*Complete in the Volumes for the years 1853, 1854, and 1855, but wants Title-page and Index.*)
- The Lias Ammonites, by Dr. Wright. (*Complete in the Volumes for the years 1878, 1879, 1880, 1881, 1882, 1883, 1884, and 1885. The Title-page and Index, with directions for the binding, will be found in the Volume for the year 1885.*)
- The Fossils of the Permian Formation, by Professor King. (*Complete, with Title-page and Index, in the Volume for the year 1849. Corrected explanations of Plates XXVIII and XXVIII* will be found in the Volume for the year 1854.*)
- The Reptilia of the London Clay (and of the Bracklesham and other Tertiary Beds), Vol. I, by Professors Owen and Bell. (*Complete in the Volumes for the years 1848, 1849, 1856, and 1864. Directions for the binding, Title-page, and Index, will be found in the Volume for the year 1864.*) Part I of Vol. II, containing *Chelone gigas* (*to be found in the Volume for the year 1880*), can be added.
- The Reptilia of the Cretaceous Formations, by Prof. Owen. (*Complete in the Volumes for the years 1851, 1857, 1858, 1862, and 1864. Directions for the binding, Title-page, and Index, will be found in the Volume for the year 1864.*)
- The Reptilia of the Wealden and Purbeck Formations, by Professor Owen. (*Complete in the Volumes for the years 1853, 1854, 1855, 1856, 1857, 1858, 1862, and 1864. Directions for the binding, Title-pages, and Index, will be found in the Volume for the year 1864.*)
- The Reptilia of the Wealden and Purbeck Formations (Supplements 4—9), by Professor Owen. (*Complete in the Volumes for the years 1871, 1873, 1876, 1878, 1879, and 1888. Directions for the binding, Title-page, Preface, and Table of Contents, will be found in the Volume for the year 1888.*)

- The Reptilia of the Kimmeridge Clay Formation, by Professor Owen. (*Complete in the Volumes for the years 1859, 1860, 1868, and 1888. Directions for the binding, Title-page, Preface, and Table of Contents, will be found in the Volume for the year 1888.*)
- The Reptilia of the Liassic Formations, by Professor Owen. (*Complete in the Volumes for the years 1859, 1860, 1863, 1869, and 1881. Directions for the binding, Title-pages, and Index, will be found in the Volume for the year 1881.*)
- The Reptilia of the Mesozoic Formations, by Professor Owen. (*Complete in the Volumes for the years 1873, 1875, 1877, and 1888. Directions for the binding, Title-page, Preface, and Table of Contents, will be found in the Volume for the year 1888.*)
- The Red Crag Cetacea, by Professor Owen. (*Complete in the Volumes for the years 1869 and 1888. Directions for the binding, Title-page, Preface, and Table of Contents, will be found in the Volume for the year 1888.*)
- The Fossil Mammalia of the Mesozoic Formations, by Professor Owen. (*Complete, with Title-page and Table of Contents, in the Volume for the year 1870.*)
- The Fossil Elephants, by Professor Leith Adams. (*Complete in the Volumes for the years 1877, 1879, and 1881. Directions for the binding, Title-page, and Index will be found in the Volume for the year 1881.*)

2. MONOGRAPHS in course of PUBLICATION :*—

- The Fossil Sponges, by Dr. G. J. Hinde.
- The Cretaceous Lamellibranchia, by Mr. H. Woods.
- The Carboniferous Lamellibranchiata, by Dr. Wheelton Hind.
- The Trilobites, by Dr. H. Woodward.
- The Inferior Oolite Ammonites, by Mr. S. S. Buckman.
- The Belemnites, by Professor Phillips.†
- The Carboniferous Cephalopoda of Ireland, by Dr. A. H. Foord.
- The Sirenoid and Crossopterygian Ganoids, by Professor Miall.
- The Fishes of the Carboniferous Formation, by Dr. R. H. Traquair.
- The Fishes of the Old Red Sandstone, by Messrs. J. Powrie and E. Ray Lankester, and Professor Traquair.
- The Pleistocene Mammalia, by Messrs. Boyd Dawkins and W. A. Sanford.
- The Fauna of the Devonian Formation of the South of England, by the Rev. G. F. Whidborne.

3. MONOGRAPHS which are promised or are in course of PREPARATION :*—

- The Fossil Cycadææ, by Mr. A. C. Seward.
- The Graptolites, by Prof. Lapworth.
- The Carboniferous Entomostraca, Part II, by Prof. T. Rupert Jones and Mr. J. W. Kirkby.
- The Wealden, Purbeck, and Jurassic Entomostraca, by Prof. T. Rupert Jones, and Messrs. C. D. Sherborn and F. Chapman.
- The Cambrian Fossils, by Dr. H. Hicks.
- The Silurian Fish Bed, by Dr. Harley.
- The Fossils of the Budleigh Salterton Pebble Bed, by the Rev. G. F. Whidborne.

* 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.

† Unfinished through the death of the Author, but will be continued by Mr. G. C. Crick.

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

Volume	I for	1847	was	issued	to the	Members,	March, 1848.
"	II	"	1848	"	"	"	July, 1849.
"	III	"	1849	"	"	"	August, 1850.
"	IV	"	1850	"	"	"	June, 1851.
"	V	"	1851	"	"	"	June, 1851.
"	VI	"	1852	"	"	"	August, 1852.
"	VII	"	1853	"	"	"	December, 1853.
"	VIII	"	1854	"	"	"	May, 1855.
"	IX	"	1855	"	"	"	February, 1857.
"	X	"	1856	"	"	"	April, 1858.
"	XI	"	1857	"	"	"	November, 1859.
"	XII	"	1858	"	"	"	March, 1861.
"	XIII	"	1859	"	"	"	December, 1861.
"	XIV	"	1860	"	"	"	May, 1863.
"	XV	"	1861	"	"	"	May, 1863.
"	XVI	"	1862	"	"	"	August, 1864.
"	XVII	"	1863	"	"	"	June, 1865.
"	XVIII	"	1864	"	"	"	April, 1866.
"	XIX	"	1865	"	"	"	December, 1866.
"	XX	"	1866	"	"	"	June, 1867.
"	XXI	"	1867	"	"	"	June, 1868.
"	XXII	"	1868	"	"	"	February, 1869.
"	XXIII	"	1869	"	"	"	January, 1870.
"	XXIV	"	1870	"	"	"	January, 1871.
"	XXV	"	1871	"	"	"	June, 1872.
"	XXVI	"	1872	"	"	"	October, 1872.
"	XXVII	"	1873	"	"	"	February, 1874.
"	XXVIII	"	1874	"	"	"	July, 1874.
"	XXIX	"	1875	"	"	"	December, 1875.
"	XXX	"	1876	"	"	"	December, 1876.
"	XXXI	"	1877	"	"	"	February, 1877.
"	XXXII	"	1878	"	"	"	March, 1878.
"	XXXIII	"	1879	"	"	"	May, 1879.
"	XXXIV	"	1880	"	"	"	May, 1880.
"	XXXV	"	1881	"	"	"	May, 1881.
"	XXXVI	"	1882	"	"	"	June, 1882.
"	XXXVII	"	1883	"	"	"	October, 1883.
"	XXXVIII	"	1884	"	"	"	December, 1884.
"	XXXIX	"	1885	"	"	"	January, 1886.
"	XL	"	1886	"	"	"	March, 1887.
"	XLI	"	1887	"	"	"	January, 1888.
"	XLII	"	1888	"	"	"	March, 1889.

Volume XLIII	for	1889	was	issued	to	the	Members,	March, 1890.
„	XLIV	„	1890	„	„	„	„	April, 1891.
„	XLV	„	1891	„	„	„	„	February, 1892.
„	XLVI	„	1892	„	„	„	„	November, 1892.
„	XLVII	„	1893	„	„	„	„	December, 1893.
„	XLVIII	„	1894	„	„	„	„	November, 1894.
„	XLIX	„	1895	„	„	„	„	October, 1895.
„	L	„	1896	„	„	„	„	October, 1896.
„	LI	„	1897	„	„	„	„	December, 1897.
„	LII	„	1898	„	„	„	„	December, 1898.
„	LIII	„	1899	„	„	„	„	December, 1899.

§ IV. SUMMARY OF THE MONOGRAPHS ISSUED TO THE MEMBERS (up to DECEMBER, 1890): 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 Monograph was issued.	III. Dates of the Years in which the Monograph was published.	IV. No. of Pages in each Monograph.	V. No. of Plates in each Monograph.	VI. No. of Figures incorporated in each Monograph.	VII. No. of Species described in the Text.
The Morphology and Histology of <i>Stigmataria</i> recedes, by Prof. W. C. Williamson, COMPLETE	1886	1887	66	15	91	1
The Eocene Flora, by Mr. J. S. Gardner and Baron Ritingshausen, Vol. I, COMPLETE	1879, 1880, 1882	1879, 1880, 1882	87	13	151	23
" " by Mr. J. S. Gardner, Vol. II, COMPLETE	1883, 1884, 1885	1883, 1884, 1886	159	27	400	31
The Flora of the Carboniferous Strata, by Mr. E. W. Binney, in course of completion	1867, 1870, 1871, 1875	1868, 1871, 1872, 1875	147	24	141	16
The Fossil Sponges, by Dr. G. J. Hinde, in course of completion	1886, 1887, 1893	1887, 1888, 1893	254	19	602	106
The Cruz Foraminifera, by Messrs. T. Rupert Jones, W. K. Parker, H. B. Brady, H. W. Burrows, C. D. Sherborn, F. W. Millett, R. Holland, and F. Chapman, COMPLETE	1865, 1895, 1896, 1897	1866, 1895, 1896, 1897	417	7	395	156
The Carboniferous and Permian Foraminifera, by Mr. H. B. Brady, COMPLETE	1876	1876	166	12	266	62
The Stromatopora, by Prof. Alleyne Nicholson, COMPLETE	1885, 1888, 1890, 1892	1886, 1889, 1891, 1892	237	29	415	44
The Tertiary, Cretaceous, Oolitic, Devonian, and Silurian Corals, by MM. Milne-Edwards and J. Haime, COMPLETE (t)	1849, 1851, 1852, 1853, 1854	1850, 1851, 1852, 1853, 1855	406	72	800	319g
Supplement to the Tertiary, Cretaceous, Oolitic, and Liassic Corals, by Prof. Duncan, COMPLETE	1865, 1866, 1867, 1868, 1869, 1872, 1880	1866, 1867, 1868, 1869, 1870, 1872, 1891	232	49	797	149
The Polyzoa of the Crag, by Mr. G. Bask, COMPLETE	1887	1889	145	22	641	122
The Tertiary Echinodermata, by Prof. Forbes, COMPLETE	1882	1882	39	4	144	44
The Oolitic Echinodermata, by Dr. Wright, Vol. I, COMPLETE (t)	1855, 1856, 1857, 1858, 1878	1857, 1858, 1859, 1861, 1878	491	43	724	120a
" " Vol. II, COMPLETE	1861, 1864, 1880	1863, 1866, 1880	207	22	232	35
The Cretaceous Echinodermata, by Dr. Wright, Vol. I, COMPLETE	1862, 1867, 1869, 1870, 1872, 1873, 1875, 1878, 1881, 1882	1864, 1868, 1870, 1871, 1872, 1874, 1875, 1878, 1881, 1882	390	87	1119	113
" " by Mr. W. Perry Sluden, Vol. II, in course of completion	1890, 1893	1891, 1893	66	16	173	19
The Fossil Cirripedes, by Mr. C. Darwin, COMPLETE	1851, 1854, 1858a	1851, 1855, 1861	137	7	320	54
The Fossil Microstrata, by Dr. H. Woodward, COMPLETE	1865, 1868, 1871, 1872, 1878	1866, 1869, 1872, 1872, 1878	265	36	365	51
The Post-Tertiary Entomostraca, by Mr. G. S. Brady, Rev. H. W. Crosskey, and Mr. D. Robert-son, COMPLETE	1874	1874	237	16	515	134
The Tertiary Entomostraca, by Prof. Rupert Jones, COMPLETE	1855	1857	74	6	253	56
" " and Mr. C. D. Sherborn (Supplement), COMPLETE	1888	1889	55	3	134	48
The Cretaceous Entomostraca, by Prof. Rupert Jones, COMPLETE	1849	1850	41	7	176	31
" " and Dr. G. J. Hinde (Supplement), COMPLETE	1889	1890	78	4	258	46
The Carboniferous Entomostraca, by Prof. Rupert Jones and Messrs. J. W. Kirkby and Prof. G. S. Brady, Part I, COMPLETE	1874, 1884	1874, 1884	95	7	374	81
The Fossil Edineira, by Prof. Rupert Jones, COMPLETE	1860	1863	139	5	158	19f
		CARRIED FORWARD...	4030	552	9624	1880

§ V. STRATIGRAPHICAL TABLE exhibiting the BRITISH FOSSILS already figured and described in the ANNUAL VOLUMES (1847—1899) of the PALEONTOGRAPHICAL SOCIETY.

	P L A N T S.		PROTOZOA.		RADIATA.		ARTICULATA.					
			Sponges.	Foraminifera.	Stramonopods and Corals.	Echinodermata.	Cirripedes.	Cypridae, Cytherinae, &c.	Phyllopoda.	Merostomata.	Trilobites.	Malacostracous Crustacea.
Pleistocene .....	...	...	...	...	...	.....	.....	{ 1874 1888				
Crag.....	...	...	{ 1865 1895 1896 1897	...	1849	1852	{ 1851 1854	1888				
Eocene	{ 1879 1880 1882 1883 1884 1885	...	...	...	{ 1849 1865	1852	{ 1851 1854	{ 1855 1888	.....	.....	.....	1856
Cretaceous .....	...	...	...	...	{ 1849 1869	{ 1862 1867 1869 1870 1872 1873 1875 1878 1881 1882 1890 1893	{ 1851 1854	{ 1849 1889	.....	.....	.....	1860
Wealden .....	...	...	...	...	...	...	.....	...	1860			
Oolitic .....	...	1893	...	...	{ 1851 1872	{ 1855, 1856, 1857, 1858, 1861, 1878, 1880	1851	...	1860			
Liasic .....	...	1893	...	...	{ 1851 1866 1867	{ 1855, 1856, 1858, 1861, 1864						
Triassic.....	...	...	...	...	...	1860	.....	...	1860			
Permian	1849	1849	{ 1849 1876	{ 1849 1852	...	1849	.....	1849	1860			
Carboniferous {	{ 1867 1870 1875 1886	1887	1876	1852	.....	.....	.....	{ 1860 1874 1884 1889	{ 1872 1878		1883, 1884	
Devonian .....	...	1887	...	{ 1853 1885 1888 1890 1892	{ 1895 1895	.....	.....	1888	1860	{ 1865 1868 1872 1878	{ 1862, 1888	
Silurian .....	...	{ 1886 1887	...	{ 1854 1885 1890	.....	.....	.....	{ 1887 1892 1898 1899	{ 1868 1871 1872 1878	{ 1862, 1863 1864, 1866		
Caubrian.....	...	{ 1886 1887	...	1890	.....	.....	.....	{ 1887 1899	.....	.....	1864	

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

STRATIGRAPHICAL TABLE exhibiting the BRITISH FOSSILS already figured and described in the ANNUAL VOLUMES (1847—1899) of the PALEONTOGRAPHICAL SOCIETY (continued).

	MOLLUSCA.				VERTEBRATA.		
	Polyzoa.	Brachiopoda.	Monomyaria, Diphyaria, and Gastropoda.	Cephalopoda.	Fishes.	Reptiles.	Mammalia.
Pleistocene .....	...	1873	.....	..	...	.....	{ 1864 1867 1868 1871 1877 1878 1879 1881 1886
Crag	1857	{ 1852 1873 1879 }	{ 1817, 1850, 1853, 1855, 1871, 1873, 1879, 1882 }	...	...	.....	{ 1869 1881 1888
Eocene .....	...	{ 1852 1873 }	{ 1852, 1854, 1855, 1858, 1859, 1862, 1870, 1877 }	1848	...	1848, 1849, 1856, 1880	
Cretaceous.....	...	{ 1852, 1854, 1873, 1884 }	{ 1872, 1875, 1877, 1879, 1899 }	{ 1853 1851 1855 }	...	{ 1851, 1857, 1858, 1862, 1873, 1888 1853, 1854, 1855, 1856, 1857, 1862, 1871, 1873, 1875, 1876, 1878, 1879 }	
Wealden .....	...	.....	.....	...	...	{ 1858 (Kin. Clay), 1859, 1860, 1868, 1873, 1875, 1877, 1888 (Great Oolite) 1875, 1888 }	
Oolitic .....	...	{ 1850, 1852, 1876, 1878, 1884 }	{ 1850, 1853, 1854, 1872, 1874, 1875, 1877, 1879, 1883, 1886, 1887, 1888, 1889, 1891, 1892, 1894, 1895, 1896 }	{ 1850, 1861, 1868, 1869, 1866, 1887, 1888, 1889, 1890, 1891, 1892, 1894, 1898, 1899 }	...	{ 1853, 1858 (Kin. Clay), 1859, 1860, 1868, 1873, 1875, 1877, 1888 (Great Oolite) 1875, 1888 }	1870
Liassic .....	...	{ 1850, 1852, 1876, 1878, 1884 }	{ 1874, 1877, 1879, 1883 }	{ 1863, 1864, 1866, 1868, 1878, 1879, 1880, 1881, 1882, 1883, 1884, 1885 }	...	{ 1859, 1860, 1863, 1869, 1873, 1881 }	
Triassic.....	...	1876, 1878	1879	.....	1878	.....	1870
Permian	1849	{ 1849, 1856, 1880 }	1849	1849	1849	1849	
Carboniferous ...	...	{ 1856, 1857, 1858, 1859, 1860, 1880, 1884 }	{ 1894, 1895, 1896, 1897, 1898, 1899 }	{ 1897 1898 }	1877		
Devonian	{ 1895 1898 }	{ 1862, 1863, 1881, 1882, 1884, 1899 1865, 1866, 1868, 1870, 1881, 1882, 1883 }	{ 1890, 1891, 1892, 1893, 1896, 1897 }	1889	{ 1867 1869 1894 }		
Silurian.....	...						
Cambrian							

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

THE
PALÆONTOGRAPHICAL SOCIETY.

INSTITUTED MDCCCXLVII.

VOLUME FOR 1899.

LONDON :

MDCCCXCIX.



A MONOGRAPH

OF THE

BRITISH PALÆOZOIC PHYLLOPODA

(PHYLLOCARIDA, PACKARD).

BY

PROF. T. RUPERT JONES, F.R.S., F.G.S., &c.,

AND

DR. HENRY WOODWARD, F.R.S., F.G.S., &c.

PART IV.

(CONCLUSION.)

GENERAL TITLE-PAGE; PAGES i—xv, 175, 176 (REPRINTED), 177—211; PLATES XXVI—XXXI.

LONDON:

PRINTED FOR THE PALÆONTOGRAPHICAL SOCIETY.

1899.

THE

PALÆONTOGRAPHICAL SOCIETY.

INSTITUTED MDCCCXLVII.

LONDON:

MDCCCLXXXVIII—MDCCXCIX.

MONOGRAPH OF THE BRITISH PALÆOZOIC PHYLLOPODA.

DIRECTIONS TO THE BINDER.

The Monograph of the British Palæozoic Phyllopora will be found in the Volumes of the Palæontographical Society for the years 1887, 1892, 1898, and 1899.

Cancel the Title-pages of Parts I, II, III, and IV in the Volumes for the years 1887, 1892, 1898, and 1899, and *substitute* the General Title-page given in the Volume for the year 1899. *Cancel* page of Addenda et Corrigenda in Part II, and pages 175 and 176 in Part III, and *substitute* pages 175 and 176 (reprinted) in Part IV.

ORDER OF BINDING AND DATES OF PUBLICATION.

PAGES	PLATES	ISSUED IN VOL. FOR YEAR	PUBLISHED
Directions for Binder	—	1899	December, 1899.
General Title-page	—	—	“ ”
Contents, i	—	—	“ ”
List of Genera and Species, iii, iv	—	—	“ ”
List of Phyllocarida, v—viii	—	—	“ ”
List of Illustrations, ix	—	—	“ ”
Addenda and Corrigenda, x—xv	—	—	“ ”
1—72	I—XII	1887	January, 1888.
73—124	XIII—XVII	1892	November, 1892.
125—176	XVIII—XXV	1898	December, 1898.
177—211	XXVI—XXXI	1899	December, 1899.

A MONOGRAPH

OF THE

BRITISH PALÆOZOIC PHYLLOPODA

(PHYLLOCARIDA, PACKARD).

BY

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AND

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LONDON:

PRINTED FOR THE PALEONTOGRAPHICAL SOCIETY.

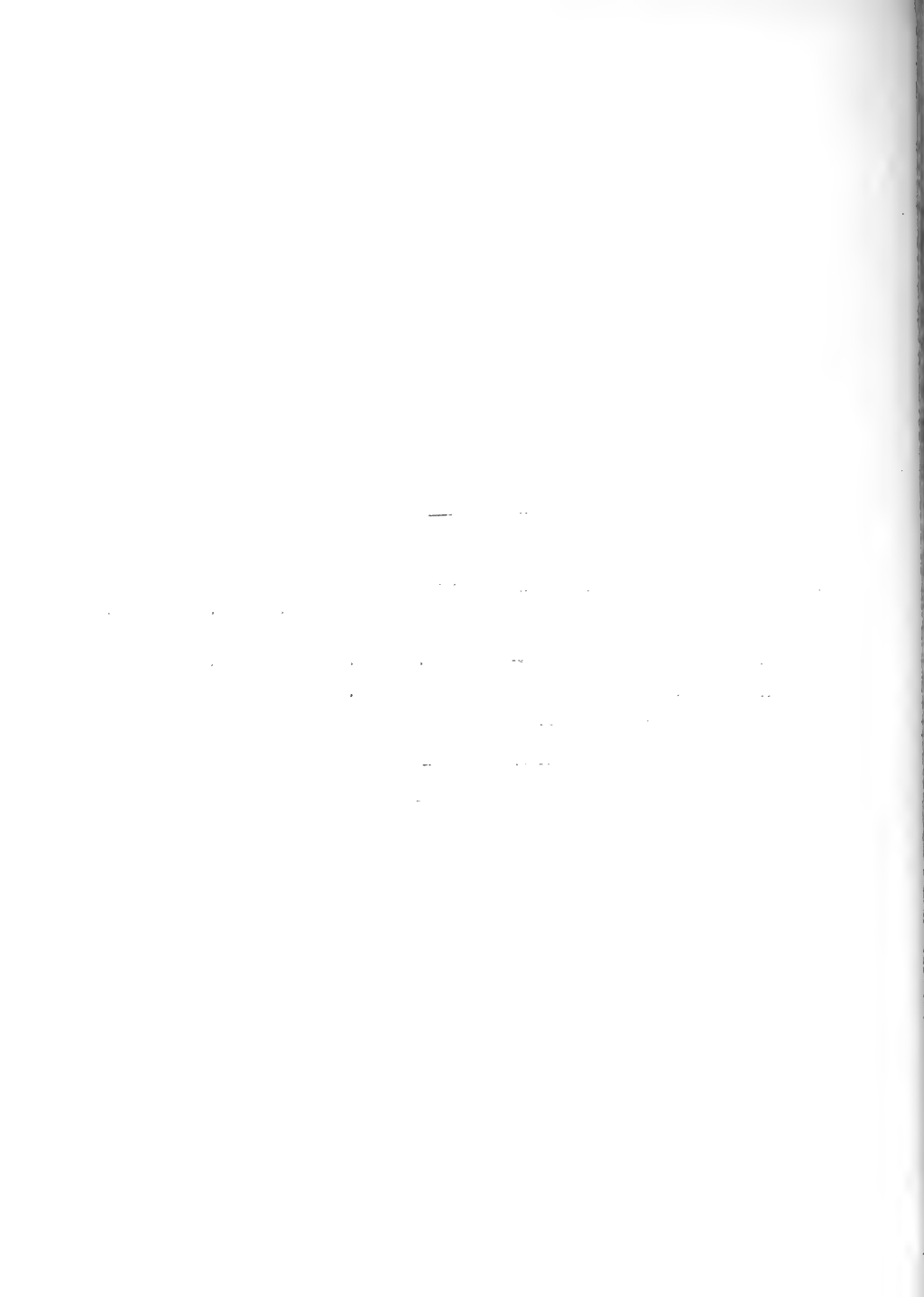
1888—1899.

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LIST OF THE PALÆOZOIC PHYLLOCARIDA DESCRIBED IN THIS MONOGRAPH
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2.	— <i>Murchisoni (Agassiz)</i>	16	7	" Ludlow	III, 4, 7; IV, 3; V, 3; VI, 1, 2.
3.	— <i>valida, Jones and Woodward</i> ...	20	2	" Ludlow	VI, 10, 11.
4.	— <i>tyrannus, Salter</i>	22	9	" Ludlow; and Helm Knot, Dent	III, 2, 3, 5, 6, 8; IV, 4; V, 4; IX, 4.
5.	— <i>gigas, Salter</i>	24	3	" Ludlow, Knighton and Dudley	III, 1; IV, 2; V, 5.
6.	— <i>Halliana, J. and W.</i>	26	6	" Ludlow	II, 1—4; IV, 5, 6; V, 6.
7.	— <i>Pardoëana, La Touche</i>	30	1	" Ludlow.	V, 1, 2.
8.	— <i>canaliculata, J. and W.</i>	31	2	" Ludlow.	IX, 2, 3.
9.	— <i>Ludensis, H. Woodward</i>	32	1	" Ludlow.	I, 1X, 1.
10.	— <i>papilio, Salter</i>	35	Many	" Benson Knot	IX, 4, 6; XII, 1.
11.	— <i>stygia, Salter</i>	38	Many	{ (Kendal), Lesmahago, and Ludlow	X, 7; XI, 1, 3, 7; XII, 2; and cuts, figs. 1 and 2, p. 12.
12.	— <i>longa, J. and W.</i>	43	3	Silurian, Ludlow	VI, 3?; XI, 2, 5.
13.	— <i>robusta, Salter</i>	44	7	" Lesmahago, Ludlow	X, 10; XI, 3, 9, 12, 15.
14.	— <i>patula, J. and W.</i>	46	1	" Ludlow	XI, 11.
15.	— <i>angusta, J. and W.</i>	47	1	" Lesmahago	X, 9.
16.	— <i>minuta, J. and W.</i>	47	2	" Ludlow	X, 11; XI, 10.
17.	— <i>inornata, M' Coy</i>	48	3	" Kendal and Lesmahago	X, 2, 3, 5.
18.	— <i>Ruthveniana, J. and W.</i>	49	11	" Kendal	X, 6.
19.	— <i>Oretonensis, H. W.</i>	50	4	{ Carboniferous Lime-stone, Oreton, Worcestershire	X, 4.
20.	— <i>truncata, H. W.</i>	51	8		X, 1.
21.	— <i>solenoides, M' Coy</i>	52	6	Silurian, Benson Knot, Kendal	VIII, 4, 5, 7—10.
22.	— <i>gobiformis, J. and W.</i>	54	2	" Benson Knot	VIII, 6, 11.
23.	— <i>Salteriana, J. and W.</i>	55	2	" Ludlow and Dudley	VII, 1—3
24.	— <i>laxa, J. and W.</i>	56	2	" Lesmahago	VIII, 12; X, 12.
25.	— <i>compta, J. and W.</i>	57	1	" Ludlow	VII, 10.
26.	— <i>cassia, Salter</i>	58	2	" Ludlow	VII, 7.
27.	— <i>cassioides, J. and W.</i>	59	3	" Ludlow	III, 9; IV, 7
28.	— ? <i>longicauda (D. Sharpe)</i>	61	1	" Portugal	XI, 16.
29.	— <i>decora (Phillips)</i>	63	1	" Malvern?, Ludlow?	Not figured.
30.	— ? <i>lata, Salter</i>	63	1	Cambrian, Garth	Not figured.
31.	— ? <i>insperata, Salter</i>	64	1	" Penmorfa	Not figured.
32.	— <i>sp.</i>	64	1	Silurian, Onny River	Not figured.
33.	— <i>perornata, Salter</i>	64	3	" Benson Knot, Kendal	Not figured.
34.	— ?	124	1	" Moffat, Dumfriesshire	XVII, 8.
35.	— ?	124	1	" Skelgill Beck, Anbleside	XVII, 12.

LIST OF PHYLLOCARIDA.

NO.	GENUS AND SPECIES.	PAGE.	NUMBER OF SPECIMENS.	STAGE AND LOCALITY.	PLATES AND FIGURES.
<i>Genus 2.</i> — <i>Xiphocaris, Jones and Woodward</i> 65					
1.	<i>Xiphocaris ensis (Salter)</i>	65	1	Silurian, Leintwardine, Ludlow	V, 7.
<i>Genus 3.</i> — <i>Physocaris, Salter</i> 66					
1.	<i>Physocaris vesica (Salter)</i>	66	1	„ Ludlow	VII, 8; and cut, fig. 3.
<i>Genus 4.</i> — <i>Emmelezoe, J. and W.</i> 68					
1.	<i>Emmelezoe elliptica (M'Coy)</i>	68	1	„ Benson Knot and Helm Knot	VIII, 1.
2.	— <i>crassistriata, J. and W.</i>	70	1	„ Presteign	VIII, 3.
3.	— <i>tenuistriata, J. and W.</i>	70	1	„ Ludlow	VII, 9.
4.	— <i>Maccoyiana, J. and W.</i>	71	1	„ Leintwardine, Ludlow	VIII, 2.
IN PART II (1892).					
<i>Genus 5.</i> — <i>Hymenocaris, Salter</i> 73					
1.	<i>Hymenocaris vermicauda</i>	74	Many	Lingula-flags, Tremadoc &c.	XIII, 1—14.
2.	— ? <i>lata, Salter</i>	79	1	Premadoc Flags, GARTH	Cut, fig. 4.
<i>Genus 6.</i> — <i>Lingulocaris, Salter</i> 80					
1.	<i>Lingulocaris lingulæcomæ, Salter</i>	81	12 ?	„ „ &c.	XIV, 4 ?.
2.	— <i>siliquiformis, Jones</i>	81	2	Lingula-flags, Garth, &c.	XIV, 1, 2.
3.	— <i>Salteriana, J. and W.</i>	82	2	Tremadoc Flags, Portmadoc and Maentrog	XIV, 3.
4.	— <i>sp.</i>	83	1	Lower Silurian, Angers, France	XIV, 5.
<i>Genus 7.</i> — <i>Saccocaris, Salter</i> 84					
1.	<i>Saccocaris major, Salter</i>	84	1	Lingula-flags, Maentrog	XIV, 6.
2.	— <i>minor, J. and W.</i>	86	Many	Lower Silurian, Arenig	XIV, 7—9, 10 ?.
<i>Genus 8.</i> — <i>Caryocaris, Salter</i> 89					
1.	<i>Caryocaris Wrightii, Salter</i>	89	{ Many	Skiddaw Slates, Keswick	XIV, 11—15.
2.	— <i>Marrii, Hicks</i>	92	{ Many	Arenig Series, Huy, Belgium	Cuts, figs. 5 and 6, p. 91.
3.	— <i>Salteri (M'Coy)</i>	93	?	Skiddaw Slates and Arenig Schists	XIV, 16—18.
4.	— ? <i>sp.</i>	124	3	Silurian, Redesdale, Victoria	Not figured.
<i>Genus 9.</i> — <i>Aptychopsis, Barrande</i> 97					
1.	<i>Aptychopsis prima, Barrande, and var. secunda, J. and W.</i>	100	Several	Silurian, Bohemia	Cuts, figs. 7 and 10, p. 109.
2.	— <i>Barrandeæ, and var. brevior, J. and W.</i>	101	2	„ Dobbs Linn, Dumfriesshire	XV, 1 and 14.
3.	<i>cordiformis, J. and W. (anatina, Salter)</i>	103	1	„ Ulverston	XV, 2.
4.	— <i>lata, J. and W.</i>	104	1	„ Dumfriesshire	XV, 6.
5.	<i>glabra, H. Woodward</i>	104	1	„ Selkirkshire	XV, 11.
6.	<i>Wilsoni, H. W.</i>	105	3	„ Dumfriesshire	XV, 12, 15, 16.
7.	<i>Lapworthi, H. W.</i>	106	Several	„ Moffat and Skelgill, Ambleside	XV, 3, 7—10, 22.
8.	— <i>ovata, J. and W.</i>	108	2	„ Dumfriesshire	XV, 4, 5; and cut, fig. 9.
9.	<i>Salteri, H. W.</i>	109	1	„ Caerarthenshire	XVII, 6; and cut, fig. 8.
10.	— <i>subquadrata, J. and W.</i>	110	1	„ Tipperary	XV, 20.
11.	<i>angulata (Bailey)</i>	110	1	„ Tipperary	XV, 13 ? , 17 ? , 19.
12.	<i>oblata, J. and W.</i>	111	3	„ Balmangan Bay and Moffat	XV, 18, 21, 23.

LIST OF PHYLLOCARIDA.

NO.	GENUS AND SPECIES.	PAGE.	NUMBER OF SPECIMENS.	STAGE AND LOCALITY.	PLATES AND FIGURES.
<i>Genus 10.</i> — <i>Peltocaris</i> , <i>Salter</i> 112					
1.	<i>Peltocaris aptychoides</i> , <i>Salter</i>	113	6	Silurian, Moffat	XVI, 1—3.
2.	— <i>anatina</i> , <i>Salter</i> (<i>Marrii</i> , <i>J. and W.</i>)	114	6	„ Skelgill and Moffat	XVI, 4—9.
3.	— <i>patula</i> , <i>J. and W.</i>	116	2	„ Skelgill and Moffat	XVI, 10, 11.
4.	— <i>Carruthersii</i> , <i>J. and W.</i>	116	2	„ Ireland and Moffat	XVII, 7.
5.	— ? <i>Harknessii</i> , <i>Salter</i>	117	1	„ Dumfriesshire	Not figured.
<i>Genus 11.</i> — <i>Pinnocaris</i> , <i>R. Etheridge, jun.</i> 117					
1.	<i>Pinnocaris</i> <i>Lapworthi</i> , <i>R. E. jun.</i>	118	Several	„ Girvan, Ayrshire	XV, 24.
<i>Genus 12.</i> — <i>Discinocaris</i> , <i>H. Woodward</i>					
1.	<i>Discinocaris</i> <i>Browniana</i> , <i>H. W.</i>	119	Several	„ Moffat and Skelgill Beck	XVI, 12—19, 21—23.
2.	— <i>ovalis</i> , <i>J. and W.</i>	121	1	„ Moffat	XVI, 20.
3.	— <i>undulata</i> , <i>J. and W.</i>	122	1	„ Moffat	XVI, 24.
4.	— <i>gigas</i> , <i>H. W.</i>	122	5	„ Moffat and Skelgill Beck	XVII, 1—5.
IN PART III (1898).					
<i>Genus 13.</i> — <i>Dithyrocaris</i> , <i>Scouler</i> 129					
1.	<i>Dithyrocaris</i> <i>glabra</i> , <i>Woodward and Etheridge</i>	136	46	16 East Kilbride, 23 Ardross, and 7 Redesdale	} XVIII, 1, 2; XIX, 1—4; XXIII, 11; XXV, 1, 2.
2.	— <i>ovalis</i> , <i>W. and E.</i>	140	1	East Kilbride	
3.	— <i>granulata</i> , <i>W. and E.</i>	142	6	East Kilbride	XVIII, 3. XVIII, 4—6; XIX, 5, 6; XX, 1—3.
4.	— <i>testudinea</i> , <i>Scouler</i>	145	24	17 East Kilbride 4 Carluke 2 Ardross 1 Paisley 1 Tyrone 1 Roxburghshire	} XIX, 7—9; XXI, 1—6, 10; XXII, 3; XXIII, 7, 8; XXIV, 7; XXVII, 3; XXVIII, 1—5; XXIX, 10—14; XXXI, 1—4.
5.	— <i>Scouleri</i> , <i>M. Coy</i>	155	2	1 Tyrone 1 Roxburghshire	
6.	— <i>funiculata</i> , <i>sp. nov.</i>	158	2	1 Tyrone 1 Roxburghshire	} XXII, 6. XXV, 3—5; XXVII, 1; XXX, 1—4; XXXI, 6, 7, and fig. 8, var.
7.	{ <i>insignis</i> , <i>sp. nov.</i> 159 (and var. <i>multijugata</i> , <i>nov.</i> 162	31	3	1 East Kilbride 30 Eccup	
8.	— <i>Colei</i> , <i>Portlock</i>	163	11	9 Tyrone and Derry 2 Roxburghshire	} XXII, 7; XXIII, 1—4; XXIV, 2, 4; XXV, 9; XXVII, 5.
9.	— <i>orbicularis</i> , <i>Portlock</i>	168	1	Londonberry	
10.	— <i>tricornis</i> , <i>Scouler</i>	170	5	3 East Kilbride 1 Redesdale 1 Paisley	} XXII, 4, 5; XXIV, 1, 5, 6; XXV, 9; XXVII, 2, 4.
IN PART IV (1899).					
11.	<i>Dithyrocaris</i> <i>Belli</i> , <i>H. Woodward</i>	177	1	Canada (Devonian)	XVIII, 8.
12.	— <i>lateralis</i> , <i>M. Coy</i>	184	2	1 Derby 1 Roxburghshire	} XXIII, 5, 6. XXIII, 9, 10; XXIX, 1, 2.
13.	— <i>Dunnii</i> , <i>sp. nov.</i>	186	3	2 Redesdale 1 Cannobie	
14.	— <i>Neilsoni</i> , <i>sp. nov.</i>	187	3	East Kilbride	XXIX, 3.
15.	— <i>sp. (? testudinea)</i> , <i>Scouler</i>	187—8	1	East Kilbride	XXI, 10.
16.	— <i>sp. (? testudinea)</i> , <i>Scouler</i>	188	1	Leet Water, Coldstream	Not figured.
17.	? <i>(Rhachura)</i> <i>venosa</i> , <i>Scudder</i>	188	2	Coal-measures, Illinois	XIX, 13.
18.	— <i>carbonaria</i> , <i>Meek and Worthen</i>	190	2 and more	Coal-measures, Illinois	XXIX, 5.
19.	— <i>Kochi</i> , <i>Ludwig</i>	191	1	Devonian, Nassau	XXIX, 7, 8.
20.	— <i>brevicauleata</i> , <i>Ludwig</i>	191	1	Devonian, Nassau	XXIX, 9.
21.	— <i>Kayseri</i> , <i>J. M. Clarke</i>	192	1	Devonian, Wildungen	Not figured.

N.B.—Nos. 1 to 10 and 12 to 18 are all of Carboniferous age.

LIST OF PHYLLOCARIDA.

NO.	GENUS AND SPECIES.	PAGE.	NUMBER OF SPECIMENS.	STAGE AND LOCALITY.	PLATES AND FIGURES.
<i>Genus 14.</i> — <i>Chænocaris</i> , <i>Jones and Woodward</i>.....178					
1.	<i>Chænocaris tenuistriata</i> (<i>M' Coy</i>).....	178	10	Lower Carboniferous { 7 Settle 1 Cork 2 Visé }	XXI, 8, 9, 11; XXIV, 8; XXXI, 5.
2.	— <i>Youngii</i> , sp. nov.	181	1	Carboniferous, Robroyston	XXII, 1.
<i>Genus 15.</i> — <i>Calyptocaris</i> , <i>J. and W.</i>.....182					
1.	<i>Calyptocaris striata</i> (<i>H. Woodward</i>)	182	1	Carboniferous, Lanark	XVIII, 7.
2.	— ? <i>Richteriana</i> , sp. nov.	183	1	Devonian, Saalfeld	XXII, 2.
<i>Genus 16.</i> — <i>Mesothyra</i> , <i>Hall</i>.....192					
1.	<i>Mesothyra Neptuni</i> , <i>Hall and Clarke</i>	192	Several	} Devonian, North } America }	} Not figured.
2.	— <i>oceani</i> , <i>Hall and Clarke</i>	193	Several		
<i>Genus 17.</i> — <i>Ptychocaris</i> , <i>Novák</i>.....193					
1.	<i>Ptychocaris</i> ? <i>Jaschei</i> (<i>Römer</i>).....	193	1	Hercynian, Hartz	XXIX, 15, 16.
<i>Genus 18.</i> — <i>Lebescontia</i> , <i>J. and W.</i>.....199					
1.	<i>Lebescontia enigmatica</i> , gen. et sp. nov.....	199	3	Lower Silurian, Brittany	Cuts, figs. 11—13.
2.	— <i>oculta</i> , sp. nov.....	203	1	Carboniferous, Scotland	Cuts, figs. 14—16b.
<i>Genus 19.</i> — <i>Hibbertia</i> , <i>J. and W.</i>.....205					
1.	<i>Hibbertia orbicularis</i> , gen. et sp. nov.....	205	1	Lower Carboniferous, Burdiehouse	XXV, 8.

LIST OF ILLUSTRATIONS IN THIS MONOGRAPH (1888—1899).

PLATES I—XII (1888); XIII—XVII (1892); XVIII—XXV (1898);
XXVI—XXXI (1899).

WOODCUTS IN PART I (1888).

FIGS.	PAGE
1 and 2. Abdominal segments and caudal spines of <i>Ceratiocaris stygia</i> , Salter, and <i>C. papilio</i> , Salter	12
3. Carapace and abdomen of <i>Physocaris vesica</i> (Salter)	67

WOODCUTS IN PART II (1892).

4. <i>Hymenocaris lata</i> , Salter; after Salter	80
5 and 6. <i>Caryocaris Wrightii</i> , Salter, from Huy, Belgium	91
7. <i>Aptychopsis prima</i> , Barrande, from Bohemia	100
8, 9, and 10. <i>Aptychopsis Salteri</i> , Woodward, <i>A. ovata</i> , J. and W., and <i>A. prima</i> , Barrande; outlines compared	109

WOODCUTS IN PART III (1898).

Not numbered sections of quarry at Congleton Edge	154 and 155
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WOODCUTS IN PART IV (1899).

Not numbered section of quarry at Congleton	xiv
11, 12 A, 12 B, and 13. <i>Lebescontia senigmatica</i> , J. and W., from Brittany	199
14, 15, 16 A, 16 B. <i>Lebescontia occulta</i> , J. and W., from Scotland	203

ADDENDA ET CORRIGENDA.

PART I.

Page 11. After the 16th line from the top *add* 1885, J. M. Clarke. The Higher Devonian Fauna of Ontario County, New York, pp. 43, 44.

Pages 16 and 19. Pl. IV, fig. 3, is *Ceratiocaris tyrannus* (not *C. Murchisoni*).

Pages 20 and 21. Pl. VI, fig. 11, is *Ceratiocaris tyrannus* (not *C. valida*).

Page 23. Before the 10th line from the bottom *add*:—A specimen of *C. tyrannus* from the Upper Coldwell beds, near Troutbeck, Westmoreland, is in Professor Törnquist's collection, Lund.

Page 25. In the last two paragraphs lines 2nd and 5th from the bottom may refer to *Ceratiocaris tyrannus* rather than to *C. gigas* or *C. Murchisoni*.

Page 37. Add to the foot-note—and 'Mem. Geol. Surv.' Explan. Sheet 23 (1879), pp. 9, &c.

Page 44. The 4th paragraph from the bottom refers to *Ceratiocaris patula* (not to *C. robusta*).

Page 45. In the paragraph of lines 10 to 6 from the bottom, *for* telson *read* style.

Pages 61 and 72. Plate XI, fig. 16, may belong to the genus *Elymocarid*, Beecher, as suggested at p. 62.

Pages 62 and 72. *Ceratiocaris? lata* belongs most probably to *Hymenocaris*.

We have to add that in the Lee Collection, British Museum, there are—

I, 1163. From the Upper Ludlow beds of Logan Water, portions of the tail-pieces of *Ceratiocaris papilio*.

I, 1169. From the Lower Ludlow of Leintwardine, near Ludlow, the end of an abdomen, telson, and cercopods of *C. papilio*.

I, 1167. From the Lower Ludlow of Church Hill, Leintwardine, the inside exposure of a left-hand valve of *C. Halliana*.

I, 1170. From the same locality a nearly perfect specimen of *C. Halliana*, young.

I, 1168. From the Lower Ludlow beds, Ludlow—*C. cassia*

PART II.

- Page 95, heading, for *CARYOCARIS SALTERI* read *SUTURAL CARAPACES AND OTHERS*.
- „ 97, line 16 from the bottom, *add* and vol. vi, pl. clxxxiii, figs. 1, 2.
- „ 98 „ 3 „ *for* *Regiones D et E* read *Regis D E*.
- „ 101 „ 2 from the top, *for* *Butowitz* read *Bubowitz*.
- „ 101 „ 7 from the bottom, *after* vertical *insert* (dorsal).
- „ 103 „ 13 from the top, *for* *CORDIFORMIS*, sp. nov., read *ANATINA* (Salter, 1873).
- „ 103 „ 29 „ *for* *anatina* is probably read *Marrii*.
- „ 103 „ 7 from the bottom, *delete* *Coll. Marr*.
- „ 107 „ 13 from the top, *for* *Inverleithen* read *Innerleithen*.
- „ „ „ 24 „ *insert* *Clingani-shales* *after* No. 9.
- „ 110 „ 13 „ *for* *Lower* read *Upper*.
- „ „ „ 15 „ *for* 1860 read 1862.
- „ „ „ 2 from the bottom, *for* *Lower* read *Upper*.
- „ 113 „ 9 „ *insert* — — *Nicholson*, 1879. *Palæontology*, edit. 2, p. 348, fig. 203 d.
- „ „ „ 21 „ *delete* and 9.
- „ 114 „ 12 „ *for* *ANATINA*, Salter, 1873, read *MARRII*, sp. nov.
- „ 115, heading, *for* *ANATINA* read *MARRII*.
- „ „ line 4 from the top, *insert* by us *after* thought.
- „ „ „ 7 „ *for* mudstone of the *Coniston* series read band of the *Skelgill* shales.
- „ 116 „ 16 „ *after* from *insert* the *Skelgill* beds of.
- „ 121 „ 13 „ *for* *A. Z.* read the *Argenteus*-zone of the *Middle Skelgill* Beds.
- „ 123 „ 2 „ *for* *Coniston* mudstone read the *Argenteus*-zone of the *Middle Skelgill* Beds.
- „ „ „ 23 „ *for* *A. Z.* read the *Argenteus*-zone of the *Middle Skelgill* Beds.
- „ 124 „ 14 „ *for* *graptolitic shale* read mudstone of the “barren band” of the *Lower Skelgill* Beds.
- „ „ „ 2 from the bottom, *for* 8, 9, and 10, read 9, 10, and 11.

PART III.

- Page 125, line 5 from bottom, *for* *Robroystone* read *Robroyston*.
- „ „ „ 3 „ *for* *Limestone* read *Ironstone*.
- „ 126, „ 9 from top, *after* *limestone* *insert*, *Carluke*.
- „ „ lines 17 and 16 from bottom, read strata under the *Main Limestone* series at *Craigenglen*, *Campsie*.
- „ „ line 5 from bottom, *for* *D. insignis* *add* also *Kilbride* as a locality.
- „ 127, first line, *for* *Chænocaris* read *Calyptocaris*.
- „ „ line 9 from top, *after* shales *add* over the *Calderwood Cement-limestone*, *East Kilbride*.
- „ „ „ 16 „ *after* *Ireland*. *add* *The Cock of Arran*.
- “*The Cock of Arran*” is a large fragment of fallen rock lying on the “*Raised Beach*,” and is so named because it was at one time supposed to resemble that bird. It gives its name to the local

farm, and is shown on the maps and mentioned in the guide-books. It is referred to in the 'Trans. Geol. Soc. of Glasgow,' vol. x, pp. 293, 296.

The tooth alluded to at p. 197, and shown in Pl. XXVI, figs. 33 and 34, was got from one of the red limestones on the beach. These belong to the Upper Limestone.—J. NEILSON, in Letters.

Page 127, line 17 from top, *for is read was*.

„ „ lines 18 and 19, *read* Caldreside, Kirktonholme, and Glebe quarries, and elsewhere in the parish of East Kilbride. Consult 'Memoirs Geol. Survey Scotland,' Explanation of Sheet 33, pp. 28—30; and Patton, "Geology of East Kilbride," 'Trans. Geol. Soc. Glasgow,' vol. vii, p. 309.—J. NEILSON, in Letters.

„ „ line 19 from top, *for two feet read eleven inches*.

„ 128, „ 3 „ *for* Ironstone *read* Ironstones; and *after* Rutherglen *add* Lanarkshire Coal-field.

„ 132, in the table, *bracket* 12 and 13 *together*, and 14 and 15 (*not* 12—14).

„ 133, line 17 from top, *read* Nos. 12 and 13.

„ „ „ 18 „ „ Nos. 14 and 15.

„ „ „ 19 „ *for is read are*.

„ „ „ 3 from bottom, *for Ch.* *read Calyptocaris*.

„ 135, last line of the table, *for Chænocaris read Calyptocaris*. *The bracket should not include No. 27.*

„ 139, line 2 from top, *after* fluted *add*, showing the ventral aspect.

„ „ „ 13 „ *add* Aspect doubtful.

„ 140 „ 6 „ *add* The granulation of the dorsal surface extends over the ridge also.

„ „ „ 16 „ *add* Probably ventral aspect.

„ „ „ 9 from bottom, *insert* Additional specimens of *Dithyrocaris glabra*, Brit. Mus., Nos. 2, 3, 4, 5, 7, all from East Kilbride.

No. 2 in non-calcareous black shale. No. 3, two separate left valves. These have no fringe on the ventral border, but the edge is turned up as a sharp rim along its front half. In very slightly calcareous black shale. Nos. 4 and 5 in black shale slightly calcareous. No. 5 is a left valve, together with the filmy relic of another similar valve, with a narrow fringe and very fine mesolateral (?) ridge. No. 7 a right valve, badly preserved as a light brown film. No. 8 (Pl. XXV, fig. 2) has a delicate fringe, continued forward into the simple raised ridge. Mus. Geol. Surv. Scotl., No. 25, is from "the shore east of Ardross Castle, Elie." In the British Museum there is a group of fifteen loose pieces of black shale with fragments of *D. glabra*, of which seven are from Ardross and eight from Castle Ardross.

"There are two places at Ardross where fossils are found. One is a little west of the remains of the old castle, and the other about a hundred yards east of it. The latter place is where *Dithyrocaris* and other crustaceans are met with. 'Ardross' and 'Ardross Castle' are used indifferently for either or both spots. Ardross itself is a farmhouse, and nearest to the *Dithyrocaris* locality. There is no village called Ardross. Elie is about a mile to the west, and is the nearest post-town and railway-station."—J. W. KIRKBY, July 5th, 1895.

Page 144, line 5 from bottom, *add* At its broken end in front the ridge overrides the edge of the right valve, and its left side has been pressed at a steep angle to the other valve.

„ 145 „ 12 from top, *add* Another *D. granulata* is Brit. Mus., No. 13, from East Kilbride. It has a rugose mesolateral ridge.

„ „ „ 14 „ *add* 10 *after* 6.

„ 146 „ 13 „ *add* The style is bayonet-shaped, with a midrib more or less recog-

nisable on each face. The stylets are sulcate, their riblets or costulae between the furrows varying in number up to six.

- Page 147, line 12 from top, *insert* The style has only a midrib; the stylets have three or four costulae. At the end of the third paragraph *add*; and this accords with the disturbed (probably twisted) state of the abdominal segments outside the carapace.
- „ 148, „ 6 „ *for* XXIX *read* XXXI.
- „ 150, „ 4 „ *after* fig. 4 *insert* a, b, c, d.
- „ „ „ 7 „ *delete* the words between shows and part.
- „ „ „ 9 „ *delete* impress of the.
- „ „ „ 11 „ *add* For a more correct description of the magnified figure see below.
- „ „ „ 13 „ *delete* the words between shows and that.
- „ „ „ 19 „ *add* Pl. XXXI, figs. 4 a, b, c, d, being magnified figures of this specimen, *add* of a more correct description, thus :

Size.—Stylets possibly about 35 mm. long when perfect.

Characters.—This specimen, magnified two diameters, shows the ventral aspect of a part of the last abdominal segment and of the trifold appendage. Parts of the dorsal face of each stylet are shown in intaglio by the loss of the ventral moiety. A part of the head of the left-hand stylet has been broken away, leaving an impression of its dorsal surface, shown by fig. 4 b. This figure (magnified ten diameters) also shows the subsidiary oblique striae on the riblets of both faces, which are four on the ventral and six on the dorsal face.

The minute lateral striae trend upwards, *i. e.* backwards, on both faces, but are more delicate and numerous on the riblets of the dorsal face. Marginal pittings, which were the bases of hairs, setae, or spinules, are magnified in fig. 4 c, from the right-hand stylet.

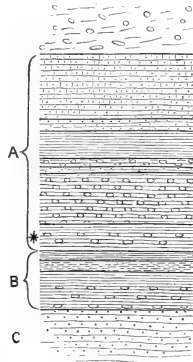
The ornament of chevron-like lines, with short, oblique, intermediate cross-lines is seen on a magnified (30 diameters) part of the ultimate segments in fig. 4 d.

The style is straight, coarsely fluted above and bayonet-shaped below; the stylets are slightly curved; coarsely striate on the dorsal, and sulcate on the ventral face.

Page 151, line 22 from top, *for* fig. 1 *read* fig. 1 a.

- „ „ „ 2 from bottom, *add* It retains part of the ventral fringe. There is the mark of a gastric tooth in its place; and there are two separate teeth, obscured with a shaly coating, in the slab.
- „ „ last line, *for* Black calcareous shale *read* From the Cement-stone.
- „ 152, line 22 from top, *add* In hard dark-coloured calcareous shale.
- „ 153, first line, *after* 10 a, b, *add* c; *for* 11 *read* 11 a, b; *for* 12 a, b, *read* 12 a—d.
- „ „ line 11 from top, *read* which we were at first inclined to refer.
- „ „ between lines 8 and 9 from bottom, *insert* *Dithyrocaris testudinea*.—Mus. Geol. Surv. Scotland, No. 1, F. 2^o, and No. 8, F. 2^o, counterparts, not figured. In hard, dark grey, non-calcareous shale, with the tooth-mark strong, and a trifold obscure. One piece marked Ardross, and the other Ardross Castle, Fife, Lower Limestone Group.
- „ „ „ „ also insert *D. testudinea*, B. M., No. 16, not figured, is an imperfect left valve, showing both the fringed ventral margin and the dorsal crest (slightly separate), very much like Pl. XXVIII, fig. 1.

Page 154.—Woodcut. Later observations made at this quarry, which has been extended, give the following section :



The section in the quarry at Congleton Edge, where the *Dithyrocaris* and *Ceratiocaris* were found in the strata marked A*.

- At the top. Grey-yellow clay, with blocks of grit : 0 to 5 feet.
- Decomposed limestone, crowded with crushed shells of *Orthis resupinata* : 5 ft. 2 in.
Grit : 1 foot.
- A } Grey shales : 3 feet.
Shale with half-inch bullions : 9 inches.
Very sandy shales : 2 to 4 inches.
Shale with slightly calcareous bullions ; marine fossils : 5 ft. 7 in.
Rather darker shale, with two lines of bullions : 3 feet.¹
- B } Calcareous shales with *Goniatites* : 8 inches.
Rather darker coarsely laminated shales, with *Glyphioceras spirale*, *Posidoniella lævis*,
and plant remains : 1 foot.
Shale with calcareous bullions and marine fossils : 4 feet.
Coal : $\frac{1}{8}$ inch.
- C } Gannister grit with plant remains : 5 ft. 8 in.
Flaggy grit with thin black shale partings : 2 feet.
Shale : 3 to 4 inches.
Grit (Gannister) : 1 ft. 6 in. to 2 feet.
Shale and thin grits : 1 ft. to 1 ft. 6 in.
Grit (Gannister) : 5 ft. 6 in.
Shale much squeezed : 2 feet.
Grit : 1 foot.
Coal : $\frac{1}{2}$ inch.
Grit (Gannister) with plant remains : 11 feet.
Shale with many plants : 3 inches.
Grit : 1 foot.
Shale : 4 ft. 6 in.
Grit (Gannister) : 3 ft. 6 in.

¹ This is the horizon at which *Dithyrocaris testudinea* and *Ceratiocaris Oretionensis* were found.

- Page 154, lines 15, 20, and 26 from bottom, for *Glyphoceras* read *Glyphioceras*.
 ,, ,, line 16 from bottom, for *Ortonensis* read *Oretonensis*.
 ,, 155 ,, 18 ,, *delete* 10 (?).
 ,, 156 ,, 16 from top, *add* 6—7 costulæ.
 ,, 156 ,, 20 from top, *add* page 149.
 ,, 159 ,, 10 ,, *for* species. From *read* species from.
 ,, ,, ,, 12 ,, *add* A fragment of a valve of *D. funiculata*, with a trace of its *marginal cord*, and a long rugose mesolateral ridge, is in the British Museum (I. 280, No. 26). It is in a thin black, micaceous, calcareous shale, consisting mainly of compressed little Ostracods, such as the shales referred to at page 164, and like some of the "oil-shales" of Scotland. From Tyrone; marked "Tyrone, Sheet 58, No. 5."
 ,, ,, ,, 14 ,, *for* 3 *read* 4.
 ,, ,, ,, 21 ,, *delete* Nos. 39 A and 44 A.
 ,, ,, ,, 2 from bottom, *after* mesolateral *insert* (see fig. 3 b).
 ,, 161 ,, 7 from top, *after* 39 B *add* Pl. XXX, figs. 4 a, b.
 ,, ,, ,, 8 ,, *for* 43 *read* 48.
 ,, ,, ,, 9 ,, *after* ventral *add* with some remains of the left valve.
 ,, ,, ,, 13 ,, *after* ridges *read* and from those of the ventral margin (fig. 4 b).
 ,, 162 ,, 3 ,, *for* 3 b *read* 3 c.
 ,, ,, ,, 10 from bottom, *after* and 9 *add* Museum of the Yorkshire College, Leeds, Nos. 43 and 40.
 ,, 163 ,, 6 from top, *after* oblique *insert* to the dorsal ridge at an angle of 85°.
 ,, ,, ,, 25 ,, *for* parallel to each other *read* divergent from each other.
 ,, 165 ,, 24 ,, *read* their relative position (though crushed, and obscure in the figure) and the ornamental lines on the ultimate segment indicate the *dorsal* aspect.
 ,, 173 ,, 22 ,, *add* In the three-spined caudal appendage the dorsal aspect is shown; for the head of the style overlaps the heads of the stylets (more clearly in the photograph than in the lithograph). The style is of a bayonet shape with a median ridge. The stylets are sulcate, with four costulæ, and have obscure indications of the bases of marginal hairs or setæ.

In Explanation of Plate XXI, line 21 from top, for *Scouleri* (?), M'Coy, *read* *testudinea*, Scouler.

,, ,, XXII, line 7 from top, for *Chænocaris* *read* *Calyptocaris*.



retaining the carapace whole, having its dorsal and two mesolateral ridges, and other characteristic features, including a reticulate and subaculeate ornament of the surface.

Compare Pl. XXII, figs. 5 *d*, *e* (for the ornament); Pl. XXIV, figs. 5 *a*, *b* (for shape and outline).

This well-preserved specimen clearly exhibits the clypeiform test, with its dorsal convexity (fig. 4 *b*) when looked at sideways, and its suboblong and angulate shape when viewed from front or behind (figs. 4 *c*, *d*). Its dorsal ridge and ornament are magnified in fig. 4 *e*.

From Kirktonholme, East Kilbride.

Pl. XXV, figs. 9 *a*—*c*. Mus. Geol. Surv. Scotland, F. $\frac{xx}{5}$, No. 20.

This is a large separate dorsal ridge, possibly belonging to *D. tricornis* or *D. Colei*, or even to a different species.

Size.—Length probably about 60 mm. when perfect; width in the middle 5 mm.

Characters.—A long, narrow, fusiform, rugose ridge, with a flat narrow flange along each side. Thus it matches such a dorsal ridge as belongs to *D. tricornis* (Pl. XXIV, figs. 1 and 6) or *D. Colei* (Pl. XXIV, fig. 2). The latter seems to have had a rather longer carapace and ridge than the former, but its ridge is not so thick.

The rugosity of fig. 9, Pl. XXV, has a slight difference of structure from that of the other rugose ridges (Pl. XX, figs. 2 *b*, 3 *g*), due to the divisions of the chevrons being more exactly alternate in their distances and in their extent over the ridge, so that there appears to be almost a double row of rounded rugæ along this ridge. This, however, may have been the character of an individual, not of a species (see *D. granulata*, Pl. XX, figs. 2 *b* and 3 *g*).

In brownish calcareous shale. From the Calceiferous Sandstone group at Larriston Burn, near New Castleton, Roxburghshire.

If this dorsal ridge belonged to either *D. tricornis* or *D. Colei*, both species are also represented in the Roxburghshire beds.

Pl. XXV, figs. 10 *a*—*c*. Mus. Geol. Surv. Scotland, F. $\frac{xx}{5}$, No. 20.

The surface of the piece of hard shale in which the foregoing dorsal ridge is embedded is covered with scattered carapaces of small Ostracoda, mainly if not entirely belonging to *Kirkbya plicata* (figs. 10 *a*, side view; 10 *b*, edge view; and 10 *c*, end view).

My friend Mr. J. W. Kirkby tells me that from this locality (Larriston Quarry) the Geological Surveyors of Scotland have obtained several good sets of Ostracoda, which he has determined as *Leperditia Okeni* (and varieties), *Kirkbya costata*, *K.*

PART IV.

11. DITHYROCARIS BELLI, *H. Woodward*, 1871. Plate XVIII, figs. 8 *a*, *b*, *c*.

- DITHYROCARIS STRIATUS, *H. Woodward*, 1871. Rep. Brit. Assoc. for 1870, Sections, p. 90.
- BELLI, *H. Woodward*, 1871. Geol. Mag., vol. viii, p. 106, pl. iii, fig. 5.
- — — 1872. Canadian Naturalist, vol. vi, pp. 18, 19.
- — *S. A. Miller*, 1877. Americ. Palæoz. Foss., p. 217.
- — *Bigsby*, 1878. Thesaur. Dev.-Carb., p. 27.
- — *Packard*, 1883. Monogr. North-American Phyll. Crust., p. 452.
- — *Etheridge, Woodward, and Jones*, 1887. Rep. Brit. Assoc. for 1886, p. 65.
- — *Hall and Clarke*, 1888. Geol. Surv. New York, Palæontology, vol. vii, p. 194.
- MESOTHYRA BELLI, *S. A. Miller*, 1889. N.-American Geol. Palæont., pp. 545 and 556.
- DITHYROCARIS BELLI, *A. W. Fogdes*, 1893. Bibliogr. Palæoz. Crust., p. 382.

Size.—Length (imperfect) 33 mm.; breadth of the two valves, shifted one on the other partially, 25 mm.; breadth of single valve probably 13 mm.

Specific Characters.—Two valves, both imperfect anteriorly. The right valve shifted forwards and partially overlapping the other at the dorsal edge; its hinder border obscure. The left valve has its posterior spine and postero-ventral region fairly exposed, with its serrated margin (fig. 8 *b*).

Each valve bears a slightly curved mesolateral ridge, marked with chevrons pointing backwards (downwards in figs. 8 *a*, *b*). The two mesolaterals are brought close together in front by the oblique shifting of the valves one on the other. The surface of the valves is ornamented with numerous delicate riblets, parallel with the mesolateral ridge and the ventral margin; some die out without reaching the posterior region. The interstices between the riblets are filled with a transverse and oblique irregular reticulation (fig. 8 *c*). An outer or second lateral ridge near the ventral margin is just visible, but rather more distinctly on the right than on the left valve.

No eye-spot is present, but a slight unevenness of the surface between the incurved ridges near the posterior end seems to have been taken for it in the

reversed figure given in the 'Geol. Mag.,' 1871, pl. iii, fig. 5. In the 'Fifth Report on Palæoz. Phyllopoda,' 1887, p. 65, it was suggested that it is possible that the figure represents two opposite valves reversed and one overlapping the other on their inner margins.

This unique specimen (British Museum, No. 25) is in grey, finely laminated sandstone (not calcareous); from the Middle Devonian, Gaspé, Province of Quebec, Canada.

CHÆNOCARIS,¹ gen. nov.

This differs from *Dithyrocaris* in not having a dorsal overriding ridge, and in its valves folding down at the sides; gaping, however, and not quite closed along the ventral region, so far as known at present.

1. CHÆNOCARIS TENUISTRATA (*McCoy*, 1844).² Plate XXI, figs. 8, 9, 11 *a-f*;
Plate XXIV, fig. 8; Plate XXXI, fig. 5.

DITHYROCARIUS TENUISTRATUS, *R. Griffith*, 1842. Notice respecting the Fossils of the Mountain-Limestone of Ireland,³ p. 22 (Table).
Nomen nudum ex *Maccoyii* manuscripto.

? AVICULA PARADOXIDES, *De Koninck*, 1842. Descript. Anim. Foss. Terrain Carbonif. Belgique, p. 139, pl. vi, fig. 6.

DITHYROCARIUS TENUISTRATUS, *McCoy*, 1844. Synops. Char. Foss. Carb. Limest. Ireland, p. 164, pl. xxiii, fig. 3; and 1862, edit. 2, p. 234.

AVICULA PARADOXIDES, *Bronn*, 1848. Index Palæont., vol. i, p. 140.

DITHYROCARIUS TENUISTRATUS, *Morris*. Catal. Brit. Foss., edit. 2, p. 107.

— — — *Salter and Woodward*, 1865. Chart Foss. Crust.,
p. 17, fig. 13.

— — — *R. Griffith*, 1866. Journ. Geol. Soc. Dublin, vol.
ix, pp. 68 and 100.

— — — *H. Woodward*, 1871. Geol. Mag., vol. viii, p. 106,
pl. iii, fig. 4, and p. 521; and Report Brit.
Assoc. for 1871 (1872), p. 53.

? — — — *J. Armstrong*, 1871. Trans. Geol. Soc. Glasgow,
vol. iii, Appendix, p. 30.

? — — — *J. R. S. Hunter*, 1875. Palæont. Carbonif. Strata⁴
W. Scotland, part ii, p. 39.

¹ *Xaίνο*, I gape; and *καρίς*, a shrimp.

² Or 1842 according to Griffith.

³ McCoy is referred to at p. 8 as having named this and other new species.

⁴ The specimen here referred to is said to have come from the "Gaunister Limestone and Shales, Upper Limestone series, Carluke."

DITHYROCARIS TENUISTRIATUS,	<i>H. Woodward</i> , 1877. Catal. Brit. Foss. Crust., p. 73.
—	— <i>Bigsby</i> , 1878. Thesaur. Dev.-Carb., p. 249.
—	— <i>Packard</i> , 1883. North-Amer. Phyll., p. 452.
—	— <i>E., W., and J.</i> , 1887. Rep. Brit. Assoc. for 1886, p. 64.
—	— <i>Etheridge</i> , 1888. Foss. Brit., vol. i, Paleoz., p. 238.

The reference of this species to de Koninck's *Avicula* (?) *paradoxides*, as probably the same, was suggested in the 'Geol. Mag.,' 1871, p. 106; but since de Koninck's determination of his fossil is avowedly doubtful and provisional, and as we have not the original before us, and the figures are unsatisfactory, we cannot take it as the published "type." An important remark by Prof. L. G. de Koninck about his fossil is thus given in the 'Description des Animaux fossiles qui se trouvent dans le Terrain Carbonifère de Belgique,' par L. de Koninck, Texte, 4to, Liège, Paris, and Bonn, 1842-4, p. 139. "15. *Avicula paradoxides*, pl. vi, figs. 6 a, b, c. Nous sommes loin d'être certain si cette espèce appartient réellement au genre auquel nous la rapportons," and in which he placed it not knowing any other genus to which its form has any analogy. From the Upper Carboniferous Limestone of Visé, very rare.

Sir Richard Griffith used the name *D. tenuistriatus* in 1842, from M'Coy's information. Sir Frederick M'Coy's description of the species, at p. 164 of his 'Synopsis Char. Carb. Fossils of Ireland,' is as follows:

"Valves elongate, ovate, rounded anteally, obtusely pointed retrally, convex; mesial ridge large, running nearly the entire length of the valve; two smaller ridges close to and parallel with the inner margin; about one fifth of the length from the anterior end, and situate between the mesial and internal ridges, there is a short sigmoidal ridge, and a fifth one at the anterior end defines, for a short way, the line which separates the flat external margin from the convex part of the valve; surface finely and regularly striated longitudinally.

"This species differs from all others of the genus in the want of the retral spine to the valve; it is also much more convex than any of its congeners; fragments may be discriminated by the regularity and fineness of the striæ. Length of the valve one inch, width five lines."

The upper one of the two figures given as "fig. 3," in M'Coy's pl. xxiii, is here repeated in Pl. XXIV, fig. 8. The locality for this specimen is stated by Sir Richard Griffith ('Journ. Geol. Soc. Dublin,' vol. ix, p. 68) to be Little Island, Cork; and at p. 100 it is referred to the Lower Carboniferous Limestone.

Pl. XXI, fig. 8. Brit. Mus., No. 32938, No. 23.

Size.—Length of valve 40 mm.; breadth of valve 14 mm.

Characters.—This is a left valve, oblong, convex along the middle; obliquely rounded in front; partly rounded behind, but showing a postero-ventral spine (damaged), and a notch (broken, and obscured by matrix). Surface apparently

smooth, having probably lost the thin external ornamented coat. Ventral margin depressed and apparently simple (but other specimens show that it turned in at the edge). Dorsal margin quite simple and straight as far as it is preserved. Along the middle of the valve is a raised ridge (mesolateral) without visible rugæ. At its front end it curves gently towards the antero-dorsal corner of the valve, and almost touches the middle of the somewhat sigmoidal *cephalic* ridge. Near and parallel to the middle part of the dorsal margin is a thin ridge (juxta-dorsal), disappearing forward among some feeble elevations accompanying a faint *nuchal* ridge. In grey Carboniferous Limestone from Visé, Belgium.

VARIETY (?).—Mounted with the foregoing there is a smaller specimen of a left valve of the same species, also from Visé (in cream-coloured limestone, with a small Gasteropod and other little fossils). This presents the same features as fig. 8, but differs in size and proportions; its ventral edge is more broadly depressed, and its median convexity is proportionally greater.

Size.—Length 13 mm.; breadth 7 mm.

Pl. XXI, fig. 9. Brit. Mus., No. 44987, No. 24.

Size.—Length of valve, imperfect, about 30 mm.; breadth of valve about 12 mm.

Characters.—A left valve, similar in general features to fig. 8, but not so obliquely rounded in front; imperfect behind. The little cephalic ridge ends behind in a small smooth knob. The surface is ornamented with numerous, delicate, closely-set striæ, curving round the front part of the valve, parallel with its border, and passing along the ventral region. The thin ridge near the dorsal border dies away forwards among numerous, small, sinuous striæ, irregularly parallel, and passing away backwards into the longitudinal striæ of the dorsal region, which are not very distinct in this specimen.

A part of a smaller valve is attached to this little piece of limestone.

This specimen (fig. 9) has been described and figured in the 'Geol. Mag.,' vol. viii, 1871, p. 106, pl. iii, fig. 4. It is from the Carboniferous Limestone of Settle, West Yorkshire. Collected by the late Mr. J. H. Burrow.

Pl. XXI, figs. 11 *a*—*f*. Mus. Univ. Cambridge.

Size.—Length of valve, imperfect, 35 mm., probably 39 mm. when perfect; breadth of valve 15 mm.

Characters.—This is a right valve, presenting the characteristic features of fig. 8, but slightly broader, and with more distinct ornament of the surface. Near the ventral margin the striæ are simple, though divergent (fig. 11 *d*); along the mesolateral ridge they run up on both sides and coincide with the angular lines of obscure chevrons (fig. 11 *e*; better seen in another specimen, not figured),

which essentially constitute angular rugæ pointing backwards, as in *Dithyrocaris*. At places on the surface one set of striæ cross another set, making a definite reticulation (fig. 11 *e*) near the mesolateral ridge; see also fig. 8 *a*, Pl. XVIII; elsewhere, in the front part of the valve, one set retain and the other lose their continuity (fig. 11 *f*). In this latter case the striæ form continuous parallel lines, with interspaces partially and irregularly traversed by short oblique lines (fig. 11 *f*). Compare Pl. XVIII, figs. 8 *b* and 8 *c*; also compare F. A. Römer's *D. (?) Jaschei*, 1855 (Pl. XXIX, fig. 15 *c*).

The specimen under notice exhibits the inturned edge of the ventral margin very clearly, as shown in figs. 11 *b* and 11 *c*; it has a strong rim along the angle of its bend, and another (slighter) along its lower or inner edge.

From the Carboniferous Limestone of Settle, Yorkshire. J. H. Burrow Coll.

Pl. XXXI, fig. 5. Mus. Univ. Cambridge.

A small and imperfect left valve, here enlarged $3\frac{1}{2}$ diameters, to show its ornament of delicate, regular, parallel, longitudinal striæ, reaching up to the anterior region, and curving inwards to the middle ridge, and parallel to the edge of the valve in the postero-ventral region.

From Settle (Burrow Coll.).

2. CHÆNOCARIS YOUNGII, sp. nov. Plate XXII, figs. 1 *a—e*. Dr. John Young's Coll. (Robroyton).

Size.—Length 6 mm.; width 3 mm.; thickness of carapace, with the valves partially closed (figs. 1 *c* and *d*), 2.4 mm.

In its general aspect this little specimen closely resembles *Ch. tenuistriata*, Pl. XXI, figs. 8, 9, and 11. The relative position of the two moieties of the carapace (Pl. XXII, fig. 1 *d*) may indicate the natural stable condition in the life of the animal, or may be due to the imperfect closing of the valves of this species, filled in with the matrix of black shale. In its small size this specimen differs from those described in the preceding pages: its cephalic ridge is not so sigmoidal, and, owing to a curved sulcus behind it, seems to be raised on a cushion-like elevation; its surface is not at all striate, but punctulate, especially near the mesolateral ridge, which is a prominent feature in this, as in the other specimens. This ridge has minute lateral notches, formed by the interspaces of the pitting being exaggerated into little buttresses of the ridge (fig. 1 *c*); and these are very analogous to the junctions of the oblique striæ with the ridge in Pl. XXI, fig. 11 *e*, and not quite so closely to those in Pl. XXII, fig. 4.

Owing to the distinctive features described above, we regard this as a new

species, named after Dr. John Young, F.G.S., Under-keeper of the Hunterian Museum, University, Glasgow, who possesses the specimen.

From Lower Carboniferous series. In the Upper Limestone group, at Robroy-ston,¹ Lanarkshire; with black, non-calcareous shale, about 300 fathoms below the Ell Coal.

At Robroyston, about three miles north-east of Glasgow; the strata are under the Upper Limestone, in the Possil Ironstone series.

CALYPTOCARIS,² gen. nov.

This phyllopod differs from *Dithyrocaris* in having had a bivalved shell capable of being closed. Its costulate ornament approximates to that of *D. Belli*.

1. CALYPTOCARIS STRIATA (*H. Woodward*), 1871. Plate XVIII, fig. 7.

	DITHYROCARI	STRIATUS,	<i>H. Woodward</i> , 1871. Report Brit. Assoc. for 1870, Sections, p. 91.
?	—	STRIATA,	<i>Woodward and Etheridge</i> , 1873. Memoir Geol. Surv. Scotland, Explan. Sheet 23, Appendix, pp. 49, 57, 100; <i>Geol. Mag.</i> , 1874, p. 109, pl. v, fig. 6; Report Brit. Assoc. for 1873, Sections, p. 92.
	—	—	<i>Armstrong and others</i> , 1876. Catal. W.-Scotl. Fossils, p. 29.
	—	—	<i>Bigsby</i> , 1878. Thesaur. Dev.-Carb., p. 249.
	—	—	<i>E., W., and J.</i> , 1887. Rep. Brit. Assoc. for 1886, p. 65.
	—	—	<i>W. W. and J.</i> , 1899. <i>Geol. Mag.</i> , dec. 4, vol. vi, p. 28.
	—	—	1899. Rep. Brit. Assoc. for 1898, p. 520.
	CALYPTOCARIS	STRIATA,	— 1899. <i>Geol. Mag.</i> , dec. 4, vol. vi, p. 29.
	—	—	1899. Rep. Brit. Assoc. for 1898, p. 521.

Size.—Length of valve probably 30 mm.; breadth of valve is 15 mm.

Specific Characters.—This imperfect bivalved test has been filled with matrix, and the hinder moiety has been broken away. The remaining front part represents the exterior of the left valve; the hinder moiety shows the inside of the right valve as far as it reaches; the posterior border of both valves is absent. The front end of the left valve is obliquely truncate, with rounded corners; and it formed apparently one side of an open angle between the antero-dorsal regions of the two valves when they were perfect and open. The surface bears eight or nine longitudinal riblets; those on the ventral region are parallel to the curved

¹ A description of this locality is given at p. 88 of the 'Catalogue Western-Scottish Fossils,' 1876. *D. tenuistriata*, at pp. 45 and 89, probably refers to this fossil specimen.

² Καλύπτω, I close or hide; and καρίς, a shrimp.

margin; those on the middle and dorsal regions are straight. No gastric nor optic ridges are visible.

The transverse fracture shows the thinness of the compressed fossil (scarcely one millimetre).

The former reference of this little fossil to *Dithyrocaris* is probably incorrect, as intimated in the 'Geol. Mag.,' 1874, p. 109, although its longitudinal riblets are not without analogies in *D. Belli* (Pl. XVIII, fig. 8, and 'Geol. Mag.,' 1871, p. 106, pl. iii, fig. 5). Nor does it fall in with the *Ceratiocaridæ*, although it has some likeness to *Ceratiocaridæ Salteriana*, J. & W., 'Monograph,' 1888, p. 55, Pl. VII, figs. 1, 2, 3. The ornament of several parallel, slightly curved ridges along the lateral moieties of the test are seen in Packard's figure of *Lepidurus Colleii*, 'North American Phyll.,' pl. xv, fig. 2.

Tropidocaris and *Rhinocaris*¹ (other Phyllocarids related to *Ceratiocaridæ*) have carapace-valves bearing longitudinal riblets, but much coarser than those of either *C. striata* or *D. Belli*, and the valves themselves differ in shape considerably from those of the two latter forms. Compare also *Ptychocaris*, Novák, 'Sitz. Böhm. Ges. Wissensch.,' 1885, p. 345, pl. o, figs. 4—8, with its numerous striae and pitted interspaces.

This unique specimen (Mus. Geol. Surv. Scot. *m* 576 A, F $\frac{1\frac{2}{3}}{96}$, No. 15) was collected from a "greenish-grey" (now reddish), flaggy, calcareous shale of the Lower Red Sandstone, of the Calciferous Sandstone series at the Carmichael Burn, near the Manse, four and a half miles south-east of Lanark.

We have to notice that a granular band, 1 mm. wide, is associated with the border of the valves, looking as if some soft material had been squeezed out from between the valves, and had helped to form a concretionary border there. It is included in the left-hand margin in the figure of the carapace.

2. CALYPTOCARIS? RICHTERIANA, sp. nov. Plate XXII, fig. 2.

Size.—Length 6 mm.; width 3·2 mm. Imperfect.

Characters.—This figure is copied from a sketch made by our friend Mr. J. W. Kirkby, who recognised it (in 1864) in some hard red shale of the so-called "Cypridinen-Schiefer" (Entomis-shales), sent by the late Dr. R. Richter from Saalfeld, Sachsen-Meiningen.

The surface is coarsely striate, and has three longitudinal riblets; unfortunately the outline is imperfect, and there are no characteristic cephalic eminences. It may indeed have some relationship with *Chænocaris* as well as with *Calyptocaris*.

It is here introduced as indicative of the wide range of the costulate forms.

¹ Hall and Clarke, 'Paleont. New York,' vol. vii (1888), pp. 184, 195, pls. xxx and xxxi.

Though not a perfect valve, yet it has distinct characters of its own, sufficient to induce us to give it a name, so that it may be noted and catalogued by our friends in Germany. It is named after the above-named worthy geologist, who for many years worked at the history of the Entomostracous Crustacea and other fossils of the Devonian and Permian strata.

Caudal Extremities of Dithyrocaris, &c., some of them Foreign.

Several have been already described as belonging to known species in the preceding pages, as indicated by the following Table.

(For the proportional characters of style and stylets see the Table at p. 134.)

PLATE	FIG.	SPECIES.	PAGE	PLATE	FIG.	SPECIES.	PAGE
XIX.	3	<i>D. glabra</i> ...	138	XXIX.	3b	<i>D. Neilsoni</i> ...	187
—	4	— ...	139	—	3c	— ...	—
XXI.	4	<i>D. testudinea</i> ...	149	—	4	<i>Rh. venosa</i> ...	188
—	5	— ...	150	—	5	<i>D. carbonaria</i> ...	190
—	10	— ...	187	—	6		
XXIII.	2	<i>D. Colei</i> ...	165	—	7	<i>D. Kochi</i> ...	191
—	3			—	8		
—	4			—	9	<i>D. breviaculeata</i> ...	191
—	5	<i>D. lateralis</i> ...	185	—	10	<i>D. testudinea</i> ...	153
—	6	— ...	184	—	11		
—	7	<i>D. testudinea</i> ...	150	—	12		
—	8	— ...	151	—	13		
—	9	<i>D. Dunnii</i> ...	186	—	14		
—	10			—	15	<i>Pt. ? Jaschei</i> ...	193
—	11	<i>D. glabra</i> ...	140	—	16		
XXIV.	1	<i>D. tricornis</i> ...	172	XXXI.	4	<i>D. testudinea</i> ...	150
—	6			—	—	6	<i>D. insignis</i> ...	162
—	7	<i>D. testudinea</i> ...	146	—	7		
XXV.	6	<i>D. Scouleri</i> ...	156			Sp. <i>D. ?</i> ...	188
XXIX.	1	<i>D. Dunnii</i> ...	186			<i>D. Kayseri</i> ...	192
—	2			—	—		<i>M. Neptuni</i> ...	192
—	3a	<i>D. Neilsoni</i> ...	187			<i>M. oceani</i> ...	193

12. DITHYROCARIIS LATERALIS, M'Coy, 1851. Plate XXIII, figs. 5 and 6.

Specific Characters.—This is a well-marked three-spined tail-piece; first described by M'Coy, in 1851, as a specimen from Derbyshire, and now also recognised from Roxburghshire. Its relationship to the known species of *Dithyrocaris* is not clear; but it may have belonged to a large form of *D. testudinea* (compare Pl. XXI, fig. 5), or a small form of *D. tricornis* (see Pl. XXIV, fig. 6).

Pl. XXIII, fig. 6. Mus. Univ. Cambridge.

DITHYROCARIS LATERALIS,	M'Coy,	1851.	Brit. Pal. Foss. Cambridge Mus.,
			fasc. 1, p. 182, pl. 3 r, fig. 36.
—	—	Morris,	1854. Catal. Brit. Foss., edit. 2, p. 107.
—	—	E., W., and J.,	1887. Rep. Brit. Assoc. for 1886,
			p. 64.
—	—	Etheridge,	1888. Brit. Foss., vol. i, Palæoz., p. 238.

Size and Characters.—A trifold caudal appendage, showing the dorsal aspect; both the telson (style) and the cercopods (stylets) are imperfect at their proximal ends; but they measure, approximately—the style, 25 mm.; the stylets, 36 mm. in length. The former is bayonet-shaped, with a mid-rib; the latter, coarsely striate or sulcate, with four costulæ, are longer than the style. This trifold may possibly belong to *Dithyrocaris testudinea* or a closely allied form. The figure referred to above as given in the 'Brit. Pal. Foss. Cambridge' is partly a restoration, not quite matching the specimen in the University Museum.

"From the black beds over the Main Limestone of Derbyshire." W. Hopkins Coll.

The following remarks on this specimen (fig. 6) are given in M'Coy's 'Pal. Foss. Cambridge Mus.,' fasc. i, 1851, p. 182:

"I have examined four species [of *Dithyrocaris*] from the Carboniferous rocks of Ireland, but the only British example I have seen is a specimen in the collection [Cambridge] from the black Carboniferous Limestone of Derbyshire, indistinctly preserved, but most probably the tripartite tail of a new species, allied to *D. Colei* (Portl.), 'Geol. Rep.,' pl. xii, and to the *D. Scouleri* (M'Coy) figured in my 'Synopsis of the Carb. Foss. of Ireland,' pl. xxiii, fig. 2, from the black shales of Aughnaclough, Clogher.

"In this species the central angularly ridged spine is about ten lines long; the two lateral spines about one inch five lines long, coarsely sulcated longitudinally with only three or four strong ridges; this great excess of the lateral over the medial spine seems to characterise the species very well, and I would provisionally call it *Dithyrocaris lateralis* (M'Coy); when imperfect, the coarseness of the few large sulci of the lateral spines easily distinguishes those parts from the two figured species alluded to."

Pl. XXIII, fig. 5. Mus. Geol. Surv. Scotl., m 4267^b, No. 25, F $\frac{xx}{16}$; and m 4268^b (counterparts).

Size and Characters.—This trifold tail-piece closely corresponds with M'Coy's *D. lateralis*; but shows the ventral aspect. The style is bayonet-shaped, measuring 31 mm. in length; the stylets are 42 mm. long, striate; all have adventitious granulations. Their proximal ends are more perfect than in the Cambridge specimen of *D. lateralis*.

From Tweeden Burn, 250 yards above its mouth, near New Castleton, Roxburghshire.

This specimen is embedded in a hard black shale of the Cement-stone, micaceous and calcareous, containing obscure small Ostracods. It is associated with three other pieces of the same shale, including its counterpart; *m* 4269^b shows another, but imperfect trifold; *m* 4270^b contains the fragment of a small dorsal rugose ridge. This is 15 mm. long, and represents probably two-thirds of the original, and is evidently the relic of some small or immature carapace, only about 20 mm. in length.

13. DITHYROCARIS DUNNII, sp. nov., *J. and W.* Plate XXIII, figs. 9 and 10;
Pl. XXIX, figs. 1 and 2.

Pl. XXIII, figs. 9 and 10. Dunn Coll., $\frac{2^s}{1}$ and $\frac{2^s}{6}$. (Redesdale.)

Size.—Fig. 9 ($\frac{2^s}{1}$) { Style 10 mm. long; 6 mm. broad at top (head or caudal
plate). Ventral ? aspect.
Stylets broken (fragments 11 mm. long).
,, Fig. 10 ($\frac{2^s}{6}$) { Style 10 mm. long; 5 mm. broad at top (head or caudal
plate). Dorsal aspect.
Stylets broken (fragments 8 mm. long).

Specific Characters.—The two specimens (figs. 9 and 10) serve as the type of the species. They were collected by Mr. John Dunn, of Redesdale, from the “deaf” nodules in the Redesdale shales.¹ A part of the last abdominal segment, much crushed, is retained in each specimen, smooth, with a broad, flat, trifold tail attached. They are peculiar on account of the broadly triangular style and the narrow stylets, originally rather longer than the style, and obscurely sulcate.

Pl. XXIX, fig. 1. Mus. Geol. Surv. Scotl., F $\frac{v}{2}$, No. 16. (Larriston Burn.)
,, fig. 2. Mus. Geol. Surv. Scotl., F $\frac{v}{4}$, No. 19. (Harelow Hill
Quarry.)

Size.—Fig. 1 { Style imperfect, 20 mm. long; 7 mm. wide at the top.
{ Stylet (the most perfect) 30 mm. long.
,, Fig. 2 { Style imperfect, 30 mm. long (not much longer originally); 10
mm. wide at the top.
Stylets broken.

Characters.—These two imperfect specimens, though much larger, seem to be closely related to *D. Dunnii* (Pl. XXIII, figs. 8 and 9), by the relatively short and

¹ See page 176. The ironstone nodules in the uppermost bed of shale are called “deaf” when they have become oxidised.

broadly triangular styles. Better specimens, however, are desirable for definite determination.

Fig. 1, from the dark-coloured calcareous shale of the Calciferous Sandstone group at Larriston Burn, six miles north of New Castleton, has the head of the style crushed, but obscurely striate as if masked with the dorsal face of an ultimate segment, broken and displaced. The stylets are coarsely striated, one of them long and curved, has 8 or 9 costulae; the other has left only an impression of part of its proximal end. Together with it is a portion of a strong oblique rugose ridge.

Fig. 2, from the dark-coloured calcareous (?) shale of the Calciferous Sandstone group at Harelow Hill Quarry, Penton, Cannobie, has the head of the style pyriform, longitudinally striate, narrowing and sulcate below. There is an obscure fragment of one stylet.

14. DITHYROCARIS NEILSONI, sp. nov., *J. and W.* Plate XXIX, figs. 3 *a*, 3 *b*, 3 *c*. Neilson Coll., K.

Size.—Fig. 3 *a* { Style 22 mm. long (including the head).
 ,, { Stylet 23 mm. long.
 ,, Fig. 3 *b*—Stylet 26 mm. long.
 ,, Fig. 3 *c* { Style (broken) 18 mm. long; 3 mm. wide near the top.
 ,, { Stylet 15 mm. long.

Specific Characters:

Fig. 3 *a*.—These are three slender caudal spines of nearly equal length, all sulcated. Dorsal aspect. The style has a mid-ridge. The others are not quite perfect at the top.

Fig. 3 *b*.—There is one stylet, slender, not quite perfect, slightly curved, and sulcate; the other is lost. The style is bayonet-shaped.

Fig. 3 *c*.—Caudal spines apparently sulcate; dorsal aspect.

All in black shale, some with adventitious granules. Small Molluscan shells lie in the shale.

Compare these with the trifold shown in Pl. XXIII, fig. 7, which is of still smaller size, but has the style longer than the stylet.

From East Kilbride.

15. Sp. Pl. XXI, fig. 10. Brit. Mus., No. 594541, No. 22.

Characters and Size.—Caudal segments and appendages. Ventral aspect. The ultimate segment, tapering from a breadth of about 12 mm. at top to 6 mm. below.

broken across in two places, and damaged by crush at the upper end, was probably 25 mm. long. It is marked with long linear chevrons, pointing obliquely downwards (backwards) from the sides, and meeting along the middle (characterising the ventral aspect). The interstitial spaces bear delicate, transverse, sinuous lines. A fragment of the crushed penultimate segment remains.

There are remains of three broad tail-spines (the fragments being 5, 5, and 7 mm. long). The middle one (style) is sulcate and flattened. The stylets are strongly striated with six costulæ; they are broader than the style. The heads of all three are crushed together under the terminal arch of the ultimate segment (more clearly seen in the photograph).

This specimen differs from that in fig. 4 (ventral aspect) of the same plate, and fig. 4, Pl. XXXI, in both size and shape, being larger. Nevertheless it is probably closely related to it (*D. testudinea*).

Some resemblance to the above-described may be seen in the smaller segments and trifid appendage of the Upper Silurian *Ceraticaris compta* (pl. VII, figs. 10 a, b, p. 57, 'Monogr. Foss. Phyllop.,' Pal. Soc., 1888). In this, showing its dorsal surface, the oblique lines of ornament converge forwards (upwards on the figure), and not backwards.

The specimen under notice has some points of agreement with that shown in M'Coy's figure of his *D. Scouleri* (see Pl. XXV, fig. 6 a), but we do not associate it with that species, for the relative measurements of the few perfect portions do not agree closely enough, and there are doubtful details in the fig. 6 a.

From East Kilbride. Paton Collection.

16. Sp. (?) Mus. Geol. Surv. Scotl., F $\frac{xx}{7(ii)}$, No. 22 m, 998 B (not figured).

A caudal extremity consisting of two abdominal segments and three tail-spines, showing the ventral aspect. They are all very much crushed, but the fragmentary segments show linear ornamentation like that in fig. 10, Pl. XXI. The spines are coarsely striate, as also in fig. 10.

From the Calciferous Sandstone group; Leet Water, below Hirsell, Coldstream. In dark grey, micaceous, calcareous shale.

17. RHACHURA (DITHYROCARIS?) VENOSA, *Scudder*, 1878. Plate XXIX, fig. 4.
(Copied from Scudder's fig. 3, op. cit. infra.)

RHACHURA VENOSA, *Scudder*, 1878. Proceed. Boston Soc. Nat. Hist., vol. xix,
pp. 296—299, pl. ix, figs. 3, 3 a.

— — *Packard*, 1883. Monogr. N.-Amer. Phyllop., p. 452.

RACHURA VENOSA,	<i>E., W., and J.,</i>	1888.	Rep. Brit. Assoc. for 1887, p. 63.
—	—	<i>Packard,</i>	1889. Proc. Boston Soc. N. H., ¹ vol. xxiv, p. 212.
—	—	<i>Miller,</i>	1889. N.-Amer. Geol. Pal., p. 556.
—	—	<i>Vogdes,</i>	1893. Bibliogr. Pal. Crust., p. 405.

At page 299 of his memoir on this interesting fossil, the author writes :

"Impression of a dorsal shield in the same nodule . . . showed that it possessed a carapace resembling that of *Dithyrocaris* in general form. It was broadly rounded in front, and its periphery had a broad flat margin, which was covered, at least laterally, with very frequent, delicate, but distinct, slightly incurved, uniform ridges, nearly parallel to the longitudinal axis of the body, and to one another. The specimen is too [much] broken to show anything of the eyes or of any other feature excepting two low longitudinal ridges marked by a sharp carina, slightly curved, opening inward, one in the middle of either lateral half of the body."

The measurements appear to be as follow in comparison with those of M'Coy's *D. Scouleri* (Pl. XXV, fig. 6 a), and the caudal extremity in Pl. XXI, fig. 10 :

<i>Rhachura venosa.</i>	M'Coy's <i>D. Scouleri.</i>	<i>D. testudinea,</i> Pl. XXI, fig. 10.
Breadth of carapace, 50 mm.	35	—
Breadth of its margin 5·5 mm.	—	—
Greatest distance of lateral ridge from the inner edge of the margin on one side, 10 mm. ; on the other, 8·5 mm.	—	—
Length of abdominal fragments and appendages (two), 48 mm.	32	45 ?
Length of antepenultimate segment, 7 mm.	—	6 ?
Breadth of antepenultimate segment, 9·5 mm.	—	15
Length of penultimate segment, 13 mm.	—	—
Breadth of the same posteriorly, 8·75 mm.	—	—
Probable length of the last segment, 5 [13 ?] mm.	15	25 ?
Length of caudal appendage [style], 26 mm.	25	10 ?
Breadth of the same at the base, 3 mm.	5	3
Breadth of the same in the middle, 2·5 mm.	3	2 ?
Breadth of the same at the broken tip, 1·2 mm.	—	—
Length of the other appendage [stylet], broken and displaced, 26 ? mm.	—	—

The illustration (pl. ix, fig. 3, nat. size, and fig. 3 a magnified) accompanying Mr. Scudder's descriptive memoir represents the ventral aspect of two broken abdominal segments, and two caudal spines (a style apparently and a broken stylet, both sulcate). The shield or carapace is not illustrated. From the comparison of the measurements tabulated above, this specimen appears to belong to a distinct species, but of its generic status we cannot offer an opinion, except that it is probably a *Dithyrocaris*. At page 297, Mr. Scudder states that the lines of ornament on the dorsal surface of the abdominal joints of *Rhachura* are ordinary raised ridges ; or, if in reverse, they appear as impressed lines or furrows which

¹ Dr. A. S. Packard has here given some notes on two specimens of this Phyllocaridan obtained by Dr. R. R. Gurley from the Middle Coal-measures of Danville, Illinois. The fragments of the carapace indicate that it was "of a general oval-triangular shape," and "a little over three inches long." Two bayonet-like spines attached to the terminal segment are 15 mm. long.

branch more or less from one another. On the antepenultimate they "converge by running, in a curving course, towards the anterior outer embossed angles of the segment,¹ or join others that do."

The specimen came from a black limestone of the Coal-measures at Danville, Illinois. Referred to "No. 14" bed of the Coal-measures of Vermilion County, Illinois, in Bradley's 'Geology of Illinois,' vol. iv, pp. 224-7.

18. DITHYROCARIS CARBONARIA, *Meek and Worthen*, 1870. Plate XXIX, figs. 5 *a*, *b*, and 6. (Copied from M. and W., figs. 1 *a* and 1 *b*, op. cit. infra.)

DITHYROCARIS CARBONARIUS, <i>Meek and Worthen</i> , 1870. Proceed. Acad. Nat. Sci. Philadelphia, vol. xxii, p. 55.		
—	—	— 1873. Geol. Surv. Illinois, vol. v (Geol. and Paleont.), p. 618, pl. xxxii, figs. 1 <i>a</i> , 1 <i>b</i> .
—	—	<i>C. A. White</i> , 1884. Thirteenth Rep. Dept. Geol. Nat. Hist. Indiana, p. 178, pl. xxxix, fig. 2.
—	(CARBONARIA, fide <i>J. P. Lesley</i>),	<i>C. E. Hall</i> , 1876. Proceed. Amer. Philos. Soc., vol. xvi, No. 6, p. 56.
—	CARBONARIA, <i>S. A. Miller</i> , 1877.	Pal. Foss. America, p. 217; and 1889, North-Amer. Geol. and Paleont., p. 545.
—	—	<i>E., W., and J.</i> , 1887. Rep. Brit. Assoc. for 1886 (1887), p. 63.
—	—	<i>J. P. Lesley</i> , 1889. Dict. Foss. Pennsylv., p. 212.
—	—	<i>A. W. Vogdes</i> , 1893. Bibliogr. Palæoz. Crust., p. 382.

Size { In fig. 6 (M. and W.'s fig. 1 *b*, nat. size); ventral aspect :
 Style (including head or caudal plate) 22 mm. long, and 4 mm. wide at the top.
 Stylets 22 mm. long when perfect, and 4 mm. wide.

Characters.—The proximal parts of a caudal trifold. The spines appear to have been relatively short and thick. The style is bayonet-shaped and smooth; sectional areas are given with M. and W.'s fig. 1 *a* for the upper and lower portions. The stylets are coarsely striate on the proximal moiety, with 5-7 costulæ; and have only smooth mid-ribs on their distal halves. The style was probably rather shorter than the stylets, but they are all broken at the tips.

From the Middle Coal-measures at Danville, Illinois; and the Coal-measures of Warren County, Pennsylvania.

¹ Analogues of these radiate knobs may be seen in the abdominal segments of *Ceratiocaris Murchisoni*, fig. 4 *a*, pl. iii, 'Monogr. Brit. Pal. Phyll.,' part i, 1888.

19. DITHYROCARIS KOCHI, *Ludwig*, 1864. Plate XXIX, figs. 7, 8. (Copied from Ludwig's figs. 1 and 1 a, nat. size, op. cit. infra.)

DITHYROCARIS KOCHI, *Ludwig*, 1864. Palæontographica, vol. xi, p. 309, pl. 1, figs. 1, 1 a, 1 b, 1 c.
 — — *J. M. Clarke*, 1884. N. Jahrb., 1884, vol. ii, p. 185.
 — — *E., W., and J.*, 1887. Rep. Brit. Assoc. for 1886, p. 66.

Size.—Fig. 7 { Style and head (caudal plate) 25 mm. long. } As figured, with
 { Stylets 24 mm. long. Dorsal aspect. } ends restored.

Pl. XXIX, fig. 7, is Ludwig's figs. 1 a (nat. size) and 1 c; fig. 8 is his figs. 1 (nat. size) and 1 b.

The stylets coming out below the caudal plate and spreading out sideways, appear to reach further than the style.

Characters.—These caudal spines are strong and more or less bayonet-shaped. The style is rather shorter than the stylets. All are represented as having on both faces a central ridge, with striæ on the sloping sides, pointing obliquely downwards and towards the middle. On the style and stylets the ridge is rugose on the dorsal surface; so is the ridge of the style on the ventral face, and possibly that of the stylets also.

Devonian. From the Goniatite-shales, near Herborn, in the Dillthal, Nassau.

20. DITHYROCARIS BREVIACULEATA, *Ludwig*, 1864. Plate XXIX, fig. 9. (Copied from Ludwig's fig. 2, nat. size, op. cit. infra.)

DITHYROCARIS BREVIACULEATA, *Ludwig*, 1864. Palæontogr., vol. xi, p. 310, pl. 1, fig. 2.
 — — *J. M. Clarke*, 1884. Neues Jahrb., 1884, vol. ii, p. 185.
 — — *E., W., and J.*, 1888. Rep. Brit. Assoc. for 1886 (1887), p. 65.

Size { Style (including the head, which is 6 mm. long and 5 mm. wide) 15
 { mm. long.
 { Stylets 15 mm. long.

Characters.—The figure shows the ventral surface; the style mid-ribbed and transversely striate; and the stylets with mid-ribs simply. The style is shorter than the stylets, and the latter are spread out sideways. This trifold seems to have the same essential features as those of *D. Kochi*, Ludwig; but it is smaller and the style is relatively blunter and shorter.

Devonian. From the Spirifer-sandstone of Butzbach, Nassau.

21. DITHYROCARIS KAYSERI, *J. M. Clarke*, 1884. 'Neues Jahrb. f. Min.,' &c., 1884, p. 185, pl. iv, fig. 6.

This, one of the largest sets of tail-spines known for the genus, is much crushed and imperfect. The best-preserved stylet measures at least 50 mm. in length, and is 12 mm. wide near its top. The style was very much larger and longer (the fragment is 100 mm. long, and nearly 20 mm. wide at top, and 7 mm. wide at its broken end. All three spines are uniformly convex, tapering to sharp ends, and are delicately striate longitudinally.

From the Upper Devonian of Wildungen, Germany.

MESOTHYRA.—Some very large forms of an allied genus, from the Devonian strata of North America, must be here referred to. The genus *Mesothyra* differs from *Dithyrocaris* especially in having a narrow plate along the hinge-area between the dorsal edges of the two valves.

1. MESOTHYRA NEPTUNI, *Hall*, 1863.

- DITHYROCARIS NEPTUNI, *Hall*, 1863. Sixteenth Annual Report of the New York State Cab. of Nat. Hist., Appendix D, p. 75, pl. i, fig. 9.
- — — 1876. Palæontology of New York, vol. v, part 2 Illustrations of Devonian Fossils (published in advance of the Pal. New York), pl. xxiii, fig. 6.
- — — *Miller*, 1877. Amer. Pal. Foss., p. 217.
- — — *Packard*, 1883. Monogr. N.-Amer. Phyllop., Twelfth Ann. Report U.S. Geol. Surv., p. 452, fig. 73.
- — — *E. W., and J.*, 1888. Rep. Brit. Assoc. for 1887, p. 65.
- MESOTHYRA NEPTUNI, *Hall and Clarke*, 1888. Palæont. New York, vol. vii, with Supplement to vol. v, part 2, p. 191, pl. xxxii, fig. 7; and pl. xxxiii, fig. 1.
- — — *Miller*, 1889. North American Geol. and Palæont., p. 556.
- — — *Vogdes*, 1893. Bibliogr. Pal. Crust., p. 299.
- — — *Clarke*, 1893. American Naturalist, Sept. 1st, 1893, p. 796.

Size { Caudal plate (27 mm. wide) and telson [style] 81 mm. long.
 Cercopods [stylets] 110 mm. long.
 Style (from its joint in the caudal plate) 75 mm. long,
 and 15 mm. wide at top.
 Stylets 120 mm. long, and 15 mm. wide at top. } As figured.

Characters.—Style (telson) broad, stout, and tapering; shorter than the stylets. The inner margin of the stylets is fringed with setæ.

2. MESOTHYRA OCEANI, *Hall and Clarke*, 1888.

DITHYROCARIS NEPTUNI, *Hall*, 1876. *Illustr. Devonian Foss.*, pl. xxii, figs. 1—5, pl. xxiii, figs. 1—3.

— — — *E., W., and J.*, 1888. *Report Brit. Assoc. for 1887*, p. 65.

MESOTHYRA OCEANI, *Hall and Clarke*, 1888. *Geol. Surv. New York, Palæont.*, vol. vii, p. 187, pl. xxxii, figs. 1—6; pl. xxxiii, figs. 1—7; pl. xxxiv, figs. 1—5.

Size	}	Carapace-valve (including posterior spine) 140 mm. long, and 60 mm. wide.	} As figured.
		Caudal plate and telson [style including head] 67 mm. long.	
		Cercopods [stylets] 70 mm. long.	
		Carapace-valve 150 mm. long, and 65 mm. wide.	
		Style 72 mm. long; wide at head, 24 mm.	
		Stylets 84 mm. long; wide at top, 13 mm.	

Characters.—Stylets vary in length, but are longer than the style. Setæ are attached to the inner margin of the stylets.

One Devonian specimen that has been referred to *Dithyrocaris* may be here noticed.

PTYCHOCARIS? JASCHEI (*F. A. Roemer*, 1855). Plate XXIX, figs. 15 *a—c*; and 16 *a, b*.

DITHYROCARIS JASCHEI, *F. A. Roemer*, 1855. *Paleontographica*, vol. v, p. 8, pl. ii, figs. 13 *a—c*; and vol. xiii, 1866, p. 219, referring to *Roemer's Beitrag III*, pl. xvii [ii], fig. 13 (misspelt *Ditryocharis*).

DITHYROCARIS? JASCHEI, *Kayser*, 1878. *Abhandl. Geol. Specialkarte von Preussen und Thüringischen Staaten*, vol. ii, Heft 4, p. 7, pl. i, figs. 13, 13 *a*.

— — — JASCHEI, *J. M. Clarke*, 1884. *N. Jahrb.*, 1884, vol. i, p. 185.

— — — ? — — — *E., W., and J.*, 1888. *Report Brit. Assoc. for 1887*, p. 66.

PTYCHOCARIS? JASCHEI, *E., W., and J.*, 1889. (After *Novák*.) *Rep. Brit. Assoc. for 1888*, p. 124.

Roemer's figures (reproduced Pl. XXIX, figs. 15*a-c*) of this obscure fossil may possibly be referable either to a portion of a bivalved carapace, with a median dorsal ridge (or hinge-line), or to a single convex valve, with a *lateral* longitudinal ridge such as that of *Ptychocaris*; in either case filled with matrix, and broken across. Being convex and ridged on one face, and nearly flat on the other, it shows a flattened subelliptical (Roemer's) or suboval (Kayser's) section. It has an ornament of straight and inosculating striæ, connected by oblique striæ, sinuous and traversing the interspaces. This is analogous to the irregular inter-linear meshwork in Pl. XVIII, fig. 8, and Pl. XXI, fig. 11.

Dr. Kayser's figures give this little fossil straighter sides, with the ridge oblique, and the section more of a flattened oval shape. The surface bears longitudinal striæ, parallel to the sides, and on one side to the ridge, but slightly oblique to it on the other.

From the Hercynian Limestone (latest Silurian or earliest Devonian) in the Klosterholz, near Ilsenberg, Hartz.

The late Ottomar Novák, in 1888 informed us that this fossil, as figured by Kayser, shows some resemblance to his *Ptychocaris*,¹ which occurs in the equivalent horizon, namely, the "Hercynian" of Beyrich and Kayser = "Étages F, G, and H" of Barrande.

The Gastric Teeth of Dithyrocaris.

In the 'Geological Magazine,' vol. ii (1865), a paper by one of us "On some Crustacean Teeth from the Carboniferous and Upper Ludlow Rocks of Scotland" describes and illustrates some of these curious little fossils. At page 401 it is stated that "So long ago as 1843 the late General Portlock (at that time a captain of the Royal Engineers conducting the Geological Branch of the Ordnance Survey of Ireland), in his 'Report on the Geology of the County of Londonderry,' figured the teeth of *Dithyrocaris* in pl. xii, fig. 6, of that work; and at page 315 he observes, "Fig. 6 represents bodies which are frequently found on the specimens of this crustacean, and in this instance together, as represented in the figured specimen, they each exhibit a single row of tubercles, and were in all probability connected with the masticatory apparatus, which it is probable, therefore, was highly developed in this large species." The figure here referred to was reproduced in the 'Geol. Mag.,' pl. xi, fig. 8; but is now much more accurately drawn (from the original specimen) in Pl. XXVI, fig. 44. We

¹ 'Sitzungsb. böhm. Ges. Wiss.,' 1885, pp. 343-346, and plate. This Phyllocarid is related to both *Ceratiocaris* and *Dithyrocaris*.

further extract from pages 401–2 of the above-mentioned paper, “Figs. 3–6 represent the teeth of *Dithyrocaris* collected by Mr. James Armstrong and Mr. J. Bennie from Campsie and East Kilbride, Lanarkshire, and Orchard Quarry, near Thornliebank, Renfrewshire.

“Mr. Bennie was so fortunate as to obtain, at Lickprivick Quarry, East Kilbride, Lanarkshire, a portion of a carapace (pl. xi, fig. 6), upon the under side of which he discovered the long-looked-for teeth *in situ* (figs. 6 *a*, *b*). This discovery is the more acceptable, because the teeth have never yet been met with at Carluke, where the carapaces are found, although the Carboniferous beds have been diligently searched for fossils by Dr. Rankin for at least thirty years; whilst the localities already named as yielding the detached teeth do not furnish remains of the carapace.

“The teeth, with one or two exceptions, always occur in ironstone nodules, and the best specimens are those which have been weathered out. . . . It is probable that the soft parts of the animal (which contained the teeth), having been, after death, detached from the carapace, became the nucleus for a concretion, such as the phosphatic and ironstone nodules in many other strata. Differences in flotation, and in the force of currents, would account for the scattering of the several parts of the animal.

“Mr. Armstrong informs us that the *Dithyrocaris* tooth from Campsie (pl. xi, figs. 4 and 4 *a*) occurs in a bed of black shale, overlying the ‘Hosie Limestone’ of the Lanarkshire Carboniferous series, which is about 670 fathoms below the ‘Ell Coal,’ . . . the horizon usually taken by the Glasgow geologists in giving the position of Carboniferous fossils. No other specimen is recorded from this locality.

“Its associated fossils are *Nucula gibbosa*, *N. lineata*; *Leda longirostris*, *L. attenuata*; *Nautilus subsulcatus*; *Goniatites Gilbertsoni*, *G. vesica*; a profusion of *Spirifer* *Urei*, *Orthoceras pygmaeum*, and a large *Cythere* (?).

“Those from Orchard Quarry, near Thornliebank, Renfrewshire (pl. xi, figs. 3 *a*, *b*, and 5, 5 *a*), are from a bed of shale about 300 fathoms below the Ell Coal. The common fossils in this bed are several species of *Cypricardia*, *Leda*, *Orthoceras*, *Productus costatus*, *Bellerophon Urei*, *B. Leveilleanus*, *Macrocheilus*, *Pleurotomaria monilifera*. No trace of carapace has been discovered at either of these localities.

“The specimen with the teeth attached to the portion of the carapace, from East Kilbride (pl. xi, fig. 6), was found in shale associated with Brachiopoda, corals, &c. The teeth are common at Orchard Quarry, but only a single specimen has been met with either at Lickprivick or Campsie.”

These teeth, so fully represented in Pl. XXVI, more nearly resemble those of the lobster than those of *Apus* in their relative size, solidity, and form (see H. Woodward’s paper on “Crustacean Teeth, &c.,” in the ‘Geological Magazine,’

already quoted above; and the *article* "Crustacea," 'Encyclopædia Britannica,' vol. vi, 1877, p. 639, fig. 13; also Huxley's "Crayfish," 1888, pp. 56—60; Rolleston's 'Forms of Life,' 2nd edit., by Mr. H. Jackson, 1888, pp. 181—184, with full references to other observers; and Howse's 'Atlas of Biology,' pl. ix).

In studying these little fossil teeth they should not lie crosswise, as in our Pl. XXVI, but the narrow and lowest (hinder) end of the tooth (pointing towards the pylorus of the stomach) should be placed downwards, and the convexity will be noticed on one side or the other. The cusps on the broad end (pointing towards the cardiac part of the stomach) are thick and high, those at the narrow end are low; the hinder (pyloric) part of the tooth being more contracted and depressed than the other (cardiac) half, as is markedly the case in the lobster (*Homarus vulgaris*) and crayfish (*Astacus fluviatilis*).

Our specimens are divisible into two groups: No. 1, those that have a convexity on the left hand, as fig. 34, when the narrow or hinder (pyloric) end is placed downwards; and No. 2, those that are convex on the right, as in fig. 20, when so placed. The anterior (cardiac) end of the tooth in Pl. XXVI, fig. 34, points to the right hand of the reader; and in fig. 20 it points to his left hand. For convenience, and indeed according to their relative position in the lobster's stomach, we term No. 1 group the *sinistral*, and No. 2 the *dextral* teeth. Both kinds are present together in fig. 44, the *sinistral* tooth lying upon and against its *dextral* fellow.

These, looking like molar teeth of some sort of the higher animals, have a crown consisting of six or seven cusps on a slightly curved solid basis, thickest in the middle. Four of the cusps on the front (cardiac) half are thick and prominent; but on the other (pyloric) half, two or three seem to have been worn down, leaving a more or less flattened or hollow surface: for instance, figs. 18, 23, 25, and 34 of the left teeth; and figs. 20, 21, 40, and 43 of the right teeth.

There is another tooth in the lobster, namely, the narrow, blunt, hook-like, overhanging *median* tooth (bifid in the crayfish), which works between the hinder flattened surfaces of the two side teeth below.

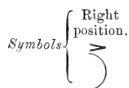
We have no evidence, however, in *Dithyrocaris* of the upper intervening median tooth, such as is associated with a similar flatness in the hinder part of the side teeth in the stomach of the lobster and crayfish.

The illustrations of Pl. XXVI were made before we had assorted the teeth in the manner above mentioned. We now find that they fall into the following arrangement, as *rights* and *lefts*:

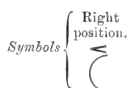
DEXTRALS.

SINISTRALS.

Figs. on Pl. XXVI.



Figs. on Pl. XXVI.







- 1. } Orchard Quarry.
- 2. } Orchard Quarry.
- 3. } Orchard Quarry.
- 4. } Campsie.
- 5. } Campsie.
- 6. } Orchard Quarry.
- 7. } Orchard Quarry.
- 13. } Orchard Quarry.
- 14. } Orchard Quarry.
- 15. } Orchard Quarry.
- 16. } Orchard Quarry.
- 19. } Newcastle-on-Tyne.
- 20. } Newcastle-on-Tyne.
- 21. } Redesdale.¹
- 22. } Redesdale.¹
- 27. Orchard Quarry.
- 30. } East Kilbride.¹
- 31. } East Kilbride.¹
- 32. Orchard Quarry.
- 37. } Orchard Quarry.
- 38. } Orchard Quarry.
- 39. } Orchard Quarry.
- 40. } Orchard Quarry.
- 43. Dunbar.
- One } Londonderry.¹
- in } Londonderry.¹
- 44. } Londonderry.¹

- 9. } Cowlands Quarry.
- 10. } Cowlands Quarry.
- 11. } Dolly Quarry.
- 12. } Dolly Quarry.
- 17. } Orchard Quarry.
- 18. } Orchard Quarry.
- 23. } Redesdale.¹
- 24. } Redesdale.¹
- 25. } Redesdale.¹
- 26. } Redesdale.¹
- 33. } Cock of Arran.
- 34. } Cock of Arran.
- 35. } Redesdale.¹
- 36. } Redesdale.¹
- 41. Orchard Quarry.
- 42. Eecup.¹
- One } Londonderry.¹
- in } Londonderry.¹
- 44. } Londonderry.¹

¹ At these localities the gastric teeth are found under two conditions; some free, and others still within the carapace, as shown by their protruding through the valves.

(All on Pl. XXVI are magnified two diameters, except figs. 1—7.)

By way of making it easy to recognise the relative position of these gastric teeth in the original stomach, as pointing fore and aft (that is, from its cardiac or front to its pyloric or hinder division), we introduce a simple symbol. The crescent refers to the curvature of the tooth, and the little angle, or angular sign, shows at which end the coarser cusps rise out of the tooth.

Thus  means a dextral convexity, with the high cusps forward, or towards the cardiac extremity of the stomach; and  indicates the sinistral position. On the plate (Pl. XXVI) the dextral teeth occur as  and the sinistrals as .

There are probably distinctions due to the relative age of individuals in the collection, but we cannot point with certainty to any specific differences among the figured specimens, except that figs. 33, 34, and 35, 36 (not quite perfect),

having a greater length of tooth, with very distinct and elevated cusps, may probably have belonged to a species of larger growth.

For a description of the Gastric Teeth of *Ceratiocaris*, compared with those of *Dithyrocaris*, see 'Geological Magazine,' dec. 3, vol. v (1888), pp. 145, &c., with illustrations.

NOTES ON DITHYROCARIS.

1. The more simple forms of *Dithyrocaris*, with ovate-oblong and smooth or somewhat granulated valves, supply 53 out of the 144 known British specimens of the genus. These, represented by Nos. 1, 2, and 3 (*D. glabra*, 46; *ovalis*, 1; and *granulata*, 6) in the table at page vii, should probably be regarded as forming a special group in the genus.

2. *D. Scouleri* (No. 5), having doubtful features in some respects (see page 156), had probably a smooth surface, but differs much from the foregoing in form.

3. *D. testudinea* (No. 4) has a speciality in its peculiar ornament of oblique and sinuous striæ passing all over its test (page 145). This is an abundant form, there being 24 known out of the 144 British specimens of *Dithyrocaris*.

4. The reticulate pattern, with modifications, characterises five British species, of which *D. insignis* (No. 7) presents the greatest number of known specimens (36). The Irish *D. Colei* (No. 8) is next most plentiful, but with only 11 specimens. The reticulation is faint in *D. funiculata* (No. 6), Pl. XXII, fig. 6; stronger and irregular in *D. insignis* (No. 7), Pl. XXV, figs. 3 and 5, Pl. XXX, figs. 3 and 4, and Pl. XXXI, fig. 8. In *D. Colei* (No. 8), in *D. tricornis* (No. 10), and probably in *D. orbicularis* (No. 9), the reticulation is emphasised by some of its meshes being produced at the angles into short triangular spines, Pl. XXII, figs. 4, 5 *a*, 5 *d*, 5 *e*, and Pl. XXVII, fig. 4 *e*.

5. Short cross-lines between longitudinal striæ, as in Pl. XXXI, figs. 2 and 4 *d* (*D. testudinea*); and an interstitial network, shown in Pl. XVIII, fig. 8, is present in the Canadian *D. Belli*.

6. Minute punctation, such as is common in crustacean tests, is seen in many specimens, both of the smooth and the reticulate kind. Thus Pl. XVIII, figs. 1 and 3 (*glabra* and *ovalis*); Pl. XX, figs. 2 and 3 (*granulata*); Pl. XXVIII, figs. 3 and 5 *c* (east), Pl. XXIV, figs. 11 *b* and 12 *d*, and Pl. XXXI, figs. 1—3 (*testudinea*); Pl. XXV, figs. 3—5, Pl. XXVII, fig. 1 *c*, Pl. XXX, fig. 3 *d*, and Pl. XXXI, figs. 7 *b* and 8 *c* (*insignis*); and Pl. XXVII, fig. 2 *c* (*tricornis*).

SOME ALLIES OF DITHYROCARIS.

I. *LEBESCONTIA ÆNIGMATICA*, gen. et sp. nov. Woodcuts, Figs. 11—13.

This was referred to in the "Seventh Report on Palæozoic Phyllopora," 'Report British Association for 1889' (1890), page 65, as having been collected by M. Paul Lebesconte, of Rennes, from the Lower Silurian rocks of Brittany and neighbourhood, thus:—"M. Lebesconte's Collection, above mentioned, comprises two specimens of *Dithyrocaris*, one from Coësmes (Ille-et-Vilaine) and one from Renazé (Mayenne), both in the 'Schiste ardoisier supérieur (Faune 2de, Barrande),' above the Grès de May."

These are specimens in rather hard, dark-blue, slaty, argillaceous schist, slightly micaceous. One of them (from Coësmes) shows a hollow impression, 45 mm. long by 30 mm. wide, and nearly 2 mm. deep at one part of the border—apparently the hollow mould of a flattened bivalve or shield-like form allied to *Dithyrocaris*, Fig. 11.

The other specimen (from Renazé), of similar slate, has a slight convexity of

FIG. 11.

FIG. 12 A.

FIG. 12 B.

FIG. 13.

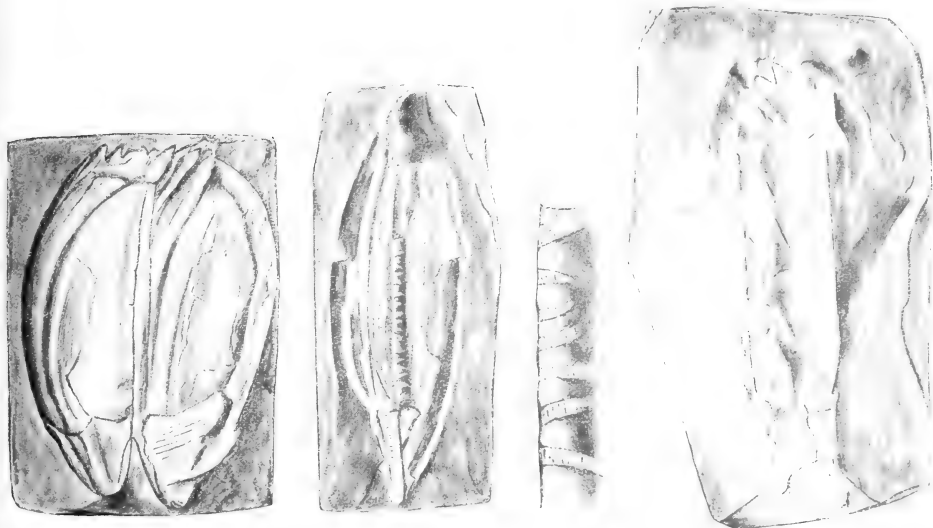


FIG. 11.—*Lebescontia ænigmatica*, gen. et sp. nov. Two flattened valves or moieties. Lower Silurian, Coësmes, Brittany. Magnified $1\frac{1}{2}$ diam.

FIGS. 12 A, B.—*Lebescontia ænigmatica*. A. Dorsal aspect. Lower Silurian. Magnified $1\frac{1}{2}$ diam. B. Raised or thickened dorsal ridge. Magnified 7 diam. Lower Silurian, Renazé, Anjou.

FIG. 13.—*Lebescontia ænigmatica*. Crushed right valve. On the back of the same specimen of slate that contains Fig. 12. Magnified $1\frac{1}{2}$ diam. Lower Silurian, Renazé, Anjou.

organic origin on each face, but not exactly corresponding one with the other in position, size, or shape. One side shows a distinct form (Figs. 12 A, 12 B), like that of the dorsal edge of a *compressed* bivalved form (50 mm. by 23 mm.); the other side shows a flatter and less shapely organism (Fig. 13), like a portion of the crushed valve of a *Dithyrocarid*.

FIG. 11.—The concave specimen on the slaty schist from Coësmes shows either an *impression* of the *outside* of two expanded valves, or at least partially (as indicated to some extent here and there by traces of a black shining film) the *inside* of the two valves. The cast of matrix once filling the cavity, and bearing probably some other details of the animal's structure, has been lost.

This has some analogy to specimens of flattened valves of *Dithyrocaris* illustrated in Pls. XVIII and XXVIII.

In the two flattened valves (Fig. 11) the dorsal edges are in contact; not quite clearly defined, however, one from the other, on account of a partial overlap, or some other discordance, along the middle line. They open out one from the other at the ends, but more definitely at one end than the other. Both of the extremities have been damaged.

Being greatly though unequally flattened by pressure, they present an aspect comparable, as far as general outline is concerned, with fig. 5 a, Pl. XXVIII, which is an impression of the outer surface of the expanded valves of *Dithyrocaris testudinea*; also to some extent with figs. 3 a and 6 of Pl. XVIII, illustrating the outside aspect of the expanded valves of *D. ovalis* and *D. granulata*. The fuller lateral curve, however, is in the anterior rather than in the posterior portion.

The upper end in Fig. 11 has a serrated edge, which has only a feeble homologue in figs. 1, 4, and 6 of Pl. XVIII, and in fig. 3 of Pl. XXII.

At the lower end of Fig. 11 each valve narrows much more quickly than in any of our other figured species of *Dithyrocaris*, and does not bear clear evidence of the usual ventral terminal spines; if ever present, they have been lost, or crushed out of recognition.

The longitudinal foldings or wrinklings of the test in each valve are probably homologous with those in *Calypptocaris striata*, Pl. XVII, fig. 7, and *C. Richteriana*, Pl. XXII, fig. 2. The ends of the valves in these two figured species are too imperfect for comparison with those of *Lebescontia*.

FIGS. 12 A and 12 B.—On the hand-specimen from Renazé, the more distinct fossil of the two, lying back to back, suggests at first sight a comparison with the dorsal aspect of a closed bivalved test of some *Dithyrocarid*, compressed, but retaining some lateral convexity (Fig. 12 A). It has a terminal appendage, or blunt spike, overlying a displaced portion of the hinder end of the right valve. The posterior process differentiates this form from Fig. 11, unless it has been lost in the latter.

The upper end of Fig. 12 A retains no evidence of the denticulate margin

seen in Fig. 11. The surface of the valves is longitudinally wrinkled and striate, as in Fig. 11.

The hinge-line is straight, and shows a thick subcylindrical body, crenulate or marked with small alternately light and dark triangles. Its anterior moiety, having been broken away, has left in the matrix an impression of the oblique segments of this seemingly *quasi*-spiral, rod-like structure, which at first sight seems to be the edge of the right valve.

In such other Dithyrocarids as figs. 1, 2, and 3 of Pl. XX, figs. 1, 2, and 6 of Pl. XXIV, figs. 1, 2, 4, 6, and 9 of Pl. XXV, and fig. 3 of Pl. XXX, we find a narrow rugose hinge-plate or dorsal ridge having little or no analogy to this dorsal rod-like structure in Figs. 12 A and 12 B.

Perhaps this long, narrow, subcylindrical body may be the remains of the straight intestinal canal, distended with food at the time of the death of the little animal.¹ Barrande has described and figured the dorsal aspect of a specimen of *Trinucleus Goldfussi* with the intestinal canal open throughout its length; and of another, with the contents of the intestine indicating its whole extent, "Syst. Silur. Bohême," 'Recherch. Paléont.,' vol. i, 1852, p. 629, pl. xxx, figs. 38 and 39. In a Scotch specimen we have lately found an analogous structure, formed by the union of narrow folds on the dorsal margins, see Fig. 14. (See NOTE at page 203.)

FIG. 13.—This seems to be a much-crushed and imperfect right-hand valve of a Dithyrocarid, with two raised lines, one of them apparently dorsal, and the other (mesolateral) near the ventral margin, which is partly broken away, but once ended with a strong spine. Another but smaller spine is present on the posterior border. The anterior margin is strongly dentate, as in Fig. 11.

As already stated, although occupying the back of the hand-specimen on which Fig. 12 A is embedded, it does not appear to belong to the latter, not being exactly behind it, and being flatter, and differently shaped.

Combining the evidences given by these specimens, although they are somewhat obscure on account of imperfection, distortion, and embedment (Figs. 11—13), we may conclude that they are the relics of some kind of bivalved or shield-like Phyllopod, near to but not identical with *Dithyrocaris*.

Fig. 11 has the general contour of such a test, with some trace of anterior prickles, but no posterior spines (possibly they may have been lost). Fig. 12 A, differently posed, shows no prickles at its imperfect front end, but has a posterior spine and a curious dorsal structure (Fig. 12 B). The longitudinal ridges, folds, and striæ present in all three, Figs. 11, 12, and 13, are also found in some Dithyrocarids.

Hence it is proposed to arrange this fossil, though difficult of interpretation,

¹ It has been suggested as a possible interpretation of the cylindrical body on Fig. 12 A, and enlarged in Fig. 12 B, that it may be a part of some other organism accidentally associated with the valves of *Lebescontia*, such as a crinoid stem or a serpulite tube; both of which kinds are found in these schists (of course altered in character, as such slate fossils usually are).

as a new genus of the *Dithyrocaridæ* under the appellation of *LEBESCONTIA*, after the well-known geologist of Rennes, who discovered it in the Lower Silurian schists of Brittany, and lent the specimens to one of us several years ago for examination and description. Its obscure and complex character suggests *ÆNIGMATICA* for its specific name. The locality and geological horizon indicate that these specimens are the oldest known individuals of this group of *Phyllopora*.

In the Report of the 'Association Française pour l'Avancement des Sciences, Congrès de Nantes, 1875,' MM. Gaston Le Goarant de Tromelin and Paul Lebesconte gave an account of the Palæozoic Formations of the north-west of France, with lists of the Silurian fossils of the Departments of Maine-et-Loire, Loire-Inférieure, and the Morbihan ('Compte-rendu du Congrès,' &c., published in June, 1876, pp. 601—687).

The palæozoic rocks of the "massif breton ou armoricain," which constitutes the great peninsula of North-western France, have been studied in more or less detail by many geologists, and the memoir mentioned above refers to their work, and gives the result of the special researches by MM. de Tromelin and Lebesconte up to 1875. In 1889 M. Lebesconte kindly lent his collection of the palæozoic fossils of Brittany to one of us, and the phylloporal specimens here figured and described were noticed among them as being probably allied to *Dithyrocaris*.

In the 'Memoir' by de Tromelin and Lebesconte no particular fossils are recorded from Coësmes, Dép. Ille-et-Vilaine (Brittany); but in the Collection above referred to there are obscure remains of Molluscan bivalves, of Trilobites and Eurypterids, also the Dithyrocarid under notice, and one or more specimens of *Coleoprion*.

Renazé, whence one of our specimens came, is just south of Brittany, in the ancient province of Anjou, not far from the border of the Département de Maine-et-Loire, but in the Dép. de la Mayenne. It is in a line with the slate quarries of Riadan¹ and Coësmes (Ille-et-Vilaine). In Table A of MM. de Tromelin and Lebesconte's 'Memoir' the following fossils are recorded from the slaty schist of Renazé:

Calymene pulchra, <i>Barrande</i> .	Ampyx tenellus, <i>Barr.</i>
Dalmanites socialis, var. <i>proæva</i> , <i>Barr.</i>	Illænus Beaumonti, <i>Rouault</i> , sp.
Trinucleus Goldfussi, <i>Barr.</i>	Acidaspis Buchi, <i>Barr.</i>
— ornatus, <i>Sternberg</i> , sp.	Serpulites Letellieri, <i>Tromelin</i> .
— Pongerardi, <i>Rouault</i> .	Ctenodonta Ciæ, <i>Sharpe</i> , sp.
	— Eschwegeji, <i>Sharpe</i> , sp.

¹ In the 'Proceedings of the Geologists' Association,' vol. xxi, pt. 3 (July, 1899), p. 111, the Riadan Slates are referred to the Middle Ordovician Series by Dr. C. Barrois; and at page 132 he refers to 'Bull. Soc. Géol. France,' ser. 3, vol. xiv (1886); and 'Annales Soc. Géol. du Nord,' vols. i to xvii, Lille, for literature on the Geology of Central Brittany.

Orthis Berthoisi, *Rouault*.
 — *mundæ*, *Sharpe*.
 — *noctilio*, *Sharpe*.
 — *Ribeiroi*, *Sharpe*.

Encrinites Andegavensis, *Trom. and Leb.*
Petraia ? *insolita*, *Trom. and Leb.*

In M. Lebesconte's Collection the following, besides the Dithyrocarid, were observed from Renazé:—genal and pleural spines of Trilobites, Eurypterid fragments, Crinoid stems (*Triacrinus*), part of an arm of an Asteriad (*Loriolaster* ?), Pteropodal (?) shells, also remains of Brachiopods and of Molluscan bivalves.

NOTE.—It is possible that Fig. 12 A does not represent a truly bivalved test, but that the two moieties of a flat carapace have been squeezed horizontally into a narrow boat-shape.

II. *LEBESCONTIA OCCULTA*, sp. nov. Woodcuts, Figs. 14, 15, and 16.

FIG. 15.

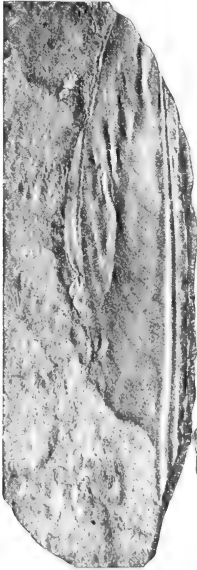


FIG. 14.



FIG. 16 A.



FIG. 16 B.



FIG. 14.—*Lebescontia occulta*, sp. nov. Right moiety of carapace, magnified $1\frac{1}{2}$ diam.

FIG. 15.—*Lebescontia occulta*, sp. nov. Counterpart, showing the impression of the right valve, Fig. 14; probably the loss of the outermost film has exposed the striae more distinctly; magnified $1\frac{1}{2}$ diam.

FIGS. 16 A, B.—Part of the structure of the dorsal margin, where the arrow points in Fig. 14; magnified 10 diam.

Since describing M. P. Lebesconte's Breton specimens, Figs. 11, 12, 13, at page 199, we have met with, among some Carboniferous fossils lent to us by Mr.

John Smith, of Kilwinning, two counterparts¹ of a dithyrocaridal valve, which has a remarkable similitude in some respects to *L. ænigmatica*.

1. Fig. 14 represents a nearly perfect right-hand valve in its lateral aspect. It is 75 mm. long by 15 mm. broad, of a pod-like shape,² nearly straight dorsally, and shallow-elliptical on its ventral margin. This is most convex in the middle, and narrows more obliquely at the compressed anterior extremity; the edge, however, is broken away at both ends. The middle third of the ventral border is markedly smooth, being probably a flange, turned in and pressed flat. A delicate rugose ridge lies along and within the middle part of the ventral edge, with a rather less curvature, and with its ends running into that border at about a fourth of the length of the valve from each of its extremities.

The dorsal edge is neatly bent along its length into a narrow fold (Fig. 16 B), which possibly overlaps a corresponding fold of the other valve, with some matrix intervening. Where broken, this arrangement has the appearance of a gutter filled with dry mud. It is not subcylindrical as in the analogous structure in *L. ænigmatica* (Fig. 12, page 199), but flattened. As a junction of the two valves, it is not compatible with a free motion of one or the other; but rather indicates a nearly flat and shield-like condition of the carapace. The upper part of this flat gutter-like hinge-structure may possibly be homologous, in some degree, with the *middle piece* in the *Rhinocaris* and *Mesothyra* of North America.

On the surface of the valve four or five oblique folds of limited extent mark the anterior moiety; and the remainder seems to be smooth, except for some very faint striæ, which are far better pronounced in Fig. 15. There is a definite posterior elongation of the dorsal border, as a stout process, not unlike, but more slender than, that shown in Fig. 12 A. It has been almost lost in Fig. 15.

2. The other counterpart (Fig. 15) is more imperfect at the ends than Fig. 14, and measures 55 mm. by 15 mm. It agrees with Fig. 11 in general shape, and in showing a straight and peculiarly folded dorsal margin. The short oblique crumpling, on the front part of the valve, and the little rough ridge (impression) near the ventral margin, and which may represent the *mesolateral* in *Dithyrocaris*, are characteristic. The surface also exhibits numerous delicate, curved, parallel striæ, starting as it were in the antero-ventral region, at first crowded, and nearly parallel with the ventral edge, but turning upwards and backwards, and feathering off, with widening interspaces, towards the dorsal border. This delicate sculpturing must have been nearly lost on the other counterpart (Fig. 14) by the removal of an outer film of the shell.

¹ A specimen consisting of two counterparts, and in so far analogous to Figs. 14 and 15, was figured in Pl. XXI, figs. 7 a, 7 b, and described at p. 158 as casts of the left-hand moiety of a carapace of probably *Dithyrocaris Scouleri*.

² Somewhat like that of *Rhinocaris bipennis*, J. M. Clarke, 'Geol. Survey State of New York,' 1896, p. 69.

These (Figs. 14 and 15) very rare representatives of a peculiar form occur in a hard, bluish, calcareous shale, with numerous fragments of shells. Several *Posidonomyæ* lie on the back of one counterpart, and *Aviculopecten* abounds on the bed-plane at the back of the other. Mr. John Smith collected them at the Linn, Dalry, in the "Upper Limestone" series, twenty miles south-west of Glasgow.

The presence of a peculiar hinge-structure is a striking feature, as in *L. enigmatica*; the pod-shape, though narrower and more graceful,—the striæ more strongly represented than in Fig. 13,—the *mesolateral*, smaller than in Fig. 13, are links between the two species, and supply distinctive characters for this one, which may be termed *occulta*, for it is not yet defined in a clear light.

The longitudinal crumple or fold of the dorsal edge may be hidden in the middle line of Fig. 11, and underneath that of Fig. 12 A. It does not seem to be traceable in any species of *Dithyrocaris*. It might possibly have some analogy to the mid-dorsal, longitudinal, thin piece, which is part of and intermediate to the junction-line in the valves of the *Rhinocaridæ*.¹

III. HIBBERTIA ORBICULARIS, *Jones and Woodward*. Plate XXV, figs. 8 a, 8 b.

HIBBERTIA ORBICULARIS, *Jones and Woodward*, 1899. Geol. Mag., dec. 4, vol. vi, p. 390, pl. xv, fig. 4.

This small Crustacean shield was presented to the British Museum many years ago by our late friend Dr. John Millar, F.G.S., of Bethnal House, Bethnal Green. The specimen is embedded in a finely laminated, micaceous, non-calcareous shale (bluish-grey in section), and bears the label "Coal M., Burdiehouse." It was at first believed to be one of Dr. Hibbert's types from Burdiehouse, but nothing like this fossil was found to have been figured or mentioned in Dr. S. Hibbert's memoir² on the strata and fossils of Burdiehouse; therefore its occurrence there, as shown by its old label, is of great interest.

It was described and figured in the 'Geological Magazine' for September, 1899, as indicated above.

Generic and Specific Characters.—A nearly circular shield, 14 mm. broad by 15 mm. long, having an opening behind, which is bounded by two acute incurved angular spines, forming the backward extremities of the concentric shield or buckler-like test. The periphery of the concentric part of the test is turned up sharply as a thin rim in the fossil, leaving a uniform narrow groove behind it,

¹ See Mr. J. M. Clarke's description of this "median plate" in 'The American Naturalist,' September 1st, 1893, pp. 793—801, and the 'Fifteenth Annual Report of the State Geologist, New York,' 1896, p. 69.

² 'Trans. Roy. Soc. Edinburgh,' vol. xiii (1836), p. 280, plates.

from which the field of the buckler rises with a gentle swelling over and along the crescentic area, except where the edge falls in for a little space just on the centre of the front border. Where the buckler becomes slightly depressed and the narrow groove along the margin is interrupted or perhaps injured there is an obscure impression of what may be a jointed antennary organ in front. The surface of the two lateral areas of the buckler have a finely granulated ornamentation, which is most marked just within the peripheral rim of the carapace, and is limited by two thin parallel granulated ridges, each starting from the incurved posterior angles of the shield, the longest being 7 mm. and the shortest only 4 mm. in length; the intervening space of 5 mm. in breadth, marking the centre of the carapace, is devoid of the granulated ornament seen on the other parts of the shield, and has only a small spine-like impression 3 mm. long, and extending for three quarters of the entire length of the shield as a curved irregular incised line. There are some other markings, too obscure for interpretation; also a slight posterior projection on the central line, doubtfully representing part of a lost series of caudal segments.

The presence of the two corresponding angles, and the narrow posterior opening between them, suggest affinities with *Dithyrocaris* (cf. *D. Scouleri* as represented by McCoy, Pl. XXV, fig. 6a, with its two raised lateral ridges), but in most of the members of this group the lateral portions of the shield are less circular in outline, and in many the surface-ornamentation is composed of linear or reticulate, and only occasionally of granulate markings. Compared with the shield of *Apus* or *Lepidurus*,¹ the general outline is much alike, but the granulated mesolateral ridges continued forward from each of the posterior angles in *Hibbertia* are not present in *Apus*, whereas the median ridge so conspicuous in both *Apus* and *Dithyrocaris* is apparently quite absent in *Hibbertia*, or is not preserved in the fossil. Contrasted with the anterior (cephalic) buckler in *Limulus*, the shield of *Hibbertia* is seen to be nearly circular, whilst that of *Limulus* is semicircular; the posterior angles of the shield of *Hibbertia* are contracted together and directed somewhat inwards at their extremities, whilst in *Limulus* they are wide apart and directed rather outwards. The mesolateral (ocular) ridges are present both in *Hibbertia* and in *Limulus*; but in *Limulus* they form a smooth, curved, broad line, not a nearly straight ridge as in *Hibbertia*.

The granulation on the lateral areas of the shield and on the ridges is also strange to *Apus*, and more closely resembles that seen in some species of the Carboniferous genus *Cyclus* (cf. *Cyclus Johnsoni*, H. Woodward,² and *C. testudo*, Peach,

¹ See Dr. S. A. Packard's 'Monograph of the Phyllopod Crustacea of North America,' 1883, pl. xvi, fig. 1, *L. glacialis*.

² See "Contributions to our Knowledge of the Genus *Cyclus* from the Carboniferous Formation of various British Localities," by H. Woodward, 'Geol. Mag.,' dec. 4, vol. i, 1894, pp. 530—539, pl. xv.

the former from the Coal-measures of Coseley, near Dudley, the latter from the Carboniferous shales—so rich in Crustacea, Arachnida, &c.—of Eskdale on the Scottish borders).¹

None of the earlier fossil forms of Limuloid Crustaceans hitherto figured and described, of which a series may be studied on pl. xxxi, figs. 1—8, 'Monograph of the Merostomata,' Palæont. Soc., part v, 1878, aid us in finding a suitable form for comparison with the shield of *Hibbertia*, nor do the larval stages of the recent *Limulus* greatly assist in this direction (op. cit., pl. xxxiii). We are therefore reduced to the conclusion that *Hibbertia* may be more conveniently placed along with and near to those forms referred to the genus *Cyclus* than with any other group. Under these circumstances we preferred to regard it as characteristic of a distinct genus; and named it after Dr. Hibbert, with whose discoveries in the Lower Carboniferous strata at Burdiehouse it is most closely associated.

From the paper on *Cyclus* by H. Woodward, already referred to, we make the following extract (pages 534 and 535), to show the conclusions arrived at by the writer as to the affinities of the curious little forms included in the genus *Cyclus*. To the same family our specimen from Burdiehouse must now be added under the name of *Hibbertia*.

"The presence of antennæ and biramous swimming-legs prove undoubtedly that *Cyclus* was a Crustacean. The large size of the former and the homogeneous nature of the rest of the appendages (all biramous swimming-legs, with possibly masticatory bases), taken in connection with the large, slightly bivalved carapace, suggest that it is an Entomostracan and probably one of the PHYLLOPODA, with a broad cephalic carapace like that possessed by *Apus* and by *Daphnia*; with large swimming second antennæ like the latter, and possibly with a pair of stalked eyes. *Cyclus*, however, differs from the Cladocera in being flattened dorso-ventrally, and from the lowest Crustacea in not apparently possessing any true jaw-parts—the head, with the labrum and mouth, being bent further back than in the living Entomostraca. These differences may either indicate very lowly characters or very much specialised ones. Two views suggest themselves:

"(1) That these animals were small, free-swimming Phyllopod, with expanded cephalic shield, swimming second antennæ, and biramous limbs, the bases of which served as masticatory organs, no true jaws having yet been developed; the backward position of the mouth may have been brought about in order to allow as many appendages as possible to serve as jaws, as is seen in *Limulus*. Or, possibly, the beast could attach itself, like a living *Daphnia*, by a cement-gland on the dorsal side of the head, in which case it might be an advantage to have the mouth as near the freer end as possible and close to the swimming legs, which were, by their movements, producing the foot-currents.

¹ 'Trans. Roy. Soc. Edinburgh,' vol. xxx (1883), p. 227, pl. xxviii, figs. 9—9 d.

“(2) The other view is that these animals were ecto-parasitic Phyllo-pods, although they had not lost their power of free movement, yet had become specialised in the form of their body, which is flattened ventrally and only slightly convex above, the whole animal being expanded horizontally, unlike most other Phyllo-pods. This view might account for the two large round structures seen on the ventral surface, situated one on either side of the body, and close to the anterior margin of the shell. These might possibly represent a pair of ventral suckers, such as are seen in the modern fish-lice; these structures, whatever they may be, are evidently enormously developed, and possess great muscles, which produce prominent modifications of the dorsal shield, where they are attached. The great labrum might possibly represent the suctorial tube of *Argulus*, under cover of which are concealed the reduced mandibles, &c.

“Some of the specimens show curious oblique scars on the coxæ of the legs, which may indicate the points of attachment of spines or setæ to enable the parasite to stick to its fishy host.”

NOTE ON *Lebescontia occulta* (see pages 203—205).

Mr. John Smith, of Kilwinning, informs us (September 5th, 1899) that the “Linn, Dalry,” where he got the remains of *Lebescontia occulta*, is the “Linn Spout, one mile south-west of Dalry,” in the ‘Catalogue of Western-Scottish Fossils,’ 1876, page 77; and he refers us to the paper on “The Upper Limestone of North Ayrshire,” by Mr. Robert Craig, of Beith, ‘Trans. Geol. Soc. Glasgow,’ vol. viii, pp. 28—35. At page 32 the “Upper Linn Limestone” is described, the section at Linn Spout being—

	Feet.	Inches.
1. Limestone	35	0
2. Shale, very fossiliferous	5	9
3. Limestone	1	0
4. Shale, full of <i>Posidonomya punctatella</i>	0	8
5. Limestone	1	2
6. Shale, indurated	1	3
7. Coal, from 2 feet to	5	0
	49	10

The *Lebescontia* was collected by Mr. J. Smith in the shale, No. 4, abounding with a fossil shell formerly known as *Estheria punctatella*, Jones. See the ‘Trans. Geol. Soc. Glasgow,’ vol. ii (1867), p. 71, and vol. ix (1891), pp. 85—87. Hence this shale has been known locally by the inaccurate name of the “*Estheria*-bed.” It is regarded by some as of estuarine origin.

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Synonyms are printed in italics.

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PLATE XXVI.

ILLUSTRATING THE MASTICATORY APPARATUS OR GASTRIC TEETH OF *Dithyrocaris*.
See pp. 194—198.

(Figs. 2—8 of natural size. Figs. 1 and 9—44 magnified twice the natural size.)

- Fig.
1. Dextral. Copied from 'Geol. Mag.,' 1865, pl. xi, fig. 3 *b* } Orchard Quarry, Thornliebank, four
 2. " " " " fig. 3 } miles from Glasgow, Renfrewshire.
 3. " " " " fig. 3 *a* }
 4. Dextral " " " " fig. 4 } Lower Marine series, Campsie.
 5. " " " " fig. 4 *a* }
 6. Dextral " " " " fig. 5 } Orchard Quarry, Thornliebank.
 7. " " " " fig. 5 *a* }
 8. Both Dextral and Sinistral, but not distinct. Copied from 'Geol. Mag.,' 1865, pl. xi, fig. 8. Lickpriveck Quarry, two miles south-west of East Kilbride.
 9. } Sinistral. Museum Geological Survey of Scotland, No. 5, F $\frac{2}{3}$. Lower Limestone Group.
 10. } Cowden's Quarry, Dunfermline.
 11. } Sinistral. Museum Geological Survey of Scotland, No. 2, F $\frac{2}{3}$. Lower Limestone Group.
 12. } Dolly Quarry, Drumford, Dunfermline.
 13. } Dextral
 14. } (Base of the tooth ironstone) } British Museum, No. 32, 59, 776. Orchard Quarry, Renfrewshire.
 15. } Dextral
 16. }
 17. } Sinistral. British Museum, No. 33, I. 754. Orchard Quarry, Renfrewshire.
 18. } (Base of tooth ironstone.)
 19. } Dextral. British Museum, No. 31, 42, 513. Coal-measures, Newcastle-on-Tyne.
 20. } (Base of tooth slightly calcareous.)
 21. Dextral
 22. Dextral, reversed. (Base of tooth calcareous) } Dunn Collection, marked C. 12. Redesdale.
 23. } Sinistral
 24. } (Calcareous base)
 25. } Sinistral
 26. }
 27. Dextral } Neilson Collection, marked L. Orchard Quarry, Renfrewshire.
 28. (?) }
 29. Sinistral }
 30. } Dextral. Neilson Collection, marked K. East Kilbride.
 31. } (Calcareous base.)
 32. Dextral. Neilson Collection, marked L. Orchard Quarry, Renfrewshire.
 33. } Sinistral. (Reddish specimen with non-calcareous base of tooth.) Neilson Collection, marked N.
 34. } Cock-of-Arran Upper Limestone series.
 35. } Sinistral. Dunn Collection, marked C. 12. Redesdale.
 36. }
 37. } Dextral
 38. }
 39. } Dextral } Neilson Collection, marked L. Orchard Quarry, Renfrewshire.
 40. } Sinistral }
 41. Sinistral
 42. Sinistral. Yorkshire College Museum, Leeds. Eccup, Yorkshire.
 43. Dextral. Neilson Collection, marked M. Enderinital Limestone, Skateraw, Dunbar.
 44. Both ; sinistral lying on the dextral tooth. Mus. Pract. Geol., 6264. Tyrone or Londonderry.

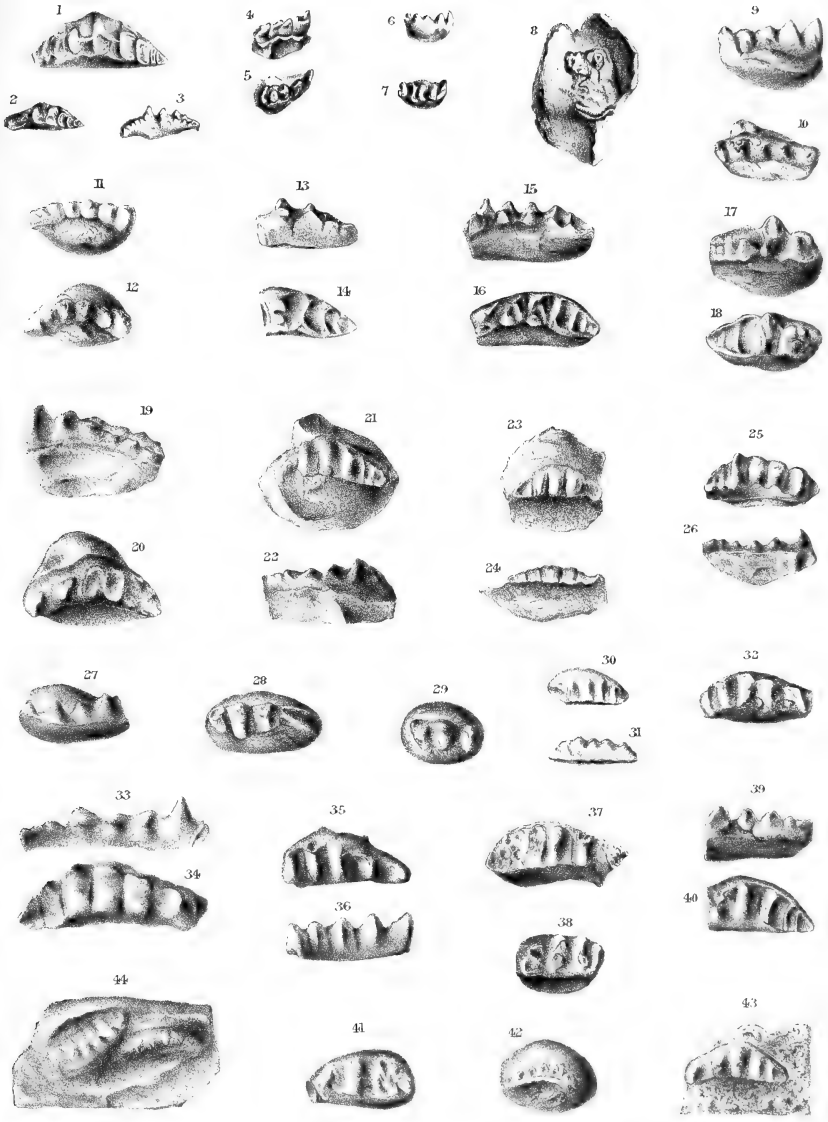




PLATE XXVII.

- Fig. 1 *a*.—*Dithyrocaris insignis*, sp. nov. Postero-ventral portion of a right-hand valve. $\times 2$. Neilson Collection, marked B. East Kilbride. } (Page 160.)
- Fig. 1 *b*.—*Dilthyrocaris insignis*, sp. nov. Part of the ornament of the valve. $\times 10$. }
- Fig. 1 *c*.—*Dithyrocaris insignis*, sp. nov. Part of the ornament of the valve. $\times 60$. }
- Fig. 2 *a*.—*D. tricornis*, Scouler. Natural impression of the postero-ventral portion (with its inturned edge) of the right valve. Nat. size. Mus. Pract. Geol. Counterpart of Plate XXIV, fig. 1. Kirktonholme, East Kilbride. } (Page 172.)
- Fig. 2 *b*.—*D. tricornis*, Scouler. Ornament from the sides of the thin ridge near its junction with the postero-ventral margin. $\times 30$. }
- Fig. 2 *c*.—Part of the same. $\times 50$. }
- Fig. 3 *a*.—*D. testudinea*, Scouler. An isolated dorsal crest. Nat. size. Neilson Collection, marked H. Kirktonholme, East Kilbride. } (Page 151.)
- Fig. 3 *b*.—*D. testudinea*, Scouler. Part of the ornament. $\times 15$. }
- Fig. 4 *a*.—*D. tricornis*, Scouler. A nearly perfect carapace of a small individual. Nat. size. Neilson Coll., marked F. East Kilbride. } (Page 174.)
- Fig. 4 *b*.—*D. tricornis*, Scouler. Side view. } $\times 3 +$.
- Fig. 4 *c*.—*D. tricornis*, Scouler. Front view. }
- Fig. 4 *d*.—*D. tricornis*, Scouler. Hind view. }
- Fig. 4 *e*.—*D. tricornis*, Scouler. Ornament at the dorsal and juxtadorsal ridges. $\times 30$. }
- Fig. 5.—*D. Colvi*, Portlock. A small specimen. Nat. size. Mus. Pract. Geol., 6260. Londonderry. (Page 168.)

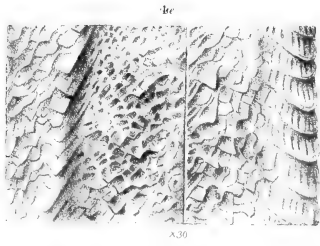
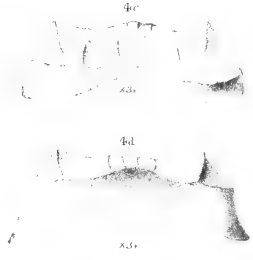
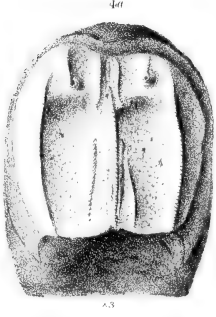
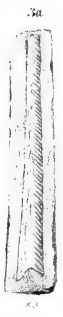
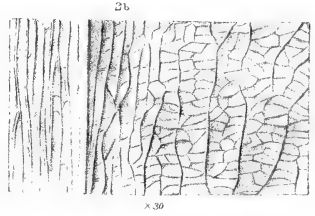
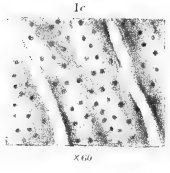
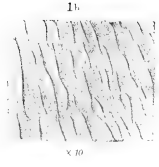
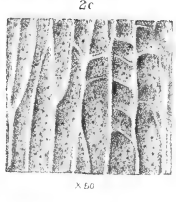
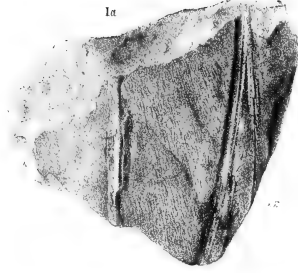




PLATE XXVIII.

Fig. 1 *a*.—*Dithyrocaris testudinea*, Scouler. A perfect right-hand valve, with its dorsal crest. $\times 2\frac{1}{2}$. Neilson Collection, marked D. East Kilbride. } (Page 151.)

Fig. 1 *b*.—Part of the dorsal crest. $\times 15$.

Fig. 2.—*D. testudinea*, Scouler. The hinder portion of a right valve. $\times 2\frac{1}{2}$. Neilson Collection, marked C. East Kilbride. (Page 151.)

Fig. 3 *a*.—*D. testudinea*, Scouler. Posterior fragment of a left-hand valve. $\times 3$. Neilson Collection, marked E. East Kilbride. } (Page 152.)

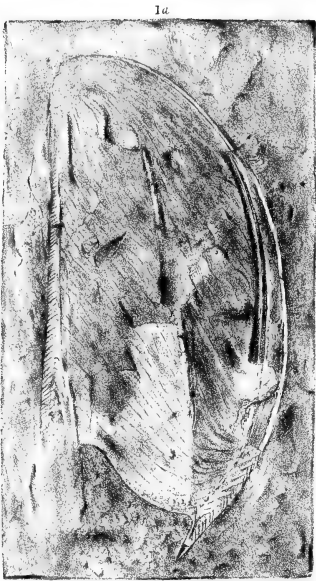
Fig. 3 *b*.—Ornament of the mesolateral ridge. $\times 30$.

Fig. 4.—*D. testudinea*, Scouler. Left valve, deformed by pressure. $\times 2\frac{1}{2}$. Mus. Geol. Surv. Scotl., F $\frac{22}{10}$, No. 10. Lickpriveck, two miles south-west of East Kilbride. (Page 152.)

Fig. 5 *a*.—*D. testudinea*, Scouler. Natural impression of the outside of the two valves of an open carapace, together with a part of the inturned ventral edge. Mus. Sc. Art Edin., No. 10. East Kilbride. } (Page 152.)

Fig. 5 *b*.—Part of the ornament of the valve as seen in the impression near the ventral margin, and the straight-lined sculpture of the inturned edge. $\times 10$.

Fig. 5 *c*.—Part of the ornament of the valve (imperfect), giving casts of small pits. $\times 50$.



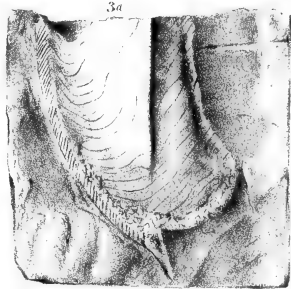
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x 15



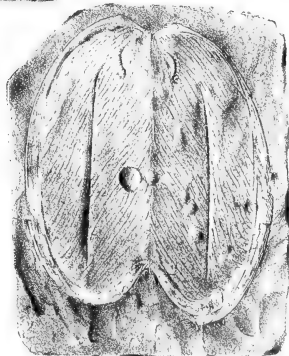
x 22



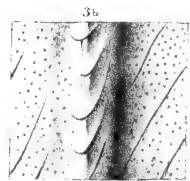
x 8



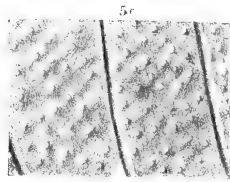
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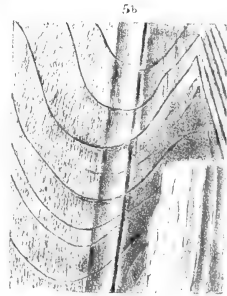
x 12



x 10



x 10



x 10



PLATE XXIX.

Fig. 1.—*Dithyrocaris Dunnii*, sp. nov. A trifold tail, imperfect. Nat. size. Mus. Geol. Surv., Scotland, F³⁵. No. 17. Larriston Burn. (Page 186.)

Fig. 2.—*D. Dunnii*. M. G. S. Sc., F³⁵. No. 19. Harebow Hill Quarry, Penton, Cannobie. Part of a caudal trifold. Nat. size. (Page 186.)

Fig. 3 *a* } *D. Neilsoni*, sp. nov. Caudal appendages. Nat. size. Neilson }
 Fig. 3 *b* } Collection, marked K. East Kilbride. } (Page 187.)
 Fig. 3 *c* }

Fig. 4.—*Rhaehura (Dithyrocaris?) venosa*, Scudder. Copied from 'Proc. Boston Soc. N. H.,' vol. xix, pl. ix, fig. 3. Caudal appendages, ventral aspect. Nat. size. Coal-measures, Illinois. (Page 188.)

Fig. 5 *a*.—*Dithyrocaris carbonaria*, Meek and Worthen. Copied from 'Geol. Surv. Ill.,' vol. v, pl. xxxii, fig. 1 *a*. Caudal appendages, ventral aspect. 1 *a*. Coal-measures, Illinois. Nat. size. (Page 190.)

Fig. 5 *b*.—*D. carbonaria*. Sectional area of thick part of the stylet (part of fig. 1 *a*).

Fig. 6.—*D. carbonaria*. Caudal appendages, dorsal aspect. Copied from M. and W.'s fig. 1 *b*.

Fig. 7.—*D. Kochi*, Ludwig. Copied from 'Palæontogr.,' vol. xi, pl. l, fig. 1 *a*. Devonian, Herborn, Dillthal, Nassau. Caudal appendages. Dorsal aspect. Nat. size. (Page 191.)

Fig. 8.—*D. Kochi*. Copied from Ludwig's fig. 1. Caudal appendage. Ventral aspect. Nat. size. Devonian, Herborn. (Page 191.)

Fig. 9.—*D. breviaculeata*, Ludwig. Copied from 'Palæontogr.,' vol. xi, pl. l, fig. 2. Caudal appendage. Ventral aspect. Devonian, Butzbach, Nassau. (Page 191.)

Fig. 10 *a*.—*D. testudinea*, Scouler. An ultimate abdominal segment. Dorsal aspect. Neilson Collection. J. East Kilbride. × 3.

Fig. 10 *b*.—*D. testudinea*, Scouler. Ventral aspect. × 3.

Fig. 10 *c*.—*D. testudinea*, Scouler. Sectional area. × 3.

Fig. 11 *a*.—*D. testudinea*, Scouler. Ventral aspect. × 3.

Fig. 11 *b*.—*D. testudinea*, Scouler. Ornament. × 100.

Fig. 12 *a*.—*D. testudinea*, Scouler. Dorsal aspect. × 3.

Fig. 12 *b*.—*D. testudinea*, Scouler. Ventral aspect. × 3.

Fig. 12 *c*.—*D. testudinea*, Scouler. Sectional area. × 3.

Fig. 12 *d*.—*D. testudinea*, Scouler. Ornament. × 20.

Fig. 13 *a*.—*D. testudinea*, Scouler. Dorsal aspect. × 3.

Fig. 13 *b*.—*D. testudinea*, Scouler. Ventral aspect. × 3.

Fig. 13 *c*.—*D. testudinea*, Scouler. Sectional area. × 3.

Fig. 14.—*D. testudinea*, Scouler. Diagram of the lines on the outside of an ultimate abdominal segment; the dorsal lines dark and the ventral lines dotted. × 3.

Fig. 15 *a*.—*Ptyhocaris? Jaschei* (Römer). Copied from 'Palæontogr.,' vol. v, pl. ii, figs. 13 *a*—*c*. Fragment. Nat. size. Devonian, Klosterholz, Hartz.

Fig. 15 *b*.—Outline of the sectional area.

Fig. 15 *c*.—Magnified part of the ornament.

Fig. 16 *a*.—Copied from (Kayser) 'Abhandl. Kart. Preuss.,' vol. ii, Heft 4, pl. i, figs. 13, 13 *a*. Fragment. Nat. size.

Fig. 16 *b*.—Sectional area.

(Page 153.)

(Page 193.)

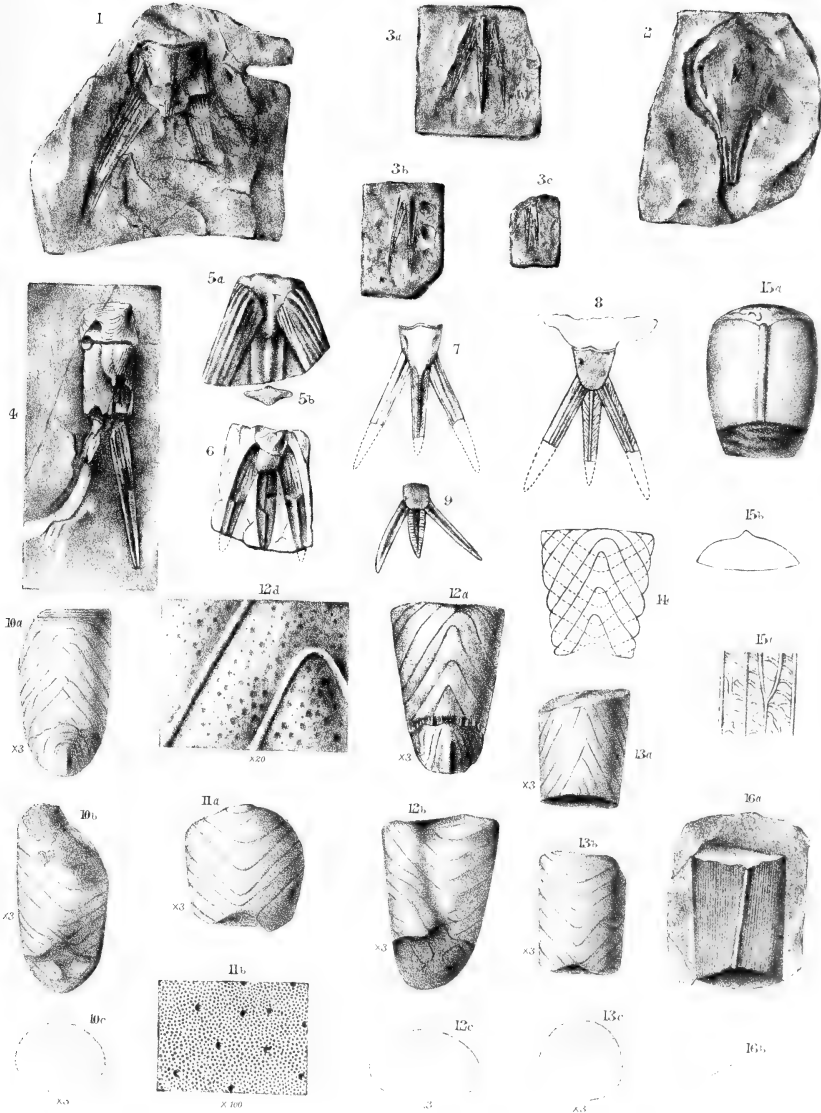




PLATE XXX.

These specimens are all from the Lower Carboniferous Series near Eecup, Yorkshire, and are in the Museum of the Yorkshire College at Leeds.*

Fig. 1.—*Dithyrocaris insignis*, sp. nov. The inside aspect of a part of a right valve, or impress of its outside. (The uppermost of the two specimens on the slab of shale.) Nat. size. Yorkshire College Museum, Leeds. No. 33a. (Page 161.)

Fig. 2 a.—The outer aspect of an imperfect left valve. (On the same slab as fig. 1.) Nat. size. (Page 161.)

Fig. 2 b.—Part of the dorsal ridge of fig. 2 a, taken at a little above the middle. $\times 5$. (Page 161.)

Fig. 3 a.—*Dithyrocaris insignis*, sp. nov. A nearly perfect carapace. Nat. size. Yorkshire Coll. Mus., No. 44A; counterpart of No. 44B. (Page 161.)

Fig. 3 b.—*Dithyrocaris insignis*, sp. nov. The posterior termination of the dorsal ridge. $\times 5$. (Page 161.)

Fig. 3 c.—*Dithyrocaris insignis*, sp. nov. Part of the ornament at the anterior ventral region of the right valve. $\times 10$. (Page 161.)

Fig. 3 d.—*Dithyrocaris insignis*, sp. nov. Part of the ornament of the mid-ventral region. $\times 50$. (Page 161.)

Fig. 3 e.—*Dithyrocaris insignis*, sp. nov. Part of the ornament of the postero-ventral region. $\times 10$. (Page 161.)

Fig. 4 a.—*Dithyrocaris insignis*, sp. nov. An imperfect carapace of a small individual. Nat. size. Yorkshire Coll. Mus., Leeds, No. 39B. (Page 161.)

Fig. 4 b.—*Dithyrocaris insignis*, sp. nov. Part of the ornament of Fig. 4 a on the ventral region just within the marginal fringe. $\times 15$. (Page 161.)

* The ultimate disposition of these interesting specimens from the Lower Carboniferous strata at Eecup is not yet known. Some may be deposited in the Yorkshire College at Leeds, and others in the British Museum and the Museum of Practical Geology.

Some that were collected by Prof. P. F. Kendall, F.G.S., referred to in Pl. XXV, figs. 1—5, page 159, have been presented to the British Museum (Natural History), Cromwell Road.

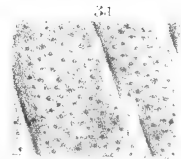
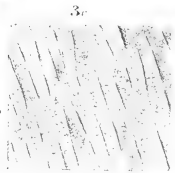
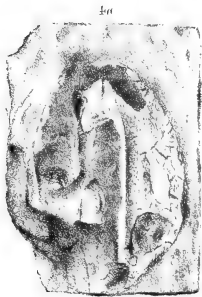
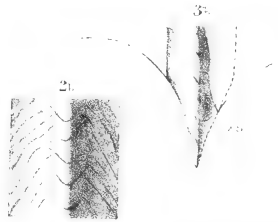
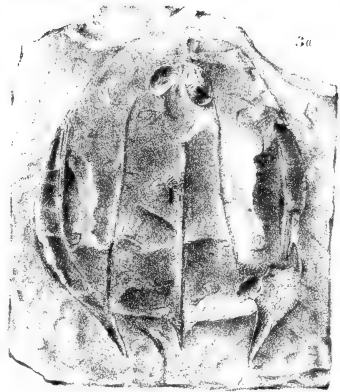




PLATE XXXI.

Fig. 1.—*Dithyrocaris testudinea*, Scouler. Part of the ornament of Pl. XIX, fig. 8, showing pores. $\times 40$. British Museum, I 109, No. 21. (Page 147.)

Fig. 2.—*D. testudinea*. Part of the ornament of Pl. XXI, fig. 3, showing intermediate striation. $\times 50$. Mus. Edinb., No. 13. (Page 149.)

Fig. 3.—*D. testudinea*. Part of the ornament of Pl. XXI, fig. 6, showing pits. $\times 40$. Mus. Edinb., No. 12. (Page 150.)

Fig. 4 a.—*D. testudinea*, Scouler. A part of the ultimate abdominal segment and the trifid appendage. Ventral aspect. $\times 2$. B. M., 59541, No. 27; Pl. XXI, fig. 5. (Page 150.)

Fig. 4 b.—Part of one of the stylets. $\times 10$.

Fig. 4 c.—Pitted margin of one of the stylets. $\times 30$.

Fig. 4 d.—Ornament of the abdominal segment. $\times 30$.

Fig. 5.—*Chænocaris tenuistriata* (M'Coy). Left valve of a small individual, imperfect, showing the longitudinal striæ. $\times 3\frac{1}{2}$. Woodwardian Museum, Cambridge. Carboniferous Limestone. Settle, Yorkshire. (Page 178.)

Fig. 6.—*Dithyrocaris insignis*, sp. nov. Trifid tail-piece. Ventral aspect. Nat. size. Leeds Coll. Mus., No. 44 b. Eecup, Yorkshire. (Page 162.)

Fig. 7 a.—*D. insignis*, sp. nov. Ultimate abdominal plate, imperfect. Ventral aspect. $\times 3$. Yorkshire Coll. Mus., Leeds, No. 602. Eecup, Yorkshire. (Page 162.)

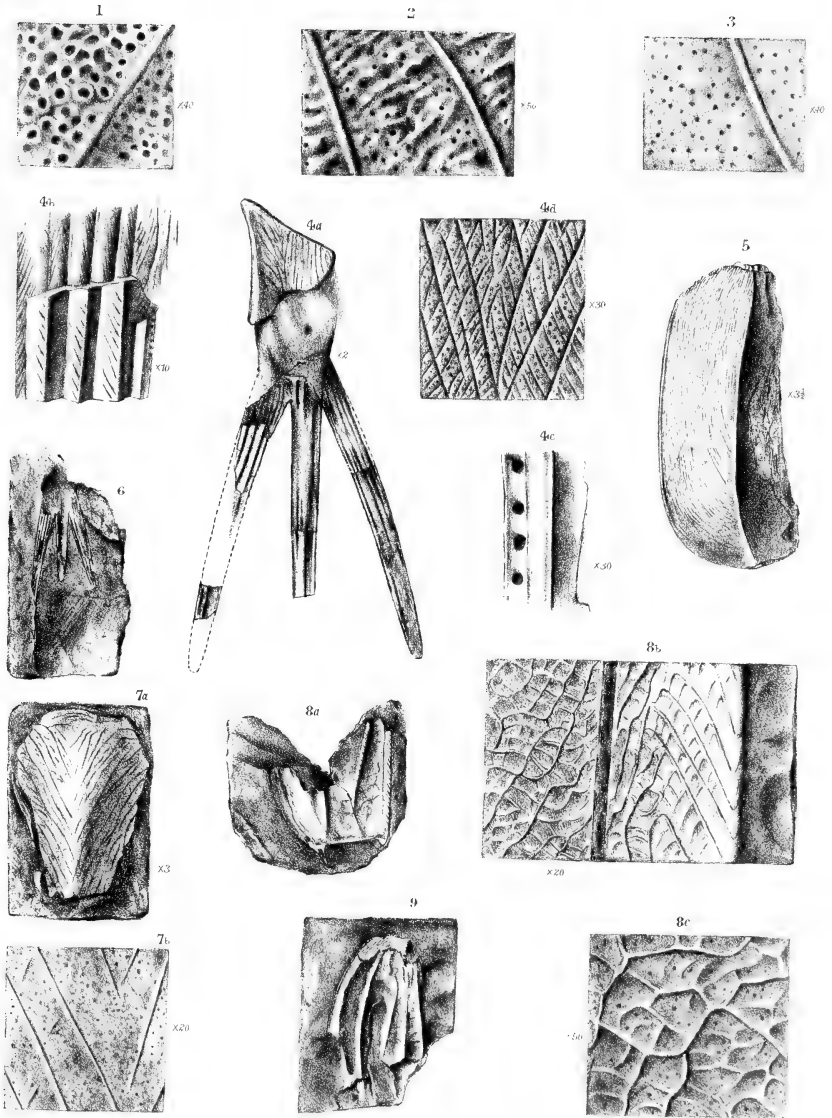
Fig. 7 b.—Part of the ornament of fig. 7 a. $\times 20$.

Fig. 8 a.—*D. insignis*, sp. nov., var. *multijugata*, nov. Posterior half of a left-hand valve. Nat. size. Yorkshire College Mus., No. 43. Eecup, Yorkshire. (Page 163.)

Fig. 8 b.—Part of ornament of fig. 8 a. Portion of the dorsal ridge, obscured with shell on one edge. $\times 20$.

Fig. 8 c.—Part of the same. $\times 50$.

Fig. 9.—*D. insignis*, var. *multijugata*, nov. An imperfect left-hand valve, with the juxta-dorsal ridge of the adjoining valve. Nat. size. Yorkshire College Mus., No. 40. Eecup, Yorkshire. (Page 163.)







THE
PALÆONTOGRAPHICAL SOCIETY.

INSTITUTED MDCCCXLVII.

VOLUME FOR 1899.

L O N D O N :

MDCCCXCIX.



A MONOGRAPH

OF THE

CRETACEOUS LAMELLIBRANCHIA

OF

ENGLAND.

BY

HENRY WOODS, M.A.,

ST. JOHN'S COLLEGE, CAMBRIDGE.

PART I.

NUCULANIDÆ, NUCULIDÆ, ANOMIIDÆ, AND ARCIDÆ.

PAGES 1—72: PLATES I—XIV.

LONDON:

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1899.

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BARTHOLOMEW CLOSE, E.C., AND 20, HANOVER SQUARE, W.

DESCRIPTION OF SPECIES.

Class—LAMELLIBRANCHIA, *Blainville*.

Family—NUCULANIDÆ, *Stoliczka*.¹

Genus—NUCULANA, *H. F. Link*, 1807.

('Beschreib. der Naturalien-Samml. der Universität zu Rostock,' vol. iii, p. 155.)

1. *Lower Cretaceous Species.*

NUCULANA SPATHULATA (*Forbes*), 1845. Plate I, figs. 1, 2 *a*—*c*, 3.

1845. NUCULA SPATHULATA, *E. Forbes*. Quart. Journ. Geol. Soc., vol. i, p. 245,
pl. iii, fig. 4.
1854. LEDA SPATHULATA, *J. Morris*. Cat. Brit. Foss., ed. 2, p. 205.
1866. — — *F. J. Pictet and G. Campiche*. Foss. du Terr. Crét.
de Ste. Croix (Matér. Pal. Suisse, ser. 4),
pt. 3, p. 401.
1884. — — *J. S. Gardner*. Quart. Journ. Geol. Soc., vol. xl, p. 139
(*partim*), pl. v, fig. 30? (*non* 31—34).

Description.—Shell thin, compressed, elongate, very inequilateral; short and rounded anteriorly; long and rapidly tapering posteriorly, with a faint carina extending from the umbo to the postero-ventral extremity, and cutting off a flattened area, which is ornamented with lines of growth only. Posterior extremity truncated and somewhat rounded. Antero-dorsal border slightly convex; postero-dorsal border nearly straight, with a slight ventral slope. Umbones small. Surface (except the postero-dorsal part) ornamented with numerous fine concentric ribs.

Measurements:

Length . . .	(1)	14·5	. . .	(2)	16·0 mm.
Height . . .	6·5	. . .	6·0	,,	

(1) In the Wiltshire Collection, Woodwardian Museum, Pl. I, figs. 2, 3.

(2) The type (a cast), Pl. I, fig. 1.

¹ For accounts of the classification of the *Nuculanidæ* see G. Seguenza, "Nuculidi terziari d' Italia," 'Atti della R. Accad. dei Lincei,' ser. 3a, vol. i (1877), p. 1163; and A. E. Verrill and K. J. Bush, 'Amer. Journ. Sci.,' ser. 4, vol. iii (1897), p. 51. Owing to the imperfect preservation of the interiors of many of the Cretaceous forms of this group, *Nuculana* is here used in the extended sense.

Affinities.—D'Orbigny¹ considered that this species was identical with his *N. lingulata*;² but that form was founded on a cast, so that an exact comparison cannot be made. *N. lingulata*, however, appears to be more pointed posteriorly and to taper more regularly than *N. spathulata*; it is also shorter anteriorly. *N. spathulata* is distinguished from *N. solea* (d'Orbigny) by its ornamentation and less elongate form.

Remarks.—This appears to be a rare species; I have seen only six examples of it. Several of the specimens recorded by Gardner do not belong to this species, but to *N. scapha* (d'Orbigny) (see p. 4). The example from Speeton which he figures may be *N. spathulata*, but it is in the form of a cast, and the posterior part is not perfect.

Types.—The type (Pl. I, fig. 1) is an internal mould, but shows indications of the ribbing; it comes from the Atherfield Clay, and is in the collection of the Geological Society of London (No. 2112).

Distribution.—Crackers of Atherfield; Atherfield Clay of Atherfield; ? Speeton Clay of Speeton.

NUCULANA SUBRECURVA (*Phillips*), 1829. Plate I, figs. 4 a—c, 5 a, b.

1829.	NUCULA SUBRECURVA,	<i>J. Phillips.</i>	Geol. Yorks., pt. 1, p. 122, pl. ii, fig. 11.
1854.	—	—	<i>J. Morris.</i> Cat. Brit. Foss., ed. 2, p. 217.
1866.	—	—	<i>E. J. Pictet and G. Campiche.</i> Foss. du Terr. Crét. des Envir. de Ste. Croix (Matér. Pal. Suisse, ser. 4), pt. 3, p. 401.
1884.	LEDA SUBRECURVA,	<i>J. S. Gardner.</i>	Quart. Journ. Geol. Soc., vol. xl, p. 135, pl. v, figs. 24, 25.
Nov 1844.	NUCULA SUBRECURVA,	<i>A. d'Orbigny.</i>	Pal. Franç. Terr. Crét., vol. iii, p. 170, pl. ccci, figs. 7—11.
—	1850.	LEDA SUBRECURVA,	<i>d'Orbigny.</i> Prod. de Pal., vol. ii, p. 136.
—	1867.	—	—
		<i>O. Fraas.</i>	Aus dem Orient, pt. i, p. 92.

Description.—Shell inflated, elongate, inequilateral, the posterior part being much longer than the anterior; ventral margin gently curved; extremities rounded; posterior part wedge-shaped; anterior part narrow. Lunule depressed, not distinctly limited. Surface with concentric grooves and concentric striæ.

Measurements :

		(1)	(2)
Length	. . .	18	. . . 18 mm.
Height	. . .	10	. . . 11 „
Thickness	. . .	10	. . . 11 „

¹ 'Prod. de Pal.,' vol. ii (1850), p. 117.

² 'Pal. Franç. Terr. Crét.,' vol. iii (1844), p. 168, pl. ccciv, figs. 1—3.

Affinities.—The shell in *N. subrecurva* is more inequilateral, and more pointed at the extremities, than in *N. phaseolina* (d'Orbigny), and the latter is ornamented with concentric ribs.

Remarks.—Phillips gave no description of this species, and his figure is an outline only, but is sufficiently characteristic to enable us to identify the form.

Types.—I have not seen the type of *N. subrecurva*. An internal cast from Speeton (8 mm. in length) in the York Museum is labelled as such, but it does not belong to this species. The specimens figured by Gardner are in the Leckenby Collection, Woodwardian Museum.

Distribution.—Speeton Clay (D 3 and D 4) of Speeton.

NUCULANA SPEETONENSIS, sp. nov. Plate I, figs. 6 a, b, 7 a, b.

? NUCULA EQUILATERALIS, *Bean MS.*, FOR *F. A. Römer*. Die Verstein. d. Norddeutsch. Oolithgeb. (1836), p. 101, pl. vi, fig. 13.

Description.—Valves almost equilateral, about twice as long as high, convex, anterior and posterior extremities almost equally rounded. Ventral margin slightly curved, almost parallel to the dorsal. Umbones nearly central, close together, of moderate size, with a depression in front and behind. Surface ornamented with numerous fine concentric striæ.

Measurements :

Length	.	.	.	(1)	.	.	(2)	mm.
				17			18	
Height	.	.	.	10	.	.	9.5	„

Affinities.—This species resembles *Leda Neckeriana*, Pictet and Roux, from the Gault; but in that form the umbones are larger and more widely separated, and the shell appears to be less equilateral.

N. phaseolina, Michelin, is smaller than *N. speetonensis*; it is also more angular posteriorly, not quite so equilateral, and apparently more coarsely ornamented.

Types.—In the British Museum, and the Museum of Practical Geology, Jermyn Street.

Distribution.—Speeton Clay of Speeton.

NUCULANA [? YOLDIA] SCAPHA (d'Orbigny), 1844. Plate I, figs. 8 a—c, 9—14.

- 1844. NUCULA SCAPHA, *A. d'Orbigny*. Pal. Franç. Terr. Crét., vol. iii, p. 167, pl. ccci, figs. 1—3.
- 1845. — — *E. Forbes*. Quart. Journ. Geol. Soc., vol. i, p. 245.
- 1854. LEDA SCAPHA, *J. Morris*. Cat. Brit. Foss., ed. 2, p. 205.
- 1866. — — *F. J. Pictet and G. Campiche*. Foss. du Terr. Crét. de Ste. Croix (Matér. Pal. Suisse, ser. 4), pt. 3, pp. 395, 400, pl. cxxix, fig. 2.

is in the Woodwardian Museum, and the original of fig. 33 in Mr. Meÿer's Collection; the originals of figs. 31 and 34 are missing.

Specimens from the Atherfield Clay of Hythe and Atherfield, which Forbes states were identified by d'Orbigny, are in the museum of the Geological Society of London (Nos. 2107, 2115).

Distribution.—Atherfield Clay of Atherfield, Sevenoaks, and Hythe; *Perna* bed of East Shalford; Lower Greensand near Devizes; Speeton Clay (C 3) of Speeton.

NUCULANA SEELEYI (*Gardner*), 1884. Plate I, figs. 15 *a*, *b*, 16 *a*, *b*, 17 *a*, *b*.

1884. LEDA SEELEYI, *J. S. Gardner*. Quart. Journ. Geol. Soc., vol. xl, p. 137, pl. v, figs. 17—19 (*non* 20).

Description.—Shell oval, nearly equilateral, high and rounded at the extremities; moderately convex; somewhat flattened. Ventral margin gently curved. Umbones rather small, almost median. Surface smooth.

Measurements :

Length . . .	(1)	(2)
Height . . .	7	10 mm.
Thickness . . .	5	7 „
	3	5.5 „

Affinities.—*N. Seeleyi* is distinguished from *N. Vibrayeana* (d'Orbigny) by the higher and more evenly rounded extremities, by the larger apical angle, by the gentler curve of the ventral margin, and by the central part of the valves being somewhat flatter.

Types.—In the Woodwardian Museum (figs. 17, 18 of Gardner) and the British Museum (figs. 19, 20).

Distribution.—Speeton Beds (C 3 and C 9) of Speeton.

2. *Gault and Upper Greensand Species.*

NUCULANA SOLEA (*d'Orbigny*), 1844. Plate I, figs. 18—24.

1844. NUCULA SOLEA, *A. d'Orbigny*. Pal. Franç. Terr. Crét., vol. iii, p. 170, pl. ccxiv, figs. 4—6.

1850. LEDA SOLEA, *A. d'Orbigny*. Prodr. de Pal., vol. ii, p. 136.

1866. — — *F. J. Pictet and G. Campiche*. Foss. Terr. Crét. de Ste. Croix (Matér. Pal. Suisse, ser. 4), pt. 3, p. 401.

1884. — — *J. S. Gardner*. Quart. Journ. Geol. Soc., vol. xl, p. 139, pl. iii, fig. 30.

Description.—Shell thin, greatly elongated, compressed; the anterior part short and rounded; the posterior part very long and tapering, with a slight carina extending from the umbo to the postero-ventral angle, cutting off a flattened area. Umbones small. Ventral margin slightly sinuous posteriorly (except in young specimens, in which the posterior part of the valve is less produced); postero-dorsal nearly straight. Posterior margin truncated. Surface glossy, with very fine concentric lines. Margin entire. Teeth very numerous, minute, short. Adductor impressions faintly marked.

Measurements :

Length	.	(1)	.	(2)	.	(3)	.	(4)	.
		26		20		14		10 mm.	
Height	.	9	.	7	.	5	.	4	„

Affinities.—*N. solea* is more elongated than any other Cretaceous species here described (see page 1).

Types.—I have not seen the type; it appears to be missing from the d'Orbigny Collection in the Museum of Natural History, Paris. Gardner's specimens are in the British Museum.

Distribution.—Lower Gault (zones ii, iii, v, vii) of Folkestone; Gault of Black Ven; Cambridge Greensand (*vide* Price).

NUCULANA MARLÆ (*d'Orbigny*), 1844. Plate I, figs. 25 *a*—*c*, 26 *a*, *b*, 27.

1844. NUCULA MARLÆ, *A. d'Orbigny*. Pal. Franç. Terr. Crét., vol. iii, p. 169, pl. ccci, figs. 4—6.
1850. LEDA MARLÆ, *A. d'Orbigny*. Prodr. de Pal., vol. ii, p. 136.
1866. — — *F. J. Pictet and G. Campiche*. Foss. du Terr. Crét. de Ste. Croix (Matér. Pal. Suisse, ser. 4), pt. 3, pp. 397, 401.
1884. — — *J. S. Gardner*. Quart. Journ. Geol. Soc., vol. xl, p. 138, pl. iii, figs. 28, 29.

Description.—Shell elongated, inequilateral. Ventral margin considerably and evenly curved; antero-dorsal straight or slightly convex, postero-dorsal slightly concave, both with a considerable ventral slope. Anterior end blunt and rounded; posterior end pointed. Posterior part of shell more compressed than the median and anterior portions. Umbones pointed. Surface ornamented with numerous fine, concentric ribs, which are absent or indistinct on the anterior and posterior parts of the valves. Anterior teeth about thirteen, posterior more.

Measurements :

Length	.	(1)	.	(2)	.	(3)	.
		8		7		4 mm.	
Height	.	5	.	4	.	3	„
Thickness	.	3·5	.	—	.	—	„

Affinities.—This species is much smaller and less inequilateral than *N. scaphoides* (Pictet and Campiche). For its relations to *N. scapha* (d'Orbigny), *N. lineata* (Sowerby), and *N. angulata* (Sowerby), see pp. 4, 7, 8.

Types.—I have not seen the type. The specimens figured by Gardner are in the British Museum.

Distribution.—Lower Gault (zones ii, and iv to vii) of Folkestone. Gardner records it also from the Folkestone Beds and the Upper Gault.

NUCULANA LINEATA (*Sowerby*), 1836. Plate I, figs. 28 *a, b*, 29, 30, 31 *a—d*, 32 *a—c*.

1836. NUCULA LINEATA, *J. de C. Sowerby*. Trans. Geol. Soc., ser. 2, vol. iv, p. 342, pl. xvii, fig. 9.

1850. LEDA LINEATA, *A. d'Orbigny*. Prodr. de Pal., vol. ii, p. 159.

1854. NUCULA LINEATA, *J. Morris*. Cat. Brit. Foss., ed. 2, p. 217.

1868. LEDA LINEATA, *A. Briart and F. L. Cornet*. Descript. Mineralog., Géol., et Pal. de la Meule de Bracquegnies (Mém. Cour. et Mém. des Sav. étrangers, vol. xxxiv), p. 63, pl. vi, figs. 8, 9.

1884. — — *J. S. Gardner*. Quart. Journ. Geol. Soc., vol. xl, p. 136, pl. iv, figs. 13—16 (? 14).

1884. — SCAPHA, *Gardner*. Ibid., p. 138 (*partim*), pl. v, figs. 21, 22 ?

Non 1837. NUCULA LINEATA, *A. Goldfuss*. Petref. Germ., vol. ii, p. 153, pl. cxvii, fig. 17 (from the St. Cassian Beds).

— 1841. — — *G. Münster*. Petrefactenkunde, pt. iv, p. 83, pl. viii, fig. 9.

— 1875. LEDA LINEATA, *J. F. Blake*. Quart. Journ. Geol. Soc., vol. xxxi, p. 228, pl. xii, fig. 12 (from the Kimmeridgian); vol. xxxvi (1880), p. 235.

Description.—Shell small, oval, elongate, somewhat compressed, rounded anteriorly, pointed posteriorly; posterior part a little longer than the anterior. Ventral margin slightly curved. Umbones not very prominent. Lunule often indistinct. Escutcheon lanceolate. Surface ornamented with well-marked concentric ribs, which disappear or become indistinct near the postero-dorsal and antero-dorsal extremities: some of the ribs cut the ventral margin obliquely near its posterior end. Margins smooth.¹ Teeth numerous, slightly bent.

Measurements:

	(1)	(2)	(3)
Length . . .	12 . . .	10 . . .	8 mm.
Height . . .	7 . . .	6 . . .	4·5 ,,
Thickness . . .	— . . .	— . . .	3 ,,

Affinities.—In this species the ribs are coarser and fewer, and the posterior part of the shell is less sharply pointed and less compressed, than in *N. Mariae*

¹ Gardner says "the lip is strongly crenated internally." I have seen no indication of this in any specimen.

(d'Orbigny). For the relation of this to *N. scapha* (d'Orbigny) and *N. phaseolina* (Michelin), see pp. 4, 9.

Remarks.—Specimens referred to *N. scapha* (d'Orbigny) by Gardner (*vide ante*, p. 4), and stated to come from the Lower Greensand of Atherfield, probably belong to this species. One example is figured on Pl. I, fig. 32.

Types.—The types, and also the specimens figured by Gardner, are in the Bristol Museum.

Distribution.—Blackdown Greensand (zone x); Greensand of Haldon (*vide Downes*); Grey Chalk of Dover (*vide Gardner*).

NUCULANA ANGULATA (*Sowerby*), 1824. Plate I, figs. 33 a—c, 34 a, b, 35 a—d.

1824. NUCULA ANGULATA, *J. de C. Sowerby*. Min. Conch., vol. v, p. 120,
pl. cccclxxvi, fig. 5.

1850. LEDA ANGULATA, *A. d'Orbigny*. Prodr. de Pal., vol. ii, p. 159.

1854. — — *J. Morris*. Cat. Brit. Foss., ed. 2, p. 205.

1866. — — *F. J. Pictet and G. Campiche*. Foss. du Terr. Crét. de
Ste. Croix (Matér. Pal. Suisse, ser. 4),
pt. 3, p. 401.

1884. — — *J. S. Gardner*. Quart. Journ. Geol. Soc., vol. xl, p. 138,
pl. iv, figs. 17—19.

Description.—Shell small, more or less oval or triangular, moderately convex; somewhat rounded anteriorly, pointed posteriorly. Ventral margin regularly curved, but slightly sinuous posteriorly. Umbones prominent, incurved; a ridge extends from each umbo both anteriorly and posteriorly, limiting two depressed areas. Ornamentation consists of fine concentric ribs. Anterior and posterior portions of the hinge-line of nearly equal length; teeth narrow, elongate.

Measurements:

Length	.	.	(1)	.	(2)	.	(3)
			5·5		5		4 mm.
Height	.	.	4	.	3·5	.	3 „
Thickness	.	.	3	.	3	.	2·2 „

(2) is one of Sowerby's types.

Affinities.—This species is similar to *N. Mariae* (d'Orbigny), but is smaller, more convex, with the posterior part of the shell usually less elongated, and the umbones more prominent.

Types.—In the British Museum. The specimens figured by Gardner are in the Bristol Museum.

Distribution.—Blackdown Greensand.

NUCULANA PHASEOLINA (*Michelin*), 1836. Plate II, figs. 1 a—d, 2 a, b, 3.

1836. NUCULA PHASEOLINA, *H. Michelin*. Mém. Soc. Géol. France, vol. iii, p. 102, pl. xii, fig. 6.
 1844. — SUBRECURVA, *A. d'Orbigny* (non *Phillips*). Pal. Franç. Terr. Crét., vol. iii, p. 170, pl. ccci, figs. 7—11.
 1850. LEDA SUBRECURVA, *A. d'Orbigny*. Prodr. de Pal., vol. ii, p. 136.
 1866. — PHASEOLINA, *F. J. Pictet and G. Campiche*. Foss. du Terr. Crét. des Envir. de Ste. Croix (Matér. Pal. Suisse, ser. 4), pt. 3, p. 401.
 1884. — — *J. S. Gardner*. Quart. Journ. Geol. Soc., vol. xl, p. 135, pl. iii, figs. 22—24 (pl. v, figs. 26—29?).

Description.—Shell oval, rather high, convex, nearly equilateral; anterior extremity broadly rounded; posterior somewhat pointed and slightly compressed; ventral margin nearly parallel to the dorsal. Umbones prominent. Lunule indistinctly defined. Escutcheon oval, deep, not sharply limited posteriorly. Surface ornamented with numerous fine, close-set, concentric ribs, which are indistinct or absent on the posterior part of the shell; a few of the later ribs cut the postero-ventral margin obliquely.

Measurements :

Length	. . . . .	10·5 mm.
Height	. . . . .	7 „
Thickness	. . . . .	7 „

Affinities.—This species is similar to *N. lineata* (Sowerby), but is more equilateral, relatively shorter, more rounded at the extremities, and the ornamentation is finer.

Nuculana Neckeriana (Pictet and Roux) is larger and more convex than *N. phaseolina*, and is apparently ornamented with lines of growth only.

Remarks.—*Michelin*'s figure and description are very unsatisfactory, and the characters of his species can only be determined from the works of later writers and from specimens in French collections. The average size of the French specimens appears to be greater than that of the English.

Types.—I have not seen the type. *D'Orbigny*'s specimens are in the Museum of Natural History, Paris. *Gardner*'s specimens are in the British Museum.

Distribution.—Lower Gault of Folkestone.

NUCULANA VIBRAYEANA (*d'Orbigny*), 1844. Plate II, figs. 4 *a—c*, 5 *a, b*, 6—9.

1844. NUCULA VIBRAYEANA, *A. d'Orbigny*. Pal. Franç. Terr. Crét., vol. iii, p. 172, pl. ecci, figs. 12—14.
1850. LEDA VIBRAYEANA, *A. d'Orbigny*. Prodr. de Pal., vol. ii, p. 136.
1852. NUCULA VIBRAYEANA, *F. J. Pictet and W. Roux*. Moll. foss. Grès vert de Genève, p. 471, pl. xxxix, fig. 2.
1861. — SUBELLIPTICA, *H. G. Seeley*. Ann. Mag. Nat. Hist., ser. 3, vol. vii, p. 120, pl. vi, fig. 4.
1861. — RHOMBOIDEA, *Seeley*. Ibid., p. 120, pl. vi, fig. 5.
1866. LEDA VIBRAYEANA, *F. J. Pictet and G. Campiche*. Foss. Terr. Crét. de Ste. Croix (Matér. Pal. Suisse, ser. 4), pt. 3, pp. 399, 401, pl. cxxix, figs. 5, 6.
1884. — — *J. S. Gardner*. Quart. Journ. Geol. Soc., vol. xl, p. 137, pl. iii, figs. 17, 18, 25; pl. iv, figs. 26, 27.

Description.—Shell oval, rounded, convex centrally, compressed at the extremities, nearly equilateral, but with the posterior part slightly longer than the anterior; extremities rounded. Ventral margin considerably curved at the median part. Antero-dorsal and postero-dorsal margins with a considerable ventral slope from the umbo. Umbones not prominent. Lunule indistinct. Escutcheon lanceolate. Surface smooth. Margins smooth. Anterior adductor impression somewhat quadrate; the posterior a little smaller and more rounded. Pallial line slightly sinuous posteriorly.

Measurements :

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	
Length	. 15	. 13	. 11	. 11	. 10	. 9	. 6.5	mm.
Height	. 12	. 10	. 8	. 9	. 8	. 7	. 5.5	„
Thickness	. 8	. 6	. 6	. 5.5	. 5	. 4.5	. 3	„

Affinities.—See under *N. Seeleyi*, Gardner (p. 5).

Remarks.—As was pointed out by Gardner, Seeley's *N. subelliptica* (Pl. II, fig. 9), and *N. rhomboidea* from the Cambridge Greensand, are simply internal casts of *N. Vibrayeana*.

Types.—I was unable to find the type in the *d'Orbigny* Collection at the Muséum of Natural History, Paris. The types of *N. subelliptica*, Seeley, and *N. rhomboidea*, Seeley, are in the Woodwardian Museum, Cambridge. The examples figured by Gardner are in the British Museum.

Distribution.—Lower Gault (zones v, vii, and viii) of Folkestone; Cambridge Greensand (derived).

3. *Chalk Species.*

NUCULANA, sp., cf. SILIQUA (*Goldfuss*). Plate II, figs. 10 a, b.

1837. NUCULA SILIQUA, *A. Goldfuss*. Petref. Germ., vol. ii, p. 156, pl. cxxv, fig. 13.
 1846. — — *A. E. Reuss*. Die Verstein. der böhm. Kreideformat.,
 pt. ii, p. 7, pl. xxxiv, fig. 11.
 1850. LEDA SILIQUA, *A. d'Orbigny*. Prodr. de Pal., vol. ii, p. 236.
 1877. — — *A. Fritsch*. Stud. im Gebiete der böhm. Kreideformat.
 ii. Die Weissenberger und Malnitzer Schichten,
 p. 117, fig. 18.
 1885. NUCULANA SILIQUA, *F. Nöthing*. Die Fauna der baltisch. Cenoman-
 Geschiebe (Palæont. Abhandl., vol. ii, pt. iv), p. 27,
 pl. iv, fig. 15.
 1889. NUCULA SILIQUA, *O. Griepenkerl*. Die Verstein. der Senon. Kreide von
 Königslutter (Palæont. Abhandl., vol. iv), p. 57.
 1889. LEDA SILIQUA, *E. Holzappel*. Die Mollusken der Aachener Kreide (Palæ-
 ontographica, vol. xxxv), p. 203.
 1892. — — *F. Vogel*. Verhandl. der naturh. Ver der preuss. Rheinl.,
 &c., vol. xlix, p. 73.
 1893. — — *A. Fritsch*. Stud. im Gebiete der böhm. Kreideformat. v.
 Priesener Schichten, p. 92.
 1895. — — *F. Vogel*. Die holland. Kreide, p. 37.
 1897. NUCULANA, cf. SILIQUA, *H. Woods*. Quart. Journ. Geol. Soc., vol. liii,
 p. 378.

Non 1842. NUCULA SILIQUA, *H. B. Geinitz*. Char. d. Schichten u. Petref. d. sächs.-
 böhm. Kreidegeb., pt. iii, p. 77, pl. xx, figs. 28, 29.

Remarks.—There are two specimens in the Montagu Smith Collection (Woodwardian Museum), which agree well with the figures of *N. siliqua* given by Goldfuss and Reuss—especially the latter; but since, like the figured specimens, they are in the form of casts, it is difficult to be sure of their identity. This form may perhaps belong to the sub-genus *Perrisonota*, Conrad.¹

Measurements:

Length 16 mm. (approximate).
 Height 6 „

Type.—The type comes from the Aachen Greensand.

Distribution.—Chalk Rock (*Reussianum*-zone) of Cuckhamsley.

¹ 'American Journal of Conchology,' vol. v (1869), p. 98, pl. ix, fig. 24.

Family—NUCULIDÆ, Gray.

Genus—NUCULA, Lamarck, 1799.¹

(‘Mém. Soc. Hist. Nat. Paris,’ p. 87.)

1. *Lower Cretaceous Species.*

NUCULA PLANATA, Deshayes, 1842. Plate II, figs. 11 *a, b*, 12 *a, b*, 13, 14 *a, b*, 15.

1829. NUCULA OVATA, *J. Phillips* (non *Mantell*). Geol. Yorks., pt. 1, pl. ii, fig. 10, p. 122.
1842. — PLANATA, *G. P. Deshayes*. In *A. Leymerie*, Mém. Soc. Géol. de France, vol. v, p. 7, pl. ix, figs. 3, 4.
1844. -- OBTUSA, *A. d'Orbigny*. Pal. Franç. Terr. Crét., vol. iii, p. 163, pl. ccc, figs. 1–5 (named *N. planata* on pl. ccc).
1858. — IMPRESSA, *F. J. Pictet and E. Renevier*. Foss. du Terr. Aptien de la Perte du Rhone, &c. (Matér. Pal. Suisse, ser. 1), p. 108, pl. xv, figs. 5, 6.
1866. — PLANATA, *F. J. Pictet and G. Campiche*. Moll. Foss. du Terr. Crét. de Ste. Croix (Matér. Pal. Suisse, ser. 4), pt. 3, pp. 404, 417, pl. cxxix, fig. 7.
1884. — — *J. S. Gardner*. Quart. Journ. Geol. Soc., vol. xl, p. 126, pl. v, figs. 1–4.

Description.—Shell oval; short and angular posteriorly, high and rounded anteriorly; ventral margin considerably curved. Postero-dorsal margin nearly straight. Lunule elongate, bounded by a blunt carina. Shell depressed in front of the umbones. A faint ridge extends from the umbones anteriorly. Surface with lines of growth only.

Measurements:

	(1)	(2)	(3)	(4)	(5)
Length . . .	27	20	14·5	16·5	16 mm.
Height . . .	17·5	14	9	11·5	·5 ,,
Thickness . . .	—	—	6·5	—	— ,,

1—3 are from Specton; 4 and 5 from Atherfield.

¹ In the genus *Nucula* I regard the *posterior* dorsal area as the lunule, and the *anterior* dorsal as the escutcheon, since, except in position, they agree precisely with the lunule and escutcheon of other genera. In this matter I am in accord with Sylvanus Hanley (Mon. ‘Nuculidæ,’ in Sowerby’s ‘Thesaurus Conchyliorum,’ vol. iii [1866], p. 147, foot-note).

Affinities.—The characters in which this species differs from *N. ovata*, Mantell, are—(i) the greater curvature of the ventral margin, (ii) the angular form of the posterior end of the shell, (iii) the absence of the constriction at the ventral margin, (iv) the absence of the sinuosity at the postero-ventral angle, (v) the usually more distinctly limited lunule. The characters i, ii, and v also serve to separate *N. planata* from *N. obtusa*, Sowerby. In *N. impressa*, Sowerby, the shell is smaller and relatively shorter, and the lunule more depressed and relatively wider than in *N. planata*. *N. Cornueliana*, d'Orbigny,¹ appears to me to be very closely allied to, if not identical with, *N. planata*, and is regarded by Pictet and Campiche as simply a variety of *N. planata*; they state that it differs from the latter in being proportionately thicker, and in having the anterior part of the shell shorter, so that the apical angle is a little smaller. In *N. simplex*, Deshayes, the posterior part is much shorter than in *N. planata*.

Types.—I have not seen the type. There are examples in the d'Orbigny Collection in the Museum of Natural History, Paris. Specimens figured by Gardner are in the Woodwardian Museum, and in Mr. Meyer's Collection. A specimen which is regarded as the original of Phillips's *N. ovata* is preserved in the York Museum.

Distribution.—Speeton Clay (C 8 and D 4); Crackers of Atherfield; *Perna* bed of Redcliff, Isle of Wight.

NUCULA, sp. Plate II, figs. 16 *a*, *b*, 17.

1884. NUCULA CORNUELIANA, *J. S. Gardner* (non *d'Orbigny*). Quart. Journ. Geol. Soc., vol. xl, p. 129, pl. v, figs. 5, 6 (non 8—10).

Description.—Shell oval, rather convex, smooth except for growth-lines. Posterior part short. Anterior extremity rounded. Postero-dorsal margin nearly straight, forming with the ventral margin almost a right angle. Ventral margin slightly curved. Lunule distinct, elongate.

Measurements :

Length	.	.	.	.	17 mm.
Height	.	.	.	.	12 „
Thickness (approximate)	.	.	.	.	12 „

¹ D'Orbigny, 'Pal. Franç. Terr. Crét.', vol. iii (1844), p. 165, pl. ccc, figs. 6—10. De Loriol, 'Anim. Invert. Foss. du Mte. Salève' (1861), p. 84, pl. x, fig. 6. Pictet and Campiche, 'Foss. du Terr. Crét. Ste. Croix' ('Matér. Pal. Suisse,' ser. 4), pt. iii, p. 406, pl. cxxix, fig. 8. Non *J. S. Gardner*, 'Quart. Journ. Geol. Soc.,' vol. xl (1884), p. 129, pl. v, figs. 5—10.

Affinities.—This form was referred by Gardner to *N. Cornueliana*, d'Orbigny, but it differs from that in (1) the lesser curvature of the ventral margin; (2) the longer postero-dorsal margin; (3) the greater ventral slope of the antero-dorsal margin. It appears to me to be allied to *N. simplex*, Deshayes,¹ but at present I am unable to speak definitely of its affinities.

Distribution.—Claxby Ironstone (zone of *Bel. lateralis*) of Benniworth Haven; Lower Greensand of Potton.

NUCULA LAMPLUGHI, sp. nov. Plate II, figs. 18 a, b, 19.

Description.—Shell oval, relatively short, rather convex in the umbonal region, but somewhat compressed and tapering anteriorly; extremities rounded. Ventral margin gently curved. Umbones of moderate size. Lunule oval, not sharply limited. Surface of shell smooth except for lines of growth.

Measurements:

		(1)		(2)
Length	. .	22	. .	17 mm.
Height	. .	16	. .	13 „
Thickness	. .	11	. .	9 „

Affinities.—This species is relatively shorter, more rounded posteriorly, and has its lunule less distinctly limited than *N. planata*, Deshayes. It is relatively higher in the umbonal region and tapers more anteriorly than *N. ovata*, Mantell.

Types.—In Mr. Lamplugh's Collection.

Distribution.—Speeton Clay (D 4) of Speeton.

NUCULA, sp. Plate II, figs. 20 a—d.

1884. NUCULA SIMPLEX, *J. S. Gardner*. Quart. Journ. Geol. Soc., vol. xl, p. 129, pl. v, figs. 11—13.

Description.—Shell small, triangular, smooth, somewhat compressed. Umbones small. Apical angle small. Lunule distinct. Posterior part of shell very

¹ 'Mém. Soc. Geol. de Franc,' vol. v (1842), pl. ix, fig. 5, p. 7. D'Orbigny, 'Pal. Franç. Terr. Crét.,' vol. iii (1843), p. 166, pl. ccc, figs. 11—15. Pictet and Campiche, 'Foss. du Terr. Crét. de Ste. Croix' ('Matér. Pal. Suisse,' ser. 4), pt. iii, p. 407. *Non* Gardner, 'Quart. Journ. Geol. Soc.,' vol. xl (1884), p. 129, pl. v, figs. 11—13.

short. Anterior extremity rounded. Antero-dorsal margin slightly curved. Postero-dorsal margin short, nearly straight. Ventral margin gently curved.

Measurements :

Length	.	.	.	.	.	7	mm.
Height	.	.	.	.	.	5.5	„
Thickness	.	.	.	.	.	3.25	„

Remarks.—There are a few specimens of this small species in the British Museum and one or two in Mr. Meÿer's Collection. One in the British Museum was figured by Gardner as *N. simplex*, Deshayes, but it seems to me to be distinct from that form—it is smaller, much more triangular, and has a smaller apical angle. Until a larger series of specimens has been obtained I do not feel justified in giving this form a distinctive name.

Distribution.—Lower Greensand of Atherfield and Shanklin.

NUCULA MEÿERI, *Gardner*, 1884. Plate II, figs. 21 *a—c*.

1884. NUCULA MEÿERI, *J. S. Gardner*. Quart. Journ. Geol. Soc., vol. xl, p. 130, pl. v, figs. 14—16.

Remarks.—This form is at present very imperfectly known. It is small, triangular, and high; with lines of growth, and a large lunule. Gardner states that “it is most nearly allied to *N. impressa* of Blackdown,” but it seems to be almost indistinguishable from *N. antiquata*, Sowerby.

Measurements :

Length	.	.	(1)	.	.	(2)	
			8.5	.	.	8.5	mm.
Height	.	.	8	.	.	7	„

1 is the type specimen; 2 is from Redeliff.

Types.—In the British Museum.

Distribution.—Lower Greensand of Atherfield; *Perna*-bed of Redeliff.

2. Gault and Upper Greensand Species.

NUCULA PECTINATA, *Sowerby*, 1818. Plate II, figs. 22, 23 *a-c*, 24—26, 27 *a-c* ;
Plate III, figs. 13 *a, b*.

1818. NUCULA PECTINATA, *J. Sowerby*. Min. Conch., vol. ii, p. 209, pl. excii,
figs. 6, 7.
1822. — — *G. Mantell*. Foss. S. Downs, p. 94, pl. xix, figs. 5,
6, 9.
1838. — — *H. Michelin*. Mém. Soc. Géol. de France, vol. iii,
p. 102.
1844. — — *A. d'Orbigny*. Pal. Franç. Terr. Crét., vol. iii, p. 177,
pl. ecciii, figs. 8—14.
1850. — — — Prodr. de Pal., vol. ii, p. 138.
1852. — — *F. J. Pictet and W. Roux*. Moll. foss. des Grès verts
de Genève, p. 472, pl. xxxix, fig. 3.
1854. — — *J. Morris*. Cat. Brit. Foss., ed. 2, p. 217.
1855. — — *G. Cotteau*. Moll. Foss. de l'Yonne, p. 84.
1862. PORTLANDIA PECTINATA, *J. G. Chenu*. Man. de Conchyl., &c., vol. ii, p. 180,
fig. 907.
1866. NUCULA PECTINATA, *F. J. Pictet and G. Campiche*. Foss. du Terr. Crét.
de Ste. Croix (Mater. Pal. Suisse, ser.
4), pt. 3, pp. 413, 418, pl. cxxix,
fig. 13.
1884. — — *J. S. Gardner*. Quart. Journ. Geol. Soc., vol. xl,
p. 132, pl. iii, figs. 15, 16.
1897. — — *R. B. Newton*. Proc. Dorset Nat. Hist. and Antiq.
Field Club, vol. xviii, p. 90.
- Non 1846. — — *A. E. Reuss*. Die Verstein. der böhm Kreideformat.,
pt. 2, p. 5, pl. xxxiv, figs. 1—5.
- 1850. — — *H. B. Geinitz*. Das Quadersandstgeb. oder Kreidegeb.
in Deutschland, p. 160.
- 1850. — — *A. Alth*. Geog.-pal. Beschrieb. der nächst. Umgeb.
von Lemberg, Haidinger's Naturw. Ab-
handl., vol. iii, pt. 2, p. 171.
- ? 1868. — — *E. Eichwald*. Lethæa Rossica, vol. ii, p. 586, pl. xxii,
fig. 17.
- 1872. — — *F. Schmidt*. Resultate du Mammuthexpedition, Mém.
de l'Acad. Imp. des Sci. de St. Pétersb., ser. 7,
vol. xviii, No. 1, p. 152, pl. ii, fig. 6.
- 1873. — — *H. B. Geinitz*. Das Elbthalgeb. in Sachsen (Palæontog-
raphica, vol. xx), pt. 2, p. 57, pl. xvii, figs. 3—5.
- 1877. — — *A. Fritsch*. Stud. im Geb. der böhm Kreideformat.
ii. Die Weissenberg. und Maluitz. Schichten, p. 117,
fig. 79.

?	Non 1852.	NUCULA PECTINATA,	<i>R. Kuer.</i>	Denkschr. d. k. Akad. Wissensch. Math.-nat. Cl., vol. iii, p. 312.
—	1885.	—	<i>F. Nötling.</i>	Die Fauna der baltisch. Cenomangeschiebe (Paläont. Abhandl., vol. ii, pt. 4), p. 27, pl. iv, fig. 12.
—	1889.	—	<i>A. Fritsch.</i>	Stud. im Geb. der böhm. Kreideformat. iii. Die Teplitzer Schichten, p. 78.
—	1893.	—	—	Ibid. v. Priesener Schichten, p. 91.
—	1897.	—	<i>A. Hennig.</i>	Revis. af Lamellibr. i Nilsson's 'Petrif. Suecana,' p. 58, pl. iii, fig. 30.

Description.—Shell thick, triangular or somewhat rhomboidal; convex, slightly compressed anteriorly; antero-dorsal border long, slightly convex; postero-dorsal much shorter and concave; ventral margin curved, the arc of the curve often increasing towards the anterior extremity. Posterior extremity angular; anterior rounded or slightly angular. Umbones prominent, curved inwards and posteriorly; usually placed rather near the posterior end of the shell. Lunule deeply depressed, broad, cordate, flattened, smooth except for growth-lines; escutcheon long, nearly smooth except for growth-lines. Surface ornamented with numerous (usually 50 to 52) radiating and rounded ribs, separated by narrower grooves; the grooves, and sometimes also the ribs (especially on the earlier portion of the shell), are crossed by numerous growth-lines. There are often also a few distant concentric depressions. A small rib is placed in the grooves of some of the larger specimens. Teeth: anterior about 22, posterior about 9. Adductor impressions deep, near the margins; the anterior a little larger than the posterior. Margins of valves rather coarsely crenulated.

Measurements :

	(1)	(2)	(3)	(4)	(5)
Length	29	27	26·5	20	17 mm.
Postero-dorsal margin	12·5	13	12	9	7·5 „
Antero-dorsal margin	22	23	19	14	13 „
Height	18	19	17·5	15	11 „
Thickness	—	—	15	11	8·5 „

Affinities.—This species is distinguished from *N. tenera*, Müller,¹ and *N. pulvillus*, Müller,² of the Aachen Greensand by its coarser ornamentation, its greater length, broader lunule, &c. From *N. arduennensis*, d'Orbigny, it is said to differ in the deep lunule and the strong ribs.

Remarks.—The specimens from the Plänerkalk of Hundorf, &c., and the Plänermergel of Luschnitz, &c., which are referred to this species by Reuss, are relatively shorter, and the umbones more acute; the examples figured by that

¹ J. Müller, 'Mon. der Petrefact. der Aachen Kreidef,' pt. i (1847), p. 17, pl. ii, fig. 1. E. Holzapfel, "Moll. der Aachen Kreide" ('Paläontographica,' xxxv, 1889), p. 200, pl. xxi, figs. 9—12.

² Müller, *ibid.*, Supplement (1859), p. 11, pl. vii, fig. 11. Holzapfel, *ibid.*, p. 201, pl. xxi, figs. 7, 8.

author are apparently all casts, so that an exact comparison cannot be made. Geinitz considers that specimens which he obtained from the Plänerkalk of Strehlen and Weinböhla, and from the Plänermergel of Walkmühle near Pirna, belong to *N. pectinata*; but they appear to differ from the English specimens in that the posterior part of the shell is rounded and relatively longer.

The variations seen in different examples of this species are chiefly in the proportions of length and breadth, and in the form of the curve of the ventral margin, the latter giving to the shell a triangular or a rhomboidal outline.

N. striatula, Römer,¹ *N. truncata*, Nilsson,² and *N. Blochmanni*, Geinitz,³ have been regarded by Geinitz and Reuss as identical with *N. pectinata*, Sowerby.

Types.—The types, now in the British Museum, are labelled "Sussex." The specimens figured by Mantell (except fig. 5) and those figured by Gardner are likewise preserved in the British Museum.

Distribution.—Through all the zones of the Gault at Folkestone; Gault of Burham, Aylesford, Black Ven, Devizes, Campton (East Bedfordshire), Ely and Haddenham (Cambs.); Marls with *Bel. minimus* at Speeton; Upper Greensand of Warminster (cast only seen).

NUCULA PECTINATA, Sowerby, var. CRETE, Gardner, 1884. Plate III, figs. 14 a, b, 15.

1884. NUCULA PECTINATA, var. CRETE, J. S. Gardner. Quart. Journ. Geol. Soc., vol. xl, p. 132.

Remarks.—This form appears to differ from *N. pectinata*, Sowerby, only in being proportionately shorter. The surface of the shell, in the two specimens which I have seen, is somewhat abraded, but I do not think that the ornamentation differs from that of *N. pectinata*.

Without more examples I am unable to say whether this form is really distinct from *N. pectinata*.

Measurements :

Length	15 mm.
Height	12 "
Thickness	9 "

Types.—In the Museum of Practical Geology (Nos. 6449, 6450).

Distribution.—Blackdown Greensand.⁴

¹ 'Die Verstein. der norddeutsch. Kreidegeb.' (1841), p. 68, pl. viii, fig. 26 (the type comes from the Plänerkalk of Strehlen).

² 'Petrif. Suecana' (1827), p. 16, pl. v, fig. 6.

³ 'Char. der Schicht. u. Petref. d. sachs. Kreidegeb.,' pt. ii (1840), p. 50, pl. x, fig. 8.

⁴ Erroneously stated by Gardner to come from the *Grey Chalk* of Devon.

Sub-genus—*ACILA*, *H. and A. Adams*, 1858.

(‘Genera of Recent Mollusca,’ vol. ii, p. 545.)

NUCULA (*ACILA*) *BIVIRGATA*, *Sowerby*, 1836. Plate III, figs. 1, 2 *a*—*c*, 3, 4, 5 *a*—*c*, 6—12.

1836. *NUCULA BIVIRGATA*, *J. de C. Sowerby*. Trans. Geol. Soc., ser. 2, vol. iv, p. 335, pl. xi, fig. 8.
1844. — — *A. d'Orbigny*. Pal. Franç. Terr. Crét., vol. iii, p. 176. pl. ccciii, figs. 1—7.
1844. — *ORNATISSIMA*, *d'Orbigny*. Ibid., p. 175, pl. cccii, figs. 9—12.
1854. — *BIVIRGATA*, *J. Morris*. Cat. Brit. Foss., ed. 2, p. 217.
1854. — *ORNATISSIMA*, *Morris*. Ibid., p. 217.
1855. — *BIVIRGATA*, *G. Cotteau*. Moll. Foss. de l'Yonne, p. 84.
1866. — — *F. J. Pictet and G. Campiche*. Foss. du Terr. Crét. de Ste. Croix (Matér. Pal. Suisse, ser. 4), pt. 3, p. 418.
1866. — *ORNATISSIMA*, *Pictet and Campiche*. Ibid., p. 418.
1875. — *BIVIRGATA*, *A. J. Jukes-Browne*. Quart. Journ. Geol. Soc., vol. xxxi, p. 299, pl. xv, figs. 4—8.
1884. — — *J. S. Gardner*. Quart. Journ. Geol. Soc., vol. xl, p. 132, pl. iii, figs. 12—14; pl. iv, figs. 20—22.

Description.—Shell oval, convex, angular posteriorly, rounded anteriorly. Antero-dorsal margin slightly convex, postero-dorsal concave. Ventral margin evenly curved. Lunule cordate, depressed, ornamented with transverse ribs; central part elevated. Escutcheon narrow, elongate, not sharply limited, ornamented with ribs. Surface of shell ornamented with numerous fine radiating ribs crossed by delicate lamellæ; the ribs diverge at an acute angle from a line extending from the umbo in an antero-ventral direction. In some cases the ribs diverge from two lines near together, forming an inverted *W*, thus *M*. New ribs may become intercalated between the others, especially near the margins of the valves of larger specimens. Margins of valves crenulated. Teeth: posterior about six, anterior about twelve. Adductor impressions distinct, rounded, near the margins; the anterior larger than the posterior.

Measurements :

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Length . . .	19	16	14	15	18·5	23	18 mm.
Height . . .	13	12	10	12	13	15·5	13 „
Antero-dorsal margin .	16	14	11	11·5	16	20	15 „
Postero-dorsal margin .	9	8	7	7	8	11	8 „
Thickness . . .	—	—	—	—	11	—	12·5 „

6 and 7 are Gardner's figured specimens of *N. ornatissima* and *N. bivirgata* respectively.

Affinities.—The forms in which the ribs diverge from two lines (thus **M**) were regarded by d'Orbigny as constituting a distinct species—*N. ornatissima*; the only difference being in the form of the ornamentation, and this feature is not constant: in some cases the ribs on the earlier part of the shell diverge from one line, whereas on the later part they diverge from two lines, or the reverse may be the case. The adductor impressions are not so deep in *N. bivirgata* as they are in *N. pectinata*.

N. Devalquei, Briart and Cornet,¹ from the Meule de Bracquegnies, is very closely related to *N. bivirgata*, but in the former the line from which the ribs diverge is directed more anteriorly than it is in the latter species. *N. Devalquei* is stated by the writers mentioned to be longer in proportion to its width than *N. bivirgata*; I have seen no examples of the former.

N. picturata, Yokoyama,² from the Upper Cretaceous of Poronai (Japan), is also allied to *N. bivirgata*; I have seen no specimen of that form, and the figures do not enable me to make an exact comparison.

Remarks.—The variation in the proportions of length and breadth is fairly considerable. In some cases the line from which the two sets of ribs diverge cuts the ventral border of the valve near its middle point, but in others more anteriorly, the position varying in different examples.

Types.—I have not seen the type; it is apparently lost. The specimens figured by Gardner (except figs. 20—22) are in the British Museum; one of those figured by Jukes-Browne (fig. 6) is in the Woodwardian Museum, Cambridge.

Distribution.—Lower Gault (zones v and vii) of Folkestone; also, perhaps, Upper Gault, according to Gardner (?). Gault of Black Ven. Cambridge Greensand.

¹ "Descript. Min., Géol., et Paléont. de la Meule de Bracquegnies" ('Mém. couron. et Mém. des Sav. étrang. Acad. Roy. Belg.', vol. xxiv, 1868), p. 62, pl. v, figs. 26—28.

² "Verstein. aus der japanisch. Kreide," 'Palæontographica,' vol. xxxvi (1889), p. 18, pl. xxv, figs. 1, 2.

NUCULA OVATA, *Mantell*, 1822. Plate III, figs. 16—18, 19 *a*, *b*, 20, 21 *a*, *b*; Plate IV, figs. 1 *a*, *b*.

1822. NUCULA OVATA, *G. Mantell*. Foss. S. Downs, p. 94, pl. xix, figs. 26, 27.
 1838. — CAPSIFORMIS, *H. Michelin*. Mém. Soc. Géol. de France, vol. iii, pl. xii, fig. 8, p. 102.
 1844. — OVATA, *A. d'Orbigny*. Pal. Franç. Terr. Crét., vol. iii, p. 173, pl. cccii, figs. 1—3.
 1850. — — — — — Prodr. de Pal., vol. ii, p. 137.
 1852. — — — — — *F. J. Pictet and W. Roux*. Moll. foss. des Grès verts de Genève, p. 473, pl. xxxix, fig. 4.
 1854. — — — — — *J. Morris*. Cat. Brit. Foss., ed. 2, p. 217.
 1866. — — — — — *F. J. Pictet and G. Campiche*. Foss. du Terr. Crét. des Envir. de Ste. Croix (Matér. Pal. Suisse, ser. 4), pt. 3 pp. 409, 417, pl. cxxix, fig. 9.
 1874. — DERANCEI, *F. G. H. Price*. Quart. Journ. Geol. Soc., vol. xxx, p. 358, pl. xxv, fig. 7.
 1874. — OVATA, *Price*. Ibid., p. 357, pl. xxv, fig. 6.
 1878. — — — — — *O. Fraas*. Aus dem Orient, pt. ii, p. 81.
 1884. — — — — — *J. S. Gardner*. Quart. Journ. Geol. Soc., vol. xl, p. 125, pl. iii, figs. 1—3; pl. iv, figs. 28—30.
 1884. — CAPSIFORMIS, *Gardner*. Ibid., p. 127, pl. iii, figs. 4, 5.
 Non 1827. NUCULA OVATA, *S. Nilsson*. Petrif. Suecana, p. 16, pl. v, fig. 5.
 — 1829. — — — — — *J. Phillips*. Geol. Yorks., pt. 1, pl. ii, fig. 10, p. 122.
 — 1837. — — — — — *W. Hisinger*. Lethæa Suecica, p. 59, pl. xviii, fig. 7.
 — 1846. — — — — — *A. E. Reuss*. Die Verstein. der böhm. Kreideformat., pt. 2, p. 8, pl. xxxiv, fig. 25.
 — 1889. — — — — — *O. Griepenkerl*. Die Verstein. der Senon. Kreide von Königslutter (Palæont. Abhandl., vol. iv), p. 56.
 — 1893. — — — — — *A. Fritsch*. Stud. im Geb. der böhm. Kreideformat. v. Priesener Schichten, p. 92, fig. 103.
 — 1897. — — — — — *A. Hennig*. Revision of Lamellibr. i Nilsson's 'Petrifacta Suecana,' p. 63, pl. iii, fig. 21.

Description.—Shell oblong or ovate-oblong, short posteriorly, compressed, with a slight constriction near the margin opposite the umbo; central part of the ventral margin straight and nearly parallel to the dorsal; anterior margin rounded, forming an obtuse angle with the dorsal; posterior margin slightly angular, but sometimes somewhat rounded. Umbones not much curved. A slight depression usually extends from near the umbo to just below the posterior angle, giving a slight sinuosity to the margin at that point. Lunule ovate, not much depressed, sometimes ill-defined. Surface smooth, but with lines of growth; and in a few cases faint indications of radial ribs, seen chiefly near the middle of the valve. Margins smooth. Adductor impressions shallow.

Measurements:

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	
Length	33	29	27	26	22·5	21	19	18	mm.
Height	21	20	17	15	13	15	13·5	12·5	,,
Thickness	14	12	—	—	—	11	9	9·5	,,

Affinities.—The larger forms of this species, described by Michelin as *N. capsiformis*, and subsequently named *N. Derancei* by Price, have been regarded by some authors as distinct from Mantell's *N. ovata*, but practically the only difference is in size: in France a perfect gradation has been traced between these two types; and a similar passage, although it is stated by Gardner not to exist, can be seen in English specimens. In England the larger forms are recorded by Price from zones i and ii only of the Lower Gault. *N. ovata* is related to *N. obtusa*, Sowerby; the points which distinguish the two are given on p. 23.

Remarks.—The variations in the relative proportions of the length, height, and thickness are fairly great, as will be seen from the table of measurements. The antero-dorsal border may be parallel to the ventral, or may slope more or less obliquely to it. The posterior extremity is commonly somewhat angular, but may be rounded.

Types.—I have not been able to trace Mantell's specimens. The examples figured by Gardner and referred to above (except, perhaps, figs. 28 to 30) are in the British Museum.

Distribution.—Through all the zones (except vii) of the Gault at Folkestone; Gault of Black Ven; Cambridge Greensand (derived); Upper Greensand of Devizes.

NUCULA OBTUSA, *Sowerby*, 1836. Plate IV, figs. 2 a, b, 3, 4 a—d.

1836.	NUCULA OBTUSA,	<i>J. de C. Sowerby.</i>	Trans. Geol. Soc., ser. 2, vol. iv, p. 342, pl. xvii, fig. 11.
1850.	—	—	<i>A. d'Orbigny.</i> Prodr. de Pal., vol. ii, p. 163.
1854.	—	—	<i>J. Morris.</i> Cat. Brit. Foss., ed. 2, p. 217.
? 1866.	—	—	<i>F. J. Pictet and G. Campiche.</i> Foss. du Terr. Crét. de Ste. Croix (Matér. Pal. Suisse, ser. 4), pt. 3, pp. 415, 418, pl. cxxix, fig. 15.
1884.	—	—	<i>J. S. Gardner.</i> Quart. Journ. Geol. Soc., vol. xl, p. 126, pl. iv, figs. 1, 2.
Non 1844.	—	—	<i>A. d'Orbigny.</i> Pal. Franç. Terr. Crét., vol. iii, p. 163, pl. ccc, figs. 1—5 (named <i>N. planata</i> on pl. ccc).

Description.—Shell oval or ovate-oblong, moderately convex, rounded anteriorly and posteriorly; ventral margin evenly curved. Umbones not prominent, placed posteriorly. Lunule indistinctly defined. Surface smooth, but with growth-lines. Hinge with numerous small teeth—about eighteen on the anterior part, and nine on the posterior,—the two parts forming an obtuse angle (about 133°).

<i>Measurements</i> :		(1)		(2)
Length		21	. . . . .	20 mm.
Height		13	. . . . .	14 „
Thickness		13	. . . . .	— „

Affinities.—*N. obtusa* is closely allied to *N. ovata*, Mantell; it differs from the latter (1) in being more oval, (2) in having the ventral margin more regularly curved, (3) in the umbones being usually placed more posteriorly, (4) in the absence of a constriction near the ventral margin, and (5) in the indistinct lunule.

Types.—The type is in the Bristol Museum. The specimen figured by Gardner is in the Museum of Practical Geology, Jermyn Street.

Distribution.—Blackdown Greensand (zones vii to x); Greensand of Haldon (*vide* Downes); Upper Greensand of Devizes and Warminster.

NUCULA IMPRESSA, *Sowerby*, 1824. Plate IV, figs. 5, 6 *a*—*c*, 7, ? 8 *a*, *b*.

1824.	NUCULA IMPRESSA,	<i>J. de C. Sowerby</i> .	Min. Conch., vol. v, p. 118, pl. cccclxxv, fig. 8.
? 1836.	—	APICULATA, <i>J. de C. Sowerby</i> .	Trans. Geol. Soc., ser. 2, vol. iv, p. 342, pl. xvii, fig. 10.
1850.	—	IMPRESSA, <i>A. d'Orbigny</i> .	Prodr. de Pal., vol. ii, p. 163.
1854.	—	— <i>J. Morris</i> .	Cat. Brit. Foss., ed. 2, p. 217.
? 1854.	—	APICULATA, <i>Morris</i> .	Ibid., p. 217.
1866.	—	IMPRESSA, <i>F. J. Pictet and G. Campiche</i> .	Foss. du Terr. Crét. de Ste. Croix (Matér. Pal. Suisse, ser. 4), pt. 3, p. 418, pl. cxxix, fig. 16.
1884.	—	— <i>J. S. Gardner</i> .	Quart. Journ. Geol. Soc., vol. xl, p. 128, pl. iv, figs. 9—12.
Non 1846.	NUCULA IMPRESSA,	<i>A. E. Reuss</i> .	Die Verstein. der böhm. Kreideformat., pt. 2, p. 6, pl. xxxiv, figs. 6, 7.
— 1867.	—	— <i>E. Guéranger</i> .	Album Paléont. du Dép. de la Sarthe, p. 15, pl. xx, fig. 16.
— 1897.	—	— <i>A. Fritsch</i> .	Stud. im Gebiete der böhm. Kreideformat. vi. Die Chlomeker Schichten, p. 56, fig. 61.

Description.—Shell oval, rounded anteriorly, angular posteriorly; ventral margin evenly curved, postero-dorsal margin slightly concave. Umbones placed

very near the posterior end. Lunule elongate, much depressed, sharply limited. Surface with lines of growth. Margins entire. Anterior part of hinge-line with about eighteen teeth, posterior part with seven.

Measurements :

	(1)	(2)	(3)	(4)	(5)
Length	13·5	11·5	11	10	9 mm.
Height	10	8·5	8	7	6 „
Thickness	—	—	5·5	4·75	4·5 „

Affinities.—This species is distinguished from *N. obtusa*, Sowerby, and *N. ovata*, Mantell, by the sharply defined lunule and the angular posterior extremity; it is also a smaller form.

N. apiculata, Sowerby (Plate IV, fig. 8), from Blackdown, appears to me to be only a variety of *N. impressa*; it is somewhat shorter in proportion to its height than the ordinary forms of *N. impressa*, and consequently has a more rounded outline. Sowerby's diagnosis of *N. apiculata* is "Convex, smooth, transversely obovate; posterior extremity pointed." A specimen in the Museum of the Geological Society of London (No. 1564, Fitton Collection) is, I believe, the type, but is a little smaller than Sowerby's figure. The only other example known to me is in Mr. Meÿer's Collection. The late Rev. W. Downes¹ considered *N. apiculata* to be a synonym of *N. antiquata*, Sowerby; but that species is more triangular in outline, the valves are much more convex, and the umbones more prominent.

Types.—One of the types (Sowerby's lower figure) is in the British Museum. One of the specimens figured by Gardner (fig. 12) is in the Bristol Museum; I have not seen the others; they are stated to be in the Rev. W. Downes' Collection, now in the Exeter Museum.

Distribution.—Blackdown Greensand.

NUCULA ALBENSIS, *d'Orbigny*, 1844. Plate IV, figs. 9 *a, b*, 10, 11, 12 *a, b*, 13 *a, b*, 14 *a, b*, 15 *a, b*, 16, ? 17.

1844.	NUCULA ALBENSIS, <i>A. d'Orbigny</i> .	Pal. Franç. Terr. Crét., vol. iii, p. 172, pl. ccci, figs. 15—17.
1850.	— — —	Prodr. de Pal., vol. ii, p. 137.
1866.	— — —	<i>E. J. Pictet and G. Campiche</i> . Foss. du Terr. Crét. de Ste. Croix (Matér. Pal. Suisse, ser. 4), pt. 3, pp. 411, 417, pl. cxxix, fig. 11.
1884.	— — —	<i>J. S. Gardner</i> . Quart. Journ. Geol. Soc., vol. xl, p. 128, pl. iii, figs. 6—8; pl. iv, figs. 24, 25.

¹ 'Trans. Dev. Assoc.,' vol. xii (1880), p. 436; and 'Quart. Journ. Geol. Soc.,' vol. xxxviii (1882), p. 88.

Description.—Shell subtriangular or more or less oval, compressed; posterior part very short and somewhat angular; anterior part usually tapering rapidly, with the extremity rounded. Ventral margin curved evenly. Antero-dorsal margin curved; postero-dorsal nearly straight or slightly concave. Umbones not prominent, curved. Lunule shallow, cordate, often not sharply defined. Anterior area limited by a faint ridge. Surface smooth, but with lines of growth. Margin smooth. Adductor impressions shallow.

Measurements :

	(1)	(2)	(3)	(4)	(5)	
Length	22	17	15	14·5	12	mm. . .
Height	15·5	12	11	10	10	„
Thickness	—	—	8	6	—	„

Affinities.—*N. Timotheana*, Pictet and Roux,¹ is shorter, and apparently more compressed than is *N. albensis*; *N. ovata*, Mantell, is less compressed and more rounded in outline; *N. impressa*, Sowerby, is more oval, and has a more depressed and better defined lunule.

Remarks.—This species varies considerably in the proportions of length and height—the shorter examples being more triangular, the longer more oval in outline. A form found in the Blackdown Greensand (Plate IV, fig. 17), of which I have seen only a few specimens, approaches very closely the shorter types of *N. albensis*, but I have not sufficient material to allow me to speak of its affinities with certainty.

Types.—I have not seen the type; it appears to be missing from the d'Orbigny Collection in the Museum of Natural History, Paris. Some of the specimens figured by Gardner (figs. 6—8) are in the British Museum.

Distribution.—Lower Gault (zone vi) of Folkestone; Gault of Black Ven; Cambridge Greensand (derived). ? Grey Chalk (*vide* Gardner).

NUCULA GAULTINA, Gardner, 1884. Plate IV, figs. 18 a—c, 19, 20, 21 a—c.

1884. NUCULA GAULTINA, J. S. Gardner. Quart. Journ. Geol. Soc., vol. xl, p. 134, pl. iii, figs. 9—11. 26, 27.

Description.—Shell small, triangular, rather convex; pointed anteriorly and posteriorly. Ventral and antero-dorsal margins gently curved; postero-dorsal margin slightly concave. Umbones pointed, curved, placed very posteriorly. Lunule cordate, sharply defined. Anterior area bounded by a ridge passing from the umbo to the anterior extremity. Surface nearly smooth, but with lines of

¹ Moll. Foss. Grès verts de Genève (1852), p. 476, pl. xxxix, fig. 7.

growth, crossed by very indistinct radial ribs. Margin crenulate. Hinge and adductor impressions not seen.

Measurements :

	(1)	(2)	(3)
Length	10	9	8 mm.
Height	8	7	6 „

Affinities.—This species is distinguished from *N. impressa*, Sowerby, by its more triangular outline and larger lunule. It is less convex and proportionately longer than *N. antiquata*, Sowerby, and has less prominent umbones. It is smaller, more pointed at the extremities, and has a deeper and more sharply limited lunule than *N. albensis*, d'Orbigny.

Types.—In the British Museum.

Distribution.—Lower Gault (zones v, vi, and vii) of Folkestone.

NUCULA ANTIQUATA, *Sowerby*, 1824. Plate IV, figs. 22 *a*—*c*, 23 *a*, *b*, 24 *a*, *b*, 25, 26.

1824.	NUCULA ANTIQUATA,	<i>J. de C. Sowerby.</i>	Min. Conch., vol. v, p. 118, pl. cccclxxv, fig. 4.
1854.	—	—	<i>J. Morris.</i> Cat. Brit. Foss., ed. 2, p. 217.
1866.	—	—	<i>F. J. Pictet and G. Campiche.</i> Foss. du Terr. Crét. de Ste. Croix (Matér. Pal. Suisse, ser. 4), pt. 3, p. 418.
1884.	—	—	<i>J. S. Gardner.</i> Quart. Journ. Geol. Soc., vol. xl, p. 134, pl. iv, figs. 3—8.

Description.—Shell very convex, triangular, posterior angle rounded, anterior somewhat pointed; ventral margin curved. Umbones prominent, curved, placed very posteriorly. Lunule very broad, cordate, smooth, depressed, sharply defined. An anterior area is cut off by a ridge passing from the umbones to the anterior margin. Surface ornamented with fine, slight, radiating ribs crossed by well-marked concentric growth-lines. Margins crenulate. Anterior part of the hinge-line has about twenty teeth, and is bent almost at right angles to the posterior part, which has about nine teeth; the anterior part is more than twice the length of the posterior part. Adductor impressions rounded, the anterior being the larger.

Measurements :

	(1)	(2)	(3)	(4)
Length	13	11	10	12 mm.
Antero-dorsal margin	12·5	10	9·5	11 „
Postero-dorsal margin	6	4·5	4·5	5 „
Height	11·5	8·5	8	9 „
Thickness	9	7·5	—	— „

Affinities.—This species is distinguished by the convexity and triangular form of the valves, and by the broad and deep lunule. *N. apiculata*, Sowerby, was regarded by the late Rev. W. Downes as a synonym of *N. antiquata* (see p. 24).

Types.—In the British Museum. The specimens figured by Gardner (except fig. 6, which is in the Downes Collection) are in the Bristol Museum.

Distribution.—Blackdown Greensand (zones vii to x).

3. Chalk Species.

NUCULA, sp. Plate IV, figs. 27, 28.

1897. NUCULA, sp., *H. Woods*. Quart. Journ. Geol. Soc., vol. liii, p. 378, pl. xxvii, figs. 1, 2.

Remarks.—A species of *Nucula* is represented in the Montagu Smith Collection (Woodwardian Museum, Cambridge) by eleven specimens; it approaches closely in form d'Orbigny's *N. Renauwiana*¹ found in the Turonian of Uchaux, but unfortunately all the specimens are internal casts, so that an exact determination is impossible.

Measurements :

Length	.	.	.	.	.	13 mm.
Height	.	.	.	.	.	10 „

Distribution.—Chalk Rock (*Reussianum*-zone) of Cuckhamsley.

Family—ANOMIIDÆ, Gray.

Genus—ANOMIA, Linnæus, 1758.

(‘Syst. Nat.’ ed. 10, p. 700.)

1. Lower Cretaceous Species.

ANOMIA PSEUDORADIATA, d'Orbigny, 1850. Plate V, figs. 1 a—c, 2, 3.

1836. ANOMIA RADIATA, *J. de C. Sowerby* (non *Risso*). Trans. Geol. Soc., ser. 2, vol. iv, p. 338, pl. xiv, fig. 5.

¹ ‘Pal. Franç. Terr. Crét.’ vol. iii (1844), p. 179, pl. ccciv, figs. 7—9. This is regarded by Pietet and Campiche (‘Foss. Terr. Crét. Ste. Croix,’ pt. iii [1866], p. 418) as a synonym of *N. impressa*, Sowerby.

1850. ANOMIA PSEUDORADIATA, *A. d'Orbigny*. Prodr. de Pal., vol. ii, p. 84.
 1854. — — — — — *RADIATA, J. Morris*. Cat. Brit. Foss., ed. 2, p. 161.
 Non ? 1846. — — — — — *A. E. Reuss*. Die Verstein. der böhm. Kreideformat.,
 pt. ii, p. 45.
 — 1877. — — — — — ? *A. Fritsch*. Stud. im Gebiete der böhm. Kriedef. ii. Die
 Weissenb. und Malnitz. Schichten, p. 142, fig. 142.

Description.—Shell oval, a little irregular, higher than long. Left valve moderately convex, ornamented with numerous radial ribs, which on the adult shell are more distinct and more wavy than on the younger part of the shell, and of two sizes, the larger being distinctly granular. The radial ribs are sometimes crossed by concentric growth-lines. Umbo near the margin.

Measurements :

	(1)	(2)	(3)
Length . . .	22 . . .	20 . . .	21 mm.
Height . . .	23 . . .	22 . . .	24 „

Affinities.—This species appears to be similar to *A. subtruncata*, d'Orbigny,¹ from the Plänerkalk of Strehlen, &c., but in that form the shell is much more regularly oval than in *A. pseudoradiata*.

Types.—In the Museum of the Geological Society (No. 2029), from the Hythe Beds, near Sandgate.

Distribution.—Crackers, &c., of Atherfield; Ferruginous Sands (upper beds) of Shanklin; Hythe Beds, near Sandgate; Atherfield Beds of East Shalford, Sevenoaks, and Redhill.

ANOMIA, sp. Plate V, figs. 4, 5 *a*, *b*.

Description.—Shell more or less orbicular or oval, and rather inequilateral. Left valve moderately convex with a rather prominent umbo at the margin; ornamented with radial ribs, which are slender, widely separated, only a little elevated, and rather irregular.

Measurements :

	(1)	(2)
Length . . .	17 . . .	9 mm.
Height . . .	16 . . .	8.5 „

Affinities.—In *A. costulata*, Römer,² the umbo is not at the margin and is somewhat spiral, and the ribs are more numerous; the last is also the case in

¹ *A. truncata*, Geinitz (*non* Linnaeus), 'Char. d. Schicht. und Petref. sächs.-böhm. Kreidegeb.', pt. iii (1842), p. 87, pl. xix, figs. 4, 5; and "Das Elbtalgeb. in Sachsen" ('Paläontographica,' vol. xx), pt. 2 (1872), p. 30, pl. viii, figs. 22, 23. *A. subtruncata*, A. d'Orbigny, 'Prodr. de Pal.' vol. ii (1850), p. 171.

² 'Die Verstein. Nord-deutsch. Ool-geb. Nachtrag' (1839), p. 24, pl. xviii, fig. 5.

A. intercostata, Zittel.¹ The ornamentation in this form resembles that of *A. subradiata*, Reuss,² but in that species the shell appears to be less inequilateral.

Remarks.—I have seen only two examples of this form; it appears to be quite distinct from the other English species, and to resemble most *A. subradiata*, Reuss, from the Plänermergel of Luschitz.

Distribution.—Crackers of Atherfield.

ANOMIA LÆVIGATA, *Sowerby*, 1836. Plate V, figs. 6, 7 *a*, *b*, 8 *a*, *b*, 9.

1836.	ANOMIA LÆVIGATA,	<i>J. de C. Sowerby.</i>	Trans. Geol. Soc., ser. 2, vol. iv, p. 338, pl. xiv, figs. 6 <i>a</i> , <i>b</i> .
? 1847.	— —	<i>A. d'Orbigny.</i>	Pal. Franç. Terr. Crét., vol. iii, p. 755, pl. cccclxxxix, figs. 4—6.
1850.	— —	—	Prodr. de Pal., vol. ii, p. 84.
1854.	— —	<i>J. Morris.</i>	Cat. Brit. Foss., ed. 2, p. 161.

Description.—Shell regular, nearly orbicular; surface smooth except for lines of growth. Left valve moderately convex; umbo small, at or near the margin.

Measurements:

	(1)	(2)	(3)
Length . . .	36	22	14 mm.
Height . . .	32	21	13 ,,

Types.—One of the types (Pl. V, fig. 6, and *Sowerby's* fig. 6 *a*), from the Hythe Beds of Lympne, is in the Museum of Practical Geology (No. 6414); I have not seen the other.

Distribution.—Ferruginous Sands (upper beds) of Shanklin; Atherfield Beds of Peasmarsh; Hythe Beds of Lympne; Lower Greensand of Punfield.

ANOMIA CONVEXA, *Sowerby*, 1836. Plate V, figs. 10 *a*, *b*.

1836.	ANOMIA CONVEXA,	<i>J. de C. Sowerby.</i>	Trans. Geol. Soc., ser. 2, vol. iv, p. 338, pl. xiv, fig. 7.
1854.	— —	<i>J. Morris.</i>	Cat. Brit. Foss., ed. 2, p. 161.

Description.—Shell rather small, more or less orbicular or quadrate; surface smooth, or with fine ribs. Left valve very much inflated, with a rather prominent umbo.

¹ 'Die Bivalven der Gosaugeb.,' pt. ii (1866), p. 51, pl. xix, fig. 10.

² 'Die Verstein. der böhm. Kreideformat.,' pt. ii (1846), p. 45, pl. xxxi, figs. 18, 19.

Measurements :

Length	.	.	.	.	.	14 mm.
Height	.	.	.	.	.	13 „

Remarks.—This species is imperfectly known at present. The only specimens I have seen are in the Museum of the Geological Society, and in Mr. Meÿer's Collection. With regard to the type specimen, Sowerby remarks, "The furrows are produced by a *Terebratula* [*Rhynchonella*] to which this specimen was attached, and to which it consequently bears a great resemblance."

Types.—The type, from the Lower Greensand of Shanklin, is in the Museum of the Geological Society (No. 2032).

Distribution.—Lower Greensand of Redhill (Reigate) and Atherfield; Ferruginous Sands (upper beds) of Shanklin.

2. *Gault and Upper Greensand Species.*

ANOMIA, sp.; cf. PSEUDORADIATA, d'Orbigny. Plate V, figs. 11 a, b.

Remarks.—This form appears to differ from *A. pseudoradiata*, d'Orbigny, only in having finer and less distinct ribs; the difference may perhaps be due to the mode of preservation. At present I have seen only two specimens.

Distribution.—Gault of Black Ven (Museum of Practical Geology, No. 6440) and Folkestone.

ANOMIA, spp.

In the Museum of Practical Geology, Jermyn Street, there are several specimens from the Upper Greensand of Devizes and Warminster; some appear to be closely related to *A. lævigata*, Sowerby, others to *A. pseudoradiata*, d'Orbigny, but they are not sufficiently well preserved to allow of exact determination.

3. *Chalk Species.*

ANOMIA ? TRANSVERSA, Seeley, 1861. Plate V, figs. 12 a, b.

1861. ANOMIA ? TRANSVERSA, H. G. Seeley. Ann. Mag. Nat. Hist., ser. 3,
vol. vii, p. 123, pl. vi, fig. 8.

Description.—"Shell ovate, elongated, inflated. Umbo large, prominent, inclining to the posterior end rather than central" (Seeley).

Measurements :

Length	17 mm.
Height	12 „

Remarks.—This form may perhaps be related to *A. papyracea*, d'Orbigny, but without better specimens I am unable to make any definite statement concerning it.

Types.—I have not seen the specimen figured by Seeley, but other examples to which he refers are preserved in the Woodwardian Museum, Cambridge.

Distribution.—Cambridge Greensand.

ANOMIA PAPHYRACEA, *d'Orbigny*, 1847. Plate V, figs. 13—16.

1847. ANOMIA PAPHYRACEA, *A. d'Orbigny*. Pal. Franç. Terr. Crét., vol. iii, p. 755, pl. cccclxxxix, figs. 7—10.
1850. ANOMIA PAPHYRACEA, *A. d'Orbigny*. Prodr. de Pal., vol. ii, p. 171.
1881. ANOMIA PAPHYRACEA, *A. d'Orbigny*, var. BURWELLENSIS, *R. Etheridge*. In Penning and Jukes-Browne, Geol. Neighbourhood of Cambridge (Mem. Geol. Survey), p. 145, pl. iii, figs. 3, 4.

Description.—Shell more or less oval, longer than high, nearly smooth, but sometimes with faintly marked concentric ribs. Left valve slightly convex; umbo small, near the margin. Right valve flat or slightly concave.

Measurements :

	(1)	(2)	(3)
Length	33	35	28 mm.
Height	23	25	21 „

Affinities.—This species is distinguished from *A. laevigata*, Sowerby, by its oval form and lesser convexity.

Types.—The type is not in the d'Orbigny Collection. The specimens figured by Etheridge are in the Woodwardian Museum, Cambridge.

Distribution.—Totternhoe Stone (zone of *Holaster subglobosus*) of Burwell and Reach.

Family—ARCIDÆ, *Lamarck*.

Genus—ARCA, *Linnaeus*, 1758 (*sensu stricto*).

(‘*Syst. Nat.*,’ ed. 10, p. 693.)

1. *Lower Cretaceous Species*.

ARCA DUPINIANA, *d’Orbigny*, 1844. Plate VI, figs. 1 a, b, 2, 3.

1844.	ARCA DUPINIANA, <i>A. d’Orbigny</i> .	Pal. Franç. Terr. Crét., vol. iii, p. 207, pl. cccx, figs. 9, 10.
1845.	— —	<i>E. Forbes</i> . Quart. Journ. Geol. Soc., vol. i, p. 246.
1850.	— —	<i>A. d’Orbigny</i> . Prodr. de Pal., vol. ii, p. 80.
1854.	— —	<i>J. Morris</i> . Cat. Brit. Foss., ed. 2, p. 185.
1855.	— —	<i>G. Cotteau</i> . Moll. Foss. de l’Yonne, p. 86.
1866.	— —	<i>F. J. Pictet and G. Campiche</i> . Foss. du Terr. Crét. Ste. Croix (Matér. Pal. Suisse, ser. 4), pt. 3, pp. 438, 468.
1867.	— —	<i>P. de Loriol</i> . In <i>A. Favre</i> , Recherch. géol. dans Savoie, &c., vol. i, p. 381.
1871.	— —	<i>F. Stoliczka</i> . Palæont. Indica, Cret. Fauna S. India, vol. iii, p. 342 (<i>Barbatia</i>).

Description.—Shell elongate, very inequilateral, convex. Anterior margin rounded. Ventral margin sinuous, roughly parallel to the hinge-line. Posterior margin very oblique, nearly straight, forming sharply marked obtuse and acute angles with the dorsal and ventral margins respectively. Umbones prominent, moderately distant, with a prominent toothed carina extending to the postero-ventral angle, and cutting off a depressed postero-dorsal area. Hinge-line long. Hinge-area rather large. Ornamentation consists of numerous fine radial ribs—more prominent at the anterior end—crossed by concentric growth-lines. Postero-dorsal area with four strong radial ribs which project posteriorly, giving a toothed margin. Teeth numerous, small, transverse, the terminal teeth slightly oblique.

Measurements :

Length	25 mm.
Height	12·5 „
Thickness	13 „

Affinities.—This species is distinguished by its prominent toothed carina and strong postero-dorsal ribs. Its form is somewhat similar to that of *A. Sanctæ-Crucis*, Pictet and Campiche (see p. 34), but its posterior margin is more oblique.

It also appears to be related to *Arca Dufrenoyi*, d'Archiac,¹ but in that form the antero-dorsal extremity is rectangular. The hinge of *A. Dufrenoyi* seems to be unknown.

Types.—I have not seen the type; it came from the Neocomian of Marolles (Aube).

Distribution.—*Perna*-bed of Atherfield; Atherfield Beds of East Shalford and Peasmarsh; Ferruginous Sands (upper beds) of Shanklin.

ARCA CARTERONI, *d'Orbigny*, 1844. Plate VI, figs. 4 a—c, 5 a—c.

1844.	ARCA CARTERONI, <i>A. d'Orbigny</i> .	Pal. Franç. Terr. Crét., vol. iii, p. 202, pl. ccxix, figs. 4—8.
1845.	— —	<i>E. Forbes</i> . Quart. Journ. Geol. Soc., vol. i, p. 246.
1854.	— —	<i>J. Morris</i> . Cat. Brit. Foss., ed. 2, p. 185.
1866.	— —	<i>F. J. Pictet and G. Campiche</i> . Foss. du Terr. Crét. de Ste. Croix (Matér. Pal. Suisse, ser. 4), pt. 3, pp. 436. 468, pl. cxxx, fig. 9.
1883.	— —	<i>W. Keeping</i> . Foss., &c., of Neoc. of Upware and Brick- hill, p. 114, pl. v, fig. 7.

Description.—Shell oblong, very elongate and thick. Dorsal and ventral margins straight and nearly parallel. Hinge-line extends to the most anterior part of the shell, and forms with the anterior margin a right angle; the anterior margin curves ventrally from the hinge-line. Posterior margin a little oblique. Umbones of moderate size, widely separated, only slightly curved, with a low rounded carina extending to the postero-ventral angle; between the carina and the hinge-line is a second indistinct carina. Hinge-area very broad and large, lozenge-shaped, with several (about seven) ligament-grooves. Ornamentation consists of fine radial ribs. Hinge: the teeth near the umbo are small and transverse, but towards the extremities they become more oblique and longer.

Measurements:

	(1)	(2)
Length	40	28 mm.
Height	16	13 „
Thickness	20	— „
	(1) From Upware.	(2) From East Shalford.

¹ 'Bull. Soc. Géol. de France,' ser. 2, vol. xi (1854), p. 214, pl. iii, fig. 9.

Affinities.—See *A. Sanctæ-Crucis* (below). The external teeth are more oblique in this than in most forms of *Arca*, in which respect it may be compared with *A. equidens*, Tate.¹

Distribution.—Lower Greensand of Upware. Atherfield Beds of East Shalford and Peasmarsh. ? *Perna*-bed of Redcliff.

ARCA SANCTÆ-CRUCIS, *Pictet and Campiche*, 1866. Plate VI, figs. 6 a—c, 7 a—c.

1866. ARCA SANCTÆ-CRUCIS, *F. J. Pictet and G. Campiche*. Foss. du Terr. Crét. de Ste. Croix (Matér. Pal. Suisse, ser. 4), pt. 3, p. 437, pl. cxxx, figs. 10, 11.

Description.—Shell elongate, very convex in the umbonal region; wedge-like posteriorly. Anterior margin rounded, more or less perpendicular to the hinge-line. Ventral margin a little sinuous, more or less parallel to the dorsal. Posterior margin nearly straight, and either at right angles or slightly oblique to the hinge-line. Umbones prominent, incurved, placed near the anterior third of the shell. Carina rounded; postero-dorsal area depressed, sometimes slightly concave, with one or two faint broad ridges. Hinge-area long and broad. Ornamentation consists of numerous fine radial ribs crossed by lines of growth. Interior not seen.

Measurements:

	(1)	(2)
Length	31	25 mm.
Height	17	14 „
Thickness	16.5	13 „

(1) and (2) are from Upware.

Affinities.—This form agrees in many respects with *A. Carteroni*, d'Orbigny, and it is likely that a large series of specimens would show a passage between the two. At present I have seen only three or four examples of each. *Arca Sanctæ-Crucis* appears to differ from *A. Carteroni* in being proportionately shorter, in having the ventral margin sinuous and less parallel to the dorsal, and in the umbones being more prominent and incurved.

It also appears to be similar to *Arca autissiodorensis*, Cotteau,² but seems to be less inflated and to have the posterior margin less oblique.

¹ 'Trans. Roy. Soc. S. Australia,' vol. viii (1886), p. 139, pl. xi, fig. 9; G. F. Harris, 'Cat. Tert. Mollusca' (Brit. Mus.), part i (1897), p. 331.

² 'Moll. Foss. de l'Yonne' (1855), p. 86; de Loriol and Cotteau, 'Mon. Pal. Géol. de Portlandien de l'Yonne' (1868), p. 179, pl. x, figs. 6, 7.

Type.—From the Valangian of Sainte Croix.

Distribution.—Lower Greensand of Upware. Atherfield Beds of East Shalford.

2. Upper Cretaceous Species.

ARCA PHOLADIFORMIS, *d'Orbigny*, 1844.

1844.	ARCA PHOLADIFORMIS,	<i>A. d'Orbigny</i> .	Pal. Franç. Terr. Crét., vol. iii, p. 219, pl. cccxv, figs. 1—3.
1850.	—	—	Prodr. de Pal., vol. ii, p. 164.
1866.	—	—	<i>F. J. Pictet and G. Campiche</i> . Foss. du Terr. Crét. Ste. Croix (Matér. Pal. Suisse, ser. 4), pt. 3, p. 473.
1867.	—	—	<i>E. Guéranger</i> . Album Paléont. Sarthe, p. 16, pl. xxi, figs. 5, 11.
1871.	—	—	<i>E. Stoliczka</i> . Palæont. Indica, Cret. Fauna S. India, vol. iii, p. 343.
?? 1883.	—	cf. —	<i>A. Fritsch</i> . Stud. im Geb. der böhm. Kreide- format. iii. Die Iser Schichten, p. 104, fig. 69.

Remarks.—An internal mould of a right valve from the Upper Greensand of Devizes, which almost certainly belongs to this species, is preserved in the Museum of Practical Geology (No. 6454); its length is 28 mm., and its height 11 mm. I have seen no other specimen. The hinge is apparently unknown.

Genus—BARBATIA, *J. E. Gray*, 1847.

[‘Syn. Brit. Mus.,’ 1840, p. 151 (*nom. nud.*); ‘Proc. Zool. Soc.,’ 1847, p. 197.]

1. Lower Cretaceous Species.

BARBATIA APTIENSIS (*Pictet and Campiche*), 1866. Plate VI, figs. 8 *a—e*, 9 *a, b*.

1845.	ARCA RAULINI,	<i>E. Forbes</i> .	Quart. Journ. Geol. Soc., vol. i, p. 245 (<i>partim</i>).
1850.	—	—	<i>A. d'Orbigny</i> . Prodr. de Pal., vol. ii, p. 80 (<i>partim</i>).
1854.	—	—	<i>J. Morris</i> . Cat. Brit. Foss., ed. 2, p. 185.
1857.	—	—	<i>F. J. Pictet and E. Renevier</i> . Foss. du Terr. Aptien (Matér. Pal. Suisse, ser. 1), p. 106, pl. xv, figs. 1—3.
? 1865.	—	CYMODOCE,	<i>H. Coquand</i> . Mon. de l'étage Aptien de l'Espagne, p. 140, pl. xii, figs. 7, 8.

1866. ARCA APTIENSIS, *F. J. Pictet and G. Campiche*. Foss. du Terr. Crét. de Ste. Croix (Matér. Pal. Suisse, ser. 4), pt. 3, pp. 454, 471.
1871. — — *F. Stoliczka*. Palæont. Indica, Cret. Fauna S. India, vol. iii, p. 343 (*Trigonoarca?*).
- ? 1871. — CYMODOCE, *Stoliczka*. Ibid., p. 345.
- ? 1884. — RAULINI, *O. Weerth*. Die Fauna Neocom. Teutoburg. Walde. (Palæont. Abhand., vol. ii), p. 47.

Description.—Shell oblong, a little higher near the posterior part of the hinge-line than elsewhere, very inequilateral. Anterior margin forming a sharp angle (often about 90°) with the hinge-line, and curving evenly to join the ventral margin, which is slightly curved, and has a general slope posteriorly. Posterior margin oblique, slightly convex, forming obtuse and acute angles with the dorsal and ventral margins respectively—the acute angle being somewhat rounded. Umbones not prominent, close together, with a rounded carina extending in a double curve to the postero-ventral angle, and cutting off a concave triangular area. Shell compressed in front of the umbones. Hinge-line about three quarters of the length of the shell. Hinge-area narrow, elongate. Ornamentation consists of well-marked concentric ribs, and numerous fine radial ribs. On the anterior part of the shell, at intervals, some of the radial ribs become more prominent, and curve anteriorly. On the postero-dorsal area, and also near the carina, at intervals, some of the radial ribs are more elevated than the others, and here the concentric ribs are less distinct than elsewhere. Central teeth small and transverse, lateral teeth oblique.¹

Measurements :

	(1)	(2)
Length	28	37 mm.
Height	14	21 „
Thickness	—	16 „

Affinities.—By most authors this species has been referred to *Cucullæa Raulini*, Leymerie,² to which it is certainly closely related; in fact, a larger collection of French specimens than I have been able to examine might well show the two forms to be identical. I have not seen the type of *B. Raulini*, nor the original of d'Orbigny's figures, but other specimens in the d'Orbigny Collection and the École des Mines, Paris. Stoliczka remarks on the difference between Leymerie's and d'Orbigny's figures of that species, and suggests that either one figure is incorrect or that they represent two distinct species. I think that the two figures

¹ The characters of the teeth are given on the authority of Pictet and Campiche.

² 'Mém. Soc. Géol. de France,' vol. v (1842), pl. x, fig. 1, p. 7; d'Orbigny, 'Pal. Franç. Terr. Crét.,' vol. iii (1844), p. 204, pl. ccxx, figs. 1, 2; Pictet and Campiche, "Foss. du Terr. Crét. de Ste. Croix" ('Matér. Pal. Suisse,' ser. 4), pt. 3, pp. 440, 469.

represent the same form, but that Leymerie's specimen was imperfect in the postero-dorsal region. *B. aptiensis* appears to differ from *B. Raulini* in the greater height of the posterior part of the shell and consequent greater obliquity and curvature of the ventral margin, and in the presence of a few radial ribs, stronger than the others, on the anterior part of the shell. The average size of the English form appears to be greater than that of the French. *B. aptiensis* is also very similar to *A. neocomiensis*, d'Orbigny. Judging from the figure the latter seems to differ chiefly in having the posterior extremity pointed instead of obliquely truncate.

Arca cymodoce, Coquand, is perhaps identical with this form, but its area appears to be shorter.

Types.—From the Crackers of Atherfield and the Aptian of the Perte-du-Rhône and Presta.

Distribution.—*Perna*-bed, Atherfield Clay, and Crackers of Atherfield; Ferruginous Sands of Sandown; Atherfield Beds of Haslemere, East Shalford, and Sevenoaks.

Sub-genus—SCAPHULA, Benson, 1834.

[‘Proc. Zool. Soc.’ pt. ii, p. 91.]

BARBATIA (SCAPHULA?) AUSTENI (*Forbes*), 1845. Plate VII, figs. 1 *a*, *b*, 2, 3.

1845. CARDIUM (HEMICARDIUM)? AUSTENI, *E. Forbes*. Quart. Journ. Geol. Soc., vol. i, p. 244, pl. iii, fig. 3.
 1850. ARCA AUSTENI, *A. d'Orbigny*. Prodr. de Pal., vol. ii, p. 118.
 1854. CARDIUM AUSTENI, *J. Morris*. Cat. Brit. Foss., ed. 2, p. 192.
 1866. ARCA AUSTENI, *F. J. Pictet and G. Campiche*. Foss. du Terr. Crét. de Ste. Croix (Matér. Pal. Suisse, ser. 4), pt. 3, p. 471.

Description.—Shell oval, very oblique and inequilateral. Anterior margin rounded, passing gradually into the curved and oblique ventral margin. Posterior margin a little convex, oblique, forming an acute angle with the ventral margin. Umbones of moderate size, incurved, with a very sharp carina extending to the postero-ventral angle; postero-dorsal area sharply depressed. Hinge-line short. Hinge-area small, triangular, with several ligament-grooves. Ornamentation consists of slightly elevated radial ribs crossed by faintly marked lines of growth; the radial ribs are sometimes indistinct, but on the postero-dorsal area they are more prominent than elsewhere. Interior not seen.

Measurements :

	(1)	(2)
Length	35	21 mm.
Height	21	17 ,,
Umbo to postero-ventral angle	47	26 ,,
	(1) <i>Perna</i> -bed, Atherfield.	(2) Crackers, Atherfield.

Affinities.—This differs from all other Cretaceous species with which I am acquainted. The form of the shell and the character of its ornamentation agree closely with the recent *Scaphula*, but since in our species the interior is unknown, I refer it with considerable doubt to that sub-genus.

Type.—In the Museum of the Geological Society (No. 2152), from Peasmarsh.

Distribution.—Atherfield Beds of Sevenoaks, Peasmarsh, East Shalford, and Redcliff (Isle of Wight). Crackers and *Perna*-bed of Atherfield.

2. *Upper and Lower Cretaceous Species.*

BARBATIA MARULLENSIS (*d'Orbigny*), 1844. Plate VII, figs. 4, 5 *a—d*, 6 *a, b, 7*.

1844. ARCA MARULLENSIS, *A. d'Orbigny*. Pal. Franç. Terr. Crét., vol. iii, p. 205, pl. cccx, figs. 3—5.
1854. — — *J. Morris*. Cat. Brit. Foss., ed. 2, p. 185.
1855. — — *G. Cotteau*. Moll. Foss. de l'Yonne, p. 87.
1866. — — *F. J. Pictet and G. Campiche*. Foss. Terr. Crét. de Ste. Croix (Matér. Pal. Suisse, ser. 4), pt. 3, pp. 432, 468, pl. cxxx, figs. 1—4.
1867. — — *P. de Loriol*. In *A. Favre*, Recherch. géol. dans Savoie, &c., vol. i, p. 382.
1869. — — *P. de Loriol and V. Gillieron*. Mon. pal. et strat. de l'étage Urgon. inf. du Landeron (Mém. Soc. Helvét. des Sci. Nat., vol. xxiii), p. 16, pl. i, fig. 13.
1871. — — *F. Stoliczka*. Paleont. Indica, Cret. Fauna S. India, vol. iii, p. 342 (*Barbatia*).
1883. — — *W. Keeping*. Foss., &c., Neoc. Upware and Brickhill, p. 114.
- NOV 1850. BYSSOARCA MARULLENSIS, *J. de C. Sowerby*. In *F. Dixon*, Geol. Sussex, p. 355, pl. xxviii, fig. 11.
- 1878. — — *Sowerby*. Ibid., ed. 2, p. 385, pl. xxviii, fig. 11.

Description.—Shell oblong, inequilateral, rather compressed. Anterior and posterior margins rounded, the postero-dorsal somewhat oblique; ventral margin parallel to the dorsal. Umbones not prominent, rather close; carina near the

umbones only, not well-marked. Postero-dorsal part of the shell sharply compressed. Hinge-area narrow, depressed, with close-set ligament-grooves. Ornamentation consists of many equal-sized radial ribs, separated by narrow grooves, and crossed by less distinct concentric grooves. Occasionally smaller ribs (radial) appear in the grooves. On the postero-dorsal area the radial ribs are broader and more flattened.

<i>Measurements :</i>	(1)	(2)	(3)	(4)
Length	25.5	31	30	15 mm.
Height	15	28	16	9 „
Thickness	11	11	—	— „

(1) is from Upware; (2)—(4) are from Folkestone.

Affinities.—The shell is more rounded at the extremities and the umbones are less anterior than in *Barbatia Raulini* (d'Orbigny).

B. marullensis is very similar to *Arca Baudoniana*, Cotteau;¹ the latter is of larger size, and may be only an older example of the former. It is also related to *A. aubersonensis*, Pictet and Campiche.²

Arca Hugardiana, d'Orbigny, differs in the ventral margin being oblique, and in having coarser radial ribs and less distinct concentric ornament. In *Arca Galliennei*, d'Orbigny, the umbones are more anterior (see p. 41).

Remarks.—I have seen only two examples from the Lower Greensand, both from Upware, but the species has been recorded from Faringdon; it is not common in the Gault. The concentric ornament is not distinctly seen in the Upware specimens, but that is probably due to the somewhat worn nature of the shell.

Types.—Specimens which agree well with the figures are in the d'Orbigny Collection, but I could not identify the type with certainty.

Distribution.—Lower Greensand of Upware, and (*vide* Morris) of Faringdon. Gault (zones iii, vii, x, xi) of Folkestone. ? Cambridge Greensand (internal moulds only).

¹ 'Moll. Foss. de l'Yonne' (1855), p. 86; Pictet and Campiche, "Foss. Terr. Crét. de Ste. Croix" ('Matér. Pal. Suisse,' ser. 4), pt. 3, p. 432, pl. cxxx, fig. 5.

² *Ibid.*, p. 433, pl. cxxx, fig. 6.

3. *Upper Cretaceous Species.*BARBATIA HUGARDIANA (*d'Orbigny*), 1844.

1844. ARCA HUGARDIANA, *A. d'Orbigny*. Pal. Franç. Terr. Crét., vol. iii, p. 216, pl. ccxciii, figs. 4—6.
 1850. — — — Prodr. de Pal., vol. ii, p. 138.
 1852. — — *F. J. Pictet and W. Roux*. Moll. Foss. Grès verts de Genève, p. 457, pl. xxxvi, fig. 1.
 1866. — — *F. J. Pictet and G. Campiche*. Foss. du Crét. de Ste. Croix (Matér. Pal. Suisse, ser. 4), pt. 3, p. 460.
 1871. — — *F. Stoliczka*. Palæont. Indica, Cret. Fauna S. India, vol. iii, p. 343 (*Barbatia*).
 1875. — — *A. J. Jukes-Browne*. Quart. Journ. Geol. Soc., vol. xxxi, p. 299 (? *partim*).

Some internal casts from the Cambridge Greensand (derived) may perhaps belong to this species.

BARBATIA ROTUNDATA (*Sowerby*), 1836. Plate VII, figs. 8 *a—c*.

1836. ARCA ROTUNDATA, *J. de C. Sowerby*. Trans. Geol. Soc., ser. 2, vol. iv, p. 342, pl. xvii, fig. 8.
 1848. — ROTUNDATA, *H. P. Nyst*. Tableau des Espèces vivante et foss. des Arcaécées (Mém. Acad. Roy. Belgique, vol. xxii), p. 64.
 1854. — ROTUNDATA, *J. Morris*. Cat. Brit. Foss., ed. 2, p. 185.
 1866. — — *F. J. Pictet and G. Campiche*. Foss. du Terr. Crét. de Ste. Croix (Matér. Pal. Suisse, ser. 4), pt. iii, p. 473.
 1871. — — *F. Stoliczka*. Palæont. Indica, Cret. Fauna S. India, vol. iii, p. 343 (*Barbatia*).

Description.—Shell moderately convex, oblong, inequilateral, highest posteriorly. Anterior and posterior margins rounded; ventral oblique to the hinge-line, sinuous at the middle. Umbones close together, with an ill-defined posterior carina. Shell much compressed postero-dorsally; also slightly compressed ventral to the umbones. Ornamentation consists of numerous fine radial ribs separated by narrow grooves, and crossed by a few distant concentric growth-lines. Interior not seen.

Measurements :

Length	26 mm.
Height (approximate)	15 ,,

Affinities.—*Barbatia rotundata* appears to be closely related to d'Orbigny's¹ *Arca Raspailli*, but without seeing specimens of the latter, and with only one example of the former before me, I am unable to determine their relationship. *B. rotundata* is much smaller than the figured forms of *A. Raspailli*, and seems to be proportionately more convex.

B. Hugardiana (d'Orbigny) is proportionately longer and more coarsely ribbed. *B. Galliennei* (d'Orbigny) is not so high posteriorly.

Type.—Bristol Museum. This is the only specimen I have seen.

Distribution.—Blackdown Greensand.

BARBATIA VENDINENSIS (d'Orbigny), 1844.

1844.	ARCA VENDINENSIS, <i>A. d'Orbigny.</i>	Pal. Franç. Terr. Crét., vol. iii, p. 220, pl. ccxv, figs. 4—7.
1850.	— — —	Prodr. de Pal., vol. ii, p. 164.
1866.	— — —	<i>F. J. Pictet and G. Campiche.</i> Foss. du Terr. Crét. Ste. Croix (Matér. Pal. Suisse, ser. 4), pt. 3, p. 474.
1871.	— — —	<i>F. Stoliczka.</i> Palæont. Indica, Cret. Fauna S. India, vol. iii, p. 343 (<i>Barbatia</i>).
? 1897.	— — —	<i>A. Fritsch.</i> Stud. im Gebiete der böhm. Kreideformat. vi. Die Chlomeker Schichten, p. 57, fig. 63.

An imperfect right valve from the Chalk Marl (Meyer's Bed 10) of Dunscombe, in Mr. Meyer's Collection, probably belongs to this species.

* BARBATIA GALLIENNEI (d'Orbigny), 1844. Plate VII, figs. 9 *a*, *b*.

1844.	ARCA GALLIENNEI, <i>A. d'Orbigny.</i>	Pal. Franç. Terr. Crét., vol. iii, p. 218, pl. ccxiv.
1850.	— — —	Prodr. de Pal., vol. ii, p. 164.
1866.	— — —	<i>F. J. Pictet and G. Campiche.</i> Foss. Terr. Crét. de Ste. Croix (Matér. Pal. Suisse, ser. 4), pt. 3, p. 473.
1867.	— — —	<i>E. Guéranger.</i> Album Pal., p. 16, pl. xxi, fig. 4.
1871.	— — —	<i>F. Stoliczka.</i> Palæont. Indica, Cret. Fauna S. India, vol. iii, p. 343 (<i>Barbatia</i>).
1873.	— — —	<i>H. B. Geinitz.</i> Das Elbthalgeb. in Sachsen (Palæontographica, vol. xx), pt. 1, p. 220, pl. xlvi, figs. 20—22.
1895.	— — —	<i>E. Tiessen.</i> Zeitsch. d. deutsch. geol. Gesellsch., vol. xlvii, p. 482.

¹ 'Pal. Franç. Terr. Crét.,' vol. iii (1847), p. 766 (*nom. mut.*); *ibid.* (as *A. Requieniana*), p. 239, pl. ccxxvi, figs. 1, 2; 'Prodr. de Pal.,' vol. ii (1850), p. 196, No. 137.

Remarks.—I have seen only a few specimens—all internal casts—of this species.

Distribution.—Base of the Chalk Marl (zone of *Schloenbachia varians*) of Lyme Regis, and Titherleigh, near Chard.

BARBATA, sp., cf. GEINITZI (*Reuss*), 1844. Plate VII, figs. 10 a, b, 11.

Cf. 1842.	ARCA RADIATA, <i>H. B. Geinitz</i> (non <i>Goldfuss</i>). Char. der Schicht. und Petref. sächs-böhm. Kreidegeb., pt. 3, p. 78, pl. xx, figs. 13, 14.
— 1844.	— GEINITZI, <i>A. E. Reuss</i> . Geogn. Skizzen, vol. ii, p. 192.
— 1846.	— — — Die Verstein. der böhm. Kreideformat., pt. 2, p. 11, pl. xxxiv, fig. 31.
— 1852.	— ? <i>R. Kner</i> . Denkschr. d. k. Akad. Wissensch. Math-nat. Cl., vol. iii, p. 314, pl. xvi, fig. 27.
— 1869.	— — <i>E. Favre</i> . Moll. Foss. de la Craie des Envir. de Lemberg, p. 125, pl. xii, figs. 15, 16.
— 1873.	— — <i>H. B. Geinitz</i> . Das Elbthalgeb. in Sachsen (Palaeontographica, vol. xx), pt. 2, p. 55, pl. xvi, figs. 7, 8.
— 1889.	— — <i>A. Fritsch</i> . Stud. im Gebiete der böhm. Kreideformat. iv. Die Teplitzer Schichten, p. 79, fig. 63.
1897.	— (BARBATA), sp., cf. GEINITZI, <i>H. Woods</i> . Quart. Journ. Geol. Soc., vol. liii, p. 378, pl. xxvii, figs. 5, 6.

Measurements :

Length (approximate)	. . . . .	23 mm.
Height	„	11 „

Remarks.—A specimen consisting of an internal and part of an external mould appears to agree with *A. Geinitzi* in form, but seems to differ in possessing rather finer ribs. It is, perhaps, the form figured by J. de C. Sowerby as *Byssoarca marullensis*,¹ from the Chalk of Kent.

Distribution.—Chalk Rock (zone of *Heteroceras Reussianum*) of Cuckhamsley.

BARBATA, sp. Plate VII, figs. 12 a, b.

ARCA, sp., cf. GALLIENNEI, <i>H. Woods</i> . Quart. Journ. Geol. Soc., vol. liii, p. 378, pl. xxvii, fig. 3.
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¹ Sowerby (non d'Orbigny), in F. Dixon's 'Geol. Sussex' (1850), p. 355, pl. xxviii, fig. 11. I have not been able to find the original of Sowerby's figure.

Measurements :

Length 33 mm.
 Height 19 „

Remarks.—There are two internal casts of left valves from Cuckhamsley in the Montagu Smith Collection, Woodwardian Museum, which, in general form, agree with *A. Galliennei*, d'Orbigny, except that they are proportionately shorter.

Distribution.—Chalk Rock (zone of *Heteroceras Reussianum*) of Cuckhamsley.

BARBATIA ? sp. Plate VII, figs. 13 *a*, *b*.

1897. ARCA, sp., *H. Woods*. Quart. Journ. Geol. Soc., vol. liii, p. 379, pl. xvii, fig. 4.

Description.—Shell elongate, oblique, very inequilateral. Anterior margin forming an angle with the hinge-line, and curving ventrally to join the ventral margin, which is nearly straight, but has a considerable slope posteriorly. Posterior margin oblique, somewhat rounded. Umbones apparently sharp, pointing anteriorly; shell compressed dorsal to a line between the umbo and the postero-ventral extremity. Surface with well-marked lines of growth; radial ribs extend from the umbo posteriorly, and perhaps occur also on other parts of the shell.

Measurements :

Length 13 mm.
 Height 6 „

Remarks.—This form is at present known by one specimen only, an internal cast, but showing indications of ornament. It resembles *Arca strehlensis*, Geinitz,¹ from the Pläner-Kalk of Strehlen (Dresden), but in that species the shell is less oblique, and the surface is generally smooth except on the anterior part, which is marked with radial ribs.

Distribution.—Chalk Rock (zone of *Heteroceras Reussianum*) of Cuckhamsley.

¹ "Das Elbthalgeb. in Sachsen" ('Paleontographica,' vol. xx), pt. 2, 1873, p. 56, pl. xvi, fig. 5.

Genus—GRAMMATODON, *Meek and Hayden* (1860), 1864.¹

['Proc. Acad. Nat. Sci. Philad.,' 1860, p. 419 (list name); "Palæontology of the Upper Missouri," 'Smithsonian Contrib. to Knowledge,' vol. xiv, No. 172, 1864, p. 89, pl. ii, fig. 9.]

GRAMMATODON SECURIS (*Leymerie*), 1842. Plate VII, figs. 14 *a*, *b*, 15 *a*, *b*; Plate VIII, figs. 1, 2.

1829. CUCULLEA, *J. Phillips*. Geol. Yorks., pt. 1, p. 186, pl. ii, fig. 16.
 1842. — SECURIS, *A. Leymerie*. Mém. Soc. Géol. France, vol. v, p. 6, pl. vii, figs. 6, 7.
 1844. ARCA SECURIS, *A. d'Orbigny*. Pal. Franç. Terr. Crét., vol. iii, p. 203, pl. cccix, figs. 9, 10.
 1845. — — *E. Forbes*. Quart. Journ. Geol. Soc., vol. i, p. 246.
 1850. — — *A. d'Orbigny*. Prodr. de Pal., vol. ii, p. 80.
 1854. — — *J. Morris*. Cat. Brit. Foss., ed. 2, p. 185.
 1855. — — *G. Cotteau*. Moll. Foss. de l'Yonne, p. 87.
 1861. — — *P. de Loriol*. Anim. Invert. Foss. du Mont Salève, p. 86, pl. x, fig. 8.
 1866. — — *F. J. Pictet and G. Campiche*. Foss. Terr. Crét. de Ste. Croix (Matér. Pal. Suisse, ser. 4), pt. 3, pp. 443, 469.
 1875. CUCULLEA SECURIS, *J. Phillips*. Geol. Yorks., pt. 1, ed. 3, p. 323, pl. ii, fig. 16.
 1896. ARCA SECURIS, *A. Wollemani*. Zeitschr. d. deutsch. geol. Gesellsch., vol. xlviii, p. 845.

Measurements :

Length	. . . . .	21 mm.
Height	. . . . .	14 „
Thickness	. . . . .	12·5 „

Affinities.—This form, as was pointed out by de Loriol, is very similar to *Grammatodon carinatus* (Sowerby) (see p. 45), and I think it is possible that they may prove to be identical, but until more specimens have been obtained I shall regard the two as distinct. In *G. securis* the area appears to be broader than in *G. carinata*; and also on the left valve of the former the ribs are more widely separated than in the latter, and there are small ribs in the interspaces. *Cucullæa Schüsteri*, Roemer,² is perhaps an allied form, but I have seen no specimen of it.

Remarks.—The specimen figured by d'Orbigny is proportionately longer than

¹ For the synonymy of this genus see Woods, 'Ann. Mag. Nat. Hist.,' ser. vii, vol. iii (1899), p. 47. To the names there given should be added *Beushausenia*, Cossman, 'Rev. crit. Palæozool.' (1897), p. 93.

² 'Die Verstein des nord-deutsch. Kreidegeb.' (1841), p. 70, pl. ix, fig. 3.

the English forms, but other examples in the d'Orbigny Collection do not differ from ours.

Types.—I have not seen the types; they are stated to have come from Dienville. The specimen from Speeton figured by Phillips (*vide supra*) is in the York Museum.

Distribution.—Speeton Clay (B. zone of *Bel. brunsvicensis*) of Speeton. ? Sandgate Beds of Sevenoaks.

GRAMMATODON CARINATUS (*Sowerby*), 1813. Plate VIII, figs. 3 *a—d*, 4 *a—c*, 5, 6, 7 *a, b, 8*.

1813. ARCA CARINATA, *J. Sowerby*. Min. Conch., vol. i, p. 96, pl. xlv (lower figure).
1824. CUCULLÆA COSTELLATA, *J. de C. Sowerby*. Ibid., vol. v, p. 67, pl. ccccxlvii, fig. 2.
1838. — STRIATELLA, *H. Michelin*. Mém. Soc. Géol. de France, vol. iii, p. 102, pl. xii, fig. 11.
1844. ARCA CARINATA, *A. d'Orbigny*. Pal. Franç. Terr. Crét., vol. iii, p. 214, pl. cccxiii, figs. 1—3.
- ? 1846. — (CUCULLÆA) COSTELLATA, *A. E. Reuss*. Die Verstein. d. böhm. Kreideformat., pt. 2, p. 11.
1850. — CARINATA, *A. d'Orbigny*. Prod. de Pal., vol. ii, pp. 138, 164.
1852. — — *F. J. Pictet and W. Roux*. Moll. Foss. Grès verts de Genève, p. 462, pl. xxxvii, fig. 1.
1854. — — *J. Morris*. Cat. Brit. Foss., ed. 2, p. 185.
1854. CUCULLÆA COSTELLATA, *J. Morris*. Ibid., p. 197 (not from locality given).
1855. ARCA CARINATA, *G. Cotteau*. Moll. Foss. de l'Yonne, p. 87.
1866. — — *F. J. Pictet and G. Campiche*. Foss. du Terr. Crét. de Ste. Croix (Matér. Pal. Suisse, ser. 4), pt. 3, pp. 463, 472.
1866. — COSTELLATA, *Pictet and Campiche*. Ibid., p. 471.
1868. — CARINATA, *A. Briart and F. L. Cornet*. Descript. de la Meule de Bracquegnies (Mém. cour. et Mém. des Savants étrang., Acad. Roy. Belg., vol. xxxiii), p. 56, pl. v, figs. 15, 16.
1871. — — and A. COSTELLATA, *F. Stoliczka*. Palæont. Indica, Cret. Fauna S. India, vol. iii, p. 343 (? *Grammatodon*).
1873. — — *H. B. Geinitz*. Das Elbthalgeb. in Sachsen (Palæontographica, vol. xx), pt. 1, p. 223 (?), pl. xlix, figs. 5 (?), 6 (from the Upper Greensand, Isle of Wight).
- ? 1882. — — *J. Kiesow*. Schrift. nat. Gesellsch. Danzig, N. F., vol. v, p. 239.
- ? 1895. — — *E. Tiessen*. Zeitsch. d. deutsch. geol. Gesell., vol. xlvii, p. 482.
1897. CUCULLÆA CARINATA, *R. B. Newton*. Proc. Dorset Nat. Hist. and Antiq. Field Club, vol. xviii, pp. 72, 84, pl. ii, fig. 6.

Non 1837. *ARCA CARINATA*, A. Goldfuss. Petref. Germ., vol. ii, p. 150, pl. cxiv, fig. 2.

— 1837. — — F. C. L. Koch and W. Dunker. Norddeutsch. Oolithgeb., p. 32, pl. ii, fig. 14.

Description.—Shell elongate, trapezoidal, inflated, inequilateral, rather short anteriorly. Dorsal and ventral margins nearly parallel. Anterior margin joining the ventral in a gradual and regular curve, but forming with the hinge-line a sharp angle, which constitutes the anterior extremity of the valve. Posterior margin oblique, more or less sinuous ventrally, and forming sharply-marked obtuse and acute angles with the dorsal and ventral margins respectively. Umbones rather prominent, much incurved, with a sharp, finely crenulate carina, which extends in a double curve to the postero-ventral angle, and thus cuts off from the rest of the shell a deeply concave postero-dorsal area. Hinge-line nearly or quite equal to the length of the shell. Hinge-area fairly broad, with a varying number (often six or more) ligament-grooves. Surface of shell ornamented with numerous, distinct, rather flattened radial ribs, separated by narrower grooves, and sometimes crossed by concentric striæ. On the anterior part of the shell the radial ribs become narrower, much more elevated, more widely separated, and are crossed by distinct ridges; smaller ribs may be seen in the grooves. In most specimens well-marked growth-lines may be seen at rather distant intervals. On the postero-dorsal area the ribs are narrow and separated by wider depressions; these ribs are more or less crenulate, and are cut by fine concentric ribs, giving a cancellated appearance; a central, and sometimes also two other inner radial ribs, are more elevated than the others. Teeth finely striated, curving obliquely outwards from under the umbo; antero-laterals oblique; postero-laterals long and parallel to the hinge-line. Posterior adductor impression without projecting edge. Margins faintly crenulate.¹

Measurements :

	(1)	(2)	(3)	(4)	(5)	(6)
Length	29	45	22	21	24·5	30 mm.
Height	16	29	12	13·5	17	21 „
Thickness	—	—	—	12	15	21·5 „

(1) is from the Upper Greensand of Devizes; (2) and (3) are from the Gault of Folkestone; (4—6) are from the Blackdown Greensand.

Affinities.—This species is closely related to *Cucullæa securis*, Leymerie (*vide supra*).

Remarks.—The form described by Sowerby as *Arca carinata* came from the Upper Greensand of Devizes Canal; it has been regarded by d'Orbigny and some other authors as identical with *Cucullæa costellata*, Sowerby, from the Blackdown

¹ Seen only in a few well-preserved specimens.

Greensand, the apparent differences between the two forms being explained by the imperfect state of preservation of the specimens from the Upper Greensand of Devizes. A comparison of a number of examples from these and other localities confirms the view of d'Orbigny.

The specimens from the Gault are, on the average, of larger size than those from the Blackdown Greensand, and, owing to their different mode of preservation, differ a little in appearance from the latter. The record of this species from the Lower Greensand of Kent, given by Morris, is apparently erroneous.

Types.—The types of both *Arca carinata* and *Cucullæa costellata* are in the British Museum.

Distribution.—Greensand of Blackdown (zones viii to xii, especially x) and Haldon. Upper Greensand of Devizes and Ventnor. Gault of Black Ven. Zones of *Acanthoceras mammillatum* and *Hoplites interruptus* at Okeford Fitzpaine. Gault (zones i, ii, viii—x) of Folkestone. Chalk Marl (zone of *Schloënbachia varians*) of Ventnor and Folkestone.

Genus—TRIGONOARCA, *T. A. Conrad*, 1863.

[‘Proc. Acad. Nat. Sci. Philad.’ (1862), 1863, p. 289; *ibid.*, 1872, p. 54; ‘Amer. Journ. Conch.’ vol. iii (1867), p. 9; Appendix to W. C. Kerr’s ‘Rep. Geol. Surv. N. Carolina, vol. i, 1875 (Raleigh); figured, ‘Journ. Acad. Nat. Sci. Philad.,’ ser. 2, vol. iv (1860), p. 281, pl. xlvii, fig. 20.]

TRIGONOARCA PASSYANA (*d'Orbigny*), 1844. Plate VIII, figs. 9 *a—c*, 10 *a, b*.

1832. CUCULLEA CARINATA, *A. Passy* (non *Sowerby*). Descript. Géolog. de la Seine-Infér., p. 8 (of expl. of plates), pl. xiv, figs. 11, 12.
1844. ARCA PASSYANA, *A. d'Orbigny*. Pal. Franç. Terr. Crét., vol. iii, p. 241, pl. ccxxvii, figs. 1, 2.
1850. — — — Prodr. de Pal., vol. ii, p. 161.
1866. — — *F. J. Pictet and G. Campiche*. Foss. du Terr. Crét. de Ste. Croix (Matér. Pal. Suisse, ser. 4), pt. 3, p. 475.
1871. — — *F. Stoliczka*. Palæont. Indica, Crét. Fauna S. India, vol. iii, p. 343 (*Trigonoarca*).
1896. — LIGERIENSIS, *A. J. Jukes-Browne and W. Hill*. Quart. Journ. Geol. Soc., vol. lii, p. 153 (from Chard).
- ? 1897. CUCULLEA PASSYANA, *R. Leonhard*. Die Fauna der Kreidef. in Oberschles. (Palæontographica, vol. xlv), p. 51.

Description.—Shell oblong, more or less elongate, convex, inequilateral, rather short anteriorly. Ventral margin nearly straight, placed a little obliquely;

anterior margin rounded; posterior nearly straight and very oblique, forming an acute angle with the ventral margin. Umbones rather prominent, with a carina which extends to the postero-ventral angle, and cuts off a depressed postero-dorsal area. Ornamentation consists of very fine radial ribs. Hinge a little curved; teeth numerous, gradually becoming larger and more oblique toward the extremities.

Measurements :

	(1)	(2)	(3)	(4)	(5)	(6)
Length	58	50	37	57	62	48 mm.
Height	45	37	27	39	39	33 ,,
Thickness	48	35	—	39	39	30 ,,

(1) From the Chloritic Marl, Warminster. (2) From the base of the Chalk Marl, Chard. (3) From the Upper Greensand, Kingskerswell. (4-6) From the Cenomanian, Rouen.

Affinities.—This species is very similar to *Trigonoarca ligeriensis* (d'Orbigny),¹ with which it may prove to be identical; that form is said to be distinguished by its greater convexity and more widely separated umbones.

It appears also to be related to d'Orbigny's *Arca royana*,² but that form is only known by its cast.

Remarks.—This species was founded on internal casts from the Cenomanian of Rouen. The only specimen I have seen with the shell preserved is a silicified example from the Greensand of Kingskerswell (British Museum, No. L 1853); an internal mould from the same locality and collection shows the character of the hinge. The internal casts from various localities agree perfectly with specimens obtained from Rouen.

Types.—Some specimens from Rouen, but apparently not the type, are in the d'Orbigny Collection.

Distribution.—Base of the Lower Chalk (zone of *Schœnbachia varians*) of Chard. Chloritic Marl of Maiden Bradley, Urchfont (near Devizes) and Warminster. Upper Greensand of Kingskerswell.

¹ 'Pal. Franç. Terr. Crét.,' vol. iii (1844), p. 227, pl. cccxvii, figs. 1-3 (*not 4, 5*).

² *Ibid.*, p. 243, pl. cccxxvii, figs. 3, 4.

Genus—CUCULLÆA, Lamarck, 1801.

['Syst. Anim. sans Vert.,' p. 116.]

1. Lower Cretaceous Species.

CUCULLÆA FORBESI (*Pictet and Campiche*), 1866. Plate IX.

1845. ARCA EXALTATA (?), *E. Forbes* (non *Nilsson*). Quart. Journ. Geol. Soc.,
vol. i, p. 245, pl. iii, fig. 5.
1850. — GABRIELIS, *A. d'Orbigny*. Prodr. de Pal., vol. ii, p. 80 (*partim*).
1854. CUCULLÆA GABRIELIS, *J. Morris*. Cat. Brit. Foss., ed. 2, p. 197.
1866. ARCA FORBESI, *F. J. Pictet and G. Campiche*. Foss. Terr. Crét. de Ste.
Croix (Matér. Pal. Suisse, ser. 4), pt. 3, p. 471.

Description.—Shell stout, much inflated, regularly convex, trapezoidal, inequilateral. Anterior margin shorter than the posterior, and forming with the hinge-line about a right angle. Ventral margin slightly curved, or in part nearly straight, sloping posteriorly. Posterior margin nearly straight, oblique, forming with the hinge-line an obtuse angle, and with the ventral margin a rounded acute angle, which is usually the most ventral part of the shell. Umbones prominent, incurved, pointed, widely separated, with a sharply defined carina extending to the postero-ventral angle, and cutting off a flattened postero-dorsal area, which is sharply bent with regard to the rest of the valve. Hinge-area very large, with numerous close-set ligament-grooves; margins curved, bounded by a ridge. Ornamentation consists of many slender, sharp, radial ribs, separated by relatively broad and shallow grooves, which are crossed at regular intervals by fine concentric ribs. On the anterior part of the shell the radial ribs become more prominent and less numerous. On the postero-dorsal area, except near the umbo, the radial ribs are much less distinct than elsewhere, but numerous radial striæ crossed by lines of growth are seen. Hinge-line long, sometimes five-sixths of the length of the shell. Central teeth numerous, perpendicular; lateral teeth few, and parallel to the hinge-margin.

Measurements :

	(1)	(2)	(3)	(4)	(5)
Length	86	79	72	63	63 mm.
Height	77	76	60	65	58 „
Thickness	80	95	71	70	72 „

Affinities.—*Cucullæa Forbesi* is closely related to *C. Gabriëlis*, Leymerie,¹ but differs from it in the presence of strong radial ribs on the adult shell. In *C. Gabriëlis* (of which I have seen three or four very perfect specimens) these ribs are found on the young parts only, and are but faintly marked. *Cucullæa tumida*, Matheron, is perhaps related to *C. Forbesi*; it was founded on an internal cast. *C. Forbesi* is distinguished from *Arca Moreana*, d'Orbigny,² by its strong carina and more widely separated umbones.

The form figured by Coquand³ as *Arca dilatata* (from the Aptian of Obon, Arcaine, &c.) is very near to *C. Forbesi*; but the shell is longer posteriorly, and the radial ribs are not seen. *A. Gresslyi*, de Loriol,⁴ is, perhaps, closely allied to *C. Forbesi*, but is at present imperfectly known.

Types.—From Atherfield. I have not seen the original of Forbes' figure (1845).

Distribution.—*Perna*-bed of Atherfield. Also, according to Fitton, in Beds iii, vi, ix, and xiii of Atherfield.

CUCULLÆA CORNUELIANA (*d'Orbigny*), 1844. Plate VIII, figs. 11—13; Plate X, figs. 1 *a*—*c*, 2 *a*, *b*, 3.

1844.	ARCA CORNUELIANA, <i>A. d'Orbigny</i> .	Pal. Franç. Terr. Crét., vol. iii, p. 208, pl. cccxi, figs. 1—3.
1845.	— —	<i>E. Forbes</i> . Quart. Journ. Geol. Soc., vol. i, p. 246.
1850.	— —	<i>A. d'Orbigny</i> . Prodr. de Pal., vol. ii, p. 80.
1854.	— —	<i>J. Morris</i> . Cat. Brit. Foss., ed. 2, p. 185.
1855.	— —	<i>G. Cotteau</i> . Moll. Foss. de l'Yonne, p. 86.
1861.	— —	<i>P. de Loriol</i> . Anim. Invert. Foss. du Mont Salève, p. 86, pl. x, fig. 7.
1866.	— —	<i>F. J. Pictet and G. Campiche</i> . Foss. Terr. Crét. de Ste. Croix (Matér. Pal. Suisse, ser. 4), pt. 3, pp. 445, 469.
1867.	— —	<i>P. de Loriol</i> . In <i>A. Favre</i> , Recherch. géol. dans Savoie, &c., vol. i, p. 380, pl. e, fig. 9.
1871.	— —	<i>F. Stoliczka</i> . Palæont. Indica, Cret. Fauna S. India, vol. iii, p. 342 (? <i>Trigonoarca</i>).
?	1883. CUCULLÆA SUBNANA, <i>W. Keeping</i> .	Foss., &c., Upware and Brickhill, p. 115 pl. v, fig. 10.

¹ 'Mém. Soc. Géol. de France,' vol. v (1842), p. 6, pl. vii, fig. 5; d'Orbigny, 'Pal. Franç. Terr. Crét.,' vol. iii (1844), p. 198, pl. cccviii.

² D'Orbigny, *ibid.*, p. 200, pl. cccix, figs. 1—3.

³ 'Mon. de l'Étage Aptien de l'Espagne' (1865), p. 139, pl. xxii, figs. 1, 2.

⁴ 'Anim. Invert. foss. Néoc. du Mt. Salève' (1861), p. 87, pl. xi, figs. 1—3.

1898. CUCULLÆA (IDONEARCA) CORNUELIANA, *E. G. Skeat and V. Madsen*. Danmarks geol. Undersøg., vol. ii, p. 167, pl. vi, fig. 5.

? Non 1846. ARCA (CUCULLÆA) CORNUELIANA, *A. E. Reuss*. Die Verstein. der böhm. Kreideformat., pt. 2, p. 13.

Description.—Shell more or less oblong, convex, a little inequilateral. Anterior border forming an angle (90° or more) with the hinge-line, gradually curving toward the ventral border. Ventral border curved. Posterior border nearly straight, oblique, forming a rounded angle with the curved ventral border. Umbones of moderate size, close together; no distinct carina, but the shell is sharply bent along a line passing from the umbo to the postero-ventral angle; this flattened part is divided into two nearly equal parts by a narrow carina passing from the umbo posteriorly; on the right valve the carina is thread-like and crenulated; on the left valve it is less sharply defined. Area small, narrow. Ornamentation consists of numerous fine concentric ribs or striae, and radial ribs usually less distinct than the concentric, but well marked anteriorly. Hinge-line relatively long. Central teeth transverse; lateral teeth parallel to the hinge-margin, striated.

Measurements :

	(1)	(2)	(3)	(4)
Length	27	25.5	38	28 mm.
Height	22	21	32	25 „
Thickness	19	20	—	— „

Affinities.—This species is closely related to *C. glabra*, Parkinson (see p. 57), but it never attains such large size, and its average is much smaller. It varies considerably in the proportion of length to height; in some cases the valves are only a little longer than high—in this respect differing from the type. Many forms are proportionately longer than is ever the case with *C. glabra*. The umbones are less prominent and less pointed than in the latter species. *Arca Robinaldina*, d'Orbigny, differs from this species in possessing a sharply defined carina, &c.

I am inclined to think that the three specimens from Upware (preserved in the Woodwardian Museum), which were referred by W. Keeping (*vide supra*) to *C. subnana*, Pictet and Roux, belong to *C. Cornueliana*.

Types.—I did not find the types in the d'Orbigny Collection.

Distribution.—Crackers and Lower *Crioceras* Group of Atherfield. Bed xiv of Blackgang Chine (*vide* Fitton). Atherfield Beds of East Shalford. ? Lower Greensand of Upware.

CUCULLÆA FITTONI (*Pictet and Campiche*), 1866. Plate X, figs. 4 a—d, 5—7.

1857. ARCA ROBINALDINA, *F. J. Pictet and E. Renevier* (non *d'Orbigny*). Foss. Terr. Aptien, &c. (Matér. Pal. Suisse, ser. 1), p. 105, pl. xv, fig. 4.
1866. — FITTONI, *F. J. Pictet and G. Campiche*. Foss. Terr. Crét. de Ste. Croix (Matér. Pal. Suisse, ser. 4), pt. 3, pp. 455, 471.
1871. — — *F. Stoliczka*. Palæont. Indica, Cret. Fauna S. India, vol. iii, p. 343 (? *Trigonoarca*).

Description.—Shell more or less oblong, rather inflated, equilateral or slightly inequilateral. Anterior margin evenly rounded, passing gradually into the ventral, which is parallel to the dorsal margin, but curves toward the postero-ventral angle. Posterior margin nearly straight, oblique. Umbones moderately large, nearly median, separated by only a small space, with a very sharp carina, curved, and passing to the postero-ventral angle. The postero-dorsal area is sharply depressed, and near its ventral third bears another carina. Hinge-line rather short; area small, with many ligament-grooves. Ornamentation consists of many fine concentric grooves, and on the antero-dorsal part of the shell of a few radial ribs; postero-dorsal area with many radial ribs. Central teeth (about ten) transverse; lateral teeth longitudinal. Interior not seen.

Measurements :

	(1)	(2)
Length . . .	19·5	14 mm.
Height . . .	15	11·5 „
Thickness . . .	12·5	9·5 „

Affinities.—This form is probably only a local variety of *Arca Robinaldina*, *d'Orbigny*; it differs from that in being less elongate posteriorly. In *d'Orbigny's* figure of *A. Robinaldina* the ventral margin has a greater curvature than in any of the specimens which I have seen in the Paris museums. *Arca Cornueliana*, *d'Orbigny*, is distinguished from *C. Fittoni* by the absence of the sharp carina. *Arca æquilateralis*, Briart and Cornet, is very similar to *C. Fittoni*, but it appears to be proportionately shorter, and to have the anterior margin less curved.

Distribution.—Crackers of Atherfield. Atherfield Beds of East Shalford.

CUCULLÆA VAGANS, *Keeping*, 1883. Plate X, figs. 8—10.

1883. CUCULLÆA VAGANS, *W. Keeping*. Foss., &c., Neoc. Upware and Brickhill, p. 151, pl. viii, fig. 8.
1883. — ERRANS, *Keeping*. Ibid., pp. 33, 34, 36, 65 (*nom. nud.*).

Description.—Shell rather stout, rounded, nearly equilateral. Anterior margin rounded; posterior a little truncated; ventral curved. Umbones prominent, incurved. Hinge-area relatively broad. Posterior part of shell sharply bent. Ornamentation consists of strong, equal, regular ribs, separated by broader grooves; the grooves are crossed at regular intervals by fine concentric ribs. Central teeth transverse; lateral parallel to the hinge-line. Margins of valves coarsely toothed.

Measurements:

Length 20 mm.

Height 18 „

Remarks.—This form, which at present is only known by a few rather imperfect specimens, appears to be clearly distinguished by the character of its ornamentation.

Cucullæa errans, Keeping, *nom. nud.*, I think undoubtedly refers to this species; the name was used in the earlier part of Keeping's work (*vide supra*), and the remarks there made concerning it agree perfectly with those given later in connection with *C. vagans*. This view is further supported by the fact that on the back of the tablet which bears the type-specimens of *C. vagans* there is written in Keeping's handwriting "*C. errans*, W. K."

Types.—In the Woodwardian Museum, Cambridge.

Distribution.—Lower Greensand (black grit nodules) of Upware. ? Spilsby Sandstone of Spilsby.

Sub-genus—DICRANODONTA, *s.-g. nov.*

Shell stout, subquadrate or rounded. Hinge-area broad. Hinge-plate large, curved; central teeth transverse; lateral teeth long, curved ventrally, nearly parallel, often bifurcating. No posterior adductor plate.

Type.—*Cucullæa domingtonensis*, Keeping (Pl. X, figs. 11—14; Pl. XI, fig. 1). Claxby Ironstone.

The form described by Keyserling,¹ and by F. Schmidt,² as *Pectunculus petschoræ* probably belongs to this sub-genus. The latter author was inclined to regard it as the type of a new genus.

¹ 'Reise in das Petschora-land' (1846), p. 306, pl. xvii, figs. 5, 6.

² "Resultate der Mammuthexpedit.," 'Mém. Acad. Imp. Sci. St. Pétersbourg,' ser. 7, vol. xviii, No. 1 (1872), p. 151, pl. i, fig. 14; pl. iii a, fig. 17.

CUCULLÆA (DICRANODONTA) DONNINGTONENSIS, *Keeping*, 1883. Plate X, figs. 11 *a-c*, 12-14; Plate XI, figs. 1 *a, b, 2*.

1883. CUCULLÆA DONNINGTONENSIS, *W. Keeping*. *Foss., &c., Neoc. Upware and Brickhill*, p. 152, pl. viii, fig. 9.

Description.—Shell stout, subquadrate, rounded, a little inequilateral, rather convex. Anterior margin rounded, uniting with the ventral in a regular curve. Ventral margin nearly parallel to the dorsal. Posterior truncated, slightly oblique, more or less curved, and forming with the ventral border a rounded angle usually a little less than a right angle. Umbones prominent, pointed, well separated; no distinct carina, but behind a line drawn from the umbo to the postero-ventral angle the shell is sharply compressed. Anteriorly the shell is gently compressed. Hinge-area broad, shorter than the length of the shell, usually three-fifths to four-fifths of the latter; ligament-grooves numerous, close-set, very regular.

Ornamentation consists of well-marked but slightly elevated radial ribs, which are less distinct on the posterior slope of the shell; between these ribs are from two to five smaller ribs; lines of growth, usually faintly marked, occur at intervals. Hinge-plate large, extending ventrally along the anterior and posterior margins of the shell; central teeth small, transverse, becoming a little oblique laterally; lateral teeth long, usually three or four at each end, curved ventrally so as to be nearly parallel to the *inner* border of the hinge-plate, and usually bifurcating. No posterior adductor plate. Margins coarsely crenulate.

Measurements :

	(1)	(2)	(3)	(4)	(5)	(6)
Length	52	51	48	41	35	19 mm.
Height	49	49	45	38	30	16 „
Thickness	48	42	36	32	25	12 „

Affinities.—This species appears to be closely allied to *Arca Sablieri*,¹ Coquand, from the Aptian of Josa, Obon, and Arcaine (Spain), but that form, so far as I am able to tell from the figures and description, differs in the shell being higher and shorter, and in having a trellis-like ornamentation. Coquand refers the specimen figured by Vilanova² as *Arca fibrosa*, d'Orbigny, to *A. Sablieri*, but Vilanova's figure appears to represent quite a different form.

Remarks.—This species was founded by Keeping on an external mould in a black grit nodule from the Lower Greensand of Upware, and that author con-

¹ 'Mon. de l'étage Aptien de l'Espagne' (1865), p. 137, pl. xiv, figs. 7, 8.

² J. Vilanova y Piera, 'Mem. geog.-agric. de Castellon' (1858), pl. ii, fig. 13.

sidered that the form which is abundant at Donnington¹ was distinct. After a careful comparison of a larger series of the latter with the type-specimen I am unable to see any real difference. The figure given by Keeping is not quite accurate in outline, and is drawn from a gutta-percha cast; the mould itself is not perfect at the anterior and ventral margins, and near the umbo a portion of the shell remains in it.

Types.—In the Woodwardian Museum, Cambridge, from Upware.

Distribution.—Lower Greensand (black grit nodules) of Upware. Claxby Ironstone (zone of *Bel. lateralis*) of Benniworth Haven, near Donnington. Spilsby Sandstone of Donnington.

CUCULLÆA (DICRANODONTA ?) OBLIQUA (*Keeping*), 1883. Plate XI, figs. 3 a—c, 4.

1883. PECTUNCULUS OBLIQUUS, *W. Keeping*. Foss., &c., Neoc. Upware and Brickhill, p. 116, pl. vi, fig. 1.

Non 1826.	—	—	<i>Defrance</i> . Dict. Sci. Nat., vol. xxxix, p. 224.
— 1833.	—	OBLIQUA, <i>J. Lea</i> . Contrib. Geol., p. 78, pl. iii, fig. 57.	
— 1835.	—	OBLIQUUS, <i>G. Münster</i> . Neues Jahrb. für Min., &c., p. 438.	
— 1843.	—	—	<i>L. Reeve</i> . Conch. Icon., vol. i, pl. vi, fig. 33.

Description.—Shell stout, ovate-oblong, inequilateral, moderately convex but flattened centrally. Anterior border rounded, ventral slightly curved, posterior oblique and slightly curved—forming with the ventral a blunt angle. Shell compressed dorsal to a line from the umbo to the postero-ventral angle. Umbones small, rather close together. Hinge-line short. Hinge-area narrow, with many ligament-grooves. Surface of shell with fine radial striæ and a few fairly well-marked lines of growth. Central teeth few, small; the laterals (two or three) long, the first parallel to the hinge-margin, but the last curving ventrally.

Measurements :

	(1)	(2)
Length	16	20 mm.
Height	13	17·75 ,,
Thickness	10	— ,,

Affinities.—This form was referred by Keeping to *Pectunculus*, but the character of the teeth show that it cannot be placed in that genus. The concluding remark of the author mentioned (“It approaches nearest to some Jurassic species from the Great Oolite and Coral Rag”) seems to show that he was really thinking of *Cucullæa* rather than *Pectunculus*. The fact that the lateral teeth (or some of

¹ Erroneously spelt *Doddington* by Keeping (‘Foss. Upware,’ &c.), p. 153.

them) curve ventrally, and also the form of the shell, seem to connect this species with *C. donningtonensis*, Keeping (*vide supra*, p. 54).

Remarks.—The specific name given by Keeping is preoccupied as shown above, but, since the species is now removed from *Pectuncululus*, the specific name can be retained.

Types.—The only specimens seen are the types (three in number) from Upware, preserved in the Woodwardian Museum, Cambridge.

Distribution.—Lower Greensand of Upware.

2. Upper Cretaceous Species.

CUCULLEA VENUSTA, *Nyst*, 1848. Plate XI, figs. 5 a—c, 6 a, b, 7 a, b.

1836. CUCULLEA FORMOSA, *J. de C. Sowerby*. Trans. Geol. Soc., ser. 2, vol. iv, p. 342, pl. xvii, fig. 7.
1848. ARCA (CUCULLEA) VENUSTA, *H. P. Nyst*. Tableau des Espèces vivant et foss. des Arcacées (Mém. Acad. Roy. Belg., vol. xxii), p. 76 (*nom. mut.*).
1850. — SUBFORMOSA, *A. d'Orbigny*. Prodr. de Pal., vol. ii, p. 164 (*nom. mut.*).
1854. CUCULLEA FORMOSA, *J. Morris*. Cat. Brit. Foss., ed. 2, p. 197.
1866. ARCA (CUCULLEA) FORMOSA, *F. J. Pictet and G. Campiche*. Foss. Terr. Crét. Ste. Croix (Matér. Pal. Suisse, ser. 4), pt. iii, p. 473.
- ? 1868. — SUBFORMOSA, *A. Briart and F. L. Cornet*. Descript. de la Meule de Braquegnies (Mém. Cour. et des Sav. étrangers, Acad. Roy. Belg., vol. xxxiv), p. 54, pl. v, figs. 11, 12.
1871. — FORMOSA, *F. Stoliczka*. Palæont. Indica, Crét. Fauna S. India, vol. iii, p. 343 (? *Trigonoarca*).
- Non 1833. CUCULLEA FORMOSA, *G. B. Sowerby*. Proc. Zool. Soc., pt. i, p. 20. (Figured Reeve, Conch. Icon., vol. ii, 1844, pl. ii, fig. 10.)

Measurements:

	(1)	(2)	(3)
Length	8	7	4 mm.
Height	6·5	5·5	3 „

Remarks.—I have seen only five specimens of this form—three in the Bristol Museum and two belonging to Mr. Meyer. The shell is not well preserved in any case. In form, and the character of the concentric ornamentation, it is near to *C. Pittoni* (see p. 52), but all five specimens are much smaller.

C. venusta appears to differ from *C. Pittoni* in being more convex; in having the ventral margin less curved posteriorly—so that the postero-ventral angle is

more acute; and the carina is perhaps less sharp. The inner carina and also the anterior radial ribs seem to be wanting in *C. venusta*.

The specimen figured by Briart and Cornet from the Meule de Bracquegnies is much more pointed posteriorly than the Blackdown examples.

Type.—Bristol Museum.

Distribution.—Blackdown Greensand.

CUCULLÆA GLABRA, *Parkinson*, 1811. Plate XI, figs. 8 *a*—*c*, 9 *a*, *b*, 10—12; Plate XII, figs. 1 *a*, *b*, 2, 3 *a*, *b*, 4, 5.

1811. CUCULLÆA GLABRA, *J. Parkinson*. Org. Remains, vol. iii, p. 171.
 1814. — — — *J. Sowerby*. Min. Conch., vol. i, pl. lxxvii, p. 151.
 1815. — — — FIBROSA, *Sowerby*. Ibid., vol. iii, p. 9, pl. ccvii, fig. 2.
 1818. — — — CARINATA, *Sowerby*. Ibid., vol. iii, p. 9, pl. ccvii, fig. 1.
 1837. ARCA GLABRA, *A. Goldfuss*. Petref. Germ., vol. ii, p. 149 (*partim*), pl. cxxiv, figs. 1 *a*, *b* (? 1 *c*).
 1843. — — — FIBROSA, *A. d'Orbigny*. Pal. Franç. Terr. Crét., vol. iii, p. 212, pl. ccxxii.
 1850. — — — — — Prodr. de Pal., vol. ii, p. 138.
 1852. — — — *F. J. Pictet and W. Roux*. Moll. Foss. Grès Verts de Genève, p. 463, pl. xxxvii, fig. 2.
 1854. CUCULLÆA GLABRA, *J. Morris*. Cat. Brit. Foss., ed. 2, p. 197.
 1854. — — — FIBROSA, *Morris*. Ibid., p. 197.
 1857. ARCA FIBROSA, *G. Cotteau*. Moll. Foss. de l'Yonne, p. 88.
 1857. — — — GLABRA, *F. J. Pictet and E. Renevier*. Foss. du Terr. Aptien de la Perte du Rhône, &c. (Matér. Pal. Suisse, ser. 1), p. 104.
 1862. IDONEARCA FIBROSA, *T. A. Conrad*. Proc. Acad. Nat. Sci. Philad. for 1863, p. 289.
 1866. ARCA GLABRA, *F. J. Pictet and G. Campiche*. Foss. Terr. Crét. de Ste. Croix (Matér. Pal. Suisse, ser. 4), pt. 3, pp. 456, 473.
 1868. — — — *A. Briart and E. L. Cornet*. Descript. de la Meule de Bracquegnies (Mém. Cour. et Mém. des Sav. étrangers, Acad. Roy. Belg., vol. xxxiv), p. 55, pl. v, figs. 1—6.
 1872. IDONEARCA GLABRA et I. FIBROSA, *T. A. Conrad*. Proc. Acad. Nat. Sci. Philad., p. 54.
 1875. ARCA GLABRA, *H. B. Geinitz*. Das Elbthalgeb. in Sachsen (Palæontographica, vol. xx), pt. 2, pl. xlix, fig. 2 (*non* figs. 1, 3).
 No. 1882. CUCULLÆA GLABRA, *A. Passy*. Descript. géol. de la Seine-Inférieure, p. 8 (of explanation of plates), pl. xiv, fig. 10.
 — 1882. — — — CARINATA, *Passy*. Ibid., p. 8, pl. xiv, figs. 11, 12.
 — 1887. ARCA CARINATA, *A. Goldfuss*. Petref. Germ., vol. ii, p. 150, pl. cxxiv, fig. 2.
 — 1899. CUCULLÆA GLABRA, *H. B. Geinitz*. Char. der Schichten und Petrefacten des sächsisch. Kreidegeb., pt. 2, p. 49.

- Non 1842. *CUCULLÆA GLABRA*, *P. Matheron*. *Catal. méthod. et descript. des Corps foss. du Bouches-du-Rhone*, p. 161.
- 1843. — — *H. B. Geinitz*. *Die Verstein. von Keislingswalda*, p. 14, pl. iii, figs. 4—7.
- ?— 1846. *ARCA (CUCULLÆA) GLABRA*, *A. E. Reuss*. *Die Verstein. der böhm. Kreideformat.*, pt. 2, p. 13, pl. xxxiv, fig. 44; pl. xxxv, figs. 1, 2.
- 1847. — *GLABRA*, *J. Müller*. *Petref. der Aachen. Kriedeformat.*, pt. 1, p. 18.
- 1847. *CUCULLÆA GLABRA*, *Müller*. *Ibid.*, p. 19.
- 1858. *ARCA FIBROSA*, *J. Vilanova y Piera*. *Mem. geog.-agric. de Castillon*, pl. ii, fig. 13.
- ?— 1863. *CUCULLÆA GLABRA*, *R. Drescher*. *Zeit. d. deutsch. geol. Gesellsch.*, vol. xv, p. 349.
- ?— 1875. *ARCA GLABRA*, *H. B. Geinitz*. *Das Elbthalgeb. in Sachsen (Palæontographica, vol. xx)*, pt. 1, p. 221, pl. xlix, figs. 1, 3.
- ?— 1881. — *FIBROSA*, *J. Kiesow*. *Schrift. d. nat. Gesellsch. Danzig, N. F.*, vol. v, p. 410.
- ?— 1885. *CUCULLÆA GLABRA*, *F. Nötling*. *Die Fauna der baltisch. Cenoman-geschiebe (Palæont. Abhandl., vol. ii)*, p. 25.
- ?— 1897. — (*IDONEARCA*) *GLABRA*, *R. Leonhard*. *Die Fauna der Kreideformat. in Oberschlesien. (Palæontographica, vol. xlv)*, pp. 21, 51.

Description.—Shell subrhomboidal or more or less oval, a little inequilateral and oblique; high, convex. Anterior margin curved, passing gradually into the ventral margin, and joining the hinge-line at a slightly obtuse angle. Posterior margin nearly straight, oblique, forming with the hinge-line an obtuse angle, and with the ventral margin an acute angle more or less rounded. Umbones large, with a rounded but usually well-marked carina extending from each to the postero-ventral angle of the valves. Sometimes a thread-like ridge, crenulated, passes from the umbo of the right valve to the middle of the posterior margin. Hinge-area long, but comparatively narrow; with three or four, sometimes more, ligament-grooves on each side. Ornamentation consists of numerous radial ribs, sometimes raised and somewhat granular, crossed by concentric growth-lines. Hinge-line long, with from five to eight central transverse teeth, and three or four long lateral teeth, placed parallel or nearly parallel to the hinge-line, and striated. Posterior adductor plate large. Anterior adductor impression smaller. Margins of valves entire.

Measurements:

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Length	74	55	47	37·5	36	22	21 mm.
Height	61	51	41	35·5	30·5	21	21 „
Thickness	62	46	40	28	31	21	15 „
Hinge-line	60	44	35	27	29·5	17	16 „

Affinities.—The forms described by Sowerby under the names *Cucullæa glabra*

and *C. fibrosa* have been considered by Briart and Cornet, Pictet and Campiche, Pictet and Renevier, Downes, and others, to belong to the same species. Sowerby's *glabra* was a more rhomboidal example than his *fibrosa*, but a large series of specimens shows that there is no essential difference between the two.

One of the specimens figured by Goldfuss (fig. 1 c) as *Arca glabra* (Sowerby) was regarded by d'Orbigny as distinct from the others (figs. 1 a, b, d), and named¹ by him *Arca subglabra*. This name has been since generally adopted for the form found in the Aachen Greensand (Senonian). Goldfuss does not state from whence his *figured* specimens came, but gives in the text, as localities of the species, Quedlinburg, Coesfeld, Aachen, Kelheim, and Blackdown. J. Böhm² found, in the Museum of the Schloss Popplesdorf, examples labelled "England" which agree well with Goldfuss' figures, and he believes that the figured specimens really came from Blackdown, and are the true *Cucullæa glabra*, Sowerby. Briart and Cornet³ also regard Goldfuss' *glabra* as identical with Sowerby's. The Blackdown specimens of *C. glabra*, Sowerby, certainly agree closely with the figures of Goldfuss (except fig. 1 c, in which the lateral teeth are not parallel to the hinge-margin, but this may have been a worn specimen); specimens and figures both differ considerably from the figures of the undoubted Aachen form given by Holzapfel;⁴ the last-named author, however, does not appear to accept Böhm's view, but takes the *glabra* of Goldfuss as the type of *Arca subglabra*, d'Orbigny.

Judging from Holzapfel's figures and description, *Cucullæa subglabra* of the Aachen Greensand differs from *C. glabra*, Sowerby, in the shell being more convex and relatively higher; the hinge-line relatively shorter; the lateral teeth shorter, somewhat curved and not quite parallel to the hinge-line; the absence or indistinct nature of the radial ribs; and perhaps also in the less distinct carina.

The arrangement of the teeth in *C. glabra* is similar to that in *C. Mülleri*, Holzapfel,⁵ from the Aachen Greensand; but in that form the shell is more rounded than in *C. glabra*, it is without a keel, the area is smaller, the hinge-line shorter, &c.

C. Mailleana (d'Orbigny) (see p. 63) is relatively longer, more oblique—owing to the greater proportionate length of the posterior margin, and is ornamented with well-marked concentric grooves, the radial ribs being absent or indistinct.

¹ 'Prodr. de Pal.,' vol. ii (1850), p. 244.

² "Der Grünsand von Aachen und seine Molluskenfauna," 'Verhandl. des naturh. Vereines der preussisch. Rheinl.,' &c., vol. xlv (1885), p. 92.

³ "Descript. de la Meule de Bracqueguies," 'Mém. Cour. et Mém. des Sav. étrangers, Acad. Roy. Belg.,' vol. xxxiv (1868), p. 55.

⁴ "Die Mollusken der Aachener Kreide" ('Palæontographica,' vol. xxxv, 1889), p. 206, pl. xxii, figs. 3, 5.

⁵ Ibid., vol. xxv (1889), p. 209, pl. xxiii, fig. 1.

C. Marceana (d'Orbigny), from the Cenomanian of Mans, is more oval in outline, the area and hinge-line are relatively shorter, and the surface of the shell is smoother than in *C. glabra*, Sowerby.

According to Geinitz *C. glabra* occurs in the Lower Quadersandstone (Cenomanian) of Koschütz, Neiderschöna, and Goldenen Höhe (Saxony). All the specimens obtained are apparently internal casts, so that comparison is very difficult, but they appear to be relatively longer and more oblique than *C. glabra*, Sowerby, and the umbo is sharper than in wax casts taken from Blackdown specimens. The same remarks apply to the Bohemian form referred by Reuss to this species.

Cucullæa (Idonearca) Shumardi, Meek and Hayden,¹ from the Fox Hill Group of Upper Missouri, appears to be very closely related to *C. glabra*, but without seeing specimens I am unable to state whether it is really distinct or not.

Remarks.—This is one of the commonest fossils in the Blackdown Greensand. In old specimens the radial ribs usually become obliterated, and the shell is then nearly smooth save for lines of growth. The appearance of the ornamentation varies considerably according to the state of preservation of the shell. In old forms the shell becomes, as a rule, relatively longer, more convex, and more oblique. Before the adult state is reached the lateral teeth are placed obliquely to the hinge-line (Pl. XI, figs. 10, 11). Two forms of this "species" may be recognised:—(i) in which the shell is rhomboidal in outline, rather compressed, and with a sharp carina (Pl. XII, figs. 3, 4); (ii) in which the shell is of more rounded outline, more inflated, and has only an indistinct carina (Pl. XI, fig. 8). These two types can be seen in various stages of growth, but there are also some examples which seem to be intermediate in character.

Types.—I have not seen the type, but the specimens figured by Sowerby as *C. glabra*, *C. fibrosa*, and *C. carinata* (all from Blackdown) are in the British Museum.

Distribution.—Blackdown Greensand (especially zone x). Gault of Folkestone.

¹ 'Proc. Acad. Nat. Sci. Philad.,' vol. viii (1856), p. 86; Meek, 'Invert. Cont. and Tert. Foss. U. Missouri,' ('Rep. U.S. Geol. Surv. Territ.,' vol. ix, 1876), p. 86, pl. xxviii, figs. 15 a—g; pl. xxix, fig. 4.

CUCULLÆA OBESA (*Pictet and Roux*), 1852. Plate XII, figs. 6, 7 a, b, 8 a, b.

1852. ARCA OBESA, *F. J. Pictet and W. Roux* (non *Sowerby*). Moll. Foss. Grès verts de Genève, p. 464, pl. xxxviii, figs. 1, 2.
 1866. — — *F. J. Pictet and G. Campiche*. Foss. du Terr. Crét. de Ste. Croix (Matér. Pal. Suisse, ser. 4), pt. 3, p. 459.
 1871. — — *F. Stoliczka*. Palæont. Indica, Cret. Fauna S. India, vol. iii, p. 343 (*Trigonoarca*?).
 Non 1833. ARCA OBESA, *G. B. Sowerby*. Proc. Zool. Soc., pt. 1, p. 21 (figured *Reeve*, Conch. Iconica, vol. ii, 1843, pl. i, fig. 3).

Description.—Shell subrhomboidal, rounded, a little inequilateral and oblique, much inflated. Posterior border slightly convex, forming an obtuse angle with the hinge-line, and joining the ventral border at an acute but rounded angle. Umbones prominent, well separated except in young forms. A prominent but rounded carina extends from the umbo to the postero-ventral angle. Hinge-area long, of moderate breadth, with numerous (often thirteen to eighteen) closely-set ligament-grooves. Ornamentation consists of faintly marked radial ribs crossed by lines of growth. Hinge with some central transverse teeth, and lateral teeth which are parallel or nearly parallel to the hinge-line. Posterior adductor plate well marked.

Measurements :

	(1)	(2)	(3)	(4)	(5)
Length	53	47	43	28	22 mm.
Height	48	42·5	40	25·5	18 „
Thickness	52	44	37	21	17 „
Hinge-line	39	31	26	15	14 „

Affinities.—This is related to *C. glabra*, *Sowerby*, but can be distinguished from that by its more inflated form, more prominent umbones, more rounded outline; the ventral margin is placed more obliquely with regard to the hinge-line; the hinge-line is relatively shorter and the ligament-grooves more numerous; the radial ribs are less distinctly marked.

Remarks.—The name *Arca obesa* was pre-occupied by *Sowerby* for a recent species dredged near the coast of West Columbia; but since the fossil form is now referred to the genus *Cucullæa* the specific name may be retained.

Types.—The types are from the Gault of the Perte du Rhône.

Distribution.—Gault of Folkestone (zones viii, ix); and Aylesford. Cambridge Greensand (derived). Chloritic Marl of the Isle of Wight and Warminster. Upper Greensand of Devizes.

CUCULLEA NANA, *Leymerie*, 1842. Plate XIII, figs. 1 *a—e*, 2, 3.

1842. CUCULLEA NANA, *A. Leymerie*. Mém. Soc. Géol. de France, vol. v, p. 7,
pl. ix, figs. 1 *a—d*.
1844. ARCA NANA, *A. d'Orbigny*. Pal. Franç. Terr. Crét., vol. iii, p. 210,
pl. ccexi, figs. 8—12.
1850. — — — — — Prodr. de Pal., vol. ii, p. 138.
1866. — — — — — *F. J. Pictet and G. Campiche*. Foss. du Terr. Crét. de Ste.
Croix (Matér. Pal. Suisse, ser. 4), pt. 3, p. 472.

Description.—Shell rhomboidal, inflated, inequilateral. Anterior margin forming about a right angle with the dorsal, and curving ventrally. Ventral margin nearly parallel to the dorsal, slightly curved. Posterior margin slightly convex or sinuous, a little oblique. Umbones of moderate size, curving forwards, more or less well separated, placed near the anterior third, with a carina extending to the postero-ventral angle; postero-dorsal area concave, but slightly raised near the middle. Hinge-area long, broadest just in front of the umbones; inner part raised in front, with a parallel-sided groove and ridge on each side; ligament-grooves numerous. Ornamentation consists of numerous slightly elevated concentric ribs, crossed by narrower radial ribs; at the anterior end of the shell some of the radial ribs at intervals are more elevated and serrate. Hinge not seen.

Measurements :

	(1)	(2)	(3)	(4)
Length	15	12·5	12	9·5 mm.
Height	11	9	9	6·75 „
Thickness	11·5	8	9	7 „

Affinities.—This species is closely allied to *Cucullæa subnana*, Pictet and Roux, but appears to differ in the form of the area, which is widest just in front of the umbones, and tapers much more rapidly anteriorly than posteriorly.

Remarks.—In many English specimens the area is wider and the umbones more distant than in the example figured by d'Orbigny; but others agree exactly with his figure, and a series of specimens shows a gradual transition from forms with a comparatively narrow area to those with a wide area.

Types.—Specimens, but probably not those figured, are in the d'Orbigny collection.

Distribution.—Gault (zones ii, vii, viii, ix, and x) of Folkestone. Cambridge Greensand (derived).

CUCULLÆA MAILLEANA (*d'Orbigny*), 1844. Plate XIII, figs. 4 a—c, 5 a, b.

1832. CUCULLÆA GLABRA, *A. Passy* (non *Sowerby*). Géol. de la Seine-Infér., p. 8 (of expl. of plates), pl. xiv, fig. 10.
 1844. ARCA MAILLEANA, *A. d'Orbigny*. Pal. Franç. Terr. Crét., vol. iii, p. 229, pl. cccxviii, figs. 3—7.
 1850. — — — — — Prodr. de Pal., vol. ii, p. 164.
 ? 1852. — — — — — *R. Kner*. Denkschr. d. k. Akad. Wissensch. Math.-nat. Sc., vol. iii, p. 313, pl. xvii, fig. 25.
 1866. — — — — — *F. J. Pictet and G. Campiche*. Foss. Terr. Crét. de Ste. Croix (Matér. Pal. Suisse, ser. 4), pt. 3, p. 475.
 1871. — — — — — *F. Stoliczka*. Palæont. Indica, Cret. Fauna S. India, vol. iii, p. 343 (*Trigonoarea*).

Description.—Shell oval or rhomboidal, convex, oblique, highest posteriorly. Anterior margin gently curved, relatively short. Posterior margin rather long, oblique, slightly curved. Ventral margin with a considerable slope posteriorly, forming an acute, but rounded, angle with the posterior margin. Umbones rather small, with a carina extending to the postero-ventral angle. A curved ridge passes from the umbo to just above the middle of the posterior side. Hinge-area rather narrow. Ornamentation consists of well-marked concentric grooves, with faint radial ribs on the posterior and anterior portions of the shell. Lateral teeth parallel to the hinge-line.

Measurements :

	(1)	(2)
Length	26	25 mm.
Height	22.5	21 „
Thickness	18.5	18 „

Affinities.—This species can be distinguished from *C. glabra*, *Sowerby*, by the great obliquity of the ventral margin of the shell, the shorter area, and the much less distinct radial, and better-marked concentric, ornamentation.

The larger forms of *C. obesa* are readily distinguished from *C. Mailleana*; in the smaller the outline of the shell is more rounded, the posterior angle is less sharp, the carina more rounded, and the concentric grooves less distinct than in *Mailleana*. *D'Orbigny* compares this species with *C. Cornueliana*, but in that form the ventral margin is more nearly parallel to the hinge-line.

In form, some examples of *C. Mailleana* resemble *Arca Dumortieri*, *d'Archiac*,¹ but the character of the ornamentation appears to be different.

¹ 'Bull. Soc. Géol. de France,' ser. 2, vol. xi (1854), p. 213, pl. xi, figs. 8, 8 a—d.

Remarks.—Most of the English specimens have only a portion of the shell preserved. I have collected examples from the Cenomanian of St. Catherine, near Rouen (the locality of the types), which agree exactly with English specimens.

Types.—Specimens from Rouen, but not the types, are in the d'Orbigny Collection at the Museum of Natural History, Paris.

Distribution.—Chalk Marl of Pinhay Cliff, Lyme Regis. Base of Chalk Marl (zone of *Schloenbachia varians*) of Chard, Maiden Newton, Eggardon Hill, and Titherleigh near Chard. Chloritic Marl of Maiden Bradley. Rye Hill Sand of Warminster. Upper Greensand of Plush.

CUCULLÆA, sp. Plate XIII, figs. 6 a, b, c.

Cf. 1844.	ARCA GUERANGERI, <i>A. d'Orbigny</i> .	Pal. Franç. Terr. Crét., vol. iii, p. 228, pl. ccxviii, figs. 1, 2.
— 1850.	— — — —	Prodr. de Pal., vol. ii, p. 164.
— 1866.	— — — —	<i>E. J. Pictet and G. Campiche</i> . Foss. du Terr. Crét. Ste. Croix (Matér. Pal. Suisse, ser. 4), pt. 3, p. 474.
— 1871.	— — — —	<i>E. Stoliczka</i> . Palæont. Indica, Cret. Fauna S. India, vol. iii, p. 343 (<i>Trigonoarca</i>).

Description.—Shell oval or rhomboidal, high, convex. Anterior and ventral margins curved. Posterior margin oblique; postero-ventral angle rounded; antero-dorsal angle sharp. Umbones rather small, close together, placed near the anterior third of the shell. Carina rounded. Hinge-area narrow. Ornamentation consists of very fine radial ribs crossed by lines of growth.

Measurements:

Length	58 mm.
Height	47 „

Remarks.—The only example I have seen of this is a right valve in Mr. Meÿer's collection. It is similar to *Arca Guerangeri*, d'Orbigny, but is less inflated. Only a small part of the hinge is seen.

Distribution.—Chalk Marl (Meÿer's Bed 10) of Dunscombe.

Genus—ISOARCA, *G. Münster*, 1842.

[‘Neues Jahrb. für Min., &c.’ 1842, p. 98; ‘Beitr. zur Petrefact.’ pt. vi, 1843, p. 81.]

ISOARCA AGASSIZII, *Pictet and Roux*, 1852. Plate XIII, figs. 7 *a*, *b*.

1842. CEROMYA CRASSICORNIS, *L. Agassiz*. Ét. Crit. Moll. Foss., p. 36 (*partim*),
pl. viii *f*, figs. 1—4 (*non* 5—10).
1850. ISOCARDIA CRASSICORNIS, *A. d’Orbigny*. Prodr. de Pal., vol. ii, p. 137
(*partim*).
1852. ISOARCA AGASSIZII, *F. J. Pictet and W. Roux*. Moll. Foss. Grès Verts de
Genève, p. 466, pl. xxxviii, fig. 3.
1866. — — *F. J. Pictet and G. Campiche*. Foss. Terr. Crét. Ste.
Croix (Matér. Pal. Suisse, ser. 3), p. 422.
1875. — — *A. J. Jukes-Browne*. Quart. Journ. Geol. Soc., vol.
xxxi, p. 300, pl. xv, figs. 1—3.
1879. — CANTABRIGIENSIS [H. G. Seeley, MS.], *F. G. H. Price*. The
Gault, p. 60 (*nom. nud.*).

The only examples which I have seen of this species are a few internal moulds found in the Cambridge Greensand (derived).

ISOARCA OBESA (*d’Orbigny*), 1844. Plate XIII, figs. 8 *a*—*c*.

1844. NUCULA OBESA, *A. d’Orbigny*. Pal. Franç. Terr. Crét., vol. iii, p. 180, pl.
ccciv, figs. 10—14.
1846. ISOCARDIA ORBIGNYANA, *A. d’Archiac*. Mém. Soc. Géol. France, ser. 2, vol.
ii, p. 305, pl. xv, fig. 1.
1847. NUCULA RHOTOMAGENSIS, *d’Orbigny*. Pal. Franç. Terr. Crét., vol. iii, p. 766.
1848. ARCA ISOCARDILEFORMIS, *H. P. Nyst*. Tableau Espèces vivant et foss.
des Arcaées, p. 38.
1850. ISOARCA OBESA, *A. d’Orbigny*. Prodr. de Pal., vol. ii, p. 163.
1866. — — *F. J. Pictet and G. Campiche*. Foss. Terr. Crét. Ste. Croix
(Matér. Pal. Suisse, ser. 3), p. 423.
Non 1837. NUCULA OBESA, *A. Goldfuss*. Petref. Germ., vol. ii, p. 150, pl. cxxiv, fig. 4.

Description.—Shell oval or slightly subquadrate, rounded, length greater than height, much inflated, short anteriorly, long posteriorly; ventral margin slightly curved. Umbones large, anterior, close together, curved forward. Hinge-line about two-thirds the length of the shell. Hinge-area indistinctly limited, short anteriorly, elongate posteriorly. Ornamentation consists of numerous, very regular, closely-set, concentric grooves, with broader, flattish interspaces; and radial grooves which are less distinct than the concentric; the

whole forms a rectangular network, with pits at the intersection of the grooves. Teeth numerous. Margins of valves smooth.

Measurements :

	(1)	(2)	(3)
Length	25	20	15.5 mm.
Height	21.5	18	13 ,,
Thickness	21	17.5	11 ,,

(1) and (3) from Ball Wood. (2) from Maiden Bradley.

Types.—From the Cenomanian of Rouen.

Distribution.—Chloritic Marl of Ball Wood, near Plush, and of Maiden Bradley. Base of Chalk Marl (zone of *Schloënbachia varians*) of Cerne, near Chard.

Genus—PECTUNCULUS, *Lamarck*, 1799.¹

[‘Mém. Soc. Hist. Nat. Paris,’ p. 87.]

1. *Lower Cretaceous Species*.

PECTUNCULUS MARULLENSIS, *Leymerie*, 1842. Plate XIII, figs. 9 a—c, 10.

1842.	PECTUNCULUS MARULLENSIS, <i>A. Leymerie</i> .	Mém. Soc. Géol. de France, vol. v, p. 7, pl. ix, fig. 2.
1844.	— — — — — <i>A. d'Orbigny</i> .	Pal. Franç. Terr. Crét., vol. iii, p. 187, pl. ccvii, figs. 1—6.
1848.	— — — — — MARULLENSIS, <i>H. G. Bronn</i> .	Index Palæont., vol. i, p. 938.
1850.	— — — — — MARULLENSIS, <i>A. d'Orbigny</i> .	Prodr. de Pal., vol. ii, p. 80.
? ? 1883.	— — — — — <i>W. Keeping</i> .	Foss., &c., Upware and Brickhill, p. 116, pl. v, fig. 11.

Description.—Shell of moderate size, suboval or nearly orbicular, longer than high, rather convex, compressed antero-dorsally and postero-dorsally. Anterior margin rounded, posterior slightly subtruncate. Umbones of moderate size, close together, nearly median. Hinge-area small. Hinge with from four to six oblique teeth on each side. Ornamentation consists of numerous radial ribs, which bear finer ribs, and are crossed by fine concentric ribs.

Measurements :

	(1)	(2)
Length	12.5	11 mm.
Height	11	9.5 ,,

(1) and (2) from Shanklin.

¹ Dall considers that the name *Glycimeris*, Da Costa, should be adopted in place of *Pectunculus* or *Acinca*. Until the necessity for this change has been definitely shown, I prefer to retain the name which has been in general use for the last hundred years. Dall, ‘Trans. Wagner Free Inst. Sci. Philadelphia,’ vol. ii, pt. iv (1898), pp. 571, 607. Cossman, ‘Rev. Crit. Palæozool.’ (1899), p. 66.

Affinities.—This is similar to *P. sublævis*, Sowerby, but is smaller, proportionately less convex, and with less prominent umbones.

Remarks.—Three specimens from the Lower Greensand of Upware, which were referred by Keeping (*vide supra*) to *Pectunculus marullensis* (and are preserved in the Woodwardian Museum), seem to differ from that species in having a subquadrate outline and more prominent umbones; the surface of the shell in those specimens is worn, and it is consequently impossible to compare satisfactorily the ornamentation. One example shows the hinge, but, unfortunately, very indistinctly; so far as I can see, the lateral teeth appear to be like those of *Cucullæa* rather than *Pectunculus*.

Types.—From the Neocomian of Marolles.

Distribution.—Ferruginous Sands (upper beds) of Shanklin.

2. Upper Cretaceous Species.

PECTUNCULUS SUBLÆVIS, Sowerby, 1824. Plate XIV, figs. 1 *a—c*, 2 *a, b*, 3 *a—d*, 4 *a—c*, 5 *a—c*, 6, 7.

1824.	PECTUNCULUS SUBLÆVIS,	<i>J. de C. Sowerby.</i>	Min. Conch., vol. v, p. 112, pl. cccclxxii, fig. 4.
1850.	—	—	<i>A. d'Orbigny</i> , Prodr. de Pal., vol. ii, p. 163 (<i>partim</i>).
1854.	—	—	<i>J. Morris.</i> Cat. Brit. Foss., ed. 2, p. 220.
1868.	—	—	<i>A. Briart and F. L. Cornet.</i> Descript. de la Meule de Bracquegnies (Mém. Cour. et Mém. des Sav. étrangers, Acad. Roy. Belg. (vol. xxxiv), p. 61, pl. v, figs. 21—23.
? ? 1883.	—	—	<i>W. Keeping.</i> Foss., &c., Upware and Brickhill, p. 115, pl. v, fig. 9.
Non 1837.	—	—	<i>A. Goldfuss.</i> Petref. Germ., vol. ii, p. 160, pl. cxxvi, fig. 3.
— 1843.	—	—	<i>H. B. Geinitz.</i> Die Verstein. von Kieslingswalda, p. 14, pl. ii, figs. 19—21.
— 1846.	—	—	<i>A. E. Reuss.</i> Die Verstein. der böhm. Kreideformat., pt. ii, p. 9, pl. xxxv, figs. 10, 11.
— 1847.	—	—	<i>J. Müller.</i> Mon. Petr. der Aachen. Kreidef., pt. i, p. 17.
? — 1883.	—	—	<i>H. Schröder.</i> Zeitschr. der Deutsch. geol. Gesellschaft., vol. xxxiv, p. 274.

Description.—Shell stout, convex, longer anteriorly than posteriorly, but sometimes nearly equilateral; outline rounded or somewhat subquadrate; usually a little longer than high. Antero-dorsal part compressed, with a rounded

anterior border; posterior border subtruncate, dorsal part of it nearly straight; posterior extremity slightly angular. Umbones of moderate size. Hinge-line long. Hinge-area moderately broad, with many ligament-grooves. Ornamentation consists of broad radial ribs separated by narrow grooves—the main ribs bearing smaller ribs; this ornamentation is less distinctly marked antero-dorsally and postero-dorsally, the change in passing to the former area being gradual, to the latter rather sudden. At distant intervals there are lines of growth. Hinge-plate stout, with two or three small transverse teeth; and oblique, moderately long lateral teeth (usually six to nine). Adductor impressions well marked; the anterior subtriangular, the posterior smaller and oval. Margins strongly crenulated.

Measurements :

	(1)	(2)	(3)	(4)	(5) Average of 29 specimens.
Length .	24 .	22 .	16 .	13·5 .	18·836 mm.
Height .	22·5 .	21 .	16 .	13 .	18·077 „
	(1—5) from Blackdown.				

Affinities.—A species from the Aachen Greensand was described and figured by Goldfuss as *P. sublævis*, Sowerby; but it has been shown by later authors to be distinct from the latter; Römer¹ and also Brauns,² have referred it to *P. lens*, Nilsson,³ but the characters of that form are known only from internal casts. Böhm⁴ has named the Aachen form *P. dux*, but Holzapfel,⁵ in a later work, refers it to *P. Geinitzi*, d'Orbigny,⁶ the type of which is *P. sublævis*, Geinitz,⁷ non Sowerby, from Kieslingswald. The Aachen species is rather variable, but a comparison of several specimens and of the good series of figures given by Holzapfel, shows that it generally differs from *P. sublævis*, Sowerby, in the following features:

(1) The average size of the adults is considerably larger, and the valves are less inflated than in *P. sublævis*.

(2) The hinge-area is smaller and the external teeth shorter.

(3) The shell is more quadrate in form, and, as a rule, a little higher than long.

(4) The ribs are more flattened and are separated by striæ.

¹ 'Die Verstein. des norddeut. Kreidegeb.' (1841), p. 68.

² 'Die senon Mergel des Salzberges, &c.,' 'Zeitsch. f. d. gesamt. Naturwiss.,' vol. xlv (1876), p. 383.

³ 'Petrif. Suecana' (1827), p. 15, pl. v, fig. 4; Hennig, 'Revis. af Lamellibr. i Nilsson's "Petrif. Suecana," 'Kongl. Fysiogr. i Lund Handl.,' vol. viii (1897), p. 63.

⁴ 'Verhandl. des naturhist. Vereines der preuss. Rheul., &c.,' vol. xlii (1885), p. 93.

⁵ 'Die Mollusk. der Aachen. Kreide.,' 'Palæontographica,' vol. xxxv (1889), p. 210, pl. xxiii, figs. 11, 12; pl. xxiv, figs. 1—10.

⁶ 'Prodr. de Pal.,' vol. ii (1850), p. 196.

⁷ 'Die Verstein. von Kieslingswalda' (1843), p. 14, pl. ii, figs. 19—21.

In *P. obsoletus*, Goldfuss,¹ the shell is oblique, and more oval and rounded in form than in *P. sublævis*.

P. subpulvinatus, d'Archiac,² from the Tourtia of Tournay, is also more oblique and has the posterior border more rounded.

For the relation of this species to *P. umbonatus*, Sowerby, see p. 70.

The two examples described by Keeping (*vide supra*) from the Lower Greensand of Upware appear to differ from *P. sublævis* in being less inflated and in having a higher area, but the specimens are not sufficiently perfect to allow me to give a definite opinion on their affinities.

Types.—From Blackdown; in the British Museum.

Distribution.—Greensand of Blackdown (zones xi and xii); Lower Gault (zone vi) of Folkestone (*vide Price*).

PECTUNCULUS UMBONATUS (*Sowerby*), 1817. Plate XIV, figs. 8 a—c, 9 a—c, 10 a—c, 11, 12.

1817.	CARDIUM UMBONATUM,	<i>J. Sowerby.</i>	Min. Conch., vol. ii, p. 128, pl. clvi, figs. 2—4.
1824.	PECTUNCULUS UMBONATUS,	<i>J. de C. Sowerby.</i>	Ibid., vol. v, p. 113, pl. cccxxii, fig. 3.
1854.	—	—	<i>J. Morris.</i> Cat. Brit. Foss., ed. 2, p. 220.
1868.	—	—	<i>A. Briart and F. L. Cornet.</i> Descript. de la Meule de Braquegnies (Mém. Cour. et Mém. des Sav. étrangers, Acad. Roy. Belg., vol. xxxiv), p. 61, pl. v, figs. 19, 20?
Non 1837.	—	—	<i>A. Goldfuss.</i> Petref. Germ., vol. ii, p. 160, pl. cxxvi, fig. 2.
? — 1841.	—	—	<i>F. A. Römer.</i> Die Verstein. des norddeutsch. Kreideformat., p. 68.
— 1846.	—	—	<i>A. E. Reuss.</i> Die Verstein. der böhm. Kreideformat., pt. ii, p. 9, pl. xli, fig. 20.
— 1857.	—	—	<i>J. W. Salter.</i> Quart. Journ. Geol. Soc., vol. xiii, p. 86. (For remarks on this form see Jukes-Browne, Geol. Mag., 1898, p. 29.)

Description.—Shell rather inflated and more or less circular or slightly subquadrate, usually a little higher than long, nearly equilateral. Anterior margin

¹ 'Petref. Germ.,' vol. ii (1837), p. 160, pl. cxxvi, fig. 4; Geinitz, "Das Ellbthalgeb. in Sachsen" 'Palæontographica,' vol. xx, pt. i (1873), p. 223, pl. xlix, figs. 7—11.

² 'Mém. Soc. Géol. de France,' ser. 2, vol. xii (1846), p. 306, pl. xv, fig. 2.

generally evenly rounded, sometimes forming an obtuse but rounded angle with the hinge-margin. Posterior extremity slightly angular; dorsal part of the posterior margin subtruncate, straight or slightly curved. Hinge-line long. Umbones prominent, pointed; valves compressed in the postero-dorsal region. Hinge-area broad, with several ligament-grooves. Ornamentation consists of broad radial ribs bearing finer ribs, and separated by narrow grooves; the ribs are crossed by lines of growth and by faintly marked concentric ridges.¹ On the anterior and posterior parts of the valves the radial ribs are less distinct. Central teeth (two to four) small, transverse; lateral teeth (eight to ten) long and oblique. Anterior adductor impression large, subtrigonal; posterior adductor a little smaller and rounded. Margins of valves strongly crenulate.

Measurements:

	(1)	(2)	(3)	(4) Average of 27 specimens.
Length .	18	17	15	18·851 mm.
Height .	20	19	16	19·924 ,,

(1—4) from Blackdown.

Affinities.—This species differs from *P. sublevis*, Sowerby, in the shell being less stout, more inflated, and usually higher than long; also in having a broader hinge-area, more prominent umbones, and fewer ribs. It resembles *P. noricus*, Zittel,² in general form, but that species appears to be usually larger, with rather less prominent umbones, fewer ribs, and less oblique lateral teeth.

The form from the Senonian of Coesfeld and Quedlinburg, which was referred by Goldfuss (*vide supra*) to this species, has been regarded as distinct by Römer,³ and named *P. decussatus*; a fuller description, but without figures, is given by Brauns.⁴ I have seen no examples of that form. The name was changed by d'Orbigny⁵ to *subdecussatus*, since *decussatus* had been used previously (1813) by Sowerby for an Eocene species.

Types.—From Blackdown; in the British Museum.

Distribution.—Blackdown Greensand (zone vii, and occasionally beneath it). Lower Gault (zones vi and vii) of Folkestone (*vide Price*). Folkestone Beds of Copt Point, Folkestone.⁶

¹ Seen in only a few specimens.

² "Die Bivalv. der Gosaugeb.," pt. i, 'Denkschr. der k. Akad. der Wissensch. Math.-nat. Cl.,' vol. xxiv (1865), p. 167, pl. ix, fig. 9.

³ 'Die Verstein. des norddeusch. Kreidegeb.' (1841), p. 69.

⁴ "Die senon. Mergel des Salzberges, &c.," 'Zeitsch. f. d. gesamt. Naturwiss.,' vol. xlvi (1876), p. 383.

⁵ 'Prodr. de Pal.,' vol. ii (1850), p. 243.

⁶ There are three specimens from this horizon in the Woodwardian Museum; the surface of the shell is not perfectly preserved, but I have very little doubt that they are referable to this species.

PECTUNCULUS EUGLYPHUS, sp. nov. Plate XIV, figs. 13 *a—e*.

Description.—Shell inflated, nearly equilateral, outline rounded, length and height nearly equal; posterior border (especially its dorsal part) less curved than the anterior. Umbones large. Hinge-line moderately long. Ornamentation consists (1) on the anterior part of the valves of numerous fine, rounded, radial ribs, crossed by very faint concentric ridges and a few distant growth-lines; the radial ribs are separated by well-marked but narrow grooves with puncta; (2) on the posterior part of the valves of broader, flatter radial ribs, crossed in a regular manner by fine, rather closely-set concentric ridges.

Measurements :

Length	22 mm.
Height	22 „

Affinities.—*Pectunculus subpulvinatus*, d'Archiac, from the Tourtia of Tournay, apparently differs from this species in the obliquity and greater convexity of the valves, and in the ornamentation being somewhat coarser and of the same type on the anterior and posterior parts of the shell.

P. euglyphus is more inflated than *P. sublævis*, and also differs in the character of the ornamentation.

Types.—Three specimens in Mr. Meÿer's collection.

Distribution.—Chalk Marl (Meÿer's Bed ii) of Dunscombe.

Genus—LIMOPSIS, *A. Sasso*, 1827.

['Giornale Ligustico di Scienze,' i, p. 476.]

LIMOPSIS ALBIENSIS, sp. nov. Plate XV, figs. 1 *a—d*, 2—4.

1874. PECTUNCULUS, sp., *F. G. H. Price*. Quart. Journ. Geol. Soc., vol. xxx,
p. 360 (in list from Bed ii).
1879. — — (= *LUCINA ORBICULARIS* ?), *Price*. The Gault, p. 62.

Description.—Shell small, oval, shorter than high, somewhat inequilateral and oblique, of moderate convexity, compressed postero-dorsally. Anterior and ventral margins evenly rounded, posterior less curved and forming a blunt angle with the hinge-line. Umbones of moderate size, pointed. Hinge-line long, more extended posteriorly than anteriorly. Hinge-area long. Ornamentation consists of broad, flattened concentric ridges, separated by sharp, narrow grooves. Radial

ribs slender, faintly marked, sometimes indistinct in part, better marked near the umbones and on the postero-dorsal region than elsewhere. Anterior teeth (about five) short and nearly perpendicular; posterior (about six) more oblique, the external being nearly horizontal. Margins entire.

Measurements :

Length	(1)	(2)	(3)
	5·5	4·25	3·75 mm.
Height	6·0	4·5	4·0 „

Affinities.—This appears to be similar to the form described as *Pectunculus insculptus*, Reuss, from the Priesen Beds of Bohemia, but since the figures¹ of that form show casts only it is difficult to determine its affinities. The hinge-line in *P. insculptus* seems to be much more curved, forming a fairly sharp angle at the umbo, and the teeth are also more numerous than in *L. albiensis*.

In *P. reticulatus*, Reuss,² the radial ribs are much better marked than in *L. albiensis*.

Types.—In the Museum of Practical Geology.

Distribution.—Lower Gault (zones ii, iii, and vii) of Folkestone.

LIMOPSIS, sp. Plate XV, figs. 5 a—c, 6 a—c.

1897. LIMOPSIS, sp., *H. Woods*. Quart. Journ. Geol. Soc., vol. liii, p. 379, pl. xxvii, figs. 7, 8.

Description.—Shell small, oval, convex, a little oblique, higher than long; margins of valves not crenulate. Casts show fine radial striæ, sometimes crossed by a few shallow concentric furrows.

Measurements :

Length	8 mm.
Height	7 „

Remarks.—At present this species is known only from internal casts, so that a complete description cannot be given; it seems, however, to be distinct from other forms.³ I have not been able to make out satisfactorily the hinge

¹ Gemitz, 'Char. der Schicht. u. Petref. d. sachs.-böhm. Kreidegeb.,' pt. iii (1842), p. 78, pl. xx, fig. 17; Reuss, 'Die Verstein. der böhm. Kreidef.,' pt. ii (1846), p. 8, pl. xxxv, fig. 5; Fritsch, 'Stud. im gebiete der böhm. Kreidef.,' v. Priesener Schichten (1893), p. 93, fig. 106.

² Reuss, *ibid.*, p. 8, pl. xxxv, figs. 7, 8.

³ Compare with the following, most of which are known as casts only:

(i) *L. calvus*, Sowerby, 'Trans. Geol. Soc.,' ser. 2, vol. iii (1832), p. 417, pl. xxxviii, fig. 2; Zittel, 'Die Bivalv. der Gosaugeb.,' 'Denkschr. d. k. Ak. d. Wissensch. Wien. Math.-nat. Cl.,' vol. xxiv (1865), p. 165, pl. ix, fig. 8.

(ii) *L. rhomboïdalis*, Alth, 'Haidinger's Naturwiss. Abhandl.,' vol. iii, pt. 2 (1850), p. 233, pl. xii, fig. 17; Favre, 'Moll. Foss. Craie de Lemberg' (1869), p. 121, pl. xii, figs. 11, 12.

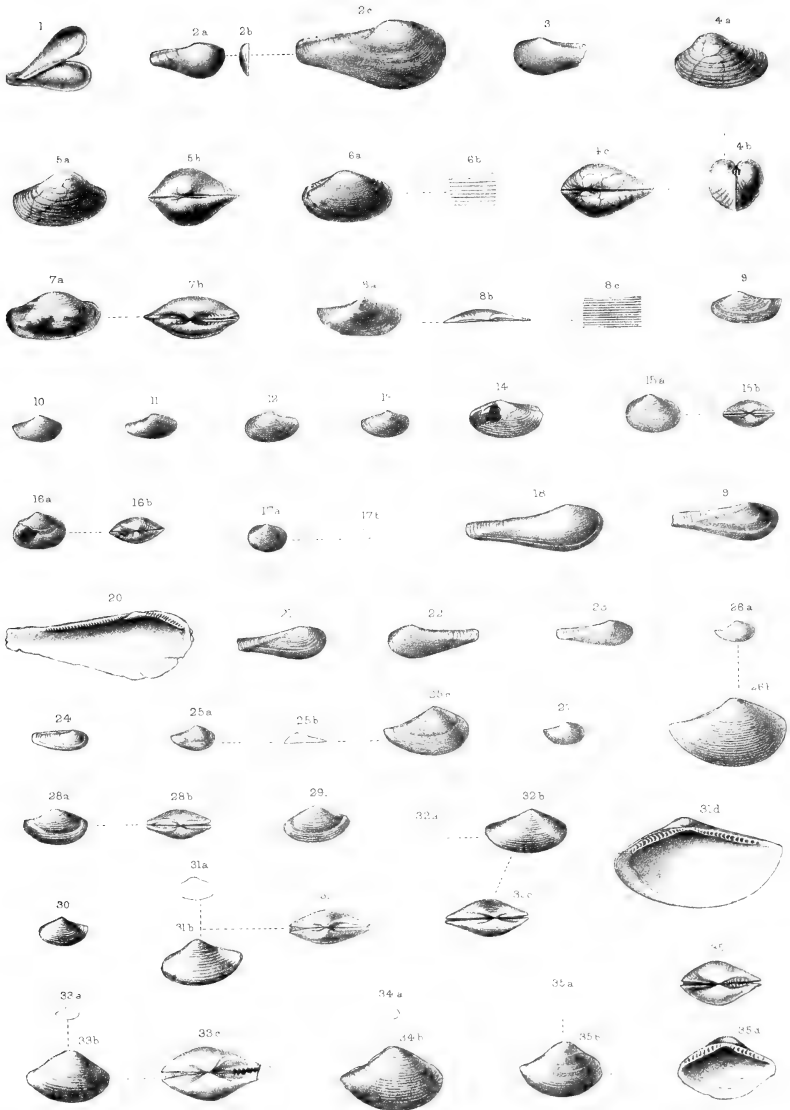
The figures are of natural size unless the amount of enlargement is stated.

PLATE I.

Genus *NUCULANA*, Link.

FIGS.

- 1—3. *N. spathulata* (Forbes). (P. 1.)
1. The Type. Atherfield Clay, Atherfield. Mus. Geol. Soc., No. 2112.
2. Crackers, Atherfield. Wiltshire Collection, Woodwardian Museum. *a*, right valve; *b*, anterior of same; *c*, same valve × 2.
3. Same horizon, locality, &c. Left valve.
- 4, 5. *N. subrecurva* (Phil.). Speeton Clay, Speeton. Leckenby Collection, Woodwardian Museum. (P. 2.)
4. *a*, left valve; *b*, anterior view; *c*, dorsal. Figured by Gardner.
5. *a*, right valve; *b*, dorsal view.
- 6, 7. *N. speetonensis*, Woods. Speeton Clay, Speeton. Museum of Practical Geology, No. 6412. (P. 3.)
6. *a*, left valve; *b*, ornament × 2.
7. *a*, left valve; *b*, dorsal view.
- 8—14. *N. [? Yoldia] scapha* (d'Orb.). 8—13, Atherfield Clay, Sevenoaks. (P. 3.)
8. Collection of C. J. A. Meyer. *a*, right valve; *b*, dorsal view; *c*, ornament × 2. Figured by Gardner.
9. British Museum, No. L 9280. Left valve.
10, 11. — — Right valves.
12. Collection of C. J. A. Meyer. Left valve.
13. — — Right valve.
14. Speeton Clay, Speeton. Woodwardian Museum. Left valve.
- 15—17. *N. Seeleyi* (Gardn.). Speeton Clay, Speeton. (P. 5.)
15. The Type. Leckenby Collection, Woodwardian Museum. *a*, left valve; *b*, dorsal view.
16. Woodwardian Museum. *a*, left valve; *b*, dorsal.
17. Bed C 3. Collection of G. W. Lamplugh. *a*, left valve; *b*, dorsal outline.
- 18—24. *N. solea* (d'Orb.). Gault, Folkestone. (P. 5.)
18, 19. Wiltshire Collection, Woodwardian Museum. Right valves.
20. Montagu Smith Collection, Woodwardian Museum. Interior of left valve × 2.
21—24. British Museum, No. L 4974. 21, 23, and 24, right valves; 22, left valve.
- 25—27. *N. Mariæ* (d'Orb.). Gault, Folkestone. (P. 6.)
25. British Museum, No. L 4973. *a*, right valve; *b*, dorsal outline; *c*, same × 2.
26. British Museum, No. L 4973. *a*, right valve; *b*, same × 3.
27. Woodwardian Museum. Right valve.
- 28—32. *N. lineata* (Sow.). 28—31, Greensand, Blackdown. (P. 7.)
28. The Type, Bristol Museum. *a*, right valve; *b*, dorsal view.
29. Collection of C. J. A. Meyer. Left valve.
30. Wiltshire Collection, Woodwardian Museum. Left valve.
31. — — — *a*, outline of left valve; *b*, same × 2; *c*, same, dorsal, × 2; *d*, interior of another specimen, right valve, × 3.
32. Lower Greensand, Atherfield. Gardner Collection, British Museum, No. L 5109. *a*, outline of right valve; *b*, same × 2; *c*, dorsal view × 2.
- 33—35. *N. angulata* (Sow.). Greensand, Blackdown. (P. 8.)
33. Collection of C. J. A. Meyer. *a*, outline of right valve; *b*, same × 4; *c*, another specimen, dorsal view, × 4.
34. *a*, outline of right valve; *b*, same × 4.
35. The Types, British Museum, No. 43213. *a*, outline of right valve; *b*, same × 3; *c*, dorsal view of another specimen × 3; *d*, interior of another specimen, right valve, × 3.



E. Wilson, del. W. H. Cressler lith.

West, Newman unsp.



PLATE II.

NUCULANA (*continued*).

FIGS.

- 1—3. *N. phaseolina* (Mich.). Gault, Folkestone. (P. 9.)
 1. British Museum, No. L 5106. *a*, left valve; *b*, dorsal view; *c*, posterior; *d*, left valve $\times 2$.
 2, 3. British Museum, No. L 4969. 2 *a*, right valve; 2 *b*, same $\times 3$; 3, left valve.
- 4—9. *N. Vibrayeana* (d'Orb.). 4—8, Gault, Folkestone. British Museum, No. L 4971. (P. 10.)
 4. *a*, right valve; *b*, same $\times 2$; *c*, dorsal view $\times 2$.
 5. *a*, right valve; *b*, dorsal view.
 6—8. Left valves.
 9. Cambridge Greensand (derived from Gault). The Type of *N. subelliptica*, Seeley, Carter Collection, Woodwardian Museum. Right valve; natural internal mould.
10. *N. sp.*, cf. *siliqua* (Goldf.). Chalk Rock (zone of *Het. Reussianum*), Cuckhamsley. Montagu Smith Collection, Woodwardian Museum. *a*, internal mould of left valve; *b*, mould of teeth $\times 3$. (P. 11.)
- Genus NUCULA, Lamarck.*
- 11—15. *N. planata*, Desh. 11—13, Speeton Clay, Speeton. Leckenby Collection, Woodwardian Museum. (P. 12.)
 11. *a*, right valve; *b*, dorsal view. Figured by Gardner, Quart. Journ. Geol. Soc., xl (1884), pl. v, f. 3.
 12. *a*, right valve; *b*, dorsal view.
 13. Right valve, somewhat crushed. Figured by Gardner, *ibid.*, pl. v, f. 2.
 14 Crackers, Atherfield. Woodwardian Museum. *a*, left valve; *b*, dorsal view. Figured by Gardner, *ibid.*, pl. v, f. 1.
 15. Crackers, Atherfield. Leckenby Collection, Woodwardian Museum. Right valve.
- 16, 17. *N. sp.* Claxby Ironstone (zone of *Belemnites lateralis*), Benniworth Haven. Woodwardian Museum. (P. 13.)
 16. *a*, left valve; *b*, same, interior filled with oolitic ironstone; *c*, same, posterior; *d*, same, dorsal. Figured by Gardner (as *N. Cornueliana*, d'Orb.), Quart. Journ. Geol. Soc., xl (1884), pl. v, f. 5, 6.
 17. Right valve.
- 18, 19. *N. Lamplughii*, Woods. Speeton Clay (D 4), Speeton. Collection of G. W. Lamplugh. (P. 14.)
 18. *a*, right valve; *b*, dorsal view.
 19. Left valve.
20. *N. sp.* Lower Greensand, Atherfield. British Museum. (P. 14.)
a, left valve, outline; *b*, same $\times 2$; *c*, same, dorsal view of both valves $\times 2$; *d*, same, posterior view $\times 2$.
21. *N. Mejeri*, Gardn. Lower Greensand, Atherfield. British Museum. The Type. (P. 15.)
a, left valve, outline; *b*, same $\times 2$; *c*, same, dorsal view of both valves $\times 2$.
- 22—27. *N. pectinata*, Sow. Gault, Folkestone (except f. 24). (P. 16.)
 22. Montagu Smith Collection, Woodwardian Museum. Right valve.
 23. Woodwardian Museum. *a*, right valve; *b*, same, posterior view; *c*, same, dorsal.
 24. Gault, Aylesford. Woodwardian Museum. Right valve.
 25. Woodwardian Museum. Left valve.
 26. Wiltshire Collection, Woodwardian Museum. Left valve.
 27. Woodwardian Museum. *a*, left valve; *b*, posterior view; *c*, portion of ornamentation of left valve enlarged.

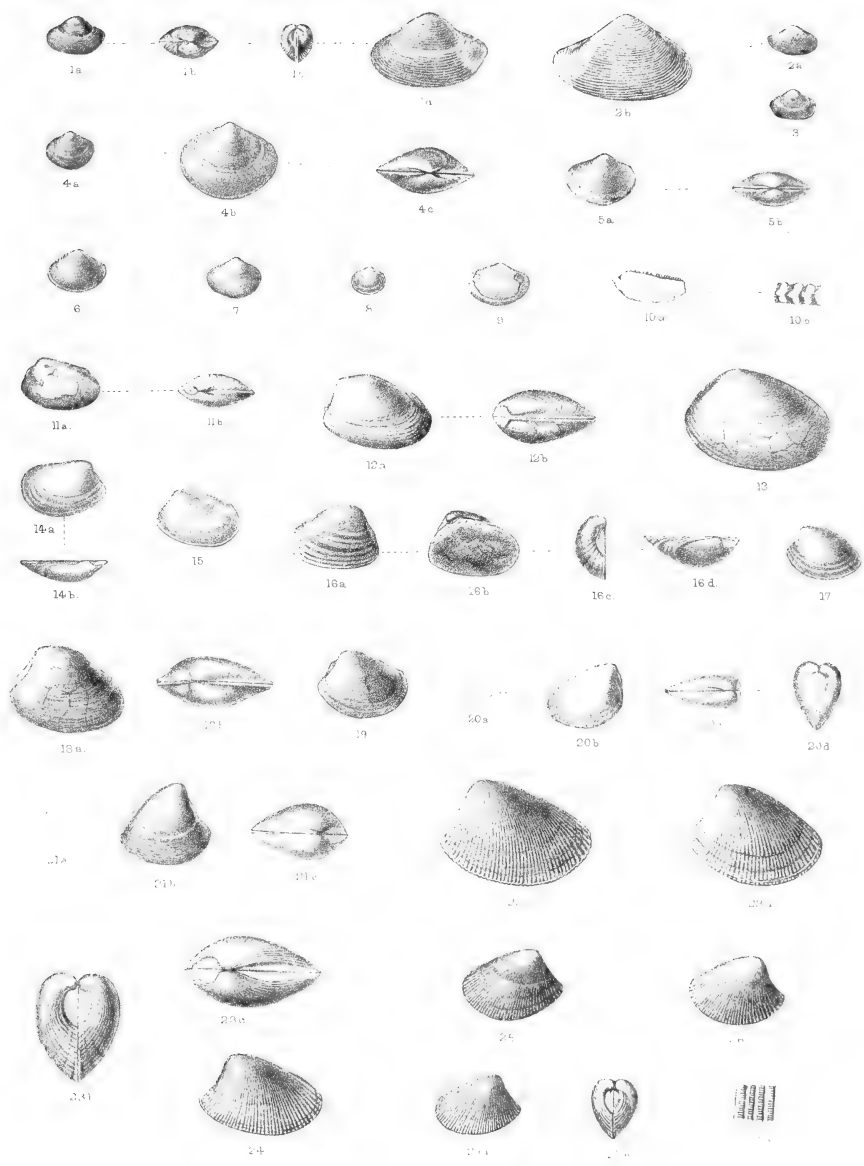


PLATE III.

NUCULA (*continued*).

FIGS.

- 1—12. *N. (Acila) bivirgata*, Sow. Gault, Folkestone (except f. 12). (P. 19.)
1. Woodwardian Museum. Right valve $\times 1\frac{1}{2}$.
 2. British Museum, No. L 5907. *a*, outline of left valve; *b*, same $\times 1\frac{1}{2}$; *c*, dorsal outline. Figured by Gardner.
 3. Wiltshire Collection, Woodwardian Museum. Right valve $\times 1\frac{1}{2}$.
 4. British Museum, No. L 5907. Left valve $\times 1\frac{1}{2}$. Figured by Gardner.
 5. — No. L 4972. *a*, right valve; *b*, posterior end; *c*, dorsal $\times 1\frac{1}{2}$.
 6. — — Left valve $\times 1\frac{1}{2}$.
 7. — — Median portion of left valve $\times 1\frac{1}{2}$.
 8. — — Median portion of right valve $\times 1\frac{1}{2}$.
 9. — — Left valve $\times 1\frac{1}{2}$.
 10. — No. L 5102. Hinge of right valve $\times 2$.
 11. Collection of C. J. A. Meyer. Antero-ventral portion of left valve $\times 6$.
 12. Cambridge Greensand. Woodwardian Museum. Internal mould, right valve.
13. *N. pectinata*, Sow. Cambridge Greensand (derived). Woodwardian Museum. Internal mould. *a*, right valve; *b*, dorsal view. (P. 16.)
- 14, 15. *N. pectinata*, var. *cretæ*, Gardner. Greensand, Blackdown. Museum of Practical Geology. The Types of var. *cretæ*. (P. 18.)
14. *a*, right valve; *b*, dorsal (No. 6449).
 15. Left valve (No. 6450).
- 16—21. *N. ovata*, Mant. Gault, Folkestone. (P. 21.)
16. British Museum, No. L 4968. Right valve.
 17. Wiltshire Collection, Woodwardian Museum. Right valve.
 - 18—20. British Museum, No. L 4968. 18, right valve. 19. *a*, left valve; *b*, dorsal view; 20, right valve.
 21. Woodwardian Museum. *a*, right valve; *b*, dorsal.



1



2a

2b

2c



3



4



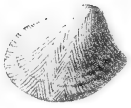
5a



5b



5c



6



7



8



9



11



12



13a



13b



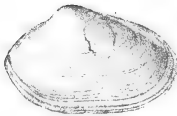
14a



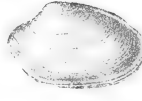
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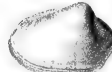
14c



16



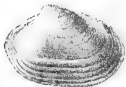
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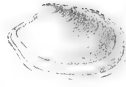
18a



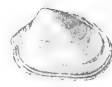
18b



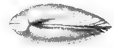
19



20



21a



21b

PLATE IV.

NUCULA (*continued*).

FIGS.

1. *N. ovata*, Mant. Gault, Folkestone. British Museum, No. L 4968.
a, right valve; *b*, dorsal. (P. 21.)
- 2—4. *N. obtusa*, Sow. Greensand, Blackdown. (P. 22.)
 2. The Type, Bristol Museum. *a*, right valve; *b*, posterior view of same.
 3. Museum of Practical Geology, No. 6351. Right valve.
 4. — — — — Left valve. Figured by Gardner.
a, left valve; *b*, posterior of same; *c*, dorsal of same; *d*, hinge $\times 2$.
- 5—8. *N. impressa*, Sow. Greensand, Blackdown. (P. 23.)
 5. Wiltshire Collection, Woodwardian Museum. Right valve.
 6. — — — — *a*, left valve; *b*, dorsal; *c*, posterior.
 7. Wiltshire Collection, Woodwardian Museum. Interior of right valve $\times 2$.
 8. Probably the type of *N. apiculata*, Sowerby. Museum of the Geological Society, No. 1564. *a*, right valve; *b*, dorsal view.
- 9—16. *N. albensis*, d'Orb. Gault, Folkestone. (P. 24.)
 9. Museum of Practical Geology, No. 1638. *a*, right valve; *b*, dorsal view.
 10. Wiltshire Collection, Woodwardian Museum. Left valve.
 11. Woodwardian Museum. Right valve.
 12. British Museum, No. 4963. *a*, left valve; *b*, dorsal view.
 13. — — — —
 14. Woodwardian Museum. *a*, left valve; *b*, dorsal view.
 15. Collection of C. J. A. Meyer. *a*, left valve; *b*, dorsal view.
 16. Wiltshire Collection, Woodwardian Museum. Left valve.
17. *N. albensis?* d'Orb. Greensand, Blackdown. Wiltshire Collection, Woodwardian Museum. Right valve. (P. 25.)
- 18—21. *N. gaultina*, Gardn. Gault, Folkestone. British Museum, No. 4970. (P. 25.)
 18. *a*, right valve; *b*, posterior; *c*, dorsal.
 19. Left valve.
 20. Right valve.
 21. *a*, left valve, outline; *b*, same $\times 1\frac{1}{2}$; *c*, dorsal $\times 1\frac{1}{2}$.
- 22—26. *N. antiqata*, Sow. Greensand, Blackdown. Wiltshire Collection, Woodwardian Museum. (P. 26.)
 22. *a*, left valve; *b*, dorsal view; *c*, posterior.
 23. *a*, right valve; *b*, dorsal view.
 24. *a*, dorsal view; *b*, left valve.
 25. Interior of right valve $\times 2$.
 26. Right valve.
- 27, 28. *N. sp.* Chalk Rock (zone of *Het. Reussianum*), Cuckhamsley. Montagu Smith Collection, Woodwardian Museum. Internal moulds of right valves. (P. 27.)

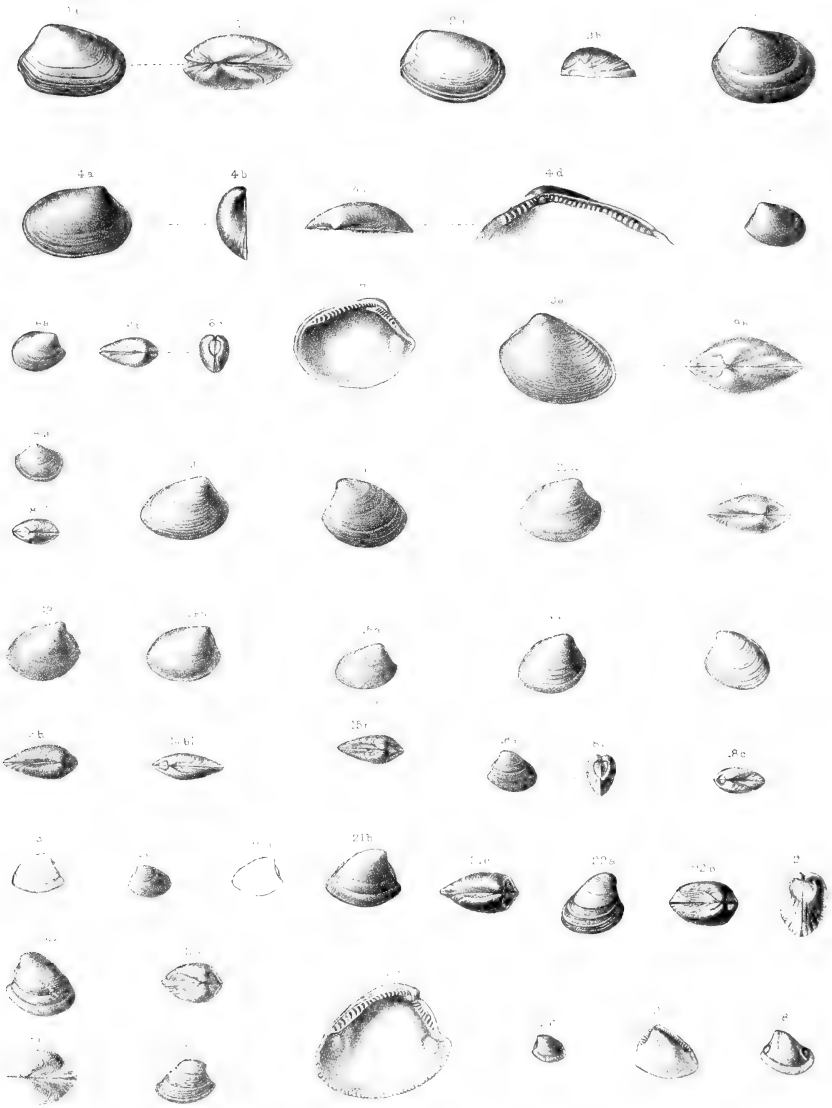


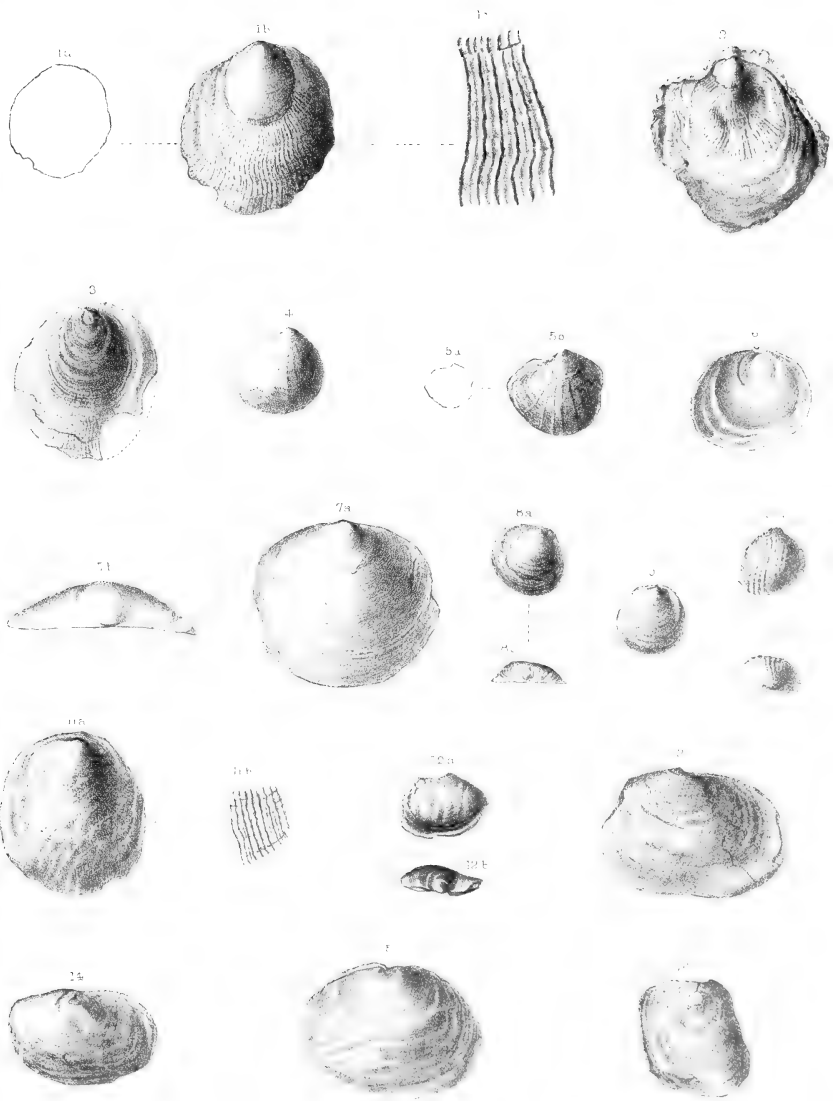


PLATE V.

Genus ANOMIA, *Linnæus*.

FIGS.

- 1—3. *A. pseudoradiata*, d'Orb. Lower Greensand. (P. 27.)
1. Crackers, Atherfield. Woodwardian Museum. *a*, outline of left valve; *b*, same $\times 1\frac{1}{2}$; *c*, ornament of same $\times 6$.
 2. Atherfield Beds, Redhill. British Museum, No. L 9288. Left valve.
 3. Atherfield. Museum of the Geological Society. Left valve (young specimen) $\times 1\frac{1}{4}$.
- 4, 5. *A. sp.* Crackers, Atherfield. (P. 28.)
4. Woodwardian Museum. Left valve.
 5. Wiltshire Collection, Woodwardian Museum. *a*, left valve, outline; *b*, same $\times 2$.
- 6—9. *A. lævigata*, Sow. Lower Greensand. (P. 29.)
6. Museum of Practical Geology, No. 6414. Hythe Beds, Lympne. ? Interior of left valve. One of the Types.
 7. Museum of Practical Geology, No. 6415. Atherfield Beds, Peasmarsh. *a*, left valve; *b*, dorsal view of same.
 8. Museum of Practical Geology, No. 6417. Punfield. *a*, left valve; *b*, dorsal.
 9. Collection of C. J. A. Meyer. Ferruginous Sands, Shanklin. Left valve.
10. *A. convexa*, Sow. Lower Greensand, Shanklin. Museum of the Geological Society, No. 2032. *a*, left valve; *b*, dorsal view. (P. 29.)
11. *A. cf. pseudoradiata*, d'Orb. Gault, Black Ven. Museum of Practical Geology, No. 6440. *a*, left valve; *b*, portion $\times 3$. (P. 30.)
12. *A. ? transversa*, Seel. Cambridge Greensand. Woodwardian Museum. *a*, left valve; *b*, dorsal view of same. (P. 30.)
- 13—16. *A. papyracea*, d'Orb. Lower Chalk—Totternhoe Stone (zone of *Holaster subglobosus*). (P. 31.)
13. Woodwardian Museum. Burwell. Left valve. Figured by Etheridge. The dorsal part of the shell is crushed, giving the umbo the appearance of being at the margin.
 14. York Museum. Reach. Left valve. Dorsal part of shell is crushed.
 15. Woodwardian Museum. Burwell. Left valve. Figured by Etheridge.
 16. Woodwardian Museum. Right valve.



T.M. Brock del. W.H. Crowder lith.

West, Newman. sculp.



PLATE VI.

Genus ARCA, Lamarck.

FIGS.

1—3. *A. Dupiniana*, d'Orb. (P. 32.)

- 1, 2. *Perna*-bed, Atherfield. Leckenby Collection. Woodwardian Museum. 1 *a*, right valve; 1 *b*, dorsal view of same specimen; 2, hinge of left valve $\times 1\frac{1}{2}$.
3. Ferruginous Sands, Shanklin. Collection of C. J. A. Meyer. Ornamentation on the right valve near the ventral margin below the umbones $\times 3$.

4, 5. *A. Carteroni*, d'Orb. (P. 33.)

4. Lower Greensand, Upware. Woodwardian Museum. *a*, left valve; *b*, anterior view; *c*, dorsal of same specimen. Figured by Keeping.
5. Atherfield Beds, East Shalford. Collection of C. J. A. Meyer. *a*, left valve; *b*, hinge and area of same $\times 1\frac{1}{2}$; *c*, ornamentation, from the anterior part of the valve, $\times 3$.

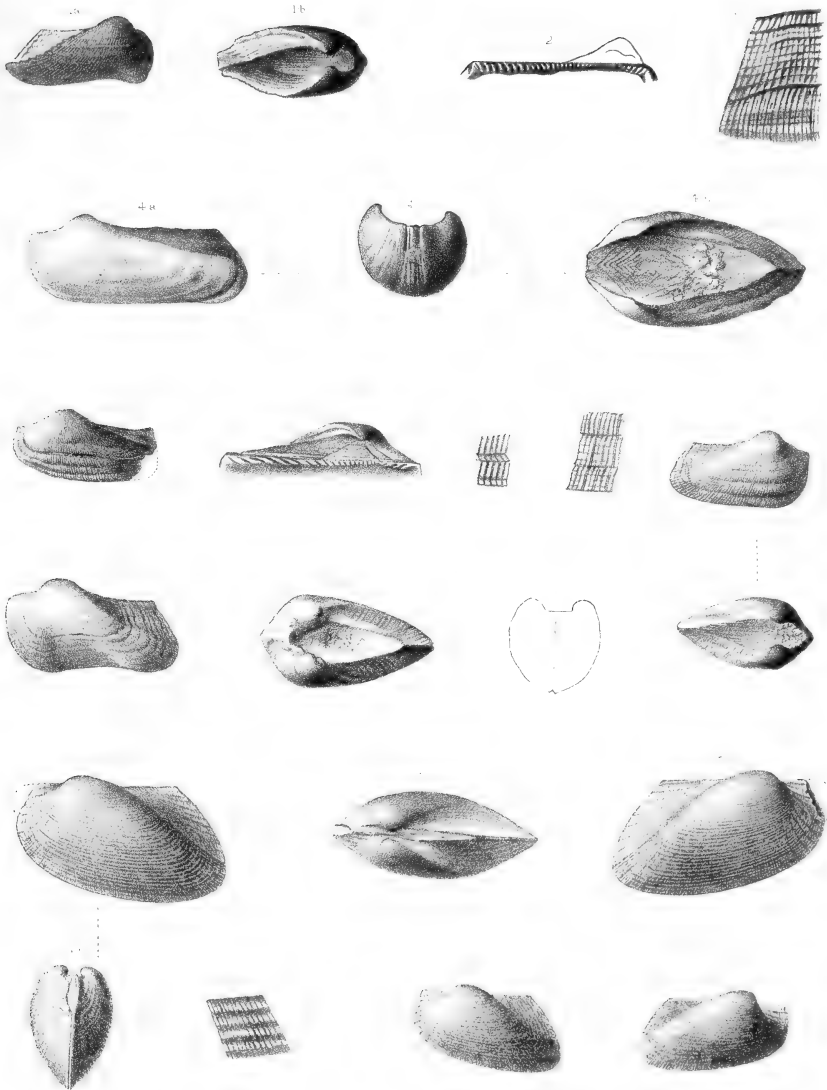
6, 7. *A. Sanctæ-Crucis*, Pict. and Camp. Lower Greensand, Upware. Woodwardian Museum. (P. 34.)

6. *a*, left valve; *b*, outline of anterior end; *c*, dorsal view of same specimen. (The right umbo and the anterior part of the area are partly obscured by adhering rock.)
7. *a*, right valve; *b*, dorsal view of same specimen; *c*, ornamentation $\times 2$.

Genus BARBATA, Gray.

8, 9. *B. aptiensis* (d'Orb.). Crackers, Atherfield. Leckenby Collection, Woodwardian Museum. (P. 35.)

8. *a*, left valve; *b*, dorsal; *c*, right valve; *d*, anterior; *e*, part of left valve near the mid-ventral margin $\times 3$.
9. *a*, left valve; *b*, right valve.



T. A. Froese del.
W. H. Crowther lith.

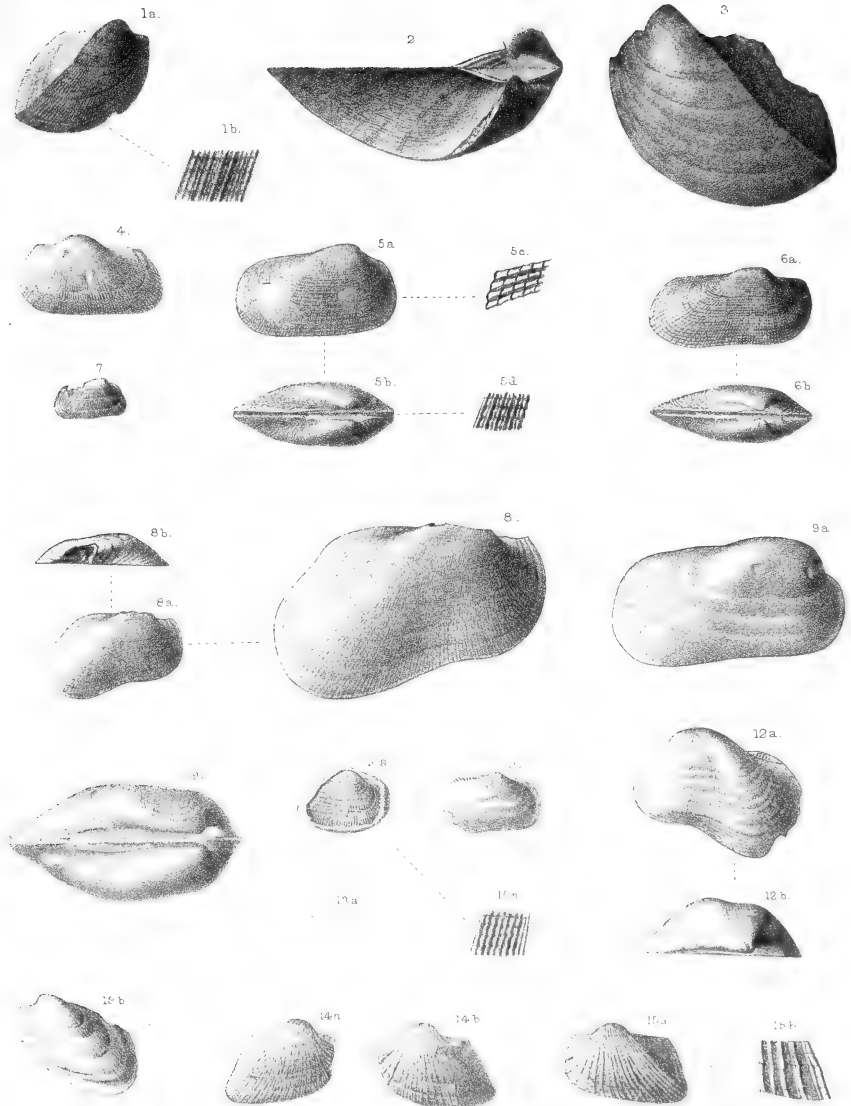
West. Newman sculp.

PLATE VII.

BARBATIA (*continued*).

FIGS.

- 1—3. *B. (Scaphula?) Austeni* (Forbes). (P. 37.)
 1, 2. Crackers, Atherfield. Leckenby Collection, Woodwardian Museum. 1 *a*, right valve; 1 *b*, ornamentation near postero-ventral angle $\times 3$. 2. Dorsal view of another specimen $\times 2$.
 3. Left valve. *Perna*-bed, Redcliff. Collection of C. J. A. Meyer.
- 4—7. *B. marullensis* (d'Orb.). (P. 38.)
 4. Left valve. Lower Greensand, Upware. Woodwardian Museum.
 5. Gault (zone iii), Folkestone. Museum of Practical Geology, No. 1630. *a*, right valve; *b*, dorsal view of same specimen; *c*, ornamentation on postero-dorsal area $\times 4$; *d*, ornamentation from near the middle of the valve $\times 4$.
 6. Gault, Folkestone. Wiltshire Collection, Woodwardian Museum. *a*, right valve; *b*, dorsal view of same specimen.
 7. Gault, Folkestone. Museum of Practical Geology, No. 6559. Right valve.
8. *B. rotundata* (Sow.). Greensand, Blackdown. The Type, Bristol Museum. *a*, right valve; *b*, dorsal view; *c*, same $\times 2$. (P. 40.)
9. *B. Galliennei* (d'Orb.). Chalk Marl, near Lyme Regis. Wiltshire Collection, Woodwardian Museum. Internal mould. *a*, right valve; *b*, dorsal view of same specimen. (P. 41.)
- 10, 11. *B. sp.*, cf. *Geinitzi* (Reuss). Chalk Rock (zone of *Het. Reussianum*), Cuckhamsley. Montagu Smith Collection, Woodwardian Museum. (P. 42.)
 10. *a*, portion of wax mould of right valve; *b*, ornamentation $\times 5$.
 11. Natural internal mould of right valve.
12. *B. sp.* Same locality and Collection. *a*, internal cast of left valve; *b*, dorsal view of same. (P. 42.)
13. *B.?* *sp.* Same locality and Collection. *a*, left valve, outline natural size; *b*, same $\times 2$. (P. 43.)
- Genus* GRAMMATODON, *Meek and Hayden*.
- 14, 15. *G. securis* (Leymerie). Speeton Clay (zone of *Bel. brunsvicensis*), Speeton. Collection of G. W. Lamplugh. (P. 44.)
 14. *a, b*, right and left valves of same specimen.
 15. *a*, left valve; *b*, ornamentation $\times 3$.



T.A. Brock del.
W.H. Crowther lith.

West, Newman imp.

PLATE VIII.

GRAMMATODON (*continued*).

FIGS.

1, 2. *G. securis* (Leym.), Speeton Clay (zone of *Bel. brunsvicensis*), Speeton. (P. 44.)

1. Collection of G. W. Lamplugh. Dorsal view $\times 2$.
2. York Museum. Left valve, with part of shell preserved.

3—8. *G. carinatus* (Sow.). (P. 45.)

3. Greensand, Blackdown. Wiltshire Collection, Woodwardian Museum. *a*, outline of left valve; *b*, same $\times 1\frac{1}{2}$; *c*, dorsal view of same $\times 1\frac{1}{2}$; *d*, hinge and area of same $\times 2$.
4. Same locality and Collection. *a*, left valve; *b*, dorsal; *c*, anterior view.
5. Same locality and Collection. Right valve.
6. Gault, Lyme Regis. Woodwardian Museum. Left valve.
7. Gault (zone ii), Folkestone. Museum of Practical Geology, No. 1632. *a*, right valve; *b*, dorsal.
8. Gault, Folkestone. Wiltshire Collection, Woodwardian Museum. Left valve. The ventral part is crushed in, so that the shell appears too long proportionately.

Genus TRIGONARCA, *Conrad*.

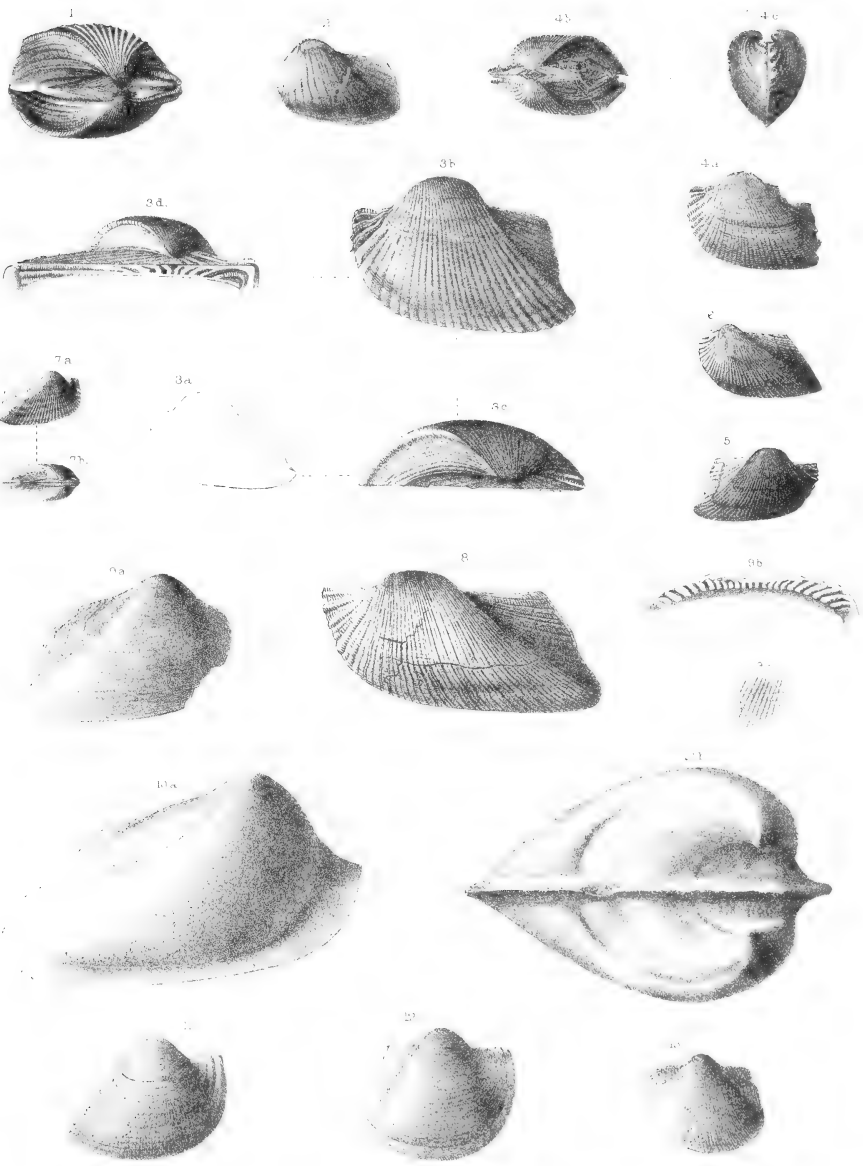
9, 10. *T. Passyana* (d'Orb.). (P. 47.)

9. Greensand, Kingskerswell. British Museum, No. L 1853. *a*, right valve; *b*, cast of hinge; *c*, ornamentation $\times 3$.
10. Chloritic Marl, Maiden Bradley. Woodwardian Museum. Internal cast. *a*, right valve; *b*, dorsal.

Genus CUCULLEA, *Lamarck*.

11—13. *C. Cornueliana* (d'Orb.). Lower Greensand, Atherfield. (P. 50.)

11. Right valve. Woodwardian Museum. Above the Crackers.
12. Right valve. Woodwardian Museum. Crackers.
13. Left valve. Woodwardian Museum. Above the Crackers.



T. A. Brock del.
A. T. Hollick lit.

West. Newman imp.

CRETACEOUS LAMELLIBRANCHIA.

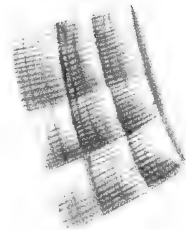
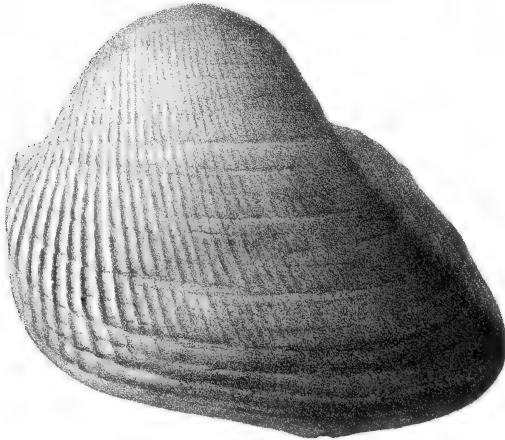
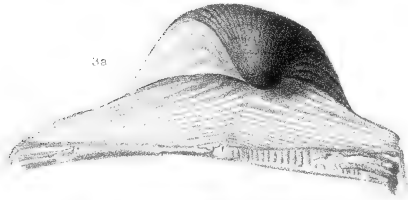
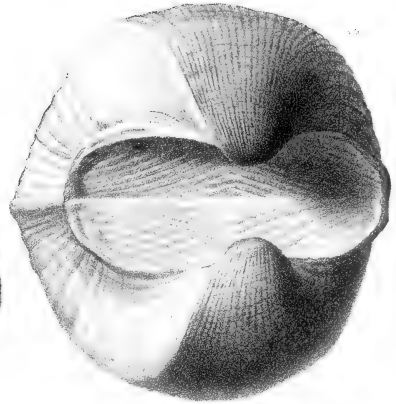
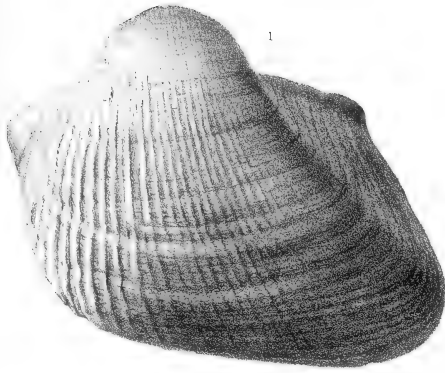


PLATE IX.

FIGS.

1—3. *Cucullwa Forbesi* (Pict. and Camp.). *Perna*-bed, Atherfield. (P. 49.)

1. Wiltshire Collection, Woodwardian Museum. Left valve.
2. Woodwardian Museum. *a*, dorsal; *b*, anterior of right valve; *c*, part of *b* × 3.
3. Wiltshire Collection, Woodwardian Museum. *a*, hinge and area of left valve; *b*, exterior of left valve.



T.A. Brook del.
W.H. Crowther lith.

West, Newman imp

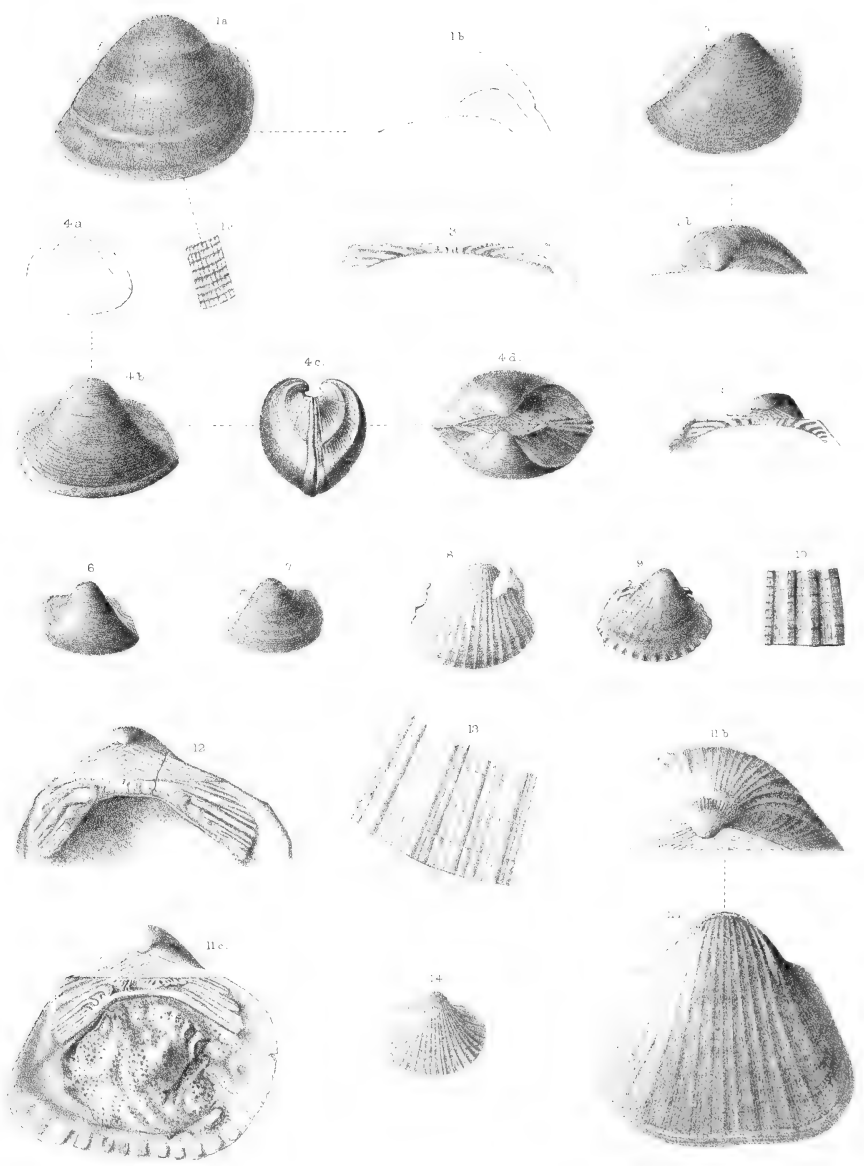


PLATE X.

CUCULLÆA (*continued*).

FIGS.

- 1—3. *C. Cornueliana* (d'Orb.). Crackers, Atherfield. (P. 50.)
1. Leckenby Collection, Woodwardian Museum. *a*, right valve; *b*, dorsal outline; *c*, ornamentation $\times 4$.
 2. Leckenby Collection, Woodwardian Museum. *a*, right valve; *b*, dorsal.
 3. Woodwardian Museum. Hinge $\times 2$.
- 4—7. *C. Fittoni* (Pict. and Camp.). Crackers, Atherfield. (P. 52.)
4. Leckenby Collection, Woodwardian Museum. *a*, outline of left valve; *b*, same $\times 1\frac{1}{2}$; *c*, posterior of same $\times 1\frac{1}{2}$; *d*, dorsal of same $\times 1\frac{1}{2}$.
 5. Woodwardian Museum. Hinge and area $\times 2$.
 6. Leckenby Collection. Left valve.
 7. Wiltshire Collection. Right valve.
- 8—10. *C. vagans*, Keeping. Lower Greensand (Black-grit nodule), Upware. Woodwardian Museum. (P. 52.)
8. Drawn from a wax mould of an external cast. Right valve.
 9. Natural internal mould. Right valve. Figured by Keeping.
 10. Ornamentation $\times 3$.
- 11—14. *C. (Dicranodonta) donningtonensis*, Keeping. Claxby Ironstone (zone of *Belemnites lateralis*), Benniworth Haven. Woodwardian Museum. (P. 54.)
11. *a*, left valve; *b*, dorsal; *c*, interior.
 12. Hinge of left valve.
 13. Ornamentation $\times 3$.
 14. Right valve.



T. A. Brock del.
A. T. Hallenk lith.

West, Newman imp.

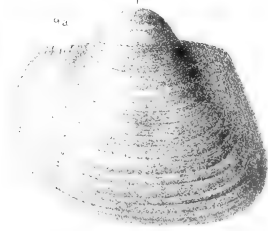
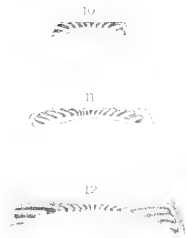
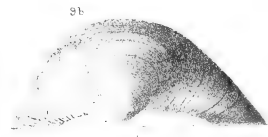
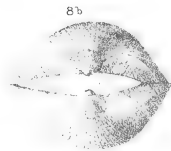
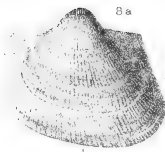
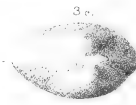
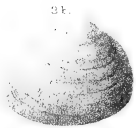
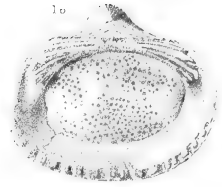
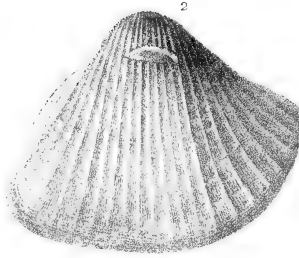
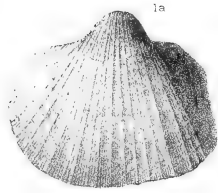


PLATE XI.

CUCULLEA (*continued*).

FIGS.

- 1, 2. *C. (Dicranodonta) donningtonensis*, Keeping. Claxby Ironstone (zone of *Belemnites lateralis*), Benniworth Haven. Woodwardian Museum. (P. 54.)
1. *a*, left valve; *b*, interior.
 2. Right valve.
- 3, 4. *C. (Dicranodonta?) obliqua* (Keeping). Lower Greensand, Upware. Woodwardian Museum. (P. 55.)
3. *a*, right valve, outline; *b*, same $\times 1\frac{1}{2}$; *c*, dorsal.
 4. Left valve, interior.
- 5—7. *C. venusta*, Nyst. Greensand, Blackdown. (P. 56.)
5. The Type, Bristol Museum. Left valve. *a*, dorsal outline; *b*, outline; *c*, same $\times 2$.
 6. The Type, Bristol Museum. Left valve. *a*, outline; *b*, same $\times 2$.
 7. Collection of C. J. A. Meyer. *a*, right valve $\times 3$ (the outer layers of the shell are absent, so that the apparent ornamentation differs from that in figs. 5 and 6); *b*, dorsal view of same $\times 3$.
- 8—12. *C. glabra*, Parkinson. Greensand, Blackdown. (P. 57.)
8. British Museum, No. 26926. *a*, left valve; *b*, dorsal of same specimen; *c*, ornamentation $\times 6$.
 9. Wiltshire Collection, Woodwardian Museum. *a*, left valve; *b*, dorsal view.
 10. Woodwardian Museum. Hinge of the left valve of a young form $\times 4$.
 11. Wiltshire Collection, Woodwardian Museum. Hinge of right valve—later stage than fig. 10— $\times 2$.
 12. Woodwardian Museum. Hinge of right valve $\times 1\frac{1}{2}$.



T. A. Breck del.
A. T. Hollick lith.

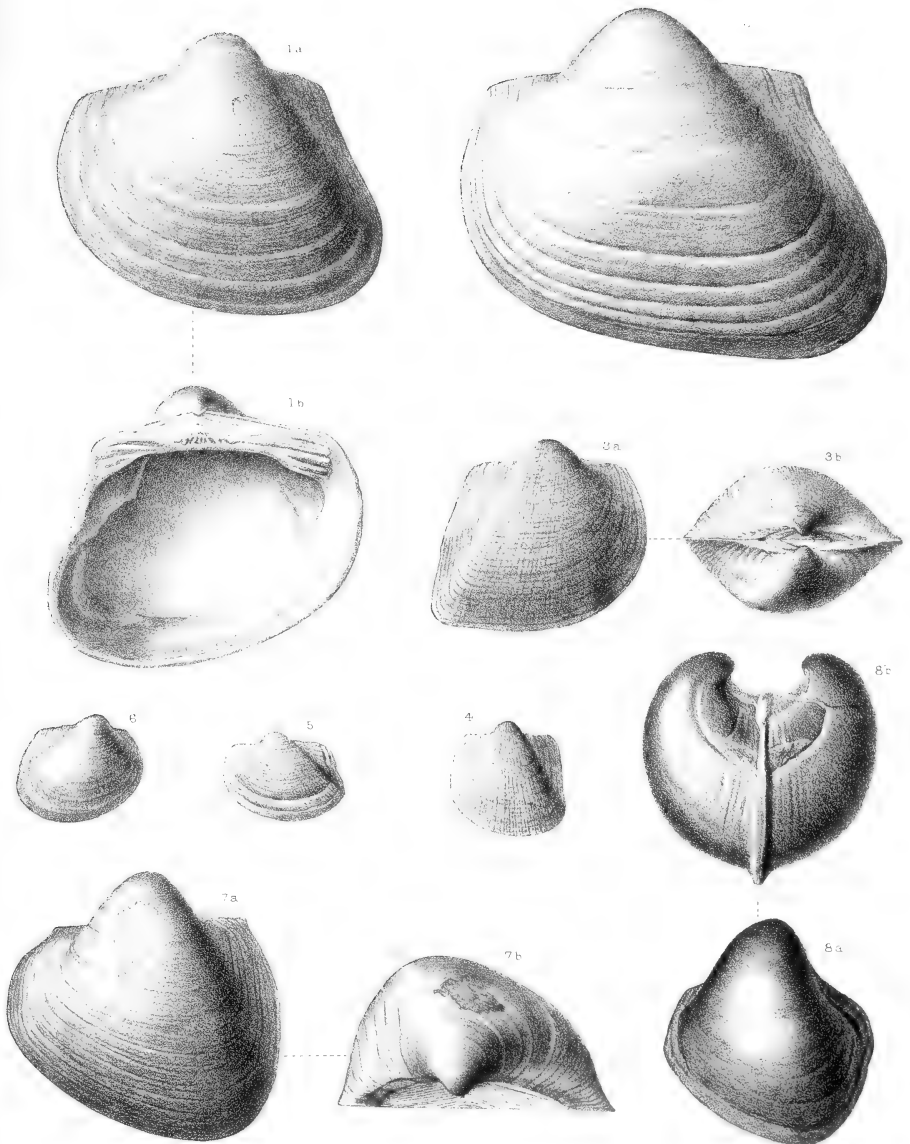
West, Newman imp.

PLATE XII.

CUCULLÆA (*continued*).

FIGS.

- 1—5. *C. glabra*, Parkinson. Greensand, Blackdown. (P. 57.)
1 *a*, 2. Wiltshire Collection, Woodwardian Museum. Left valves.
3. Woodwardian Museum. *a*, right valve; *b*, dorsal view of same specimen.
4. — — Left valve.
5. Elongate variety. Wiltshire Collection, Woodwardian Museum. Left valve.
- 6—8. *C. obesa*, Pict. and Camp. Gault. (P. 61.)
6. Folkestone. Wiltshire Collection, Woodwardian Museum. Young form. Right valve.
7. Same locality and Collection. *a*, left valve; *b*, dorsal view of same.
8. Cambridge Greensand (derived from the Gault). Woodwardian Museum. Internal cast. *a*, left valve; *b*, posterior view.



T A Brock del
W H Crowther lith

West Newman imp



PLATE XIII.

CUCULLÆA (*continued*).

FIGS.

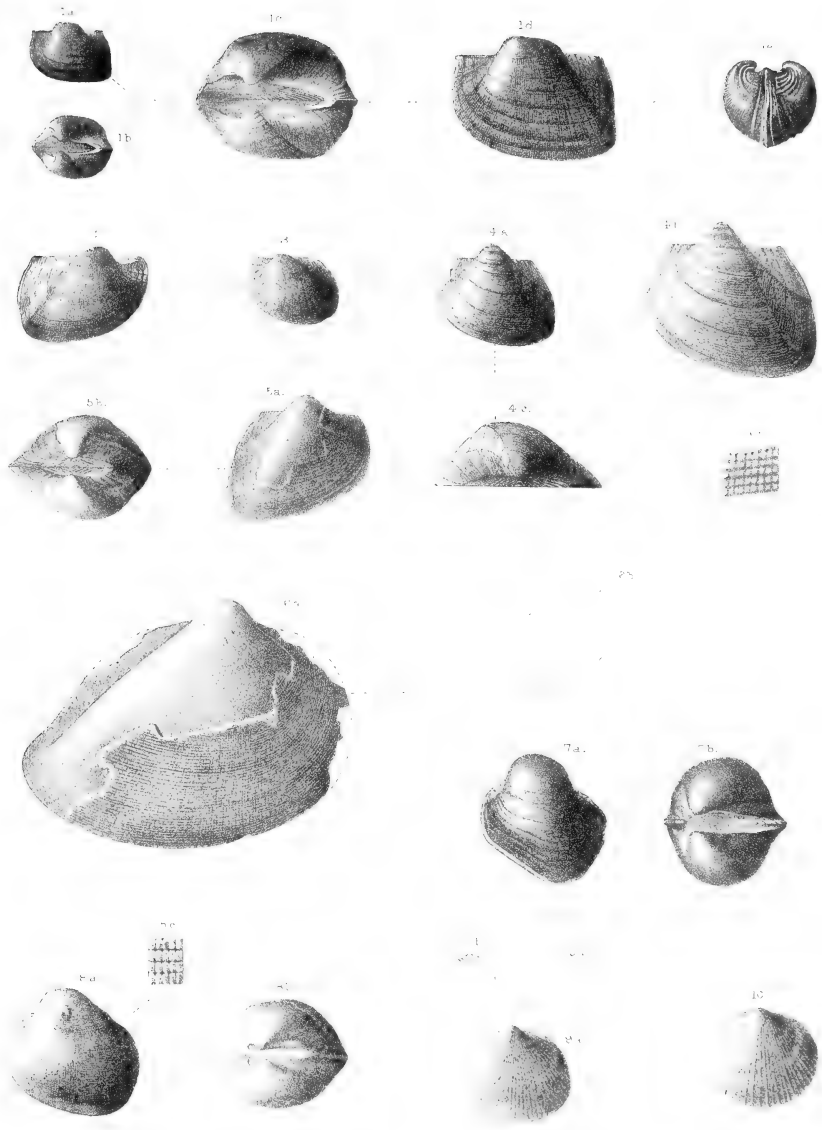
- 1—3. *C. nana*, Leym. Gault, Folkestone. British Museum, No. L 4946. (P. 62.)
1. *a*, left valve; *b*, dorsal of same; *c*, same $\times 2$; *d*, left $\times 2$; *e*, anterior view $\times 1\frac{1}{2}$. (The umbo is slightly pressed in, and consequently in 1 *a*, *d*, appears less sharp than usual.)
 2. Right valve $\times 2$.
 3. Left valve; the posterior margin is slightly imperfect. $\times 1\frac{1}{2}$.
- 4, 5. *C. Mailleana* (d'Orb.). (P. 63.)
4. Chalk Marl, Pinhay Cliffs. Collection of C. J. A. Meÿer. *a*, left valve; *b*, same, $\times 1\frac{1}{2}$; *c*, same, dorsal, $\times 1\frac{1}{2}$.
 5. Chloritic Marl, Maiden Bradley. Woodwardian Museum. With the shell partly removed. *a*, right valve; *b*, dorsal of same specimen.
6. *C.*, sp. Chalk Marl (Bed 10), Dunscombe. Collection of C. J. A. Meÿer. *a*, right valve; *b*, dorsal outline; *c*, ornamentation $\times 4$. (P. 64.)

Genus ISOARCA, Münster.

7. *I. Agassizi*, Pict. and Roux. Cambridge Greensand (derived). Internal mould. Figured by Jukes-Browne. Woodwardian Museum. *a*, left valve; *b*, dorsal. (P. 65.)
8. *I. obesa* (d'Orb.). Chloritic Marl, Ball Wood. Museum of Practical Geology, No. 6349. *a*, left valve; *b*, dorsal; *c*, ornamentation $\times 5$. (P. 65.)

Genus PECTUNCULUS, Lamarck.

- 9, 10. *Pectunculus marullensis*, Leym. Ferruginous Sands, Shanklin. Collection of C. J. A. Meÿer. (P. 66.)
9. Left valve. *a*, $\times 2$; *b*, interior; *c*, dorsal outline.
 10. Left valve $\times 3$ (another specimen).



G. A. Brown del.
 A. T. Hall sculp.

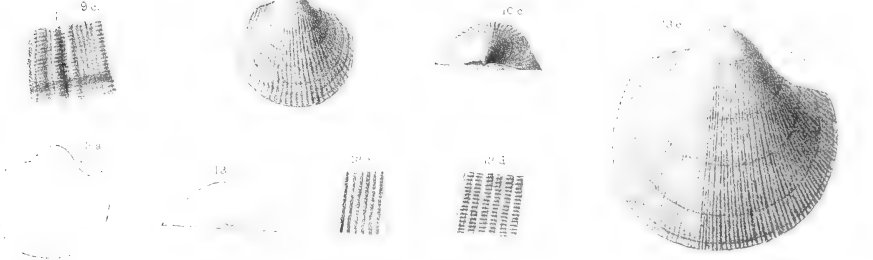
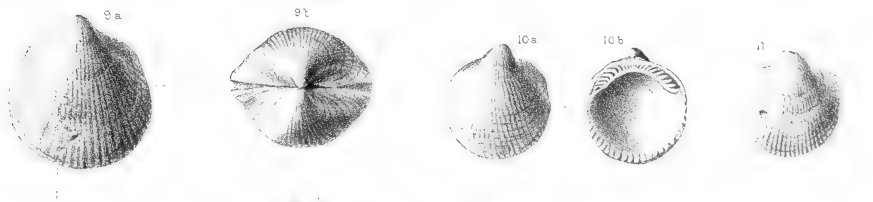
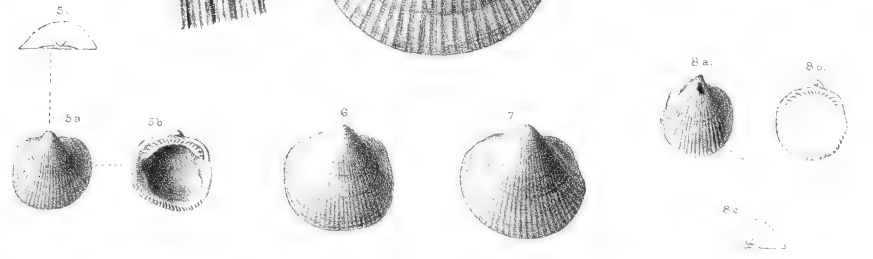
West. New York State

PLATE XIV.

PECTUNCULUS (*continued*).

FIGS.

- 1—7. *P. sublævis*, Sow. Greensand, Blackdown. (P. 67.)
- 1 *a*—*c*. Wiltshire Collection, Woodwardian Museum. Right valve.
 - 2 *a*, *b*. Walton Collection, Woodwardian Museum. Right valve.
 3. Wiltshire Collection, Woodwardian Museum. Right valve. *a*, interior; *b*, dorsal; *c*, exterior $\times 2$; *d*, ornament of same $\times 5$.
 4. Same Collection. Young form. *a*, left valve; *b*, same $\times 2$; *c*, dorsal outline.
 5. Same Collection. *a*, *b*, right valve; *c*, dorsal outline.
 - 6, 7. Museum of Practical Geology, No. 6573. Left valves.
- 8—12. *P. umbonatus* (Sow.). Greensand, Blackdown. (P. 69.)
8. Wiltshire Collection, Woodwardian Museum. *a*, right valve; *b*, outline of interior of same; *c*, dorsal outline.
 9. Walton Collection, Woodwardian Museum. *a*, left valve $\times 1\frac{1}{2}$; *b*, dorsal $\times 1\frac{1}{2}$; *c*, ornamentation $\times 5$.
 10. Same Collection. *a*, left valve; *b*, interior; *c*, dorsal.
 11. Wiltshire Collection, Woodwardian Museum. Right valve.
 12. Museum of Practical Geology, No. 6572. Right valve.
13. *P. euglyphus*, Woods. Chalk Marl (Bed ii), Dunscombe. Collection of C. J. A. Meÿer. (P. 71.)
13. *a*, right valve, outline; *b*, dorsal outline of same; *c*, ornamentation on anterior part of shell $\times 4$; *d*, ornamentation on posterior part of shell $\times 4$; *e*, same valve $\times 2$.



T. A. Prok del
W. H. Crowther lith

West Newman, 1911

CRETACEOUS LAMELLIBRANCHIA





THE
PALÆONTOGRAPHICAL SOCIETY.

INSTITUTED MDCCCXLVII.

VOLUME FOR 1899.

L O N D O N :

MDCCCXCIX.

A MONOGRAPH

OF THE

BRITISH CARBONIFEROUS
LAMELLIBRANCHIATA.

BY

WHEELTON HIND, M.D., B.S.LOND., F.R.C.S., F.G.S.,

MEMB. SOC. GEOL. BELGIUM.

PART IV.

EDMONDIDÆ, CYPRINIDÆ, CRASSITELLIDÆ.

PAGES 277—300; PLATES XXVI—XXXIX.

LONDON :

PRINTED FOR THE PALEONTOGRAPHICAL SOCIETY.

1899.

PRINTED BY ADLARD AND SON,
BARTHOLOMEW CLOSE, E.C.1. AND 20, MANOVER SQUARE, W.

Genus—SEDGWICKIA, M'Coy, 1844.

Synonyms :

- SEDGWICKIA, M'Coy, 1844. Synops. Carb. Foss. Ireland, p. 61.
 DOLABRA (pars), M'Coy, 1844. Ibid., p. 66.
 LYONSIA (pars), d'Orbigny, 1850. Prodrome de paléont., p. 128.
 SEDGWICKIA, Morris, 1854. Cat. Brit. Foss., p. 224.
 — ? (SANGUINOLITES), Meek and Worthen, 1865. Proc. Acad. Nat. Sci. Philad., p. 251.
 — Meek and Hayden, 1865. Pal. of the Upper Missouri, Smithsonian Cont. Knowledge, p. 38.
 — (SANGUINOLITES?), Meek and Worthen, 1868. Pal. of Illinois, vol. iii, p. 537.
 — ?, Hall and Whitfield, 1872. Pal. Ohio, vol. ii, p. 89.
 — Bigsby, 1878. Thesaurus Devonico-Carboniferus, p. 310.
 — Etheridge, 1888. Brit. Foss., pt. 1, Palaeozoic, p. 290.
 — Miller, 1889. N. Amer. Geol. and Pal., p. 511.

Generic Characters.—Shell equivalve, inequilateral, more or less ovate and gibbose. The anterior end is rounded, the posterior obliquely subtruncate, umbones pointed and raised, dorsal slope much compressed and broad. Hinge edentulous, or with a single small cardinal tooth in the left valve. Muscle-impressions very faint; pallial line entire. Surface ornamented by regular, well-marked, concentric small ridges in the anterior part, which gradually become obsolete, so that the posterior two thirds of the valve is smooth.

Observations.—The genus was founded by M'Coy, who described and figured six species, two of which I am able to retain, but unfortunately the types of the others are not preserved or are too fragmentary for identification. To these must be added *Venus centralis*, M'Coy, and *Dolabra securiformis*, M'Coy, which doubtless belong to the genus; unfortunately, however, the type specimen of the former has decomposed, and that name can no longer be retained, and the latter is evidently the interior of *S. gigantea*.

M'Coy says, "The genus *Sedgwickia* (M'Coy) is composed of a very elegant little group of shells, having analogies which place them, as it were, between the so-called *Cypriocardia* of the older strata, the *Avini* (Sow.), and the *Leptodomi* (M'Coy)."

The genus *Schizodus*, to which the *Avini* are now referred, certainly has a very close resemblance to *Sedgwickia*, but the latter genus is distinguished by its characteristic surface-markings, the edentulous hinge or single small cardinal tooth, smaller degree of obliquity, and the fact that the umbones are not at all prosogyrous.

I have pointed out *antea*, p. 228, the unsatisfactory nature of M'Coy's genus

Leptodomus, but am in agreement with that author in acknowledging the propinquity to *Sedgwickia* of some of the shells originally referred to that genus.

Messrs. Meek and Hayden have given an exhaustive summary of the characters and affinities of *Sedgwickia* (*op. sup. cit.*); the shells which they, however, refer to this genus are much more transverse than any British examples; and these authors are inclined to refer to the genus several shells of widely different affinities, such as *Leptodomus costellatus*, M'Coy, *Sanguinolites variabilis*, M'Coy, and *Leptodomus truncatus*, M'Coy. With regard to the first two of these, at any rate, there are no grounds whatever for extending the genus to receive them.

I have grave doubts whether any of the three species included by these authors in the genus really belong to it; and it would appear that they were themselves in doubt, for their shells are named "*Sedgwickia Topekoensis?*" "*Sedgwickia ? concava,*" and "*Sedgwickia ? altirostrata.*" The former of these is shown in the figure to have a well-marked escutcheon and lunule, characters which are not present in *Sedgwickia*.

According to M'Coy, the hinge in *Sedgwickia* is edentulous, and in several species I can see no indications of hinge-teeth in casts, though I must confess that my material was not very suitable for the demonstration of teeth if these were very small; but in a specimen of *Sedgwickia ovata*, Pl. XXVII, fig. 2, there is an unmistakable cardinal tooth, which is directed obliquely backwards, in the right valve.

The presence of a small cardinal tooth in at least one species of the genus emphasises the relationship between *Schizodus* and *Sedgwickia* which I have referred to above, and may indicate the lines along which these forms evolved; but more accurate knowledge must be known about the Lamellibranchs of the earlier palæozoic rocks before anything can be definitely stated on this subject.

M'Coy does not advance any evidence for his statement *re Sedgwickia*, "They are entirely without hinge-teeth, their hinge resembling that of *Thracia*," all the figures being those of exteriors. The statement itself, too, seems contradictory, as the hinge of *Thracia* possesses a large cartilage socket and ossicle, which are certainly not to be seen in *Sedgwickia*.

SEDGWICKIA GIGANTEA, M'Coy, 1844. Plate XXVI, figs. 1—3; Plate XXVII, fig. 10.

SEDGWICKIA GIGANTEA, M'Coy, 1844. *Synops. Carb. Foss. Ireland*, p. 62, pl. xi, fig. 40.

DOLABRA SECURIFORMIS, M'Coy, 1844. *Ibid.*, p. 66, pl. xi, fig. 15.

LYONSIA SECURIFORMIS, d'Orbigny, 1850. *Prodrome de paléont.*, p. 128.

— — — — — *Ibid.*, p. 129.

- SEDGWICKIA GIGANTEA, *Morris*, 1854. Cat. Brit. Foss., 2nd edit., p. 224.
 DOLABRA SECURIFORMIS, *Morris*, 1854. Ibid., p. 202.
 SEDGWICKIA GIGANTEA, *Bigsby*, 1878. Thesaurus Devonico-Carboniferus, p. 311.
 CUCULLEA SECURIFORMIS, *Bigsby*, 1878. Ibid., p. 305.
 SEDGWICKIA GIGANTEA, *Kirkby*, 1880. Quart. Journ. Geol. Soc., vol. xxxvi,
 p. 586.
 — — — *Etheridge*, 1888. Brit. Foss., pt. 1, Palæozoic, p. 290.
 DOLABRA SECURIFORMIS, *Etheridge*, 1888. Ibid., p. 283.

Specific Characters.—Shell large, ovately rhomboidal, convex, slightly inequilateral. The anterior end is well developed, and its border is elliptically curved, and is continuous with the upper and lower margins. The inferior border is markedly convex in front, but becomes almost straight behind, where it rises to meet the posterior border. The latter is narrowed by the approximation of the upper and lower margins, and is almost straight, obliquely truncate from above downwards and backwards, making obtuse angles with the upper and lower margins. The hinge-line is curved, produced and depressed posteriorly. The umbones are large, subcentral, raised, tumid, pointed, incurved, and contiguous. The umbones rise gradually from the surface of the valve, which appears to have been evenly convex over its greater extent, but compressed posteriorly. Passing from the posterior edge of the umbo downwards and backwards obliquely towards the posterior inferior angle is a ridge, which soon becomes lost on the surface of the shell.

Interior.—The anterior adductor scar is of moderate size, pear-shaped with the apex prolonged upwards, and situated immediately within the antero-superior angle of the shell; the posterior adductor is elongate and rough, situated in the dorsal slope near the upper margin of the valve. The hinge-plate is edentulous, small, and narrow, formed by a thickening of the free edge after the manner of *Edmondia*, but less developed. The pallial line is entire.

Exterior.—The anterior portion of the shell is ornamented with numerous fairly large concentric ridges, separated by shallow sulci, which become entirely obsolete about the junction of the middle and anterior thirds of the valve, from which point posteriorly the valve is perfectly smooth except near the margin, where faint lines of growth may at times be distinguished. Shell very thin.

Dimensions.—The type specimen, Pl. XXVI, fig. 1, figured by M'Coy, measures—

Antero-posteriorly	.	.	.	61 mm.
Dorso-ventrally	.	.	.	40 mm.

A large crushed example, Pl. XXVI, fig. 2, from the Calciferous series of Randerstone, Fife, measures—

Antero-posteriorly	.	.	.	77 mm.
Dorso-ventrally	.	.	.	52 mm.

As both specimens are crushed, it is impossible to obtain an idea of the convexity of the valves.

Localities.—Scotland: Limestone No. 6, Randerstone, Fife, Calciferous Sandstone series; and Magazine, Midlothian, Carboniferous Limestone series. Ireland: Carrowmacrory, Templeboy; and in arenaceous shale, Rahan's Bay, Dunkinealy.

Observations.—The type specimen is very imperfect and much crushed, as are also all the specimens I have been able to examine from Randerstone, but there can be little doubt that M'Coy's species was well established. I have fortunately procured a fine cast of the interior of a pair of valves from Magazine, Pl. XXVI, fig. 3, which enables me to give details of the interior, and also gives a good idea of the shape of the shell. The hinge is represented in this specimen by a hollow groove, showing that M'Coy was correct in asserting that certain species of this genus were edentulous.

Mr. Kirkby, referring to the Randerstone shells, says (*op. supra cit.*), "I have several specimens of a large *Schizodus*-shaped shell from Limestone No. 6, Randerstone, which evidently came very close to the *Sedgwickia gigantea*, M'Coy. The specimens which are all more or less crushed are thin-shelled, from three to three and a quarter inches long, two inches wide, and have the anterior side marked with the regular strong ridges parallel with the margin that are characteristic of the genus, the remainder of the surface being comparatively smooth." I think there is no doubt that this reference is correct, for although much larger, as far as may be judged from their crushed condition, they are identical in character with the type.

It would appear that M'Coy's figure of *S. gigantea* is largely ideal; the type specimen preserved in the Griffith Collection of the Royal Museum of Science and Art, Dublin, is very much crushed and imperfect. I have been kindly permitted by the authorities to re-figure this specimen, Pl. XXVI, fig. 1.

I have placed the *Dolabra securiformis*, M'Coy, as a synonym of *S. gigantea*, of which it is an internal cast, and its figure, Pl. XXVII, fig. 10, is seen to be identical with the very perfect specimen from Magazine, near Edinburgh, which is represented on Pl. XXVI, fig. 3. The casts of *S. gigantea* do not exhibit any marked traces of the peculiar external ornament, and are therefore somewhat difficult to separate from specimens of *Protoschizodus* in a similar state of preservation, especially if no trace of the hinge of the latter genus be visible.

SEDGWICKIA OVATA, sp. nov. Plate XXVI, figs. 8—11; Plate XXVII, figs. 1—4.

? LEPTODOMUS COSTELLATUS, *Kirkby*, 1880. Quart. Journ. Geol. Soc., vol. xxxvi, p. 563.

Specific Characters.—Shell transversely and triangularly ovate, gibbose, much narrowed posteriorly by the approximation of the superior and lower borders. The anterior border is semicircularly curved, passing without a break in the hinge-line above and the inferior border below. The latter is gently convex, rising behind to meet the posterior border at a well-marked obtusely blunted angle. The posterior margin is narrow, obliquely truncate, and meets the hinge-line above at an obscure obtuse angle. The hinge-line is arched in front, but extended and compressed posteriorly. The umbones are swollen, pointed, incurved, contiguous, and directed slightly forwards, elevated above the hinge-line, and situated about the junction of the anterior and middle thirds of the valve.

The greater part of the valve is regularly swollen, and the umbo arises gradually from the valve in front, but posteriorly it is limited by a well-marked rounded ridge which passes downwards and backwards to the postero-inferior angle of the valve; behind this line, the valve is rapidly compressed, so that the dorsal slope is hollowed and wide, and the postero-superior angle slightly expanded. Valves closed all round. Ligament external, contained in a narrow elongated groove parallel with the edge of the valve.

Interior.—The anterior adductor muscle-scar is round and shallow, situated near the margin at the antero-superior angle, marked off from the cavity of the umbo by a ridge, and there are small linear accessory muscle-scars immediately above it. The posterior adductor scar is elongate and almost obsolete, and placed in the hollow of the dorsal slope. The hinge of the right valve contains a single small cardinal tooth. Pallial line entire, remote from the margin.

Exterior.—The anterior part of the valve is ornamented with many regular concentric ridges and grooves, which soon become obsolete, so that the posterior two thirds of the shell is smooth, and the lines of growth only faintly indicated. Shell very thin.

Dimensions.—Pl. XXVI, fig. 10, measures—

Antero-posteriorly	.	.	.	38 mm.
Dorso-ventrally	.	.	.	31 mm.
Elevation of valve	.	.	.	13 mm.

Localities.—England: the Redesdale Ironstone Shale, Redesdale, Northumberland. Scotland: the Scorpion-beds of Glencartholme, Eskdale, Dumfriesshire; Tweeden Burn, Cement Stone series, Roxburgh; Encrinite-bed, east of Pittenweem Harbour, Fife.

Observations.—None of the species of *Sedgwickia* described by M'Coy seem to possess the characters of the shells from Redesdale. I have therefore been obliged to establish a new species for them. More gibbose and less transverse than *S. gigantea*, *S. ovata* is even less like the subquadrate form of *S. scotica*, and it is easily separated from *S. suborbicularis* by its larger size and its characteristic contour.

S. ovata is fairly plentiful at Redesdale, but is often badly preserved: figs. 8—10, Pl. XXVI, are from this locality, and fig. 11, Pl. XXVI, from the famous Scorpion-beds of Glencartholme, Dumfriesshire; the latter locality is supposed to be at a much lower horizon than the Redesdale Ironstone, and is placed in the Calciferous Sandstone series. It is interesting to note that the species also occurs in the same series of the east of Scotland.

I have been able to isolate the hinge in one specimen, and this shows distinctly that the right valve has a small single cardinal tooth, fig. 1 a, Pl. XXVII. M'Coy states that the genus *Sedgwickia* is edentulous, but figures no specimens; and although I cannot affirm that any other species of the genus has a tooth in its hinge, it is possible that, owing to its very small size, this character may have been overlooked, and it would appear from the east of *S. gigantea*, Pl. XXVI, fig. 3, that that species at least was edentulous. *S. ovata* is much more ovate and transverse than *S. scotica*, and appears not to attain to so large a size. The diagonal ridge is not so well marked, and the posterior end is narrower and less truncate.

Mr. Kirkby has, I think, identified specimens of this species which occur in the Encrinite-bed of Mr. Brown, east of Pittenweem Harbour, with *Leptodomus costellatus*, M'Coy (*op. supra cit.*). I have myself collected from this bed, and have found *Sedgwickia ovata* there, but not the other shell. If only the anterior part of the shell be seen the mistake is easily made. I am strengthened in this opinion by drawings of the shell in a MS. book, kindly lent me by Mr. Kirkby, in which a very typical example of *Sedgwickia ovata* is called *Leptodomus costellatus*.

S. ovata has somewhat the shape of *S. bullata*, M'Coy, but the elevated ridges on the front of the shell are very few and far apart in the latter species. The figure shows only half a dozen; and I think that this shell may possibly be the *Edmondia Josepha* of the West of Scotland; but I hesitate yet to give it as a synonym. None of the other species of *Sedgwickia* which I have been able to examine have so few concentric ridges anteriorly.

The original description of *S. bullata* is as follows:—"Transversely oblong, very gibbous, length about two thirds the width; anterior side short, rounded; hinge-line nearly as long as the shell is wide, posterior end slightly oblique, subtruncate; beaks very large, tumid; an obtusely rounded ridge from the beak to the posterior angle; anterior side with strong rounded distinct ridges; middle of the shell and posterior side smooth."

SEDGWICKIA SCOTICA, sp. nov. Plate XXVI, figs. 4—7.

Specific Characters.—Shell of moderate size, inequilateral, quadrately ovate, tumid in the anterior two thirds, but compressed behind. The anterior portion of the valve is short but deep, its border regularly and broadly rounded, forming a continuous curve with the upper and lower margins. The inferior border is extended, convex, more so at each extremity. The posterior border is narrow, obliquely truncate from above downwards and backwards, making obtuse angles with the upper and lower margins. The hinge-line is arched, but is extended, erect, and nearly straight behind. The umbones are large, gibbose, elevated, contiguous, and not twisted forwards, and situated in front of the centre of the hinge-line.

The umbonal swelling rises gradually from the convexity of the shell in front, but is limited behind by a line which passes downwards and backwards obliquely to the postero-inferior angle. Behind this line the shell is rapidly compressed and somewhat expanded.

There is neither lunule nor escutcheon.

The greatest gibbosity of the valves is subumbonal.

Interior.—The anterior adductor muscle-scar is small and shallow, situated just within the margin of the shell at the antero-superior angle. The posterior adductor scar, shallow and almost obsolete, is placed in the hollow of the dorsal slope. Hinge as yet unknown. Pallial line entire, situated near the margin of the valve.

Exterior.—The anterior third of the valve is ornamented with many regular, fine, concentric ridges, which soon become obsolete, so that the posterior two thirds of the valve including the umbones is perfectly smooth. Shell very thin.

Dimensions.—Pl. XXVI, fig. 4, a specimen in the possession of Mr. Adam Whyte of Muirkirk, from the McDonald Limestone of that district, measures—

Antero-posteriorly	.	.	.	44 mm.
Dorso-ventrally	.	.	.	37 mm.
From side to side	.	.	.	25 mm.

Localities.—Scotland: the Lower Limestone series of Beith, and the McDonald Limestone, Muirkirk, Ayrshire.

Observations.—This species is founded upon a number of specimens in the cabinets of Mr. J. Neilson, Mr. R. Craig, and Mr. Adam Whyte, and bears a closer resemblance to the general form of *Schizodus axiniformis*, Phillips, sp., than any other species of the genus; the posterior end is more truncate and less pointed, the umbones less prosogyrous than in this species, which possesses a totally distinct ornamentation to that which obtains in *Sedgwickia scotica*, and in casts there appear to be no indications that the hinge possessed teeth.

At present this species has only been obtained from the horizon of the Lower or Beith Limestone, of which the McDonald Limestone at Muirkirk is the equivalent, the shells occurring in the shales which are found in connection with the beds of limestone, and not in the limestones themselves.

SEDGWICKIA SUBORBICULARIS, sp. nov. Plate XXVII, figs. 5—8.

Specific Characters.—Shell transversely suborbicular, compressed, very slightly oblique, inequilateral. The anterior end is short but deep, compressed, its margin regularly rounded, passing without a break into the superior and inferior borders. The lower margin is only slightly convex, the posterior regularly convex, passing into the hinge-line above and the lower margin below with an uninterrupted curve. The hinge-line is gently curved, subparallel with the lower border. The umbones are broad, flattened, raised above the hinge-line, and placed in the anterior third of the shell. The posterior part of the shell is compressed and somewhat expanded. The general curvature of the valve is regular, but slight in amount.

Interior unknown.

Exterior.—The surface is ornamented with about twenty-five regular raised lines, which separate as they pass backwards, but become obsolete about the junction of the anterior and middle thirds of the valve. Posteriorly the shell is almost smooth, or with a few obsolete flattened sulci. If the outer layer of shell be removed, the inner portion shows obscure radiating lines. Shell very thin.

Dimensions.—Fig. 6, Pl. XXVII, a left valve, measures—

Antero-posteriorly	36 mm.
Dorso-ventrally	28 mm.
Elevation of valve	4 mm.

Localities.—Scotland: Inverteil Quarry, Linktown, Kirkcaldy; and Potmetal Plantation, Kirkcaldy; Hope Quarry, Pathhead, Haddingtonshire.

Observations.—I have founded this species on four specimens in the Collection of the Geological Survey of Scotland, one of which, Pl. XXVII, fig. 7, is that of a very young example. All the specimens have the shell preserved, so that it is impossible to say anything about the interior of the valve.

None of the six species described by McCoy resemble *S. suborbicularis*, which is at once distinguished by its blunt, obtusely rounded posterior end, which is larger from above downwards than the anterior. The species is also much more compressed than any other member of the genus.

Both the specimens from Inverteil, figs. 5 and 6, Pl. XXVII, have the

umbones and upper part of the centre of the shell eroded, so that the lower layers of the shell are exposed; but it is doubtful whether any definite opinion as to the habitat of this species can be based on the fact, *Edmondia*, sp., and *Pecten*, sp., occurring at the same locality. I think that there is no doubt, however, that the erosion of the valves is in this case due to the usual cause, that is the presence of CO₂ in the water, and that possibly this is an indication of a strong admixture of fresh with salt water, but a careful research into the fauna of the bed is necessary to settle the question.

SEDGWICKIA ATTENUATA, *M'Coy*, 1844. Plate XXVII, figs. 9, 11—14.

- SEDGWICKIA ATTENUATA, *M'Coy*, 1844. Synops. Carb. Foss. Ireland, p. 62, pl. xi, fig. 39.
- LYONSIA ATTENUATA, *d'Orbigny*, 1850. Prodrome de Paléontol., p. 128.
- SEDGWICKIA ATTENUATA, *Morris*, 1854. Cat. Brit. Foss., 2nd edit., p. 224.
- — *Bigsby*, 1878. Thesaurus Devonico-Carboniferus, p. 311.
- — *Etheridge*, 1888. Brit. Foss., pt. 1, Palaeozoic, p. 290.
- — *Barnes and Holroyd*, 1897. Trans. Manch. Geol. Soc., vol. xxv, p. 187, fig. 14, 3rd pl.

Specific Characters.—Shell of less than medium size, transversely ovate, moderately convex, inequilateral. The anterior end is short, convex, deep from above downwards, and has a well-rounded border, somewhat elliptically curved. The inferior margin is almost straight except at the extremities. The posterior border is obliquely truncate from above downwards, almost straight, and narrowed, the postero-inferior angle being bluntly rounded, the postero-superior being a well-marked obtuse angle. The hinge-line is curved in front; produced, depressed, and straight posteriorly. The umbones are tumid, not marked off from the shell by folds, elevated, and situated in the anterior third of the valve. The valves are regularly convex, but there is a well-marked ridge which extends from the umbo to the postero-inferior angle, above which the shell is compressed and flattened.

Interior.—The anterior adductor muscle-scar is shallow, elongate, situated just within the antero-superior angle. The posterior is rounded, shallow, and situated near the postero-inferior angle in the hollow of the dorsal slope. The pallial line is entire and remote from the margin. The hinge is edentulous. The interior exhibited obsolete concentric folds in the anterior part of the valve, and very faint radiating striæ over the middle and posterior portions.

Exterior.—The surface seems to be ornamented with fine concentric lines of growth, strong anteriorly but becoming obsolete posteriorly.

Dimensions.—Pl. XXVII, fig. 12, a cast, measures—

Antero-posteriorly	23 mm.
Dorso-ventrally	14 mm.
Laterally	8 mm.

Localities.—England:—In a calcareous grit in the Millstone-grit series of Pule Hill, Marsden. Ireland: in arenaceous shale, river Bannagh, Drumcurren.

Observations.—The type specimen, fig. 9, Pl. XXVII, of M'Coy's *Sedgwickia attenuata*—a left valve, not, as shown in his figure, a right valve—is preserved in the Museum of Science and Art, Dublin, and is a very poor example on which to found a species. However, the description seems to do very well for a shell which is very plentiful in a curious ochreous, calcareous grit on Pule Hill. This shell occurs generally in the form of casts, but some idea of the exterior can be obtained from hollow casts. I have referred this shell to *Sedgwickia* on account of its edentulous hinge, truncate posterior end, and oblique ridge.

The fauna of this bed is a curious one; the following species occur in it, all in the form of casts:

<i>Myalina Flemingi</i> , M'Coy.	<i>Bellerophon Urei</i> (very common).
— <i>Verneuilii</i> , M'Coy.	<i>Lingula</i> , sp.
<i>Schizodus antiquus</i> , Hind.	<i>Gonitites</i> , sp.
Many species of Gasteropoda.	

I think that the bed is somewhat low down in the grit series of Pule Hill.

Sedgwickia attenuata is more transverse than any other species of the genus, and is not likely to be confounded with any of them.

Genus EDMONDIA, de Koninck, 1843.

- COBULA?, *Phillips*, 1836. Geol. Yorks., pt. 2, p. 209.
 LUCINA?, *Phillips*, 1836. Ibid., p. 209.
 ISOCARDIA (pars), *Phillips*, 1836. Ibid., p. 209.
 EDMONDIA, *de Koninck*, 1843. Desc. des Anim. foss., p. 66.
 CARDIOMORPHA (pars), *de Koninck*, 1843. Ibid., p. 109.
 LUTRARIA, *Portlock*, 1843. Rep. Geol. Co. Londonderry, p. 441.
 EDMONDIA, *Morris*, 1843. Cat. Brit. Foss., p. 88.
 LUCINA?, *Morris*, 1843. Ibid., p. 89.
 LUTRARIA, *Morris*, 1843. Ibid., p. 91.
 — *M'Coy*, 1844. Synops. Carb. Foss. Ireland, p. 52.
 ASTARTE, *M'Coy*, 1844. Ibid., p. 55.
 EDMONDIA?, *M'Coy*, 1844. Ibid., p. 52.
 VENERUPIS, *M'Coy*, 1844. Ibid., p. 67.
 SANGUINOLITES (pars), *M'Coy*, 1844. Ibid., p. 48.
 CARDIOMORPHA, *de Verneuil*, 1845. Géol. Russie, p. 303.
 ALLORISMA (pars), *de Verneuil*, 1843. Ibid., p. 298.
 SCALDIA (pars), *de Ryckholt*, 1847. Mém. paléontol., pl. x, figs. 27, 28.

- EDMONDIA (pars), *King*, 1849. Permian Fossils, p. 162.
 — *Brown*, 1849. Illust. Foss. Conch., p. 198.
 SANGUINOLITES (pars), *Brown*, 1849. *Ibid.*, p. 219.
 CARDIOMORPHA (pars), *d'Orbigny*, 1850. Prodrome de paléont., p. 132.
 EDMONDIA (pars), *d'Orbigny*, 1850. *Ibid.*, p. 133.
 — — *McCoy*, 1851. Ann. and Mag. Nat. Hist., ser. 2, vol. vii, p. 190.
 CARDIOMORPHA (pars), *de Ryckholt*, 1852. Mém. paléontol., pt. 2, p. 93.
 ΠΑΝΟΡÆΑ (pars) — 1852. *Ibid.*, p. 29.
 SOLENOPSIS (pars) — 1852. *Ibid.*, p. 64.
 SOLEMYA (pars) — 1852. *Ibid.*, p. 51.
 CARDIOMORPHA, *Eichwald*, 1853-61. Lethæa Rossica, p. 1034.
 EDMONDIA (pars), *Morris*, 1854. Cat. Brit. Foss., 2nd edit., p. 202.
 — *McCoy*, 1855. Brit. Pal. Rocks and Foss., p. 499.
 — *Shumard and Swallow*, 1858. Trans. Acad. Sci. St. Louis, vol. i, p. 209.
 — *Swallow*, 1860. *Ibid.*, vol. i, p. 635.
 — *Salter*, 1861. Iron Ores Gt. Brit., pt. 3, p. 221, pl. i, fig. 29.
 — *Winchell*, 1862. Proc. Acad. Nat. Sci. Phil., p. 414.
 — — 1863. *Ibid.*, p. 12.
 — — 1865. *Ibid.*, p. 127.
 — *Meek and Worthen*, 1866. Rep. Geol. Surv. Illinois, vol. ii (Pal.), p. 364.
 — *Dawson*, 1868-78. Acadian Geology, p. 303.
 — *Young and Armstrong*, 1871. Trans. Geol. Soc. Glas., pt. 3, p. 51.
 — *Stoliczka*, 1871. Pal. Indica, vol. iii, p. 66.
 — *Meek*, 1872. Rep. Pal. Eastern Nebraska, p. 213.
 — *Etheridge, jun.*, 1873. Geol. Mag., vol. x, p. 299.
 — — 1876. Ann. Mag. Nat. Hist., ser. iv, vol. xviii, p. 99.
 — *Young and Armstrong*, 1876. Cat. Foss. West Scotland, p. 53.
 — *Bigsby*, 1878. Thesaurus Devonico-Carboniferus, p. 307.
 ? — *Barrois*, 1882. Recherches Terr. anciens des Asturies, p. 345.
 — *Walcott*, 1884. Mon. U.S. Geol. Surv., Pal. Eureka Dist., p. 245.
 BROECKIA, *de Koninck*, 1885. Ann. Mus. Roy. d'Hist. Nat. Belge, tom. xi, p. 19.
 EDMONDIA, *de Koninck*, 1885. *Ibid.*, p. 28.
 — *Etheridge*, 1885. Brit. Foss., pt. 1, Palæozoic, p. 283.
 — *Miller*, 1889. North Amer. Geol. and Pal., p. 478.
 — *Worthen*, 1890. Geol. Surv. Illinois, vol. viii, p. 121.

Generic Characters.—Shell transversely ovate, equivalve, close all round, convexly swollen. Hinge edentulous, simple and erect, possessing a transverse, deeply situated, thickened ridge, separated from the edge of the valve by a smooth groove. This edge commences below the umbo and passes backwards till it becomes lost. Casts show that there existed, posterior to the hinge-plate, an internal ossicle, elongate, flattened, which was directed outwards and downwards into the cavity of the umbo. External ligament small, contained in a narrow groove at the margin of the valve; lunule and escutcheon absent. Pallial line entire, usually remote from the margin. External ornament consists of concentric striæ or rugæ.

Observations.—This genus was erected by de Koninck, who professed to take the *Isocardia unioniformis* of Phillips as his type, but the shells which he figured as belonging to this species are quite different, being almost orbicular, as he says, “à peu près ronde;” but fortunately Phillips’s shell undoubtedly belongs to the genus *Edmondia*, and therefore may still be considered as the type of this genus. Part of the original generic diagnosis is as follows: “Lunule échancrée; charnière dépourvu de dents, remplacées par une lamelle transverse, étroite, profondément située et en partie recouverte par le crochet et ayant probablement servi à supporter un ligament interne d’une form à peu près analogue.” The figures show conclusively that there is no lunule, and no mention is made of this character in the amended diagnosis of 1885 (*op. supra cit.*), which states that the hinge is “dépourvue de dents, munie de grands plaques du cartilage, obliques, placées au-dessous des crochets.”

Fortunately many specimens of different species showing the hinge have been obtained from Tournai, one of which I figure, Pl. XXVII, figs. 16 *a*, *b*, but none of these show any indications of cartilage-plates; but there is, however, as is stated in the first description, a curved transverse lamella, situated deeply, and separated from the edge of the shell by a groove parallel to it, which does not extend forward in front of the umbo. Probably, as de Koninck observed, this groove did contain some structure of the nature of an internal ligament. In casts this ridge is represented by a well-marked groove between the umbo and the edge of the valve; but external to it in the hollow of the umbo is a deep groove, which extends forwards in front of the umbo and also passes backwards, becoming wider and broader, to within a short distance from the postero-superior angle, in which lodged a process of shell; from the splendid way in which in many specimens this groove is preserved, I should incline to the view that it had originally contained an ossicle and not cartilage.

Professor King referred a shell to this genus, under the name *Edmondia sulcata* (‘Monog. Permian Fossils,’ pp. 163–4, pl. xx, figs. 1–4), which has somewhat similar well-marked internal ossicles; but the arrangement, shape, and the whole structure of this shell and process differ from that which is found in the more ovate smooth-shelled group of *Edmondia*. That the process was of shelly structure, and not cartilaginous, is evident from the preservation of this portion of the hinge in a specimen of *E. Pentonensis*. McCoy placed *Edmondia* with the *Mytilidæ*; but King erected a new family, *Edmondidæ*, which he placed immediately after the *Mytilidæ*. The valves are, however, always equal, and there is a well-marked but small external ligament, and no constriction of the valves or other indications of a byssus in *Edmondia*.

De Verneuil confounded *Edmondia* and *Allorisma*. His specimen on pl. xix, figs. 6 *a*, *b*, agrees undoubtedly with the *Allorisma* of King; but the shell figured

under the same name in pl. xxi, figs. 11 *a*, *b*, is certainly an *Edmondia*; for the specimen depicted is a cast showing the groove for the shelly processes of the hinge. This author mentioned this fact in an appendix to his observations, and stated that he only provisionally united the latter specimen to *Allorisma*.

Fischer thought that *Edmondia*, de Koninck, comprised two genera,—one typified by *E. Josepha*, which possessed no external ligament; and another which he calls *Pseudedmondia*, which possessed this character. De Koninck, however, gives in his diagnosis the following statement:—"Sillons du ligament étroits, externes," and *E. Josepha* does possess a very small external ligament. Fischer erroneously quotes de Koninck as the authority for the presence "d'un osselet calcaire (de Koninck)," but I cannot ascertain that he ever made use of such a term; indeed, de Koninck is quite silent on the subject, and does not even refer to King's observations, probably because he does not appear to have examined many specimens in the condition of casts. As de Koninck points out, Morris placed a great many shells of widely different characters in this genus, and de Ryckholt referred many species to *Cardiomorpha* which should be more correctly placed in *Edmondia*.

I am unable to discover any character of specific value to distinguish de Koninck's genus *Broeckia* from *Edmondia* except that of size. Curiously enough, although he compares his new genus to *Cardiomorpha*, and admits that they possess analogous hinges, he does not contrast this genus with *Edmondia* further than stating that he considered Morris was wrong in referring the *Lutraria prisca*, M'Coy, to *Edmondia*, because it was much less globular and less rugose on the surface than the majority of species of which the genus was composed.

De Koninck described ten species of *Broeckia*, nine of which were supposed to be new; but most of them I believe will prove to be synonymous, the species being founded on shells of different stages of growth, and on imperfect specimens.

Sixty-eight species of *Edmondia* are described in the same work, twenty-six being doubtfully referred to the genus; and fifty-four are new. De Koninck says of the group to which he affixes the ?, "Le second group est formé d'espèces ordinairement moins épaisses, plus longues que larges, dont la forme rapelle celles des anciennes *Venus*, reunis actuellement sous le nom générique de *Tapes*, dont les plis de la surface sont ordinairement mieux marqués et plus saillants, et dont je ne suis pas encore parvenu à isoler la charnière. Ce n'est dont qu'avec doute que les espèces de ce dernier groupe peuvent être introduites dans le genre *Edmondia*." Some of these species certainly should be removed from the genus, *e. g.* *E. minima*, *E. sublamellosa*, which do not possess the simple erect hinge-line posteriorly, characteristic of the genus, but which have a well-marked escutcheon. These two forms are not regarded as questionable *Edmondia*, and I am of opinion that the greater part if not all of those species referred with a ? to this genus are

correctly placed. On the other hand, I regard a large number of the species as synonymous, either representing individuals in different stages of growth, or being founded on merely small varietal characters which are not of specific value.

I have mentioned the fact above, p. 255, that many specimens of *E. Kickxiana*, in the fine series possessed by the Royal Natural History Museum of Brussels, show the rudiments of a cardinal tooth, which is so characteristic of the genus *Scaldia*, de Ryckholt. This first appears as a little irregularity of the surface of the lamellar ridge; in other specimens there is a distinct rounded nodule, with a depression for the corresponding tooth of the opposite valve.

The genus *Edmondia* is known from Devonian rocks; but *Scaldia*, according to de Koninck, at present has not been recognised below the Carboniferous series.

With regard to the function of the shelly process, the ossicle, which in *Edmondia* occupies the cavity of the umbo, it probably maintained the shells in contact, acting as a fulcrum for the attachment of either an internal cartilage or some special muscles. An edentulous hinge and shallow muscle-scars show that some special apparatus was necessary, which probably could not, owing to the great thinness of the shells in this genus, be satisfactorily placed on the surface of the valve.

The genus *Edmondia* appears to be subdivided into two well-marked groups; (*a*) those with fine regular concentric lines of growth, and (*b*) those with well-marked concentric ridges and sulci. *E. unioformis* may be regarded as the type of the former, *E. sulcata* as characteristic of the latter. I have been for some time undecided whether or no to subdivide the genus on these lines; but it seems to me that intermediate forms exist, e. g. *E. rudis*, which connects the two groups. Each group comprises suborbicular forms. Moreover all the species which I have included within the genus possess the peculiar process from the back of the hinge-plate which I have termed the ossicle, and which King and previous authors called "cartilage plaques." It appears that the transverse and sulcated shells had this characteristic feature more highly developed and differentiated than the suborbicular forms, and consequently, as de Koninck had made his observations on the hinge-plates chiefly on the species belonging to the latter group, his descriptions obviously are hardly broad enough to apply to the group of sulcated species. It is due to the perspicacity of Professor King that he perceived that the genus *Edmondia* really contained such diverse forms as *E. unioformis* and *E. sulcata*. In M'Coy's earlier work this genus, like many others, was misunderstood; but in his later work (*op. supra cit.*) he seems to have recognised that the genus included forms with very diverse external characters, and of the nine species described by him as coming from Carboniferous rocks I am able to retain eight in the genus; and the other, *E. Egertoni*, belongs to the family Edmondidæ, but to another genus, closely allied, however, to *Edmondia*.

A very large number of species of *Edmondia* have been described from American Carboniferous rocks, and these are divisible into two groups, the smooth forms and the sulcated. It is difficult to decide, in the absence of material for exact comparison, whether or no any species are common to the Eastern and Western Hemispheres; but with a single exception, *E. unioniformis*, American authors have come to the conclusion that the species found in the Carboniferous rocks of the West are distinct from those which occur in Europe.

Waagen does not describe any representatives of the genus *Edmondia* from the Salt Range of India; but, as he entirely misconceives the characters of *Allorisma*, which he figures ('Palæontologica Indica,' sect. 13, pl. xvii, figs. 3, 4, and 9) as not possessing an escutcheon, it is not impossible that he may have mistaken species of *Edmondia* and designated them as belonging to that genus.

Benshausen figures as *Paracyclas proavia*, Goldf., sp. (*op. supra cit.*, p. 169), an orbicular shell which has a well-marked, elongate, internal groove in a cast, internal to the umbones, exactly like that which obtains in *Edmondia*. He says, p. 166, under his generic description, "Ligament von aussen nicht sichtbar, innerlich in einer kürzeren oder längeren ausgehöhlten Grube dicht hinter den Wirbeln gelegen."

This genus possesses hinge-teeth of an orbicular shape, and does not resemble *Edmondia* in any other character than the possession of the groove for the long narrow process at the back of the hinge-plate, which was evidently not a ligament but a shelly process. The possession in common of such a highly differentiated character, a peculiarity at present known only to be found in these two genera and in *Scaldia*, seems to me to throw some important light upon the relationship of these two palæozoic genera.

EDMONDIA UNIONIFORMIS, *Phillips*, sp., 1836. Plate XXVIII, figs. 1—7.

- ISOCARDIA UNIONIFORMIS, *Phillips*, 1836. Geol. Yorks., pt. 2, p. 209, pl. v, fig. 18.
 EDMONDIA UNIONIFORMIS, *de Koninck*, 1842. Desc. des Anim. foss., p. 67, pl. i, figs. 4 a—c.
 — — — *Morris*, 1843. Cat. Brit. Foss., 1st edit., p. 88.
 — — — *de Verneuil*, 1845. Russia and the Ural Mts., vol. ii, p. 299, pl. xix, fig. 18.
 — — — *Keyserling*, 1846. Reise Petschoraland, p. 259.
 — — — *Bronn*, 1848. Nomencl. Pal., p. 452.
 — — — *Brown*, 1849. Illust. Foss. Conch., p. 198, pl. lxxxi, fig. 15.
 — — — *d'Orbigny*, 1850. Prod. de Pal., p. 133.
 CARDIOMORPHA RETROSECTA, *de Ryckholt*, 1852. Mém. Pal., 2e partie, p. 100, pl. xiii, figs. 15, 16.
 PHOLADOMYA VAULXIANA, *de Ryckholt* 1852. Ibid., p. 23, pl. xi, figs. 1, 2.

CARBONIFEROUS LAMELLIBRANCHIATA.

			EDMONDIA UNIONIFORMIS, <i>Morris</i> , 1854. Cat. Brit. Foss., 2nd edit., p. 202.
	—	—	<i>McCoy</i> , 1855. Brit. Pal. Foss., p. 503.
	—	—	<i>Eichwald</i> , 1860. Letbæa Rossica, vol. i, p. 1034.
Non	--	--	<i>Salter</i> , 1861. Mem. Geol. Surv. Gt. Brit., Iron Ores Gt. Brit., pt. 3, pp. 221, 222, pl. i, fig. 29.
	—	—	<i>Meek and Worthen</i> , 1866. Geol. Surv. Illinois, vol. ii, Pal., p. 346, pl. xxvii, figs. 6 a, b.
	—	—	<i>Young and Armstrong</i> , 1871. Trans. Geol. Soc. Glasg., vol. iii, Suppl., p. 51.
	—	—	— 1876. Carb. Foss. West of Scotland, p. 54.
	—	—	<i>R. Etheridge, jun.</i> , 1876. Ann. Mag. Nat. Hist., ser. 4, vol. xviii, p. 99, pl. iv, fig. 3.
	—	—	<i>Miller</i> , 1877. Amer. Pal. Foss., p. 191.
	—	—	<i>Bigsby</i> , 1878. Thesaurus Devonico - Carboniferus, pp. 306, 307.
Non	—	—	<i>de Koninck</i> , 1885. Ann. Mus. Roy. d'Hist. Nat., tom. xi, p. 29, pl. xi, figs. 32—36; pl. xiii, figs. 42, 43.
	—	PRELATA, <i>de Koninck</i> , 1885. Ibid., p. 36, pl. xiii, fig. 26.	
	—	—	<i>Etheridge</i> , 1888. Brit. Foss., pt. 1, Palæozoic, p. 284.
Comp.	—	?	DECORATA, <i>de Koninck</i> , 1885. Ibid., p. 48, pl. x, figs. 15—20.
—	—	?	PRÆCOX, <i>de Koninck</i> , 1885. Ibid., p. 48, pl. x, figs. 31, 32.
—	—	?	TENUILINEATA, <i>de Koninck</i> , 1885. Ibid., p. 44, pl. x, figs. 23, 24.
—	—	?	PULCHELLA, <i>de Koninck</i> , 1885. Ibid., p. 52, pl. x, figs. 21, 22.
—	—	?	ANODONTA, <i>de Koninck</i> , 1885. Ibid., p. 49, pl. iv, figs. 7, 14.

Specific Characters.—Shell transversely broadly ovate, gibbose. The anterior end is small, convexly curved, but comparatively deep in a dorso-ventral direction. The anterior border is semicircularly rounded, passing without a break into the inferior border, which is much less convex and extended. The posterior border is obtusely rounded without any approach to angulation at its junction with the superior and inferior borders. The hinge-line is nearly as long as the shell, and slightly arched. The umbones are obtuse, twisted forwards and incurved, somewhat raised, close, and situated in the anterior quarter of the hinge-line. There is no lunule and no escutcheon. The posterior end is somewhat narrowed in its dorso-ventral diameter by the approach of its upper and lower borders. The valves are regularly and convexly swollen, there being no oblique line, but the dorsal slope is somewhat flattened. The cardinal margin is simple and sharp, coming immediately into contact with its fellow. External ligament-groove short and narrow.

Interior.—The anterior adductor muscle-scar is shallow, and situated just within the antero-superior angle; the posterior is situated within the dorsal

slope, remote from the margin. The hinge-plate is edentulous, with a deep, thick, curved vertical ridge of shell, and the flat expanded ossicle seen as a groove in casts. Pallial line entire.

Exterior.—The surface is ornamented with concentric lines and fine ridges, very conspicuous in the anterior part of the shell. Posteriorly the shell is almost smooth, but the linear ridges are more apparent again near their termination as they curve round to pass into the superior border. Shell moderately thick.

Dimensions.—Fig. 1, Pl. XXVIII, the type of *Isocardia unioniformis*, Phillips, measures—

Antero-posteriorly	49 mm.
Dorso-ventrally	36 mm.
Laterally	26 mm.

Localities.—England: the Carboniferous Limestone of Bolland, Withgill, and Hill Bolton, Yorkshire; Castleton, Thorpe Cloud, Derbyshire; the Redesdale Ironstone shale and limestone of Lowick and the Coombs, Northumberland. The Upper Carboniferous Limestone of Poolvash, Isle of Man. Scotland: The Lower Limestone series of Beith; Hind og glen, Dalry; Inverteil, Kirkcaldy; Tweeden burn, Cement stone Series, Roxburgh; Encrinite-bed, St. Andrews, Fife. Ireland: Rochfort Lodge, Bundoran, co. Donegal; Tomdeely, Ballygarrane, and Ballyshonickbane, co. Limerick.

Observations.—This species was described by Phillips under the genus *Isocardia*, and de Koninck subsequently thought that he founded the genus *Edmondia* on Belgian shells which were identical with the British species. This, however, was not the case, for, as M'Coy pointed out, the Belgian examples were "too nearly orbicular, the anterior end being too long and the ventral margin too much arched to agree with the present species." The same criticism can be applied to the shells referred to *Edmondia unioniformis* in de Koninck's later work, which certainly do not belong to that species. The shells named by de Koninck *E. praelata* belong, I think, undoubtedly to the species under discussion, probably also *E. decorata* and *E. praecox*. Phillips makes the following statement:—"Surface wrinkled on the posterior slope," the accuracy of which M'Coy questioned. I think that this mistake arose from the absence of the shell in the anterior portion of the type specimen; for on reference to fig. 1, Pl. XXVIII, it will be seen that the posterior portion of the shell has its markings more apparent.

M'Coy describes the "anterior lunette" as "very large, oval, deep;" but in common with all other members of the family there is no lunule, the concentric lines of growth curving round the antero-superior angle to terminate in the hinge-line.

I am of opinion that most of the species in lists named *E. unioniformis* are erroneously referred to this species. I have been able to find only very few examples which agree in character with the type.

The shell referred to *E. unioniformis* by Salter as occurring in a marine bed in the South Wales coal-field is much too quadrate posteriorly, and should be more correctly named *E. oblonga*.

There are several species described by de Koninck which I think should be more correctly referred to Phillips's shell,—*E. ? præcox*, *E. tenuilineata*, *E. ? pulchella*, *E. ? decorata*, and *E. ovata*. These are all transversely ovate in shape, and have a similar external ornament, comparatively smooth and regular, but becoming more marked in large examples towards the lower border, and all come from the same horizon, Étage II of Pauquys and Waulsort, with the exception of *E. ovata* and *E. præolata*, which are from the lowest division, Tournai.

E. ? anodonta, de Koninck, is another of this author's species which I should place as a synonym of *E. unioniformis*. This species is stated to be founded on a single specimen, but two are figured, and the specific character is the comparatively compressed condition of the valves.

Mr. R. Etheridge, jun., figured a specimen of *E. unioniformis* from the Encrinite-bed of St. Andrews (*op. supra cit.*), and remarks on the wide distribution of the species, which is said to occur in Russia.

Struvé ('Mém. Acad. Imp. des Sci. de St. Pétersbourg,' tom. xxxiv, No. 6, p. 104) quotes *E. unioniformis* as occurring in the *Productus giganteus* zone, and the coal-bearing beds below, of the Moscow coal-basin.

EDMONDIA JOSEPHA, de Koninck, 1842. Plate XXXIII, figs. 10—14.

- EDMONDIA JOSEPHA, de Koninck, 1842. Foss. Carb. Belg., p. 68, pl. i, fig. 5.
 — — Bronn, 1848. Nomencl. palæontol., p. 452.
 — — d'Orbigny, 1850. Prodrome de Paléontol., p. 133.
 Non — — M'Coy, 1855. Brit. Pal. Foss., p. 500.
 — — Bigsby, 1878. Thesaurus Devonico-Carboniferus, p. 307.
 — RUDIS, Kirkby, 1880. Quart. Journ. Geol. Soc., vol. xxxvi, p. 560.
 — JOSEPHA, de Koninck, 1885. Ann. Mus. Roy. Hist. Nat. Belg.,
 tom. xi, p. 30, pl. xi, figs. 30—32.
 — ASTARTOIDES, de Koninck, 1885. Ibid., p. 36, pl. vii, figs. 33, 34.
 — JOSEPHA, Etheridge, 1888. Brit. Foss., pt. 1, Palæozoic, p. 283.
 Compare SCALDIA KICKSIANA, de Ryckholt, 1847. Mém. pal., 1e partie, pl. x, figs. 27, 28.
 CARDIOMORPHA LACORDAIREANA, de Ryckholt, 1853. Ibid., 2e partie, p. 95,
 pl. xiii, figs. 5, 6.
 EDMONDIA KICKSIANA, de Koninck, 1885. Ann. Mus. d'Hist. Nat. Belge, tom. xi,
 p. 32, pl. viii, figs. 7—9.
 — LACORDAIREANA, de Koninck, 1885. Ibid., p. 33, pl. ix, figs. 1—4.
 — PIRETI, de Koninck, 1885. Ibid., pl. ix, figs. 17—22; pl. xii, figs. 23—
 25, 32—34.

Specific Characters.—Shell of medium size, suboval, inequilateral, somewhat oblique, moderately gibbose. The contour—anterior, inferior, and posterior borders—of the shell forms an unbroken curve, which becomes less convex along the lower margin. The cardinal border is only slightly arched, and is relatively short. The umbones are inclined obliquely forwards, pointed, with the beaks twisted forwards and contiguous, raised above the hinge-line, excavated anteriorly, and situated in the anterior third of the hinge-line. The anterior end is much narrower from above downwards than the posterior, and is compressed. The rest of the valve is regularly and gradually curved with a moderate convexity, from which the umbones arise very gradually. The ligament is internal, small, and lodged in a narrow groove of small extent close to the edge of the hinge.

Interior.—The anterior adductor muscle-scar very large, shallow, and smooth, occupies a large portion of the anterior part of the valve. The posterior adductor scar is inconspicuous. The hinge is edentulous. Pallial lines entire, deep, and near the margin. The internal surface is smooth, with here and there indications of concentric sulci, crossed by very obscure, almost obsolete, but regular radiating lines.

Exterior.—The surface is ornamented with very fine concentric lines, some of which are elevated at equal intervals, and very distinct near the anterior margin, but become less marked towards the middle of the valve. Here and there are irregular, broad, very shallow, concentric sulci, but there is much individual variation. Shell thin.

Dimensions.—Pl. XXXIII, fig. 12, measures—

Antero-posteriorly	.	.	.	.	31 mm.
Dorso-ventrally	.	.	.	.	23 mm.
Laterally	.	.	.	.	18 mm.

Localities.—Scotland: the Upper Limestone series of Garngad Road, Glasgow; the Lower Limestone series of Langside and Dockra, Beith, Ayrshire; Lugton Water; the Calciferous Sandstone series of Fife, Bed No. 1 Limestone, east of St. Monans. Ireland: the Carboniferous Limestone of Firog, co. Limerick, and Carnteel, co. Tyrone.

Observations.—*Edmondia Josepha* was one of the two species originally referred to the genus by its author, de Koninck. The description was extremely meagre, but the external characters are described as “surface unie, recouverte d’un grand nombre de petites stries d’accroissement.” Later on (*op. supra cit.*) de Koninck described several species which appear to me to differ in no characters of specific value from *E. Josepha*, which was re-described and figured in the same work. I have seen on several occasions the fine series of these shells in the Royal Natural History Museum of Brussels, and possess some well-preserved specimens in my own collection, and am of opinion that the five species, *E. Josepha*, *E. Kicksiana*,

E. Lacordaireana, *E. Pireti*, and *E. astartoides*, do not differ from each other more than one finds to be the case in a long series of examples of any species. De Koninck has, I think, made a mistake in his conception of *E. unioniformis* (*vide antea*, p. 293), and consequently his remarks on the differences between that species and *E. Josepha* cannot be accepted.

In *E. unioniformis* the anterior end is deeper from above downwards than the posterior, and the umbones are not much raised above the hinge-line; but in *E. Josepha* the anterior part of the shell is much narrower than the posterior, and the umbones in consequence appear to be much raised above it, and in addition *E. unioniformis* is less oblique and relatively more transverse than *E. Josepha*.

M'Coy gave a description, without figures, of some shells from the limestone of Lowick, Northumberland, under the name *E. Josepha*, but states in his remarks, "It is doubtful whether this species be perfectly identical with that of de Koninck, as it is concentrically ridged as well as striated." I have examined the specimens in the Woodwardian Museum, Cambridge, from Lowick which are labelled *E. Josepha*, and can see no ground for referring them to that species. One is very imperfect, but the other specimen is, I think, an example of *E. rudis*. The specimens are casts, and are too rugose, and have well-marked concentric grooves and ridges well marked, which is a character belonging to that species, while the interiors of *E. Josepha* are almost smooth (Pl. XXXIII, fig. 11).

I have obtained two specimens of this species from the No. 1 Marine Limestone of Mr. Kirkby, east of St. Monans, which he considers to be ninety-seven feet below the base of the Hurlet Limestone, and therefore belonging to the Carboniferous Sandstone series. Mr. Kirkby has stated the presence of *E. rudis* in this bed, but I cannot find that species there myself.

EDMONDIA LOWICKENSIS, sp. nov. Plate XXXIII, figs. 1—4.

EDMONDIA PHASEOLINA, *M'Coy*, 1855. Brit. Pal. Foss., p. 502.

— — *Etheridge*, 1888. Brit. Foss., pt. 1, Palæozoic, p. 283.

Specific Characters.—Shell of only very moderate size, transversely hatchet-shaped; narrowed anteriorly, expanded and truncate behind, oblique, moderately gibbose. The anterior end is produced forwards; narrowed by the approach of the inferior and superior margins; its border elliptically curved, passes below into the inferior margin, which is gently but regularly convex. The posterior border is obliquely cut from above downwards and backwards, nearly straight, making a well-marked obtuse angle with the hinge-line, and a rounded obtuse angle with the inferior border. The hinge-line is well curved in front, but nearly straight posteriorly. The umbones are small, tumid, pointed, incurved, and slightly twisted forwards, contiguous, elevated, and situated in the front part of the

middle third of the valve. Passing downwards from the umbo to the posterior inferior angle is an obscure rounded ridge, posterior to which the valve is rapidly compressed into the margin. Elsewhere the valve is regularly and evenly convex, the point of greatest curvature being high up about the centre of the transverse diameter. The dorsal slope is much compressed.

Interior.—The anterior adductor muscle-scar is round, shallow, deeper internally, where it is separated from the umbonal hollow by a slight ridge, and situated just within the margin of the antero-superior angle. The posterior scar is almost obsolete. The pallial line is entire and marginal. The hinge-plate has attached to it the elongate flattened ossicle which is placed in the hollow of the umbo, and represented in the cast by a narrow elongate slit. The interior of the shell is marked by shallow grooves and obsolete ridges, crossed by very fine regular radiating lines.

Exterior.—The surface is covered by very fine, regular, close, concentric lines of growth, with here and there an approach to sulcation.

Dimensions.—Fig. 1, Pl. XXXIII, from Thornliebank, measures—

Antero-posteriorly	.	.	.	32 mm.
Dorso-ventrally	.	.	.	23 mm.
Laterally	.	.	.	16 mm.

Localities.—England: one of the Limestones of Lowick and the Four Laws Limestone at the Coombs, Northumberland. Scotland: the Upper Limestone series of the Girtle quarry near Dalry, and Thornliebank; Index Limestone, Hullerhirst.

Observations.—This species was referred by M'Coy to Goldfuss's *Sanguinolaria phaseolina* from the Eifelian of the Continent. I cannot see any reason for such an opinion on comparing the suite of British specimens with the figure; and although the meagre description does to a certain extent coincide with that given by M'Coy, I have thought it wiser to give a new name to the species. Goldfuss says that his species has "striæ radiantæ," which is not the case with the external shell of *E. Lowickensis*. Giebel gives the stage for Goldfuss's *S. phaseolina* as "Grauwackenformation," in his 'Repertorium zu Goldfuss's Petrefakten Deutschlands,' p. 84. The species is retained by Benshausen in his work 'Die Lamellibrauchiaten des rheinischen Devon,' under the name *Jancia phaseolina*, and his figures amply demonstrate that Goldfuss's and M'Coy's shells are entirely different. The specimens on which M'Coy founded his description are from Lowick, and are in the Woodwardian Museum, Cambridge. They are all casts, and exhibit the internal characters very well. Fortunately a very fine example has been obtained by Mr. J. Neilson at Thornliebank, which has the test preserved (fig. 1, Pl. XXXIII), and I have obtained a small suite of specimens from the Girtle quarry near Dalry. Mr. J. Dunn has obtained a small fragment from the limestone at the Coombs, south of Redesdale village, which I regard as the Four Laws limestone,

which at this place is very fossiliferous, and the fauna, as far as has been ascertained at present, contains a very large percentage of the fossils collected at Lowick by the Rev. E. Jenkinson. The identical bed where the Lowick fossils were obtained is not now exactly known, but it is an important fact that the limestone at the Coombs, which lies about forty miles S.S.E. of Lowick, from its relation to the Redesdale limestone below and the Four Laws coal above, must be the Four Laws limestone; and this may lead to the identification of the fossil-bearing bed at Lowick.

The narrow extended anterior end and the squarely cut posterior border are very characteristic of the species; and in addition I regard the approach to an oblique ridge from the umbo to the posterior inferior angle, a feature very rare in the *Edmondidae*, as an important specific character.

EDMONDIA OBLONGA, *Portlock*, sp., 1843. Plate XXIX, figs. 1—3 and 5.

- SANGUINOLARIA OBLONGA, *Portlock*, 1843. Geol. Rep. Londonderry, p. 434, pl. xxxvi, fig. 2.
- — *Brown*, 1849. Illustr. Foss. Conch., p. 219, pl. xc, fig. 43.
- ? PANOPEA COYANA, de *Ryckholt*, 1853. Mélanges paléontol. p. 31, pl. xi, figs. 7 and 8.
- SANGUINOLITES OBLONGA, *Morris*, 1854. Cat. Brit. Foss., 2nd edit., p. 223.
- EDMONDIA OBLONGA, *M'Coy*, 1855. Brit. Pal. Foss., p. 501, pl. 3 F, fig. 10.
- UNIONIFORMIS, *Salter*, 1861. Mem. Geol. Surv. Gt. Brit., Iron Ores Gt. Brit., pt. 3, p. 221, pl. i, fig. 29.
- OBLONGA, *Young and Armstrong*, 1871. Trans. Geol. Soc. Glasg., vol. iii, Suppl., p. 51.
- — — 1876. Carb. Foss. West of Scotland, p. 54.
- — *Roemer*, 1876. Lethæa Palæoz., pl. xlv, fig. 5.
- — *Biggsby*, 1878. Thesaurus Devonico-Carb., p. 307.
- — *Etheridge*, 1888. Brit. Foss., pt. 1, Palæozoic, p. 233.

Specific Characters.—Shell of moderately large size, transversely oblong, tumid, very inequilateral, slightly oblique, margins subparallel. The anterior end short and gibbose, and narrower in the dorso-ventral direction than the posterior. The anterior border is curved, its junction with the hinge-line above often approaching to a rounded right angle; below, the curvature sweeps broadly round into the inferior border, which is convex at each extremity, but nearly straight for the greater part of its extent. The posterior border is very bluntly rounded, approaching to angulation at the junction with the upper and lower borders, so that the posterior end is subquadrate. The hinge-line is very nearly straight and prolonged posteriorly. The umbones are moderately large, tumid, curved, slightly

raised, the beaks being twisted forwards and inwards, contiguous, and situated in the anterior quarter of the shell. Lunule and escutcheon absent. The valves are regularly and convexly swollen, but in very large specimens there is an obscure approach to angulation along the line where the shell becomes compressed to form the posterior slope.

Interior.—The anterior adductor muscle-scar is large, shallow, and round, and is situated within the antero-superior angle of the valve, encroaching largely upon the umbonal hollow; the posterior is large and rounded, shallow, situated on the hollow of the dorsal slope, remote from the margin. Above this and at the extreme end of the hinge-plate, and just within the margin of the valve, is a small round scar for an accessory muscle. The pallial line is entire and very remote from the margin. The hinge consists of a plate thickened on its external border, which is placed at right angles to the valve, and formed by the valve being bent acutely on itself. This leaves, in casts, two parallel grooves, which become shallower as they pass backwards, and terminate at some distance from the posterior end. The hinge-plate is apparently edentulous. The internal surface as seen in casts shows numerous concentric ridges and sulci, which become broader and further apart as they approach the lower margin.

Exterior.—The surface is ornamented with bundles of fine concentric striæ, separated into groups by well-marked concentric folds and ridges, which are broader near the lower margin.

Dimensions.—Pl. XXIX, fig. 5, the type of *Sanguinolaria oblonga*, Portlock, measures—

Antero-posteriorly	.	.	.	.	56 mm.
Dorso-ventrally	.	.	.	.	38 mm.
Elevation of valve	.	.	.	.	15 mm.

Locality.—England: in one of the beds of limestone, Lowick; the Coombs limestone, Redesdale, Northumberland. Wales: below the Farewell Rock of Glan Rhyrney and Beaufort, South Wales. Scotland: the Lower Limestone series of Beith, Ayrshire. Ireland: in black limestone, Errigle Keerogue, co. Tyrone.

Observations.—When M'Coy described his new species of *E. oblonga* he was aware of the close similarity of his shell to that described by Portlock. He states (*op. sup. cit.*, p. 501), "The *Sanguinolaria oblonga*, Portlock, . . . seems to be more compressed, to have a more defined posterior slope, and to have large regular imbrications in addition to the small concentric markings. They may, however, be identical."

A close comparison of the types of each author, which I am fortunately able to figure through the kind permission of Sir A. Geikie and Professor McKenny Hughes, shows the identity of *Sanguinolaria oblonga*, Portlock, Pl. XXIX, fig. 5, with *Edmondia oblonga*, M'Coy, Pl. XXIX, fig. 1, the differences noted by M'Coy

being largely due to the fact that M'Coy's specimens were all casts of the interior, and Portlock's specimen is a cast of the exterior. The greater definition of the posterior slope in the latter example is due to age and condition.

M'Coy gave the name var. *B. brevis* to a shorter form of this species. He says, "The var. *B. brevis* differs in nothing but the shorter figure above given, and I have seen most of the intermediate grades." I do not, however, propose to retain the variety.

E. oblonga might be in a few cases mistaken for *E. grandis*, but the former is less orbicular, less oblique, and has its borders almost parallel, and the posterior end more produced and oblong. It is much less orbicular and more regularly oblong than *E. Lyellii*.

EDMONDIA LYELLII, sp. nov. Plate XXIX, fig. 4; Plate XXXI, figs. 1—5.

Specific Characters.—Shell of moderately large size, gibbose, triangularly ovate, inequilateral. The anterior end is depressed, and narrowed from above downwards, gradually compressed, the border elliptically curved, passing with regular sweep into the lower margin, which is extended and only slightly convex, for the greater part of its extent, but becomes more curved behind, where it passes evenly into the posterior border. The latter is blunt, almost straight, and somewhat narrowed by the depression of the upper border, which it meets at an obtusely rounded angle. The hinge-line is arched and extended behind. The umbones are large, gibbose, incurved and twisted forwards, contiguous, elevated above the hinge-line, and situated in the front part of the middle third of the valve. The valves are regularly convexly curved, but there is some flattening along the dorsal slope and towards the posterior end of the valve. There is a well-marked groove above and parallel with the hinge-line for the external ligament.

Interior.—The anterior adductor muscle-scar is large, ovate, placed well within the margin of the shell, in the hollow of the valve, at a level with the antero-superior angle. The posterior adductor scar is large, shallow, and oval, situated near the greater superior angle, remote from the margin. The pallial line is remote from the margin and entire. The hinge-plate is thick; to the inner edge of it was attached a plate, represented in casts by a narrow groove, which was directed downwards and outwards. This groove is deep and wide in front, but becomes narrow and shallower behind.

Exterior.—The surface is covered with fine concentric lines of growth, which are elevated into fine ridges in front and at the margin, which may appear at times almost subimbricate. Here and there over the surface of the shell are

irregularly placed concentric ridges or depressions; above these was a finely punctate periostracum. Shell thick.

Dimensions.—Fig. 4, Pl. XXXI, a perfect right valve, measures—

Antero-posteriorly	65 mm.
Dorso-ventrally	58 mm.
Elevation of valve	18 mm.

Localities.—England: Northumberland, the limestone of Lowick. The Middle limestone, West Witton, Wensleydale; the limestone of Poolwash, Isle of Man. Scotland: Lower Limestone series of Newfield, High Blantyre; of Craigen Glen, Campsie; Swinlees; Auchenskeith; Dalry; Broadstone, Beith; McDonald Limestone series, Muirkirk; Craighall, Fife. Ireland: the Carboniferous Limestone of Galway.

Observations.—This species is founded on numerous very fine examples from the localities named above, and has externally a strong resemblance to the genus *Cardiomorpha*, but the possession of an ossicle attached to the hinge-plate and the different position of the anterior adductor muscle-scars separate it from that genus, the position of the anterior adductor muscle being lower down and more remote from the margin than obtains in *Cardiomorpha*; the shell is also thicker, and the surface-markings stronger than in that genus. Fig. 5, Pl. XXXI, is a very fine example from Craighall, Fife, and is in the Museum of Science and Art, Edinburgh, and I am indebted to Dr. Traquair for permission to figure the specimen. Fig. 1, Pl. XXXI, a specimen from the limestone of Beith, Ayrshire, in the possession of Mr. R. Craig, shows that the species possessed a periostracum with spotted markings, of which a view is given, Pl. XXXI, fig. 1 a. At least one other species of the genus, *E. sulcata*, has the same character; but owing to the fact that specimens of any of the species rarely occur which have the periostracum preserved, indeed the majority are found in the condition of internal casts, this character cannot be yet stated to be universal in the species of this genus.

Fig. 3, Pl. XXXI, a specimen from Beith, is in the cabinet of Dr. John Young, of the Hunterian Museum, Glasgow, and shows the very thick and deep groove for the ossicle, and the adductor muscle-scars and pallial line.

Fortunately, I have been able to isolate the hinge in the specimen, fig. 2, Pl. XXXI, belonging to the Geological Survey of Ireland; and fig. 4 a, Pl. XXXI, a shell belonging to the Geological Society of Glasgow, also shows this portion of the shell very well. Compared with other species of *Edmondia*, the shell of *E. Lyellii* was very thick, very much thicker than that of *E. primæva*, a much larger shell.

From *E. oblonga*, *E. Lyellii* is easily distinguished by its greater obliquity and longer, narrower anterior end, and the orbicular shape of the shell.

Dr. Traquair informs me that the specimen from Craighall, Fife, bears a label, in Fleming's handwriting, *Venerupis Lyellii*. I have, therefore, adopted this specific name.

EDMONDIA RUDIS, *M'Coy*, 1851. Plate XXVIII, figs. 8—14.

- ? CORBULA? SENILIS, *Phillips*, 1836. Geol. Yorks., pt. 2, p. 209, pl. v, fig. 1.
 — ? — *Morris*, 1843. Cat. Brit. Foss., 1st edit., p. 83.
 LEPTODOMUS SENILIS, *M'Coy*, 1844. Synops. Carb. Foss. Ireland, p. 67.
 CARDIOMORPHA SENILIS, *d'Orbigny*, 1850. Prodrome de Paléontol., p. 132.
 EDMONDIA RUDIS, *M'Coy*, 1851. Ann. Mag. Nat. Hist., ser. 2, vol. xii, p. 190.
 — — *Morris*, 1854. Cat. Brit. Foss., 2nd edit., p. 202.
 LEPTODOMUS? SENILIS, *Morris*, 1854. Ibid., p. 206.
 EDMONDIA RUDIS, *M'Coy*, 1855. Brit. Pal. Foss., p. 502, pl. 3 F, fig. 9.
 — — *Young and Armstrong*, 1871. Trans. Geol. Soc. Glasgow, vol. iii,
 Supplement, p. 51.
 — — *Armstrong, Young, and Robertson*, 1876. Cat. Western Scottish
 Fossils, p. 54.
 — — *Biggsby*, 1878. Thesaurus Devonico-Carboniferus, p. 307.
 LEPTODOMUS SENILIS, *Biggsby*, 1878. Ibid., p. 307.
 EDMONDIA RUGATA, *de Koninck*, 1885. Ann. Mus. Roy. d'Hist. Nat. Belgique,
 tom. xi, p. 31, pl. ii, figs. 1, 2.
 — UNIFORMIS, *de Koninck*, 1885. Ibid., p. 29, pl. ii, figs. 32—36.
 — RUDIS, *Etheridge*, 1888. Brit. Foss., pt. 1, Palæozoic, p. 283.
 LEPTODOMUS SENILIS, *Etheridge*, 1888. Ibid., p. 284.

Specific Characters.—Shell subquadrate, somewhat transverse, gibbose, inequilateral, slightly oblique. The anterior side is very short, abruptly compressed, and its margin almost straight in the upper portion, but becoming curved in the lower to pass into the inferior border, which is only very gently convex. The posterior end is broader than the anterior, and is obliquely and very bluntly curved, the upper and lower angles being obtusely rounded.

The hinge-line is somewhat arcuate in front, but nearly straight and somewhat produced posteriorly.

The umbones are comparatively large and obtuse, their apices incurved and twisted forwards, contiguous, raised above the hinge-line, and situated at about the anterior fourth of the hinge-line. Passing backwards from the apex of the umbo, and almost parallel to the hinge-line, is a well-marked ridge, becoming lost near the posterior end, which separates a smooth, narrow, elongate hollow from the dorsal slope.

The valve is regularly convex from above downwards and strongly curved. From before backwards the convexity is a little less than in the vertical diameter, but there is an obscure approach to angulation along two lines before and also behind, which pass from the umbo towards the antero-inferior and postero-inferior angles respectively. The greatest convexity of the valve is a little above the median transverse diameter.

Interior.—The anterior adductor muscle-scar is large and shallow, situated remote from the margin in the hollow of the umbonal swelling. The posterior, even more obscure, is situated in the hollow of the dorsal slope. There is an accessory posterior muscle-scar placed at the posterior extremity of the narrow elongate groove, parallel to the edge of the valve. The pallial line is almost obsolete, but entire. The hinge is shown by casts to be edentulous. There is an elongate flattened ossicle which is directed outwards and downwards into the umbonal cavity. The internal surface shows obscure concentric grooves and rounded ridges, but is on the whole smooth.

Exterior.—The surface is ornamented with well-marked, unequal concentric, rugose folds and grooves, which are, however, less marked in front and behind, where the shell has a tendency to become smooth.

Dimensions.—Fig. 8, Plate XXVIII, measures—

Antero-posteriorly	.	.	.	33 mm.
Dorso-ventrally	.	.	.	28 mm.
From side to side	.	.	.	19 mm.

Localities.—England: one of the Limestones of Lowick, the Coombs Limestone, near Redesdale, and Lewisburn, Northumberland; the Carboniferous Limestone of Thorpe Cloud and Castleton, Derbyshire; the Cayton Gill beds, near Harrogate, Millstone-grit series; the Pennystone Ironstone, Coalbrookdale; the Upper Carboniferous Limestone of Poolvash, Isle of Man. Scotland: Lower Limestone series of Newfield, High Blantyre; Langside, Beith; Craigenglen; and Hind Og Glen, Dalry; Archerbeckburn, Canobie, Roxburgh.

Observations.—Since the type specimen of *Corbula ? senilis*, Phillips, has disappeared, and the figure is poor and the description meagre, I think there may be some little doubt of the species being identical with that described later by M'Coy as *Edmondia rudis*. Under the circumstances, however, I am compelled to adopt the later name, and to place Phillips's shell as a doubtful synonym, since this species has never been redescribed or apparently adopted, except in mere catalogues, probably on account of the loss of the type.

This species is characterised by its rugose appearance and quadrate gibbose form even in casts. In the West of Scotland, in the nodules of the shales of the Lower Limestone series, it is perhaps the most common species of the genus; but it also is found in the upper beds of the Carboniferous Limestone of Derbyshire and the Isle of Man, and as a dwarfed form in the Pennystone Ironstone of the Coal-measures of Coalbrookdale. De Koninck seems always to have misunderstood the characters of Phillips's *E. uniconiformis*, and I am of opinion that the shells figured by him in his latter work as specimens of that species are small examples of *E. rudis*, and I have no hesitation whatever in placing *E. rugata* of the same author as a synonym of M'Coy's species. Speaking of his *E. rugata*,

de Koninck says "Cette espèce a de grands rapports avec l'*Edmondia rudis*, F. M'Coy, qui s'en distingue par la situation antérieure de ses crochets et la forme beaucoup plus arrondie des extrémités de son bord cardinal." A large series of specimens of *E. rudis* show that the actual position and degree of elevation of the umbone is variable and depends largely on the stage of growth. In old shells the umbones are less anterior and more elevated than when young. M'Coy's type specimen is one which had only attained to medium growth, while the type of de Koninck's *E. rugata* is much more fully grown.

The Scotch examples are nearly all in the condition of internal casts. These show the elongate narrow groove in the umbonal cavity which lodged the internal ossicle, and other details of the interior. The internal surface was often as rugose as the external, owing to the extreme thinness of the shell; but the fine, sharp lines of growth which are placed all over the rugged external surface are, of course, wanting.

The wide horizontal and vertical distribution of this species is to be noted. While few of the Lamellibranchs which occur in Carboniferous Limestone series of Scotland are found in the Carboniferous Limestone of Yorkshire and Derbyshire, *E. rudis* seems to have flourished equally well during the different conditions under which each deposit was laid down, for it attains a full degree of development in each locality, and only becomes dwarfed when it is found at a much higher horizon, the Coal-measures.

EDMONDIA COMPRESSA, M'Coy, 1844. Plate XXXIII, figs. 5—9.

EDMONDIA ? COMPRESSA, M'Coy, 1844. Synopsis Carb. Foss. Ireland, p. 52, pl. xiii, fig. 10.

CARDIOMORPHA COMPRESSA, d'Orbigny, 1850. Prodrome de Paléontol., p. 133.

EDMONDIA COMPRESSA, Morris, 1854. Cat. Brit. Foss., 2nd edit., p. 202.

— — M'Coy, 1855. Brit. Pal. Foss., p. 500.

— — Bigsby, 1878. Thesaurus Devonico-Carboniferus, p. 307.

— — Etheridge, 1888. Brit. Foss., pt. 1, Palaeozoic, p. 283.

Compare — ? PRELONGA, de Koninck, 1885. Ann. Mus. d'Hist. Nat. Belgique, p. 50, pl. vii, fig. 21.

Specific Characters.—Shell transversely ovate, very inequilateral, compressed, slightly oblique. The anterior end is very short, but deep, and only slightly convex. The margin which forms a right angle with the hinge-line, descends at first almost in a straight line, and then becomes very convex, sweeping round into the inferior margin without a break. The inferior border is produced and convex, especially behind, where it rises to join the posterior end, which is bluntly rounded. The hinge-line is long and gently arched.

The umbones are of moderate size, elongate, tumid, twisted inwards and forwards, only slightly raised above the hinge-line and situated very far forwards, and excavated in front. The valves are evenly and gently convex, except in front, where there is a rapid compression. The dorsal slope is very gentle, and the posterior end is narrowed by the approach of the dorsal and ventral border.

Interior.—Few details have been yet observed. The interior of casts is almost smooth. The hinge-plate is furnished with the internal, elongated, expanded ossicle which obtains in other species of the genus.

Exterior.—The surface is covered with numerous very fine regularly arranged concentric lines of growth. Shell thin.

Dimensions.—Pl. XXXIII, fig. 7, M'Coy's type specimen, measures—

Antero-posteriorly	.	.	.	50 mm.
Dorso-ventrally	.	.	.	33 mm.
Elevation of valve	.	.	.	6 mm.

Localities.—England: the Carboniferous Limestone of Thorpe Cloud and Castleton, Derbyshire; Carboniferous Limestone, Isle of Man (M'Coy). Ireland: Cork.

Observations.—*E. compressa* differs from *E. unioformis*, being more transverse, less gibbose, and more oblique, having the umbones more anterior and more prosogyrous, and the surface-markings much finer than in the latter species.

E. compressa was described twice by M'Coy, *op. supra cit.* The type which served for description is preserved in the Griffith Collection of the Science and Art Museum, Dublin; and I am fortunately able to refigure this specimen, Pl. XXXIII, fig. 7. The second description was evidently based on a specimen from the Carboniferous Limestone of the Isle of Man, but was accompanied by no figure. In the later description, a much fuller one than the former, the dorsal margin is said to be nearly straight, but in the original account it was described as "obtusely rounded." The latter is correct, for although the type specimen is incomplete posteriorly, observation shows that the lines of growth representing the contour of the shell in a young state are distinctly rounded. Allusion is also made to a lunette, but no lunule occurs in the genus *Edmondia*.

E. compressa more closely resembles *E. transversa* than any other species of the genus. The latter is more convex; its upper and lower margins are subparallel and the posterior end is truncate, and even in casts have well-marked concentric ridges and sulci. The umbones are somewhat less anterior, and the shell only attains to about half the size of *E. compressa*.

Edmondia (?) *prælonga*, de Koninck, has somewhat the general character of *E. compressa*, but it has its dorso-ventral diameter much shorter; but this is the case in young specimens of the latter species, as may be noted by observing some of the earlier lines of growth in the type specimen.

EDMONDIA PRIMEVA, *Portlock*, sp., 1843. Plate XXIX, figs. 6—8; Plate XXX, figs. 1—3.

- LUTRABIA PRIMEVA, *Portlock*, 1843. Geol. Rep. Londonderry, p. 441, pl. xxxvi, fig. 5.
- PRISCA, *M'Coy*, 1844. Synops. Carb. Foss. Ireland, p. 52, pl. xii, fig. 4.
- PRIMEVA, *Morris*, 1845. Cat. Brit. Foss., p. 90.
- CARDIOMORPHA PRISCA, *d'Orbigny*, 1850. Prodrome de Paléontol., p. 133.
- EDMONDIA PRISCA, *Morris*, 1854. Cat. Brit. Foss., 2nd edit., p. 202.
- MYACITES? TENUILINEATA, *Etheridge*, 1873. Geol. Mag., vol. x, p. 299, pl. xii, fig. 7.
- EDMONDIA TENUILINEATA, *Bigsby*, 1878. Thesaurus Devonico-Carboniferus, p. 307.
- CARDIOMORPHA TENUILINEATA, *Bigsby*, 1878. *Ibid.*, p. 301.
- LUTRABIA TENUILINEATA, *Etheridge*, 1885. Brit. Foss., pt. 1, Palæozoic, p. 285.
- MYACITES PRIMEVA, *Etheridge*, 1885. *Ibid.*, p. 286.
- BROECKIA PRISCA, *de Koninck*, 1885. Ann. Mus. d'Hist. Nat. Belgique, tom. xi, p. 20, pl. ii, figs. 14, 15.
- LATISSIMA, *de Koninck*, 1885. *Ibid.*, p. 20, pl. ii, fig. 13.
- KAYSERI, *de Koninck*, 1885. *Ibid.*, p. 25, pl. v, figs. 13, 14.
- NORMALIS, *de Koninck*, 1885. *Ibid.*, p. 22, pl. v, figs. 3, 15, 16.

Specific Characters.—Shell ovate, transverse, moderately convex, very inequilateral. The anterior end is small, but deeper in the dorso-ventral diameter than the posterior, its border regularly rounded, passing with a continuous sweep into the inferior margin, which is convex and extended. The posterior border is narrowed by the approach of the upper and lower margins, and is bluntly rounded. The hinge-line is long and gently arched, somewhat depressed posteriorly. The umbones are large, elongated, incurved, and slightly twisted forwards, contiguous, elevated, and situated in the anterior fourth of the valve; well marked off in front from the compressed antero-superior angle, but behind they are continuous with the general curvature of the valve. The dorsal slope is not marked off from the rest of the shell. The upper margin is simple and erect, and comes in contact with its fellow. There is a small elongate groove for the external ligament for a short distance between the umbonal swellings. No escutcheon or lunule.

Interior.—The anterior adductor muscle-scar is shallow and placed high up. The posterior is oval and is situated within the dorsal slope, remote from the posterior end. The pallial line is entire. The hinge is edentulous, with a curved ridge of shell situated some little distance within the margin, represented in casts by a groove.

The Exterior.—The surface is ornamented by concentric lines, fine, distinct in

front, but becoming less well marked posteriorly, with here and there a deeper concentric groove. Shell of moderate thickness.

Dimensions.—Fig. 2, Plate XXX. The type of M'Coy's *Lutraria prisca* measures—

Antero-posteriorly	.	.	.	.	97 mm.
Dorso-ventrally	.	.	.	.	64 mm.
Elevation of valve	.	.	.	.	20 mm.

Localities.—England: the Carboniferous Limestone of Castleton and Thorpe Cloud, Derbyshire. Scotland: Lower Limestone series of Langside, Beith; Cousland, near Edinburgh. Ireland: the Carboniferous Limestone of Millicent, Clane, co. Cork; Doohybeg, co. Limerick.

Observations.—The original specimen of *Lutraria primæva*, Portlock, has disappeared, but the figures and description afford sufficient evidence of the characters of the species. Apparently another shell has been placed in the collection under the name, which belongs to quite a different genus, and this quite accounts for the fact that Mr. Etheridge (*op. supra cit.*) refers Portlock's shell to the genus *Mjyacites*.

M'Coy considered that his *Lutraria prisca* was less transverse than *L. primæva*, and that the ventral margin was more convex, which is true for the type, which was a much larger example than that of Portlock. When, however, the lines marking the several stages of growth are examined in the shells with a flattened ventral border, it is seen that when young and in the immature stage the ventral border was very much rounded, and the flattening only occurs later on; and it is to be noted also that this flattening of the ventral border is accompanied by a compression of the valves, as if regular growth had been in some way interfered with. Unfortunately, I have not a large number of examples to study, but specimens with and without a flattened lower border occur together in the same beds, and the latter never exhibit the irregularities of growth. I have, therefore, considered M'Coy's species to be synonymous with the *Edmondia primæva*, Portlock, sp.

De Koninck has adopted M'Coy's specific name without any reference to Portlock's specimen. He describes three other species which I think must be regarded as synonymous. *Broeckia latissima* is said to differ from *B. prisca* "par sa moindre épaisseur, par sa différence dans les rapports entre la hauteur et la largeur et par ses crochets plus antérieurs."

The dimensions of *B. latissima* are given as: length 106 mm., height 71 mm.; that of *B. prisca*, from a very imperfect example: length 95 mm., height 64 mm.; which are at once seen to be very fairly identical. *B. Kayseri* is said to differ in the same character from *B. latissima*, the dimensions of the former being; length 95 mm., height 60 mm. Of *B. normalis* he remarks, "Le *Broeckia normalis* a une

grande ressemblance avec le *Broeckia Kayseri*, dont les crochets sont plus petits, le côté postérieur plus allongé, et les bords plus arrondis." I do not think that the characters here relied upon for specific determination and for the erection of four species are more than the normal amount of variation to be found in a species which attains a large size. It may be mentioned that de Koninck states that the whole four species occur at one horizon, that is, in his étage II. With the exception of *B. prisca*, all the others are said to be rare.

For such a large shell the groove for the external ligament is very small, and it is very probable that, as in other members of the family *Edmondidæ*, there was some internal ligament, for the muscle-scars are very shallow and inconspicuous, and do not show any indications of great strength.

I have no doubt that the shell described as *Myacites? tenuilineata* by R. Etheridge, jun., is a somewhat undergrown example of Portlock's species. This is the only Scottish example of the species that I know. Mr. Etheridge states, "Surface with numerous close, thin, concentric lines, which here and there show traces of granulation." Further on he says, "With a good lens traces of the granulation can be detected. This would still further tend to ally it with *Myacites*." This author was probably not aware that this character had been shown to be present in *Edmondia* by King.

EDMONDIA GIGANTEA, de Koninck, sp., 1885. Plate XXX, figs. 4, 4 a.

- BROECKIA GIGANTEA, de Koninck, 1885. *Ann. Mus. Roy. d'Hist. Nat. Belgique*,
 tom. xi, p. 22, pl. v, figs. 1, 2.
 — DEPRESSA, de Koninck, 1885. *Ibid.*, p. 22, pl. v, figs. 7, 8.
 — SUBÆQUALIS, de Koninck, 1885. *Ibid.*, p. 21, pl. iii, figs. 19, 20.

Specific Characters.—Shell large, ovately rhomboidal, compressed, only slightly convex, inequilateral; the anterior end is small but deep, rapidly compressed into the edge of the valve, especially at the antero-superior angle, which is erect and bluntly angular. The anterior border is regularly rounded, and passes with a sweep into the ventral edge, which is only slightly convex, and subparallel with the dorsal border. The posterior border is almost truncate and subquadrately rounded at each extremity. The hinge-line is long and gently arcuate. The umbones are elongate, compressed, small, strongly incurved, and twisted on themselves, contiguous, and situated in the anterior quarter of the valve. They are raised above the hinge-line, and are well marked off from the valve in front, where they are on a much higher level than the front part of the hinge-line; but behind they form a compressed elongated swelling on each side of and above the

hinge-line, but continuous below with the general convexity of the valve. The valves are gently and regularly convex from before backwards and from above downwards. Internal to the umbonal swelling is a narrow, depressed, elongated trench, in the anterior part of which was placed the external ligament.

Interior.—Unknown.

Exterior.—The surface is ornamented with groups of fine concentric lines of growth, separated by somewhat deeper grooves and more conspicuous in the lower and newer portion of the valve; the umbonal region is almost smooth. The greatest convexity is about the centre of the valve; shell thin.

Dimensions.—Fig. 4, Pl. XXX, measures antero-posteriorly (estimated) 95 mm., dorso-ventrally 71 mm., side to side 39 mm.

Localities.—Ireland: the Carboniferous Limestone of Little Island, co. Cork.

Observations.—This species does not seem to have been described before from Great Britain. Fig. 4, Pl. XXX, is in the cabinet of Mr. J. Wright, of Belfast, and was obtained from Little Island, co. Cork.

De Koninck has described three species under the names *Broeckia gigantea*, *B. depressa*, and *B. subæqualis*, the two former of which I have no hesitation in regarding as one species. Of *B. depressa* that author says, "Cette grande et belle espèce se distingue facilement de ses voisines, et particulièrement du *Broeckia gigantea*, par sa forme moins ovale et par sa faible épaisseur relativement à sa longueur." *B. gigantea* is said to have the following proportions, but a large part of the posterior end is absent: "longueur 114 mm., hauteur 75, épaisseur 60 mm. *B. depressa*, l. 115, h. 72, é. 40."

E. gigantea is less convex, more quadrate, and much deeper in the dorso-ventral diameter than *E. primæva*; it wants the transverse sulcations which characterise *E. expansa*.

EDMONDIA GOLDFUSSI, *de Koninck*. Plate XXXII, figs. 7—11.

EDMONDIA GOLDFUSSI, *de Koninck*, 1885. Ann. Mus. d'Hist. Nat. Belgique, tom. xi, p. 31, pl. xii, figs. 11, 12.

Specific Characters.—Shell of medium size, broadly ovate, slightly oblique, convex, inequilateral. The anterior end is deep from above downwards, short, compressed, with its border almost straight above, but the curvature below is that of an arc of a circle, where it sweeps round into the ventral margin, which is much less convex in its median portion, but behind curves upwards to pass into the posterior border, which is regularly rounded, almost semicircular. The hinge-line is arched, forming more or less of an angle with the anterior edge, but behind

forms a continuous curve with the posterior border. The umbones are tumid, short, somewhat twisted forwards, forming the highest part of the shell, and are placed in the anterior quarter of the valve.

The valves are regularly convex from above downwards and before backwards, the point of greatest convexity being about the centre of the antero-posterior diameter, which passes through the junction of the upper and middle thirds of the valve. There is a small, narrow groove above the hinge-edge for the external ligament.

Interior.—The muscle-scars are normal in position, and the hinge-plate is furnished with a comparatively large ossicle, which projects outwards into the cavity of the umbo. The pallial line is entire. The internal surface is for the great part smooth, but there are some irregular concentric sulci towards the lower margin.

Exterior.—The surface is covered by very fine concentric lines of growth, best marked at the anterior edge of the valve, but becoming almost obsolete over the posterior half of the shell. Here and there towards the lower margin are irregular, shallow, concentric grooves. Shell thin.

Dimensions.—Pl. XXXII, fig. 7, measures—

Antero-posteriorly	.	.	.	33 mm.
Dorso-ventrally	.	.	.	25 mm.
Elevation of valve	.	.	.	10 mm.

Localities.—England: the Carboniferous Limestone of Thorpe Cloud and Castleton, Derbyshire.

Observations.—This species occurs in fair abundance at Castleton and Thorpe Cloud, and is characterised by the regularly rounded form of its posterior end and its broad anterior extremity, and the fineness of the concentric striæ on the surface.

It is much shorter and comparatively more oblique than *E. unioniformis*, to which species it appears to me to have a closer affinity than to any other.

De Koninck gives the comparative dimensions of his type specimens as: "longeur 36 mm., hauteur 16 mm., épaisseur 22 mm." It will be seen on referring to his figure that hauteur 16 mm. is a misprint for 22 mm. This species was obtained from the Upper or Viséan beds of the Carboniferous Limestone of Belgium.

EDMONDIA ARCUATA, *Phillips*, sp., 1836. Plate XXXV, figs. 1—4, 6—10.

SANGUINOLARIA? ARCUATA, *Phillips*, 1836. Geol. York., pt. 2, p. 209, pl. v, fig. 4.

— ? — *Morris*, 1843. Cat. Brit. Fossils, 1st edit., p. 100.

SANGUINOLITES ARCUATUS, *McCoy*, 1844. Syn. Carb. Foss. Ireland, p. 48.

- EDMONDIA ARCUATA, *King*, 1849. Monogr. Permian Foss., p. 164.
 SANGUINOLITES ARCUATUS, *Brown*, 1849. Illustr. Foss. Conch., p. 219, pl. xc,
 fig. 16.
 LYONSIA ARCUATA, *d'Orbigny*, 1850. Prodrome de Paléontol., p. 128.
 SANGUINOLITES ARCUATUS, *Morris*, 1854. Cat. Brit. Foss., 2nd edit., p. 223.
 EDMONDIA ARCUATA, *Bigsby*, 1878. Thesaurus Devonico-Carboniferus, p. 307.
 — — *Lebour*, 1878. Outlines Geol. Northumberland and Durham,
 p. 121.
 — — *Etheridge*, 1888. Brit. Foss., pt. 1, Palæozoic, p. 283.

Specific Characters.—Transversely elongate, elliptically almond-shaped, very inequilateral, gibbose, slightly oblique. The anterior end is very short, depressed, compressed much below the level of the umbones, and has its border erect, almost semicircular in curvature, passing into the inferior margin, which is elongate, and almost straight for the greater part of its extent, but is curved upwards at the posterior end. The posterior margin is bluntly but regularly rounded. The hinge-line is long and gently arched. The umbones are small, elongate, incurved, contiguous, not much raised above the body of the shell, and placed in the anterior fifth of the valve, much excavated anteriorly. The valves are regularly convex from before backwards and above downwards, so much hollowed out anterior to the umbones as to be concave. The dorsal slope is broad but only slightly depressed, and in old specimens there is the slightest approach to obtuseness along a line passing from the umbo to the postero-inferior angle. Owing to the narrow anterior end and the obliquity of the valve, the posterior end has a false appearance of being somewhat expanded from above downwards.

Interior.—The anterior adductor muscle-scar is large, triangularly ovate, and situated remote from the margin in the hollow at the base of the anterior limb of the umbo, bounded behind by a shallow groove. Immediately above this, and in the hollow of the anterior limb of the umbo, are some deep accessory muscle-scars. The posterior adductor is large, shallow, and placed close to the postero-superior angle. In casts, external to the hinge-plate, is an elongate narrow groove, expanding and becoming shallower posteriorly, in which lodged the ossicle peculiar to the genus. In well-preserved casts there is also, posterior to the umbones, an elongate depression, marked off by a curved line, which starts immediately behind the umbo, and, turning outwards at first, returns to the edge of the ridge, which is above the slit for the ossicle and probably represents a thickening of the roof of the umbo for the support of this process. Hinge edentulous. The interior of the shell has markedly shallow concentric grooves and ridges. Pallial line entire.

Exterior.—The surface of the valve is covered by numerous, distinct, fine concentric lines of growth, with here and there a deeper sulcus, all of which commence and end in the upper margin of the shell, curving completely round each end. Shell very thin.

Localities.—England: the Redesdale Ironstone of Redesdale and Bellingham, Northumberland.

Dimensions.—Pl. XXXV, fig. 3, a medium-sized example, measures—

Antero-posteriorly	42 mm.
Dorso-ventrally	20 mm.
From side to side	16 mm.

Observations.—The type of this species, described under the name *Sanguinolaria ? arcuata* by Phillips, is stated to have come from Harelaw, Northumberland. There is a locality named Harelaw Hill Quarry in Scotland, just over the border, about a mile west of Penton, which yields Carboniferous Lamellibranchs, and which may possibly be the locality whence the original of this shell was obtained. Professor Lebour thinks that Harelaw may be a misprint for Hareshaw (*op. supra cit.*, p. 126), which is quoted by d'Orbigny as a locality for Carboniferous fossils in Northumberland. *E. arcuata* is a fairly common fossil at the old ironstone mines of Redesdale, occurring chiefly in the form of casts, which show the details of the interior very well, but casts of the exterior are also to be found in a band of shelly ironstone which occurs in the series.

This species differs from most of the others of the genus in the shape and position of the anterior adductor muscle-scar. This is very far inside the margin, large, surmounted by small accessory scars, and situated quite in the umbonal hollow. *E. scalaris*, a very different shell, is the only other species of the genus where this arrangement obtains.

The elliptically pointed end is very characteristic, being proportionally much longer than obtains in any other species of the genus, and this character serves at once to distinguish the shell from *E. Pentonensis*, which has a short but deep anterior end.

Pl. XXXV, fig. 7, is a fine cast of both valves, and shows the relation of the hinge-line to the slits on each side, *a* and *b*, which received the sharp extended ridge (ossicle) or outer edge of the hinge-plate, and *c c*, the hollows for the leaf-like thickening of the posterior part of the roof of the umbonal cavity. There was not any space between this process and the shell, and its function probably was merely to strengthen the base of origin of the hinge-plate and its peculiar process which projected outwards into the cavity of the umbo. How far these processes extended outwards from the hinge-plates of this species is well seen in this specimen, because, being a cast, the actual edge of the hinge occupied the grooves immediately on each side of the median line, which are seen to be internal to and below the ossicle. The depth of the process of shell in the roof of the umbonal cavity varies; in some specimens it is only just visible, though the line bounding its outer edge may be sharply defined, and in a few examples the line passes across the umbo to its anterior edge. I do not think that this space could

have served as an attachment for muscle or ligament; it is not roughened or punctate, but is the representative probably of the winged process described by King as present in *Edmondia sulcata* ('Mon. Permian Fossils,' p. 164, pl. xx, figs. 3 and 4).

The shape and contour of a great many of the specimens obtained at Redesdale are misleading. Very frequently the cast has not been completely filled, and the contours of the anterior and posterior extremities are often made to appear as if truncated and obtuse. This condition can be easily recognised by tracing the concentric markings which are present both on the exterior and interior, which will be found to terminate abruptly on the anterior and posterior margins, instead of curving round, in each case, to end in the upper border of the valve. Occasionally good impressions of the exterior can be obtained from a bed of shelly calcareous ironstone which occurs in the series of the Redesdale Ironstone Measures.

EDMONDIA PENTONENSIS, sp. nov. Plate XXXV, figs. 12—16.

Specific Characters.—Shell of medium size, transversely oblong-oval, elongate, compressed, upper and lower margins sub-parallel, very inequilateral. The anterior end is short, compressed, but deep from above downwards, its border regularly and almost semicircularly curved. The inferior margin is long, very slightly convex; the posterior border is bluntly rounded below and curved above, but the curvature of its upper portion is the arc of a much larger circle than that of the lower part. The hinge-line is much shorter than the greatest length of the shell, and almost straight, slightly elevated posteriorly. The umbones are small, incurved, and twisted forwards, contiguous, raised above the anterior end of the shell, but not elevated above the hinge-line, and situated in the anterior fifth of the shell.

The valves are regularly but very slightly curved from above downwards and before backwards. The posterior end is somewhat expanded, being deeper than the anterior in a dorso-ventral diameter. There is a narrow elongate groove for the external ligament, parallel to and just above the hinge-line.

Interior.—The arrangement of the muscle-scars has not been seen. The hinge is edentulous, and has a long narrow ridge projecting outwards into the umbonal cavity.

Exterior.—The surface is covered with numerous fine lines of growth, arranged concentrically, with several shallow, broad, concentric sulci, more pronounced near the lower margin, and here and there a line much more apparent than the others. Shell very thin.

Dimensions.—Fig. 12, Pl. XXXV, measures—

Antero-posteriorly	64 mm.
Dorso-ventrally	30 mm.
Elevation of valve	7 mm.

Localities.—England: rare in the Redesdale Ironstone, Northumberland. Scotland: in a bed of shale between two limestones at Penton Linns, river Liddle, Dumfriesshire; in the *Schizodus Pentlandicus* bed, Randerston, Fife, Lower Limestone series.

Observations.—This species occurs at Penton Linns in a bed of shale lying between two thick limestones, associated with a very rich fauna. The following Lamellibranchs occur there:—*Nucula undulata*, *N. gibbosa*, *Nucula attenuata*, *Ctenodonta Pentonenensis*, *Protoschizodus axiniformis*, together with several species of *Murchisonia*, *Macrocheilus*, *Bellerophon*, *Orthoceras*, Brachiopods, Crinoids, *Fenestella*, &c. &c. From the fauna, I should certainly regard the bed as belonging to the Carboniferous Limestone series, and probably as representing the Beith, Hurlet, or Lower Limestone series of the west of Scotland; and it is probably the same as that which is exposed at Harelaw Hill and Peter's Crook quarries, about a mile E. and W. respectively.

I have been fortunate enough to obtain one specimen which has the external surface of the shell removed in the neighbourhood of the hinge-line, showing the outer edge of the process of the hinge-plate (*a*), which I have called the ossicle, present in all species of the genus *Edmondia*, fig. 12, Pl. XXXV. This shows that the plate was shelly and not cartilaginous. The outer edge of this ossicle is 4 mm. external to the hinge-line, and its use was probably, as Professor King suggested, as a fulcrum, but it is not clear that an internal cartilage was attached to it. A fair-sized shell, like *Edmondia*, with an edentulous hinge, would necessarily need some strongly-developed muscles and ligaments to keep the valves in contact; but, compared to the size of the shells, the muscle-scars are very shallow, hence the necessity for the development of some special form of closing apparatus.

I have been unable to refer the Penton specimens to any described species, but they approach to *E. arcuata* more nearly than to any other. From this species *E. Pentonenensis* is easily distinguished by the absence of obliquity, the short but deep anterior end, and the flat oblong shape of the valves.

Three specimens from the Redesdale Ironstone I doubtfully refer to this species, but these are not perfect, and are only half the size of the Penton examples. They are without the obliquity of *E. arcuata*, which is very common at that locality, and have a deep and comparatively shorter anterior end, but it is possible that they are only aberrant forms of the latter species.

EDMONDIA SUBPLICATA, *Kirkby*, sp., 1880. Plate XXXVIII, figs. 1—5.

SANGUINOLITES SUBPLICATUS, *Kirkby*, 1880. Quart. Journ. Geol. Soc., vol. xxxvi,
p. 586.
— — — *Etheridge*, 1888. Brit. Foss., pt. 1, Palæozoic,
p. 290.

Specific Characters.—Shell much produced transversely, almost lanceolate, very feebly gibbose, markedly inequilateral, narrow in the dorso-ventral diameter. The anterior end is compressed and very short comparatively, but long compared to other species of the genus. It is much lower than the umbones, and has a well-marked antero-posterior angle. The border is elliptically curved. The inferior border is very long and almost straight, parallel with the hinge-line, hardly rising at all posteriorly, where it makes a blunted angle with the posterior border. The latter is obliquely truncate from above downwards and backwards, and forms an obtuse angle above with the hinge-line. The hinge-line is straight, much shorter than the inferior border. The umbones are small, compressed, not elevated, and situated in the anterior fifth of the shell. Passing downwards from the umbo to the postero-inferior angle is an ill-defined ridge, above which the valve is flattened and compressed. Elsewhere the valve is only very slightly convex. There is a narrow elongate groove at the upper edge of the valve from the external ligament.

Interior.—The anterior adductor muscle-scar is deep, circular, bounded behind by a ridge, and placed immediately within the antero-superior angle of the valve. The position of posterior scar is not known.

The hinge is edentulous. There is a rolled and thickened hinge-plate, bevelled at the expense of its lower border, which projects outwards and downwards. Between this plate and the umbo is a narrow elongate groove, which splits up and becomes irregular in front. Pallial line deep, entire, and remote from the margin.

Exterior.—The surface is covered with fine concentric lines of growth, which become stronger and subimbricating near the lower margin. Shell very thin.

Dimensions.—Pl. XXXVIII, fig. 1, measures—

Antero-posteriorly	.	.	.	50 mm.
Dorso-ventrally	.	.	.	15 mm.
Elevation of valve	.	.	.	4 mm.

Localities.—In shale below the limestone east of the Coal Farm, St. Monan's, Fife, and Randerston, Fife; in Limestone No. 5 of Mr. Kirkby (*op. supra cit.*), Calciferous Sandstone series.

Observations.—This species was founded by Mr. Kirkby (*op. supra cit.*) for some very elongate narrow shells, found in the *Schizodus Pentlandicus* bed at Randerston. I think, from a study of the hinge and from the general characters, that his reference of the shell to the genus *Sanguinolites* was a mistake, as it possesses far greater affinities with that group of *Edmondia* of which *E. arcuata*, Phillips, sp., is typical. I have fortunately been able to obtain a specimen which has the hinge-plate preserved, Pl. XXXVIII, fig. 2, which places the advisability of referring the species to *Edmondia* beyond all doubt.

Associated with this species at Randerston is *E. Pentonensis*, from which it is distinguished by its much narrower dorso-ventral diameter and obliquely truncate posterior end.

Mr. Kirkby thought that *E. subplicata* was limited to the lower part of the Calciferous Sandstone series of Fife, and gives its distribution as 3000 to 3800 feet below the Carboniferous Limestone. I have, however, obtained the shell from the bed of shale below the limestone at St. Monan's, Fife, which Mr. Kirkby takes as the base of the Carboniferous Limestone of Fife.

I have examined the type of Portlock's *Sanguinolaria plicata*, and am of opinion that it does not belong to the genus *Edmondia*, but has more affinity to the shells hitherto known as *Sanguinolites iridinoïdes*, M'Coy. Mr. Kirkby quotes *Sanguinolites plicatus* from the shales at St. Monan's, and probably he did not recognise that the species found there was the same as his *S. subplicatus* from Randerston, for in the shales the shell is less crushed, and has the external surface beautifully preserved. The *Schizodus Pentlandicus* bed, Mr. Kirkby's No. 5 Limestone, is most interesting. The upper surface is strewn with shells and shell débris, and evidently represents a beach, for much of the bed is made up of rolled shell fragments and shelly detritus. Large numbers of several genera of small Gasteropoda are strewn over the surface, and some of the best preserved shells have *Spirorbis* adhering to them. The limestone is a very hard band, 1 foot thick, but the waves wear away the cementing material quicker than the fossil shells, which consequently stand out in relief. The fauna of this bed is, I think, characteristic of littoral conditions. Below and separated from this limestone by a bed of shale 9 inches thick, probably of fresh-water origin, is another limestone, 1 foot thick, with plant remains, *Naiadites* and *Rhizodus Hibberti*, pointing out the rapid alteration of conditions which obtained during the deposit of the Calciferous Sandstone series of the Fifeshire coast.

Mr. Kirkby thinks it probable that the shell termed *Modiola* in the East of Fife sheet, No. 41 of the Geological Survey maps, is the same as *Edmondia subplicata*.

EDMONDIA TRANSVERSA, sp. nov. Plate XXXII, figs. 12—16.

Specific Characters.—Shell of moderate size, transversely ovate, very inequilateral, gibbose. The anterior end is extremely short and compressed, its border curved and narrowed from above downwards.

The inferior border is slightly convex and produced, passing into the posterior border with an increased curvature. The posterior margin is bluntly rounded, without any approach to angulation above or below. The hinge-line is arched in front, but prolonged and almost straight behind. The umbones are gibbose, prolonged transversely, pointed, twisted inwards and forwards, contiguous, somewhat raised, and situated quite in the anterior portion of the valve.

The valves are evenly and convexly curved, and have a long dorsal slope, not well marked off from the rest of the valve; the greatest convexity is in front and above the centre of the shell.

Interior.—The anterior adductor scar is small and shallow, placed within the antero-superior angle of the shell; the posterior scar is obsolete. The hinge-plate in casts leaves two grooves parallel with the edge of the valve. The pallial sinus is entire, and is represented by a well-marked groove not far from the margin. The interior shows well-marked concentric grooves and sulci, crossed by very fine decussating lines.

Exterior.—The surface is ornamented with concentric grooves and sulci, more or less regular, which are occupied by very fine concentric lines. Shell very thin.

Dimensions.—Fig. 12, Pl. XXXII, measures—

Antero-posteriorly	35 mm.
Dorso-ventrally	24 mm.
Laterally	12 mm.

Localities.—Scotland: the Upper Limestone series of Garngad Road, Glasgow; the Lower Limestone series of Beith and Auchenskeith, Ayrshire.

Observations.—This species is associated with *E. rudis* in nodules in the shales connected with the Beith Limestones in the Lower Limestone series of Ayrshire, and though fairly plentiful, is not so frequent as the latter. *E. transversa* seems to occupy a position midway between *E. unioniformis* and *E. rudis*. It is more transverse and less deep in front than the latter, and more oblique than either. At present I am unable to record the presence of this species, except at the horizon noted above.

It is probable that these are the shells referred to *E. Egertoni* in the catalogues

Observations.—This species was founded by Mr. Kirkby (*op. supra cit.*) for some very elongate narrow shells, found in the *Schizodus Pentlandicus* bed at Randerston. I think, from a study of the hinge and from the general characters, that his reference of the shell to the genus *Sanguinolites* was a mistake, as it possesses far greater affinities with that group of *Edmondia* of which *E. arcuata*, Phillips, sp., is typical. I have fortunately been able to obtain a specimen which has the hinge-plate preserved, Pl. XXXVIII, fig. 2, which places the advisability of referring the species to *Edmondia* beyond all doubt.

Associated with this species at Randerston is *E. Pentonensis*, from which it is distinguished by its much narrower dorso-ventral diameter and obliquely truncate posterior end.

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Mr. Kirkby thinks it probable that the shell termed *Modiola* in the East of Fife sheet, No. 41 of the Geological Survey maps, is the same as *Edmondia subplicata*.

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Specific Characters.—Shell of moderate size, transversely ovate, very inequilateral, gibbose. The anterior end is extremely short and compressed, its border curved and narrowed from above downwards.

The inferior border is slightly convex and produced, passing into the posterior border with an increased curvature. The posterior margin is bluntly rounded, without any approach to angulation above or below. The hinge-line is arched in front, but prolonged and almost straight behind. The umbones are gibbose, prolonged transversely, pointed, twisted inwards and forwards, contiguous, somewhat raised, and situated quite in the anterior portion of the valve.

The valves are evenly and convexly curved, and have a long dorsal slope, not well marked off from the rest of the valve; the greatest convexity is in front and above the centre of the shell.

Interior.—The anterior adductor scar is small and shallow, placed within the antero-superior angle of the shell; the posterior scar is obsolete. The hinge-plate in casts leaves two grooves parallel with the edge of the valve. The pallial sinus is entire, and is represented by a well-marked groove not far from the margin. The interior shows well-marked concentric grooves and sulci, crossed by very fine decussating lines.

Exterior.—The surface is ornamented with concentric grooves and sulci, more or less regular, which are occupied by very fine concentric lines. Shell very thin.

Dimensions.—Fig. 12, Pl. XXXII, measures—

Antero-posteriorly	35 mm.
Dorso-ventrally	24 mm.
Laterally	12 mm.

Localities.—Scotland: the Upper Limestone series of Garngad Road, Glasgow; the Lower Limestone series of Beith and Auchenskeith, Ayrshire.

Observations.—This species is associated with *E. rudis* in nodules in the shales connected with the Beith Limestones in the Lower Limestone series of Ayrshire, and though fairly plentiful, is not so frequent as the latter. *E. transversa* seems to occupy a position midway between *E. unioniformis* and *E. rudis*. It is more transverse and less deep in front than the latter, and more oblique than either. At present I am unable to record the presence of this species, except at the horizon noted above.

It is probable that these are the shells referred to *E. Egertoni* in the catalogues

of Messrs. Young and Armstrong, as I find specimens of *E. transversa* bear this name in the cabinets of Scotch collectors. The former species now referred to *Cardiomorpha* is, as far as I can ascertain, not present in the Carboniferous series of the West of Scotland.

EDMONDIA SULCATA, *Phillips*, sp., 1836. Plate XXXIII, fig. 15; Plate XXXIV, figs. 3, 5, 6, 6 a; Plate XXXV, figs. 5, 11.

- HIATELLA SULCATA (pars?), *Fleming*, 1828. Hist. Brit. Anim., p. 461.
 SANGUINOLARIA SULCATA, *Phillips*, 1836. Geol. Yorks., pt. 2, p. 209, pl. v, fig. 5.
 — — *McCoy*, 1844. Synopsis Carb. Foss. Ireland, p. 50.
 — — (pars), *Morris*, 1845. Cat. Brit. Foss., p. 100.
 AILORISMA REGULARIS (pars), *de Verneuil*, 1845. Géol. Russie, vol. iii, p. 298,
 pl. xxi, figs. 11 a, b.
 EDMONDIA SULCATA, *King*, 1849. Permian Foss., p. 164, pl. xx, figs. 1—4.
 ? SANGUINOLARIA SULCATA, *Brown*, 1849. Illustr. Foss. Conch., p. 220.
 PHOLADOMYA SULCATA, *d'Orbigny*, 1850. Prodrome de Paléontol., p. 128.
 ? SOLEMYA PARALLELA, *de Ryckholt*, 1852. Mém. pal., 2e partie, p. 51, pl. xi,
 figs. 11, 12.
 EDMONDIA SULCATA, *McCoy*, 1855. Brit. Pal. Foss., p. 503.
 — — *Bigsby*, 1878. Thesaurus Devonico-Carboniferus, p. 307.
 — — *Etheridge*, 1888. Brit. Foss., pt. 1, Palæozoic, p. 284.
 Non — — *Tornquist*, 1896. Fossilführ. untercarbon sudvogesen, vol. ii,
 p. 142, pl. xix, figs. 2, 3.

Specific Characters.—Shell of medium size, inequilateral, oblong-oval, moderately convex, close all round. The anterior end is short, and narrower from above downwards than any other part of the shell, convexly curved into the edge, which is regularly and almost semicircularly rounded. The inferior border is extended and almost straight for the greater part of its extent, but is regularly and almost semicircularly rounded at each extremity, where it is continuous with the curvature of the anterior and posterior borders. The latter is convexly rounded, the upper part being the segment of a larger circle than the lower. The hinge-line is almost straight, much shorter than the greatest antero-posterior diameter of the valve. The umbones are small, pointed, elongate, incurved, and twisted forwards, close, not much raised above the hinge-line, and situated in the anterior fifth of the valve.

The valves are evenly curved from above downwards and before backwards; there is no ridge or constriction, but a certain amount of flattening or compression along the dorsal slope.

Interior.—The anterior adductor muscle-scar is small, shallow, rounded, and

situated just within the antero-superior angle of the valve, and surmounted by an excavated, elongate, pear-shaped accessory scar, which is deeper and narrower above, and is separated from the umbonal cavity by the process of shell (ossicle) which projects from the lower part of the hinge-plate, and from the edge of the shell by the thickened hinge-plate. The posterior adductor scar is large, shallow, and punctate, placed near the postero-superior angle in the hollow of the dorsal slope.

The hinge is simple and erect; but projecting from the back of the hinge-plate into the hollow of the umbo is a large, curved, thin, expanded process, which looks somewhat like a bivalve shell with umbones in front and a long, pointed process posteriorly, the ossicle. The interior of the shell was deeply marked by regular concentric grooves and ribs, the latter often bifurcating in front into two thin, narrow ridges, with a tendency to more or less irregularity. There are faint indications of radiating striæ over the body of the shell. Pallial sinus entire, deeply marked, remote from the margin.

Exterior.—The surface is ornamented with regular, broad, deep, concentric ribs and sulci. The former are narrow and double at first, but unite sooner or later, and towards the posterior end of the shell the ribs become thicker and further apart, all, however, passing round, to terminate in the upper edge of the valve. The periostracum is comparatively thick, and covered with fine, close, regular, radiating rows of small tubercles, which pass indiscriminately over both sulci and folds. Shell thin.

Dimensions.—Fig. 6, Plate XXXIV, measures—

Antero-posteriorly	.	.	.	52 mm.
Dorso-ventrally	.	.	.	26 mm.
Laterally	.	.	.	14 mm.

Localities.—England: the Middle Limestone of West Witton, Wensleydale, and from the neighbourhood of Richmond, Yorkshire; one of the Limestones of Lowick and the Redesdale Ironstone, the Lewisburn, near Plashetts, Northumberland; the Carboniferous Limestone of Kendal; the Upper Grey and Middle White Limestones of Llangollen, North Wales; Ballasalla quarry, Isle of Man; marine bed below the Millstone-grit of Congleton Edge, Cheshire; the Gannister beds, Snosteriey, Durham. Scotland: the Lower Limestone series of Beith; Bathgate and Carluke; Brinston Colliery, Penicuik; Pot-metal, near Kirkealdy; Lawston Linns, Liddlewater; Muirburn, Newcastleton, Harelaw Hill quarry, Roxburgh. Ireland: the Carboniferous Limestone of Rochfort Lodge, Bundoran; Kildare; Grange Blundel and Arghamont, Armagh; Derryloran and Caledon, Tyrone.

Observations.—In spite of the fact that Professor King pointed out that two perfectly distinct shells were generally referred to the *S. ? sulcata*, Phillips and

Fleming, sp., there has always existed considerable confusion between them. King was of opinion that the shells described by Phillips and Fleming were quite distinct, and referred Phillips's shell to *Edmondia sulcata* and Fleming's to *Allorisma sulcata*. But considerable doubt exists that such was the case, and, from the descriptions of both by Phillips and Fleming, I think it highly probable that each had specimens of both shells before him when writing the description. These shells certainly have a certain broad resemblance and may be easily mistaken, but careful examination shows that they hardly possess a single character in common. King described Fleming's shell under the name *Allorisma sulcata*, which perhaps belongs to the family *Grammysidæ*, for it has the typical hinge and constriction from the umbo to the lower margin characteristic of that family. The shell of *A. sulcata* is more oblique, has the umbones more anterior, and the anterior umbonal limb rises gradually from the anterior edge of the shell, and not by a distinct well-marked fold. The position of the anterior adductor scar is different from that of *E. sulcata*, and there is no large accessory scar; moreover the pallial line in *A. sulcata* is deeply sinuated, and there is no ossicle attached to the back of the hinge-plate, and the shell possesses a long escutcheon and fairly well-marked lunule. Externally the ribs are simple and not double in the anterior part of the valve. But with all the important differences, the general appearance of the two shells is so strikingly similar, that the question naturally arises as to what could have been the reason for such an external resemblance in two such differently constructed animals. Is it possible that this resemblance is due to protective mimicry, and that this factor of natural selection was already exerting its influence in Carboniferous times? Both species occur together, and I have an idea that in any given locality one or other species is rare and the other common. It is so at Lowick and Redesdale, but I have not sufficient evidence from other localities to make the statement absolute.

The descriptions given by Phillips and Fleming are so meagre that it has been largely a matter of conjecture and of external evidence to decide to which shell these authors were referring. King seems to have gone into the matter very carefully, and referred some specimens to Fleming for comparison. Phillips, however, thought that his and Fleming's species were identical; and it is quite possible that Fleming founded his species on specimens of both shells, for his description is as follows: "*Hiatella sulcata*.—Beak nearly terminal, both extremities rounded, concentrically sulcated, ridges large retrally, formed by the union of two or more ribs; closely and obsoletely striated longitudinally, striæ consisting of minute tubercles."

The beaks of *Edmondia sulcata* are not nearly terminal, but neither are the concentric ridges of *Allorisma sulcata* "large retrally, formed by the union of two or more ribs." Internal casts of *E. sulcata* have obsolete radiating striæ, which

casts of *A. sulcata* have not; *E. sulcata* has external radiating striæ formed of rows of minute tubercles, while *A. sulcata* also has this form of marking, rendering the mimicry more perfect. King quotes a letter from Fleming (*op. supra cit.*, p. 163) in which he says, "Two of the shells do certainly resemble my *Hiatella sulcata*. On one of the casts there are traces of the striæ, a character rarely to be met with, owing to the extreme thinness of the shell, and its usual imperfectly preserved state." Mr. Neilson has a fine series of *Allorisma sulcata* from the Garngad Road strata of Glasgow, which show the external markings very well, but the shells are at once distinguished from *Edmondia* by the well-developed elongate escutcheon and the presence of a definite lunule.

Phillips states that his *S. sulcata* came from Redesdale, and I cannot trace the original. In the York Museum there are four good examples which belonged to the Yorkshire Physical Society, and which are labelled "Richmond," one of which I think is very probably the type specimen. I figure it Pl. XXXIV, fig. 3.

Phillips's description is very meagre, and does not mention the bifurcation of the concentric folds in front, though the lower part of his figure shows them; and the umbones are not anterior enough for *A. sulcata*.

King, it appears, had originally placed both shells in the genus *Allorisma* ('Ann. Mag. Nat. Hist.,' Nov., 1844), but Morris pointed out that one of these did not possess a sinuated pallial sinus (Strzelecki's 'Physical Description, New South Wales,' p. 270); and therefore, in the 'Monograph of Permian Fossils,' King mentions that he considered the shell should be referred to *Edmondia*, de Koninck. Although no fresh description was given, there are good figures of the shell and its peculiar expanded ossicle; in fact, the generic character of this appendage is induced from this species. The ossicle is, however, apparently far better developed and more differentiated in *E. sulcata* than in any other species of the genus.

M'Coy gave a long description of the species (*op. supra cit.*), and described accurately the relation of the ossicle to the muscle-scars. He, however, seems to have misunderstood King, for he correctly describes the pallial line as "perfectly entire," as did that author ('Monograph of Permian Fossils,' p. 163), but M'Coy adds, "so that Mr. King must have been deceived in this respect." Perhaps, however, M'Coy had not taken the trouble to consult this work of King's, published several years before his own, and was basing his criticism on the preliminary notice in the 'Ann. and Mag. Nat. Hist.,' noted above.

The specimen of *E. sulcata* figured by King is preserved in the museum of Newcastle-on-Tyne, but I am unfortunately not permitted to refigure it. The umbones which King had knocked off, so as to expose the ossicle, have been cemented on, so that this feature is not visible to the visitor. I have fortunately been able to figure an example from the collection of Mr. Morton, of Liverpool,

which has the umbo of the left valve removed and the ossicle well exposed (fig. 5, Pl. XXXV). This specimen was obtained from the Middle White Limestone of Craig-Fawr, North Wales.

Fig. 6, Pl. XXXIV, is a specimen in my own collection, which shows the cast of the interior muscle-scars and a slit which corresponds to the ossicle. The strongly developed accessory muscle-scar is very well shown.

Figs. 11, 11*a*, Pl. XXXV, show portions of the exterior of the shell, with the peculiar punctate markings arranged in radiating rows. I have not been able to decide definitely whether these markings existed in the upper layer of the shell, or were confined to the periostracum only. Unfortunately, specimens which retain the shell are exceedingly rare.

The vertical range of this species seems to have extended up into the Gannister series in Durham. De Verneuil (*op. cit.*) has figured a very fine cast, showing the groove for the ossicle, from the Carboniferous Limestone of Stolobinskoi, Russia; and de Ryckholt a species from the Carboniferous shales of Tournai; but beyond these two records nothing is known of the distribution of this species in the Carboniferous beds of Europe. De Koninek does not describe the species in either of his great works.

Tornquist has evidently made a mistake in referring his specimens to this species; his figures have nothing in common with Phillips's species.

EDMONDIA EXPANSA, sp. nov. Plate XXXIII, figs. 16, 16*a*; Plate XXXIV, figs. 1, 2, 4, 7.

Specific Characters.—Shell large, transversely oblong-oval, inequilateral, compressed. The anterior end is short, deep, with a rounded border, the lower part being the arc of a much larger circle than the upper. The lower border is long, very convex in front, then becomes almost straight, till it becomes convex again, when it passes into the posterior border. The latter is extensive, almost semi-circular. The hinge-line is much shorter than the antero-posterior diameter, and is curved in front, but is straight posterior to the umbo. The umbones are small, elongate, pointed, incurved, hardly raised above the rest of the shell, and placed in the anterior fourth of the valve. The valves are only slightly convex from before backwards, but a little more so from above downwards, and somewhat compressed along the dorsal slope.

Interior.—No details beyond the fact that the shell possesses the characteristic ossicle have been yet observed. The interior of the shell had strongly marked concentric rugæ and folds.

Exterior.—The surface is ornamented with regular close-set concentric folds

and rugæ, which become larger and further apart towards the lower margin. The folds commence close together in the anterior part of the upper border, and, following the contours of the shell, become split up into twos and threes, which reunite into a simple large fold terminating in the posterior part of the upper border. The rugæ become very greatly dilated and widely separated on the dorsal slope, and all over the rugæ and sinuses are close, fine, concentric lines of growth. Shell very thin.

Dimensions.—Plate XXXIII, fig. 16, a specimen in the Grosvenor Museum, Chester, measures—

Antero-posteriorly	100 mm.
Dorso-ventrally	57 mm.
Laterally	30 mm.

The specimen is somewhat too narrow in the last diameter owing to the overriding of the valves on each other.

Localities.—England: the Carboniferous Limestone, North Riding, Yorkshire (the specimens in the York Museum are labelled Wensleydale); and Halkyn Mountain, North Wales.

Observations.—I have founded this species on four very fine examples, one of which, fig. 16, Pl. XXXIII, is in the possession of the Grosvenor Museum, Chester, and was obtained from Halkyn Mountain; one other, fig. 7, Pl. XXXIV, is in the collection of Mr. Joseph Wright, of Belfast, and is labelled North Riding, Yorkshire. It was presented to him by the late Mr. E. Wood, whose name was given to the genus of Crinoids, *Woodicrinus*. It is unfortunate that the exact bed of limestone whence it was obtained cannot, therefore, be located, but it most probably was obtained from one of the beds of the so-called Yoredale Limestones, which are, in my opinion, only the local representatives of the upper part of the Carboniferous Limestone of Derbyshire. Both specimens possess the two valves, and are fine casts of the exterior, but Mr. Wright's specimen is incomplete near the umbones, and shows the characteristic ossicle in section.

Two other specimens labelled Wensleydale are in the York Museum (Reed collection [Wood]). It appeared to me at first that possibly this species was only a giant form of *E. sulcata*; but, though in general characters coming closer to that species than to any other of the genus, *E. expansa* has, in the young stage even, the double ribs in the central part of the shell much closer than in that species, and it is also comparatively much less transverse.

In size *E. expansa* approaches *E. primæva*, but the latter species has not the well-marked ribs and sulci, and is comparatively much broader in its dorso-ventral diameter.

EDMONDIA LAMINATA, *Phillips*, sp., 1836. Plate XXXVI, figs. 1—7, 10—12, 31.

- LUCINA? LAMINATA, *Phillips*, 1836. Geol. Yorks., pt. 2, p. 209, pl. v, fig. 12.
 CARDINIA? LAMINATA, *de Koninck*, 1842. Carb. Foss., p. 78, pl. II, figs. 9 a—c.
 CARDIOMORPHA SULCATA, *de Koninck*, 1842. Ibid., p. 109, pl. II, figs. 18 a, b.
 ASTARTE QUADRATA, *M'Coy*, 1844. Carb. Foss. Ireland, p. 53, pl. XI, fig. 4.
 CARDIOMORPHA SULCATA, *de Verneuil*, 1845. Géol. de la Russie, vol. II, p. 303,
 pl. XX, figs. 2 a—c.
 LUCINA? LAMINATA, *Morris*, 1845. Cat. Brit. Foss., 1st edit., p. 89.
 — — *Brown*, 1849. Illust. Foss. Conch., p. 217.
 CARDIUM LAMINATUM, *d'Orbigny*, 1850. Prodrome de Paléontol., p. 131.
 ? CARDIOMORPHA GLEBOSA, *de Ryckholt*, 1852. Mélanges paléontol., 2e partie,
 p. 93, pl. XIII, figs. 1 and 2.
 PHOLADOMYA TORNACENSIS, *de Ryckholt*, 1852. Ibid., p. 37, pl. X, figs. 3, 4.
 LYONSIA QUADRATA, *d'Orbigny*, 1852. Prodrome de Paléontol., p. 129.
 LUCINA? LAMINATA, *Morris*, 1854. Cat. Brit. Foss., 2nd edit., p. 208.
 CARDIOMORPHA LAMINATA, *Morris*, 1854. Ibid., p. 190.
 EDMONDIA QUADRATA, *Morris*, 1854. Ibid., p. 202.
 CARDIOMORPHA LAMINATA, *Bigsby*, 1878. Thesaurus Devonico-Carbonif., p. 301.
 EDMONDIA QUADRATA, *Bigsby*, 1878. Ibid., p. 307.
 — SCULPTA, *de Koninck*, 1885. Ann. Mus. Roy. d'Hist. Nat. de Belgique,
 tom. XI, p. 42, pl. XI, figs. 20, 21, 44, 46.
 — TORNACENSIS, *de Koninck*, 1885. Ibid., p. 44, pl. XII, figs. 4—7.
 CARDIOMORPHA LAMINATA, *Etheridge*, 1888. Brit. Foss., pt. 1, Palæozoic, p. 280.
 EDMONDIA QUADRATA, *Etheridge*, 1888. Ibid., p. 283.

Specific Characters.—Shell below medium size, transverse, subquadrately oval, inequilateral, moderately gibbose. The anterior end is very short, gradually curved to the margin, and has an almost semicircular border; but where it passes into the inferior margin the curve is the arc of a larger circle than the upper part. The lower border is regularly and very slightly convex, except at the extremities. The posterior margin is broader than the anterior, and is obtusely rounded. The hinge-line is somewhat arched produced posteriorly. The umbones are small, regularly gibbose, pointed, incurved, and twisted forwards, somewhat elevated above the rest of the valve, and situated in the anterior quarter of the shell.

The valves are regularly convex from above downwards and before backwards, the greatest convexity being about the centre of the dorso-ventral diameter, but in front of the centre of the antero-posterior diameter. Towards the posterior end and along the dorsal slope the valve is somewhat compressed. No escutcheon or lunule.

Interior.—Unknown.

Exterior.—The surface is ornamented with very regular, simple, erect, concentric, fine ridges, separated by smooth, regular grooves. These ridges are

crowded in front, and at the extreme anterior margin become obsolete, but they increase in definition, and are somewhat wider apart posteriorly.

Localities.—England: the Carboniferous Limestone of Thorpe Cloud and Chrome Hill, Derbyshire; Thorpe, near Grassington, and Settle, Yorkshire; the Upper Carboniferous Limestone of Poolvash, Isle of Man. Ireland: the Carboniferous Limestone of Kildare; Carboniferous Slate, Ballymeeny, Easky; shale in Carboniferous Limestone at St. Dooghlas quarry, co. Dublin.

Dimensions.—Fig. 3, Pl. XXXVI, measures—

Antero-posteriorly	35 mm.
Dorso-ventrally	25 mm.
Elevation of valve	8 mm.

Observations.—The type of Phillips's *Lucina laminata* is preserved in the Gilbertson Collection of the British Museum (Nat. Hist.), South Kensington, and I refigure it, Pl. XXXVI, fig. 11, by the kind permission of Dr. H. Woodward. This specimen is only imperfect at the umbo, and the greater part of the valve, with its characteristic markings, is well preserved. It represents a specimen in advanced growth, and was obtained from the Bolland district of Yorkshire. The type of M'Coy's *Astarte quadrata* is preserved in the Griffith Collection of the Science and Art Museum, Dublin, and Dr. Scharff has permitted me to refigure it, Pl. XXXVI, fig. 12. It is a somewhat imperfect example of a left valve of full size, not of the right valve, as M'Coy's figure would appear to show; and, although the greater part of the valve has been removed, quite sufficient remains to demonstrate the identity of this shell with *E. laminata*, Phillips, sp. The growth of this shell has been interrupted from some cause or other, and it will be noticed that the regularity of curvature was interfered with when the shell had attained about two thirds of its growth. This was doubtless an accident, but M'Coy seems to have regarded the condition as a specific character, for he says, "This shell has a thick and somewhat rugged appearance from the prominence of the few large wrinkles of growth (as distinguished from the transverse sulci)." Many specimens, however, as might naturally be expected, exhibit slight variations in the strength and extent of the concentric ridges and sulci. I have been fortunate enough to obtain numerous specimens of this shell at Thorpe Cloud, the conical hill at the entrance to Dovedale, and have no hesitation in referring them to Phillips's species, *E. laminata*. De Koninck described a medium-sized shell of this species under the name *E. sculpta*, and he seems to have satisfied himself that it possesses the characteristic internal characters of *Edmondia*; for, although he does not figure the hinge-plate, he places no ? after the genus, as is his custom when he has not seen the hinge. De Koninck says that "les ornements de la surface de cette petite espèce ressemblent à ceux d'*E. globosa*, de Ryckholt, qui en diffère par sa grande taille et par l'épaisseur relativement plus grand de sa coquille." From

the description of *Cardiomorpha glebosa*, de Ryckholt, I see no reason to think the shells distinct, and am of opinion that it is highly probable that the two species are the same. Unfortunately, de Ryckholt's specimens cannot be examined, and therefore some slight degree of uncertainty must remain. De Koninck's type came from Visé, de Ryckholt's from Tournai. The latter shell measured 37 mm. antero-posteriorly, 27 mm. from above downwards. I think that the *Pholadomya Tornacensis*, de Koninck, should also be placed under this species.

British specimens of *E. laminata* have, curiously enough, generally been referred to *Pullastra crassistria*, M'Coy, and not to *Astarte quadrata*, M'Coy, which has been shown to be identical with Phillips's species. The type of the former species is so very imperfect as to be quite unrecognisable, but enough of the external surface remains to render it certain that the *E. laminata*, Phillips, sp., and *Pullastra crassistria*, M'Coy, are quite distinct.

Fig. 31, Pl. XXXVI, a specimen from Park Hill in the Collection of the Geological Survey, Jermyn Street, is the largest example I have seen, being larger than Phillips's type, Pl. XXXVI, fig. 11. Specimens in the younger stages of growth are relatively more transverse than adults, and there seems to be a large amount of variation in the size and number of the concentric ridges. It seems to me to be probable that the *Solenopsis parallela*, de Ryckholt, may be a very large example of this genus.

I have procured a fair number of specimens from Thorpe Cloud, in all stages of growth, which demonstrate the gradual changes of contour with increasing age. Unfortunately, so far, I have not been able to collect examples exhibiting any details of the interior, nor to assure myself that the shell possesses the characteristic ossicle of the genus. There appears to have been some considerable amount of variation in the number and size of the concentric ridges and grooves, some half-grown examples showing much larger and more widely separated ridges than many of the more fully-grown examples.

De Koninck, in 1842 (*op. supra cit.*), figured a specimen from Tournai which he referred to the genus *Cardinia*? and which he thought to be identical with Phillips's shell, but he does not appear to have retained the species in his second work. I think that *Cardiomorpha sulcata*, 1842, of this author is also a synonym of the species under description. This species is also not mentioned in de Koninck's later work. A well-marked variety of *E. laminata* occurs in the same beds at Thorpe Cloud (see p. 327).

E. LAMINATA, var. *SUBLEVIS*, var. *NOV.* Plate XXXVI, figs. 13—18.

Description.—Shape as in *E. laminata*, but the external surface is covered with concentric striæ and sulci of unequal strength and size, and the regular markings of *E. sculpta* are absent.

Comparative dimensions as in *E. laminata*, but I have never met with specimens of as large size as obtains in the specific form.

Observations.—I possess a small series of shells from Thorpe Cloud which possess the general character of *E. sculpta*, but differ markedly in the ornamentation of the surface. As ornamentation is known to be altered by divers conditions, I have not thought it wise to found a new species on a single character. De Koninck does not seem to have met with any shells like mine, for he gives no figures to which I can in any way refer the specimens. The Geological Survey Museum, Jermyn Street, possesses two specimens, internal casts, from Thorpe (near Grassington ?), which show the details of the interior, and also demonstrate that the variety possesses the ossicle or lamelliform process projecting from the back of the hinge-plate into the umbonal cavity.

EDMONDIA SCALARIS, *M'Coy*, 1844. Plate XXXVI, figs. 9, 19—22.

VENERUPIS SCALARIS, *M'Coy*, 1844. Synops. Carb. Foss. Ireland, p. 67, pl. x, fig. 6.

CARDIOMORPHA SCALARIS, *d'Orbigny*, 1850. Prodrome de Paléontol., p. 133.

NON EDMONDIA SCALARIS, *M'Coy*, 1855. Brit. Palæozoic Foss., p. 502, pl. 3 H, p. 96.

VENERUPIS SCALARIS, *Griffiths*, 1860. Journ. Geol. Soc. Dublin, vol. ix, p. 60.

CARDIOMORPHA SCALARIS, *Bigsby*, 1878. Thesaurus Devonico-Carboniferus, p. 301.

VENERUPIS SCALARIS, *Bigsby*, 1878. Ibid., p. 315.

EDMONDIA SCALARIS, *de Koninck*, 1885. Ann. Mus. Roy. d'Hist. Nat. de Belgique, p. 41, pl. x, figs. 25, 26.

— — (pars), *Etheridge*, 1888. Brit. Foss., pt. 1, Palæozoic, p. 284.

Specific Characters.—Shell of moderate size, obliquely suboval, very gibbose, inequilateral. The anterior end is short and small, compressed, and produced forwards at the antero-superior angle, which is the most anterior point of the valve. The anterior border curves downwards and backwards rapidly from the angle, so that it appears to be almost obsolete, and in its place is a very extensive convex lower border. The posterior border is broad, bluntly curved, and joins the hinge-line at an obtuse angle. The hinge-line is not quite as long as the

greatest antero-posterior length of the valve, and is gently arcuate. The umbones are gibbose, incurved, and twisted forwards, much elevated above the anterior portion of the valve, contiguous and situated in the anterior third of the valve, and excavated in front. The whole valve is regularly curved and very convex, compared to its size, and the dorsal slope broad.

Interior.—The anterior adductor muscle-scar is pear-shaped, large, shallow and striated from above downwards, placed in the anterior part of the umbonal hollow remote from the margin. The posterior scar has not yet been observed. Details of the hinge and pallial line not known. The cast shows deep ridges and sulci on the internal surface of the valve.

Exterior.—The shell is ornamented with a few, fifteen to twenty, broad concentric sulci, which are close in front, and all spring from the anterior part of the hinge-line; they expand as they cross the shell, becoming closer as they approach the posterior part of the hinge-line in which they terminate. These sulci are separated by blunt, imbricating, broad ridges, which become irregular in size and position towards the lower margin, and are very close and small in front. When the test is preserved, the whole of the grooves and ridges are covered by fine concentric lines of growth, one or more of which, here and there, on the sloping lower part of the ridges, are much accentuated. Shell thin.

Dimensions.—Fig. 21, Pl. XXXVI.

Antero-posteriorly	35 mm.
Dorso-ventrally	25 mm.
Elevation of valve	16 mm.

Localities.—England: the Limestone of Thorpe Cloud, Derbyshire. Ireland: the Carboniferous Limestone of St. Doogblas, co. Dublin, Kildare, and Millicent, Clane, co. Cork.

Observations.—This species was described and figured by M'Coy in 1844, but subsequently was confounded with another from Lowick (1885), which he erroneously described under the same name. De Koninck drew attention to this fact, and I am in accord with his remarks on the subject, which are as follows: "M. F. M'Coy paraît avoir confonder cette espèce, qu'il a décrite et figurée en 1844, avec une autre qu'il a désignée sous le même nom en 1855. Il est vrai que cette dernière s'en rapproche par sa forme et la largeur de ses plis concentriques, mais ceux-ci sont moins nombreux, quoique la taille de la coquille soit à peu près la même; elle diffère en outre par sa forme générale, qui est beaucoup plus rectangulaire, et par la situation plus antérieure de ses crochets." This shell I now describe as *E. MacCoyii*, and it may at once be recognised from *E. scalaris* by its more rectangular form, the anterior position of the umbones, the absence of obliquity, the smaller number of ridges, and the deep quadrate anterior end.

E. scalaris has externally somewhat the shape of *Cardiomorpha*, but the

anterior muscle-scar is not in the position which obtains in that genus, though the umbones are markedly prosogyrous. It is noteworthy that at least one species of *Cardiomorpha*, *C. corrugata*, M'Coy, has well-marked, broad, concentric grooves and ridges (Pl. XXIII, figs. 5—7). M'Coy's type specimen is preserved in the Griffith Collection of the Museum of Science and Art, Dublin, and I reproduce it, Pl. XXXVI, fig. 20, by the kindness of the director, Dr. Scharff. It is a medium-sized specimen, and was obtained from Millicent, Clane, co. Cork. M'Coy describes it as being "transversely ovate, short, and very gibbose, anterior end obtusely pointed;" and it is difficult to understand why later on he referred a shell to this species which he described as "oblong, short, very tumid, anterior end very small, compressed, rotundato-quadrate." The two descriptions of *E. scalaris* by M'Coy are so totally different, that there can be no doubt that he had a totally different shell under observation when writing his later work. The type of his second shell, in the collection of the Woodwardian Museum, Cambridge, was obtained from Lowick. The same collection contains several other specimens from the Carboniferous Limestone of Settle, which are certainly different from the Irish shell.

EDMONDIA MACCOYII, sp. nov. Plate XXXVI, figs. 23—30.

EDMONDIA SCALARIS, M'Coy, 1855. Brit. Pal. Foss., p. 502, pl. 3 II, fig. 6.

— — (pars), Etheridge, 1888. Brit. Foss., pt. 1, Palæozoic, p. 284.

Specific Characters.—Shell transversely subquadrate, very inequilateral, gibbose. The anterior end is very short, rapidly compressed, and relatively deep from above downwards. The anterior border, commencing above, makes blunted right angle with the hinge-line, and descends downwards in an almost straight line, becoming very bluntly curved below, where it passes into the inferior border, which is itself but very feebly curved. The posterior border is truncate, almost straight, joining the lower border with an obtuse curve, and forming a right angle with the hinge-line above. The hinge-line is almost straight, produced posteriorly, as long as any antero-posterior diameter of the shell. The umbones are comparatively large, tumid, incurved, and twisted forwards, contiguous, only slightly elevated above the hinge-line, and situated in the anterior quarter of the shell. The valves are regularly convex, but rapidly compressed above a line passing from the umbo to the postero-inferior angle. There is no lunule or escutcheon. The greatest convexity of the valve is at the junction of the upper and middle thirds of the shell, a little in front of the middle of the valve.

Interior.—The anterior adductor muscle-scar is placed in the anterior part of the umbonal hollow, and is shallow but large and striated. The posterior scar

appears to be obsolete. The hinge-plate consists of a thickened ridge leaving a groove in casts. Pallial line entire. The internal surface of the shell is deeply marked with concentric grooves and ridges corresponding to those on the surface.

Exterior.—The surface is ornamented with regular, broad, angular ridges, twelve to fifteen in number, separated by concentric grooves which enlarge rapidly as they pass across the shell, and become broader as they approach the lower margin, the ridges and grooves being themselves covered with fine concentric lines of growth, which are variable as to size and distance apart. Shell very thin.

Dimensions.—Pl. XXXVI, fig. 24, measures—

Antero-posteriorly	32 mm.
Dorso-ventrally	25 mm.
Elevation of valve	10 mm.

Localities.—England: the Carboniferous Limestone of Settle, Yorkshire; Thorpe Cloud, Castleton and Park Hill, Derbyshire; Narrowdale, Staffordshire; The Coomb and Lowick, Northumberland; the Cayton Gill beds near Harrogate in the Millstone-grit series. Scotland: the Lower Limestone of Auchenskeith and Dockra. Ireland: Carnteel, Tyrone.

Observations.—This species was described as *E. scalaris* by M'Coy in his second great work (*op. supra cit.*), but it differs markedly from the original type, as pointed out by De Koninck. The question of the affinities and differences of the two species has been discussed under my observations on *E. scalaris*, and need not be repeated here.

De Koninck has described a shell, under the name *E. scalariformis*, somewhat the shape of *E. MacCoyii*, but it is rather more transverse. It is quite possible that the two forms may be nothing more than varieties of the same species, but at present I have not access to enough material to venture on any definite statement with regard to them. I may say that the only difference between the shells is that of relative measurements, De Koninck's *E. scalariformis* having its antero-posterior diameter 40 mm. and dorso-ventral 26 mm.; in *E. MacCoyii* the diameters are as 32 : 25.

There appears to have been a great amount of variation in the size, number, and proximity of the concentric ribs. M'Coy's type shows only about ten, while fig. 28, Pl. XXXVI, a specimen from Settle, shows about thirty; but examples with much fewer ribs occur in the same locality.

In shape *E. MacCoyii* resembles *E. rudis* very closely, and the more regularly marked examples of the latter species would appear to pass into the more closely ribbed forms of the former. The extremes are, however, so distinct that I have not hesitated to retain both species.

EDMONDIA ACCIPIENS, *Sowerby*, sp., 1850. Plate XXXVII, figs. 8—16.

- NUCULA ACCIPIENS, *J. de C. Sowerby*, 1840. Geol. Coalbrookdale exp., pl. xxxix, fig. 4.
- UNIO UREI, *J. de C. Sowerby*, 1840. Ibid., pl. xxxix, figs. 6, 6 a.
- PARALLELUS, *J. de C. Sowerby*, 1840. Ibid., pl. xxxix, fig. 8.
- NUCULA ACCIPIENS, *Morris*, 1843. Cat. Brit. Foss., 1st edit., p. 93.
- UNIO UREI, *Morris*, 1843. Ibid., p. 105.
- PARALLELUS, *Morris*, 1843. Ibid., p. 105.
- NUCULA ACCIPIENS, *Brown*, 1849. Illus. Foss. Conch., p. 187.
- UNIO UREI, *Brown*, 1849. Ibid., p. 180, pl. lxxxviii, figs. 9, 10.
- PARALLELUS, *Brown*, 1849. Ibid., p. 180, pl. lxxxviii, fig. 26.
- NUCULA ? ACCIPIENS, *Morris*, 1854. Cat. Brit. Foss., 2nd edit., p. 216.
- UNIO ? UREI, *Morris*, 1854. Ibid., p. 230.
- ? PARALLELUS, *Morris*, 1854. Ibid., p. 230.
- CRENODONTA ACCIPIENS, *Bigsby*, 1877. Thesaurus Devonico-Carboniferus, p. 303.
- NUCULA ACCIPIENS, *Etheridge*, 1888. Brit. Foss., pt. 1, Palæozoic, p. 287.
- UNIO UREI, *Etheridge*, 1888. Ibid., p. 291.
- PARALLELUS, *Etheridge*, 1888. Ibid., p. 291.
- SANGUINOLITES GRANULATUS, *Etheridge*, 1890. Trans. N. Staff. Min. and Mech. Engineers, vol. x, p. 127, pl. i, fig. 12.

Specific Characters.—Shell transversely rhomboid-oval, moderately convex, very inequilateral, closed all round. The anterior end is very short, gibbose, and moderately deep from above downwards, its border regularly rounded. The inferior border is long and almost straight for the greater part of its extent, but posteriorly is curved upwards to pass into the posterior border without any angulation. The posterior border is bluntly but regularly rounded, passing with a regular curvature into the hinge-line. The superior border is long, straight, parallel with the ventral border, curved at either extremity, and somewhat shorter than the greatest antero-posterior diameter of the valve. The umbones are gibbose, raised, incurved and twisted forwards, contiguous, and placed close to the anterior extremity of the valve. The hinge-line is erect. Lunule and escutcheon absent. The valves are gibbose in front, and gradually compressed in the posterior half. There is no indication of any oblique line or fold in uncrushed specimens, but there is a slight constriction about the centre of the valve, which becomes broader and shallower as it approaches the margin.

Interior unknown.

Exterior.—The surface is ornamented with concentric sulci and rugæ, which have a direction parallel to the contour of the valve. The rugæ are more regular and better marked in the umbonal region; lower down they often subdivide as they cross the valve, and become split up into bundles of fine striæ of growth, the

sulci becoming also less well marked. In the better preserved specimens granular markings are seen over the valves, especially on the posterior slope.

Dimensions.—Fig. 10, Pl. XXXVII, from the Pennystone Ironstone, Coalbrookdale, in my Collection, measures—

Antero-posteriorly	74 mm.
Dorso-ventrally	34 mm.
From side to side	25 mm.

Localities.—England: the Pennystone Ironstone, Coalbrookdale. A band containing a marine fauna.

Observations.—This shell was described by J. de C. Sowerby, in an appendix to Prestwich's 'Geology of Coalbrookdale,' under three specific names; the very young shell being described as *Nucula accipiens*, while the well-sulcated full-grown shell was erroneously referred to the *Unio* figured by Ure ('History of Rutherglen,' p. 311, pl. xvi, fig. 4) as *Unio Urei*, and a variety with the concentric rugæ more split up into lines and striæ was named *Unio parallelus*. The *Unio* of Ure is *Carbonicola aquilina*, and is perfectly distinct from the species under discussion; moreover it has never yet been found in association with marine fossils. This specific name cannot be retained, and the term *accipiens* is adopted as it is the prior one on the page of description.

Professor Amalizky placed the name *Unio Urei* as a possible synonym of his *Naiadites Verneuli*, a genus of fresh-water edentulous shells allied to *Carbonicola*, but not belonging to *Naiadites*, Dawson.¹ This was of course due to a mistake arising from the comparison of figures, and partly due to the very meagre description of *Unio Urei* originally given.

There appear to be two well-marked forms of this shell, one of which, like the type of *Unio Urei*, has well-marked sulcations, and rugæ only becoming linear near the lower border; the other like the type of *Unio parallelus*, where the rugæ and sulci are somewhat obscure, and they tend to split up even in the upper part of the shell: but in shape and size the two forms are identical, and all gradations of external ornament exist between the extremes. I have, therefore, decided to unite the two species. In the original figures the posterior ends of both forms are incomplete. The postero-superior angle of the type of *Unio Urei* has gone, and a great deal of the posterior end of the type of *U. parallelus* is absent. An examination of the curvature of the lines of growth will demonstrate at once that the posterior end in both forms is rounded, but this is rarely seen owing to the incomplete preservation of the shell above and behind. Fig. 15, Pl. XXXVII, however, shows the real shape of the contour of the posterior end. The valves are often crushed, and this often gives rise to a false appearance of an oblique ridge,—in fact, it is very rare to find a perfect specimen.

¹ 'Quart. Journ. Geol. Soc.,' vol. 1, p. 439.

Sowerby described *Unio Urei* as having its "posterior extremity rather pointed," but this was not correct, for he did not recognise that he was describing a specimen with an incomplete posterior end; similarly he does not seem to have recognised that his type of *U. parallelus* was a fragment only, for the measurements given are those of the broken shell.

Mr. Etheridge described a shell (*op. supra cit.*) in the cabinet of Mr. J. Ward, of Longton, as *Sanguinolites granulatus*, which was stated to have come from the North Staffordshire Coal-field at Adderley Green, horizon uncertain. This shell is identical with the specimens from Coalbrookdale, which also possess the minute tubercles thought to be characteristic of his new specimen by Mr. Etheridge. In this character *E. accipiens* agrees with *E. Lyellii* and *E. sulcata*. I am very doubtful whether the shell in question was really obtained from North Staffordshire. Mr. Ward himself is very doubtful where he obtained the specimen, and I have had several talks with him on the subject, and judging from the matrix and condition of his specimen I am of opinion that it originally came from Coalbrookdale, from which place he has a fine series of shells. Mr. Ward has been such an accurate and careful collector that I feel sure that the find of a marine shell in the Coal measures of Adderley Green would never have given rise to an uncertainty of the horizon in his mind. In this specimen the ridge described by Mr. Etheridge is due to crushing. I re-figure the specimen by the kind permission of Mr. J. Ward, fig. 9, Pl. XXXVII.

Edmondia accipiens more closely resembles *E. sulcata* than any other species of the genus, but is distinguished by the following characters:—The umbones are more anterior and the shell more inequilateral; the sulcations and rugæ are not so well marked, and tend to split up into lines and plicæ of growth. The valves are more transverse. There is also a somewhat close resemblance to *Allorisma sulcata*, but the presence of escutcheon, lunule, and sinuate pallial sinus in the latter at once seems to separate the two species.

Sub-genus SCALDIA, de Ryckholt, 1852.

SCALDIA, de Ryckholt, 1852. *Mélanges paléontol.*, 1e partie, pl. x, figs. 24–26 ;
2e partie, p. 67.

- S. P. Woodward, 1851–6. *Manual of Mollusca*, p. 498.
- Bigsby, 1877. *Thesaurus Devonico-Carboniferus*, p. 311.
- de Koninck, 1885. *Ann. Mus. Roy. d'Hist. Nat. Belgique*, tom. xi, p. 54.
- Fischer, 1887. *Manuel de Conchyliologie*, p. 1100.

Generic Characters.—Shell subcircular or oval, equivalve, slightly inequilateral, moderately gibbose. Umbones subcentral, small. No lunule or escutcheon. Ligament external, small, contained in a very narrow groove just above the edge of the hinge.

Interior.—Adductor muscle-scars shallow, more or less rounded. Pallial sinus entire. Hinge-line simple, erect, with a single tooth in each valve under the umbo. Formula : $\begin{matrix} R. 0, 1 \\ L. 1, 0 \end{matrix}$. There is a thickened, depressed, vertical plate, much hollowed internally, the free edge of which extends outwards into the cavity of the umbo.

Externally the surface is almost smooth, or ornamented by numerous fine concentric lines.

Observations.—This genus was established by de Ryckholt (*op. supra cit.*), and the type was *Scaldia Kickxiana* ; but de Koninck considers this species to belong to *Edmondia*, but retains the genus for the six other species originally referred to it by de Ryckholt. In the original description the genus is said to have a sinuated pallial sinus, but de Koninck has shown that this was an error. I am not strongly convinced of the value of this genus, which differs from *Edmondia* in its more orbicular shape, and in the possession of a cardinal tooth in each valve ; but, as I have said (*ante*, p. 290), I have seen specimens of *Edmondia Kickxiana* which occasionally show a rudimentary cardinal tooth. De Koninck, however, will not allow that this is the case, for he says, speaking of the type of Ryckholt's *S. Kickxiana*, “ Il a considéré comme dent un faible renflement de la lame cardinale, comme le prouve l'exemplaire même dont il s'est servi pour décrire et figurer l'espèce.” De Ryckholt's figure shows the muscle-scars and sinuated pallial line very prettily, but no indications of these characters are shown in the type.

I have retained the term *Scaldia* as a sub-genus of *Edmondia*, following Woodward, and regard the hinge and suborbicular shape as important characters for the separation of the two genera.

De Koninck has described ten species as belonging to the genus, retaining six species figured and described by de Ryckholt, but I think it probable that many of them represent only different stages of growth of a species.

I have not found any species of *Scaldia* in the rich fossiliferous localities of the Mountain Limestone of England, but the genus occurs in the Carboniferous Limestone series of Scotland, and is represented by one species which I refer to, *S. fragilis*, de Koninck. In Ireland one species, *S. Benedeniana*, is represented by one specimen in the Museum of the Geological Survey of Ireland from the Limestone of Tuogh, co. Limerick, and two specimens from Kildare in the Museum of the Geological Survey at Jermyn Street, London. Unfortunately, in none of the specimens from these localities is the hinge to be seen.

I figure, for purposes of comparison, a specimen of *Scaldia Lambotteana*, from the Tournay beds, Pl. XXXVII, fig. 4. This specimen (a left valve) shows the hinge-line with the characteristic single cardinal tooth. As in the more ovate species of *Edmondia*, this species resembles that genus in possessing a shelly process of the hinge-plate which projects into the umbonal cavity. There is probably a very close relationship between *Paracyclas*, Hall, 1843, and *Scaldia*, de Ryckholt, 1852. Hall states in his diagnosis, "Structure of hinge not fully observed; ligament supported on each side by a narrow plate, and leaving in the cast two diverging grooves directed forward from the beak." The Devonian shells referred to *Paracyclas* are flatter and more generally compressed, and much more nearly shaped like *Lucina* than the Carboniferous shells referred to *Scaldia*. In the absence, however, of sufficient evidence of the exact structure of the hinge of *Paracyclas*, it is impossible to say at present that the two genera are synonymous.

SCALDIA FRAGILIS, de Koninck, 1885. Plate XXXVII, figs. 5—7.

SCALDIA FRAGILIS, de Koninck, 1885. Ann. Mus. Roy. d'Hist. Nat. de Belgique, tom. xi, p. 58, pl. xiv, figs. 36—38.

Specific Characters.—Shell of less than medium size, subcircular, strongly gibbose, slightly inequilateral. The anterior end is deep in the dorso-ventral direction, regularly convex, and its border almost semicircularly curved. The inferior border is convexly curved, and the posterior truncate, forming with the inferior margin a bluntly rounded angle. The hinge-line is curved, and makes a more or less obsolete obtuse angle behind with the posterior border. The umbones are small, triangular, and acutely pointed, incurved, subcentral, and somewhat raised above the rest of the shell. The valves are strongly and regularly convex, especially above. Passing obliquely downwards and backwards

from the umbo to the postero-inferior angle is an obscure ridge, above which the shell is compressed and slightly expanded.

Interior.—Not exposed.

Exterior.—The surface is almost smooth, but the microscope shows very fine, close, and regular concentric lines, more pronounced on the dorsal slope. Shell thin.

Dimensions.—Fig. 7, Pl. XXXVII, measures—

Antero-posteriorly	29 mm.
Dorso-ventrally	23 mm.
Elevation of valve	8 mm.

Localities.—Scotland: the Upper Limestone series of Kirktonholm, East Kilbride, in the Cement stone.

Observations.—De Koninck founded the species *S. fragilis* on a single somewhat imperfect valve from the Calcschist of Tournay, and his description is therefore necessarily meagre. The specimens which I have referred to this species are from the cabinet of Mr. J. Neilson, and seem to agree perfectly with de Koninck's figures. One example, Pl. XXXVII, fig. 7, is fairly perfect; and another, Pl. XXXVII, fig. 6, has the greater part of both valves preserved. I have not been able to see any details of the hinge or the interior in the specimens from East Kilbride, the locality where Mr. Neilson obtained his specimens, but Mr. Smith of Kilwinning has a fragment of a valve from Glencart, Dalry, which shows the characteristic single hinge-tooth of *Scaldia*; but there is not enough left of the shell to speak accurately about its specific affinities, and the surface markings are too pronounced to refer it to the species under discussion.

Scaldia fragilis is distinguished from other species of the genus by the presence of the slight oblique ridge separating the dorsal slope from the rest of the valve.

SCALDIA BENEDENIANA, *de Ryckholt*, 1852. Plate XXXVII, figs. 1—3.

SCALDIA BENEDENIANA, *de Ryckholt*, 1853. Mélanges paléontol., pt. 2, p. 71, pl. xiv, figs. 30, 31.

CARDIOMORPHA SECTOR, *de Ryckholt*, 1853. Ibid., p. 97, pl. xiii, fig. 9.

SCALDIA BENEDIANA, *Bigsby*, 1877. Thésaurus Devonico-Carboniferus, p. 313.

— — — *de Koninck*, 1885. Ann. Mus. Roy. d'Hist. Nat. Belgique, tom. xi, p. 55, pl. xiv, figs. 18—20, 44.

Specific Characters.—Shell below medium size, suborbicular, very slightly oblique, gibbose, somewhat inequilateral. The border is regularly rounded, and passes in a continuous curve from the antero-superior border to the hinge-line just posterior to the umbones. The hinge-line is regularly arched. The umbones are tumid, incurved, and twisted forwards, contiguous and raised above the

hinge-line, and placed somewhat in front of the middle line of the valve. The shell is regularly gibbose, without compression or oblique ridge, nor is the dorsal slope marked off from the rest of the valve. Escutcheon and lunule absent.

Interior.—The anterior adductor muscle-scar is pear-shaped, and situated in the umbonal hollow remote from the margin, bounded behind by a broad shallow ridge. The posterior adductor scar is shallow, and placed in the hollow of the dorsal slope remote from the margin. Pallial line simple. Hinge not exposed in British examples, but it is known in Belgian specimens to be normal. The cavity of the valve is marked by obscure concentric grooves, especially near the lower margin.

Exterior.—The surface of the valve is ornamented by well-marked concentric ridges and lines of growth, with here and there deeper broad concentric grooves in which the striæ of growth are still marked.

Dimensions.—Fig. 1, Pl. XXXVII, in the Museum of the Geological Survey, Jermyn Street, measures—

Antero-posteriorly	21 mm.
Dorso-ventrally	19.5 mm.
From side to side	13 mm.

Localities.—Ireland: the Carboniferous Limestone of Kildare and Tuogh, co. Limerick.

Observations.—This species was described and figured by de Ryckholt as one of six species belonging to his new genus *Scaldia*. De Koninck has retained five of these; but some of them, if not all, are probably slight varieties of the same shell. Added to these should be some of the species described by de Ryckholt under the genus *Cardiomorpha*,—*C. lacordaireana*, *C. solida*, *C. sector*, and *C. orbitosa*.

It is to be noted that all the species of *Scaldia* described by de Ryckholt were obtained from the beds of Tournay, while eight of the ten species retained by de Koninck are from the same locality.

In the well-preserved condition this species is easily distinguished by the well-marked concentric grooves and ridges of its surface, and its suborbicular contour. The surface of *S. fragilis*, on the contrary, is much more nearly smooth, and it has a somewhat hollowed dorsal slope, and is less oblique.

Although this species is found in at least two localities in Ireland, I am unable to identify any of the shells figured by McCoy as belonging to this genus. At present I have not met with the species in the Carboniferous Limestone of England.

Family CYPRINIDÆ.

Genus MYTLOMORPHA, gen. nov.

- CYPRICARDIA, *Phillips*, 1836. Geol. Yorks., pt. 2, p. 209.
 CYPRICARDITES, *Conrad*, 1841. Ann. Rep. Geol. Surv. N.Y., p. 53.
 CYPRICARDIA (pars), *de Koninck*, 1842. Desc. des Anim. Foss., p. 94.
 — *Morris*, 1843. Cat. Brit. Foss., 1st edit., p. 85.
 — *Murchison, de Verneuil, and de Keyserling*, 1845. Geol. Russie d'Europe, p. 804.
 GONIOPHORA, *Phillips*, 1848. Mem. Geol. Surv. Gt. Brit., vol. ii, p. 264.
 CYPRICARDIA, *d'Orbigny*, 1849. Prodrome de Paléontol., p. 130.
 — *Brown*, 1849. Illust. Foss. Conch., p. 198.
 — *Eichwald*, 1853-61. Lethæa Rossica, pt. 1, p. 1014.
 TRAPEZIUM (pars), *de Ryckholt*, 1853. Mélanges paléont., pt. 2me, p. 130.
 SOLENOPsis (pars), *de Ryckholt*, 1853. Ibid.
 CYPRICARDIA (pars), *Morris*, 1854. Cat. Brit. Foss., 2nd edit., p. 198.
 GONIOPHORA (pars), *Eichwald*, 1860. Lethæa Rossica, p. 1014.
 CYPRICARDIA, *Armstrong*, 1864-5. Trans. Geol. Soc. Glasgow, vol. ii, pt. 1, p. 28.
 SANGUINOLITES, *Hall*, 1870. Pal. New York, vol. v, p. 299.
 CYPRICARDIA, *Young and Armstrong*, 1871. Trans. Soc. Geol. Glasgow, vol. iii, Supplement, p. 50.
 — *Young, Armstrong, and Robertson*, 1876. Cat. Western Scottish Fossils, p. 53.
 — *Bigsby*, 1878. Thesaurus Devonico-Carboniferus, p. 305.
 EUCHARIS, *Waagen*, 1881. Pal. Indica, ser. xiii, vol. i, pt. 3, p. 189.
 GONIOPHORA, *Hall*, 1883. Pal. New York, vol. v, pt. 1, p. xxiii.
 SANGUINOLITES (pars), *de Koninck*, 1885. Ann. Mus. Roy. d'Hist. Nat. de Belgique, tom. xi, p. 58.
 GONIOPHORA, *Hall*, 1885. Nat. Hist. New York Palæontol., vol. v, pt. 1; Lamelli-branchiata, pt. 2, p. xxiii.
 — *Fischer*, 1887. Manuel de Conchyliologie, p. 1077.
 CYPRICARDIA (pars), *Etheridge*, 1888. Brit. Foss., pt. 1, Palæozoic, p. 282.
 GONIOPHORA, *Miller*, 1889. N. American Geol. and Palæontol., p. 481.
 — *Whidborne*, 1891. Devonian Fauna, vol. ii, pt. 1, p. 16.
 — *Neumayr*, 1895. Beit. z. einer Morphol. Einth. d. Bivalven, p. 35.
 — *Beushausen*, 1895. Abh. de K. Preuss. Geol. Landesanstalt, neue F., Heft 17, p. 196.
 CARDIOMORPHA (pars), *Beushausen*, 1895. Abh. k. Preuss. Geol. Landesanstalt, neue Folge, Heft 17, p. 283.

Generic Characters.—Shell equivalve, very inequilateral, more or less triangularly rhomboidal, with a very sharp elevated ridge passing backwards and downwards from the umbo to the postero-inferior angle. The umbones are small and acute, keeled. Lunule small, escutcheon well marked and elongate.

Interior.—The adductor muscle-scars are well marked and deep. Hinge: the

left valve has a strong fold or tooth in front, which is received into a corresponding cavity in the right valve. Pallial line entire, remote from the margin.

Exterior.—The surface is ornamented with close, fine, concentric lines of growth, often subimbricate.

Observations.—The name *Goniophora* was proposed by Phillips (*op. supra cit.*) for the *Cypricardia cymbæformis* of Murchison ('Sil. Syst.,' pl. iii, fig. 10 a), but no definition of the genus was given. Hall was the first to give a regular description of the genus, which he adopted for a number of shells occurring in the Devonian series of the State of New York. It appears that the term *Goniophorus* was invented by Agassiz for a genus of Crinoids, and it must therefore be regarded as preoccupied and inadmissible for a genus of shells. None of the synonyms of the genus can be retained, as they all were founded on shells possessing characters distinct from the genus under discussion, and it is therefore necessary to erect a new genus. The term *Mytilomorpha* seems to me to be a suitable one, more especially as I think there is strong evidence that this genus is descended from a mytiliform ancestor. Hall's description of the hinge of *Goniophora* is as follows: "Hinge furnished with a strong oblique fold or tooth in the left valve, situated just beneath the beak, and a corresponding depression in the right valve. No lateral teeth have been observed." These characters obtain in the Carboniferous species. There is certainly no lateral tooth, and I have seen traces of the anterior teeth, but unfortunately I have no specimen sufficiently perfect to figure which shows them.

Whidborne, Neumayer, S. A. Miller, and Beushausen all adopt the genus *Goniophora* for Devonian shells, and the latter gives a lengthy description of the genus, following Hall in his account of the hinge. Whidborne describes his shell as possessing "one if not two small oblique teeth on each valve below the umbo, and perhaps a long transverse lateral tooth behind." M'Coy states ('Brit. Pal. Foss.,' p. 275) that the shell on which Phillips founded the genus does possess a "moderately slender lateral tooth," but referred the shell to *Orthonotus*, Conrad. There can be no doubt as to the intimate external resemblance of the Carboniferous shells which I have placed under the genus *Goniophora*, to those described by the above authors from the Devonian beds of Germany and North America. Neither can there be any doubt as to the advisability of removing these species from the genus *Cypricardia* on account of the structural differences in the hinge, and, moreover, according to Fischer ('Manuel de Conchyliologie,' p. 1072), *Cypricardia*, Lamarek, 1819, was forestalled by *Libitina*, Schumacher, 1817. Neumayer, however, erected a new family, *Goniophorinæ*. It would seem that some of the species included under *Mecynodon*, Keferst, have some external resemblance to *Mytilomorpha*. Some species are, however, entirely without the typical carination. Frech ('Zeit. deutsch. Geol. Ges.,' Bd. xli, p. 127) thinks some

species of this genus are related to *Myophoria*. Kayser ('Jahresbuch Preuss. Geol. Landes,' 1844) thought that there was more similarity between *Mecynodon* and *Mytilomorpha*, but with this Frech evidently does not agree. Beushausen (*op. supra cit.*) retains both *Goniophora* and *Mecynodon*, and he gives such fine figures of the hinge-plate of the latter genus as make it at once plain that the two genera have little or nothing in common. The shape and external marking of the valves in *Mytilomorpha*, and the possession of traces of a byssal sinus, seem to point conclusively to a descent from a mytiliform ancestor; but at the same time the position of the adductor muscle-scars, the large lunule and escutcheon, and the structure of the hinge and absence of an internal ligament, show that the shell cannot be retained in any genus of the family *Mytilidæ*. I have not been able to satisfy myself that a byssus was actually present, the inferior margin of the valves of *Mytilomorpha* containing no byssal notch. The genus is, on the other hand, closely related to *Cypricardella* and *Sanguinolites*, in the latter of which *M. rhombea* has been placed by de Koninck. I think, however, that, seeing how in Devonian times many allied forms were in existence, it is better to separate the strongly keeled mytiloid group from *Sanguinolites*, as other authors have done. *Cypricardella* has such a characteristic hinge and concentric markings on the surface that there can be no doubt of the propriety of distinguishing these two genera. *Sanguinolites* may be distinguished from *Mytilomorpha* by its more transverse, less oblique, less strongly carinate form, with the surface of the valves more ornate, generally furnished with lamellæ or concentric sulcations and ridges, having a rolled hinge-plate, and one or more radiating folds on the dorsal slope.

Although much more numerous a species in Devonian times, I only refer two species of Carboniferous Lamellibranchs to *Mytilomorpha*, one of which is new. The typical Carboniferous form is that described by Phillips as *Cypricardia rhombea*.

De Ryckholt referred the same species to *Solenopsis*.

It seems probable, from the description, that the shell described by Waagen (*op. supra cit.*) as *Eucharis grandæva*, from the Salt Range of India, should rather be referred to *Mytilomorpha*. I am at a loss to conceive why he should have thought that there existed grounds for referring this shell to any genus of the *Myidæ*. His description is an excellent one, and perfectly characteristic of the genus *Mytilomorpha*.

MYTILOMORPHA RHOMBEA, *Phillips*, sp., 1836. Plate XXXVIII, figs. 6—11.

CYPRICARDIA RHOMBEA, *Phillips*, 1836. Geol. Yorks., pt. 2, p. 209, pl. v, fig. 10.

— GLABRATA, *Phillips*, 1836. *Ibid.*, p. 209, pl. v, fig. 25.

- CYPRICARDIA BIPARTITA, *de Koninck*, 1842. Desc. anim. foss. de Belg., p. 94,
pl. i, figs. 15 *a-c*.
- RHOMBEA, *Morris*, 1843. Cat. Brit. Foss., 1st edit., p. 86.
- GLABRATA, *Morris*, 1843. Ibid., p. 85.
- RHOMBEA, *McCoy*, 1844. Synopsis Carb. Foss. Ireland, p. 61.
- — *de Verneuil*, 1845. Geol. Russia in Europe, &c., vol. ii,
p. 304, pl. xix, fig. 15.
- — *Bronn*, 1848. Nomenclat. Palæontol., p. 386.
- GLABRATA, *Bronn*, 1848. Ibid., p. 386.
- RHOMBEA, *Brown*, 1849. Atlas Foss. Conch., pl. lxxxii, fig. 3.
- GLABRATA, *Brown*, 1849. Ibid., pl. lxxxii, fig. 10.
- RHOMBEA, *d'Orbigny*, 1850. Prodrome de paléontol., p. 130.
- SOLENOPSIS SCAPHA, *de Ryckholt*, 1853. Mélanges paléontol., p. 61, pl. xiv,
figs. 5, 6.
- CYPRICARDIA RHOMBEA, *Morris*, 1854. Cat. Brit. Foss., 2nd edit., p. 198.
- GLABRATA, *Morris*, 1854. Ibid., p. 198.
- Non — RHOMBEA, *Eichwald*, 1860. Lethæa Rossica, vol. i, p. 1014.
- — *Young and Armstrong*, 1871. Trans. Geol. Soc. Glasgow,
vol. iii, Supplement, p. 51.
- — GLABRATA, *Young and Armstrong*, 1871. Ibid., p. 50.
- — RHOMBEA, *Young, Armstrong, and Robertson*, 1876. Cat. West
Scotl. Foss., p. 53.
- — GLABRATA, *Young, Armstrong, and Robertson*, 1876. Ibid., p. 53.
- RHOMBEA, *Biggsby*, 1878. Thesaurus Devonico-Carboniferus, p. 305.
- GLABRATA, *Biggsby*, 1878. Ibid., p. 305.
- SANGUINOLITES RHOMBEUS, *de Koninck*, 1885. Ann. Mus. d'Hist. Nat. de Belgique,
tom. xi, p. 68, pl. xv, fig. 28.
- BIPARTITUS, *de Koninck*, 1885. Ibid., p. 69, pl. xv, fig. 27.
- CUNEATUS, *de Koninck*, 1885. Ibid., p. 71, pl. xvi, figs. 14, 15.
- SCAPHA, *de Koninck*, 1885. Ibid., p. 70, pl. xv, fig. 38.
- CYPRICARDIA RHOMBEA, *Etheridge*, 1888. Brit. Foss., pt. I, Palæozoic, p. 282.
- GLABRATA, *Etheridge*, 1888. Ibid., p. 282.

Specific Characters.—Shell above medium size, very inequilateral, transversely and somewhat irregularly trapezoidal, narrowed anteriorly, expanded posteriorly, strongly carinate. The anterior end is very small and narrow, projecting forwards much below the level of the rest of the valve, its border an irregular ellipse passing into the long and straight ventral margin, which forms the longest diameter of the shell, and meets the posterior margin at a rounded right angle. The posterior border is truncate from above downwards, and is almost vertical, very slightly curved, meeting the hinge-line at a rounded angle, almost a right angle. The hinge-line is arched in front but produced, straight and elevated behind. The umbones are comparatively small, angular, incurved and directed forwards, so that they appear produced over the small and low anterior part, but do not form the most anterior part of the valve. Passing obliquely downwards

and backwards from the umbo to the postero-inferior angle is a strong well-marked angular ridge, which divides the shell into two almost equal triangular portions, which are inclined to each other at an obtuse angle. The inferior and lower is compressed and hollowed from before backwards just in front of the ridge, but becomes convex in the anterior part of the valve. The upper and posterior triangle is gently convex, and forms the dorsal slope, but becomes compressed and expanded towards the posterior border. Lunule well developed. Escutcheon large and broad.

Interior.—The anterior adductor muscle-scar is large, deep, and rough, and occupies almost the whole of the cavity of the anterior portion of the shell, and is surrounded behind by a broad ridge of moderate dimensions. The posterior adductor scar is large, smooth, deep posteriorly, and placed immediately below the superior border some distance from the posterior end. The anterior part of the hinge has not been exposed, but posteriorly there is evidence of a simple edentulous, rolled, hinge edge. The pallial line is well marked, entire, and remote from the margin.

Exterior.—The surface is covered with fine, almost obsolete, close, concentric lines and striæ of growth, which in the front part of the valve become near the lower edge collected into bundles separated by deeper grooves. Towards the posterior edge the lines of growth are stronger, and may become almost imbricate. Shell thin.

Dimensions.—The type specimen of Phillips's *Cypricardia rhombea*, Pl. XXXVIII, fig. 8, measures—

Antero-posteriorly	30 mm.
Dorso-ventrally	18 mm.
Greatest lateral gibbosity of single valve	7 mm.

A very large specimen from the Isle of Man, in the collection of Mr. Law, Pl. XXXVIII, fig. 11, measures—

Antero-posteriorly	90 mm.
Dorso-ventrally	38 mm.
Laterally	14 mm.

Localities.—England: the Carboniferous Limestone of Hill Bolton and Settle, and the Bolland District of Yorkshire; Wetton, North Staffordshire; Thorpe Cloud, Dovedale, and Castleton, Derbyshire; the Upper Shelly Limestone of Poolvash, Isle of Man. Ireland: the Carboniferous Limestone of Ballycane, co. Limerick.

Observations.—Under the names *Cypricardia rhombea* and *C. glabrata*, Phillips described two shells from the Carboniferous Limestone of Bolland, of which the type of the former only is still preserved. This is in the Gilbertson Collection of the Museum of Natural History, South Kensington, and I am kindly permitted

by the authorities to refigure it, Pl. XXXVIII, fig. 8. I have, however, a strong suspicion that the two shells really belong to one species, and that *C. glabrata* was only the young state of *Mytilomorpha rhombea*. I have therefore considered it as a synonym, but it would be impossible to retain the species in the absence of the type and any definite description; for, meagre as were the descriptions generally given by Phillips, he described his *C. rhombea* as "rhomboidal valves diagonally carinated," and *C. glabrata* "ovato-rhomboidal valves diagonally tumid."

In company with Morris, de Verneuil, Etheridge, and others, I regard the *C. bipartita* of de Koninck (*op. supra cit.*) as a synonym of Phillips's shell, although in his later work de Koninck protests against such a view, and says, p. 69, "le *S. rhombeus* est relativement plus large, surtout vers son extrémité postérieure, que le *S. bipartitus*; parce que le carène diagonale de celui-ci est beaucoup plus arquée, et que son bord antérieur est formé d'une courbe d'un rayon beaucoup plus court." He gives the following comparative dimensions:—*S. rhombeus*, l. 30 mm., h. 15 mm., ép. 12 mm.; *S. bipartitus*, l. 25 mm., h. 12 mm., ép. 14 mm. I do not believe that any useful purpose can be served by the erection of species on small differences in comparative measurements, and I would remark that in Belgium both species occur at the same horizon, Étage III, Viséan. Judging from the drawing alone there would be some doubt whether de Verneuil's shell is identical with Phillips's, but that author expresses himself in the text as thoroughly convinced upon this point.

I have placed *Solenopsis scapha* of de Ryckholt as a possible synonym. This species occurred in the beds at Visé, and the species was adopted by de Koninck, who figures a very young specimen.

I am also disposed to regard de Koninck's *Sanguinolites cuneatus* as synonymous with *M. rhombea*.

I am of opinion that an error has been made in referring shells, from various localities in the Carboniferous series of the west of Scotland, to the species by Messrs. Young and Armstrong. I have as yet seen nothing like the shell from these localities, but in Scotch cabinets I find that the name *Cypricardia rhombea*, Phillips, is applied to those shells which I describe, p. 356, as *Cypricardella rectangularis*.

The full-grown example, fig. 11, Pl. XXXVIII, from the cabinet of Mr. R. Law of Hipperholm, Yorkshire, far exceeds in size any other specimens with which I am acquainted, and serves to emphasise the essential differences between this species and *M. angulata*. This specimen is a cast of the interior, only incomplete at the postero-superior angle. The details of the anterior part of the hinge are still unknown, and only enough of the posterior hinge-line is left to show a rolled edge and the absence of a lateral tooth. There is no evidence that

this or any other species of the genus possessed a byssus, but the marked sulcation anterior to the ridge very closely resembles the byssal sulcus in shells possessing that organ, but it is probably an ancestral relic pointing to descent from some byssiferous ancestor.

MYTILOMORPHA ANGULATA, sp. nov. Pl. XXXVIII, figs. 12—18.

Specific Characters.—Shell large, triangularly cuneate, much swollen, markedly angulate and carinate, very inequilateral and oblique. The anterior end is very short and narrowed from above downwards, much compressed, its border rounded and small in extent. The inferior border is produced, sinuous, directed downwards and backwards, and becomes convex posteriorly. The posterior border is truncated obliquely from above downwards and backwards, nearly straight for the upper two-thirds, but below it is gradually rounded forwards to meet the inferior border at a well-marked angle, slightly larger than a right angle. The hinge-line is arched and depressed in front, but posterior to the umbones is straight and produced. The umbones are small, pointed, contiguous, twisted forwards and downwards, and reach almost as far as the anterior edge of the shell, above which they are raised. The lunule is deep and excavated, and the escutcheon is long and wide, bounded externally by a marked elongate angular fold. Passing backwards and downwards from the umbo to the posterior inferior angle is a very high acute ridge, which is gently sinuous and often everted in a downward direction, and divides the valves into two unequal parts—an anterior and lower, which is elongate and narrowed; an upper and posterior, which is shorter and broader. These portions are placed at an angle of about 45° to each other. To attain this position the lower portion becomes twisted on itself, the extreme anterior end being flat and vertical. The lower portion of the valve is compressed and hollowed so as to be slightly concave on section, the lower part of the valve being bent rapidly inwards to meet its fellow; the upper portion, forming the dorsal slope, is regularly but slightly convex.

Interior.—The anterior adductor muscle-scar is large, deep, and triangular, placed within the small anterior end, the greater part of which it occupies. The scar is bounded behind and below by a ridge of shelly material. The posterior adductor scar is large, rounded, rough, placed well within the margin of the shell, and some distance below the hinge-line in the hollow of the posterior slope. The pallial line is entire and remote from the margin.

The hinge has not been clearly seen.

The interior of the shell is smooth, the anterior portion showing behind the

ridge bounding the muscle-scar an oblique hollow, behind which is an oblique depression.

Exterior.—The shell is covered with concentric lines of growth, which become very much accentuated as they approach the oblique ridge; on the posterior slope they become flattened and markedly imbricate. The shell is of moderate thickness.

Dimensions.—Fig. 12, Pl. XXXVIII, in my own collection from the upper bed of Thorpe Cloud, measures—

Antero-posteriorly	73 mm.
Dorso-ventrally	45 mm.
Elevation of valve	15 mm.

Locality.—England: the Carboniferous Limestone of Thorpe Cloud, Derbyshire.

Observations.—*Mytilomorpha angulata* attains to a fairly large size, but it is much less transverse and more nearly quadrate than *M. rhombea*; moreover in the latter the segment of the valve in front and below the oblique keel is almost equal to the upper and posterior segment, but with regard to *M. angulata* the latter is much larger than the former, and in addition the oblique ridge is also much more acute, and the anterior end is much smaller in every way.

This species has a considerable superficial resemblance to a mytiloid shell, especially to *Myalina Flemingi*, but the internal characters and the hinge-line show that it has no real affinity to this genus. I cannot find any Belgian specimens of this species, nor at present have I obtained it from any other locality than that of Thorpe Cloud at the entrance to Dovedale. Here it is not at all uncommon, but perfect examples are rare, and I have not yet seen a specimen possessing both valves *in situ*. Casts of the hinge are not common, but show a simple linear hinge edge posteriorly, and in front a thickened hinge-plate with indications of teeth.

Family CRASSITELLIDÆ.

Genus CYPRICARDELLA, Hall, 1858.

- VENUS, *Phillips*, 1836. Geol. Yorks., pt. 2, p. 209.
 MICRODON, *Conrad*, 1842. Journ. Acad. Nat. Sci. Phil., vol. viii, p. 247.
 CYPRICARDIA, *de Koninck*, 1843. Desc. Anim. Foss., p. 97.
 ASTARTE (pars), *de Koninck*, 1843. Ibid., p. 80.
 VENUS, *Morris*, 1843. Cat. Brit. Foss., 1st edit., p. 104.
 — *Brown*, 1849. Illust. Foss. Conch., p. 205.
 CYPRICARDIA (pars), *d'Orbigny*, 1851. Prodrome de Paléontol., p. 130.
 MEGALODON (pars), *d'Orbigny*, 1851. Ibid., p. 130.

- ASTARTE, *de Ryckholt*, 1853. *Mélanges paléontol.*, 2me partie, p. 111.
- VENUS (?), *Morris*, 1854. *Cat. Brit. Foss.*, 2nd edit., p. 231.
- CYPRICARDELLA, *Hall*, 1856. *Trans. Albany Inst.*, vol. iv, p. 17.
- ASTARTELLA, *Hall*, 1858. *Geol. Rep. Iowa*, p. 715.
- CYPRICARDIA, *Armstrong*, 1864-5. *Trans. Geol. Soc. Glasgow*, vol. ii, pt. 1, p. 28.
- *Young and Armstrong*, 1871. *Trans. Geol. Soc. Glasgow*, vol. iii, Supplement, p. 50.
- *Young, Armstrong, and Robertson*, 1876. *Cat. West Scottish Foss.*, p. 53.
- EODON, *Hall*, 1877. *Am. Pal. Foss.*, 1st edit., p. 244.
- CYPRICARDIA, *Bigsby*, 1878. *Thesaurus Devonico-Carboniferus*, p. 305.
- CYPRICARDELLA, *Bigsby*, 1878. *Ibid.*, p. 304.
- ASTARTELLA, *Bigsby*, 1878. *Ibid.*, p. 298.
- MICRODONELLA, *Ehlerlert*, 1881.
- CYPRICARDELLA, *Whitfield*, 1882. *Bull. Am. Mus. Nat. Hist.*, vol. i, No. 3, p. 63.
- *de Koninck*, 1885. *Ann. Mus. Roy. d'Hist. Nat. Belge*, tom. xi, p. 91.
- ? EDMONDIA (pars), *de Koninck*, 1885. *Ibid.*, p. 43.
- MICRODON (CYPRICARDELLA), *Hall*, 1885. *Nat. Hist. N. York Palæontol.*, vol. v, pt. 1, Lamell., ii, p. xxv.
- CYPRICARDELLA, *Fischer*, 1887. *Man. de Conchyliologie*, p. 1020.
- SANGUINOLITES (pars), *de Koninck*, 1888. *Ibid.*, p. 64.
- CYPRICARDIA, *Etheridge*, 1888. *Brit. Foss.*, pt. Palæozoic, p. 282.
- *Miller*, 1889. *N. Amer. Geol. and Pal.*, p. 474.
- CYPRICARDELLA, *Beushausen*, 1889. *Jahrbuch d. Königl. Geol. Landesanstalt*, S. 226.
- *Ehlerlert*, 1889. *Unterdevon. Zeitschrift a. Deutsch. Geol. Ges.*, Bd. xli, p. 213.
- ASTARTELLA, *Miller*, 1889. *N. Amer. Geol. and Pal.*, p. 463.
- *Keyes*, 1894. *Missouri Geol. Surv.*, vol. v, p. 125.
- *Goodchild*, 1894. *Proc. Roy. Phys. Soc. Edin.*, vol. xii, p. 356.
- CYPRICARDELLA, *Beushausen*, 1895. *Abl. Königl. Preuss. Geol. Landesanstalt*, Heft 17, p. 134.

Generic Characters.—Shell ovate, subquadrate, compressed, with a truncated posterior end and oblique ridge. Lunule and escutcheon large, the outer edge of the latter strongly everted. Shell ornamented with concentric ridges or striæ of growth.

Interior.—Hinge with one or two cardinal teeth in each valve, and a long lamellar anterior and posterior lateral teeth. Pallial line entire, internal surface of lower margin often crenulated, shell moderately thick.

Observations.—The genus *Cypricardella* was founded in 1856 by Hall for shells which have been shown to be identical with *Microdon* of Conrad. The latter name, however, had been used by Agassiz for a genus of fishes, and, as de Koninck points out, by Meigen for a genus of Diptera in 1803, and consequently

has to be discarded. Whitfield and de Koninck have both adopted *Cypricardella*, the latter referring fifteen species to it from the Carboniferous beds of Belgium, four of them being doubtfully placed in this genus.

In the second volume of the 'Lamellibranchiata of New York' (*op. supra cit.*) Hall acknowledges the identity of *Microdon* and *Cypricardella*. I am of opinion that Hall's genus *Astartella* is probably identical with *Cypricardella*. The species on which this genus was founded, *A. vera*, possesses all the characters which I regard as diagnostic of *Cypricardella*. The date of the description of *Astartella* is 1858, the same year as that of *Cypricardella*, but I am unable to ascertain which of the two was actually published first.

It is to be noted that the existence of a posterior lateral tooth was not recognised in either of Hall's genera, but the hinge of *Cypricardella* is described as follows:—"Hinge characterised by a triangular tooth in each valve, that of the left valve short and situated beneath the beak, with a more elongate pit or groove behind it for the reception of the tooth of the right valve. The right valve has also a triangular pit beneath the beak for the reception of the short tooth in the left valve, and a long triangular fold behind, which is sometimes double. No lateral teeth have been observed, unless the long oblique fold of the right valve be regarded as a lateral tooth." It is just such a character as this that I have described as a lateral tooth, and if the sides of a tooth socket be at all pronounced they immediately become cardinal teeth; hence I consider that this description of the hinge is practically identical with that which obtains in the Carboniferous shells which I refer to *Cypricardella*. De Koninck says that the right valve has two teeth separated by a socket for the single tooth of the left valve, and the cardinal border possesses a long straight groove in both valves destined to receive a ligament which is partly external and partly internal. With the fact that a groove is present I am in agreement, but I do not consider that this groove was for the ligament, as the edges of the valves are in contact at the bottom of the escutcheon, and it is difficult to see how a ligament in such a case could be partly external and partly internal.

Astartella is stated to have two teeth in each valve, the anterior tooth of the right valve being large and strong, and having a longitudinal pit in the summit; but I am only able to find figures of the hinge in the work (*op. supra cit.*) with the original description.

The shells now referred to *Cypricardella* have been generally classed with *Cypricardia* by British palæontologists, but the characters of the hinge at once separate them from this genus; but I think that Hall's genus may be placed in the family *Crassitellidæ* rather than in the family *Astartidæ*, to which Fischer and Beushausen have referred it, though it really possesses characters intermediate between the two genera.

Cypricardella is very closely related to *Mytilomorpha* and *Sanguinolites*. The former genus is, however, distinguished by its strong keel dividing the shell into two flattened triangular portions, the absence of well-marked posterior lateral teeth, and the relatively small development of the lunule and escutcheon, the almost obsolete anterior end, the pointed, almost terminal, and angularly compressed umbones, and the absence of regular concentric grooves and ridges externally. The genus *Sanguinolites* is even more closely related to *Cypricardella*, but is more transverse, has a stronger diagonal fold or ridge, and a rolled edge to the hinge-plate posteriorly and an entirely different hinge. The escutcheon is without an everted edge, and the concentric ridges and markings fail on the dorsal slope, which is hollowed and often traversed by one or more diagonal lines, and the periostracum is tuberculated.

Edmondia filigrana, de Koninck, if correctly drawn, is shown to possess a lunule and escutcheon, and therefore cannot be correctly referred to that genus, which possesses neither of those characters. It is of course possible that the artist has committed the error, but if lunule and escutcheon are present the shell would have far greater affinities with *Cypricardella* than with *Edmondia*.

CYPRICARDELLA PARALLELA, *Phillips*, sp. Plate XXXIX, figs. 1—7.

VENUS PARALLELA, *Phillips*, 1836. Geol. Yorks., pt. 2, p. 209, pl. v, fig. 8.

CYPRICARDIA PARALLELA, de *Koninck*, 1843. Desc. Anim. Foss., p. 97, pl. iii, fig. 15.

VENUS PARALLELA, *Morris*, 1843. Cat. Brit. Foss., 1st edit., p. 104.

— — *Brown*, 1849. Illust. Foss. Conch., p. 205, pl. lxxxiii, figs. 3, 4.

CYPRICARDIA PARALLELA, d'*Orbigny*, 1851. Prodrome de paléontol., p. 130.

ASTARTE PARALLELA, de *Ryckholt*, 1853. Mélanges paléontol., partie ii, p. 119.

— DECURTATA, de *Ryckholt*, 1853. Ibid., p. 113, pl. xv, figs. 5, 6.

? — STENOSOMA, de *Ryckholt*, 1853. Ibid., p. 118, pl. xv, figs. 9, 10.

VENUS? PARALLELA, *Morris*, 1854. Cat. Brit. Foss., 2nd edit., p. 231.

ASTARTE PARALLELA, *Bigsby*, 1878. Thesaurus Devonico-Carboniferus, p. 299.

CYPRICARDIA PARALLELA, *Bigsby*, 1878. Ibid., p. 305.

ASTARTE STENOSOMA, *Bigsby*, 1878. Ibid., p. 301.

CYPRICARDELLA PARALLELA, de *Koninck*, 1885. Ann. Mus. d'Hist. Nat. Belge, tom. xi, p. 96, pl. xiii, figs. 50, 51.

— DECURTATA, de *Koninck*, 1885. Ibid., p. 94, pl. xxi, figs. 35, 36.

? — STENOSOMA, de *Koninck*, 1885. Ibid., p. 95, pl. xxi, figs. 24—27.

CYPRICARDIA PARALLELA, *Etheridge*, 1888. Brit. Foss., pt. 1, Palæozoic, p. 282.

? VENUS PARALLELA, *Goodechild*, 1894. Proc. Roy. Phys. Soc. Edinburgh, vol. xii, p. 356.

Specific Characters.—Shell below medium size, subrhomboidal, slightly gibbose, inequilateral. The anterior end is short, moderately deep, excavated above by a

deep lunule, compressed, with a regularly rounded border. The inferior margin is regularly and gently convex. The posterior margin is subtruncate, slightly convex, the postero-inferior angle regularly rounded, the postero-superior a well-marked slightly obtuse angle. The hinge-line is arched, produced, and depressed posteriorly. The umbones are small, incurved and twisted forwards, pointed, contiguous, slightly raised above the hinge-line, and placed at the junction of the anterior and middle thirds of the valve. Passing obliquely downwards and backwards from the umbo to the postero-inferior angle is an obscure ridge which separates the compressed and flattened dorsal slope from the rest of the valve, which is regularly but gently curved, the greatest convexity of the valves being subumbonal. A strong ridge passes backwards from the umbo to the postero-superior angle, separating the escutcheon from the dorsal slope. The escutcheon is large and elongate, and trench-like.

Interior.—No details of the interior have been observed.

Exterior.—The surface is ornamented with regular, close, concentric, fine ridges and sulci, which are continued over the dorsal slope, and terminate in the hinge-line. Shell comparatively thick.

Dimensions.—Fig. 3, Pl. XXXIX, from South-west Yorkshire, measures—

Antero-posteriorly	17 mm.
Dorso-ventrally	14 mm.
From side to side	9 mm.

Localities.—The Carboniferous Limestone of Hill Stebden, Yorkshire, and Pilsbury, Derbyshire.

Observations.—Type specimen of Phillips's *Venus parallela* is preserved in the Gilbertson Collection of the Natural History Museum, South Kensington, and I am permitted to refigure it by the kind permission of Dr. Henry Woodward, fig. 1, Pl. XXXIX. It is a much smaller specimen than some of those I figure, but is fairly perfect. De Koninck somewhat doubtfully referred a specimen from the Limestone of Visé to this species (*op. supra cit.*); and de Ryckholt also adopted it, but undoubtedly described as new, shells of this same species which varied slightly in shape from his conception of the type. De Koninck in his later work adopted several of de Ryckholt's species, but I consider that these are founded on insufficient evidence, the minor differences of size and strength of the external ornament not being of specific value.

C. concentrica approaches nearer to *C. parallela* than any other species of the genus, but the hinge-line is much straighter and more produced posteriorly, and much less compressed, the concentric ridges are much fewer, larger, and further apart, and the shells less convex.

Phillips gives the locality for his shell as Bolland. I have not yet been able to obtain any of his species in that district, though the majority of those

referred to Bolland are to be obtained in the Craven district. A series of five well-preserved but small specimens of this species are in the Museum of the Geological Survey, Jermyn Street, and Mr. E. J. Garwood has collected several examples from the so-called knoll reefs between Cracoe and Burnsall in Craven. Mr. Goodchild refers a number of specimens, in the Armstrong Collection of the Edinburgh Museum of Science and Art, and in the collection of the Geological Survey, to the *Venus parallela* of Phillips, and states that in his opinion this species should be referred to *Cypricardella* of Hall. I expect that he has mistaken *C. crebricostata* of Armstrong and some of the other species of the genus which occur in Scotland for Phillips's shell. He evidently is in error in supposing that the *Cypricardia rhombea* of authors has any relationship to *C. parallela*, for it belongs to a totally different genus, and I have not met with any specimens of that shell from the Carboniferous beds of Scotland. Fig. 6, Pl. XXXIX, is a curious variety, differing much in contour from the type of the species. As it is the only specimen of its kind, I hesitate to erect a new species for it, and for the present suggest that it may be a mere sport.

CYPRICARDELLA CONCENTRICA, sp. nov. Pl. XXXIX, figs. 8—11.

? VENUS ELLIPTICA, *Young and Armstrong*, 1871. Trans. Geol. Soc. Glasgow, 1871, vol. iii, Supplement, p. 54.

? — — *Young, Armstrong, and Robertson*, 1876. Cat. West. Scot. Foss., p. 55.

Specific Characters.—Shell small, subcircularly quadrate, very moderately gibbose, slightly inequilateral, very obscurely carinate. The anterior end comprises the anterior third of the valve, and is compressed and narrowed; its border rounded, forming with the inferior border as far as the postero-inferior angle a single almost semicircular curve. The posterior margin is almost straight and obliquely truncate from above downwards and forwards, forming a well-marked almost right angle with the hinge-line, and being bluntly rounded below into the inferior border. The hinge-line is arched, straight, depressed, and often bent downwards on itself posteriorly. The umbones are small, pointed, incurved, contiguous, tumid, slightly raised and placed in front of the middle line. The lunule is narrow, steep, and elongate, the escutcheon broad, deep, and long, marked off from the dorsal slope by an erect, narrow, slightly curved, angular ridge, often bent on itself. Passing downwards and obliquely backwards from the umbones to the postero-inferior angle is an obscurely angular ridge, which separates the compressed and hollowed dorsal slope from the rest of the valve, which is regularly but very gently convex.

Interior.—The anterior adductor muscle-scar is small, round, and marginal. The posterior, very small, is placed immediately below the hinge-line, remote from the posterior end. The pallial line is entire. The hinge consists of a single cardinal tooth with a cavity on each side of it, and an elongate posterior lateral lamellar tooth in the right valve. In the left are two cardinal teeth, separated by a deep triangular cavity and an elongate posterior lateral tooth. Formula R. 0,010,1
L. 0,101,1. The interior of the valve is smooth.

Exterior.—The surface is ornamented with regular, concentric, raised angular ridges, separated by grooves which are finely striated concentrically; these ridges all terminate at the oblique ridge, only an occasional one being carried across the dorsal slope, which is smooth or very finely striate. Shell moderately thick for its size.

Dimensions.—Fig. 8, Pl. XXXIX, a specimen in the cabinet of Mr. J. Neilson, measures—

Antero-posteriorly	17 mm.
Dorso-ventrally	14 mm.
From side to side	8 mm.

Localities.—Scotland: the Upper Limestone series of Linn Spout, Dalry, and Gare; the Lower Limestone series of Law, near Dalry, and Craigen Glen.

Observations.—I am of opinion that the species just described has been referred to *Venus elliptica* of Phillips by Scotch geologists, but that shell is probably a truncated and incompletely preserved specimen of *Allorisma sulcata*. The majority of specimens which I have examined are small, but Messrs. Neilson and Smith have lent me specimens, Figs. 8 and 10, Pl. XXXIX, which show the shell in its adult state. Mr. Smith, in addition, has examples of the shell showing the hinge, fig. 10 a, Pl. XXXIX.

The majority of the species of this genus are not so strongly ribbed concentrically, but one other species, *C. parallela*, which occurs in the Carboniferous Limestone of Hill Stebden, S.W. Yorkshire, possesses this character; here the ribs are much more numerous and closer, and the shell is more gibbose, and has the postero-superior angle much less elevated. The *Astartella vera* of Hall has a very close resemblance indeed to *C. concentrica*, but is more gibbose, transverse, and has a well-marked oblique ridge, and the concentric ridges are more numerous and closer. I have been able to compare the two species directly, as a series of *Astartella vera* were sent to me by the Smithsonian Institution.

CYPRICARDELLA CREBRICOSTATA, *Armstrong*, sp., 1865. Plate XXXIX, figs. 12, 13.

- CYPRICARDIA CREBRICOSTATA, *Armstrong*, 1865. Trans. Geol. Soc. Glasgow, vol. ii, pt. 1, p. 28, pl. i, fig. 4.
 — — — *Young and Armstrong*, 1871. Ibid., vol. iii, Supplement, p. 50.
 — — — *Young, Armstrong, and Robertson*, 1876. Cat. Western Scottish Fossils, p. 53.
 — — — *Bigsby*, 1878. Thesaurus Devonico-Carboniferus, p. 203.
 — — — *Etheridge*, 1888. Brit. Foss., pt. 1, Palæozoic, p. 282.

Specific Characters.—Shell transversely subquadrate, tumid, anterior and posterior ends both narrowed in the dorso-ventral direction, inequilateral. The anterior end is short, the antero-superior angle a well-marked right angle, from which the margin descends, becoming rounded below, and passes with a rapid curve into the inferior border. The upper part of the anterior end is much encroached upon by a large depressed lunule. The inferior border is almost straight, rounded at either extremity. The posterior margin is bluntly truncate and almost straight, somewhat narrowed in adult specimens by the depression of the posterior part of the hinge-line. The hinge-line is arched, depressed and extended posteriorly, and may be emarginate, thus causing the postero-superior angle to vary in degree. The postero-inferior angle is a right angle. The umbones are comparatively large, tumid, elongate, twisted inwards, pointed, contiguous, very little raised, and placed in the anterior third of the valve. Passing obliquely downwards and backwards from the umbo to the postero-inferior angle is a bluntly rounded ridge, which separates the compressed and hollowed dorsal slope from the rest of the valve. The upper margin of the shell is formed behind by a raised angular everted ridge, which passes backwards and is somewhat depressed, and which separates the deep, wide and elongated escutcheon from the dorsal slope. Anterior to the oblique ridge the valve is regularly and convexly curved from above downwards and before backwards, being more convex in the dorso-ventral diameter.

Interior.—Not yet seen.

Exterior.—The surface is ornamented with very numerous regular distinct rounded ridges, only well seen under the microscope, which are continued across the dorsal slope to the upper margin of the valve. Shell thin.

Dimensions.—Fig. 13, Pl. XXXIX, from shale above the Arden Limestone, in the collection of Mr. J. Smith, measures—

Antero-posteriorly	.	.	.	12 mm.
Dorso-ventrally	.	.	.	10 mm.
From side to side	.	.	.	7 mm.

Localities.—Scotland: the Upper Limestone series of Westerhouse and Gare, in shale above the Arden Limestone, Carluke.

Observations.—This species is one of two very distinct species of the genus *Cypricardella* described by Armstrong (*op. supra cit.*). In the Armstrong Collection of the Edinburgh Museum of Science and Art are four tablets labelled *Cypricardia crebricostata*. Dr. Traquair has kindly compared them for me with specimens of other Scotch species which I forwarded to him, so that there is no doubt of the true characters of Armstrong's species, which can be distinguished from all others of the genus by its shape and markings. The concentric ribs are very regular, closer and finer than obtains in any other species. The shell is comparatively more gibbose than *C. parallela*, and has the posterior end narrowed from above downwards by the descent of the upper border, which is very marked. All the localities where the shell has been yet obtained are on one horizon, which is placed at 300 fathoms below the Ell coal. Armstrong's figures are much enlarged, but are not particularly distinctive of the species.

CYPRICARDELLA SELYSIANA, de Koninck, sp., 1843. Plate XXXIX, figs. 27—30.

- CYPRICARDIA SELYSIANA, de Koninck, 1843. Desc. Anim. Foss., p. 95, pl. vi, fig. 7.
- — d'Orbigny, 1850. Prodrome de paléontol., p. 130.
- TRAPEZIUM LYELLIANUM, de Ryckholt, 1853. Mélanges paléontol., 2me partie, p. 133, pl. xiv, figs. 27, 28.
- PRÆSECTUM, de Ryckholt, 1853. Ibid., p. 132, pl. xiv, figs. 15, 16.
- CYPRICARDIA RHOMBEA, Young and Armstrong, 1871. Trans. Geol. Soc. Glas., vol. iii, Supplement, p. 51.
- — Armstrong, Young, and Robertson, 1876. Cat. West. Scotl. Foss., p. 53.
- SELYSIANA, Bigsby, 1878. Thesaurus Devonico-Carboniferus, p. 305.
- TRAPEZIUM PRÆSECTUM, Bigsby, 1878. Ibid., p. 315.
- LYELLIANUM, Bigsby, 1878. Ibid., p. 315.
- SANGUINOLITES SELYSIANUS, de Koninck, 1885. Ann. Mus. Roy. d'Hist. Nat. Belg., tom. xi, p. 64, pl. xv, fig. 36.
- LYELLIANUS, de Koninck, 1885. Ibid., p. 64, pl. xv, fig. 39; pl. xvii, figs. 9, 10.
- PRÆSECTUS, de Koninck, 1885. Ibid., p. 67, pl. xv, fig. 37.
- CYPRICARDIA SELYSIANA, Etheridge, 1888. Brit. Foss., pt. I, Palæozoic, p. 282.

Specific Characters.—Shell very inequilateral, subquadrate, oblique, only moderately tumid, carinate. The anterior end is short and narrow in the dorso-ventral diameter, compressed, and its border is gradually rounded, its upper border being much below the level of the umbones. The inferior border is convex

in front, but almost straight for its posterior two thirds. The posterior border is truncated obliquely from above downwards and forwards, and is straight, so that the postero-superior angle projects further backwards than any other part of the shell. The postero-inferior angle is blunt and obtuse, the postero-superior angle almost a right angle, and is well marked. The superior border is much arched in front, and is almost straight posterior to the umbones. The umbones are small, pointed, twisted forwards, contiguous, and are placed very far forwards, being encroached upon in front by a large lunule. Passing obliquely backwards and downwards from the umbo to the postero-inferior angle is a blunt, obtuse, but well-defined ridge separating the shell into two unequal portions: the anterior or larger is very gently convex; the posterior is compressed, expanded and hollowed, forming the dorsal slope. The escutcheon is large, and becomes wider and deeper as it passes backwards.

Interior.—The anterior adductor muscle-scar is small and deep, situated immediately within the anterior superior angle, and separated from the rest of the shell by a ridge, which leaves a groove in casts. The posterior adductor scar is small and shallow, and is placed a little within the margin of the posterior superior angle. Pallial line entire. The hinge of the right valve consists of a thin anterior lamellar tooth, with a hollow groove above it for the corresponding tooth of the opposite valve, a cardinal tooth with a socket in front and behind it, and a long lamellar posterior lateral tooth.

Exterior.—The surface is ornamented with fine concentric lines of growth, and an occasional one so much accentuated that it forms a well-marked sulcus.

Localities.—Scotland: the Upper Limestone series of Gare, Robroyston. The Lower Limestone series of Craigen Glen; Law, Dalry. Roscobie and Daloch Quarry, Fife.

Dimensions.—Fig. 30, Pl. XXXIX, measures—

Antero-posteriorly	13 mm.
Dorso-ventrally	10 mm.
Elevation of valve	2·5 mm.

Observations.—This species was established for a specimen from the Limestone of Visé in 1842 by de Koninck, and re-described in 1885, a single figure only being given. In the meanwhile de Ryckholt (*op. supra cit.*) had described under the genus Trapezium two shells, also from the limestone of Visé, which I have no doubt are synonymous with *C. Selysiana*. De Koninck retained the three species, referring them to the genus *Sanguinolites*, and says in his observations on the latter species it is closer to *S. præsectus* and *S. Lyellianus* than any other, and is distinguished from the former by its rectangular shape, and from the latter by having the umbones placed not so far forward and by the prolongation of its anterior end below them. A large series of examples shows that these characters

are only varietal, or due to small differences of growth only, and indeed de Koninck's descriptions of all these species are practically identical. He has correctly recognised that the *Cypricardia rhombea* of Young and Armstrong is not the *C. rhombea* of Phillips, but referred it to *T. præsectum* of de Ryckholt.

I have been able fortunately to meet with shells showing the hinge and internal characters most perfectly preserved, and therefore have sufficient grounds for placing the species under *Cypricardella* rather than under *Sanguinolites*; but the external form, and above all the peculiar everted margin of the escutcheon, show more affinity to the former than to the latter genus.

CYPRICARDELLA ANNÆ, *de Ryckholt*, sp., 1853. Plate XXXIX, figs. 31—35.

? NUCULA CARINATA, *McCoy*, 1844. Synops. Carb. Foss. Ireland, p. 68, pl. xi, fig. 21.

? TRAPEZIUM ANNÆ, *de Ryckholt*, 1852. Mélanges paléontol., p. 134, pl. xiv, figs. 21, 22.

? LEDA CARINATA, *Morris*, 1854. Cat. Brit. Foss., 2nd edit., p. 205.

CIENODONTA CARINATA, *Bigsby*, 1877. Thesaurus Devonico-Carboniferus, p. 303.

SANGUINOLITES ANNÆ, *de Koninck*, 1885. Ann. Mus. d'Hist. Nat. de Belgique, tom. xi, p. 65, pl. xvii, figs. 11, 12.

Specific Characters.—Shell small, oblique, nearly regularly diamond-shaped, inequilateral, strongly carinate. The anterior end is short, narrow, and almost obsolete, its border rounded. The inferior margin is straight, depressed, and comparatively short, meeting the posterior border at a wide obtuse angle. The posterior border is obliquely truncate from above downwards and forwards, almost straight, and about as long as the inferior border. The hinge-line is very long, arched in front, slightly curved, produced, depressed posteriorly, meeting the posterior border at a well-marked acute angle. The umbones are small, obtuse, twisted forwards, not elevated, and placed very far forwards. Passing downwards and obliquely backwards from the umbones to the postero-inferior angle is a well-marked obtuse keel, which divides the valve into two almost equal triangular portions: the lower and anterior is gently swollen; the upper and posterior is compressed and somewhat concave, forming an expanded dorsal slope. Lunule and escutcheon well marked. The latter is wide and deep, its edges angular.

Interior.—The anterior adductor muscle-scar is small, rounded, situated immediately within the antero-superior angle, and is marked off from the rest of the valve below and behind by a well-marked ridge. The posterior muscle-scar is larger, and is placed just within the postero-superior angle. The pallial line is simple. The hinge appears to have a thin elongate posterior lateral tooth, but the anterior part has not yet been isolated.

Exterior.—The surface is ornamented with many regular very fine lines of growth, parallel to the contour of the shell. Shell thin.

Dimensions.—Pl. XXXIX, fig. 35, a specimen from Poolvash, Isle of Man, in the collection of Mr. R. Law, measures—

Antero-posteriorly	16 mm.
Dorso-ventrally	12 mm.
From side to side	8 mm.

Localities.—England: the Carboniferous Limestone of Settle, Yorkshire; in shale above the Underset Limestone, Faraday Gill, West Flank of the Nine Standards, near Kirkby Stephen, and the Shelly Limestone of Poolvash, Isle of Man.

Observations.—This species was described by de Ryckholt under the term *Trapezium annæ*, and was referred to *Sanguinolites* by de Koninck (*op. supra cit.*). It has, however, a far greater affinity to *C. Selysiana*, the hinge of which has been isolated, and on these grounds I have removed it to the genus *Cypricardella*. The shape of the shell is peculiar, being almost a true lozenge. The oblique ridge is more pronounced and more nearly vertical than in *C. Selysiana*, apparently dividing the valve into two equal triangular portions. The postero-superior angle is so much produced backwards beyond the rest of the valve that the posterior margin is obliquely truncate downwards and forwards, and the postero-inferior angle is beneath the umbo.

I am inclined to think that the *Nucula carinata* of M'Coy may have belonged to this species. The type of this shell is still preserved in the Griffith Collection of the Science and Art Museum, Dublin, but it is so imperfect and badly preserved that I am unable to be absolutely certain as to what it really is. I have therefore felt unable to adopt this name, which is prior to that of de Ryckholt.

CYPRICARDELLA RECTANGULARIS, M'Coy, sp. Plate XXXIX, figs. 20—26.

? NUCULA RECTANGULARIS, M'Coy, 1844. Synops. Carb. Foss. Ireland, p. 71, pl. xi, fig. 20.

Specific Characters.—Shell very inequilateral, transversely rectangular, compressed, keeled. The anterior end is very short, and narrowed from above downwards, being only about half the height of the other dorso-ventral diameters of the valve. Its border is rounded, the antero-superior and inferior angles being obsolete. The inferior border is nearly straight, almost parallel to the hinge-line. The posterior border is truncate and nearly straight, almost vertical, with well-marked postero-superior and inferior angles. The hinge-line is arched in front, straight, somewhat raised, and produced posteriorly, as long as the

antero-posterior diameter of the valve. The umbones are small, contiguous, and directed forwards, and placed very anteriorly, much elevated above the anterior end, but not raised above the rest of the shell. The lunule is well marked, and the escutcheon elongate and narrow. Passing downwards and backwards obliquely from the umbo to the postero-inferior angle is an obtuse ridge, in front of which the valve is slightly convex, but behind it is rapidly compressed and expanded, forming the dorsal slope.

Interior.—The anterior adductor muscle-scar is small and round, placed immediately within the antero-superior angle. The hinge of the right valve has a single, central, cardinal tooth, with a socket on either side, a long, anterior, lamellar tooth, and a smooth hinge-plate posteriorly bevelled at the expense of its lower edge.

Exterior.—The surface is ornamented with fine, concentric, raised lines of growth.

Dimensions.—Fig. 21, Pl. XXXIX, in the collection of Mr. J. Neilson, from Gallowhill, Strathavon, measures—

Antero-posteriorly	12 mm.
Dorso-ventrally	8 mm.
From side to side	5 mm.

Localities.—England: in a thick bed of calcareous shales, in the Faraday Gill, above the Underset Limestone on the west flank of the Nine Standards, Kirkby Stephen. Scotland: the Upper Limestone series of Orchard, and Williamswood; the Lower Limestone series of Craigen Glen, Campsie; Gallowhill, Strathavon.

Observations.—This species, I have every reason to believe, is that described by Young and Armstrong in both their catalogues as *Cypricardia rhombea*, to which, however, it has not the very slightest resemblance. *C. rectangularis* is much less strongly marked with concentric ridges than *C. concentrica*, but is not so smooth as *C. Annæ*; but the latter is at once distinguished by its square shape, *C. rectangularis* always being oblong even in the very young. The stages of growth are very well marked on the valves, and the protoconch has the same shape as the full-grown shell.

Fortunately I have been able to obtain access to a specimen which shows the hinge-plate and part of the interior, fig. 23, Pl. XXXIX. This is in the collection of Mr. J. Smith, of Kilwinning.

Notwithstanding the large size of the escutcheon, no trace of external ligament is visible in the most perfect examples.

Nucula rectangularis, M'Coy, is preserved in the Griffith Collection of the Science and Art Museum, Dublin. It is a very small and poor specimen, but it certainly has many of the characteristics of the better preserved Scotch examples. M'Coy's description is far from accurate, and I cannot think that his observation

that the shell possessed hinge-teeth like *Nucula* can be correct. The shell is so unlike this genus in every important character, and I feel certain that it should be more correctly referred to *Cypricardella*. I have adopted M'Coy's name for the Scotch shells with a certain amount of hesitation, for the poorness of the type and the meagreness of the description make it impossible to be absolutely certain as to its identity.

In England I have only obtained specimens of this species from a bed of shale very high up in the Yoredale series of the Upper Eden Valley (*loc. supra cit.*). This shale has an interesting marine fauna, and is exposed in a little stream marked on the map as the Faraday Gill, which carries off the water from the west flank of the Nine Standards. The position of the shale is probably between the Underset and the Main Limestones, but it may be really higher up in the series. The stratigraphical succession is as follows, but some of the Limestones are evidently repeated by a fault.

Massive grit, forming top of hill.	Thin coal smut. (Series continued.)
Shales, much obscured by peat.	Shales.
Massive grit.	Thin coal.
Sandy micaceous shales with fragments of marine shells.	Black shales.
Grit, soft and red, very fossiliferous, containing <i>Productus semireticulatus</i> , <i>P. cora</i> , <i>Spirifer trigonalis</i> , <i>Sp. lineata</i> , <i>Sp. glabra</i> , <i>Sp. ovalis</i> , <i>Streptorhynchus crenistria</i> , <i>Athyris ambigua</i> , <i>Bellerophon</i> , sp., <i>Pleurotomaria</i> , sp.	Sandstone.
Fine sandstones.	Limestone, thick, with large corals.
Thin sandy shales.	Black and grey shales becoming calcareous, very fossiliferous. With <i>C. rectangularis</i> , etc.
Muddy micaceous shales.	Limestone, thick; ? Underset Limestone.
Chert.	Sandstone.
Black cherty limestone.	Shales with stigmaria.
Brown shales.	Yellow stigmarian clay.
Sandstone, thick.	Thin sandstone.
Sandy shales.	Shales.
Sandstone full of plant remains.	Thin coal.
Sandstone, massive.	Sandstone.
Shales, micaceous.	Dark shales.
Limestone, thick white, with eucrinites; ? Main Limestone.	Slack sandstone with plant remains.
Sandstone.	Shales.
Shales.	Limestone (? 3 yards limestone).
Thin coals.	Sandstones.
Sandstone.	Shales.
Sandy shales.	Grit.
Black earthy shales.	Shales.
Thin limestone.	Limestone (5 yards limestone).
Earthy shales.	Shale.
Limestone.	Grit.
Sandstone.	Shales.
Sandy shales.	Coal.
Black shale with thin sources of sandstone near the base.	Underclay.
	Grits.
	Sandstones and shales.
	Limestone (scar or middle limestone).

From the point near the shooting box the section is continued downwards in the stream, of which details have also been given in the 'Memoir of the Geological Survey, Geology of the Country round Mallerstang,' p. 83. Two beds of Limestone are seen in the section, which are identified as the Five Yards and the Middle Limestone, here full of *Productus giganteus*. This would make the Limestone immediately below the fossiliferous shales the Underset, and would fix the horizon of that band; but in a brook on the east side of Swarth Fell a series of fossiliferous shales are above the Main Limestone, and the faunas of the two localities are very nearly identical, though this fact only points to similarity of conditions under which the beds were deposited.

The following fossils occur with *C. rectangularis*:—*Cypricardella Annæ*, *Nuculana attenuata*, *Ctenodonta sinuosa*, *Pecten*, sp., *Murchisonia*, sp., *Discites*, sp., *Productus semireticulatus*, *P. punctatus*, *Spirifera trigonalis*, *Sp. ovalis*, *Athyris ambigua*, *Streptorhynchus crenistria*, *Discina nitida*, stems of encrinites, and *Phillipsia*, sp.

CYPRICARDELLA ACUTICARINATA, *Armstrong*, sp., 1865. Pl. XXXIX, figs. 14—19.

- CYPRICARDIA ACUTICARINATA, *Armstrong*, 1865. Trans. Geol. Soc. Glasgow, vol. ii, pt. 1, p. 28, pl. i, figs. 3, 3 a.
 — — — *Young and Armstrong*, 1871. Ibid., vol. iii, Supplement, p. 50.
 — — — *Armstrong, Young, and Robertson*, 1876. Cat. Western Scottish Fossils, p. 53.
 — — — *Bigsby*, 1878. Thesaurus Devonico-Carboniferus, p. 203.
 SANGUINOLITES ACUTICARINATA, *de Koninck*, 1885. Ann. Mus. Roy. d'Hist. Nat., tom. xi, p. 63, pl. xv, figs. 48—50.
 CYPRICARDIA ACUTICARINATA, *Etheridge*, 1888. Brit. Foss., pt. 1, Palæozoic, p. 282.

Specific Characters.—Shell subtrapezoidal, at times almost quadrate, very inequilateral, strongly carinate. The anterior end is very short and low, and compressed, its border rounded, much encroached upon above by the comparatively large lunule. The inferior border is convexo-concave, and terminates posteriorly at a sharp-pointed projection where it meets the posterior border. The posterior border is truncated, slightly oblique from above downwards or even vertical, concave above; it joins the posterior border with a well-marked angle, which may project slightly backwards.

The superior border is shorter than the antero-posterior diameter of the shell, and appears to be straight for the greater part of its extent, but it is really gently arcuate when examined in the single valve.

The umbones are small, contiguous, pointed, twisted inwards and forwards, and are situated very far forwards. Springing from the posterior edge of the umbo is a very marked, raised, narrow, sharp, erect ridge, which passes obliquely downwards and backwards to the postero-inferior angle, becoming more pronounced as it passes across the shell. This ridge divides the valve into two

portions, of which the anterior is the larger, and this part of the valve is convexly swollen. Posterior to the ridge the valve is so rapidly compressed as to be concave along the dorsal slope. The lunule is large and cordate; the escutcheon large, deep, and elongate, deeper and wider behind than anteriorly.

Interior.—The anterior adductor muscle-scar is small and deep, situated immediately within the anterior superior angle, and separated from the rest of the shell by a ridge. The posterior adductor scar is small and shallow, situated at the posterior superior angle some little distance from the margin. Pallial line entire, very finely marked, and remote from the margin. The hinge consists in the right valve of a single cardinal tooth with a shallow pit on each side, and an elongate groove between two ridges posteriorly to receive the tooth of the opposite valve. The left valve possesses a central pit for the cardinal tooth of the right valve, with a rudimentary tooth on each side, and a single, long, lamellar posterior tooth. Formula $\begin{matrix} R\ 0; & 010; & 0 \\ L\ 0; & 1.0.1; & 1 \end{matrix}$. The inferior and posterior edges of the valve are finely serrate on the internal aspect, as in *Astarte*.

Exterior.—The surface is ornamented with very concentric, fine lines of growth, but here and there one of them becomes highly accentuated, especially near the lower border. The umbonal region and the upper part of the valve are almost smooth.

Dimensions.—Fig. 18, Pl. XXXIX, a specimen from Orchard, in the collection of Mr. J. Neilson, measures—

Antero-posteriorly	.	.	.	.	11 mm.
Dorso-ventrally	.	.	.	.	7 mm.
From side to side	.	.	.	.	8 mm.

Localities.—Scotland: the Upper Limestone series of Orchard; Linn Spout, Dalry; Robroyston; Gare and Westerhouse, Carluke; Williamswood, Cathcart; Auchentibber, Kilwinning; Lower Limestone series, Law, Dalry.

Observations.—This species was described as occurring in Scottish Carboniferous beds by Armstrong. It can be distinguished at once from all the smaller species of the genus by the strong, acute, oblique keel, which gives the shell a very characteristic contour when viewed from above. De Koninck has figured this species apparently from the Limestone of Visé, but from his language there appears to have been some doubt as to the locality. He says, "Cette espèce paraît avoir été trouvée dans le Calcaire Carbonifère de Visé."

I have been fortunate enough to isolate the hinge in a left valve in the collection of Mr. J. Smith, of Kilwinning, fig. 15, Pl. XXXIX. The other details have been obtained from mere fragments; in hinge structure and internal anatomy *C. acuticarinata* agrees entirely with those of *C. crebricostata*, of which some fine and perfect valves have been obtained.

PLATE XXVI.

Fig. 1.—*Sedgwickia gigantea*. M'Coy's type specimen preserved in the Griffith Collection of the Museum of Science and Art, Dublin. (Page 278.)

Fig. 2.—*Sedgwickia gigantea*. A full-grown, much crushed specimen. From the *Schizodus pentlandicus* bed, Randerston, Fife. My Collection. (Page 278.)

Fig. 3.—*Sedgwickia gigantea*. A cast of the interior. From Magazine, Midlothian. My Collection. (Page 278.)

Fig. 4.—*Sedgwickia scotica*. A very fine example. From the McDonald Limestone beds of Muirkirk. In the Collection of Mr. Adam Whyte, of Muirkirk. (Page 283.)

Fig. 4 a.—*Sedgwickia scotica*. The same specimen viewed from above.

Fig. 5.—*Sedgwickia scotica*. A medium-sized example. From the Lower Limestone series of Bath. In the Collection of Mr. J. Neilson. (Page 283.)

Fig. 6.—*Sedgwickia scotica*. A larger specimen. From the same locality at Muirkirk. My Collection. (Page 283.)

Fig. 7.—*Sedgwickia scotica*. A specimen with the anterior concentric lines of growth very well preserved. From Beith. My Collection. (Page 283.)

Fig. 8.—*Sedgwickia ovata*. A portion of a cast of a right valve, showing the anterior adductor muscle-scar. From the Redesdale Ironstone. My Collection. (Page 281.)

Fig. 9.—*Sedgwickia ovata*. A fairly perfect bivalve example. Same locality. My Collection. (Page 281.)

Fig. 9 a.—*Sedgwickia ovata*. The same specimen viewed from above.

Fig. 10.—*Sedgwickia ovata*. A specimen of a testiferous right valve of average size. Same locality. My Collection. (Page 281.)

Fig. 11.—*Sedgwickia ovata*. A specimen from the Scorpion beds of Glen-cartholne, Eskdale. My Collection. (Page 281.)

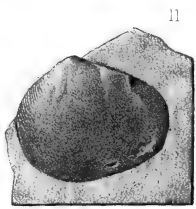
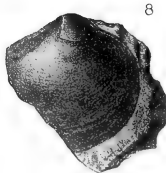
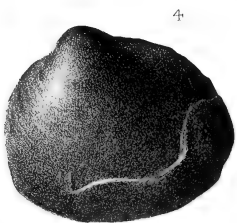
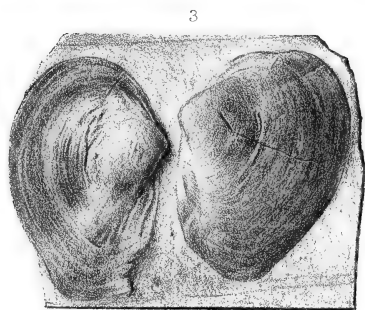
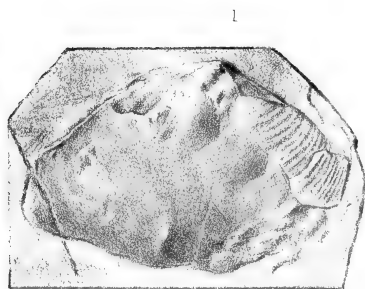


PLATE XXVII.

Fig. 1.—*Sedgwickia ovata*. A right valve, showing the characteristic markings in front. From the Redesdale Ironstone. My Collection. (Page 281.)

Fig. 1 *a*.—*Sedgwickia ovata*. The same shell, showing the hinge with a small median cardinal tooth.

Fig. 2.—*Sedgwickia ovata*. A left valve with the shell removed posteriorly, showing the posterior adductor muscle-scar and pallial line. Same locality. My Collection. (Page 281.)

Fig. 3.—*Sedgwickia ovata*. A right valve with most of the test preserved. Same locality. My Collection. (Page 281.)

Fig. 4.—*Sedgwickia ovata*. A young specimen of the left valve. Same locality. My Collection. (Page 281.)

Fig. 5.—*Sedgwickia suborbicularis*. A testiferous left valve. From Pot Metal Plantation, Kirkaldy. In the Collection of the Geological Survey of Scotland. (Page 284.)

Fig. 6.—*Sedgwickia suborbicularis*. A full-grown left valve. From Inverteel Quarry, Kirkaldy. Same Collection. (Page 284.)

Fig. 7.—*Sedgwickia suborbicularis*. A young example. From Hope Quarry, Pathhead, Haddingtonshire. Same Collection. (Page 284.)

Fig. 8.—*Sedgwickia suborbicularis*. A testiferous right valve, showing erosion of the umbo. The same locality and Collection as Fig. 6. (Page 284.)

Fig. 9.—*Sedgwickia attenuata*. M'Coy's type. A right valve. Preserved in the Griffith Collection of the Museum of Science and Art, Dublin. (Page 285.)

Fig. 10.—*Sedgwickia gigantea*. The type of M'Coy's *Dolabra securiformis*. A cast of both valves. Same Collection. (Page 278.)

Fig. 11.—*Sedgwickia attenuata*. The cast of a right valve. From Calcareous-grit, Pulse Hill, near Marsden. My Collection. (Page 285.)

Fig. 12.—*Sedgwickia attenuata*. The cast of both valves. Same locality. My Collection. (Page 285.)

Figs. 13, 14. *Sedgwickia attenuata*. Casts. Same locality. My Collection. (Page 285.)

Fig. 15.—*Edmondia rudis*. A perfectly preserved cast of the interior. From the Carboniferous Limestone of Castleton, Derbyshire. In the Collection of Mr. J. Barnes, F.G.S. (Page 302.)

Fig. 15 *a*.—*Edmondia rudis*. The same specimen viewed from above, showing the grooves of the lamellæ attached to the hinge-plate.

Fig. 16.—*Edmondia unioniformis*. From the Carboniferous Limestone of Tournay, Belgium, showing the edentulous hinge, 16 *a*, and at 16 *b* the hinge viewed from below. (Page 291.)

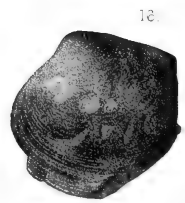
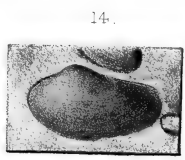
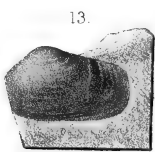
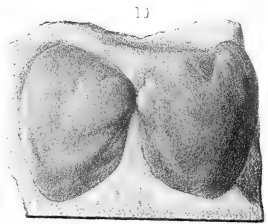
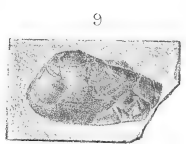
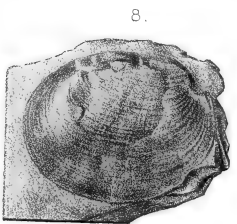
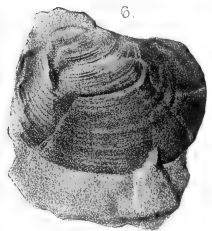
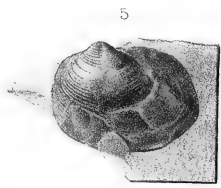
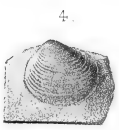
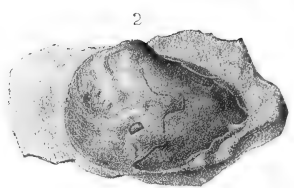
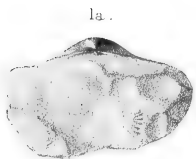
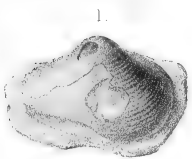


PLATE XXVIII.

Fig. 1.—*Edmondia unioniformis*. The type of Phillips's *Isocardon unioniformis*. Preserved in the Gilbertson Collection of the Natural History Museum, South Kensington. (Page 291.)

Fig. 1 a.—*Edmondia unioniformis*. The same specimen viewed from above.

Fig. 2.—*Edmondia unioniformis*. A perfectly-preserved specimen (a cast). From Tomdeeby, Limerick. In the Collection of the Geological Survey of Ireland. (Page 291.)

Fig. 2 a.—The same specimen viewed from above.

Fig. 3.—*Edmondia unioniformis*. A left testiferous valve. From the Redesdale Ironstone, Bellingham. My Collection. (Page 291.)

Fig. 4.—*Edmondia unioniformis*. A right testiferous valve. From the Carboniferous Limestone of Castleton, Derbyshire. My Collection. (Page 291.)

Fig. 5.—*Edmondia unioniformis*. The cast of both valves. Same locality. My Collection. (Page 291.)

Fig. 5 a.—*Edmondia unioniformis*. The same specimen, viewed from the front, showing the absence of the lunule.

Fig. 6.—*Edmondia unioniformis*. A beautiful example of the left valve. From the Limestone of Rockfort Lodge, Bandoran. In the Collection of the Geological Survey of Ireland. (Page 291.)

Fig. 7.—*Edmondia unioniformis*. A testiferous left valve. From Castleton, Derbyshire. My Collection. (Page 291.)

Figs. 8, 9.—*Edmondia rudis*. Two very well-preserved specimens (casts) of the interior. From the Lower Limestone shales of Beith. In the Collection of Mr. J. Neilson. (Page 302.)

Fig. 10.—*Edmondia rudis*. A specimen from the same locality, viewed from above, showing the grooves for the lamellar process of the hinge-plate. My Collection. (Page 302.)

Fig. 11.—*Edmondia rudis*. The cast of the interior of a medium-sized example. Same locality. My Collection. (Page 302.)

Figs. 12—14.—*Edmondia rudis*. Three examples, dwarfed in size. From the Pennystone Ironstone Coal-measures, Coalbrookdale. My Collection. (Page 302.)

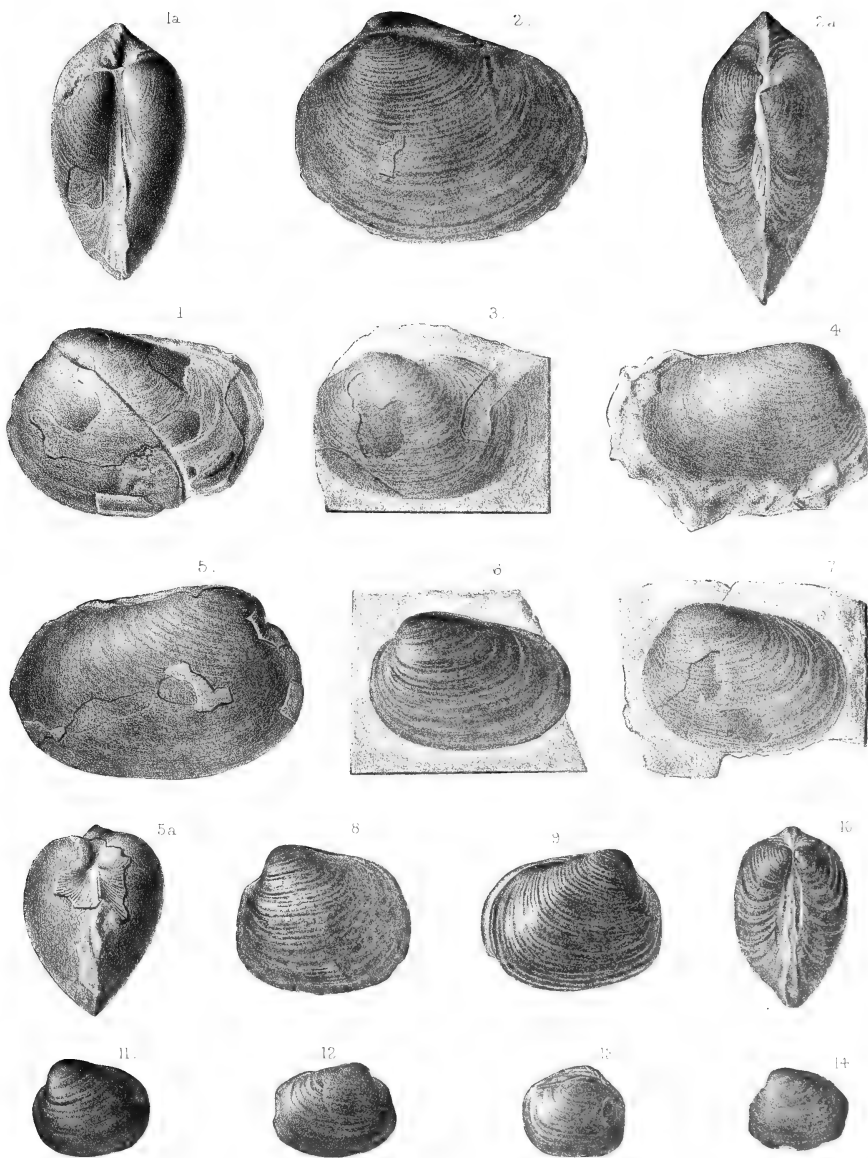


PLATE XXIX.

Fig. 1.—*Edmondia oblonga*. A left valve. From the Carboniferous Limestone of Lowick. In the Woodwardian Museum, Cambridge. (Page 298.)

Fig. 2.—*Edmondia oblonga*. The cast of a perfect specimen, showing the adductor muscle-scars and pallial line. Same locality and Collection. (Page 298.)

Fig. 3.—*Edmondia oblonga*. A full-grown example of the right valve. Same locality and Collection. (Page 298.)

Fig. 4.—*Edmondia Lyellii*. The cast of both valves. From the Lower Limestone series of Beith. My Collection. (Page 300.)

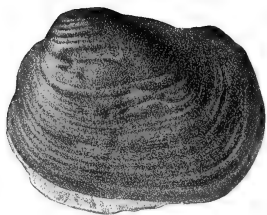
Fig. 5.—*Edmondia oblonga*. The type of Portlock's *Sanguinolaria oblonga*. From co. Tyrone. Preserved in the Museum of the Geological Survey, Jernyn Street. (Page 298.)

Fig. 6.—*Edmondia primæva*. The cast of a left valve. From Doohybeg. In the collection of the Geological Survey of Ireland. (Page 306.)

Fig. 7.—*Edmondia primæva*. A right valve with portions of the test preserved. Same locality. My Collection. (Page 306.)

Fig. 8.—*Edmondia primæva*. A large left valve. Same locality. My Collection. (Page 306.)

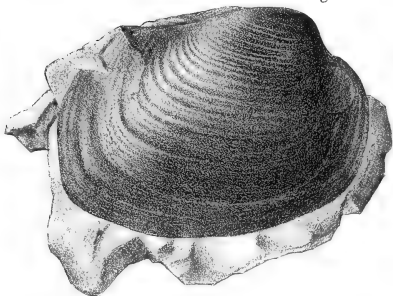
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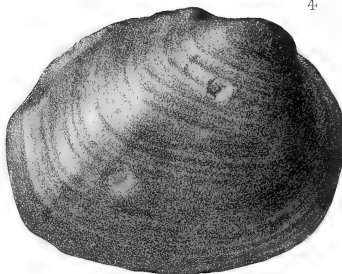
2



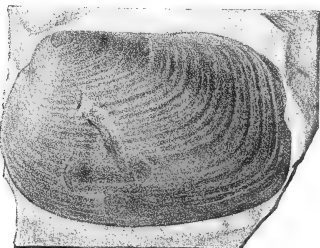
3



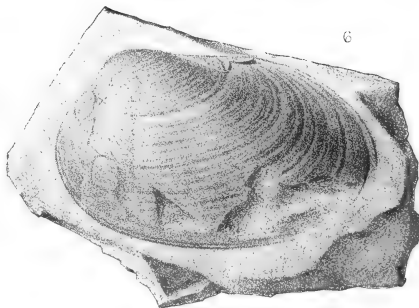
4



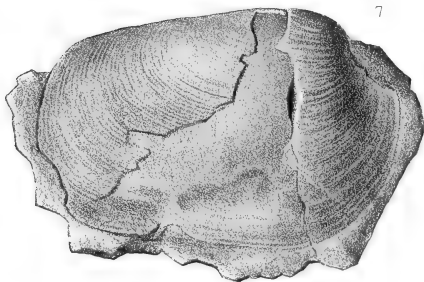
5



6



7



8

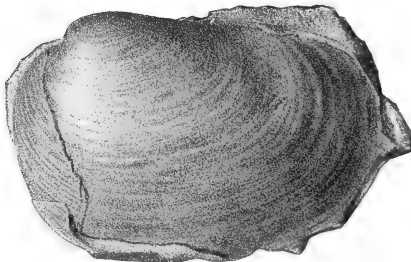


PLATE XXX.

Fig. 1.—*Edmondia primæva*. A fine example of the right valve. From Doohybeg, co. Limerick. In the Collection of the Geological Survey of Dublin. (Page 306.)

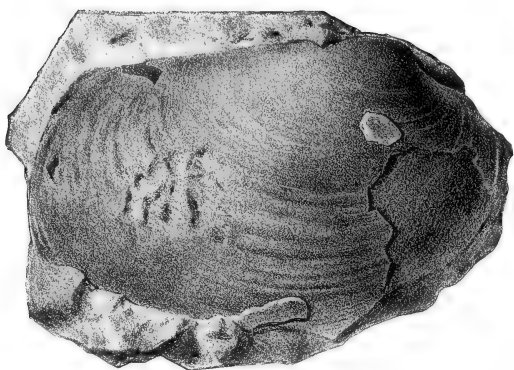
Fig. 2.—*Edmondia primæva*. The type of M'Coy's *Lutraria prisca*. Preserved in the Griffith Collection of the Museum of Science and Art, Dublin. (Page 306.)

Fig. 3.—*Edmondia primæva*. A large specimen (fragment), viewed from above, showing the umbo and dorsal edge of the valve. From Doohybeg, co. Limerick. In the Collection of the Geological Survey of Ireland. (Page 306.)

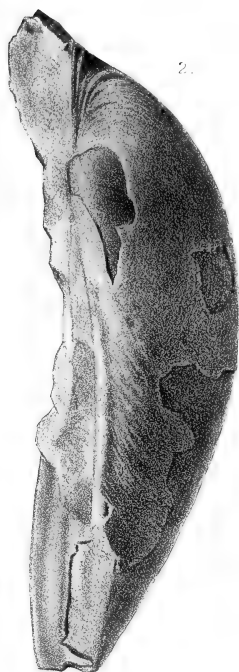
Fig. 4.—*Edmondia gigantea*. A fine specimen. From Little Island, co. Cork. In the Collection of Mr. J. Wright, of Belfast. (Page 308.)

Fig. 4 a.—*Edmondia gigantea*. The same specimen viewed from above.

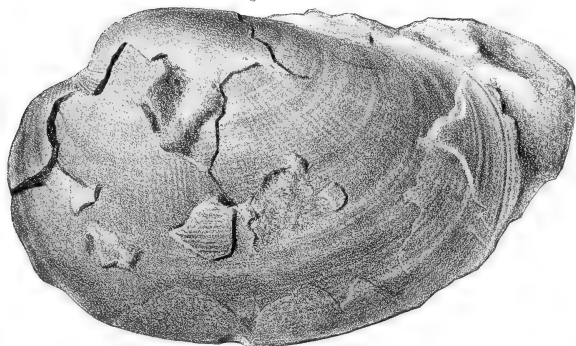
1.



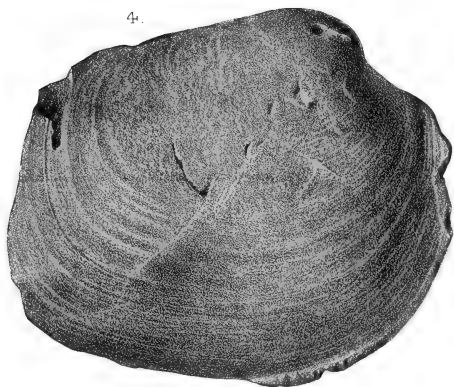
2.



3.



4.



4a.





PLATE XXXI.

Fig. 1.—*Edmondia Lyellii*. A bivalve specimen, from Beith, showing the anterior adductor muscle-scar. In the Collection of Mr. R. Craig, of Beith. (Page 300.)

Fig. 1 *a*.—*Edmondia Lyellii*. A portion of the shell of the same specimen, magnified to show the punctate markings on the surface.

Fig. 2.—*Edmondia Lyellii*. A fine testiferous example of the left valve. From the Carboniferous Limestone of Galway. In the Collection of the Geological Survey of Ireland. (Page 300.)

Fig. 2 *a*.—*Edmondia Lyellii*. The same specimen viewed from in front.

Fig. 3.—*Edmondia Lyellii*. A cast of the left valve, showing both adductor muscle-scars and the pallial line. From Beith. In the Collection of Mr. J. Young, LL.D. (Page 300.)

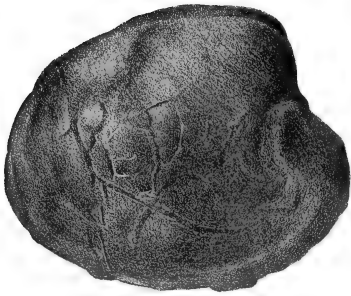
Figs. 3 *a*, *b*.—*Edmondia Lyellii*. Two views, to show the groove for the lamellar process of the hinge-plate.

Fig. 4.—*Edmondia Lyellii*. A perfect specimen of the right valve. From Beith. In the Collection of the Geological Society of Glasgow. (Page 300.)

Fig. 4 *a*.—*Edmondia Lyellii*. The same specimen, showing the edentulous hinge and groove for the external ligament.

Fig. 5.—*Edmondia Lyellii*. A very fine example of both valves from Craighall, Fife. In the Museum of Science and Art, Edinburgh. (Page 300.)

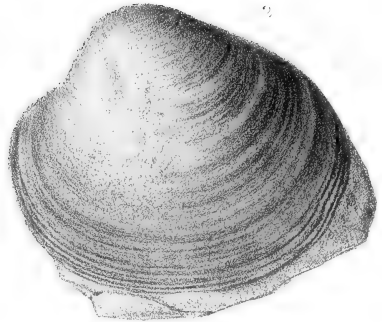
1.



1a



2.



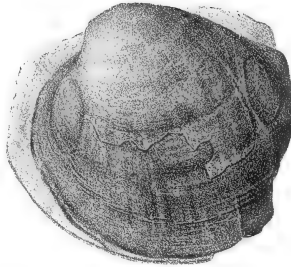
3a.



3b



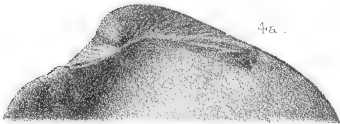
3.



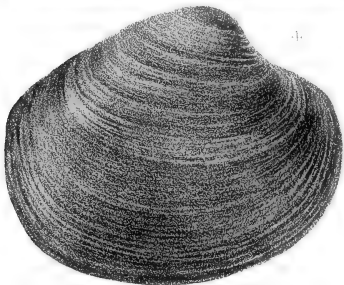
2a.



4a.



4.



5.

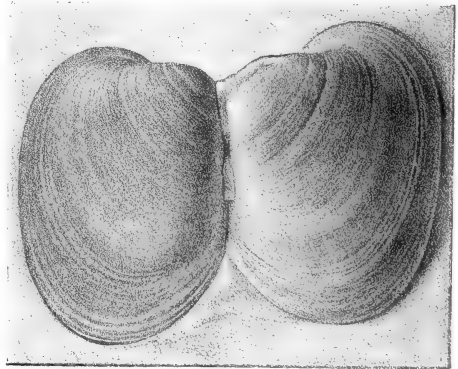




PLATE XXXII.

Fig. 1.—*Edmondia rudis*. A medium-sized left valve. From the upper beds of the Carboniferous Limestone of Castleton, Derbyshire. My Collection. (Page 302.)

Fig. 2.—*Edmondia unioformis*. A left valve, with more strongly-marked ridges of growth than usual. Same locality. My Collection. (Page 291.)

Fig. 3.—*Edmondia rudis*. The cast of a left valve. From the Shelly Limestone of Poolvash, Isle of Man. My Collection. (Page 302.)

Fig. 4.—*Edmondia rudis*. The cast of a right valve, of deeper dimensions than is usually found. From the upper beds of the Carboniferous Limestone of Castleton, Derbyshire. My Collection. (Page 302.)

Fig. 5.—*Edmondia rudis*. A less rugose form, incomplete at the posterior part of the hinge-line. Same locality. My Collection. (Page 302.)

Fig. 6.—*Edmondia rudis*. A large example, with more regular markings, having the contour of *Corbula? senilis* of Phillips. Same locality. My Collection. (Page 302.)

Fig. 7.—*Edmondia Goldfussi*.—A left valve, chiefly a cast of the interior. From the upper beds of the Carboniferous Limestone, Thorpe Cloud, Derbyshire. My Collection. (Page 309.)

Fig. 8.—*Edmondia Goldfussi*. The cast of a left valve. From the upper beds of the Carboniferous Limestone of Castleton, Derbyshire. My Collection. (Page 309.)

Figs. 9, 10.—*Edmondia Goldfussi*. A left and right valve respectively, with portions of the test preserved. Same locality. My Collection. (Page 309.)

Fig. 11.—*Edmondia Goldfussi*. The cast of a left valve. Same locality. My Collection. (Page 309.)

Fig. 12.—*Edmondia transversa*. A right valve. From the shales below the limestone of Hind Og Glen, Dalry, Ayrshire. My Collection. (Page 317.)

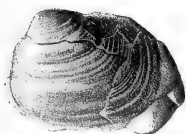
Fig. 13.—*Edmondia transversa*. The left valve of a bivalve example. From the Lower Limestone series of Auchenskeith, Ayrshire. My Collection. (Page 317.)

Fig. 14.—*Edmondia transversa*. A bivalve example. From the same horizon at Beith, Ayrshire. My Collection. (Page 317.)

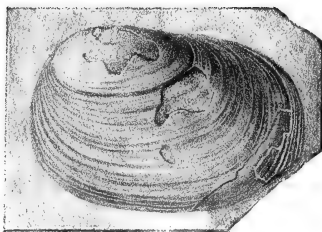
Fig. 15.—*Edmondia transversa*. A young example. From Garngad Road, Glasgow. In the Collection of Mr. J. Neilson. (Page 317.)

Fig. 16.—*Edmondia transversa*. An almost perfect cast, showing (16a) the grooves for the lamellar processes of the hinge-plate. Same locality as Fig. 14. My Collection. (Page 317.)

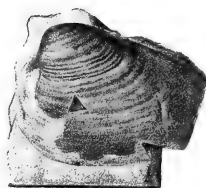
1.



2.



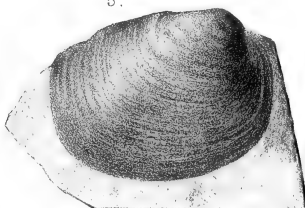
3.



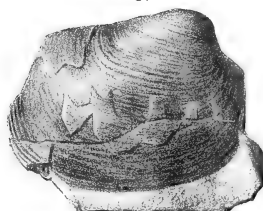
4.



5.



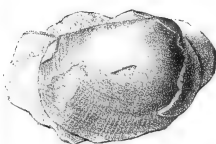
6.



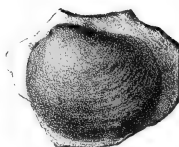
7.



8.



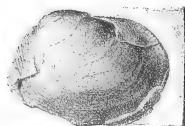
9.



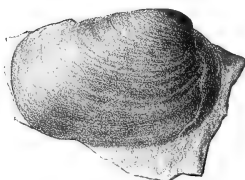
10.



11.



12.



13.



14.



15.



16.



16a.





PLATE XXXIII.

Fig. 1.—*Edmondia Lowickensis*. A perfect specimen. From the Index Limestone series of Thornliebank, Scotland. In the Collection of Mr. J. Neilson. (Page 296.)

Fig. 1 *a*.—The same specimen viewed from above.

Figs. 2, 3.—*Edmondia Lowickensis*. The cast of a left valve, which shows the groove for the lamellar process of the hinge (not in the figure). From one of the limestones at Lowick. In the Collection of the Woodwardian Museum, Cambridge. (Page 296.)

Fig. 4.—*Edmondia Lowickensis*. The cast of a left valve, showing the adductor muscle-scars and pallial line. Same locality and Collection. (Page 296.)

Fig. 5.—*Edmondia compressa*. The anterior half of a left valve. From the upper beds of the Carboniferous Limestone, Thorpe Cloud, Derbyshire. My Collection. (Page 304.)

Fig. 6.—*Edmondia compressa*. A left valve. From the upper beds of the Carboniferous Limestone, Castleton, Derbyshire. My Collection. (Page 304.)

Fig. 7.—*Edmondia compressa*. The type specimen figured by M'Coy. Preserved in the Griffith Collection of the Museum of Science and Art, Dublin. (Page 304.)

Figs. 8, 9.—*Edmondia compressa*. Two examples of medium size. From the same locality as Fig. 6. My Collection. (Page 304.)

Fig. 10.—*Edmondia Josepha*. A testiferous example. From the shales of the Lower Limestone series of Beith, Ayrshire. My Collection. (Page 294.)

Fig. 11.—*Edmondia Josepha*. A cast showing the details of the interior and the lamellar process of the hinge-plate. Same locality. My Collection. (Page 294.)

Fig. 12.—*Edmondia Josepha*. A very fine testiferous example. From the same locality. My Collection. (Page 294.)

Fig. 12 *a*.—*Edmondia Josepha*. The same specimen viewed from above.

Fig. 13.—*Edmondia Josepha*. A cast. From a marine band in the Calciferous Sandstone series of Fife. My Collection. (Page 294.)

Fig. 14.—*Edmondia Josepha*. The cast of a young example. From Beith. My Collection. (Page 294.)

Fig. 15.—*Edmondia sulcata*. A small example. A cast from the Limestone at Lowick, Northumberland. In the Woodwardian Museum, Cambridge. (Page 318.)

Fig. 16.—*Edmondia expansa*. A very fine example. From the Carboniferous Limestone of Halkyn Mountain, North Wales. In the Collection of the Grosvenor Museum, Chester. (Page 322.)

Fig. 16 *a*.—*Edmondia expansa*. The same specimen viewed from above.

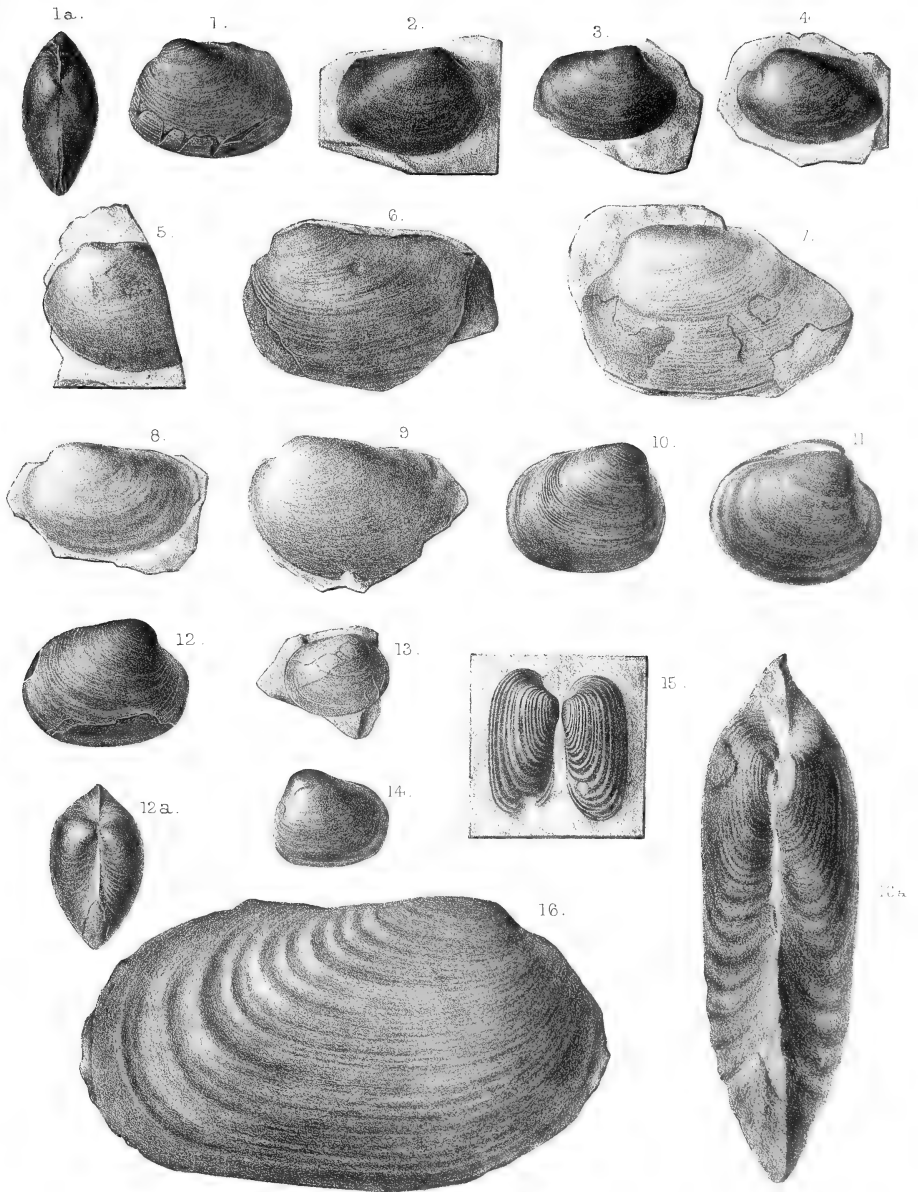




PLATE XXXIV.

Fig. 1.—*Edmondia expansa*. The cast of a medium-sized shell. From one of the Limestones near Richmond, Yorkshire. In the Collection of the York Museum. (Page 322.)

Fig. 2.—*Edmondia expansa*. The right valve of a full-grown shell. From Wensleydale. In the same Collection. (Page 322.)

Fig. 3.—*Edmondia sulcata*. Probably the type of Phillips's *Sanguinolaria? sulcata*. Same locality and Collection. (Page 318.)

Fig. 4.—*Edmondia expansa*. The cast of a small example from the Main Limestone, West Witton, Yorkshire. My Collection. (Page 322.)

Fig. 5.—*Edmondia sulcata*. A fine example from the Carboniferous Limestone of Kildare. In the Collection of the Woodwardian Museum, Cambridge. (Page 318.)

Fig. 6.—*Edmondia sulcata*. A very fine cast, showing the hollow for the lamellar process of the hinge. From the Beith Limestone series. My Collection. (Page 318.)

Fig. 6 a.—*Edmondia sulcata*. The same specimen viewed from above.

Fig. 7.—*Edmondia expansa*. A left testiferous valve. From the Carboniferous beds of North Yorkshire. In the Collection of Mr. J. Wright of Belfast. (Page 322.)

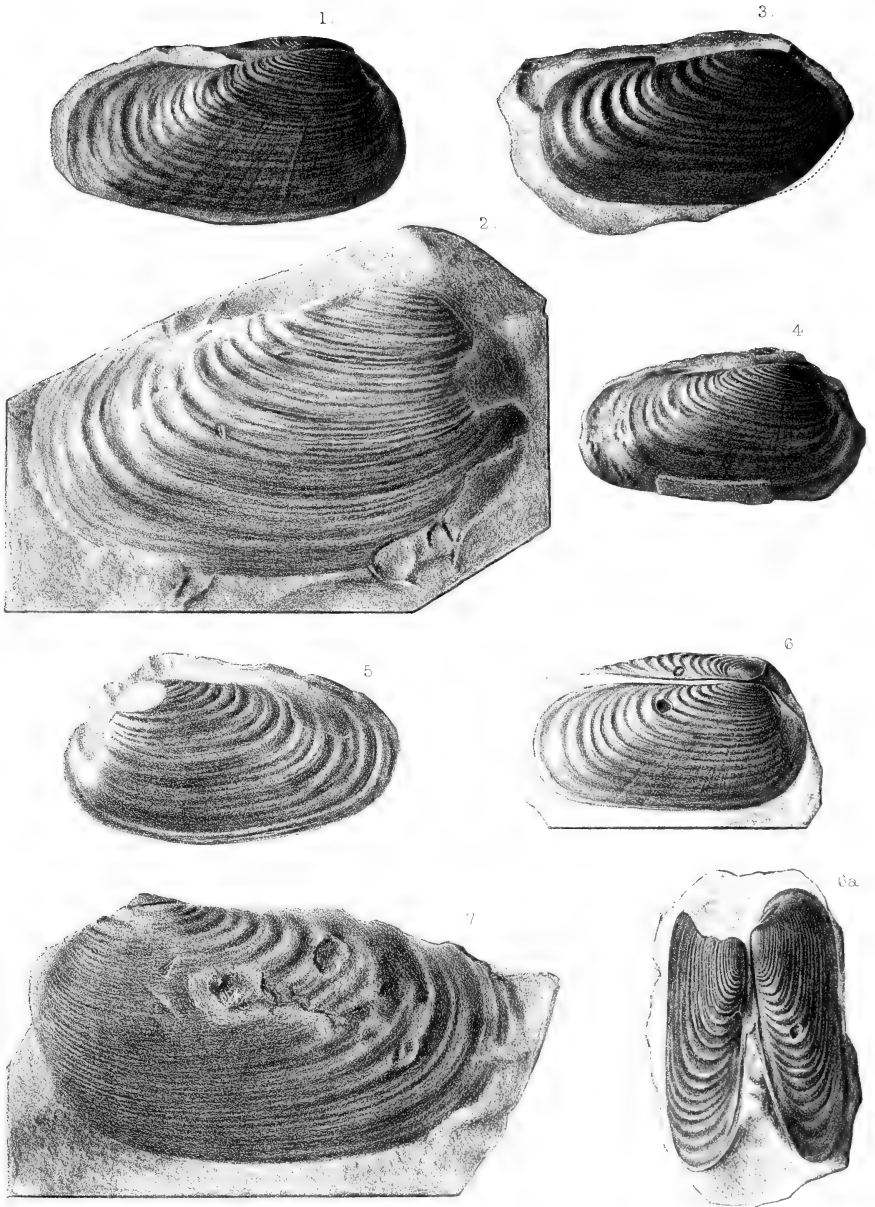


PLATE XXXV.

Fig. 1.—*Edmondia arcuata*. From the horizon of the Hurlet Limestone, St. Monans, Fife. (Page 310.)

Fig. 2.—*Edmondia arcuata*. The left valve of a cast, showing the anterior adductor muscle-scar. From the Redesdale Ironstone beds. My Collection. (Page 310.)

Figs. 3, 4.—*Edmondia arcuata*. The right valves of casts. From the same locality. My Collection. (Page 310.)

Fig. 5.—*Edmondia sulcata*. A specimen from the Limestone of North Wales, showing (*a*) the lamellar plate of the hinge of the left valve. In the Collection of Mr. G. H. Morton. (Page 318.)

Fig. 6.—*Edmondia arcuata*. A testiferous example. From the Redesdale Ironstone series. My Collection. (Page 310.)

Fig. 7.—*Edmondia arcuata*. A very fine specimen of a cast, showing the details of the interior. Same series, Bellingham. My Collection. (Page 310.)

Fig. 7 *a*.—*Edmondia arcuata*. The same specimen viewed from above, showing the grooves from the lamellar process of the hinge, and the lanceolate depressions caused by the thickening within the umbo.

Fig. 8.—*Edmondia arcuata*. A small example from the same series. My Collection. (Page 310.)

Fig. 9.—*Edmondia arcuata*. A less transverse variety. Same locality. My Collection. (Page 310.)

Fig. 10.—*Edmondia arcuata*. A testiferous example of the right valve. Same locality and Collection. (Page 310.)

Fig. 11.—*Edmondia sulcata*. A specimen with the tuberculated periostracum preserved. From Hind Og Glen, Dalry. My Collection. (Page 318.)

Fig. 11 *a*.—*Edmondia sulcata*. A portion of the above shell magnified.

Fig. 12.—*Edmondia Pentonensis*. A full-grown right valve, showing (*a*) the internal lamellar plate of the hinge. From shale between the Limestones at Penton Linns, Roxburgh. My Collection. (Page 313.)

Fig. 13.—*Edmondia Pentonensis*. A left valve. Same locality and Collection. (Page 313.)

Fig. 14.—*Edmondia Pentonensis*. A right valve. From the Redesdale Ironstone beds. My Collection. (Page 313.)

Figs. 15, 16.—*Edmondia Pentonensis*. Two valves from Penton Linns. My Collection. (Page 313.)

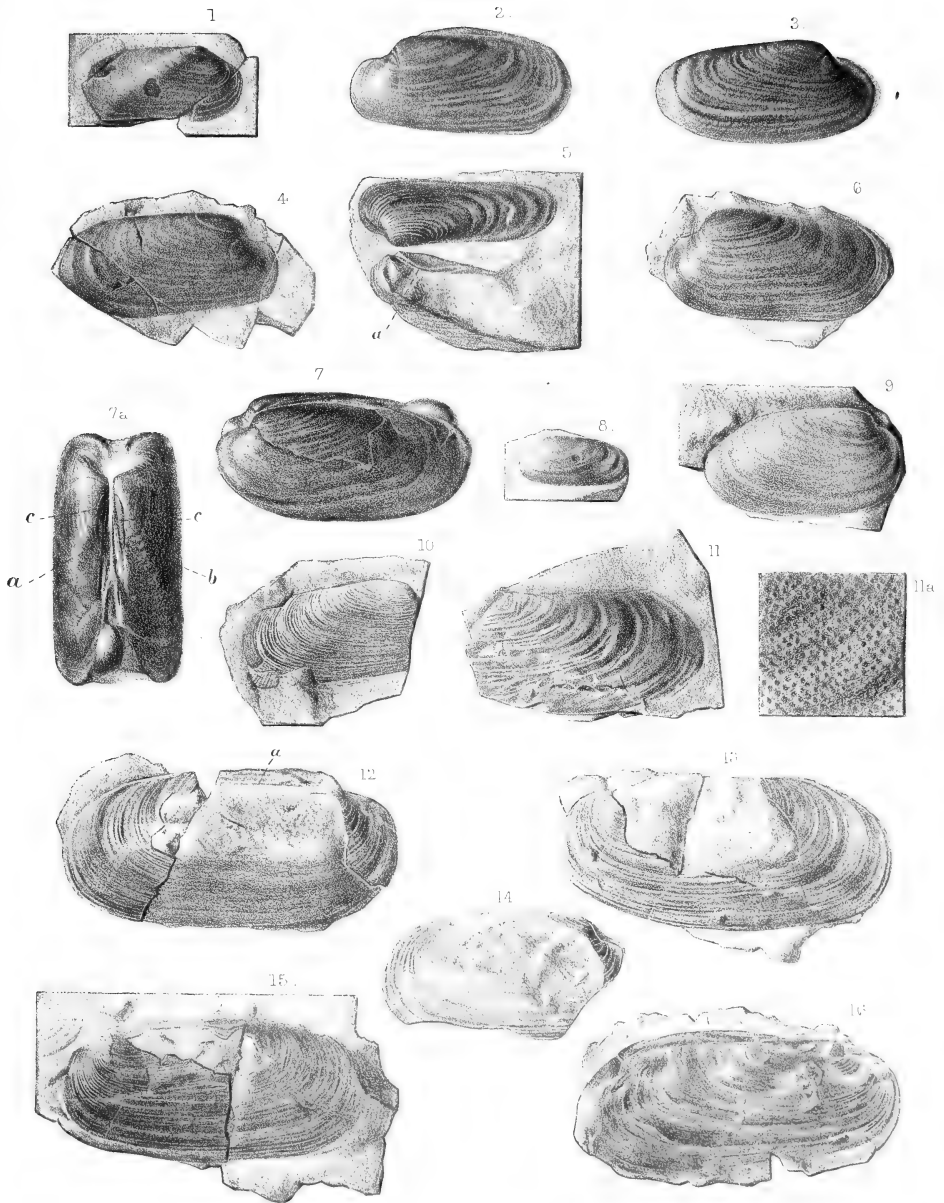


PLATE XXXVI.

Fig. 1.—*Edmondia laminata*. A left valve. From the Carboniferous Limestone of Thorpe, Grassington. In the Collection of the Geological Survey, Jermyn Street. (Page 324.)

Fig. 2.—*Edmondia laminata*. A left valve. From the Carboniferous Limestone of Thorpe Cloud, Derbyshire. My Collection. (Page 324.)

Fig. 3.—*Edmondia laminata*. A medium-sized right valve. From the Carboniferous Limestone of Settle. In the Collection of the Woodwardian Museum, Cambridge. (Page 324.)

Figs. 4—7.—*Edmondia laminata*. A series to show different stages of growth. From the Carboniferous Limestone of Thorpe Cloud. My Collection. (Page 324.)

Fig. 8.—*Edmondia MacCoyii*. A very young shell. Same locality and Collection. (Page 328.)

Fig. 9.—*Edmondia scalaris*. A very young example. From the Carboniferous Limestone of Thorpe Cloud. My Collection. (Page 327.)

Fig. 10.—*Edmondia laminata*. A specimen showing a much smoother surface, the strong ridges and sulcations becoming much less marked. (Page 324.)

Fig. 11.—*Edmondia laminata*. The type specimen of Phillips's *Lucina laminata*. Preserved in the Gilbertson Collection of the Natural History Museum, South Kensington. (Page 324.)

Fig. 12.—*Edmondia laminata*. The type specimen of M'Coy's *Astarte quadrata*. Preserved in the Griffith Collection of the Museum of Science and Art, Dublin. (Page 324.)

Fig. 13.—*Edmondia laminata*, var. *sublævis*. A left valve. From the Carboniferous Limestone of Thorpe, near Grassington. In the Collection of the Geological Survey, Jermyn Street. (Page 327.)

Figs. 14—16.—*Edmondia laminata*, var. *sublævis*. Valves showing different degrees of variation in the concentric ridges. From the Carboniferous Limestone of Thorpe Cloud. My Collection. (Page 327.)

Fig. 17.—*Edmondia laminata*, var. *sublævis*. A cast of the interior. Same locality and Collection. (Page 327.)

Fig. 18.—*Edmondia laminata*, var. *sublævis*. From the Carboniferous Limestone of Castleton, Derbyshire. My Collection. (Page 327.)

Fig. 19.—*Edmondia scalaris*. A right valve. From the Carboniferous Limestone of Kildare. In the Collection of the Geological Survey, Jermyn Street. (Page 327.)

Fig. 20.—*Edmondia scalaris*. The type specimen figured by M'Coy. In the Griffith Collection of the Museum of Science and Art, Dublin. (Page 327.)

Fig. 21.—*Edmondia scalaris*. A full-grown left valve. From the Carboniferous Ironstone of St. Dooghlas, co. Dublin. My Collection. (Page 327.)

Fig. 22.—*Edmondia scalaris*. A bivalve example. From the south of Ireland. In the Collection of Mr. J. Neilson, of Glasgow. (Page 327.)

Fig. 23.—*Edmondia MacCoyii*. A testiferous example. From the Carboniferous Limestone of Park Hill, Derbyshire. In the Collection of the Geological Survey, Jermyn Street. (Page 329.)

Fig. 24.—*Edmondia MacCoyii*. A cast of the interior. Same locality and Collection. (Page 329.)

Fig. 25.—*Edmondia MacCoyii*. A young example. From the Carboniferous Limestone of Settle. My Collection. (Page 329.)

Figs. 26, 28, 30.—*Edmondia MacCoyii*. A series of specimens showing variation in the number and distance of the concentric ridges. From Settle. In the Currow Collection of the Woodwardian Museum, Cambridge. (Page 329.)

Fig. 27.—*Edmondia MacCoyii*. A small testiferous example. From the Carboniferous Limestone of Castleton. My Collection. (Page 329.)

Fig. 29.—*Edmondia MacCoyii*.—A specimen of the left valve. Same locality and Collection. (Page 329.)

Fig. 31.—*Edmondia laminata*.—A giant specimen. From the Carboniferous Limestone of Park Hill, Derbyshire. In the Collection of the Geological Survey. (Page 324.)

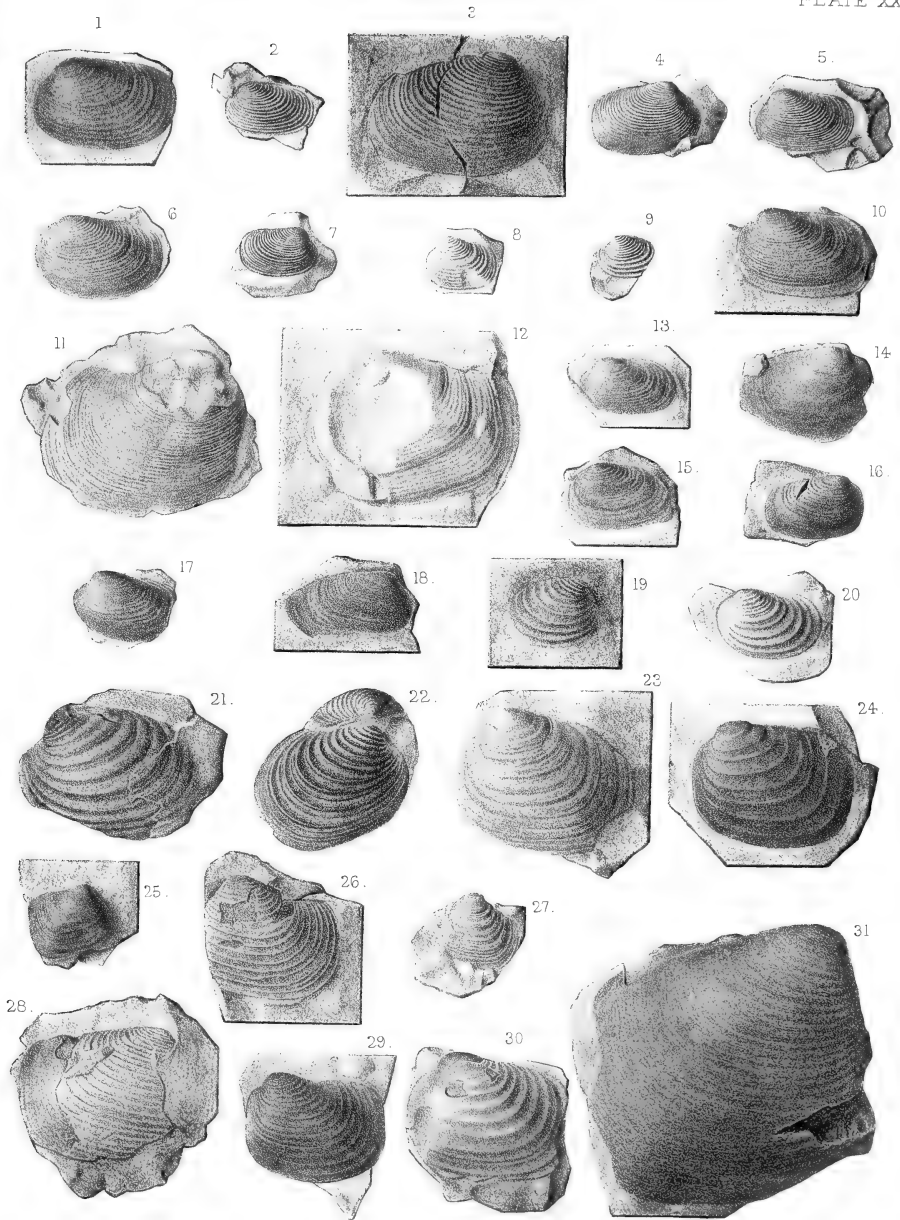


PLATE XXXVII.

Fig. 1.—*Scaldia Benedeniana*. A testiferous example from the Carboniferous Limestone of Kildare. In the Collection of the Geological Survey, Jermyn Street. (Page 336.)

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Fig. 6.—*Scaldia fragilis*. A pair of testiferous valves. Same locality and Collection. (Page 335.)

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Fig. 8.—*Edmondia accipiens*. The type specimen of *Nucula accipiens*, figured by Sowerby in Prestwich's 'Geology of Coalbrookdale.' In the Collection of the Natural History Museum, South Kensington. (Page 331.)

Fig. 9.—*Edmondia accipiens*. The specimen on which Etheridge founded *Sanguinolites granulatus*. Locality doubtful. In the Collection of Mr. J. Ward, F.G.S., of Longton. (Page 331.)

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Fig. 11.—*Edmondia accipiens*. A specimen showing an artificial oblique ridge, due to crushing. Posterior end almost perfect. Same locality. My Collection. (Page 331.)

Fig. 12.—*Edmondia accipiens*. A deep variety named *Unio parallelus* by Sowerby. Striæ more numerous and closer. Same locality. My Collection. (Page 331.)

Fig. 13.—*Edmondia accipiens*. A strongly sulcated variety. Same locality and Collection. (Page 331.)

Fig. 14.—*Edmondia accipiens*. The type specimen of Sowerby's *Unio Urei*. From the same locality. In the Collection of the Natural History Museum, South Kensington. (Page 331.)

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Fig. 16.—*Edmondia accipiens*. A specimen of Sowerby's *Unio parallelus*. Same locality. My Collection. (Page 331.)

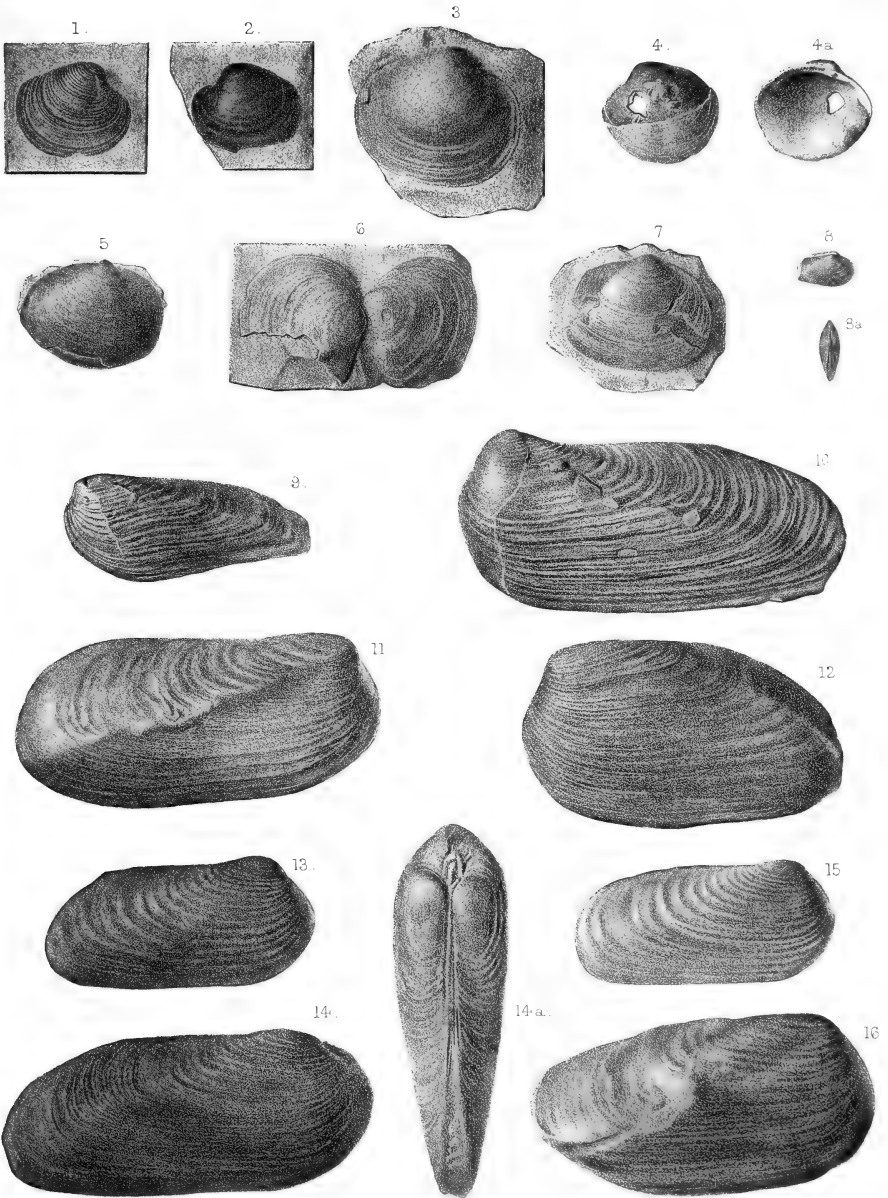


PLATE XXXVIII.

Fig. 1.—*Edmondia subplicata*. A specimen of a right valve to show contour. The outer coat of the shell has been removed by the waves. From the Calceiferous Sandstone series of Randerston, Fife. My Collection. (Page 315.)

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Fig. 3.—*Edmondia subplicata*. A testiferous example. Same locality and Collection. (Page 315.)

Fig. 4.—*Edmondia subplicata*. An almost complete right valve. Same locality and Collection. (Page 315.)

Fig. 5.—*Edmondia subplicata*. A left valve, with the outer shell removed. Same locality and Collection. (Page 315.)

Fig. 6.—*Mytilomorpha rhombea*. A left valve, from the Carboniferous Limestone of Wetton, Staffordshire. Purchased by grant from Royal Society to be placed in the Natural History Museum, South Kensington. (Page 340.)

Fig. 7.—*Mytilomorpha rhombea*. A right valve, from the Carboniferous Limestone of Poolvash, Isle of Man. Collected by Mr. Law. (Page 340.)

Fig. 8.—*Mytilomorpha rhombea*. The type specimen of Phillips's *Cypricardia rhombea*. A right valve from the Carboniferous Limestone of Bolland. In the Gilbertson Collection of the Natural History Museum, South Kensington. (Page 340.)

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Fig. 11.—*Mytilomorpha rhombea*. The cast of a very fine example of the left valve. In the Collection of Mr. Law. Same locality. (Page 340.)

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Fig. 18.—*Mytilomorpha angulata*. A right valve. Same locality and Collection. (Page 344.)

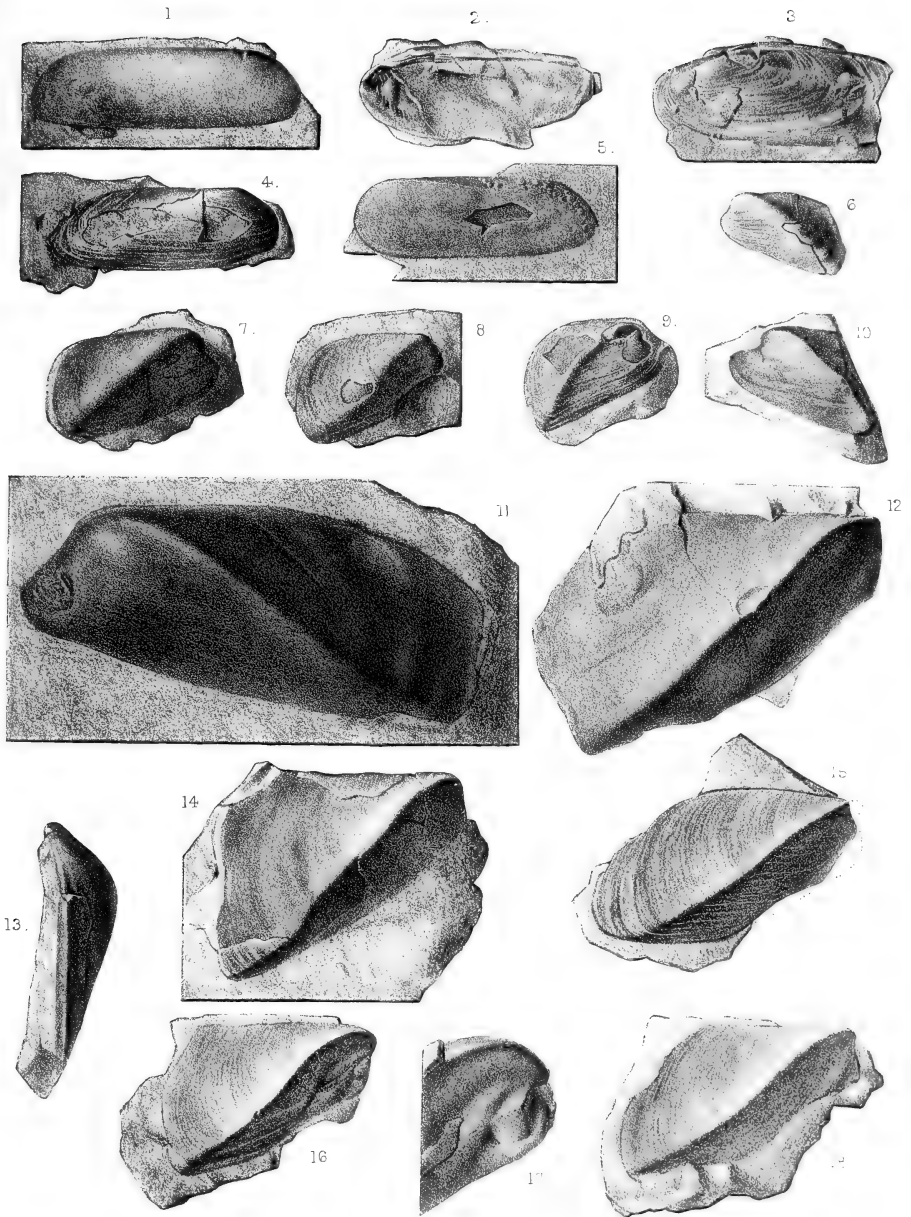
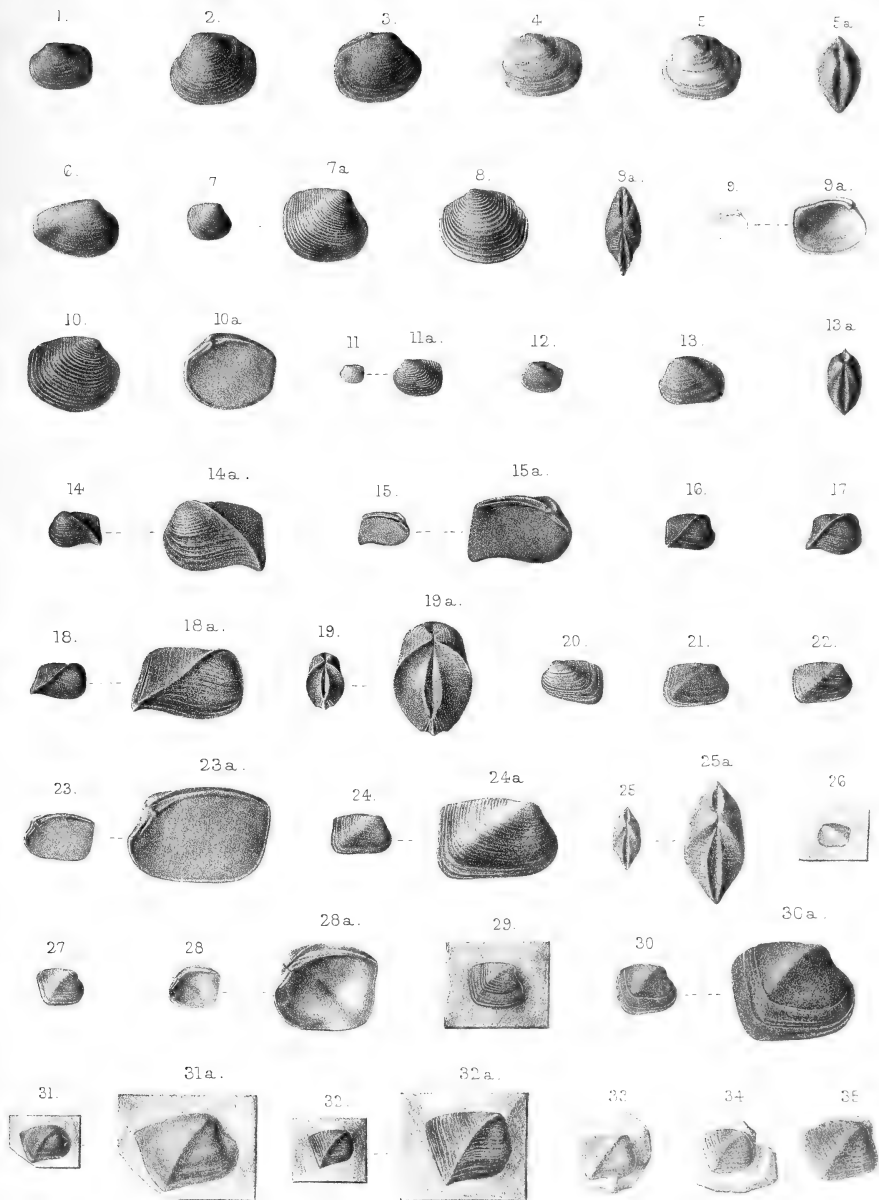




PLATE XXXIX.

- Fig. 1.—*Cypricardella parallela*. The type specimen of Phillips's *Venus parallela* from the Carboniferous Limestone of Bolland. In the Gilbertson Collection, Natural History Museum, South Kensington. (Page 348.)
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- Fig. 8.—*Cypricardella concentrica*. A fine full-grown shell from the Lower Limestone series of Craigen Glen. In the Collection of Mr. J. Neilson, with a view, Fig. 8*a*, of the lunule, umbones, and escutcheon. (Page 350.)
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THE

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L O N D O N :

MDCCCXCIX.



A MONOGRAPH

ON THE

INFERIOR OOLITE AMMONITES

OF

THE BRITISH ISLANDS.

BY

S. S. BUCKMAN, F.G.S.,

HONORARY MEMBER OF THE YORKSHIRE PHILOSOPHICAL SOCIETY; HONORARY SECRETARY OF THE COTTESWOLD
NATURALISTS' FIELD CLUB, ETC.

PART XI.

SUPPLEMENT:

II.—REVISION OF, AND ADDITION TO, THE HILDOCERATIDÆ.

PAGES xxxiii—lxiv; PLATES V—XIV.

LONDON:

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general characters nearest to *Phymatoceras*, but lacks the bisulcate periphery found in the stenogyral species of that genus; besides, the carina is small and non-septate.

3. BRODIEIA? WITCHELLI, *S. Buckman*. Plate XXIII, figs. 9, 10.

1889. LUDWIGIA sp., This Monogr., Pl. xxiii, figs. 9, 10.

Description.—Substeno-leptogyral, excentrumbilicate, parvinodate,¹ rursiflexicostate, parvi-nonsepti-carinate.

Localities and Stratum.—Gloucestershire: Nailsworth (Cotteswold Sands—E. Witchell, F.G.S., the figured specimen); Standish Beacon (Cotteswold Sands).

Date of Existence.—*Variabilis* hemera.

While this sheet is passing through the press, Mr. G. C. Crick, F.G.S., informs me that a genus "*Brodia*" is already in use for fossil insects. Therefore it is necessary to substitute *Brodiceras* for *Brodieia* above.

The Genus *Lioceras* and opalinoid Ammonites.

There is very considerable trouble here, and so it is necessary to make the following prefatory remarks:

Hyatt established the genus *Lioceras*, and referred thereto eight species of what may be called platyleptogyral, angustumbilicate, striate or subcostate Ammonites. Bayle employed it as a generic designation in a somewhat similar manner, but omitted therefrom the species *opalinus*, which he referred to *Ludwigia*.

When I discussed the genus *Lioceras*² I selected from Hyatt's original series three species which, as it seemed to me, possessed genetic affinity. From these three species I chose *opalinus* to be the type of the genus. Of the remainder of Hyatt's original series I placed *lythensis* as the type of another genus, *Pseudolioceras*; *discoides* as the type of yet a third genus, *Polyplectus*; while in a later communication I gave definite restriction to the genus *Harpoceras*, constituting *falcifer* as its type species: that genus would probably embrace the remainder of Hyatt's original series.

So far the matter is sufficiently straightforward. *Opalinus* is the type of *Lioceras*, although its selection for that position was founded on more than one misconception, particularly a mistake as regards the genetic affinity of the species

¹ The nodi are a little elongate in the direction of the costæ.

² This Monogr., p. 12.

associated with it. But it is desirable that that should not affect the selection when once made. The difficulty is to identify *opalinus*.

There are a number of platyleptogyral, striate Ammonites which have been regarded as *opalinus*: the figures by different authors bear testimony to that. They are all very like one another; but, first, there are differences in umbilication. All the latumbilicate forms may be at once excluded, for *opalinus* is angustumbilicate,—in fact, practically subconcaui-umbilicate. Secondly, examination of the remaining series reveals differences in the curve of the radial line.

Of the radial line there are at least two distinct types, as shown by the figures appended. Suppl., Fig. 1, is from a Cotteswold specimen figured as *opalinus*. It has a longer peripheral projection and a rather straighter course on the lateral area than Fig. 2, taken from a Dorset specimen which has hitherto been supposed to be the same species.

FIG. 1.



FIG. 2.



FIG. 3.



FIG. 4.



FIG. 1.—Radial line of *Cypholicoeras opaliniforme*.
 FIG. 2.—Radial line of *Lioceras opalinum*.
 FIG. 3.—Outline of mouth-border of *Cypholicoeras opaliniforme*.
 FIG. 4.—Outline of mouth-border of *Lioceras aff. partitum*.

Which of these two types agrees with Reinecke's *opalinus* it is impossible to say, for the radial curves in his drawing are obviously incorrect. So far as that matter is concerned Reinecke's figure must be put out of court. It is right, then, to take as type of *opalinus* the next specimen so identified, provided that it otherwise agrees with Reinecke's example. This happens to be Quenstedt's, in 'Ceph.,' pl. vii, fig. 10. It has a radial line agreeing with that of Fig. 2.

This, then, is the position arrived at. *Opalinus* is the type species of *Lioceras*,

and Quenstedt's¹ fig. 10 in pl. vii of his 'Cephalopoden' is regarded as the arbiter of what is *opalinus*.

There is, however, further trouble. The *opalinus* as now identified occurs at a higher horizon—it lived at a later date—than what I regarded, in part, as *opalinus* before, so that the term "*opalinus* beds" must be rejected, and the heneral nomenclature must be altered in accordance with the present conclusions.

The annexed table gives the strata of the Cotteswolds and of the South Dorset coast, which were deposited during four hemeræ; and it will therefore show the relative dates of *opalinus* and of opalinoid species.

Date.	Stratal succession.	
	COTTESWOLDS.	SOUTH DORSET COAST, generalised.
<i>Murchisonæ</i>	Pea-grit series, with <i>Amm.</i> of the <i>Murchisonæ</i> type.	Ironshot Limestone = the "Wild Bed" of Chideock Quarry, with <i>Amm.</i> of the <i>Murchisonæ</i> type.
<i>Scissi</i>	Sandy ferruginous Limestone with <i>Tmetoceras scissum</i> and <i>Lioceras</i> species.	Bluish-grey Limestone with <i>Tmetoceras scissum</i> and <i>Lioceras</i> species.
<i>Opaliniformis</i>	Hard ironshot Limestone capping the Cephalopod-bed, with opalinoid species = <i>Cypholioceras</i> .	Yellow sands with opalinoid species = <i>Cypholioceras</i> .
<i>Aalensis</i>	Ironshot marly stone of the Cephalopod-bed, with species of the <i>aalense</i> type.	Yellow sands with species of the <i>aalense</i> type.

The genus *Lioceras* and its species may now be considered in detail.

VII. Genus—LIO CERAS, Hyatt.

(Type: LIO CERAS OPALINUM, Reinecke sp.)

1867. LIO CERAS, Hyatt, Foss. Ceph., Bull. Mus. Comp. Zool., p. 101 (pars).

1887. — This Monogr., pp. 12, 21 (pars).

Definition.—Platyleptogyral, angustumbilicate; subdensiseptate, subbrevisangustilobate; laterally flexiradiate; peripherally subanguliradiate, subacutifastigate, parvi-nonsepti-carinate.

History.—See the prefatory remarks, p. xxxiii.

¹ Quenstedt himself confused several species as *opalinus*. In the 'Jura' he figures two forms which show differences of radial curve, and in his 'Schwäbischen Amm.' he depicts not only forms with differences of radial curve, but also lat- and angust-umbilicate examples, all as *opalinus*.

Literature.—Few species of this genus, as it is now restricted, have been figured. The following may be noticed :

- COMPTUS, NAUTILUS, *Reinecke*, *Maris protog. Naut. et Argon.*, pl. i, figs. 5, 6.
 COSTULA, AMMONITES, *Dumortier*, *Bassin du Rhône*, iv, pl. li, figs. 1, 2.
 ELEGANS, AMMONITES, *Vacek*, *Ool. Cap San Vigilio*; *Abb. k. k. Geol. Reichs.*, Bd. xii, pl. vii, fig. 17. Somewhat doubtful.
 MEANDRUS, NAUTILUS, *Reinecke*, *Maris protog. Naut. et Argonautas*, pl. i, figs. 3, 4.
 OPALINUS, AMMONITES, *Quenstedt*, *Ceph.*, pl. vii, fig. 10.
 — — — *Der Jura*, pl. xlv, fig. 10. Somewhat doubtful in radial curve.
 — — — *Schwäbischen Amm.*, pl. lv, fig. 1. Somewhat doubtful.
 — COSTOSUS, AMMONITES, *Quenstedt*, *ibid.*, pl. lv, fig. 20.
 OPALINUM, HARPOCERAS, *Wright*, *Monogr. Lias Amm.*, *Pal. Soc.*, pl. lxxx, fig. 4.
 OPALINUS, NAUTILUS, *Reinecke*, *Maris protog. Naut. et Argon.*, figs. 1, 2.

Correction.—Nearly all the specimens inscribed as *Lioceras* in the body of this work must be removed from that position.

Specific Characters.—The species to be described in this genus may be divided by their surface ornamentation into the following groups :

A. Costate.	B. Subcostate.	C. Striate.	D. Renovate.
uncinatum	bifidatum	grave	comptum
uncum	undulatum	lineatum	
costosum	plectile	opalinum	
subcostosum	plicatellum	striatum	
gracile	partitum		
	Thompsoni		

A. Species in the costate stage.

1. LIOCERAS UNCINATUM, *S. Buckman*. *Suppl.*, Plate V, figs. 7—11.

Cf. ? 1874. AMMONITES COSTULA, *Dumortier* (non *Reinecke*), pt. 4, pl. li, figs. 1, 2.

1885. HILDOCERAS MURCHISONÆ, *Haug*, *Beitr. Monogr. Harpoceras*; *Neues Jahrbuch für Mineral., &c., Beil.-Bd. iii*, p. 687 (pars ?).

Description.—Platyteptogyral, gradumbilicate, flexicostate.

Distinction.—From *Ammonites costula*, *Dumortier*, less umbilicate and less distantly costate. From *Hildoceras connectens*, *Haug*, less umbilicate, differently ornate; and, so far as can be judged from the figure, *connectens* has a more pronounced peripheral projection of the radii.

Localities and Strata.—Dorset: Burton Bradstock (grey limestone above the

yellow sands); Stoke Knap (sandy grits, about the horizon of *Terebratula infra-oolithica* and *Rhynchonella Stephensi*).

Date of Existence.—*Scissi* hemera.

2. LIOCERAS UNCUM, *S. Buckman*. Suppl., Plate VI, figs. 8—10.

Platyteptogyral, gradumbilicate, flexi-subparvicostate.

Distinction.—From *uncinatum*, less costate and less umbilicate.

Note.—The costæ are by no means so strongly marked as in *uncinatum*, and they show signs of degeneration when those of that species are well developed.

Locality and Stratum.—Burton Bradstock (in the grey limestone above the yellow sands).

Date of Existence.—*Scissi* hemera.

3. LIOCERAS COSTOSUM (*Quenstedt*). Suppl., Plate VI, figs. 1—4.

1886. AMMONITES OPALINUS COSTOSUS, *Quenstedt*, *Amm. Schwab. Jura*, pl. lv, fig. 20.

Description.—Platyteptogyral, gradumbilicate, flexi-subparvicostate.

Distinction.—From *uncinatum*, less umbilicate; from *uncum*, umbilicus is slightly larger and less sparsicostate.

Note.—The costæ visible in the umbilicus are closer together and not so large as those of *uncum*.

Localities and Strata.—Dorset: Burton Bradstock, in grey limestone above the sands; Symonds bury, in yellowish-grey limestone with *Tmetoc. scissum*, below *Zeilleria anglica* and *Amm.* of the *Murchisonæ* type.

Date of Existence.—*Scissi* hemera.

4. LIOCERAS SUBCOSTOSUM, *S. Buckman*. Plate XX, figs. 11, 12; Suppl., Plate VI, figs. 5—7.

1889. LUDWIGIA COSTOSA, *This Monogr.*, Pl. xx, figs. 11, 12.

Description.—Platyteptogyral, subgradumbilicate, flexi-subparvicostate, peripherally subacutifastigate.

Distinction.—From *costosum*, less umbilicate and more compressed.

History.—Figured and described in the body of this work as *Ludwigia costosa*, identified with *Am. opalinus costosus*, Quenstedt. But it is distinctly thinner than the preceding species, which is now, with better reason, identified therewith.

Localities and Strata.—Dorset: Burton Bradstock, with the foregoing. Somerset: Stoford, near Yeovil, in a bluish-grey limestone.

Date of Existence.—*Scissi* hemera.

5. *LIOCERAS GRACILE*, *S. Buckman*. Suppl., Plate VI, figs. 11—13.

Description.—Platyleptogyral, subconcaumbilicate, flexi-subparvicostate.

Distinction.—Less umbilicate than any of the foregoing species.

Locality and Stratum.—Burton Bradstock, with the preceding species.

Date of Existence.—*Scissi* hemera.

B. Species which show a costate followed by a striate stage.

They are distinguished from any of the foregoing by the costæ changing to striæ at a fairly early period of growth.

6. *LIOCERAS BIFIDATUM*, *S. Buckman*. Suppl., Plate VII, figs. 1—6.

Description.—Platyleptogyral, gradumbilicate, flexicostate, changing to flexistriate.

Remarks.—The costate stage gives place to a striate stage, in which the ribs are only partially developed. Later the ribs appear only as somewhat irregular wave-like bulgings developed in the middle of the lateral area.

Locality and Stratum.—Burton Bradstock, with the foregoing species.

Date of Existence.—*Scissi* hemera.

7. *LIOCERAS Plicatellum*, *S. Buckman*. Suppl., Plate VIII, figs. 10—12 ;
Suppl., Plate IX, figs. 7—9.

Description.—Platyleptogyral; subconcaumbilicate, becoming excentrumbilicate in adult; flexistriate.

Remarks.—The costate stage gives place at an early date to a striate stage.

Distinction.—The costate stage is shorter, and changes to striate more completely than in *bifidatum*.

Localities and Strata.—Dorset: Burton Bradstock, with the preceding species; Gloucestershire: Stinchcombe, in the sandy ferruginous beds above the Cephalopod-bed; Leckhampton Hill, similarly (Mr. J. F. Walker, F.G.S.).

Date of Existence.—*Scissi* hemera.

8. LIOCERAS UNDULATUM, *S. Buckman*. Suppl., Plate IX, figs. 1—3, and ? figs. 13, 14.

Description.—Platyteptogyral, excentri-gradumbilicate, flexiradiate—costate and striate.

Distinction.—More umbilicate than the two preceding species.

Locality and Stratum.—Burton Bradstock, with the preceding species.

Date of Existence.—*Scissi* hemera.

9. LIOCERAS PLECTILE, *S. Buckman*. Suppl., Plate IX, figs. 10—12.

Description.—Platyteptogyral, excentri-gradumbilicate, flexiradiate—sparsiparvicostate, and striate.

Distinction.—Less umbilicate than *undulatum*. More umbilicate and differently ornate to *plicatellum*.

Locality and Stratum.—Burton Bradstock, with the foregoing species.

Date of Existence.—*Scissi* hemera.

10. LIOCERAS PARTITUM, *S. Buckman*. Plate XIII, fig. 11; Plate XIV, figs. 3, 4; Suppl., Plate IX, figs. 4—6.

1888. LIOCERAS OPALINUM, *var. COMPTUM*, This Monogr., Pl. xiii, fig. 11; Pl. xiv, figs. 3, 4.

Description.—Platyteptogyral, excentri-gradumbilicate, flexistriate, with costæ developed at intervals, but these costæ fail in the adult.

Distinction.—More excentriumbilicate than the other species. From *plectile*, more compressed.

Locality and Stratum.—Dorset: Burton Bradstock, with the other species.

Date of Existence.—*Scissi* hemera.

11. LIOCERAS THOMPSONI, *S. Buckman*. Suppl., Plate VII, figs. 13—16.

Cf. ? 1818. NAUTILUS MEANDRUS, *Reinecke*, pl. i, figs. 3, 4.

Description.—Platyleptogyral, subgradumbilicate, flexiradiate—striate and parvicostate.

Distinction.—From *partitum*, thicker, more ornate, and concentumbilicate; from *bifidatum*, less umbilicate, less costate, thicker.

Remarks.—It is just possible that this species may be the *Am. mæandrus* (*Reinecke*); but, considering how very inferior is that author's figure, it seems preferable to definitely give this species a distinct name than to hazard a most speculative identification. If *Reinecke's* specimens were in existence it would be another matter, but they are not; and the most diverse views have been expressed not only as to the identification of *mæandrus*, but as to what stratum it came from. Thus *Quenstedt* says that the original locality, "Langheim, would indicate the *Ornat* beds"¹ (Oxford clay); while *Zieten* figures as *mæandrus*² what appears to be *Oxynotoceras oxynotus*, which would be from the Lias. Under these circumstances it is advisable not to attempt any identification of *Reinecke's* figure.

Accordingly I name this species in compliment to Mr. Beeby Thompson, F.G.S., who has done such good work among the Liassic rocks of Northamptonshire. I am indebted to him for very kindly adding this and several other good Ammonites to my collection.

Localities and Strata.—Northamptonshire: Duston, near Northampton, in the sands of that name. Dorset: Burton Bradstock, with the other species.

Date of Existence.—*Scissi* hemera.

C. Species which have reached the striate stage.

12. LIOCERAS LINEATUM, *S. Buckman*. Suppl., Plate VIII, figs. 1—3.

Description.—Platyleptogyral, costati-gradumbilicate, flexistriate.

Note.—The remains of the costate stage may be seen in the bulgings visible in the umbilicus.

Distinction.—The umbilicus is more coarsely costate than in *Thompsoni*.

¹ 'Amm. Schwäb. Jura,' p. 442.

² 'Verstein Württ.,' pl. ix, fig. 6.

Locality and Stratum.—Dorset: Burton Bradstock, in the same bed as the other species.

Date of Existence.—*Scissi* hemera.

13. LIOCERAS GRAVE, *S. Buckman*. Suppl., Plate VIII, figs. 4—6.

Description.—Platyleptogyral, concavumbilicate, flexistriate.

Distinction.—From all other species by the concavumbilicus.

Locality and Stratum.—Dorset: Burton Bradstock, with the other species.

Date of Existence.—*Scissi* hemera.

14. LIOCERAS OPALINUM (*Reinecke*). Suppl., Plate X, figs. 6—8.

1818. NAUTILUS OPALINUS, *Reinecke*, *Maris Protog.*, figs. 1, 2.

1849. AMMONITES OPALINUS, *Quenstedt*, *Die Ceph.*, pl. vii, fig. 10.¹

Description.—Platyleptogyral, subconcavumbilicate, flexistriate.

Note.—There is a slight fasciation of the radii, giving the test a somewhat wavy appearance.

Distinction.—In umbilication it is most like *grave*, but it is much more compressed than that species. In the matter of ornament there is considerable similarity to *Thompsoni*, but the umbilicus is distinctly smaller, showing practically no gradumbilicate character until excentricity begins. It therefore does not show the small costæ in the umbilical whorls which are noticeable in *Thompsoni*.

Remarks.—*Quenstedt*'s figure is taken as the type for the reasons which have been already stated (p. xxxiv). It is considered as supplementing *Reinecke*'s in the detail of the radial line.

Correction.—The appellation of the specimens called *Lioceras opalinum* in the body of the work must now be altered. (See syn. of other species of this genus, of *Cypholioceras opaliniforme*, &c.)

Locality and Stratum.—Dorset: Burton Bradstock, with the preceding species.

Date of Existence.—*Scissi* hemera.

¹ Of the other figures of platyleptogyral, angustumbilicate, striate Ammonites quoted by the specific name *opalinus* in the synonymy given in this Monograph, p. 35, many are evidently distinct from this genus as now defined on account of the radial line, so far as its course can be judged from the figures, and none probably belong to this species.

15. *LIOCERAS STRIATUM*, *S. Buckman*. Plate XIII, figs. 6, 12; Suppl., Plate X, fig. 10.

1884. *HARPOCERAS OPALINUM*, *Wright*, Monogr. Lias Amm., Pal. Soc., pl. lxxx, fig. 4 (?).

1888. *LIOCERAS OPALINUM*, This Monogr., Pl. xiii, fig. 6.

1888. *LIOCERAS* between *OPALINUM* and *COMPTUM*, Pl. xiii, fig. 12.

Description.—Platyteptogyrul, gradumbilicate, flexistriate.

Distinction.—Like *opalinum*, but with a wider umbilicus. The peripheral area is a little less acutely fastigate. There is a similar fasciation to what obtains in *opalinum*, but it is scarcely noticeable in the young shell, which appears simply striate. This appearance distinguishes it from other gradumbilicate species, which are costate in the umbilicus—for instance, *undulatum*, which it resembles in its proportions.

Remarks.—From the figure only I cannot say if Dr. Wright's specimen belongs to this species, or even to this genus; but it agrees in proportions: all depends on the radial line.

Localities and Strata.—Dorset: Burton Bradstock, with the other species. Gloucestershire: Penn Wood, near Stroud (sandy ferruginous limestone); Frocester Hill.

Date of Existence.—*Scissi* hemera.

16. *LIOCERAS* sp. Plate XIV, figs. 1, 2; Suppl., Plate X, fig. 9.

1888. *LIOCERAS OPALINUM*, var. *COMPTUM*, This Monogr., Pl. xiv, figs. 1, 2.

Distinction.—From *opalinum*, by being thicker and having a smaller umbilicus with the excentricity commencing earlier. From *grave*, by a smaller umbilicus.

Locality and Stratum.—Dorset: Burton Bradstock, with the other species.

Date of Existence.—*Scissi* hemera.

D. Species which have reached the renovate stage.

Distinguished from all other species of the genus by the ornament increasing instead of decreasing with growth—a costate stage succeeding a striate stage.

17. *LIOCERAS COMPTUM* (*Reinecke*). Suppl., Plate VII, figs. 7—12.

1818. *NAUTILUS COMPTUS*, *Reinecke*, *Maris protog. Naut. et Argon.*, pl. i, figs. 5, 6.

Description.—Platypleptogyral, subexcentri-angustumbilicate, flexistriate becoming flexicostate; subdensiseptate, subinornatilobate.

Remarks.—The identification of the figured specimens with *Reinecke's comptus* seems to be justifiable. His figure certainly shows a flexistriate shell which is, comparatively with other species of this genus, somewhat latumbilicate, somewhat pachygyral. These comparative characters seem to be very closely approached in the small specimen depicted in Suppl., Pl. VII, figs. 7, 8.

It will be noticed that the identification of *comptum* in the body of the work has now undergone considerable revision. Some of the forms identified therewith are not sufficiently umbilicate, others too thin or too costate.

Localities and Strata.—Dorset: Burton Bradstock, with the foregoing species; Beaminster, in an oolitic limestone.

Date of Existence.—*Scissi* hemera.

By the kindness of Mr. L. Brasil, of Caen, I have seen specimens from Normandy of this genus, as now restricted. They represented the species *uncinatum* and *gracile*; and others were allied to *uncum*, *gracile*, and *costosum*.

VIII. Genus—CYPHOLIOCERAS,¹ *S. Buckman*.

(Type—*Cypholioceras plicatum*, sp. n.)

1887. *LIOCERAS*, This Monogr., pp. 12, 21 (pars).

Definition.—Platypleptogyral, angustumbilicate; subdensiseptate, subbrevilatilobate; laterally flexiradiate; peripherally acutanguliradiate, subacutifastigate, parvi-nonsepti-carinate.

Note.—The definition is drawn up from the type, except the part which refers to the suture-lines; that is taken from a specimen of *C. opaliniforme*, and its suture-line is figured in p. 36 with the appellation *Lioceras opalinum*.

Distinction.—Separable from *Lioceras* as now defined and restricted, by the longer peripheral projection of the radii (see figs. 1, 2, p. xxxiv); also when the outlines of the body-chamber edge of adult specimens of the two genera are compared

¹ *Kyphós*, bent.

it will be seen that the present genus has a distinctly longer peripheral projection—in other words, is more decidedly rostrate—than is *Lioceras*. The woodcuts, figs. 3, 4, p. xxxiv, illustrate the difference in this respect between homœomorphs of the two genera.

History.—Species of this genus, together with species of *Lioceras*, were described as *Lioceras opalinum* in the body of the work, and consequently taken as types of the genus *Lioceras*, p. 21. For remarks thereon see p. xxxiii.

Geological Position.—The striate species of this genus occur in Dorset in the top part of the Yeovil Sands, underneath the limestone with *Tmetoceras*; and in Gloucestershire in the hard ironshot limestone capping the Cephalopod-bed,—that is in bed No. 15, sect. v, p. 43, and No. 4, sect. vi, p. 45, and underneath the sandy ferruginous limestone. (See p. xxxv.)

Remarks.—The genus, of which only a few species are known, presents certain shells comparable to the striate and renovate series of *Lioceras*, which, however, they preceded in point of time. So the species to be now described form part of a series obviously parallel to *Lioceras*, but earlier in date. The likeness of *Cypholioceras* to *Lioceras* has given much trouble in correlation of strata.

1. *CYPHOLIOCERAS*? *VITIOSUM*, *S. Buckman*. Suppl., Plate V, figs. 1, 2.

Description.—Steno-subleptogyral, latumbilicate; laterally flexicostate; peripherally angulistriate, subtabulate.

Remarks.—The costæ are connate near the edge of the inner margin, forming a short, slightly stouter rib. Only fragments of the body-whorl of this species have been found, and the pieces figured do not therefore belong to the same specimen.

The placing of this species in the genus *Cypholioceras* must be considered as doubtful. It is a possible ancestor of *plicatum*, allowing that increase of the peripheral projection of the radius accompanied increased compression.

Locality and Stratum.—Gloucestershire: Standish Beacon, in marl with *Terebratula haresfieldensis*.¹

Date of Existence.—*Dumortierix* hemera.

¹ It is the bed 19 of the section v (p. 44). In this bed the Ammonites are mostly fragmentary and in poor condition. The *Gramm. striatum* quoted is a mistake for *Dumortieria* (see p. 166).

2. CYPHOLIOCERAS? PIGRUM, *S. Buckman*. Suppl., Plate V, figs. 3, 4.

Description.—Subplaty-subleptogyral, sublatumbilicate; laterally flexicostate; peripherally angulistriate, subtabulate.

Remarks.—The costæ are occasionally connate, as in the last species.

The placing of this species in *Cypholioceras* is doubtful. It would not be the link between *vitiosum* and *plicatum*, but would indicate an incipient departure in another direction.

Distinction.—From *vitiosum*, smaller umbilicus, less prominent costæ.

Locality and Stratum.—With the preceding species. Only fragments of body-whorls have been obtained.

Date of Existence.—*Dumortieria* hemera.

3. CYPHOLIOCERAS PLICATUM, *S. Buckman*. Suppl., Plate VIII, figs. 7, 9.

Description.—Platyleptogyral, costati-gradumbilicate, flexistriate.

Note.—The portions of the whorls visible in the umbilicus show that the species is costate in youth.

Distinction.—The species is exactly comparable with *Lioceras lineatum*, and is almost in the same stage of development. It is separable not only by the radial curve, but by the difference of striation—the striæ are coarse and much more distant.

Locality and Stratum.—Gloucestershire: Haresfield Hill, in the hard bed below the sandy ferruginous beds. See above, p. xxxv.

Date of Existence.—*Opaliniformis* hemera.

4. CYPHOLIOCERAS OPALINIFORME, *S. Buckman*. Plate XIII, figs. 1—3; Plate A, fig. 10; Suppl., Plate X, figs. 1—4.

1888. LIOCERAS OPALINUM, This Monogr., Pl. xiii, figs. 1—3; Pl. A, fig. 10; p. 36, fig. 1.

Description.—Platyleptogyral, concavi-excentrumbilicate, flexistriate.

Distinction.—From *plicatum*, by umbilication and ornament, the striæ being much finer. It is exactly comparable with *Lioceras opalinum*; but besides the difference of the radial curve, it may be noticed that the umbilicus is more concave with sides less steeply sloped, and that the striæ are not fasciated.

History.—Figured and described in the body of the work with other platyleptogyral, angustumbilicate species, as *Lioceras opalinum*. A study of the radial

curves points out that small differences in mode of growth and ornamentation cannot be disregarded, and that a separation on the present lines is imperative.

Remarks.—The specimen depicted in Pl. XIII, figs. 1, 2, is a fine shell. It shows distinctly the amount of the overlap of what is called the dorsal fold of the mantle—on the commencement of the ultimate whorl; but this has not been brought out in the drawing.

Locality and Stratum.—Haresfield Hill, with the preceding species.

Date of Existence.—*Opaliniformis* hemera.

Note.—What has been hitherto called *opalini* hemera—the date of the deposition of beds with a species supposed to be *opalinus*—may now be known, to avoid undue change, by the term *opaliniiformis* hemera.

5. CYPHOLIOCERAS aff. OPALINIFORME.

1884. HARPOCERAS OPALINUM, *Wright*, Monogr. Lias Amm. Pal. Soc., pl. lxxx, figs. 6—8.

Note.—Wright's figures appear to depict a distinctly stouter specimen than my type of *opaliniiforme*. Except for umbilication it is a homœomorph of *Lioceras grave*.

Locality and Stratum.—"Haresfield Hill" (*Wright*) [and from the same bed as the other species].

6. CYPHOLIOCERAS RENOVATUM, *S. Buckman*. Plate XIV, figs. 7—9; Suppl., Plate X, fig. 5.

1888. LIOCERAS sp. ?, This Monogr., Pl. xiv, figs. 7—9.

Description.—Platyleptogyral, excentri-angustumbilicate, flexistriate changing to flexicostate.

Note.—The central part of the umbilicus is very small, and concave. Then excentricity commences, and soon afterwards there is the change from striæ to costæ.

Distinction.—Quite separable from the other species of the genus by umbilication and ornament. It is a "renovate" species, somewhat comparable to *Lioceras comptum*, so far as change of ornament is concerned, otherwise there is no likeness.

It is very similar to *Lioceras* sp., No. 16, and exact comparison is not easy. In this case, however, there seems to be, in addition to the longer peripheral projection to the radius, a less distinct carina.

Locality and Stratum.—Haresfield Hill, with the preceding species.

Date of Existence.—*Opaliniformis* hemera.

IX. Genus—*ANCOLIOCERAS*,¹ *S. Buckman*.(Type—*Ancolioceras substriatum*, sp. n.)

Definition.—Platyteptogyral, angustumbilicate; subdensiseptate, subbrevisublatilobate; laterally subflexiradiate; peripherally acutanguliradiate, subacutifastigate, subalti-nonsepti-carinate.

Distinction.—From *Lioceras*, the radial line is straighter laterally and more projected peripherally; the suture-line has shorter lobes; the carina is more distinctly prominent. From *Cypholioceras*, the radial line is straighter laterally, scarcely so projected peripherally, and the carina is more distinctly separated.

Remarks.—This is a third series of Lioceratoids, occurring at a later date than *Lioceras* or *Cypholioceras*. From them it is distinguishable by slight differences in the curvature of the radial line. Unfortunately the material is scanty, but it is sufficient to indicate that these differences would be associated with another very distinctive feature—an elevated carina.

The scanty material shows that if the series were complete there would be species in three stages of development—tuberculate, costate, costatistriate; and inferentially in a fourth, striate.

Although the species of this genus occur at a later date than *Lioceras* or *Cypholioceras*, yet one of them indicates an earlier stage of development than is seen in either of those genera—the tuberculate stage.

FIG. 5.—Radial line
of *Ancolioceras*
substriatum.

1. *ANCOLIOCERAS CARINIFERUM*, *S. Buckman*. Suppl., Plate XI, figs. 7—9.

Description.—Subplatyteptogyral, sublatumbilicate, flexi-suberassi-costate, bullate, subalticarinata.

Remarks.—The bullæ are placed round the edge of the umbilicus, along the top of the inner margin. A bulla gives rise to two costæ, and there is between two groups of bullicostæ a single costa, which is obsolete in the area where the others join a bulla.

Distinction.—The rather strongly elevated nonsepti-carina forms a particular feature separating this shell from other tuberculate species; and the radial curve must also be considered.

¹ "Αγχοσ, a bend.

Locality and Stratum.—Dorset: Mapperton, near Beaminster, evidently from near the base of the Inferior Oolite limestone.

Date of Existence.—*Murchisonæ* hemera.

2. ANCOLIOCERAS SUBSTRIATUM, *S. Buckman*. Suppl., Plate VI, figs. 14—16.

Description.—Platypleptogyral, subconcaumbilicate, laterally subflexicostate passing into substriate.

Remarks.—In the costate stage the ornament is, in design, similar to that of the previous species, only the bulla has lengthened out into a rib. In degree it is less, and it changes rather quickly to what is little more than a striate stage. In this stage there are not the intermittent bulges seen in *Lioceras*. As this species is the homœomorph of *Lioceras bifidatum*, and as *cariniferum* is less developed than *L. uncinatum*, it may be surmised that there are at least three species separating this one from the last—forms corresponding to *uncinatum*, *uncum*, and *gracile*.

Locality and Horizon.—Dorset: Stoke Knap, in the “Bottom Bed,” as the quarrymen term it—the bed below the “Building Stone.”

Date of Existence.—*Murchisonæ* hemera.

3. ANCOLIOCERAS? COSTATUM, *S. Buckman*. Plate VII, fig. 7; Plate A, fig. 11; Suppl., Plate XVII, fig. 30.

1888. *LIOCERAS AMBIGUUM*, var. *COSTATUM*, This Monogr., Pl. vii, fig. 7; 1889, Pl. a, fig. 11.

Description.—Platypleptogyral, excentrumbilicate, parvi-subdensi-flexicostate.

Note.—In connection with the excentrumbilication the periphery becomes broader, more rounded, and less carinate.

Remarks.—The radial curve is similar to that of *Ancol. cariniferum* and *substriatum*, there being a rather long peripheral projection. There are, however, differences in points of detail in regard to the radial curve, costation, mode of growth, &c., which make the generic association doubtful.

Distinction.—From *substriatum*, character of costation, absence of striate stage.

Locality and Stratum.—Somerset: Haselbury, near Crewkerne, in the beds of the “lower division.”¹

¹ See Hudleston, ‘*Monogr. Gasteropoda*,’ p. 41. The species is probably from the first or second bed of the lower division.

Date of Existence.—*Bradfordensis*, or *Murchisonæ* hemera.


In the neighbourhood of Crewkerne there are several other species more or less allied to the last, and they seem to be somewhat peculiar to that district. Their preservation is too often inferior.

X. *Genus*—ASTHENOCERAS,¹ *S. Buckman*.

(Type—*Asthenoceras nannodes*, *S. Buckman*.)

Definition.—Stenoleptogyral, latumbilicate; laterally flexiradiate; peripherally anguliradiate, subfastigate, alti-septicarinate.

Distinction.—The thin whorls associated with a wide umbilicus and a septicarina distinguish this genus from any one described in this Supplement.

FIG. 6.—Radial line of *Asthenoceras nannodes*. 

Remarks.—The strong carination and the curvature of the radius may suggest affinity with *Ancolioceras*; but the wide umbilicus and the paucity of ornament forbid direct connection with *Anc. cariniferum*.

1. ASTHENOCERAS NANNODES, *S. Buckman*. Plate XXXIII, figs. 13—16; Suppl., Plate XI, fig. 28.

1890. GRAMMOCERAS NANNODES, This Monogr., Pl. xxxiii, figs. 13—16.

Remarks.—The radial curve is depicted in fig. 6 above, and also in Suppl., Pl. XI, fig. 28.

Date of Existence.—*Murchisonæ* hemera.

XI. *Genus*—CYLICOCERAS, *S. Buckman*.

(Type—*Cylicoceras undatum*, sp. n.)

Definition.—Platy-subpachygyral, subangustumbilicate, laterally subflexiradiate, peripherally obtusanguliradiate, subfastigate, non-septi-carinate.

Distinction.—From *Lioceras*, radial line—the peripheral projection is shorter: mode of growth—thicker in proportion to umbilication, periphery less acutely fastigate.

FIG. 7.—Radial line of *Cylicoceras undatum*. 

¹ Ἀσθενής, without strength, feeble.

1. CYLICOCERAS UNDATUM, *S. Buckman*. Suppl., Plate V, figs. 5, 6.

Description.—Given under genus; substitute costate for radiate.

Locality and Stratum.—Gloucestershire: Haresfield Hill (Bed 15 of Section v, p. 43).

Date of Existence.—*Opaliniformis* hemera.

XII. Genus—GEYERIA,¹ *S. Buckman*.

(Type—*Geyeria fasciata*, sp. n.)

Definition.—Platyleptogyral, subangustumbilicate; denseptate, subbrevisangustilobate; laterally flexiradiate; periphery anguliradiate, subtabulate, parvi-nonsepti-carinate.

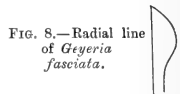


FIG. 8.—Radial line of *Geyeria fasciata*.

Distinction.—From *Lioceras* or *Cypholioceras*, greater densiseptation and the subtabulate periphery. From *Lioceras* or *Cylicoceras*, a difference of rib flexure—the longer peripheral projection; and from the latter, too, mode of growth—the greater compression proportionate to umbilication.

1. GEYERIA FASCIATA, *S. Buckman*. Suppl., Plate VI, figs. 17—19.

Description.—Platyleptogyral, subangustumbilicate, flexi-constrictocostate.

Locality and Stratum.—Dorset: Sherborne, in a greyish sandy matrix, not far above the Yeovil sands.

Date of Existence.—*Murchisonæ*, or possibly *scissi* hemera.

The following species has some resemblance, but it seems scarcely to be a *Geyeria*. The radial curve is more biarcuate, also there are characters of pauciseptation, brevilobation, and less compression.

2. GEYERIA? EVERTENS, *S. Buckman*. Suppl., Plate XI, figs. 10—12.

Description.—Platy-subleptogyral, sublatumbilicate; subparvicostate; periphery subfastigate, changing to subconvex, parvi-subacuticarinata.



FIG. 9.—Radial line of *Geyeria? evertens*.

¹ In honour of Dr. G. Geyer.

Note.—This is a very interesting species because, though the costæ are present, there are some obvious gerontic characters, namely, incipient excentrumbilication, correlated slight inflation of whorl, greater convexity of periphery, decay of carina, and shortening of rostration as shown by radial lines. The character of the septa may also be gerontic.

Locality and Stratum.—Dorset: Mapperton, near Beaminster, in a whitish stone, near base of limestone beds.

Date of Existence.—*Scissi* or *Murchisonæ* hemera.

XIII. Genus—WELSCHIA,¹ *S. Buckman.*

(Type—*Welschia obtusiformis*,² sp. n.)

Definition.—Platy-subpachygyral, angustumbilicate; subdensiseptate, sublongi-angustilobate; laterally subflexiradiate; peripherally subanguliradiate, subconvexi-fastigate, parvi-nonsepticarinata.

Distinction.—From *Cylicoceras*, the radial line is more curved and slightly more peripherally projected; the mode of growth is different—a small umbilicus is associated with thicker whorls, and the periphery is more tabulate.



FIG. 10.—Radial line of *Welschia obtusiformis*.

1. WELSCHIA OBTUSIFORMIS, *S. Buckman.* Plate I; Suppl., Plates IV, fig. 19; and XII, figs. 1—3 a (Type).

1887. LUDWIGIA MURCHISONÆ, This Monogr., Pl. i.

Description.—Platy-subpachygyral, angusti-gradumbilicate, costate.

Notes.—The large specimen, Pl. I, is just a trifle more umbilicate than the small one. Owing to its preservation it has been very difficult to trace its radial curve. The result given in Suppl., Pl. IV, fig. 19, may not be exactly accurate.

Mr. C. Upton has shown me a specimen from Chideock identifiable with this species, and about the size of the figured type; but it possesses only small costæ in the inner whorls. It is, perhaps, a case of temporary arrested development in youth.

¹ In honour of M. Jules Welsch.

² The type specimen of the genus is the one figured Suppl., Pl. XII, figs. 1—3.

Localities and Strata.—Dorset: Chideock Quarry Hill, in the Wild Bed; Bradford Abbas, in the Paving Bed.

Date of Existence.—*Murchisonæ* hemera.

2. WELSCHIA RUSTICA, *S. Buckman*. Suppl., Plate IV, figs. 16—18.

Description.—Platy-subpachygyral, angusti-gradumbilicate, parvicostate, subfastigate.

Distinction.—From *obtusiformis*, greater compression and less coarse ornament, particularly in the umbilicus. The periphery is more acutely fastigate. There is a slight difference in the radial curve.

Localities and Strata.—Dorset: Stoke Knap, near Broad Windsor, from the Building Stone; Louse Hill, near Sherborne, from the *ringens* bed, by matrix.

Date of Existence.—*Bradfordensis* hemera.

3. WELSCHIA PAGANA, *S. Buckman*. Plate XII, figs. 5—7; Suppl., Plate XI, fig. 32.

1888. LIOCERAS BRADFORDENSE, *var. GIGANTEUM*, This Monogr., Pl. xii, figs. 5—7.

Description.—Platy-subleptogyral, subgradumbilicate, parvicostate.

Note.—The last few ribs in this specimen are shown rather too coarsely.

Distinction.—From *rustica* smaller costæ.

Locality and Stratum.—Dorset: Stoke Knap in the Building Stone.

Date of Existence.—*Bradfordensis* hemera, presumably.

XIV. Genus—COSMOGYRIA,¹ *S. Buckman*.

(Type—*Cosmogyrria obtusa*,² Quenstedt, sp.)

Definition.—Platy-subpachygyral, angustumbilicate; subpaucisepate, longi-angustilobate; laterally subflexiradiate; peripherally subanguliradiate, tabulate, parvi-nonsepti-carinate.

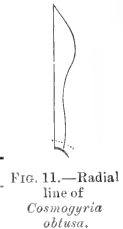


FIG. 11.—Radial line of *Cosmogyrria obtusa*.

¹ *Κόσμος*, ornament; *γῦρος*, a whorl.

² In case fault should be found with the identification, I select as the type of the genus the specimen now figured, Suppl., Pl. IV, figs. 10—12.

Distinction.—From *Welschia*, the suture-line has longer and narrower lobes, the periphery is more tabulate, and the ornament is coarser.

1. COSMOGYRIA OBTUSA (*Quenstedt*). Suppl., Plate IV, figs. 10—12 *d*.

1849. AMMONITES MURCHISONÆ OBTUSUS, *Quenstedt*, *Ceph.*, pl. vii, fig. 12.

Description.—Platy - subpachygyral, angustumbilicate, subcrassi - subpaucicostate.

Remarks.—The distinctive features of *Quenstedt*'s figure are—stout whorls and a small umbilicus, costæ almost straight across the lateral area, fairly large and somewhat distant, a very distinctly flattened periphery wherein the carina seems a trifle sunk, a rather long and narrow superior lateral lobe. It seems that the specimen now figured agrees with *Quenstedt*'s delineation in all these details.

Although so like *obtusiformis* in its general appearance and proportions, yet as the degree of ornamentation and the shape of the periphery are different, it cannot be the same species; and as the suture-line is certainly different, while the radial line is somewhat so, it cannot be placed in the same genus.

Locality and Stratum.—Somerset: Dundry Hill, the west end, from a rather hard, greyish-brown ironshot limestone.

Date of Existence.—*Murchisonæ* hemera, probably.

2. COSMOGYRIA SUBTABULATA, *S. Buckman*. Suppl., Plate IV, figs. 13—15 *b*.

Description.—Platy - subpachygyral, gradumbilicate, subcrassicostate, periphery subtabulate.

Distinction.—From *obtusa*, a more concentric umbilicus, more numerous and more elevated costæ, a broad and more tabulate periphery.

Locality and Stratum.—Dorset: Chideock Quarry Hill, from what the workmen call the "Building Stone" or the "Red Beds."

Date of Existence.—*Bradfordensis* hemera.

3. COSMOGYRIA sp. Suppl., Plate XIV, figs. 11, 12.

The small specimen figured is not the young of any species which has been described.

The radial line seems to indicate its position in this genus.

Locality and Stratum.—Dorset: Chideock Hill, in the "Wild Bed."

Date of Existence.—*Murchisonæ* hemera.

In the following species the character of the suture-line agrees with that of this genus; and so do the proportions in the case of the first. But the radial line differs,—there is more lateral curvature.

4. COSMOGYRIA? MAGGSI,¹ *S. Buckman.* Suppl., Plate X, figs. 23—25 (Type), and figs. 26—28.

Description.—Platy-subleptogyral, excentri-concavumbilicate, striate.

Localities and Stratum.—Dorset: Sherborne, two specimens from the Collection of Mr. T. C. Maggs, F.G.S., and one from my father's Collection, from the *Rhynchonella ringens* bed; Louse Hill, near Halfway House.

Date of Existence.—*Bradfordensis* hemera.

5. COSMOGYRIA? CIRRATA, *S. Buckman.* Suppl., Plate X, figs. 32—34.

Description.—Platyleptogyral, gradumbilicate, striate.

Distinction.—From *Maggsi* greater compression, more excentric umbilicus.

Locality and Stratum.—Dorset: Halfway House, probably from the *Rhynchonella ringens* bed.

Date of Existence.—*Bradfordensis* hemera, probably.

¹ In compliment to Mr. T. C. Maggs, F.G.S.

XV. Genus—HYATTIA,¹ S. Buckman.(Type: *Hyattia pustulifera*, sp. n.)

Definition.—Platy-subpachygyral, subangustumbilicate; subpauciseptate, sublongi-angustilobate; laterally subflexiradiate; peripherally anguliradiate, planifastigate, parvi-nonsepti-carinate.

Distinction.—From *Welschia*, greater proportionate umbilication, a more planifastigate periphery.

Note.—The periphery is more definitely separated from the lateral area than in *Welschia*.

FIG. 12.—Radial line of *Hyattia pustulifera*.

1. HYATTIA BULLIFERA, S. Buckman. Suppl., Plate XIV, figs. 1, 2.

1886. AMMONITES MURCHISONÆ OBTUSUS, *Quenstedt*, *Amm. Schwäb. Jura*, pl. lviii, fig. 10.

Description.—Substeno-subpachygyral, latumbilicate, irregulari-bullicostate.

Note.—The description is taken from what is presumed to be a young shell, and so the proportions would alter very much with age.

The bullæ rise prominently above the inner margin, and send forth two or three costæ. There are costæ also between the bullæ, so that of about five costæ two are plain, and three are united into a bulla.

Localities and Strata.—Gloucestershire, from the Pea Grit of the Cheltenham neighbourhood, probably from Birdlip. Foreign: Normandy, Feuguerolles, “*Murchisonæ* bed” (M. L. Brasil).

Date of Existence.—*Murchisonæ* hemera.

2. HYATTIA PUSTULIFERA, S. Buckman. Suppl., Plate XIII, figs. 1—3.

Description.—Platy-subpachygyral, subangustumbilicate; costate, in youth irregulari-bullicostate.

Distinction.—It is not the adult of *bullifera*, because the bullicostæ are much less pronounced.

Locality and Stratum.—Dorset: Chideock Quarry Hill, in the “Wild Bed.”

Date of Existence.—*Murchisonæ* hemera.

¹ In compliment to Prof. Alpheus Hyatt.

3. *HYATTIA WILSONI*, *S. Buckman*. Suppl., Plate XII, figs. 4—9.

Description.—Platyleptogyral, gradumbilicate; costate declining to striate; periphery fastigate, parvicarinate.

Distinction.—From *pustulifera*, decline of ornament.

It may be compared with *Am. Murchisonæ*, Zieten,¹ which was made a species by Mayer under the name *opalinoïdes*. But in the present species the suture-lines are more ornate and more lobate, the specimens are more coarsely costate, rather thicker, and less acuti-fastigate.

Remarks.—Greatly do I regret to say that since the name was given to this species, and the description written, the friend to whom it was dedicated as a reminiscence of our joint work at Dundry is deceased. I allude to the late E. Wilson, F.G.S., the former curator of the Bristol Museum. I am indebted to him in very many ways; and through the keen interest which he took in this work I have derived the greatest assistance in the way of interesting material.

Localities and Strata.—Dorset: Chideock Quarry Hill, in the "Wild Bed;" Somerset: Dundry Hill, probably from the hard, irony bed.

Date of Existence.—*Murchisonæ* hemera.

4. *HYATTIA SUBCAVA*, *S. Buckman*. Woodcut Fig. 13 in text.

Description.—Platyleptogyral, parvigradumbilicate, subcostate declining to striate, periphery fastigate, parvicarinate.

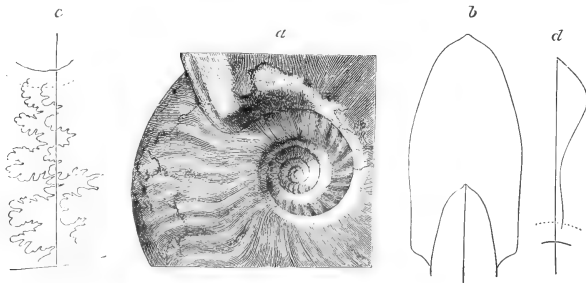


FIG. 13.—*Hyattia subcava*, *S. Buckman*. Paving Bed, Bradford Abbas, Dorset. *a*, side view; *b*, whorl-section; *c*, suture-lines; *d*, radial curve.

¹ Verstein, Württ., Pl. vi, fig. 1 only.

Note.—Costæ give way to striæ at a diameter of about 75 mm.

Distinction.—From *Wilsoni*, smaller umbilicus, earlier failure of costæ.

Locality and Stratum.—Dorset : Bradford Abbas, and by matrix certainly from Paving Bed.

Date of Existence.—*Bradfordensis*, or *Murchisonæ* hemera.

XVI. Genus—HYATTINA, *S. Buckman*.

(Type—*Hyattina Brasili*, sp. n.)

Definition.—Platyteptogyral, angustumbilicate; subdensiseptate, brevi-angustilobate; laterally subflexiradiate; peripherally anguliradiate, subtabulate, parvi-nonsepti-carinate.

Remarks.—There is but little curvature in the course of the costæ on the lateral area. Other noticeable features in combination therewith are the small umbilicus, the compression, the subtabulate periphery, and the short, narrow lobes of the suture-line.

Distinction.—From the genera which it resembles in the course of the radial line, it is distinguished by the combination of characters noticed above. The brevi-angustilobate, densiseptate character of the suture-line is, perhaps, most distinctive.



FIG. 14.—Radial line of *Hyattina Brasili*.

1. HYATTINA BRASILI, *S. Buckman*. Suppl., Plate XIII, figs. 7—9.

Description.—Platyteptogyral, angustumbilicate, costate; periphery subtabulate.

Localities and Strata.—Somerset : Haselbury, near Crewkerne, from the “lower beds.” Foreign : Normandy (Calvados), Feuguerolles, two specimens (one from M. L. Brasil, labelled “*Murchisonæ* beds”).

Date of Existence.—*Murchisonæ* hemera.

XVII. *Genus*—MANSELIA,¹ *S. Buckman*.(Type—*Manselia subfalcata*, sp. n.)

Definition.—Platyleptogyral, angustumbilicate; subdensiseptate, sublongi-subangusti-lobate; laterally subflexiradiate; peripherally anguliradiate, subacutifastigate, parvi-nonsepti-carinate.

Distinction.—From *Ancolloceras*, the radial line has less peripheral projection; the suture-line has longer, somewhat narrower lobes. From *Hyattina*, the more acute periphery, and the longer lobes of the suture-line. From *Hyattia*, greater compression.



FIG. 15.—Radial line of *Manselia subfalcata*.

1. MANSELIA SUBACUTA, *S. Buckman*. Suppl., Plate XIII, figs. 4—6.

Description.—Platyleptogyral, gradumbilicate, subparvi-costate.

Remarks.—A doubt may be expressed whether this species is correctly assigned to a genus, whereof *subfalcata* is the type. The costation is of a coarser character, and the lobes of the suture-line seem to be shorter in proportion.

Localities and Strata.—Dorset: Symondsburry, near Bridport, from a yellowish sandy matrix—a similar bed contains *Zelleria anglica*; Bradford Abbas, from the Paving Bed.

Date of Existence.—*Murchisonæ* hemera.

2. MANSELIA SUBFALCATA, *S. Buckman*. Suppl., Plate XI, figs. 25—27.

Description.—Platyleptogyral, gradumbilicate, parvicostate.

Distinction.—There is some likeness to *Am. Murchisonæ falcatus*, Quenstedt, but that shell has a more tabulate, more distinctly carinate periphery. From *subacuta*, less coarse ornament.

Localities and Strata.—Dorset: Halfway House, near Sherborne, from a greyish limestone, evidently the bed just above the Sands.² Gloucestershire: Leckhampton Hill, from the Pea Grit, or Lower Freestone.

Date of Existence.—*Murchisonæ* hemera.

¹ In compliment to Mr. J. C. Mansel-Pleydell, F.L.S., F.G.S., President of the Dorset Natural History and Antiquarian Field Club.

² "Bajocian Sherborne District," 'Quart. Journ. Geol. Soc.,' vol. xlix, p. 486, sect. 4, Bed 11.

3. MANSELIA TRICHINA, *S. Buckman*. Suppl., Plate X, figs. 14—16.

Description.—Platyleptogyral, subconcaumbilicate, subcostate to striate.

Distinction.—From the other species by the character of the ornament.

Localities and Strata.—Dorset: Horn Park, near Beaminster, from a greyish matrix, evidently below the ironshot; Bradford Abbas, Paving Bed. And a slightly more costate specimen, Normandy: Feuguerolles, “Murchisonæ, upper part” (M. L. Brasil).

Date of Existence.—*Murchisonæ* hemera.

A species possibly to be assigned to this genus is—

1886. AMMONITES MURCHISONÆ ACUTUS, *Quenstedt*. *Amm. Schwäb. Jura*, pl. lix, fig. 3.

Its position would be between *subfalcata* and *trichina*.

XVIII. Genus—APEDOGYRIA,¹ *S. Buckman*.

(Type—*Apedogyria patellaria*, sp. n.)

Definition.—Subplatyleptogyral, latumbilicate; subdensiseptate, subbrevisublati-lobate; laterally flexiradiate; peripherally sub-anguliradiate, subtabulate, parvi-nonsepti-carinate.

Distinction.—Much compressed like the last two genera, but more umbilicate. From *Hyattina*, the shorter, broader lobes of the suture-line form an excellent distinguishing character.



FIG. 16.—Radial line of *Apedogyria patellaria*.

1. APEDOGYRIA PATELLARIA, *S. Buckman*. Suppl., Plate XIV, figs. 3—5.

1878. LUDWIGIA MURCHISONÆ, *Bayle*. *Explic. carte géol. France*, pl. lxxxv, fig. 3, only.

Description.—Subplatyleptogyral, latumbilicate; costate declining to striate; periphery subtabulate.

Remarks.—The flat sides of the whorls and the slight increase in thickness give this species a peculiar plate-like appearance.

Localities and Strata.—Dorset: Chideock Hill, from the “Wild Bed;” Marston Road, near Sherborne, probably from below the *ringens* bed. Foreign: Normandy, Feuguerolles. Bayles specimen is from “Lias supérieur, Éterville (Calvados).”

Date of Existence.—*Murchisonæ* hemera.

¹ ἄπειδος, level, flat; γῦρος, a whorl.

2. APEDOGYRIA PLATYCHORA,¹ *S. Buckman*. Plate V; Plate IV, fig. 8; Suppl., Plate XI, fig. 33.

1887. LIOCERAS BRADFORDENSE, *This Monogr.*, Pl. v; Pl. iv, fig. 8 only.

Description.—Platyteptogyral, excentri-gradumbilicate, parvi-subobsoleticostate.

Distinction.—From *patellaria*, less costation.

Localities and Strata.—Dorset: Horn Park, Beaminster, from the ironshot bed; Stoke Knap, from the Building Stone; Chideock, from base of Building Stone.

Date of Existence.—*Bradfordensis* hemera.

3. APEDOGYRIA? SUBCORNUTA, *S. Buckman*. Suppl., Plate XIV, figs. 13—15.

Description.—Platyteptogyral, excentri-gradumbilicate, subdensiseptate, brevisangustilobate, densi-parvi-costate.

Notes.—The periphery is very narrow and subfastigate. Accompanying the excentrumbilicatum there is a slight increase in progressive thickness of whorl. The mouth-border has short (incomplete) lateral lappets; hence the specific name.

Remarks.—The generic position is not quite satisfactory, though there is fair agreement in radial and suture-lines.

Distinction.—From *platychora*, costæ smaller and more numerous, different umbilication.

There is a similarity to *Am. Murchisonæ intralævis*. Quenstedt,² except in the costation, which, in this fossil, is more angulate.

Localities and Strata.—Dorset: Horn Park, near Beaminster, in the lower, not ironshot, beds, about the horizon of *Zeilleria anglica* (Opper); Chideock, top of "Wild Bed" or base of Building Stone; Somerset: Stoford, from a grey limestone.

Date of Existence.—*Murchisonæ* hemera.

¹ Πλατύχωρος, with a broad place or space.

² 'Schwäb. Amm.,' pl. lix, fig. 10.

XIX. Genus—LUDWIGINA, *S. Buckman*.

(Type—*Ludwigina patula*, sp. n.).

1887. LUDWIGIA (pars), This Monogr., p. 16.

Definition.—Substeno-leptogyral, latumbilicate; pauciseptate, sublongi-subangustilobate; laterally flexiradiate; peripherally anguliradiate, subtabulate, parvi-nonsepti-carinate.

Distinction.—Similar to *Apedogyria*, but more umbilicate.

Remarks.—The radial curves in this and the last genus are practically the same. But *Ludwigina patula* and *Apedogyria patellaria* are in the same degree of development. The degree of costation and compression is similar, but the umbilicus associated therewith is much larger in the present genus.



FIG. 17.—Radial line of *Ludwigina patula*.

1. LUDWIGINA PATULA, *S. Buckman*. Plate III, fig. 3; Suppl., Plate XIV, figs. 7, 8.

1887. LUDWIGIA MURCHISONÆ, This Monogr., Pl. iii, fig. 3 only.

Description.—Substeno-leptogyral, latumbilicate; costate.

Localities and Strata.—Dorset: Louse Hill, near Halfway House; Bradford Abbas, in the Paving Bed; Marston Road, near Sherborne, probably from below the *ringens* horizon.

Date of Existence.—*Murchisonæ* hemera.

2. LUDWIGINA UMBILICATA, *S. Buckman*. Woodcut Fig. 18 in text.

Description.—Subplaty-leptogyral, latumbilicate; subparvicostate.

Distinction.—From *patula*, less coarse costation, smaller umbilicus, greater compression. And the small *patula* (Suppl., Plate XIV, figs. 7, 8) shows rather more angustilobation than Fig. 18, *c*.

Locality and Stratum.—Dorset: Bradford Abbas, in the Paving Bed.

Date of Existence.—*Murchisonæ* hemera.

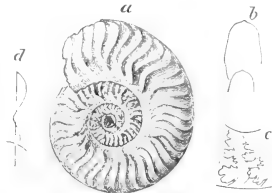


FIG. 18.—*Ludwigina umbilicata*.
a, side view; b, section; c, suture-line;
d, radial line.

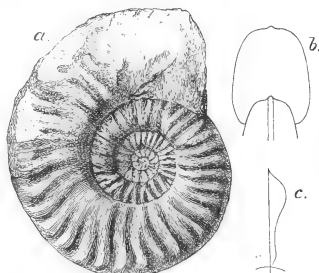
XX. Genus—STROPHOGYRIA,¹ S. Buckman.(Type—*Strophogyria cosmia*, sp. n.)

Definition.—Substeno-subleptogyral, latumbilicate; subdensiseptate, subbrevisublatilobate; laterally subflexiradiate; peripherally anguliradiate, tabulate, parvi-nonsepti-carinate.

Distinction.—From *Ludwigina*, umbilication is rather less proportionately to development of other characters, compression is less, and periphery is tabulate.

1. STROPHOGYRIA AGRIA, S. Buckman. Woodcut Fig. 19 in text.

Description.—Substeno-leptogyral, latumbilicate; subcrassicostate; periphery tabulate, almost sulcate.

FIG. 19.—*Strophogyria agria*; a, side view; b, section; c, radial line.

Locality and Stratum.—Dorset: Bradford Abbas, apparently from the Paving Bed.

Date of Existence.—*Murchisonæ* hemera.

2. STROPHOGYRIA COSMIA, S. Buckman. Woodcut Fig. 20 in text.

Description.—Subplaty-subleptogyral, sublatumbilicate, costate; periphery tabulate, almost sulcate.

¹ Στρογγύριος, a band.

Distinction.—From *agriæ*, less umbilicate and more compressed.

Localities and Strata.—Dorset: Mapperton, near Beaminster, from a whitish stone; Bradford Abbas, Paving Bed; and a near ally, Chideock, top of “Wild Bed,” by matrix (C. Upton).

Date of Existence.—*Murchisonæ hemera*.

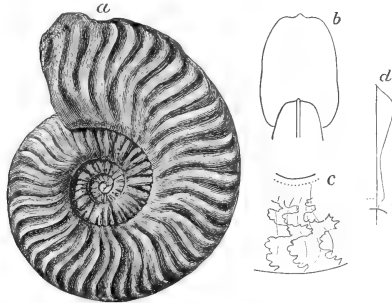


FIG. 20.—*Strophogyria cosmia*: a, side view; b, section; c, suture-line; d, radial line. Mapperton.

3. STROPHOGYRIA PINAX, *S. Buckman*. Plate II, figs. 3, 4; Woodcut Fig. 21 in text.

1887. LUDWIGIA MURCHISONÆ, This Monogr., Pl. ii, figs. 3, 4.

Description.—Platyleptogyral, angustumbilicate; subparvicostate, declining to striate; periphery subtabulate.

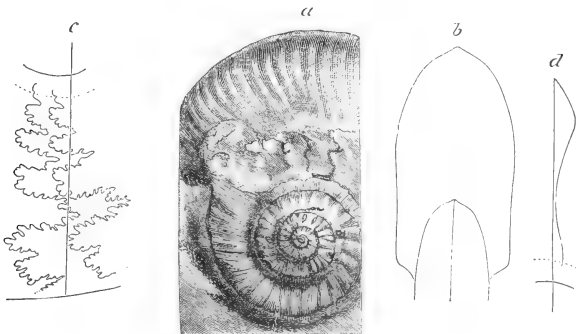


FIG. 21.—*Strophogyria pinax*: a, side view; b, whorl section; c, suture-lines; d, radial line. Broad Windsor, Dorset.

Distinction.—From *cosmia*, a smaller umbilicus, greater compression, less ornament.

Locality and Stratum.—Dorset: Broad Windsor, probably from the lower beds of the road-cutting at the entrance to the village (collected by Mr. Darell Stephens, F.G.S.); Bradford Abbas, from the Paving Bed; Mapperton, near Beaminster, from a grey matrix.

Date of Existence.—*Murchisonæ-hemera*.

ANGULIRADIATE.

In the genera now to be described the lateral angularity of the radial line forms a particular distinction from those preceding, especially when, as is often the case, it is associated with a very small peripheral projection.

The species allotted to the genera xxi—xxiii may be divided into two series by the suture-lines:—A. Parvilobate, xxi, xxii; B. Magnilobate, xxiii.

In the division A, however, there are three series. One is not accorded generic rank now, but some Gloucestershire material obtained while these pages are passing through the press seems to indicate that it will merit such distinction in the future. So in the parvilobate division there may be separated—1, angustilobate, *Kiliania*; 2, latilobate, *Paquieria*. But then 1 is capable of further division:— α . Periphery tabulate (example, *Kiliania laciniosa*); β . Periphery subtabulate (example, *Kiliania? tuberata*).

In degeneration (phylogerontic stage) both the series α and β should acquire fastigate peripheries, but that of β should be the more acute.

A. PARVILOBATE.

1. *Angustilobate*.

XXI. Genus—KILIANIA,¹ S. Buckman.

(Type—*Kiliania laciniosa*, sp. n.)

Definition.—Platy-subpachygyral, angustumbilicate, subpauciseptate, sublongi-subangustilobate; laterally subanguliradiate; peripherally obtusanguliradiate, tabulate, parvi-nonseptecarinata.

Distinction.—The proportions are similar to those of *Welschia*;



FIG. 22.—Radial line of *Kiliania laciniosa*.

¹ In honour of M. W. Kilian, professeur à la Université de Grenoble.

SUPPLEMENT, PLATE V.

Dumortieria hemera.

Figs. 1, 2.—*CYPHOLIOCERAS* ? *VITOSUM*, *S. Buckman.*

Fig. 1.—Portions of two specimens. These fragments are placed according to the position they would apparently occupy in a complete shell, which is outlined by dots. Standish Beacon. My Collection. (Page xlv.)

Fig. 2.—View of the peripheral area. 2 *a.*—Outline of the whorl-section. 2 *b.*—Radial curve.

Figs. 3, 4.—*CYPHOLIOCERAS* ? *PIGRUM*, *S. Buckman.*

Fig. 3.—Side view of a fragment. Standish Beacon. My Collection. (Page xlv.)

Fig. 4.—Outline of the whorl-section. 4 *a.*—Radial curve.

Opaliniiformis hemera.

Figs. 5, 6.—*CYLIOCERAS UNDATUM*, *S. Buckman.*

Fig. 5.—Side view of a somewhat ill-preserved specimen, the test mostly replaced by a film of iron oxide. Haresfield Hill. My Collection. (Bed 15, section v, p. 43.) (Page l.)

Fig. 6.—Outline of the whorl-section. 6 *a.*—Radial curve.

*Scissi hemera.*¹

Figs. 7—11.—*LIOCERAS UNCINATUM*, *S. Buckman.*

Fig. 7.—Side view of a very well-preserved specimen, with most of its test present. Burton Bradstock. Collected by Mr. Darell Stephens, F.G.S. Now in my cabinet. (Page xxxvi.)

Fig. 8.—View of whorl-section and peripheral area, from part of which the test is absent.

Fig. 9.—Suture-line. 9 *a.*—Radial curve.

Fig. 10.—Side view of a young specimen broken up to furnish material for figs. 11—11 *g.* Burton Bradstock. Mr. Darell Stephens.

Fig. 11.—Side view of the first whorl broken out of the specimen shown in fig. 10. 11 *a.*—Front view $\times 6$. 11 *b.*—Peripheral view. 11 *c.*—Suture-line, enlarged. 11 *d.*—Side view of the third whorl embracing part of the second whorl. 11 *e.*—Peripheral view showing incipient carina. 11 *f.*—Outline of the sections of whorls 2, 3, 4, 5, to show the change in shape and in amount of inclusion; the bottom whorl (2) fits to the end of 11 *a.* 11 *g.*—The whorls 2 and 3 of 11 *f* enlarged twice.

¹ The date in the case of these Burton Bradstock species is known by the matrix.

Fig 5

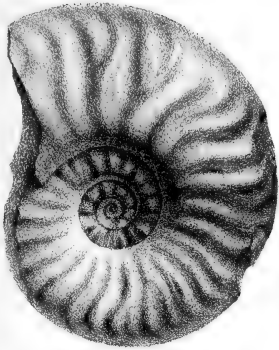


Fig 6.



Fig 6a



Fig 4a



Fig 3



Fig 4



Fig 11d.



Fig 11e.



Fig 10



Fig 11c.

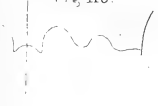


Fig 11f.



Fig 11g.



Fig 11a



Fig 11b



Fig 2



Fig 9



Fig 11

Fig 2a



Fig 2b



Fig 2a.



Fig. 7

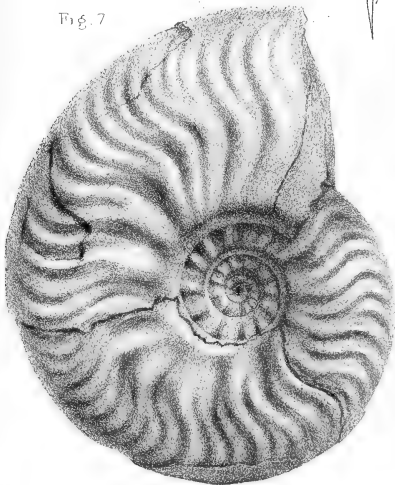


Fig 8.



Fig 1





SUPPLEMENT, PLATE VI.

Scissi hemera.

Figs. 1—4.—*LIOCERAS COSTOSUM* (*Quenstedt*).

Fig. 1.—Side view of an immature specimen without much test. Burton Bradstock. From the collection of Mr. Darell Stephens, F.G.S. Now in my Cabinet. (Page xxxvii.)

Fig. 2.—Peripheral view.

Fig. 3.—Outline of the whorl-section.

Fig. 4.—Part of suture-line. 4 a.—Radial curve.

Figs. 5—7.—*LIOCERAS SUBCOSTOSUM*, *S. Buckman*.

Fig. 5.—Side view of a wholly septate specimen, without test. It is labelled "Stoford," but the matrix seems to indicate Burton Bradstock. The specimen was probably obtained from a working collector. My Collection. (Page xxxvii.)

Fig. 6.—Front view.

Fig. 7.—Suture line. 7 a.—Radial curve.

(For other figures of this species see Pl. XX, figs. 11, 12, under the name "*Ludwigia costosa*," which should now be altered.)

Figs. 8—10.—*LIOCERAS UNCUM*, *S. Buckman*.

Fig. 8.—Side view of a wholly septate, partially testate specimen. Burton Bradstock. From the collection of Mr. Darell Stephens, F.G.S. Now in my Cabinet. (Page xxxvii.)

Fig. 9.—Front view.

Fig. 10.—Suture-lines. 10 a, 10 b.—Radial curves.

Figs. 11—13.—*LIOCERAS GRACILE*, *S. Buckman*.

Fig. 11.—Side view of a mostly testate specimen. Burton Bradstock. From the Collection of Mr. Darell Stephens, F.G.S. Now in my Cabinet. (Page xxxviii.)

Fig. 12.—Front view.

Fig. 13.—Suture line. 13 a.—Radial curve.

Murchisonæ hemera.

Figs. 14—16.—*ANCOLIOCERAS SUBSTRIATUM*, *S. Buckman*.

Fig. 14.—Side view of a wholly septate, partially testate specimen, showing costæ passing into somewhat fine striae. From the "BOTTOM BED" at Stoke Knap, near Broad Windsor, Dorset. My Collection. (Page xlviii.)

Fig. 15.—Front view.

Fig. 16.—Suture-lines. 16 a.—Radial curve taken from where the costæ are present. 16 b.—Another taken where striae are developed.

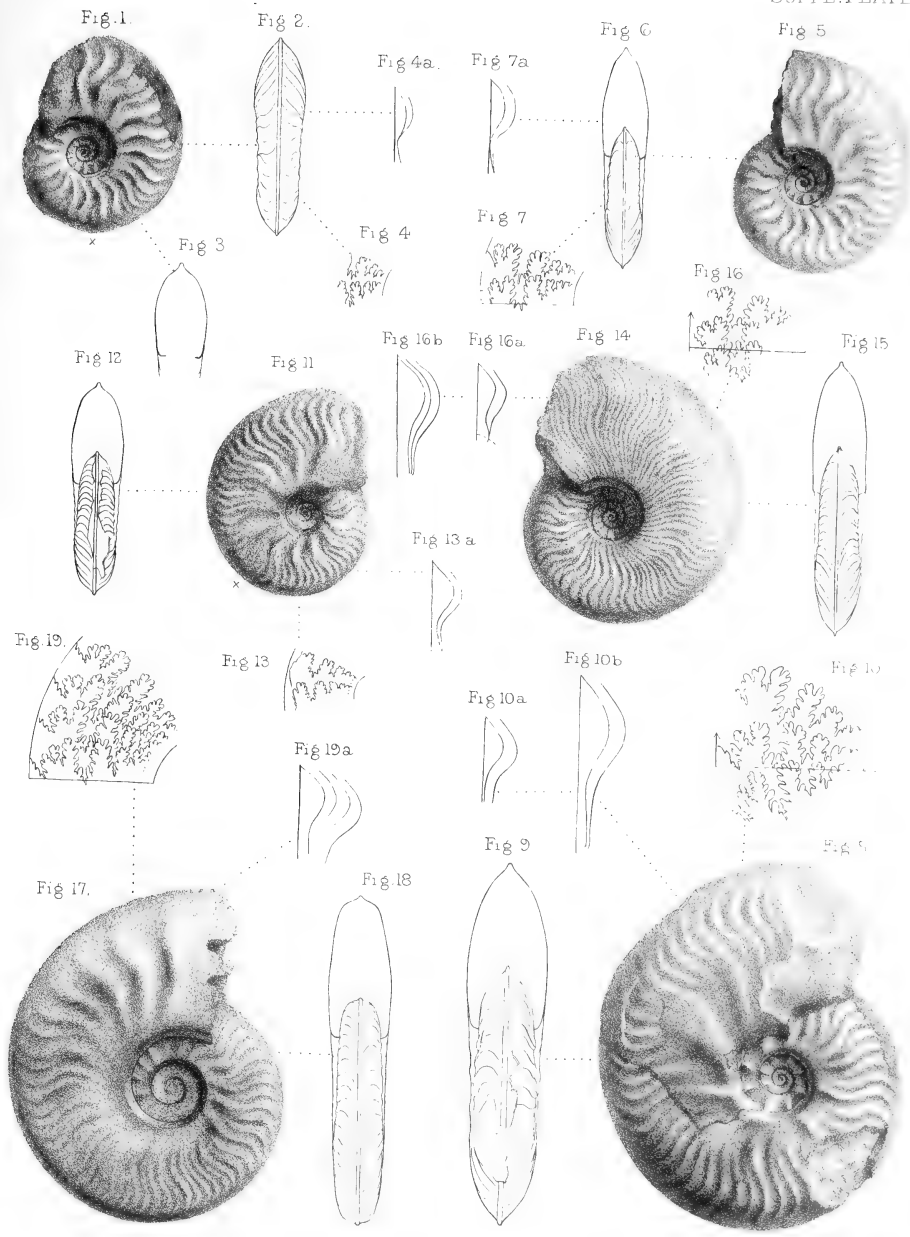
Scissi or *Murchisonæ* hemera.

Figs. 17—19.—*GEYERIA FASCIATA*, *S. Buckman*.

Fig. 17.—Side view of a wholly septate specimen without test. The specimen is labelled "Sherborne," Dorset, and its matrix shows that it is from not far above the Sands. My Collection. (Page 1.)

Fig. 18.—Front view.

Fig. 19.—Suture-lines. 19 a.—Radial curves.





SUPPLEMENT, PLATE VII.

Scissi hemera.

Figs. 1—6.—*LIOCERAS BIFIDATUM*, *S. Buckman.*

Fig. 1.—Side view of a specimen with practically complete body-chamber. Burton Bradstock, Dorset. From the Collection of Mr. Darell Stephens, F.G.S. (Page xxxviii.)

Fig. 2.—Front view.

Fig. 3.—Radial curve.

Fig. 4.—Side view of a young example, showing costæ passing into striæ. Burton Bradstock. From the same Collection.

Fig. 5.—Front view.

Fig. 6.—Radial curve (costate stage). 6 *a*.—The same (striate stage).

Figs. 7—12.—*LIOCERAS COMPTUM* (*Reinecke*).

Fig. 7.—Side view of a young, wholly septate example with test. Burton Bradstock. From the same Collection. (Page xliii.)

Fig. 8.—Front view, in outline.

Fig. 9.—Suture-line. 9 *a*.—Radial curve.

Fig. 10.—Side view of a larger example. Beaminster, Dorset. From the same Collection.

Fig. 11.—Front view.

Fig. 12. Suture-lines. 12 *a*, 12 *b*.—Radial curves.

Figs. 13—16.—*LIOCERAS THOMPSONI*, *S. Buckman.*

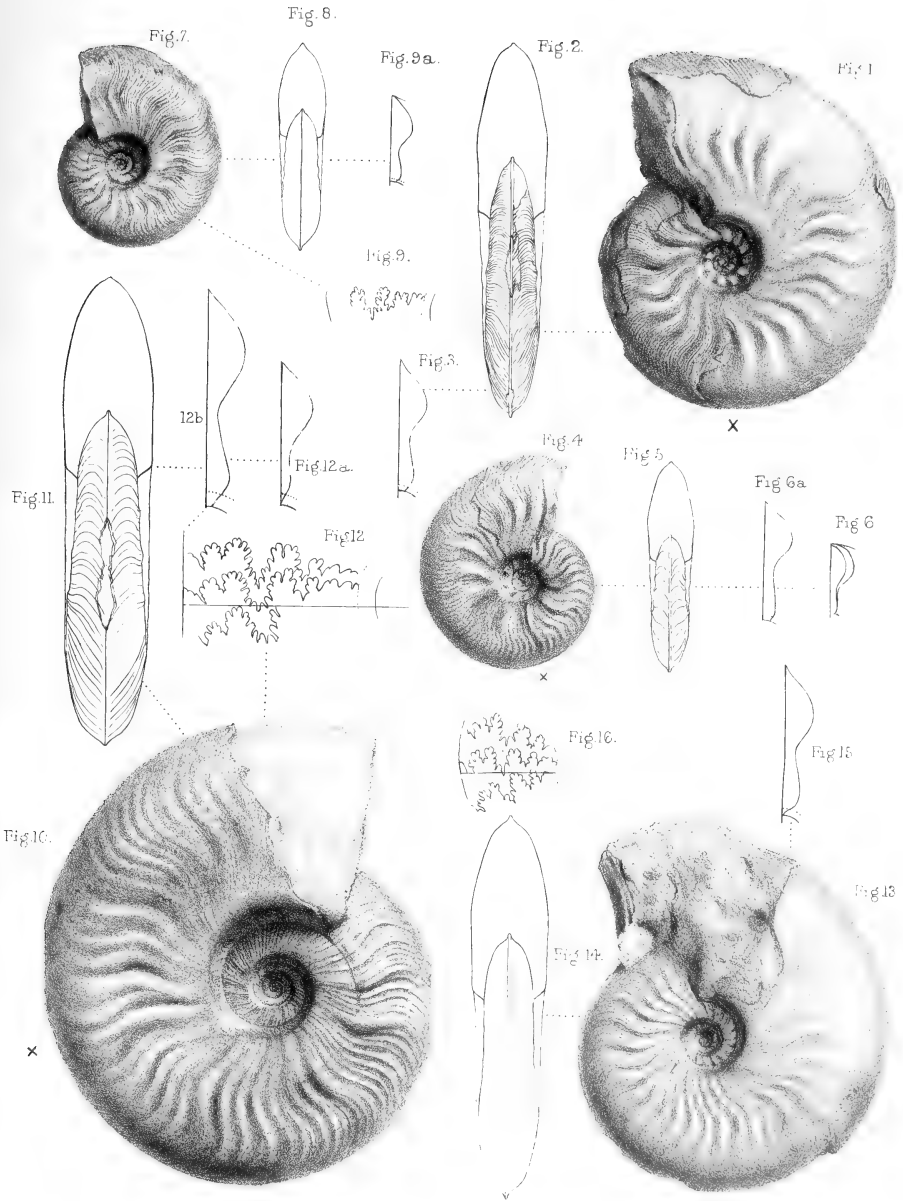
Fig. 13.—Side view of a wholly septate specimen with test. From the Northampton Sands, Duston, near Northampton. From the Collection of Mr. Beeby Thompson, F.G.S. (Page xl.)

Fig. 14.—Front view, in outline.

Fig. 15.—Radial curve.

Fig. 16.—Suture-lines from another specimen. Same locality and Collection.

All the specimens depicted in this Plate are now in my cabinet.





SUPPLEMENT, PLATE VIII.

Scissi hemera.

Figs. 1—3.—*LIOCERAS LINEATUM*, *S. Buckman*.

Fig. 1.—Side view of a wholly septate specimen. Burton Bradstock, Dorset. From the Collection of Mr. Darell Stephens, F.G.S. (Page xl.)

Fig. 2.—Front view, in outline. 2 *a*.—Section of periphery with test.

Fig. 3.—Parts of two suture-lines. 3 *a*.—The same at a larger diameter. 3 *b*.—Radial curves.

Figs. 4—6.—*LIOCERAS GRAVE*, *S. Buckman*.

Fig. 4.—Portion of side view, to show concavumbilicus. Burton Bradstock. From the same Collection. (Page xli.)

Fig. 5.—Front view, in outline.

Fig. 6.—Parts of suture-lines. 6 *a*.—Radial curve.

Opaliniformis hemera.

Figs. 7—9.—*CYPHOLIOCERAS PPLICATUM*, *S. Buckman*.

Fig. 7.—Side view of a specimen with test. Haresfield Hill, Gloucestershire. My Collection. (Page xlv.)

Fig. 8.—Front view in outline.

Fig. 9.—Radial curve.

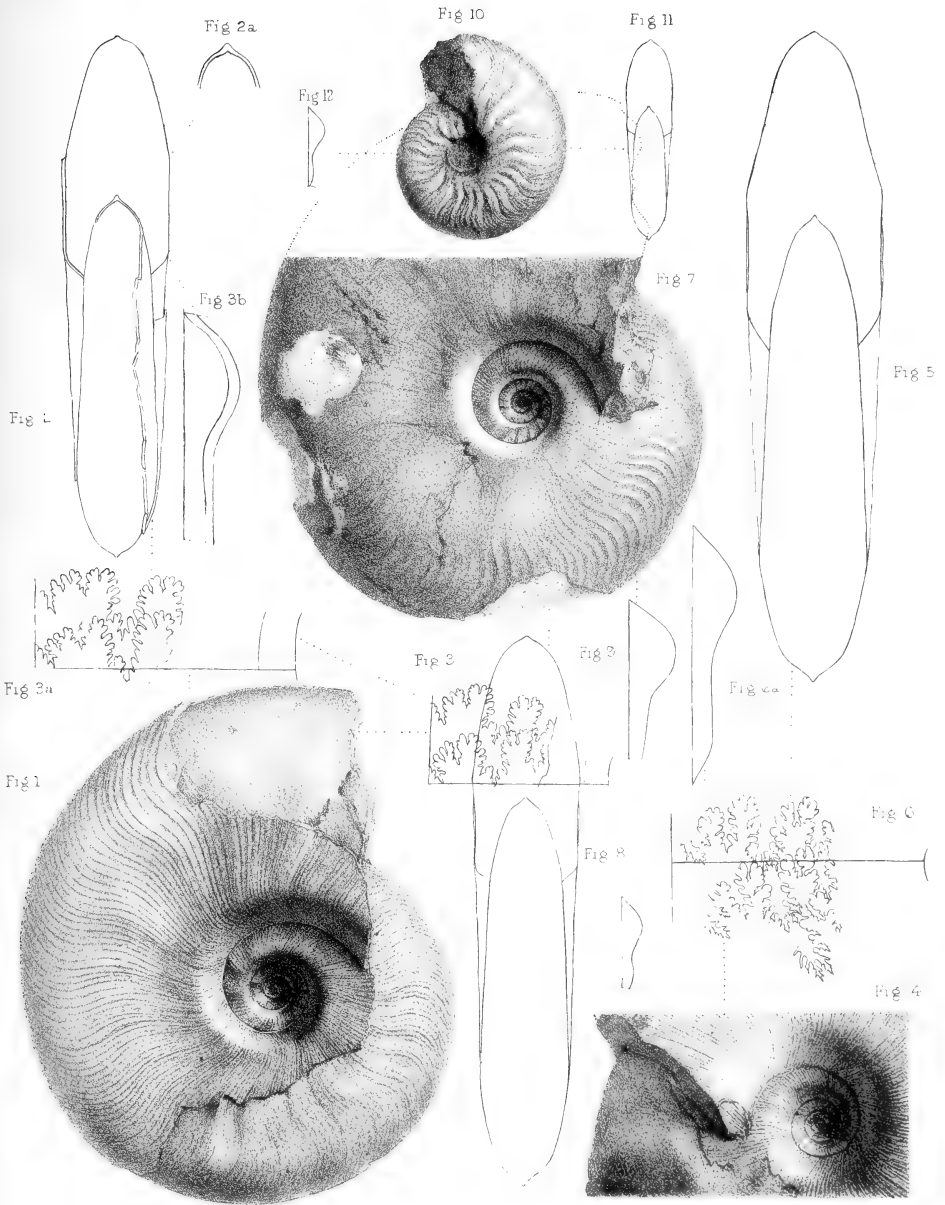
Scissi hemera.

Figs. 10—12.—*LIOCERAS PPLICATELLUM*, *S. Buckman*.

Fig. 10.—Side view. Stinchcombe Hill, Gloucestershire. My Collection. (Page xxxviii.)

Fig. 11.—Front view, in outline.

Fig. 12.—Radial curve, taken where costate stage is passing to striate.





SUPPLEMENT, PLATE IX.

Scissi hemera.

Figs. 1—3.—*LIOCERAS UNDULATUM*, *S. Buckman.*

- Fig. 1.—Side view of a specimen almost without test. Burton Bradstock. (Page xxxix.)
Fig. 2.—Front view.
Fig. 3.—Radial curves.

Figs. 4—6.—*LIOCERAS PARTITUM*, *S. Buckman.*

- Fig. 4.—Side view of a specimen with a portion of test preserved. Burton Bradstock. (Page xxxix.)
Fig. 5.—Whorl-section.
Fig. 6.—Suture-lines. 6 *a*, 6 *b*.—Radial curves.
(This is the type. For figures of other examples see Pl. XIII, fig. 11, Pl. XIV, figs. 3, 4, under the name *Lioceras opalinum*, var. *comptum*, which should now be altered.)

Figs. 7—9.—*LIOCERAS PlicateLLUM*, *S. Buckman.*

- Fig. 7.—Side view, mostly without test. (Page xxxviii.)
Fig. 8.—Front view.
Fig. 9.—Suture-lines. 9 *a*.—Radial curves.
(This specimen is the type. For a young example see Supplement, Pl. VIII, figs. 10—12.)

Figs. 10—12.—*LIOCERAS Plectile*, *S. Buckman.*

- Fig. 10.—Side view, with a considerable portion of test present. Burton Bradstock. (Page xxxix.)
Fig. 11.—Front view.
Fig. 12.—Parts of suture-lines. 12 *a*.—Radial curves.

Figs. 13, 14.—*LIOCERAS* sp., cf. *UNDULATUM*.

- Fig. 13.—Side view of a small example with most of the test present. Enlarged $1\frac{1}{2}$. Burton Bradstock. (Page xxxix.)
Fig. 14.—Front view.

All the specimens depicted in this Plate were collected by Mr. Darell Stephens, F.G.S. They are now in my cabinet.

Fig. 1



Fig. 2



Fig. 13

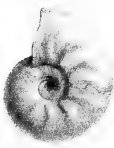


Fig. 4



x

Fig. 3



Fig. 14



Fig. 6

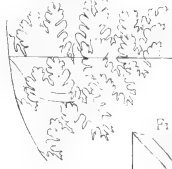


Fig. 5a

Fig. 5b

Fig. 5c

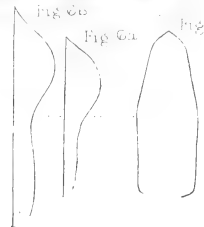


Fig. 9



Fig. 12a



Fig. 9a



Fig. 12



Fig. 8

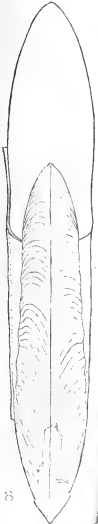


Fig. 7



Fig. 11



x



SUPPLEMENT, PLATE X.

Opaliniformis hemera.

Figs. 1—4.—*CYPHOLIOCERAS OPALINIFORME*, *S. Buckman*.

Fig. 1.—Side view of a young specimen. From the hard bed above the cephalopod bed, Haresfield Hill, Gloucestershire. (Page xlv.)

Fig. 2.—Whorl-section.

Fig. 3.—Radial line.

Fig. 4.—Radial line of the specimen depicted in Pl. XIII, figs. 1, 2.

Fig. 5.—*CYPHOLIOCERAS RENOVATUM*, *S. Buckman*.

Fig. 5.—Radial lines of the specimen depicted in Pl. XIV, figs. 7, 8. (Page xlvi.)

Scissi hemera.

Figs. 6—8.—*LIOCERAS OPALINUM* (*Reinecke*).

Fig. 6.—Side view. Burton Bradstock. Collected by Mr. Darell Stephens, F.G.S. (Page xli.)

Fig. 7.—Whorl-section.

Fig. 8.—Suture-lines. 8 *a*, *b*.—Radial-lines.

Fig. 9.—*LIOCERAS* sp.

Fig. 9.—Radial line of the specimen depicted in Pl. XIV, fig. 1. (Page xlii.)

Fig. 10.—*LIOCERAS STRIATUM*, *S. Buckman*.

Fig. 10.—Radial-line of the specimen shown in Pl. XIII, fig. 6, as *Lioceras opalinum*, which should now be altered. (Page xlii.)

Aalensis hemera.

Figs. 11—13.—*PLEYDELLIA COMATA*, *S. Buckman*.

Fig. 11.—Side view. Burton Bradstock.

Fig. 12.—Whorl-section.

Fig. 13.—Suture-line. 13 *a*. Radial-line.

Murchisonæ hemera.

Figs. 14—16.—*MANSSELLIA TRICHINIA*, *S. Buckman*.

Fig. 14.—Side view. Horn Park, near Beamister. (Page lix.)

Fig. 15.—Whorl-section.

Fig. 16.—Suture-lines. 16 *a*, *b*. Radial-lines.

Figs. 17—19.—*VACEKIA STEPHENSI*, *S. Buckman*.

Fig. 17.—Side view. Bradford Abbas. Collected by Mr. Darell Stephens.

Fig. 18.—Front view.

Fig. 19.—Suture-lines. 19 *a*.—Radial-line.

Bradfordensis hemera.

Figs. 20—22.—*PAQUIERIA FLOCCOSA*, *S. Buckman*.

Fig. 20.—Side view. "Stoford, Somerset." (Page lxxviii.)

Fig. 21.—Whorl-section.

Fig. 22.—Suture-lines. 22 *a*.—Radial-line.

Figs. 23—28.—*COSMOGYRIA ? MAGGSI*, *S. Buckman*.

Fig. 23.—Side view of a medium-sized specimen. Sherborne, Dorset. From the Collection of Mr. T. C. Maggs, F.G.S. (Page liv.) The ribs in the umbilicus have been rather exaggerated.

Fig. 24.—Whorl-section.

Fig. 25.—Suture-lines (part of). 25 *a*.—Radial-lines.

Fig. 26.—Side view of a young specimen. Probably from Sherborne. Collected by my father.

Fig. 27.—Front view.

Fig. 28.—Radial-line.

Figs. 29—31.—*BRASILINA CRINALIS*, *S. Buckman*.

Fig. 29.—Side view. Possibly from Halfway House, Dorset. From my father's Collection.

Fig. 30.—Whorl-section.

Fig. 31.—Radial-line.

Figs. 32—34.—*COSMOGYRIA ? CIRREATA*, *S. Buckman*.

Fig. 32.—Side view. From Halfway House, Dorset. From the Collection of Mr. F. Ellis, who kindly added it to my cabinet. (Page liv.)

Fig. 33.—Whorl-section.

Fig. 34.—Suture-lines. 34 *a*.—Radial-line.

Figs. 35—37.—*Incerta sedis*.

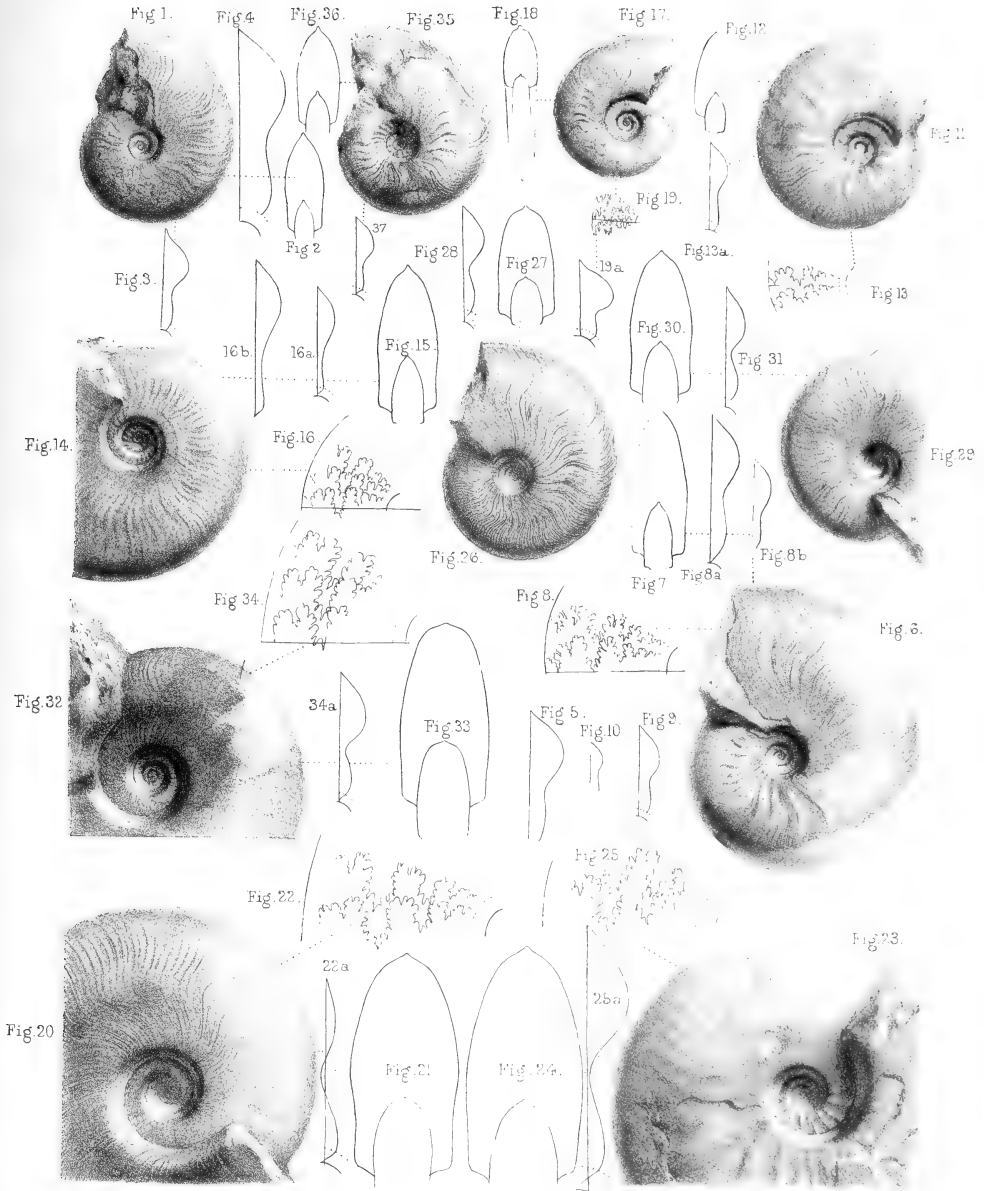
Fig. 35.—Side view. Paving Bed, Bradford Abbas. Collected by Mr. D. Stephens.

Fig. 36.—Whorl-section.

Fig. 37.—Radial-line.

All the specimens are in my Collection.

(NOTE.—This series of platyleptogyrul, striate Ammonites, which may be called Opalinoids, has been purposely brought together on one plate to show the resemblance in superficial appearance and the difference in details. At least seven different types of radial curve are shown, the extremes being *Paquieria floccosa* and *Vacekia stephensi*.)





SUPPLEMENT, PLATE XI.

Scissi hemera.

Figs. 1—3.—*RHÆBOCERAS TORTUM*, *S. Buckman.*

Fig. 1.—Side view. Burton Bradstock. Collected by Mr. Darell Stephens, F.G.S. (Page lxxiii.)

Fig. 2.—Whorl-section.

Fig. 3.—Radial-lines.

Figs. 4—6.—*RHÆBOCERAS TOLUTARIUM* (*Dumortier*).

Fig. 4.—Side view. Burton Bradstock. Collected by Mr. Darell Stephens, F.G.S. (Page lxxiii.)

Fig. 5.—Whorl-section.

Figs. 6, 6 a.—Radial-lines.

Murchisonæ hemera.

Figs. 7—9.—*ANCOLIOCERAS CABINIFERUM*, *S. Buckman.*

Fig. 7.—Side view. Mapperton, near Beaminster. (Page xlvi.)

Fig. 8.—Whorl-section.

Fig. 9.—Radial-lines.

Figs. 10—12.—*GEYERIA* ? *EVERTENS*, *S. Buckman.*

Fig. 10.—Side view. Mapperton, near Beaminster. (Page l.)

Fig. 11.—Front view, outline.

Fig. 12.—Suture-lines. 12 a, b.—Radial curves.

Figs. 13—15.—*LUDWIGIA LEVIGATA*, *S. Buckman.*

Fig. 13.—Side view (portion). "Bottom Bed," Stoke Knap, near Broad Windsor, Dorset. (Page lxxii.)

Fig. 14.—Whorl-section.

Fig. 15.—Suture-line. 15 a.—Radial curve.

Figs. 16—18.—*CRICKIA REFLUA*, *S. Buckman.*

Fig. 16.—Side view. Broad Windsor, Dorset. Collected by Mr. Darell Stephens, F.G.S. (Page lxxiv.)

Fig. 17.—Whorl-section.

Fig. 18.—Suture-line. 18 a.—Radial curve.

Figs. 19—21.—*PSEUDOGRAPHOCERAS LITERATUM*, *S. Buckman.*

Fig. 19.—Side view of a specimen with test. Paving Bed, Bradford Abbas, Dorset. Collected by Mr. D. Stephens, F.G.S.

Fig. 20.—Whorl-section.

Figs. 21, 21 a.—Radial curves.

Bradfordensis hemera.

Figs. 22—24.—*PSEUDOGRAPHOCERAS DELETUM*, *S. Buckman.*

Fig. 22.—Side view of a specimen with test. Bradford Abbas, Dorset, probably from marly stone just above the Paving Bed.

Fig. 23.—Whorl-section.

Figs. 24, 24 a.—Radial curves.

Murchisonæ hemera.

Figs. 25—27.—*MANSIELIA SUBFALCATA*, *S. Buckman.*

Fig. 25.—Side view of a specimen without test. Halfway House, near Sherborne, Dorset. Collected by Mr. Darell Stephens. (Page lviii.)

Fig. 26.—Whorl-section.

Fig. 27.—Suture-lines. 27 a. Radial-line. (The middle portion should be nearer to the straight line.)

Figs. 28—36.—Radial lines.

Fig. 28.—*Asthenoceras nannodes*, Pl. XXXIII, figs. 15, 16.

Fig. 29.—*Ludwigia patula*, Pl. III, fig. 3.

Fig. 30.—*Ludwigia tuberculata*, Pl. III, figs. 4, 5.

Fig. 31.—*Witshireia gigantea*, Pl. XI, fig. 1.

Fig. 32.—*Welschia payana*, Pl. XII, figs. 5, 6, 7. (Page lii.)

Fig. 33.—*Apodogyria platychora*, Pl. V.

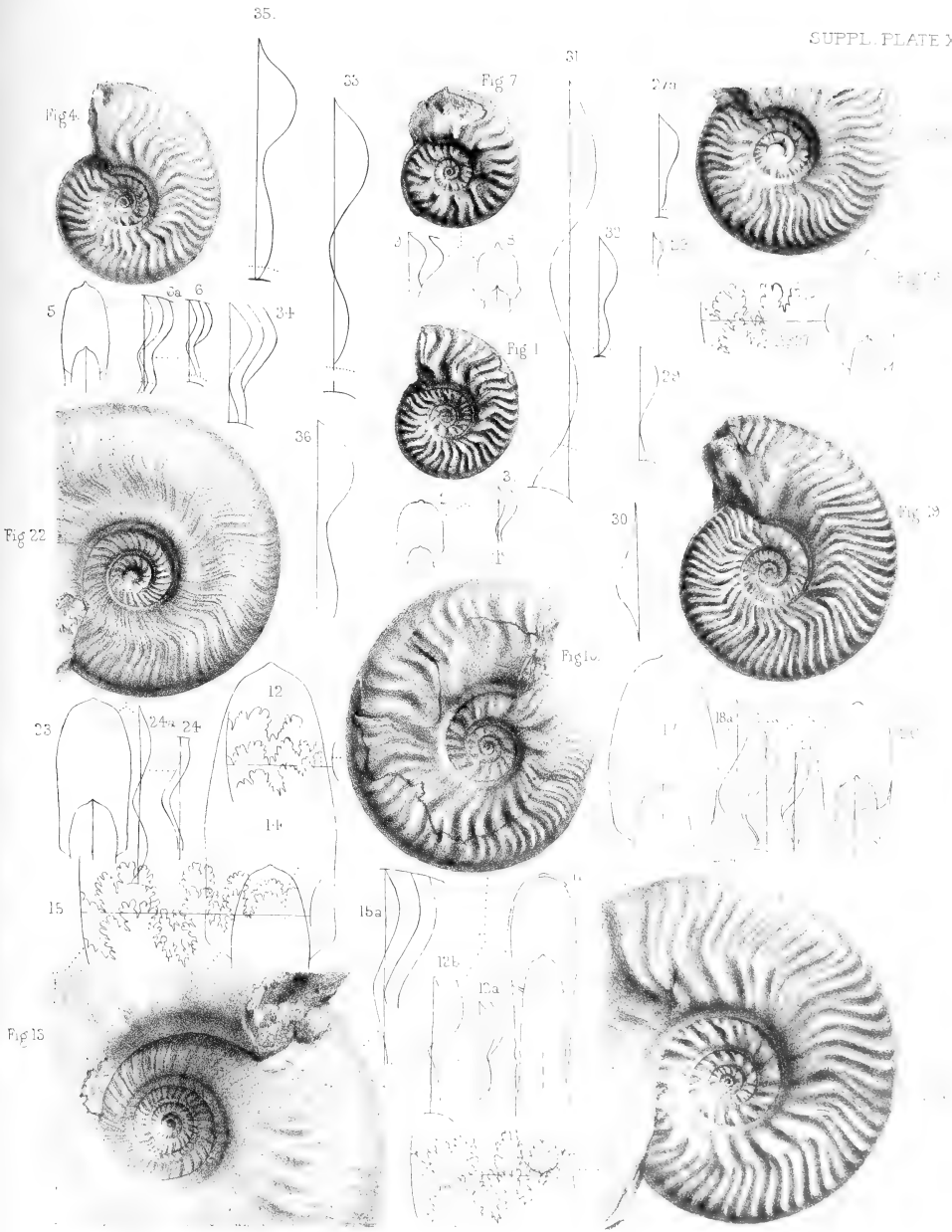
Fig. 34.—*Brasilina Buglii*, Pl. III, fig. 6.

Fig. 35.—*Brasilina decipiens*, Pl. XII, figs. 8, 9.

Fig. 36.—*Brasilina similis*, Pl. XV, figs. 1, 2.

The references denote the specimens from which the radial lines have been taken.

All the specimens are in my Collection.





SUPPLEMENT, PLATE XII.

Murchisonæ hemera.

Figs. 1—3.—*WELSCHIA OBTUSIFORMIS*, *S. Buckman.*

Fig. 1.—Side view of the type specimen with test. “Wild Bed,” Chideock Quarry Hill, Dorset. (Page li.)

Fig. 2.—Front view.

Fig. 3.—Suture-lines. 3 *a.* Radial-lines.

Figs. 4—9.—*HYATTIA WILSONI*, *S. Buckman.*

Fig. 4.—Side view of a specimen with test (the type). “Wild Bed,” Chideock Quarry Hill, Dorset. (Page lvi.)

Fig. 5.—Whorl-section.

Fig. 6.—Suture-lines. 6 *a.* Radial-line.

Fig. 7.—Side view of a specimen without test. Dundry, Somerset. Collected by the late Mr. E. Wilson, F.G.S.

Fig. 8.—Front view.

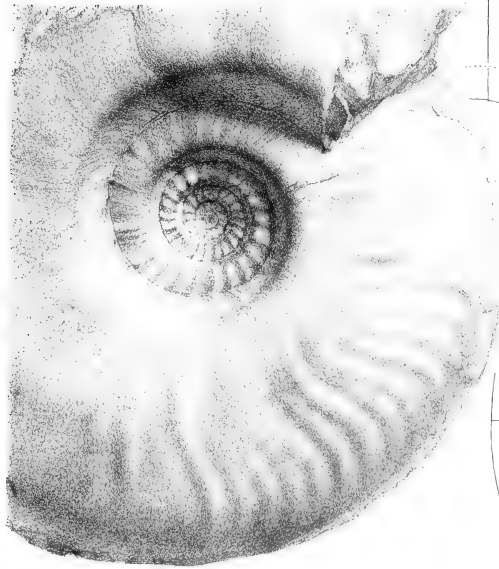
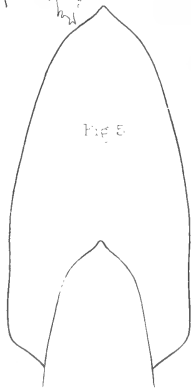
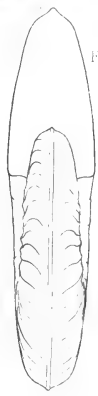
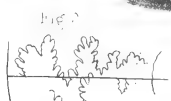
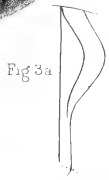
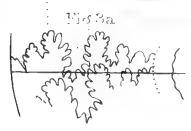
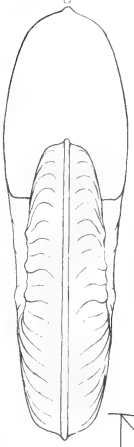
Fig. 9.—Suture-lines. 9 *a.* Radial-lines.

All the specimens are in my Collection.

Fig 1



Fig 2





SUPPLEMENT, PLATE XIII.

Murchisonæ hemera.

Figs. 1—3.—*HYATTIA PUSTULIFERA*, *S. Buckman*.

Fig. 1.—Side view of a specimen with test well preserved. Chideock Quarry Hill, Dorset, from the "Wild Bed." (Page lv.)

Fig. 2.—Front view.

Fig. 3.—Suture-lines. 3 *a.*—Radial lines.

Figs. 4—6.—*MANSSELIA SUBACUTA*, *S. Buckman*.

Fig. 4.—Side view of a specimen without test. Symondsburry, Dorset. (Page lviii.)

Fig. 5.—Whorl-section.

Fig. 6.—Suture-lines. 6 *a.*—Radial-line.

Figs. 7—9.—*HYATTINA BRASILI*, *S. Buckman*.

Fig. 7.—Side view of a specimen without test. Haselbury, Somerset. Collected by Mr. Darell Stephens. (Page lvii.)

Fig. 8.—Front view.

Fig. 9.—Suture-lines. 9 *a.*—Radial lines.

The specimens are in my Collection.

Fig 7.



Fig 9a. Fig 5 Fig 6a

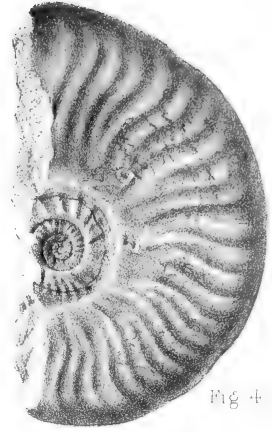


Fig 4

Fig 2

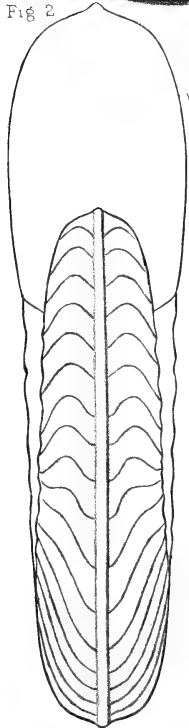


Fig 3



Fig 3a.



Fig 8

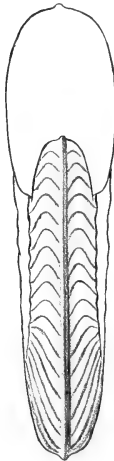
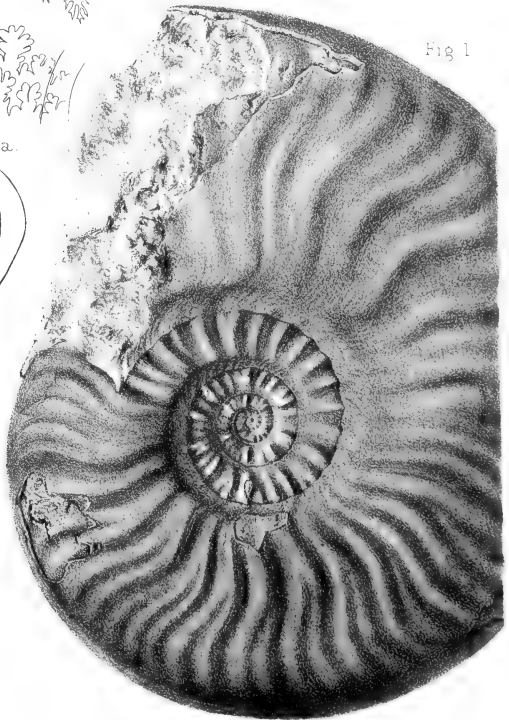


Fig 1





SUPPLEMENT, PLATE XIV.

Murchisonæ hemera.

Figs. 1, 2.—HYATTIA BULLIFERA, *S. Buckman*.

Fig. 1.—Side view. Pea Grit of the Cheltenham district, probably from Birdlip. Collected by my father. (Page lv.)

Fig. 2.—Whorl-section.

Figs. 3—5.—APEDOGYRIA PATELLARIA, *S. Buckman*.

Fig. 3.—Side view of a specimen with test. "Wild Bed," Chideock Quarry Hill, Dorset. (Page lix.)

Fig. 4.—Front view.

Fig. 5.—Suture-line. 5 *a*. Radial-line.

Figs. 6, 7.—LUDWIGINA PATULA, *S. Buckman*.

Fig. 6.—Side view. From Paving Bed, Bradford Abbas, Dorset, by matrix. Collected by my father. (Page lxi.)

Fig. 7.—Whorl-section.

For other figures of this species see Pl. III, fig. 3, under the name
Ludwigia Murchisonæ, which should now be altered.

Figs. 8—10.—LUDWIGIA HAUGI, *Douvillé*.

Fig. 8.—Side view. From Paving Bed, Bradford Abbas, by matrix. Collected by my father. (Page lxx.)

Fig. 9.—Peripheral view. 9 *a*.—Whorl-section.

Fig. 10.—Suture-lines. 10 *a*.—Radial-line.

Figs. 11, 12.—COSMOGYRIA sp.

Fig. 11.—Side view. From the "Wild Bed," Chideock Quarry Hill, Dorset. (Page liv.)

Fig. 12.—Peripheral view. 12 *a*.—Whorl-section. 12 *b*.—Radial-line.

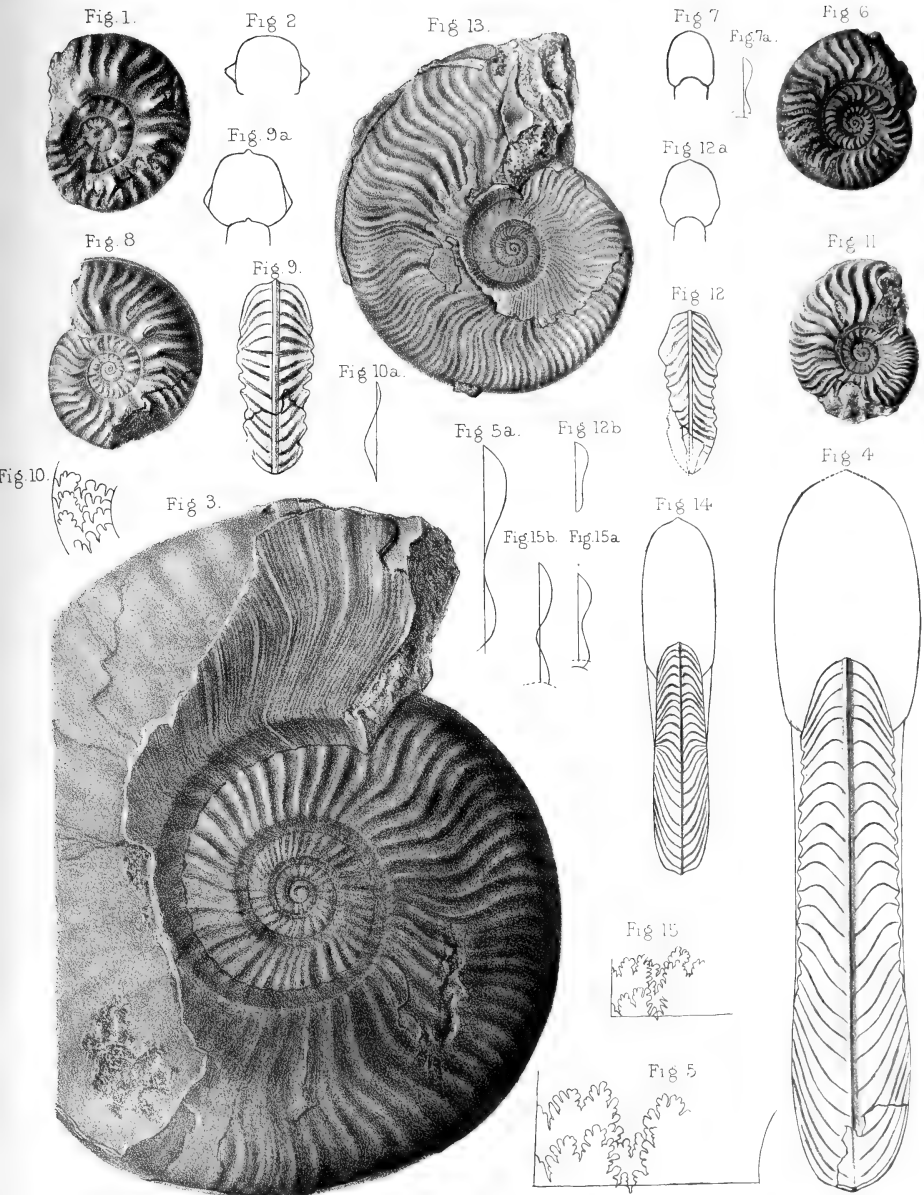
Figs. 13—15.—APEDOGYRIA? SUBCORNUTA, *S. Buckman*.

Fig. 13.—Side view, showing mouth-border with portion of lateral lappet. Horn Park, near Beaminster. (Page lx.)

Fig. 14.—Front view. The peripheral view is not sufficiently compressed.

Fig. 15.—Suture-lines. 15 *a*, *b*.—Radial-lines.

All the specimens are in my Collection.









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