PALÆONTOGRAPHICAL SOCIETY.

VOL. LXXII.

THE PLIOCENE MOLLUSCA.

VOL. II, PART I.

PAGES 485—652; PLATES XLV—LIX.

ORDOVICIAN AND SILURIAN BELLEROPHONTACEA.

PART I.

PAGES 1—48; PLATES I—VIII.

ISSUED FOR 1918.

PALÆONTOGRAPHICAL SOCIETY.

VOLUME LXXII.

CONTAINING

1. THE PLIOCENE MOLLUSCA. Vol. II, Part I. By Mr. F. W. Harmer. Eight Plates.
2. THE ORDOVICIAN AND SILURIAN BELLEROPHONTACEA. Part I. By Dr. F. R. Cowper Reed. Eight Plates.

ISSUED FOR 1918.

LONDON:
PRINTED FOR THE PALÆONTOGRAPHICAL SOCIETY.

AGENTS FOR THE SOCIETY
DULAU AND CO., LTD., 34–36, MARGARET STREET, CAVENDISH SQUARE, W. 1.

DECEMBER, 1920.

THE PALÆONTOGRAPHICAL SOCIETY was established in the year 1847, for the purpose of figuring and describing British Fossils.

Each person subscribing ONE GUINEA *is considered a Member of the Society, and is entitled to the Volume issued for the Year to which the Subscription relates. The price of the Volume to Non-subscribers is* TWENTY-FIVE SHILLINGS NET.

Subscriptions are considered to be due on the 1st of January in each year.

The Annual Volumes are now issued in *two forms of Binding:* 1st, with all the Monographs stitched together and enclosed in one cover; 2nd, with each of the Monographs in a paper cover, and the whole of the separate parts enclosed in an envelope. Members wishing to obtain the Volume arranged in the LATTER FORM are requested to communicate with the Secretary.

Most of the *back volumes* are in stock. Monographs or parts of Monographs already published can be obtained, apart from the annual volumes, from Messrs. DULAU AND CO., LTD., 34–36, Margaret Street, London, W. 1, who will forward a complete price list on application.

Members desirous of forwarding the objects of the Society can be provided with plates and circulars for distribution on application to the Secretary, Dr. A. SMITH WOODWARD, British Museum (Nat. Hist.), South Kensington, London, S.W. 7.

The following Monographs are in course of preparation and publication:

The Cambrian Trilobites, by Mr. Philip Lake.

The Carboniferous Insects, by Mr. Herbert Bolton.

The Palæozoic Asterozoa, by Dr. W. K. Spencer.

The British Bellerophontacea, by Dr. F. R. Cowper Reed.

The Pliocene Mollusca, by Mr. F. W. Harmer.

The Pleistocene Mammalia, by Prof. S. H. Reynolds.

Owing to scarcity of paper, the Council has decided to omit from the present volume the usual lists of members and publications. Full particulars can be obtained from the Secretary.

Members deceased during 1918: Mr. W. E. Balston, Mr. C. H. Cunnington, Mr. Upfield Green, Dr. J. Foulerton, Prof. McKenny Hughes, Mr. H. R. Knipe, and the Duke of Northumberland.

New members: Miss Angus, Lieut.-Col. C. Broad, Mr. Cecil W. Cunnington, Lieut. W. Angus McIntyre, R.E., and the Kendal Municipal Museum.

ANNUAL REPORT OF THE COUNCIL

FOR THE YEAR ENDING 31ST DECEMBER, 1917.

READ AND ADOPTED AT THE

ANNUAL GENERAL MEETING,

HELD AT THE APARTMENTS OF THE GEOLOGICAL SOCIETY, BURLINGTON HOUSE,

5TH APRIL, 1918,

DR. HENRY WOODWARD, F.R.S., PRESIDENT,

IN THE CHAIR.

THE Council, in presenting its Seventy-First Annual Report, regrets that, owing to the various difficulties of existing circumstances, its publications still remain in arrear. The volume for 1916 was completed in February, 1918, but its publication and distribution were unfortunately delayed by the shortage of labour, and it cannot be issued until a few weeks hence. There is no lack of offers of Monographs to the Society, and the volume for 1917 has already been arranged to contain instalments of Pliocene Mollusca, Cambrian Trilobites, Palæozoic Asterozoa, and Wealden and Purbeck Fishes. The number of plates, however, will be reduced to twenty, and the amount of text must also be diminished while the cost of publication remains so high as at present. The expenditure during the year has exceeded the income by £112 11*s.* 11*d.*, but this excess is met by the savings of preceding years when there was less activity.

Among members who have died since the last Annual Meeting, the Council especially laments the loss of its Vice-President, Dr. George Jennings Hinde, F.R.S. He not only contributed an important volume on British Fossil Sponges to the series of Monographs, but also did great service as a member of Council

from 1897 onwards. The Society particularly remembers with gratitude his untiring efforts for its welfare while he held the office of Treasurer from 1904 until 1914. Sir Charles Holcroft and Prof. McKenny Hughes were also valued supporters for many years, and the latter had served on the Council. To replace the losses sustained the Council would welcome help in making the work and needs of the Society more widely known.

The thanks of the Society are due to the Council of the Geological Society for permission both to store the stock of back volumes, and to hold the Council Meetings and Annual General Meeting in their apartments.

In conclusion, it is proposed that the retiring members of Council be Mr. Dewey, Dr. Trechmann, Mr. Woods, and the late Dr. Hinde; that the new members be Mr. C. H. Cunnington, Mr. Ernest Gibson, Mr. A. W. Oke, and Dr. A. Strahan; that the new Vice-President be Dr. A. Strahan; that the President be Dr. Henry Woodward; the Treasurer, Mr. Robert S. Herries; and the Secretary, Dr. A. Smith Woodward.

Annexed is the Balance-sheet.

The PALÆONTOGRAPHICAL SOCIETY in account with ROBERT S. HERRIES, Esq., M.A., F.G.S., Treasurer.

Cr. *From January 1st, 1917, to December 31st, 1917.* *Dr.*

		£ s. d.	£ s. d.
Balance from last Account			316 3 2
Members' Subscriptions—1911–1916	43	45 3 0	
,, ,, 1917	120	126 0 0	
,, ,, 1918–1919	8	8 8 0	
	171	179 11 0	179 11 0
One incomplete Subscription			0 19 10
Carriage paid by Members			0 9 6
Sales of back Stock to Members			40 17 0
Sales by Messrs. Dulau & Co., Ltd.			42 5 9
Repaid Income Tax (1 year)			3 15 0
Dividend on £500 Natal 3 per cent. Stock (less income tax)			11 5 0
Dividend on £210 10s. 6d. 5 per cent. War Loan			10 3 9
Dividend on £400 6 per cent. Exchequer Bonds (less income tax)			11 8 3
Interest on Deposit			10 15 5
Due to Bank on Current Account			96 8 9
			£724 2 5

	£ s. d.	£ s. d.
Printing, etc., Vol. LXX (on account)		150 0 0
Drawing illustrations and preparing blocks		115 13 0
Collotype and lithographic printing		99 10 0
Secretary's honorarium		52 10 0
Postage and stationery		4 3 0
Premium—Fire Insurance		0 15 0
Petty charges—Porter	0 15 0	
Bank	0 6 5	
		1 1 5
Anti-aircraft insurance of Stock		0 10 0
Balance at Bank, Deposit Account		300 0 0
		£724 2 5

We have examined the above account, compared it with the vouchers, and find it to be correct; we have also seen the receipt for £500 Natal 3 per cent. Consolidated Stock, and for the £210 10s. 6d. 5 per cent. War Loan, and £400 6 per cent. Exchequer Bonds.

Robert S. Herries,
Treasurer.

March 21st, 1918.

HENRY DEWEY
ERNEST GIBSON
W. D. LANG
WALCOT GIBSON
Auditors.

Council and Officers elected March, 1918.

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Palæontographical Society, 1918.

THE PLIOCENE MOLLUSCA OF GREAT BRITAIN,

BEING SUPPLEMENTARY TO

S. V. WOOD'S MONOGRAPH OF THE CRAG MOLLUSCA.

BY

F. W. HARMER, Hon. M.A.Cantab., F.G.S., F.R.Met.S.,

MEMBRE HONORAIRE DE LA SOCIÉTÉ BELGE DE GÉOLOGIE ET DE PALÉONTOLOGIE.

VOL. II, PART I.

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December, 1920.

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THE PLIOCENE MOLLUSCA OF GREAT BRITAIN.

VOLUME II.

INTRODUCTION.

The commencement of a new volume gives me the opportunity of offering a rapid summary of my views as to the relation of the various horizons of the English Crag to each other and to those of Belgium and Holland, as well as to the different conditions under which they may have originated.

It seems desirable, however, in the first place to discuss with some care an opinion lately expressed by my friend Mr. R. B. Newton, that "the Coralline Crag, the St. Erth beds and the Lenham beds of Britain, together with the Diestien and Anversien of Belgium, are of Upper Miocene or Mio-Pliocene age, while the Boxstones or Nodule beds of East Anglia should be referred to the Vindobonean division of the Middle Miocene."[1] A recent paper by Mr. A. Bell[2] supports the view that the Boxstone fauna is considerably older than the Coralline Crag, but I cannot think the latter has any close relation to the Lenham bed and still less to the Anversien (Miocene) of Belgium, zones *à Panopæa Menardi* and *à Pectunculus pilosus*. Belgian geologists consider that the latter deposits indicate approximately the western limit of the Anversien sea. No traces of these beds are known in the region between Antwerp and the Belgian coast. That the Miocene sea ever reached the Coralline Crag region of Suffolk seems to me improbable.

For some time I have considered, on the contrary, that the fauna of the Coralline Crag resembles more nearly that of the Waltonian of Essex and of its equivalent, the Scaldisien of Belgium, and that it should be grouped, not even with the Lenham-Diestien deposits as Lower, but with the former, the Waltonian and Scaldisien, as Upper Pliocene.

[1] Journ. of Conch., vol. xv, p. 118, 1916.

[2] Geol. Mag. [6], vol. v, p. 15, 1918.

It is true that in 1848 in the Introduction to the first part of his Monograph of the Crag Mollusca, following the ideas then current, Wood expressed the opinion that the Coralline Crag might be of Miocene age,[1] but two years later, in his second part of 1850, that view was withdrawn,[2] and no attempt has been made since, either in this country or abroad, to revive it.

Four hundred and thirty species of marine Mollusca were reported by Wood from the Coralline Crag in his synoptical list of 1874.[3] Of these only about 90, 21 per cent., were known at that time from Walton, but even then he had come to the conclusion that there was a close and general connection between the two deposits.[4]

The subsequent investigations of Prof. Kendall and the late R. G. Bell at Walton, and my own at Little Oakley have strongly supported Wood's later opinion. Of the 430 Coralline Crag species referred to, 270, or about 64 per cent., are now known from the Waltonian or from some later horizon,[5] while hardly any of the rest can be considered as common or representative Coralline Crag forms. To regard a species of which only one, or at the most a very few specimens, have been obtained during the labours of a century, as of equivalent value for purposes of analysis to others of which a large number could be found at any time in a few hours, is misleading. It is by the general facies of a fauna—by the abundant and not by the rare examples—that we should be guided.

While, therefore, nearly all the more characteristic Coralline Crag species continued to exist in the Anglo-Belgian basin during Waltonian times, or even to a later period, no such correspondence can be traced between the Coralline Crag fauna and that of the Belgian Miocene of Antwerp. Out of 230 species of Mollusca reported from the latter,[6] only 106, or 46 per cent., are known from the Coralline Crag, the rest being generally and distinctly of an older type.

The true Belgian equivalent of the Coralline Crag is the zone *à Isocardia cor* of Van den Broeck, for which I have revived his name, Casterlien, the fauna of the two being practically identical. Of about 150 species from the latter recorded by that authority[7] and by M. Bernays,[8] all but about half-a-dozen have been obtained from the Coralline or the Waltonian horizons. The Casterlien fauna of

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[1] Mon. Crag Moll., pt. i, Introduction, p. v, 1848.

[2] *Op. cit.*, pt. ii, p. 302, 1850.

[3] *Op. cit.*, 1st Suppl., pt. ii, p. 203.

[4] In the 4th ed. of his Antiquity of Man (p. 250, 1873), Lyell quoted Wood's opinion that the Walton bed had an essential affinity with the Coralline Crag.

[5] The discovery by Alfred Bell in the Coralline Crag of Boyton of some typical Red Crag species such as *Nassa reticosa*, unknown from the Gedgrave horizon, tends still further to connect the latter with the Walton beds (see Journ. Ipswich Field Club, vol. iii, pp. 11, 15, 1911).

[6] Ann. Soc. Malac. Belg., vol. ix, pp. 118, 134, 1874.

[7] *Op. cit.*, p. 187.

[8] Bull. Soc. Belge Géol., vol. x, Mém., p. 128, 1896.

Belgium, moreover, bears a general resemblance to the Scaldisien of that country similar to that existing between those of the Coralline and Waltonian Crags. The connection between the Coralline-Casterlien and the Waltonian-Scaldisien is as clearly marked as the difference between those groups and the Miocene of Antwerp.

In his Pliocene Deposits of Britain, p. 222, 1890, the late Cl. Reid identified the Lower Red Crag (Waltonian) with the Astien of Piedmont, and the Coralline Crag with the Plaisancien, placing the first in the Upper and the second in the Lower Pliocene, but in the light of our present knowledge I cannot see any sufficient reason for such a separation. The principal difference between the Coralline and the Waltonian Crags is, that the latter contains a large number of boreal species unknown from or exceedingly rare in the former, but the sudden appearance of such shells in the Anglo-Belgian basin was due, I submit, to the subsidence of the northern part of the area at that period, described in one of my former papers,[1] by which the Crag sea was for the first time brought, probably somewhat suddenly, under the influence of marine currents from the north.

THE LENHAM BED.

While agreeing with Mr. Newton that the Lenham fauna is older than that of the Coralline Crag, I cannot consider it to be Miocene. I do not think that the

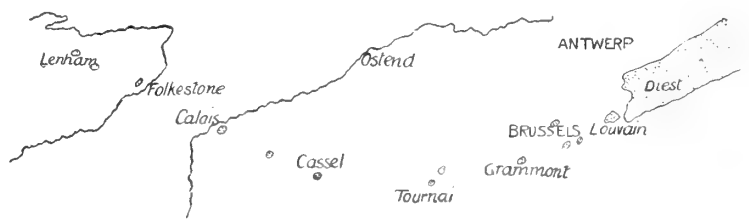

Fig. 1.—Sketch map, showing the connection between the Lenham bed and the Diestien sands of Louvain and Diest (after Rutot).—F. W. H.

list of Lenham fossils given and figured by him could be taken by anyone having a working knowledge of the subject for a typical collection of Coralline species.

Stratigraphically the Lenham bed is connected with the sands of Louvain and Diest (zone *à Terebratula grandis* of Van den Broeck) by a remarkable series of isolated Diestien hills which form a curved line extending from west to east through Folkestone, Calais, Cassel, Tournai, Grammont, Brussels and Louvain; beyond that region, as at Diest, these deposits cover the country with a continuous sheet (see Fig. 1).

The Diestien sands have been always regarded as Pliocene by Belgian geologists,

[1] "The Pliocene Deposits of Holland," Quart. Journ. Geol. Soc., vol. lii, p. 761, fig. 4, 1896 (see also Fig. 3 of this work).

and until now I have never heard it suggested that they may be Miocene. If the stratigraphical evidence is of any value and the Diestien beds are of Pliocene age, the Lenham bed must be Pliocene also, though belonging, I consider, to its Lower and not to its Upper division.

The zoological evidence, so far as it goes, points in the same direction. The Lenham-Diestien beds, it is true, contain some characteristic Miocene or Lower Pliocene fossils unknown from either the Coralline or the Casterlien zones, but they include also a considerable proportion of a more recent character which would seem out of place in a typical Miocene deposit.

For zoological, therefore, as well as for stratigraphical reasons, I draw what seems to me a well-marked line separating the Lower and Upper Pliocene, between Lenham and the Coralline Crag. The line between the Coralline Crag and the Waltonian, as explained above, appears to me much less distinct.

The term "Red Crag," including, as it does, beds differing considerably in age and character, is vague and, when we attempt to correlate them with those of other countries, inconvenient, the Scaldisien of Belgium with its southern fauna representing one part of it and the Amstelien of Holland, which contains northern species, another. Retaining it, therefore, for general use it seems desirable to adopt for its different horizons some more definite and distinctive names.

At a meeting of the British Association for the Advancement of Science at Dover in 1899[1] I proposed the following classification of the Pliocene deposits of the East of England (republished with a slight alteration in Vol. I, p. 5 of the present work) with that of their Belgian and Dutch equivalents:

Upper Pliocene.			
Icenian	Red Crag	Weybourne horizon (zone of *Tellina balthica*) Chillesford horizon (estuarine) Norwich horizon (zone of *Astarte borealis*)	
Butleyan	Red Crag	Zone of *Cardium groenlandicum*	Amstelien.
Newbournian	Red Crag		Amstelien.
Waltonian	Red Crag	Oakley horizon Walton horizon } zone of *Neptunea contraria*	Poederlien. Scaldisien.
Boytonian	Coralline Crag	(Containing *Nassa reticosa* and some other characteristic Red Crag species)	Casterlien, zone of *Isocardia cor.*
Gedgravian	Coralline Crag		Casterlien, zone of *Isocardia cor.*
Lower Pliocene.			
Lenham bed		Zone of *Arca diluvii*	Diestien, zone of *Terebratula grandis.*

[1] Trans. of Sections, p. 751.

THE CORALLINE CRAG.

Gedgravian, Boytonian.

In his well-known paper[1] Prestwich divided the Coralline Crag into eight zones, characterised by distinctive groups of fossils (for which division, however, both S. V. Wood, jun., and I considered he offered no satisfactory evidence), accompanied by great physiographical changes, as, for example, at one stage a submergence of the Crag area with a subsequent re-emergence amounting to from 500 or 1000 feet, a view which seemed to us highly improbable.[2] The apparently well-marked separation, moreover, between the incoherent glauconitic and fossiliferous sands of the lower part of the formation and the indurated ferruginous rock-bed of the upper part, has been now found to be more apparent than real, the rock-bed being merely an altered condition of the shelly sands caused by an infiltration of acidulated water by which the aragonite fossils were removed, though their casts may be observed in places, while the calcite Polyzoa and a few calcite Mollusca remained.[3]

When we examine the matrix of the Coralline Crag from different localities or different levels, whether microscopically or chemically, we find no essential difference in it. It is mainly of organic origin, consisting principally of the comminuted shells of marine organisms or of calcareous matter derived from their decomposition, with layers of perfect shells in places, nowhere presenting the features of a typical deep-sea formation.

With the exception of a thin basement bed, not everywhere present, it seems to me probable that the greater part of the Coralline Crag was deposited under conditions more or less uniform, in water sufficiently shallow to be within the reach of currents,[4] at no great distance from the western margin of the Crag sea and in banks which were possibly more or less parallel with it.

There is no evidence to show that masses of dead shells are now being laid down simultaneously in British seas over large and continuous areas. They originate locally, however, in comparatively shallow-water deposits, often false bedded, containing stratified beds of molluscan *débris*, for the most part those of dead animals, accumulated under the influence of currents.

As to Prestwich's suggestion that there may have been a submergence of from

[1] Quart. Journ. Geol. Soc., vol. xxvii, p. 171, 1871.

[2] These views were discussed by us in the Introduction to the 1st Suppl. to Wood's Monograph (Palæont. Soc., 1872), and by myself in the Quart. Journ. Geol. Soc , vol. lix, p. 320, 1898.

[3] See P. F. Kendall, Geol. Mag. [2], vol. x, p. 497, 1883.

[4] Reef-building polyzoa are common at some localities in the Coralline Crag. Such forms are said to flourish best in clear water agitated by currents. The late Cl. Reid remarks, moreover, that the whole of the Coralline Crag is more or less current-bedded (*op. cit.*, p. 36).

500 to 1000 feet at a certain stage of the Coralline Crag period, I am not aware that any evidence has been adduced in confirmation of such a view. The occasional occurrence of drifted specimens of a few deep-sea forms in a current-bedded deposit can be otherwise explained.

As is well known, the general facies of the Coralline Crag fauna is distinctly southern. Of the species still living most are now found in the Mediterranean or along the western coasts of France and Portugal,[1] while characteristically northern species are as a rule conspicuous by their absence. These facts point, I think, to the view that free communication then existed between the Crag basin and the Atlantic, but not with northern seas.

The English Crag deposits may have originated in two ways—first, as submarine banks, in a sea of no great depth, under the influence of currents, and next as littoral drift, the one representing the conditions attending the deposition of the Coralline Crag, the other those under which recent shell-beaches and sand-banks are now being formed in Holland on the one hand, and those of the Pliocene Red Crag on the other. One case of the former kind, to which Jeffreys called attention, is that of the Turbot Bank off the coast of Antrim, in Ireland, which stretches from the entrance to Belfast Lough towards the Copeland Isles, and lies at a depth of from 25 to 30 fathoms below ordnance datum. It rests against the shore, extending seawards for a short distance and then shelving into deeper water. The coast of Antrim is separated from Scotland by a narrow channel, through which currents run with great velocity. No deposition takes place there, but shells are swept up from some adjacent sea-bottom and deposited in a spot which is comparatively sheltered. Most of the mollusca of the Irish Sea live at a depth of less than 50 fathoms, except *Isocardia cor*, a mud-loving species, rare in the Coralline Crag, which gives its name to the Casterlien of Belgium, a deposit, as urged above, synchronous with it, which M. Van den Broeck considers to represent a sea-bottom, undisturbed by currents, in which lamellibranchiate mollusca are found with both valves united and in the position of growth.

The recorded exposures of Coralline Crag arrange themselves along a curved line, extending in a S.W.—N.E. direction for about 25 miles from Tattingstone, near Ipswich, to Aldeburgh in Suffolk, with a submerged continuation to Thorpe and Sizewell to the north of the latter place. The largest group of these exposures is that between Gedgrave marshes and Aldeburgh, which is narrow and elongate, about 12 miles in length and 2 in width. A map showing the position of the various sections and borings at that time available was published by me in 1898,[2] and is reproduced, by consent of the Council of the

[1] Many Coralline Crag species, moreover, are to be found in the Pleistocene deposits of Calabria and Sicily.

[2] Quart. Journ. Geol. Soc., vol. liv, p. 326, fig. 4.

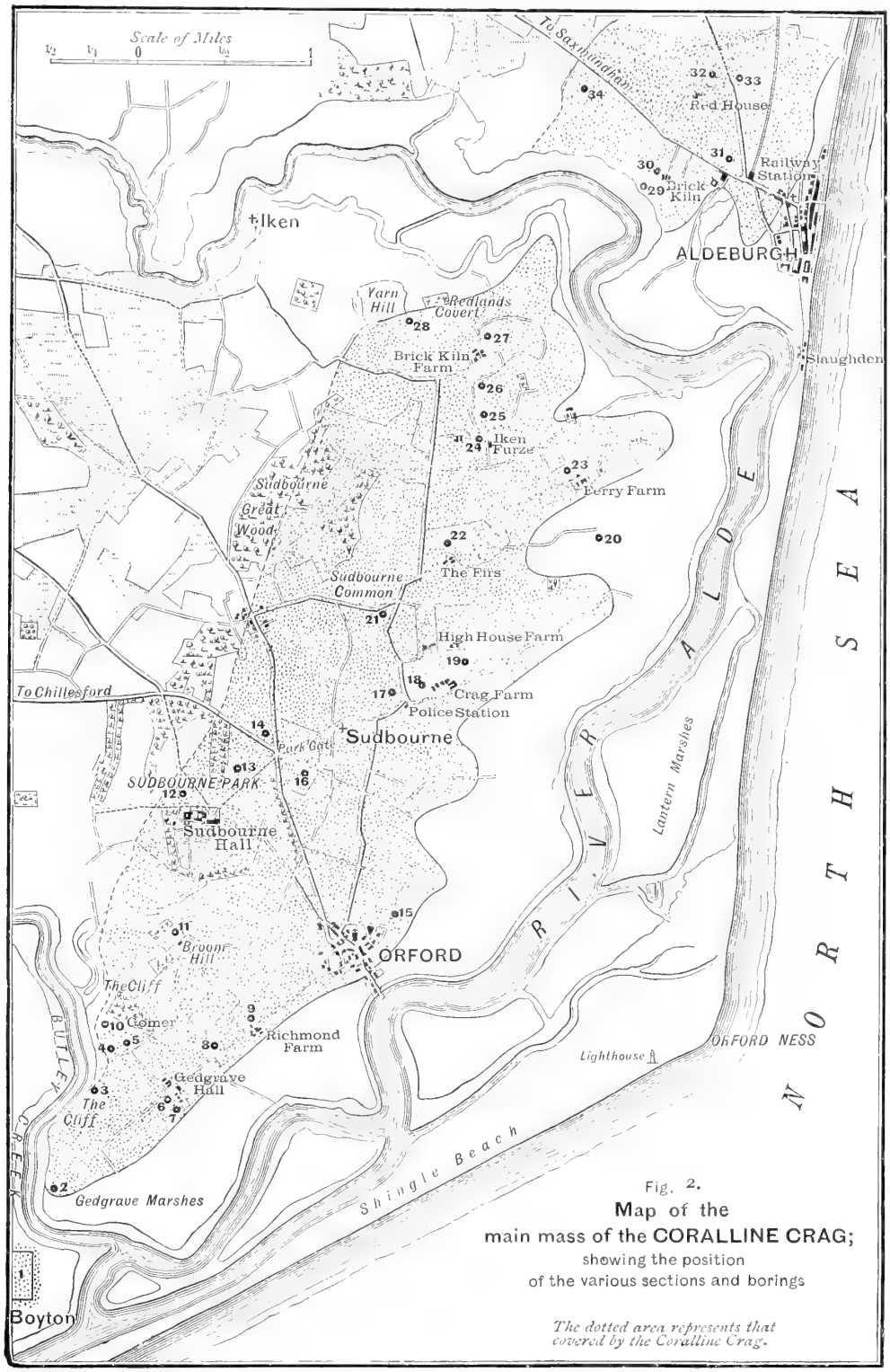

Fig. 2 (reproduced by permission of the Council of the Geological Society of London).—F. W. H.

Geological Society, in Fig. 2 of the present volume. There are a few other outliers of the Coralline Crag, as at Boyton, Sutton or Ramsholt, but they are isolated and much smaller.

In an interesting paper on the Boyton Crag,[1] which should not be overlooked, Mr. Bell gives a list of mollusca from that deposit, containing, together with a characteristic Gedgravian fauna, some typical Red Crag species unknown from the latter. Of these, *Nassa reticosa* and its varieties may be specially mentioned, as well as a single immature specimen of the Waltonian *Neptunea contraria*, now in the York Museum (figured in Pl. XXXVII, fig. 3, of my Vol. I).

Such facts have led Mr. Bell to the conclusion, with which I agree, that the Boyton Crag is of an intermediate age between those of Gedgrave and Walton, still further connecting these deposits.

In my list of characteristic Waltonian shells given on p. 495, those occurring at Boyton, but not at Sutton or Gedgrave, are indicated by an asterisk (*).

THE RED CRAG.

Waltonian, Newbournian, Butleyan.

While engaged in the study of the conditions under which the English Crag beds were deposited I was fortunate enough to receive from Dr. J. Lorié, of Utrecht, some valuable papers on the strata met with in deep borings at several localities in different parts of Holland. When shown in section these revealed the interesting fact that the Pliocene beds underlying that country not only attain a thickness of nearly 500 feet, but that they have been persistently and gradually depressed till, at the furthest point north to which the borings were carried, they were found to reach a depth of more than 1000 feet below their original position. This northerly subsidence seems to have been coincident with an earth-movement of elevation to the south (see section, Fig. 3) by which the Lenham-Diestien beds have attained a maximum height of more than 600 feet above the level of the sea, the line of greatest disturbance, so far as the evidence goes, running at right angles to the strike, from the Straits of Dover to Amsterdam. A comparison of the mollusca found at different levels in these Dutch borings points to the conclusion that those found in the lower part correspond more or less nearly with the characteristic fossils of the Diestien, Casterlien and Scaldisien deposits of Belgium, while those of the upper portion are on the whole of a newer character. For the latter I proposed, in consultation with Dr. Lorié, the term "Amstelien," which, so far as I know, has been generally accepted by Belgian and Dutch geologists.

The sections (Figs. 1 and 3) show that since the deposition of the Lenham bed and of the ferruginous sandstones of Louvain and Diest, the south of England has

[1] Journ. Ipswich Field Club, vol. iii, p. 5, 1911.

risen more than 600 feet, the elevatory movement having been gradually less eastward, in the direction of Belgium, the present heights of these deposits above the level of the sea being at Lenham 600, at Cassel 515, at Grammont 375, at Brussels 235, and at Diest 205 feet (see Fig. 1). On the other hand subsidence has taken place in Holland, regularly increasing northwards towards Amsterdam, where probably it may have amounted to 1500 feet (Fig. 3).

Since the Lower Pliocene period the Anglo-Belgian basin has moved as on a pivot, rising in the south and sinking in the north. The edge of this earth-movement of northerly depression may be traced also in East Anglia, giving us a clue to the conditions under which our newer Pliocene deposits may have originated. In the earliest of our Red Crag beds, those of Walton, Beaumont and Oakley, which in 1899 I grouped as Waltonian,[1] correlating them with the Scaldisien and Poederlien of Belgium, we find, as before stated, many of the more

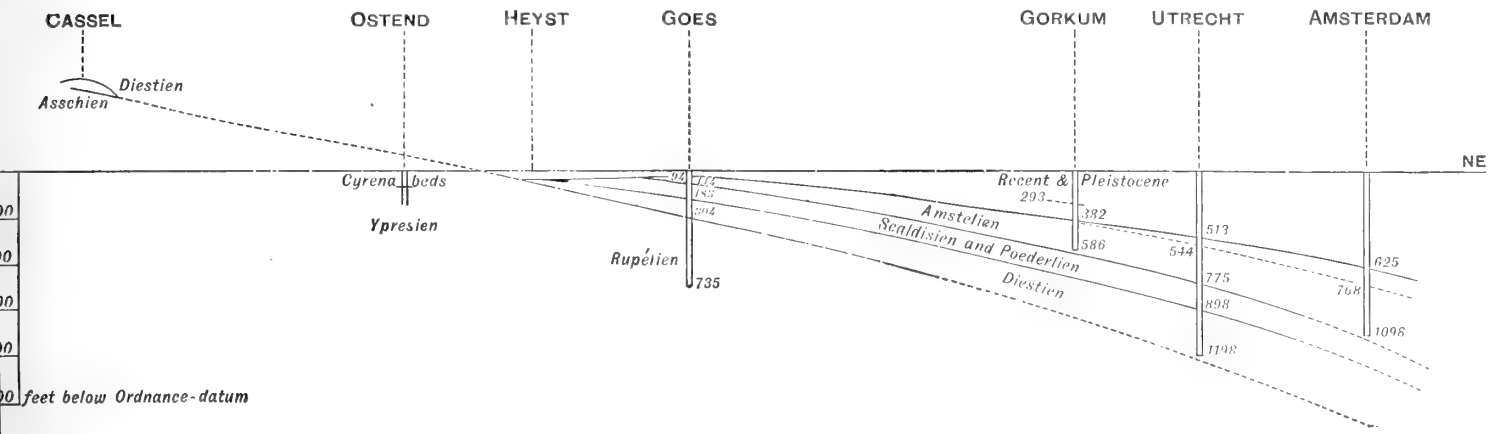

Fig. 3.—Section from Cassel to Amsterdam.—F. W. H. (Reproduced by permission of the Council of the Geological Society of London).

abundant mollusca of the Coralline Crag. As the result of the upheaval of the Lenham-Diestien area, communication between the Crag sea and the Atlantic was interrupted, while by the northerly subsidence, connection with northern seas was established and many boreal and some arctic species were introduced, apparently rather suddenly, to the Crag basin. Hence the facies of the molluscan fauna of the region in question was gradually and steadily changed, its general character eventually becoming strongly northern. As long as communication with southern seas remained open the southern mollusca held their own, but when it was interrupted and the latter came under the influence of colder currents from the north, they gradually disappeared. At first, during the Waltonian, it was boreal species, such as the sinistral *Neptunea contraria*, that established themselves, while afterwards, at the Oakley stage, before the southern forms had died out, characteristically

[1] "A New Classification of the Pliocene Deposits of the East of England," Rep. Brit. Assoc. (Dover), p. 751, 1899.

arctic shells like *N. despecta* made their appearance; in this way, I take it, the general character of the molluscan fauna of Red Crag times was gradually changed, eventually becoming distinctly northern.[1]

The Red Crag beds, nowhere attaining any considerable thickness, their fossils being with few exceptions the drifted and stratified shells of dead mollusca, seem to have been deposited as beaches against the shore or as submarine banks in proximity to it, in the shallow water of land-locked bays or inlets. The position of these inlets was successively shifted towards the north as the northerly depression progressed, and they were silted up one after another by masses of shelly sand. As far as the evidence goes, the different fossiliferous zones of the Red Crag do not overlap, occurring in horizontal rather than in vertical sequence. As we trace the northward retreat of the Crag sea from Walton-on-Naze on the south to Weybourne on the Norfolk coast, we find the various deposits to assume regularly a more recent as well as a more boreal and eventually a sub-arctic character. By comparing the percentages of the more prominent northern or southern mollusca on the one hand, and of the recent or extinct species on the other, we are able to apply to the Crag beds in different localities a test of their comparative age. The older and distinctively southern fauna occurs towards the south of the Crag district, the northern and more recent towards the north. The change is gradual, and, as just stated, there is no overlapping. The Red Crag deposits represent therefore a succession of shelly false-bedded strata having a sandy and not an organic matrix, as in the case of the Coralline Crag, accumulated near the then western margin of the North Sea as submarine, shallow-water banks or, with a more highly inclined stratification, as beaches against the shore.

No such masses of dead shells as those which, in inconceivable numbers, were heaped against the western coast of the North Sea in Red Crag times, are now to be found in that region. One may sometimes walk for a mile or two along the beach, for instance at Yarmouth or Lowestoft, without finding a single specimen. When we pass to Holland, however, we find deposits of shelly *débris*, continuous for many miles, which can only be compared in extent and importance with those of the Crag.[2] The difference seems to have been due to the fact that the cyclonic disturbances from the Atlantic which now cross East Anglia are attended by a prevalence of stormy gales from the west, owing to the centres of the cyclones passing to the north of it. The effect of stormy weather attended by strong winds is to agitate the water to a considerable depth and to sweep the sea-bottom where mollusca live, their shells being afterwards carried forwards towards the

[1] This view has been more fully discussed in the first volume of the present memoir, p. 156 *et seq.* In the Scaldisien of Belgium only the sinistral form of *Neptunea* occurs, as at Walton; in the Poederlien the dextral and northern shell *N. despecta* is found with it, as at Oakley.

[2] During an excursion to the Hook of Holland with my friend Dr. Lorié I was shown some steam dredgers which I was told raised 100,000 tons of dead shells annually for the manufacture of lime.

opposing coast. It seems probable, therefore, that during the Red Crag period the Atlantic storms crossed East Anglia further to the south, being attended by a prevalence of easterly rather than of westerly gales.[1]

The Crag of Walton-on-Naze in the county of Essex contains, as just stated, many Coralline (Gedgravian) Crag forms, some of them in great abundance, but we find there also a fair number of species unknown or very rare at the latter place, which were probably immigrants from outside regions. Of these may be specially mentioned :

**Nassa elegans.*
* „ *propinqua.*
* „ *reticosa* and vars.
Purpura lapillus (Lower Crag varieties).
* „ *tetragona.*
**Neptunea contraria*, one minute and young specimen in the Coralline Crag of Boyton.
Searlesia costifer.
Raphitoma mitrula.
Eulimene pendula.
* „ *terebellata.*
Lacuna suboperta.
**Trochus cineroides.*
„ *noduliferens.*
* „ *subexcavatus.*
**Natica catenoides.*
Actæon Noæ.
Melampus pyramidalis.
**Nucula lævigata.*
Pectunculus glycimeris, var. *subobliqua.*
**Cardium Parkinsoni.*
„ *edule* (large and strong variety).
**Astarte obliquata.*
**Venus imbricata.*
Artemis exoleta.
**Mactra arcuata.*
* „ *elliptica.*
Corbulomya complanata.
**Pholas crispata.*
* „ *cylindrica.*

*Those marked with a * occur also in the Coralline Crag of Boyton.* As before stated most of the characteristic species of the Coralline Crag are found also at Walton or Oakley. Cl. Reid remarks that the principal interest of the Walton Crag lies in the close resemblance of its fauna to that of the Coralline Crag (*op. cit.*, p. 83).

It may be noticed that the Walton species just named are not specially northern forms. The invasion of the latter had at that time hardly commenced. At Little Oakley, however, a village about 5 miles to the N.N.W. of Walton, there is a remarkable section, the importance of which I discovered by accident, with a fauna containing nearly all the southern species of the latter place and generally identical with it, but also some distinctly northern and arctic forms, unknown or rare at the earlier horizon, such as—

[1] In a short paper published in 1849 (Quart. Journ. Geol. Soc., vol. v, p. 353) Mr. T. G. Ringler Thompson expressed the opinion, though on different grounds, that a great part of the Red Crag originated under the influence of easterly winds. (See also F. W. Harmer, Quart. Journ. Geol. Soc. vol. lvii, p. 407, 1901.)

Buccinum ciliatum.
„ *finmarchianum.*
„ *fragile.*
„ *groenlandicum.*
Neptunea despecta.[1]
„ „ var. *carinata.*
„ „ var. *decemcostata.*
„ *ventricosa.*
Trophon clathratus.
„ „ var. *attenuata.*
Many northern species of *Sipho*, including the Icelandic *S. Olavii*; some northern *Belas*, but not *B. turricula.*
Volutopsis Largillierti.
„ *norvegica.*
Natica affinis.
Tellina (*Macoma*) *obliqua.*
„ *prætenuis.*
Mactra elliptica, var. *obtruncata*, and others.

I have obtained between 600 and 700 species and well-marked varieties of mollusca within an area of twenty yards square at this truly prolific spot.

This zone is specially characterised by the first appearance in the Crag basin of dextral *Neptuneas* of a distinctly arctic and carinated type, though the sinistral Waltonian species, *N. contraria*, is still the more abundant.[2]

In the group of Red Crag deposits, for which I have adopted the name "Newbournian," the southern element is not so preponderant as it is in the Waltonian, and it contains a larger percentage of northern and recent species. The localities, the fauna of which I refer to this division, occur in an area to the north and north-east of those last described at Foxhall, Waldringfield, Newbourn and elsewhere as shown on the map, Fig. 4.

The latest or Butleyan division of the Red Crag may be studied at Bawdsey, Alderton, Hollesley, Sudbourn, Butley, and in the stack-yard just below Chillesford Church, a district lying to the north-east of the Newbournian area (see map, Fig. 4). This group of deposits has been long known to contain a molluscan fauna of a decidedly northern as well as of a more recent type. Including, in addition to some of the shells given above as characteristic of the earlier part of the Red Crag, the following species may be specially mentioned:

Nassa incrassata, var. β.
Buccinum undatum, var. *cærulea.*
Purpura lapillus, recent vars.
Neptunea antiqua, recent British form.
Anomalosipho altus.
Natica catena.
Trochus tumidus.
Nucula Cobboldiæ.
Loripes divaricatus.
Cardium angustatum.
„ (*Serripes*) *grœnlandicum.*
Astarte compressa.
Tellina prætenuis.
Mactra constricta.

[1] In my paper on the Crag of Essex (Waltonian), Quart. Journ. Geol. Soc., vol. lvi, p. 718, 1900, this shell was regarded as equivalent to the recent British form *N. antiqua*. In the present work I consider it to be a different and northern species, *N. despecta* (see Vol. I, pp. 160 *et seq.*).

[2] A photograph of the Oakley section appeared on p. 483 of the first volume of this work.

Counting specimens as well as species, the percentage of northern and recent forms in this division is considerably greater, and of southern and extinct forms considerably smaller than in the earlier horizons of the Red Crag. The typical *Neptunea antiqua* of British seas begins to be more common, while the proportion of sinistral forms of that genus, as compared with that of the dextral ones, is less.

It will be seen from the above remarks that my views on the Red Crag differ widely from those of the late Sir Joseph Prestwich, who divided the latter into two parts only, in the lower of which he grouped the very different faunas of

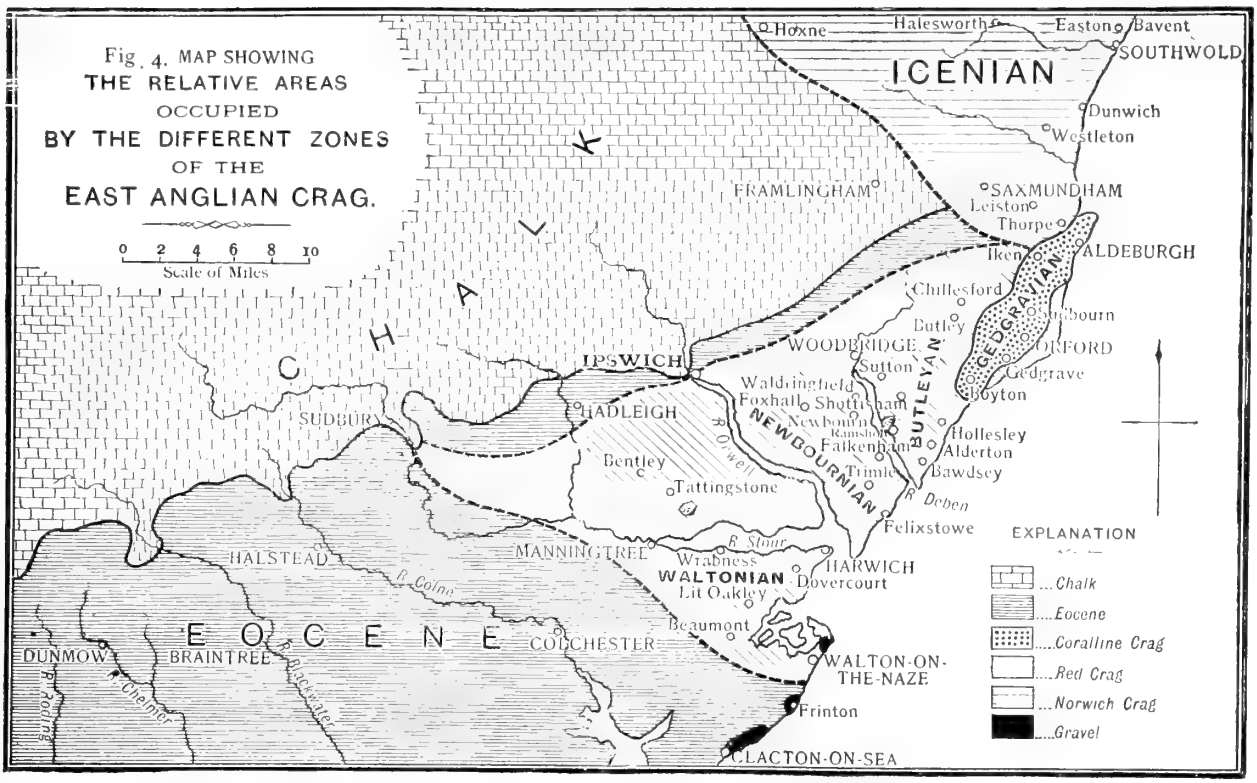

FIG. 4 (reproduced by permission of the Council of the Geological Society).—F. W. H.

Walton-on-the-Naze, Sutton, Bawdsey, Sudbourn and Aldeburgh,[1] the upper consisting of what he originally called "the unfossiliferous sands of the Crag" (now believed to be a part of the deposit which has been deprived of its shells by the infiltration of acidulated water) and of the Chillesford beds. The Norwich Crag, in which he included the Weybourne beds containing *Tellina balthica*, he held to be equivalent, partly to his lower (namely to the Crag of Walton, Sutton, Butley, etc.), and partly to his upper or Chillesford division.

The beds met with in the Dutch borings, for which I have adopted the term

[1] He remarks, "I can see no distinction in the organic remains from the base of the Red Crag to the top of the lower division," Quart. Journ. Geol. Soc., vol. xxvii, p. 354, 1871.

"Amstelien," containing a somewhat more boreal fauna than do the Scaldisien and Poederlien of Belgian geologists, are not known from Belgium but only to the north of it; they may probably represent the Newbournian or Butleyan zones of the English Crag. Nothing has been met with in Belgium or Holland that I can identify with the Icenian of East Anglia.

The history of these Red Crag deposits shows, therefore, a gradual but constant change in their fauna, from one having an affinity with that of the Mediterranean to one decidedly boreal, with a noteworthy percentage of distinctly arctic species.

THE ICENIAN CRAG.

Norwich, Chillesford, Weybourne.

Norwich Horizon.

The beds I group under this name occupy a distinct and wide-spread area to the north of that of the Red Crag which they are not known to overlap (see map, Fig. 4). They never exhibit the highly inclined bedding characteristic of the latter, and appear to have originated under different conditions, in an open and shallow sea, possibly as the western edge of the great delta deposit of the Rhine, which attains such proportions in the sub-soil of Holland.

The Icenian beds come on suddenly, extending northwards more or less continuously from Aldeburgh in Suffolk to the Norfolk coast, a distance of 40 miles in one direction, and covering an area from west to east of about 20 miles in another (Fig. 4). Towards the west they are comparatively thin, and near Norwich finally disappear, while they thicken rapidly in an easterly direction, having been found to reach, at Southwold in Suffolk, a thickness of 150 feet, the mollusca maintaining generally the same comparatively recent and shallow-water character throughout. In East Anglia, as in Holland, subsidence seems to have gone on *pari passu* with the accumulation of sediment.

The marine fauna of the Icenian Crag is of an increasingly impoverished character, the total number of species reported from the Norwich zone being not more than 150 in all, of which only about 40 are really abundant, most of them still living in British seas,[1] while the number obtained from the later Weybourne zone is still less. By this time the greater part of the characteristic shells of the earlier Crag horizons had disappeared. Specimens from the Norwich sections are generally smaller as well as thinner and more fragile than those of the Red Crag, some of them approaching in character those of a freshwater deposit. *Cardium edule*, for example, specimens of which from the Red Crag of Oakley are usually

[1] The best list of the Icenian Mollusca of Bramerton is that published by Mr. Jas. Reeve in the Proc. Norwich Geol. Soc., vol. i, p. 69, 1879 (70 species in all), the result of many years' labour. His specimens are in the Norwich Museum.

large, thick and solid, are smaller and rather delicate in the Icenian Crag of Bramerton, so much so that it is not always easy to obtain them in perfect condition.

In the first volume of this work (p. 413) I suggested that the impoverished condition of many of the Icenian fossils may have been due to a decrease in the salinity of the Crag water—a feature reported by Swedish observers as met with in the Baltic.[1] It seems to me not unlikely that the advance of the Scandinavian ice may have wholly or partially blocked the northern outlet of the Icenian sea, which may have still received volumes of fresh water (at least in summer) from the rivers of central or southern Europe. The local presence of land and freshwater species in these deposits was formerly supposed to indicate the existence of estuarine conditions at this period.[2] A more probable explanation seems to be that such fossils were introduced in places by streams into what was then becoming a land-locked and increasingly brackish lake.

The matrix of the Icenian Crag appears to have been to a considerable extent of southern origin. It contains many pebbles of white quartz and much mica, as do the Chillesford beds, next to be described, probably derived in both cases from the Palæozoic rocks of the Ardennes. The Rhine and its effluents seem to have been a not unimportant factor in the later Pliocene history of East Anglia.

When the Introduction to Wood's First Supplement to the Monograph of the Crag Mollusca was written in 1872, his son and I were disposed to separate a certain portion of the Icenian beds as newer than the rest, and as a fluvio-marine deposit equivalent to that of the Churchyard-pit at Chillesford, but I now consider this was a mistake. Further comparison of the faunas of these various exposures has shown that the difference between their fossils is very slight, while the fauna of the Churchyard-pit, so far as it goes, is, I think, very different. With the latter I associate the many exposures of laminated clays to be dealt with in the next paragraph, confining to these two the term "Chillesford beds." The conditions under which they originated, if my explanation of the subject is correct, were of an estuarine character, while the beds which I now group as those of the Norwich horizon originated in a shallow and somewhat wide-spread and brackish sea.

Among the characteristic species of the Norwich division the following may be specially mentioned :

Nassa incrassata.
„ *pusillina.*
Purpura lapillus, recent variety.
Neptunea antiqua.
Bela turricula.
Potamides tricinctus, var. *icenica.*
Turritella terebra.
Scala grœnlandica.
Turbonilla internodula.
Littorina littorea and varieties.
„ *rudis* and varieties.
Rissoa semicostata.
Paludestrina minuta.
Nucula Cobboldiæ.

[1] See also as to this, H. W. Shimer, Amer. Natur., vol. xlii, p. 473, 1908.

[2] Hence the term "Fluvio-marine Crag."

Nucula tenuis.
Leda oblongoides.
Cardium edule, thin variety.
„ *Serripes grœnlandicum.*
Astarte compressa.
„ (*Tridonta*) *borealis.*
Tellina (*Macoma*) *lata.*
„ „ *obliqua.*
Tapes aureus (local).
„ *virgineus.*
Corbula striata.
Scrobicularia piperata (local).
Mactra subtruncata.
„ *elliptica.*
Mya arenaria.
Together with a number of non-marine forms.

The arctic species *Astarte* (*Tridonta*) *borealis* is specially characteristic of the northern part of the Icenian Crag, occurring frequently near Norwich and at the Weybourne horizon, but it is less so at the southern localities. It may be noticed that while the sub-estuarine *Mya arenaria* is common in the Icenian, it is almost unknown from the Coralline and Waltonian horizons, where the more distinctly marine *Mya truncata* is rather abundant. For the guidance of collectors when dealing with imperfect specimens it may be remarked that the hinge of these two species is different. (See figures in a paper by Sir H. H. Howorth, Proc. Zool Soc., p. 755, figs. 241—243, 1909.)

Chillesford Horizon.

Overlying in places the Red, Norwich, and in one locality the Coralline Crag, are some beds of dark laminated clay,[1] always highly micaceous, which maintain the same character from Chillesford in Suffolk to Burgh in Norfolk,[2] where, in my opinion, they abruptly disappear. When plotted on a map they are found to arrange themselves along a narrow and sinuous belt, as if representing the bed of a former and muddy estuary. Differing essentially from the coarse sandy matrix of the typical Crag, they must have originated under different conditions. When examined microscopically the late Cl. Reid could not find this deposit to contain a single Crag fragment of sand, the grains consisting of quartz, small and little worn. The view that the Chillesford Clay is of an estuarine character seems to be supported by the fact that at one spot the complete and undisturbed skeleton of a large cetacean, which Dr. Crisp ascertained to be 31 feet in length, was found in it.[2]

At the Church-pit at Chillesford typical Chillesford Clay is underlain conformably by a bed of stratified sand containing a special group of fossils, which are not the drifted shells of dead animals like those of the Red and Norwich Crags, but for the most part double and thin and fragile. They are of a northern type but never contain the characteristic form of the Weybourne horizon, *Tellina* (*Macoma*) *balthica*. In the superabundant mica they contain, the Chillesford beds resemble

[1] First described by Prestwich in 1849 (Quart. Journ. Geol. Soc., vol. v, p. 345).
[2] Rep. Brit. Assoc. (Norwich), Trans., p. 61, 1868.

those of the Norwich zone, connecting it with the latter as well as with the Ardennes, probably representing one of the channels by which the drainage of that region then reached the sea. The abrupt disappearance towards the north of typical Chillesford beds near Burgh may have been due, I suggest, to the invasion of this region by the Weybournian sea. If my view of the case is correct, it follows that a slight elevation of this region took place at this stage, the shallow sea of the Norwich Crag being for a time converted into land traversed by the micaceous and sheltered waters of the Chillesford estuary.

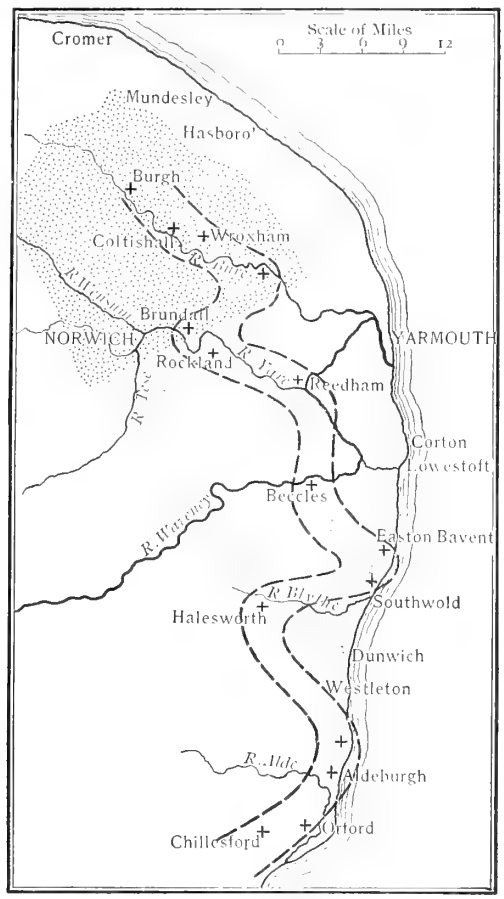

FIG. 5.—Map showing the principal exposures of undoubted Chillesford Clay (marked +) between Chillesford in Suffolk and Burgh in Norfolk in the Bure valley, the probable course of one of the estuaries of the Rhine during this stage. The dotted area is that covered by the Westleton shingle of Prestwich (Pleistocene). —F. W. H. (Reproduced by permission of the Council of the Geologists' Association.)

The total number of the more characteristic mollusca of the horizon represented by the Chillesford Church-pit is not great, but they differ considerably from those of the Norwich and Weybourne zones, conditions suggesting a difference in the conditions under which they were deposited. Among them may be specially mentioned:

Turritella communis.
Nucula tenuis.
Leda lanceolata.
Leda oblongoides.
Cardium (Serripes) grænlandicum.
Tellina (Macoma) calcarea.

Weybourne Horizon.

The deposition of the Chillesford beds, which thus indicates a slight upheaval of the western part of the Crag area, was followed by an inconsiderable depression which enabled the sea to re-invade the northern portion of the county of Norfolk, encroaching, probably in the form of a small inlet, as far to the south as Belaugh in the valley of the Bure, and to Crostwick, Spixworth and Rackheath to the south of that river. Unfortunately none of these sections are now accessible.

At Weybourne and elsewhere on the Cromer coast there are some fossiliferous deposits containing, together with those of the localities named above, a meagre molluscan fauna of about 50 species, of which 34, or 68 per cent., are common and abundant British forms, 21 are arctic, 33 Scandinavian, 32 west European and 23 Mediterranean. Of the non-British species 4 are arctic and 7 Scandinavian, while 6 are not recorded living.

The most distinctive feature of the Weybourne beds, however, is the occurrence in them, as stated above, of *Tellina* (*Macoma*) *balthica*, a species unknown from the Norwich or Chillesford horizons, which made its first appearance in the Crag at this stage in great abundance, specimens of this shell outnumbering those of all the other Weybourne species taken together. The increasingly impoverished character of the Crag fauna is strongly marked at this horizon.

A list of the Weybournian mollusca was published by me in 1905 in the Bull. Soc. Belge de Géol., vol. xix, p. 326.

There are some laminated beds at Walton-on-Naze of somewhat similar though not identical character to those of Chillesford, which were considered by Prestwich and afterwards by the younger Wood and myself to be Chillesford Clay; I now think this was a mistake, and confine that term to such deposits as occur in the region lying between Chillesford and Burgh, as shown in Fig. 5, where they always maintain their typical and highly micaceous appearance—an indication I think of their southern origin. Other laminated clays are found in places on the Cromer coast which the Rev. J. Gunn and Cl. Reid regarded as Chillesfordian, but they are associated with beds of typical *Tellina balthica* (Weybournian) Crag, a deposit I consider to have been introduced from the north, *Tellina balthica* being a Scandinavian shell and a northern immigrant which reached this district suddenly and in great abundance at that stage of the Pliocene history. The Chillesfordian and southern estuary must represent a slight elevation of the Icenian area or a shrinking of the Icenian basin, the Weybournian beds a limited re-invasion of Norfolk by the northern sea. If these views are correct, the presence or absence of this mollusc from the fossiliferous beds of north-east Norfolk may give us a reliable test of their comparative age.

THE WESTERN BASIN.

St. Erth, Wexford, Manxland.

The true relation of the fossiliferous deposits of the East Anglian Crag basin to those of the western area, viz. of St. Erth on the one hand, and of Wexford and Manxland on the other, has given rise to some difference of opinion. As to the older of the three, those of St. Erth, S. V. Wood, jun., who first described them in 1885, just before his premature death,[1] and Messrs. Kendall and R. G. Bell, whose paper appeared a year later, regarded them as being more or less equivalent to an early stage of the Red Crag.[2] Gwyn Jeffreys and the late Clement Reid,[3] however, believed them to be older—a view which the researches of Mr. Alfred Bell, given in two other papers, lead me to support.[4]

A large number of specimens, many of them those left undescribed by Wood, and some believed by Mr. Bell to be new to science, are now in the British Museum. Some of these, with the kind permission of Dr. A. Smith Woodward, I am able to figure in the present work; others I may give hereafter. A considerable number are minute forms belonging to genera such as *Odostomia*, *Turbonilla*, *Eulima*, *Rissoa*, etc. A few are larger and deserve here a passing notice, as, for example:

**Nassa semireticosa*, Etheridge and Bell, Pl. III, fig. 11.
„ *solida*, S. V. Wood, MS., Pl. XXXIII, fig. 22.
„ *mutabilis*, var. *erthensis*, S. V. Wood, MS., Pl. XXXIII, fig. 26.
**Bittium reticulatum*, var. *trinodosa*, Etheridge and Bell, Pl. XLI, fig. 4.
„ *incile*, Watson.
**Turritella erthensis*, sp. nov., Pl. XLII, fig. 4.

Three of these, marked (*), are exceedingly common at St. Erth. They are very distinct, and, so far as I can ascertain, are unknown from any Miocene or Pliocene deposit, either in England or elsewhere.

Many of the characteristic and abundant groups of the Red Crag univalves, moreover, are unrecorded from St. Erth, as, *e. g.*, certain species of *Nassa*, *Buccinum*, *Ocinebra*, *Neptunea*, *Sipho*, *Searlesia* and *Scala*. Speaking generally, the mollusca of the latter are not of a Red Crag type, northern shells being wholly absent. At the same time it must be remembered that the area from which they have been obtained is very restricted. Possibly other exposures will be discovered hereafter which may throw further light on the subject.

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[1] Quart. Journ. Geol. Soc., vol. xli, pp. 65—73, 1885.

[2] Quart. Journ. Geol. Soc., vol. xlii, pp. 201—215, 1886.

[3] "Pliocene Deposits of Britain," Mem. Geol. Surv., pp. 59, 61, 62, 1890.

[4] Proc. Roy. Irish Acad. [3], vol. ii, pp. 620—642, 1883; Trans. Roy. Geol. Soc. Cornwall, vol. xii, pp. 111—166, pls. i—iii, 1898.

The fauna of the Wexford gravels is much newer, having on the whole a northern and Pleistocene rather than a Pliocene character, including abundant specimens of *Nassa incrassata*, *N. reticulata* (the most characteristic Red Crag *Nassas* being altogether wanting), a thick and coarsely sculptured form of *Purpura lapillus*, with very many species of northern *Trophon*, *Buccinum undatum*, *Ocinebra erinacea*, *Scala similis*, and many examples of a sinistral *Neptunea* (not the southern *N. contraria* of the Crag, but a short tumid form allied to an arctic species, *N. deformis*—see Pl. XXXVI, figs. 30, 31) and other recent shells. The Wexford beds have been described by Mr. Alfred Bell in papers often quoted in this work. The Manxland drift contains a fauna allied to that of Wexford, both of them containing many northern and recent forms with a few of a decidedly Pliocene type.[1] An explanation of this well-known mixed character of the Manx shells, so different, as Prof. Kendall observes, from the natural grouping, is that we have in Manxland the remains of two distinct deposits, one older than the other, but this view is not accepted by Mr. Alfred Bell.

THE PLEISTOCENE AND HOLOCENE DEPOSITS.

No general agreement has been at present arrived at from the point of view of their marine conchology as to the relation which the various exposures of these beds bear to each other. The fauna of the interesting deposit at Selsey in Sussex, however, deserves a passing notice. Originally described systematically by Godwin-Austen in the Quarterly Journal of the Geological Society for 1857 (vol. xii, p. 4), it has been subsequently studied by Mr. A. Bell, who has collected and identified from it more than 220 species of marine mollusca besides 120 vertebrate and invertebrate forms belonging to other groups. The molluscan fossils are in unusually perfect condition, many of them being here figured as British for the first time. Taken as a whole they seem to be unique, of a well-marked southern character, having no equivalent in any of our post-Pliocene deposits. As to this, reference is suggested to the lists in the undermentioned paper by Mr. Bell.[2] The subject deserves further investigation, though unfortunately it is only occasionally that the Selsey deposit is accessible to the collector.

The subject of the Crag deposits has been more fully treated by the author in the following papers:

1896. "The Pliocene Deposits of Holland and their Relation to the English and Belgian Crags," Quart. Journ. Geol. Soc., vol. lii, pp. 748—782.

1898. "The Lenham Beds and the Coralline Crag," Quart. Journ. Geol. Soc., vol. liv, pp. 308—356.

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[1] See Vol. I, p. 123, of the present work.

[2] Rep. Yorks. Phil. Soc., 1892, p. 62.

1900. "The Crag of Essex (Waltonian) and its Relation to that of Suffolk and Norfolk," Quart. Journ. Geol. Soc., vol. lvi, pp. 705—743.
1901. "The Influence of the Winds upon Climate," Quart. Journ. Geol. Soc., vol. lvii, pp. 405—476.
1902. "The Later Tertiary History of East Anglia," Proc. Geol. Assoc., vol. xvii, pp. 416—451.
1905. "L'horizon weybournien du Crag icenien," Bull. Soc. Belge de Géol., vol. xix, pp. 322—328.
1909. "The Pliocene Deposits of the Eastern Counties of England," Proc. Geol. Assoc. (Jubilee vol.), pp. 86—102.

A detailed and complete list of the numerous works relating to the Pliocene deposits, commencing with that published in 1704 by S. Dale on the fossil shells of Harwich Cliff in the 'Phil. Trans.,' vol. xxiv, pp. 1568—78 to those of the year 1890, was given by the late Clement Reid in that year in his "Pliocene Deposits of Britain," together with many original remarks thereon and a comprehensive review of the whole subject (Mem. Geol. Survey, pp. 19—41, and pp. 71—146).

Genus **TEREBRA**, Adanson (*continued from Vol. I, p. 55*).

Sub-genus **STRIOTEREBRUM**, Sacco, 1891.

Terebra (Strioterebrum) Basteroti (Nyst). Plate XLVII, fig. 8.

1814. *Buccinum duplicatum*, Brocchi (not Linné), Conch. foss. subap., vol. ii, p. 347.
1825. *Terebra duplicata*, Basterot, Desc. Geol. Bass. tert. S. O. France, p. 53.
1836—44. *Terebra duplicata*, Philippi, Enum. Moll. Sic., vol. i, p. 227, 1836; vol. ii, p. 194, 1844.
1840. *Terebra duplicata*, Grateloup, Conch. Terr. tert. Adour, pl. xxxv, fig. 24.
1843. *Terebra Basteroti*, Nyst, Coq. foss. Belg., p. 582.
1856. *Terebra Basteroti*, Hörnes, Foss. Moll. Tert. Wien, vol. i, p 132, pl. xi, figs. 27, 28.
1867. *Terebra Basteroti*, Da Costa, Gaster. Dep. terc. Portugal, p. 80, pl. xiii, fig. 10.
1875. *Terebra Basteroti*, Seguenza, Boll. R. Com. Geol. Ital., vol. vi, p. 278, no. 289.
1881. *Terebra Basteroti*, Fontannes, Moll. plioc. Vall. du Rhone, vol. i, p. 125.
1890. *Terebra Basteroti*, C. Reid, Plioc. Dep. Brit., p. 257.
1890—91. *Terebra Basteroti*, Sacco, Boll. Soc. Geol. Ital., vol. ix, p. 265, no. 3880, 1890; *T.* (*Strioterebrum*) *Basteroti*, Moll. Terr. Tert. Piem., pt. x, p. 33, pl. ii, fig. i, 1891.

Specific Characters.—Shell solid, slender, turreted; whorls about 12, flattened; ornamented by numerous, fine longitudinal costæ and minute spiral striæ with a sulcation below the suture; spire elongate, regularly diminishing upwards to a blunt point; suture slight; mouth small, angulate above; canal short, distinct.

Dimensions.—L. 18—25 mm. B. 5—6 mm.

Distribution.—Not known living.

Fossil: Coralline Crag: Gedgrave.

Miocene: France, Italy, Vienna basin, Belgium, Portugal.

Lower Pliocene: Italy, France.

Upper Pliocene: Italy—Orciano, Peccioli, Legoli, Bologna, Asti, Masserano, Cornarè.

Remarks.—The specimen figured under this name is one Mr. Bell received from Mr. Kennard, who obtained it from the Broom Hill pit at Gedgrave. It belongs to a species characteristic of the Miocene of Italy, Portugal, France, Belgium and Vienna, but is found also in the Pliocene of Italy and France. Except for the present specimen it is unknown from the English Crag.

Genus **OVULA**, Bruguière, 1789.

Ovula spelta (Linné). Plate XLV, fig. 7.

1766. *Bulla spelta*, Linné, Syst. Nat., ed. xii, p. 1182.
1822. *Ovula spelta*, Lamarck, Anim. sans Vert., vol. vii, p. 370.
1824. *Ovula Leathesii*, J. Sowerby, Min. Conch., vol. v, p. 124, pl. ccccIxxviii.
1836—44. *Ovula spelta*, Philippi, Enum. Moll. Sic., vol. i, p. 233, pl. xii, fig. 13, 1836; vol. ii, p. 198, 1844.
1842—48. *Ovula Leathesii*, S. V. Wood, Ann. Mag. Nat. Hist. [1], vol. ix, p. 544, 1842; Mon. Crag Moll., pt. i, p. 14, pl. ii, fig. 1 *a*, 1848.
1843—81. *Ovula Leathesii*, Nyst., Coq. foss. Terr. tert. Belg., p. 605, pl. xliii, fig. 19, 1843; *O. spelta*, Conch. Terr. tert. Belg., p. 61, pl. v, fig. 4, 1881.
1864. *Ovulum Leathesii*, S. P. Woodward in Green's Hist. of Norfolk, ed. 3, p. 118.
1871. *Bulla spelta*, Jeffreys in Prestwich, Quart. Journ. Geol. Soc., vol. xxvii, pp. 144, 490.
1871. *Ovula adriatica*, A. Bell, Ann. Mag. Nat. Hist. [4], vol. vii, p. 359; Geol. Mag., vol. viii, p. 454.
1872. *Ovula spelta*, A. and R. Bell, Proc. Geol. Assoc., vol. ii, pp. 203, 209, 213.
1875. *Ovula spelta*, Seguenza, Boll. R. Com. Geol. Ital., vol. vi, p. 153, no. 74.
1883. *Ovula* (*Simnia*) *spelta*, Bucquoy, Dautzenberg et Dollfus, Moll. mar. Rouss., vol. i, p. 134, pl. xvi, figs. 27, 28.
1886. *Ovula* (*Simnia*) *spelta*, Dollfus et Dautzenberg, Feuille des Jeunes Nat., vol. xvi, p. 104.
1890. *Ovula spelta*, C. Reid, Plioc. Dep. Brit., p. 251.
1890—4. *Ovula spelta*, Sacco, Boll. Soc. Geol. Ital., vol. ix, p. 191, no. 2176, 1890; *Neosimnia spelta*, Moll. Terr. Terz. Piem., pt. xv, p. 64, 1894.
1892. *Ovula spelta*, Locard, Coq. mar. Côtes de France, p. 35, fig. 22.
1908. *Amphiperas* (*Neosimnia*) *spelta*, Kobelt, Icon. schalentrag. europ. Meeresconch., vol. iv, p. 138, pl. cvii, figs. 14—17.
1911. *Amphiperas* (*Neosimnia*) *spelta*, Cerulli-Irelli, Palaeont. Ital., vol. xvii, p. 268, pl. xxvi, fig. 7.

Specific Characters.—Shell slender, elongate, widened in the middle, attenuate at each extremity; mouth contracted at the summit, somewhat enlarged towards

the base; columella expanded centrally, excavated below; outer lip thickened, forming a short canal at the point of union with the columella; inner lip thin, expanded, with an obtuse fold on the upper part.

Dimensions.—L. 16 mm. B. 10 mm.

Distribution.—*Recent:* Mediterranean, Adriatic, Canary Isles.

Fossil: Coralline Crag: Gedgrave, Ramsholt, Sutton, Boyton. Waltonian: Walton-on-Naze, Little Oakley. Newbournian: Waldringfield, Newbourn. Icenian: Bramerton.

Miocene: Vienna, Touraine.

Lower Pliocene: Italy—Piacentino—Albenga.

Upper Pliocene: Astiano, Monte Mario, Altavilla. Scaldisien: Antwerp.

Pleistocene: Pozzuoli.

Remarks.—This species, recorded by several authors from the Miocene and Pliocene of central and southern Europe, is widely diffused in the existing Mediterranean. Wood records the type-form from the English Crag, but it is a rare shell in our deposits. Dr. S. P. Woodward gives it from the Icenian of Bramerton on the authority of the late Mr. R. Fitch, but the specimen cannot now be traced. The late Mr. Charlesworth considered its occurrence at that locality more than doubtful.

Genus **TRIVIA**, Gray, 1832 (*continued from Vol. I, p. 51*).

Trivia europæa (Montagu). Plate XLV, fig. 11 (*continued from Vol. I, p. 49*).

1823. *Cypræa coccinelloides*, J. Sowerby, Min. Conch., vol. iv, p. 107, pl. cccIxxviii, fig. 1.

1836—44. *Cypræa coccinella*, Philippi, Enum. Moll. Sic., vol. i, p. 236, 1836; vol. ii, p. 199, 1844.

1843—81. *Cypræa coccinella*, Nyst, Coq. foss. Terr. tert. Belg., p. 609, pl. xlv, fig. 14, 1843; *C. europæa*, Conch. Terr. tert. Belg., p. 59, pl. v, fig. 2, 1881.

1859. *Cypræa europæa*, G. B. Sowerby, Ill. Ind. Brit. Shells, pl. xix, fig. 28.

1864. *Cypræa europæa*, S. P. Woodward in White's Hist. of Norfolk, ed. 3, p. 118.

1870—89. *Cypræa europæa*, A. Bell, Journ. de Conch., vol. xviii, p. 349, no. 314, 1870; Geol. Mag., vol. viii, p. 454, 1871; Proc. Roy. Phys. Soc. Edin., vol. x, p. 296, 1889.

1872. *Cypræa europæa*, A. and R. Bell, Proc. Geol. Assoc., vol. ii, pp. 203, 209, 213.

1873—5. *Trivia europæa*, Seguenza, Boll. R. Com. Geol. Ital., vol. iv, p. 294, no. 55, 1873; vol. vi, p. 153, no. 80, 1875.

1874—92. *Cypræa europæa*, Van den Broeck, Ann. Soc. malac. Belg., vol. ix, pp. 187, 356, 1874; Bull. Soc. Belge Géol., vol. xi (Mémoires), pp. 122, 132, 1892.

1878. *Trivia europæa*, G. O. Sars, Moll. Reg. arct. Norv., pp. 154, 358.

1892. *Trivia europæa*, Locard, Coq. mar. Côtes de France, p. 37, fig. 23.

1908. *Trivia europæa*, Kobelt, Icon. schalentrag. europ. Meeresconch., vol. iv, p. 51, pl. cviii, figs. 18, 19.

1901. *Trivia europæa*, Brøgger, Norges geol. Undersøgelse, No. 31, p. 660.

1912. *Cypræa europæa*, Tesch, Med. v. d. Rijks. v. Delfstoffen, No. 4, p. 76, o. 183.

1914. *Trivia europæa*, F. W. Harmer, Plioc. Moll. Gt. Brit., vol. i, p. 49.

1915. *Trivia europæa*, R. B. Newton, Journ. of Conch., vol. xv, p. 69.

Remarks.—A passing reference was made to this well-known Crag shell in Vol. I of the present work, but it was not figured. As I am now describing the other species of Crag Trivias it seems desirable to represent a typical specimen of *T. europæa* in order to show on the same plate the difference between them, and to give also some further reference to the literature of the subject.

Dimensions.—L. 6—20 mm B. 5—14 mm.

Distribution.—Recent: British Seas—Shetland to Guernsey. West European—English Channel to Gibraltar, Mediterranean, Adriatic, Ægean. Norway—Christiania fiord to Trondhjem, Lofoten Islands, widely diffused and abundant.

Fossil: Lenham, St. Erth, Coralline Crag *passim.* Red Crag—Waltonian, Newbournian, Butleyan. Icenian: Thorpe near Norwich. Pleistocene: Billockby, Gorleston, Selsey, Isle of Man, Cheshire, Lancashire, Yorkshire, Kelsey Hill, Saltburn, Garvel Park, Largo, Cumbræ, Shewalton. Wexford to Portrush.

Belgium—Casterlien, Scaldisien, Poederlien. Holland—Scaldisien.

Pliocene: Biot, Altavilla, Orciano, Bologna, Livorno, Messina, Gourbesville.

Pleistocene: Monte Pellegrino, Ficarazzi, Catania, Reggio, Gravina, Livorno, Valle Biaia. Tapes-banks: Christiania fiord.

Remarks.—This species, varying in size from var. *minor* to var. *sphæriculata*, the last a Miocene form, is very abundant in the Red Crag, especially at Oakley, where I have collected many specimens. In the Icenian Crag it has only been reported from one locality, the well-known but now inaccessible pit at Thorpe near Norwich, from which formerly so many interesting fossils were obtained. It would not be difficult to obtain permission to re-open this famous section, but at present but little local interest is taken in the subject. The wonderful success which has attended the exploration of the Little Oakley pit, the existence of which was discovered almost by accident, should stimulate similar inquiry elsewhere.

Trivia retusa (J. Sowerby). Plate XLV, fig. 8.

1823. *Cypræa retusa*, J. Sowerby, Min. Conch., vol. iv, p. 107, pl. cccIxxviii, fig. 2.
1842—48. *Trivia retusa*, S. V. Wood, Ann. Mag. Nat. Hist. [1], vol. ix, p. 544, 1842; *Cypræa retusa*, Mon. Crag Moll., pt. i, p. 16, pl. ii, fig. 8.
1871. *Cypræa retusa*, Jeffreys in Prestwich, Quart. Journ. Geol. Soc., vol. xxvii, pp. 143, 488.
1872. *Cypræa retusa*, A. and R. Beil, Proc. Geol. Assoc., vol. ii, pp. 203, 209, 213.
1881. *Cypræa retusa*, Nyst, Conch. Terr. tert. Belg., p. 60, pl. v, fig. 3.
1890. *Cypræa retusa*, C. Reid, Plioc. Dep. Brit., p. 243.
1892. *Cypræa retusa*, Van den Broeck, Bull. Soc. Belge Géol., vol. vi (Mémoires), p. 147.

Specific Characters.—Shell small, ovato-globose, ornamented by a comparatively small number of transverse ridges, without dorsal furrow; mouth sub-central.

Dimensions.—L. 10 mm. B. 8 mm.

Distribution.—Not known living.

Fossil: Coralline Crag, Waltonian and Newbournian zones of Red Crag, fairly common in places.

Remarks.—This species and its variety *angliæ* may be distinguished from the typical form of *T. europæa* by the smaller number of its transverse ridges, generally about 8 or 9 in number, and by its more globular and rounded form. It is not so abundant in the Crag as is the latter, though fairly common in places. I have obtained 40 specimens or more from Oakley. It is a Pliocene species. I have no knowledge of its having been found at any Pleistocene locality.

Var. **angliæ,** S. V. Wood. Plate XLV, fig. 9.

1842—48. *Trivia angliæ*, S. V. Wood, Ann. Mag. Nat. Hist. [1], vol. ix, p. 543, 1842; Mon. Crag Moll., pt. 1, p. 16, pl. ii, fig. 7, 1848.

1871. *Cypræa retusa*, var., Jeffreys in Prestwich, Quart. Journ. Geol. Soc., vol. xxvii, p. 488.

1881. *Cypræa retusa*, var. *angliæ*, Nyst, Conch. Terr. tert. Belg., p. 60.

1890. *Cypræa angliæ*, C. Reid, Plioc. Dep. Brit., p. 243.

Varietal Characters.—Resembles *T. retusa* in size, form, and the smaller number of its transverse ridges, but may be distinguished from the latter in having a well-marked dorsal sulcus.

Dimensions.—L. 10 mm. B. 8 mm.

Distribution.—Not recorded living.

Fossil: Coralline Crag: Sutton. Waltonian: Walton-on-Naze, Little Oakley. Newbournian: Waldringfield, Newbourn, Sutton.

Remarks.—This form is rare in the Crag, but it has been reported from the Coralline horizon and from several localities in the Red. I found half a dozen specimens at Oakley, one of which is here figured. By Jeffreys and Nyst it was regarded as a variety of *T. retusa*, a view which in his Supplement Wood seemed inclined to accept.

Trivia avellana (J. Sowerby). Plate XLV, fig. 10.

1823. *Cypræa avellana*, J. Sowerby, Min. Conch., vol. iv, p. 107, pl. cccIxxviii, fig. 3.

1842—48. *Trivia avellana*, S. V. Wood, Ann. Mag. Nat. Hist. [1], vol. ix, p. 543, 1842; *Cypræa avellana*, Mon. Crag Moll., pt. i, p. 15, pl. ii, fig. 5, 1848.

1843—81. *Cypræa avellana*, Nyst, Coq. foss. Terr. tert. Belg., p. 608, pl. xlv, fig. 13, 1843; Conch. Terr. tert. Belg., p. 58, pl. v, fig. 1, 1881.

1870—98. *Cypræa avellana*, A. Bell, Journ. de Conch., vol. xviii, p. 349, no. 311, 1870; Geol. Mag., vol. viii, p. 454, 1871; Trans. Roy. Geol. Soc. Cornwall, vol. xii, p. 136, 1898.

1871. *Cypræa avellana*, Jeffreys in Prestwich, Quart. Journ. Geol. Soc., vol. xxvii, pp. 143, 488.

1872. *Cypræa avellana*, A. and R. Bell, Proc. Geol. Assoc., vol. ii, pp. 203, 209, 213.

1875. *Trivia avellana*, Dollfus, Étud. Terr. tert. Cotentin, vol. vi, p. 367.

1890. *Cypræa avellana*, C. Reid, Plioc. Dep. Brit., p. 243.

1892. *Cypræa avellana*, Van den Broeck, Bull. Soc. Belge Géol., vol. vi (Mémoires), pp. 122, 123, 143.

1894. *Trivia avellana* and vars., Sacco, Moll. Terr. Terz. Piem., pt. xv, p. 51, pl. iii, fig. 41; *T. sphæriculata*, var. *propeavellana*, p. 49, fig. 35.

Specific Characters.—Shell ovato-globose, thick and strong; generally larger than the typical *T. affinis*, covered by numerous transverse ridges more or less interrupted by a distinct longitudinal sulcus, outline rounded at both ends, not projecting.

Dimensions.—L. 16—20 mm. B. 14—17 mm.

Distribution.—Not known living.

Fossil: St. Erth. Coralline Crag: Sutton, Gedgrave, Boyton. Red Crag—Waltonian to Butleyan (*passim*). Scaldisien, Poederlien: Belgium.

Miocene: Italy, France—Touraine. Pliocene: France—Gourbesville.

Remarks.—What I regard as the typical *T. avellana* is a large, wide and strong shell with a sulcated back, the upper part having a flattened outline. It has been separated from *T. affinis* by the transverse ridges being continuous across the sulcus, while in the latter they are said to be thickened, irregular and discontinuous, but this is an irregular characteristic. The two shells are allied, but they seem to be most easily separated by their form, size and general appearance. Similar fossils occur in the Italian Miocene, and, according to Lyell, in the Faluns of Touraine.

Trivia affinis (Dujardin). Plate XLV, figs. 12, 13 (*continued from Vol. I, p.* 50).

1870—98. *Cypræa affinis*, A. Bell, Journ. de Conch., vol. xviii, p. 349, no. 313, 1870; *C.* (*Trivia*) *europæa*, var. *affinis*, Trans. Roy. Geol. Soc. Cornwall, vol. xii, p. 136, 1898.
1871. *Cypræa avellana*, var., Jeffreys in Prestwich, Quart. Journ. Geol. Soc., vol. xxvii, p. 143.
1872. *Cypræa* (*Trivia*) *affinis*, Von Koenen, Mioc. Nord-Deutsch. Moll.-Fauna, vol. i, p. 122, no. 140.
1872. *Cypræa affinis*, A. and R. Bell, Proc. Geol. Assoc., vol. ii, p. 203.
1875. *Trivia affinis*, Dollfus, Étud. Terr. tert. Cotentin, vol. vi, p. 367.
1878. *Trivia affinis*, de Stefani e Pantinelli, Boll. Soc. Malac. Ital., vol. iv, p. 138.
1886. *Trivia affinis*, Dollfus et Dautzenberg, Feuille des Jeunes Natur., vol. xvi, p. 205.
1890. *Cypræa avellana*, var., C. Reid, Plioc. Dep. Brit., p. 243.
1914. *Trivia affinis*, F. W. Harmer, Plioc. Moll. Gt. Brit., vol. i, p. 50.

Specific Characters.—Smaller, narrower and more elongate than *T. avellana*, the transverse ridges being finer and less regular.

Dimensions.—L. 15 mm. B. 10—12 mm.

Distribution.—Not known living.

Fossil: St. Erth. Coralline Crag: Sutton. Waltonian: Walton-on-Naze, Little Oakley. Newbournian: Sutton, Waldringfield, Felixstowe, Shottisham.

Miocene: France—Touraine, Germany, Italy, Vienna basin. Pliocene: Biot, Siena, Asti, Gourbesville.

Remarks.—This species is allied to *T. avellana*, and was considered to be a variety of it by Jeffreys. It is, however, not so globose and more elongate, as shown in my plate and in the specimen figured by Wood. It does not seem to be so common in the Crag as I supposed when writing my notice of it in the first volume of this work, and it is not a Pleistocene species as there stated.

Genus **ERATO**, Risso, 1826.

Erato lævis (Donovan). Plate XLV, fig. 1.

1799. *Voluta lævis*, Donovan, Brit. Shells, vol. v, pl. clxv.
1803. *Cypræa voluta*, Montagu, Test. Brit., pt. i, p. 203, pl. vi, fig. 7.
1842—48. *Erato lævis*, S. V. Wood, Ann. Mag. Nat. Hist. [1], vol. ix, p. 544, 1842; Mon. Crag Moll., pt. i, p. 18, pl. ii, fig. 10, 1848.
1844. *Marginella lævis*, Philippi, Enum. Moll. Sic., vol. ii, p. 197.
1853. *Marginella lævis*, Forbes and Hanley, Brit. Moll., vol. iii, p. 502, pl. cxiv, *b*, figs. 4, 5.
1856. *Erato lævis*, Hörnes, Foss. Moll. Tert. Wien, vol. i, p. 79, pl. viii, fig. 16.
1859. *Erato lævis*, G. B. Sowerby, Ill. Ind. Brit. Shells, pl. xix, fig. 27.
1864. *Erato lævis*, S. P. Woodward in White's Hist. of Norfolk, ed. 3, p. 117.
1867—71. *Marginella lævis*, Jeffreys, Brit. Conch., vol. iv, p. 400, pl. vii, fig. 3, 1867; vol. v, pl. xcii, fig. 1, 1869; in Prestwich, Quart. Journ. Geol. Soc., vol. xxvii, pp. 143, 488, 1871.
1870—71. *Marginella lævis*, A. Bell, Journ. de Conch., vol. xviii, p. 349, no. 307, 1870; *Erato lævis*, Geol. Mag., vol. viii, p. 454, 1871.
1871. *Erato lævis*, A. and R. Bell, Proc. Geol. Assoc., vol. ii, pp. 203, 209, 213.
1873—75. *Erato lævis*, Seguenza, Boll. R. Com. Geol. Ital., vol. iv, p. 294, no. 58, 1873; vol. v, p. 274, no. 25, 1874; vol. vi, p. 153, no. 85, 1875.
1874. *Erato lævis*, Van den Broeck, Ann. Soc. Malac. Belg., vol. ix, p. 118.
1886. *Erato lævis*, Dollfus et Dautzenberg, Feuille des Jeunes Natur., vol. xvi, p. 105.
1890. *Erato lævis*, C. Reid, Plioc. Dep. Brit., p. 243.
1890. *Erato lævis*, Carus, Prod. Faun. Medit., vol. ii, p. 372.
1890—4. *Erato lævis*, Sacco, Boll. Soc. Geol. Ital., vol. ix, p. 191, no. 2177, 1890; Moll. Terr. Terz. Piem., pt. xv, p. 58, pl. iii, figs. 62—68, 1894.
1892. *Erato lævis*, Locard, Coq. mar. Côtes de France, p. 39, fig. 25.
1898. *Erato lævis*, Bucquoy, Dautzenberg et Dollfus, Moll. mar. Rouss., vol. ii, p. 794.
1902. *Erato lævis*, Conch. Soc. List., Journ. of Conch., vol. x, p. 22, no. 379.
1903. *Erato lævis*, Cossmann, Ess. Palæoconch. compar., vol. v, p. 183, pl. viii, figs. 10, 11.
1906. *Erato lævis*, Sykes, Proc. Malac. Soc., vol. vii, p. 333.

Specific Characters.—Small, pyriform, inflated above, base attenuated, solid, without sculpture; whorls 5 or 6, the last occupying nearly the whole of the shell; spire minute, very short, projecting; suture indistinct; mouth narrow, elongate, nearly equal in width, length co-extensive with that of the body-whorl; canal wide and open; outer lip thick and broad, forming a rim continued round the base, inside closely notched with about 15 small teeth; pillar flexuous, with 2 or 3 slight plaits and a row of minute tubercles above.

Dimensions.—L. 10 mm. B. 7 mm.

Distribution.—Recent: British coasts, local, Shetland to Guernsey. Brittany, west Atlantic, Mediterranean, Adriatic, Ægean.

Fossil: Coralline Crag: Sutton. Waltonian: Walton-on-Naze, Little Oakley. Newbournian: Bentley, Waldringfield, Newbourn, Sutton, Butleyan: Butley. Icenian: Bramerton.

Miocene: Touraine, Vienna basin, Italy.

Pliocene: Biot, Bologna, Orciano, Livorno, Caltabiano, Messina.

Pleistocene: Monte Pellegrino, Ficarazzi, Gravina, Livorno, Valle Biaia, Naso, Messina.

Remarks.—This small shell, known to Wood from two localities only, has since been found not only in the Coralline, but, though rarely, at all horizons in the Red Crag from Walton to Butley, and *fide* R. Wigham, in the Icenian of the Norwich district. It is a southern and Miocene form with a wide range in the Pliocene and Pleistocene of the Mediterranean region. Prof. Sacco figures 8 or 9 different varieties of it.

Erato Maugeriæ, Gray. Plate XLV, fig. 2.

1841. *Erato Maugeriæ*, Gray in G. B. Sowerby, Conch. Illustr., fig. 57.
1842—48. *Erato Maugeriæ*, S. V. Wood, Ann. Mag. Nat. Hist. [1], vol. ix, p. 544, 1842; Mon. Crag Moll., pt. i, p. 19, pl. ii, fig. 11.
1851. *Erato Maugeriæ*, S. P. Woodward, Man. Moll., p. 379.
1858. *Erato Maugeriæ*, H. and A. Adams, Gen. Rec. Moll., vol. i, p. 190.
1871. *Marginella Maugeriæ*, Jeffreys in Prestwich, Quart. Journ. Geol. Soc., vol. xxvii, pp. 143, 488.
1871. *Erato Maugeriæ*, A. Bell, Geol. Mag., vol. viii, p. 454.
1872. *Erato Maugeriæ*, A. and R. Bell, Proc. Geol. Assoc., vol. ii, pp. 203, 209, 213.
1886. *Erato Maugeriæ*, Dollfus et Dautzenberg, Feuille des Jeunes Natur., vol. xvi, p. 205.
1890. *Erato Maugeriæ*, C. Reid, Plioc. Dep. Brit., p. 243.

Specific Characters.—Smaller than *E. lævis*, conoidal, subangulated; spire short; whorls 3—4, tumid, base subcanaliculate, with a few folds on the lower part of the columella; outer lip slightly thickened in the middle.

Dimensions.—L. 5 mm. B. 4 mm.

Distribution.—*Recent:* West Indies.

Fossil: Coralline Crag: Gedgrave, Sutton, Boyton. Red Crag: Little Oakley, Sutton, Shottisham, Butley.

Miocene: Touraine. Pliocene (Sacco)?

Remarks.—I have found two or three specimens of this West Indian and Miocene shell at Oakley, and it has been obtained at various other localities of the Coralline, where Wood says it is not rare, though in the Red Crag it is decidedly so.

Genus **VOLUTA,** Linné, 1767.

Voluta Lamberti, J. Sowerby. Plate XLV, fig. 3.

1816. *Voluta Lamberti*, J. Sowerby, Min. Conch., vol. ii, p. 65, pl. cxxix.
1837. *Voluta Lamberti*, Charlesworth, Mag. Nat. Hist. [n. s.], vol. i, pp. 37, 90, fig. 7.
1842—74. *Voluta Lamberti*, S. V. Wood, Ann. Mag. Nat. Hist. [1], vol. ix, p. 543, 1842; Mon. Crag Moll., pt. i, p. 20, pl. ii, fig. 3, 1848; 1st Suppl., pt. i, p. 7, 1872; pt. ii, p. 173, 1874.

1843—81. *Voluta Lamberti*, Nyst, Coq. foss. Terr. tert. Belg., p. 587, pl. xlv, fig. 4, 1843; Conch. Terr. tert. Belg., p. 56, pl. iv, fig. 1, 1881.
1864. *Voluta Lamberti*, S. P. Woodward in White's History of Norfolk, ed. 3, p. 117.
1869. *Voluta (Pyrgomitra) Lamberti*, Mörch, Journ. de Conch., vol. xvii, p. 428.
1871. *Voluta Lamberti*, Jeffreys in Prestwich, Quart. Journ. Geol. Soc., vol. xxvii, pp. 146, 492.
1871. *Voluta Lamberti*, A. Bell, Geol. Mag., vol. viii, p. 454.
1872. *Voluta Lamberti*, A. and R. Bell, Proc. Geol. Assoc., vol. ii, pp. 204, 210, 214.
1874—92. *Voluta Lamberti*, Van den Broeck, Ann. Soc. malac. Belg., vol. ix, pp. 260, 272, 1874; Bull. Soc. Belge Géol., vol. vi (Mémoires), pp. 122, 132, 1892.
1875. *Voluta (Scaphella) Lamberti*, Dollfus, Étud. Terr. tert. Cotentin, vol. vi, p. 366.
1896. *Voluta Lamberti*, Bernays, Bull. Soc. Belge Géol., vol. x (Mémoires), p. 128.
1900. *Voluta Lamberti*, C. Reid, Plioc. Dep. Brit., p. 261, pl. ii, fig. 5.
1912. *Voluta Lamberti*, Tesch, Med. v. d. Rijks. v. Delfstoffen, No. 4, p. 84, no. 212.
1916. *Maculopeplum Lamberti*, R. B. Newton, Journ. of Conch., vol. xv, pp. 76, 111.

Specific Characters.—Shell large, strong and solid, subfusiform, more or less elongate, but varying in the proportion between its length and its breadth; whorls 5 or 6, but slightly convex, compressed below the suture, smooth or but very finely striated, the last much the largest, sometimes three-fourths the total length; suture slight; spire conical with a truncate and obtusely rounded apex; mouth oval, acutely angulated above, passing into a short, rather wide and open canal; outer lip gently curved; columella with 4 oblique and prominent plaits.

Dimensions.—L. 120—180 mm. B. 60 mm.

Distribution.—Not known living.

Fossil: Lenham. Coralline Crag: Ramsholt, Gedgrave, Sutton, Aldeburgh, Boyton. Red Crag—Waltonian to Butleyan (*passim*). Icenian: Norwich, doubtful.

Casterlien, Scaldisien, Poederlien: Belgium. Scaldisien, Poederlien: Holland. Gourbesville, France.

Remarks.—This fine shell is found everywhere in the Pliocene of the east of England from Lenham to Butley and in that of Belgium, in fair abundance. It is reported in Dr. S. P. Woodward's list from the Icenian of Norwich on the authority of the late R. Wigham, but this has never been confirmed by any later authority and may be regarded as doubtful.

A closely allied shell is reported from the Miocene of Touraine under the name of *V.* (*Aulica*) *miocænica* by Messrs. Dollfus and Dautzenberg, and similar forms are known from other Miocene deposits. Whether any of these should be regarded as varieties of the Anglo-Belgian and Pliocene *V. Lamberti* or specifically distinct from it, is a matter for continental rather than for English geologists.

There are two distinct types of this shell in the Crag—one short and tumid, about twice as long as broad, the other slender and three times as long.

Genus **CASSIDARIA**, Lamarck, 1812 (*continued from Vol. I, p.* 59).

Cassidaria bicatenata (J. Sowerby). Plate XLV, fig. 14.

1824. *Cassis bicatenatus*, J. Sowerby, Min. Conch., vol. ii, p. 117, pl. cli.
1837. *Cassidaria bicatenata*, Charlesworth, Mag. Nat. Hist. [n. s.], vol. i, p. 38.
1842—48. *Cassidaria bicatenata*, S. V. Wood, Ann. Mag. Nat. Hist. [1], vol. ix, p. 538, 1842; Mon. Crag Moll., pt. i, p. 27, pl. iv, fig. 5, 1848.
1844—81. *Cassidaria bicatenata*, Nyst, Coq. foss. Terr. tert. Belg., p. 565, pl. xliv, fig. 6, 1844; Conch. Terr. tert. Belg., p. 34, pl. ii, figs. 14 *d*, 14 *f*, 1881.
1871. *Cassidaria bicatenata*, A. Bell, Geol. Mag., vol. viii, p. 454; Ann. Mag. Nat. Hist. [4], vol. viii, p. 356.
1872. *Cassidaria bicatenata*, A. and R. Bell, Proc. Geol. Assoc., vol. ii, pp. 203, 209, 213.
1872. *Cassidaria bicatenata*, Jeffreys in Prestwich, Quart. Journ. Geol. Soc., vol. xxvii, pp. 142, 487.
1874—92. *Cassidaria bicatenata*, Van den Broeck, Ann. Soc. malac. Belg., vol. ix, pp. 134, 187, 260, 1874; vol. xiv, p. 70, 1881; vol. xix, p. 17, 1884; vol. xx, p. 26, 1885; Bull. Soc. Belge Géol., vol. vi (Mémoires), pp. 121, 132, 147, 1892.
1890. *Cassidaria bicatenata*, C. Reid, Plioc. Dep. Brit., p. 240, pl. ii, fig. 7.
1896. *Cassidaria bicatenata*, Bernays, Bull. Soc. Belge Géol., vol. x, p. 131.
1896—1902. *Cassidaria bicatenata*, F. W. Harmer, Quart. Journ. Geol. Soc., vol. lii, p. 779, 1896; vol. lvi, p. 722, 1900; Proc. Geol. Assoc., vol. xvii, p. 419.
1912. *Cassidaria bicatenata*, Tesch, Med. v. d. Rijks. v. Delfstoffen, No. iv, p. 76, no. 185.

Specific Characters.—Shell large, solid, ovato-ventricose; whorls 6 or 7, the last inflated, much the largest, seven-eighths the total length; angulated and ornamented by transverse ridges, strong and clearly marked in the type, extending to the base, and having towards the upper portion 2 or 3 tubercular rows of a cancellate character; occasionally the shell is traversed with a thick and prominent varix, the labial rib of an earlier period of growth; at other times, but infrequently, the external sculpture becomes of a more or less obsolete character; mouth large, showing inside and faintly the exterior sculpture, bounded by a strong and thickened labial rib; outer lip denticulated within; canal short, wide and open, turning to the left; columella internally ridged.

Dimensions.—L. 90 mm. B. 60 mm.

Distribution.—Not known living.

Fossil: Coralline Crag: Gedgrave, Ramsholt. Waltonian: Walton-on-Naze, Beaumont, Little Oakley. Newbournian: Bentley, Waldringfield, Newbourn, Sutton, Felixstowe. Butleyan: Bawdsey, Hollesley.

Bolderien, Diestien, Casterlien, Scaldisien, Poederlien: Belgium.

Scaldisien, Poederlien: Holland.

Remarks.—This fine and very distinct shell is especially interesting, as it is unrecorded, so far as I know, either as recent or fossil, from any locality outside the Anglo-Belgian area; although not abundant, it is found in most of our Crag exposures. From Oakley, for example, I have about 40 examples in my own possession, though they are all fragmentary. Perfect specimens have been

obtained, however, from many exposures of the Coralline and Red Crags. M. Van den Broeck has reported it from the zone *à Pectunculus pilosus* of Antwerp (Bolderien), but it is unknown from any other Miocene horizon of any part of Europe.

Var. **ecatenata,** S. V. Wood. Plate XLV, figs. 15, 16.

1872. *Cassidaria bicatenata,* var. *ecatenata,* S. V. Wood, Mon. Crag Moll., 1st Suppl., pt. i, p. 11, pl. vi, figs. 2*a*, 2*b*.

1868—81. *Cassidaria bicatenata,* Nyst in d'Halloy, Abr. élem. de Géol., p. 612, 1868; var. *ecatenata,* Conch. Terr. tert. Belg., p. 34, pl. ii, figs. 14 *a*, 14 *e*, 1881.

Varietal Characters.—Differs from the type in the absence of a distinct keel and of any cancellation on the upper part of the upper whorls.

Dimensions.—L. 85 mm. B. 60 mm.

Distribution.—Not known living.

Fossil: Coralline Crag: near Orford. Waltonian Crag: Little Oakley. Newbournian: Sutton, Felixstowe. (Probably elsewhere in the Red Crag.)

Remarks.—The specimen now figured (fig. 16) from the Newbournian Crag of Sutton belongs to the Wood Collection in the Norwich Museum, and corresponds with the var. *ecatenata,* described by him in 1872, in the absence of distinct angulation and the want of the special tuberculation characteristic of the type-form. There is another specimen in the Crowfoot Collection at Norwich, also figured (fig. 15), having a strong varix across the centre of the body-whorl, the origin of which is explained by Wood's fig. 2*b* of the immature shell shown on the plate named above.

Cassidaria tyrrhena (Chemnitz). Plate XLV, fig. 17 (*continued from Vol. I, p.* 58).

1914. *Cassidaria tyrrhena,* F. W. Harmer, Plioc. Moll. Gt. Brit., vol. i, p. 58, pl. ii, fig. 13.

Remarks.—When examining a consignment of shelly material he had received from Father Codd (now the Bishop of Ferns), which had been collected at Blackwater in the Wexford gravels, my colleague Alfred Bell detected a small fragment, now figured, which we both think may be identified with *C. tyrrhena.* It shows the varix which is found occasionally in specimens of *C. bicatenata* from the Crag, as it is sometimes in recent examples of the present species.

Genus **FICULA,** Swainson, 1840.

Ficula condita (Brongniart). Plate XLVI, fig. 12.

1823. *Pyrula condita,* Brongniart, Mem. Terr. calc. Vicentin, p. 75, pl. vi, fig. 4.

1825. *Pyrula condita,* Basterot, Mem. Geol. Env. Bordeaux, p. 67.

1842—48. *Pyrula reticulata,* S. V. Wood, Ann. Mag. Nat. Hist. [1], vol. ix, p. 543, pl. v, fig. 17, 1842; Mon. Crag Moll., pt. i, p. 42, pl. ii, fig. 12, 1848.

1853. *Pyrula condita*, Hörnes, Foss. Moll. Tert. Wien, vol. i, p. 270, pl. xxviii, figs. 4—6.
1871. *Pyrula acclinis*, Jeffreys (pars), in Prestwich, Quart. Journ. Geol. Soc., vol. xxvii, pp. 145, 490.
1872. *Pyrula cancellata*, A. and R. Bell, Proc. Geol. Assoc., vol. ii, pp. 204, 210.
1874—84. *Ficula condita*, Van den Broeck, Ann. Soc. malac. Belg., vol. ix, pp. 120, 134, 187, 1874; *F. intermedia*, vol. xvii, p. cliv, 1882; vol. xix, pp. 18, 30, 35, 1884.
1875. *Pirula (Ficula) condita*, Dollfus, Étud. Géol. Terr. tert. Cotentin, p. 367.
1881. *Ficula intermedia*, Nyst, Conch. Terr. tert. Belg., p. 40, pl. i, fig. 8.
1885. *Ficula condita*, De Gregorio, Conch. Medit. viv. e foss., p. 317.
1890. *Pyrula reticulata*, C. Reid, Plioc. Dep. Brit., p. 254, pl. iii, fig. 4.
1890—91. *Ficula condita*, Sacco, Boll. Soc. Geol. Ital., vol. ix, p. 203, no. 2412, 1890; Moll. Terr. Terz. Piem., pt. viii, p. 23, pl. i, fig. 27, 1891.
1898. *Pyrula reticulata*, F. W. Harmer, Quart. Journ. Geol. Soc., vol. liv, p. 319.
1912. *Ficula reticulata*, Tesch, Med. v. d. Rijks. v. Delfstoffen, No. 4, p. 78, no. 186.
1916. *Ficus reticulata*, R. B. Newton, Journ. of Conch., vol. xv, pp. 73, 111, 141, pl. iv, figs. 1, 2.
1917. *Ficula condita*, A. Bell, Geol. Mag. [6], vol. iv, pp. 412, 413.

Specific Characters.—Shell large, pyriform, the body-whorl and mouth occupying nearly the entire length, squarely angulate and flattened above, excavated and narrowed below; spire excessively short and depressed; ornamented by numerous fine but well-marked transverse ridges with still finer ones in the interspaces, crossed by delicate longitudinal striæ and by the lines of growth.

Dimensions.—L. 60—65 mm. B. 35—42 mm.

Distribution.—Not known living.

Fossil: Boxstones. Lenham. Coralline Crag: Ramsholt, Gedgrave. Waltonian: Walton-on-Naze. Newbournian: Sutton, Waldringfield.

Miocene: Belgium, France, Vienna basin, Germany, Italy.

Pliocene (Casterlien, Scaldisien): Belgium—Waenrode. Scaldisien: Holland.

Remarks.—Considerable difference of opinion has existed as to the correct determination of the shell figured by Wood as *Pyrula reticulata*. Of late years it has been more generally referred to the genus *Ficula* (*Ficus*) and to the species *condita*, with which it seems to me most nearly to agree. It is a distinctly Miocene form, but appears to have been also a rare survivor to Pliocene times. Specimens occurring in the Coralline Crag present no appearance of derivation. Those from the Red Crag are worn, as indeed are many other of the shells of that formation. The specimen now figured belongs to the York Museum, and was found in the Newbournian Crag of Sutton.

Genus **NASSA**, Lamarck.

Sub-genus **HINIA** (*continued from Vol. I, p. 323*).

Nassa (Hinia) assimilis, sp. nov. Plate XLVII, fig. 12.

Specific Characters.—Shell small, solid, conical; whorls 7, flattened, slightly angulate above, the last much the largest, three-fourths of the total length;

rapidly diminishing to a blunt point; suture well marked but not deep; ornamented by wide and oblique but not prominent longitudinal costæ, placed close together and crossed by rather strong spiral striæ, the basal portion, which is also spirally striated, being separated from the rest of the body-whorl by a deep groove; mouth irregularly ovate with an angular notch above and ridged within; inner lip wide, ridged and folded upon the pillar; canal short, turning abruptly to the left and ending in a deep notch.

Dimensions.—L. 12 mm. B. 6 mm.

Distribution.—Not known living.

Fossil: St. Erth.

Remarks.—The shell here figured is from the Warburton Collection in the British Museum, where it bears the name of *N. costulata*. It does not agree, however, with Brocchi's figure of the *N. costulata* of Renier, and so far as I can make out is an undescribed species. The sculpture, consisting of wide, flattened costæ crowded together and crossed by spiral striæ, is different from that of any *Nassa* hitherto described from our English deposits, though somewhat like that of the *N. diversa* of Bellardi. In other respects, however, our shell is different.

In the Warburton Collection in the British Museum there is a characteristic specimen of the recent British shell *Nassa reticulata*, labelled from St. Erth, but accompanied by a notice in Robert Bell's handwriting: "This came with Mr. Wood's specimens." The locality given for it may probably have been a mistake.

Sub-genus **UZITA** (*continued from Vol. I, p.* 66).

Nassa (Uzita) reticosa, type (J. Sowerby). Plate XLVI, figs. 1—3 (*continued from Vol. I, p.* 62).

1818. *Buccinum reticosum*, J. Sowerby, Min. Conch., vol. ii, p. 17, pl. cx, fig. 2.
1848. *Nassa reticosa*, S. V. Wood, Mon. Crag Moll., pt. i, p. 33, pl. iii, fig. 10 *a*.

Remarks.—As to this form Sowerby and Wood are practically agreed. The specimens now figured, though not absolutely the same, may be regarded as typical.

Var. **rugosa** (J. Sowerby). Plate XLVI, fig. 11.

1818. *Buccinum rugosum*, J. Sowerby, Min. Conch., vol. ii, p. 16, pl. cx, fig. 3.
1844. *Buccinum elongatum*, var. B, Nyst, Coq. foss. Terr. tert. Belg., p. 572, pl. xlv, fig. 3.
1914. *Nassa reticosa*, var. *costata*, F. W. Harmer, Plioc. Moll. Gt. Brit., vol. i, p. 63, pl. iii, fig. 15.

Remarks.—In my short allusion to this interesting, abundant, but very variable group of shells, I lost sight of the fact that the *B. rugosum* of Sowerby does not agree with that figured subsequently by Wood under that name. Sowerby gives three figures of this group, viz. of *B. elongatum*, *B. reticosum* and *B. rugosum*, two

of them agreeing more or less nearly with those of Wood. The third, however, is different. As figured by Sowerby, it is a distinct form easily separated from other varieties of this species by its prominent and rather distant ribs. As Sowerby's Memoir is considerably the older, his shell must be accepted as the true var. *rugosa*, Wood's name being withdrawn in its favour as well as one of those described by me (in error) as var. *costata* in Pl. III, fig. 15, of Vol. I. For Wood's shell I propose the varietal name *Woodii*, see below, while my fig. 15 becomes var. *rugosa*.

Among a large number of specimens of this variable species it is not easy to refer all of them to those that may be fairly regarded as varietal types, as some are of an intermediate character. It may be desirable, however, to figure examples of those that may be regarded as specifically distinct, of which I have about ten kinds in my collection.

Var. **Woodii,** nov. Plate XLVI, fig. 6.

1848. *Nassa reticosa*, var. *rugosa*, S. V. Wood, Mon. Crag Moll., pt. i, p. 33, pl. iii, fig. 10 *b*.

Remarks.—For reasons just given Wood's varietal name of *rugosa* must be discontinued in favour of Sowerby's costated variety. I substitute for it that given above in remembrance of my old friend. The specimen now given is from the Crowfoot Collection and was found at Butley ; its whorls are wide and buccinoform as in that figured by Wood.

Var. **elongata** (J. Sowerby). Plate XLVI, fig. 4.

1818. *Buccinum elongatum*, J. Sowerby, Min. Conch., vol. ii, p. 15, pl. cx, fig. 1.

1842—48. *Nassa elongata*, S. V. Wood, Ann. Mag. Nat. Hist. [1], vol. ix, p. 539, 1842 ; *N. reticosa*, var. *elongata*, Mon. Crag Moll., pt. i, p. 33, pl. iii, fig. 10 *c*.

Remarks.—Wood's figure of this variety corresponds very closely with what is one of the most distinct and abundant forms of *N. reticosa* in the English Crag. It is elongate in form, generally rather thin and fragile, the longitudinal costæ being fine, inconspicuous and numerous—confined, as a rule, to the upper whorls. Nyst's figures of this species are also elongate, but the sculpture is coarser and the ribs stronger and less numerous. It may be interesting to notice that a closely allied, if if not identical shell, *Nassa aubigiensis* (fig. 8), occurs in the Lower Pliocene of Bosq d'Aubigny in the south-west of France, a specimen of which I have received from my friend M. Dautzenberg and is here given for comparison. This is interesting, suggesting a southern origin for this remarkable group of molluscs. Appearing first in the Coralline Crag of Sutton, in which they are very rare, they become abundant in that of Boyton, where Mr. Bell informs me they were formerly obtained in great numbers. From the Waltonian Crag he and I have obtained about 500 specimens, including rarities. In the later beds of the Red Crag, on the contrary, they became less common and finally disappeared, killed off possibly by the increasing cold. I

have before pointed out the importance of the Boyton fauna as forming a link between the Coralline Crag of Sutton and Gedgrave and the Red Crag of Walton and Oakley.

Var. **costata,** S. V. Wood. Plate XLVI, fig. 7.

1848. *Nassa reticosa*, var. *costata*, S. V. Wood, Mon. Crag Moll., pt. i, p. 33, pl. iii, fig. 10 *h*.
1914. *Nassa reticosa*, var. *costata*, F. W. Harmer, Plioc. Moll. Gt. Britain, vol. i, p. 63, pl. iii, fig. 16.

Remarks.—The specimen figured by Wood under this name is a small shell with strong longitudinal costæ. It is not uncommon, either in the Coralline Crag of Boyton or in the Waltonian of Walton and Little Oakley. My own fossil, fig. 7, comes from Walton. It is not unlike the var. *rugosa*, but is smaller and more delicately striated.

Var. **tiara,** S. V. Wood. Plate XLVI, fig. 10.

1842–48. *Nassa reticosa*, var. *tiara*, S. V. Wood, Ann. Mag. Nat. Hist. [1], vol. ix, p. 539, 1842; Mon. Crag Moll., pt. i, p. 33, pl. iii, fig. 10 *d*, 1848.

Remarks.—This distinct variety is rare in the Crag and is not often obtained perfect.

Var. **fenestralis,** S. V. Wood. Plate XLVI, fig. 5.

1848. *Nassa reticosa*, var. *fenestralis*, S. V. Wood, Mon. Crag Moll., pt. i, p. 33, pl. iii, fig. 10 *e*.

Remarks.—This variety occurs both in the Coralline Crag of Boyton and in the Red Crag of Oakley and elsewhere. It is specially characterised by its turreted spire and its granulated sculpture.

Var. **concinna,** S. V. Wood. Plate XLVI, fig. 9.

1848. *Nassa reticosa*, var. *concinna*, S. V. Wood, Mon. Crag Moll., pt. i, p. 33, pl. iii, fig. 10 *g*.

Remarks.—This variety is small and slender with delicate sculpture, longitudinal and transverse, the latter extending to the base. It occurs also in the Belgian Crag, as do most of the varieties found in that of East Anglia.

Var. **deformis,** S. V. Wood.

1848. *Nassa reticosa*, var. *deformis*, S. V. Wood, Mon. Crag Moll., pt. i, p. 33, pl. iii, fig. 10 *f*.

Remarks.—This form may possibly be an abortive growth. I have never met with it myself.

Genus **LIOMESUS**, Stimpson, 1865 (*continued from Vol. I, p.* 116).

Liomesus Dalei (J. Sowerby). Plate XLV, figs. 4—6.

1825. *Buccinum Dalei*, J. Sowerby, Min. Conch., vol. v, p. 139, pl. cccclxxxvi, figs. 1, 2.
1842–48. *Buccinum Dalei*, S. V. Wood, Ann. Mag. Nat. Hist. [1], vol. ix, p. 540, 1842; Mon. Crag Moll., pt. i, p. 34, pl. iii, fig. 10, 1848.
1844–81. *Buccinum crassum*, Nyst, Coq. foss. Terr. tert. Belg., p. 569, pl. lxiv, fig. 7; *B. Dalei*, p. 570, 1844; *Buccinopsis Dalei*, var. *crassa*, Conch. Terr. tert. Belg., p. 17, pl. ii, fig. 1, 1881.
1853. *Buccinum Dalei*, Forbes and Hanley, Brit. Moll., vol. iii, p. 408, pl. cix, figs. 1, 2.
1859. *Buccinum Dalei*, G. B. Sowerby, Ill. Ind. Brit. Shells, pl. xviii, fig. 12.
1867–71. *Buccinopsis Dalei*, Jeffreys, Brit. Conch., vol. iv, p. 298, 1867; vol. v, p. 218, pl. lxxxiii, fig. 2, 1869; in Prestwich, Quart. Journ. Geol. Soc., vol. xxvii, pp. 142, 486, 1871.
1870–1911.? *Buccinopsis Dalei*, A. Bell, Ann. Mag. Nat. Hist. [4], vol. vi, p. 214, 1870; Geol. Mag., vol. viii, p. 453, 1871; Journ. Ipswich Field Club, vol. iii, p. 15, 1911.
1872. *Buccinopsis Dalei*, A. and R. Bell, Proc. Geol. Assoc., vol. ii, pp. 203, 209, 213.
1874–1892. *Buccinopsis Dalei*, Van den Broeck, Ann. Soc. malac. Belg., vol. ix, pp. 260, 272, 1874; vol. xiv, p. 70, 1879; vol. xix, p. 18, 1884; Bull. Soc. Belge Géol., vol. vi (Mémoires), pp. 121, 131, 1892.
1878. *Buccinopsis eburnea*, G. O. Sars, Moll. Reg. arct. Norv., p. 265, pl. xiii, fig. 13.
1887. *Buccinopsis Dalei*, Kobelt, Icon. schalentrag. europ. Meeresconch., vol. i, p. 116, pl. xxi, fig. 3.
1890. *Buccinum Dalei*, C. Reid, Plioc. Dep. Brit., p. 238.
1896. *Buccinopsis Dalei*, var. *crassa*, Bernays, Bull. Soc. Belge Géol., vol. x (Mémoires), p. 128.
1896–1900. *Buccinopsis Dalei*, F. W. Harmer, Quart. Journ. Geol. Soc, vol. lii, p. 756, 1896; vol. liv, p. 317, 1898; vol. lvi, pp. 712, 719, 1900.
1902. *Liomesus Dalei*, Conch. Soc. List, Journ. of Conch., vol. x, p. 25, No. 494.
1906. *Liomesus Dalei*, Sykes, Proc. Malac. Soc., vol. vii, p. 341.
1912. *Buccinopsis Dalei*, Tesch, Med. v. d. Rijks. v. Delfstoffen, no. 4, p. 78, No. 190.

Specific Characters.—Shell usually strong and solid, ovato-elongate, with a truncated base; whorls 5 or 6, decidedly convex, the last much the largest; suture deep; spire varying in length, regularly enlarging, sometimes smooth, at others ornamented by spiral striation as well as by conspicuous lines of growth; mouth large, angulated above, terminating in a short, wide, and open canal which turns to the left; outer lip gently curved, not expanded; sculpture, where present, generally very fine above, stronger below.

Dimensions.—L. 30—50 mm. B. 15—30 mm.

Distribution.—Recent: west coast of Ireland; Shetland, Aberdeenshire, soft ground beyond the Dogger Bank. Norwegian coasts, Lofoten Islands.

Fossil: Coralline Crag. Red Crag—Waltonian to Butleyan (*passim*). Icenian: Chillesford, Southwold, Easton Bavent, Bramerton, Postwick.

Diestien, Casterlien, Scaldisien, Poederlien: Belgium.

Scaldisien, Poederlien: Holland.

Remarks.—This shell, which has a limited range both as recent and as fossil, is specially characteristic of the Anglo-Belgian Pliocene. In the Red Crag it is

found everywhere and in considerable abundance though it is less common in the Coralline. It varies in size, form, and the length of the shell, which in some of the Belgian specimens reaches as much as 90 mm. It is not at all common in the Icenian Crag, in which it has only been obtained rarely from three or four localities. My fig. 4 corresponds to the var. *crassa* of Nyst, fig. 5 approaches more nearly the *B. eburnea* of Prof. Sars, but there are many intermediate forms, some of them being without distinct sculpture. As a rule the spiral sculpture is fine and delicate in the earlier whorls, often becoming coarse and strong in the lower ones, as shown in my fig. 6.

Genus **NEPTUNEA**, Bolten (*continued from Vol. I, p.* 370).

Neptunea tenuistriata, F. W. Harmer. Plate XLVI, fig. 13.

1918. *Neptunea tenuistriata,* F. W. Harmer, Plioc. Moll. Gt. Brit., vol. i, pt. iii, p. 369, pl. xxxvii, figs. 1, 2.

Dimensions.—L. 40 mm. B. 24 mm.

Distribution.—Butleyan Crag: Hollesley or Butley (additional).

Remarks.—In Vol. I a specimen from Bridlington was figured under the present name which seemed to correspond with one of the Newfoundland species, *Fusus striatus* (Reeve), which I had received from my friend Prof. Sparre Schneider. Up to that time it had not been reported from the Crag. As to the identification of the Crag fossil with it I think there can be no doubt. The latter belongs to my own collection.

Genus **MUREX** (*continued from Vol. I, p.* 339).

Murex Harrisoni, A. Bell. Plate XLVII, fig. 2.

1915. *Murex Harrisoni,* A. Bell, Geol. Mag. [6], vol. ii, p. 167.

Specific Characters.—Shell small, thick and solid, ovato-turreted with a wide base; whorls convex, the last much the largest; ornamented by 7 irregular ribs, the labial one thickened, flat, varicose and much expanded; spire short, rapidly diminishing in size upwards; suture deep; mouth oval; outer lip wide, straight, rectangular both above and below, flattened and enlarged at the base, denticulate within; inner lip strong, reflected on the pillar; canal open, narrow, slightly oblique.

Dimensions.—L. 24 mm. B. 13 mm.

Distribution.—Not known living.

Fossil: Isle of Man (Cranstal Point).

Remarks.—The specimen figured under this name is one of two from the Manxland drift received from the Rev. S. N. Harrison by Mr. Bell, which we are unable to identify satisfactorily with any recognised species known to us. Messrs. Dollfus and Dautzenberg, moreover, who have been kind enough to examine this form and the one next described, inform me that they cannot find anything, either recent or fossil, to which they can be referred. We have pleasure in dedicating it to its discoverer.

Genus **OCINEBRA**, Leach (*continued from Vol. I, p.* 347).

Ocinebra Kendalli, sp. nov. Plate XLVII, fig. 3.

Specific Characters.—Shell thick and solid, ovate, turreted; whorls 5, convex, angulated obtusely below the suture; ornamented by about 10 strong and continuous ribs which extend to the base and the canal, and by strong spiral ridges crossing the ribs which are slightly granular at the points of intersection; spire short, rapidly diminishing upwards toward a blunt and flattened apex; suture deep but not channelled; mouth oval with a distinct and narrow canal; outer lip angulated above, expanded and strengthened by a prominent varix, with several well-marked tubercles within; inner lip thin, nearly straight in the middle, covering the pillar.

Dimensions.—L. 25 mm. B. 15 mm.

Distribution.—Not known living.

Fossil: Manxland drift.

Remarks.—This is another of the Rev. S. N. Harrison's discoveries, which, as stated above, neither I nor my friends are able to identify. It is one of the shells which are of a decidedly older type either than that of the Wexford fauna or, generally, of the Manxland beds.

Genus **EUTHRIA**, Gray (*continued from Vol. I, p.* 363).

Euthria cornea (Linné). Plate XLVII, fig. 1.

1918. *Euthria cornea*, F. W. Harmer, Plioc. Moll. Gt. Brit., vol. i, pt. iii, p. 361, pl. xxxvii, figs. 7, 8

Remarks.—The specimen now figured under the present name is also from St. Erth and belongs to the British Museum (Natural History). It differs materially from the variety figured in my first volume, being larger, with more convex whorls, compressed below the suture and a bent and strongly recurved canal. It agrees much more nearly with Bellardi's type-figure.

Genus **RAPHITOMA**, Bellardi (*continued from Vol. I, p.* 388).

Raphitoma lævis (A. Bell). Plate XLVII, fig. 10.

1846. *Pleurotoma* sp., E. Forbes, Mem. Geol. Surv., vol. i, p. 426, no. 127.
1890. *Pleurotoma lævis*, A. Bell, Rep. Brit. Assoc. (Leeds), p. 410.

Specific Characters.—Shell smooth and solid with a comparatively wide base and a slender elongated spire; whorls 6, convex, the last expanded, much the largest, more than half the total length; upper part gradually tapering to a blunt and rounded apex, suture well-marked but not deep; mouth oval, angulate above, rounded below; outer lip gently curved, somewhat expanded; canal short, rather wide, open.

Dimensions.—L. 12 mm. B. 4 mm.

Distribution.—Not known living.

Fossil: Wexford.

Remarks.—The shell figured under this name belongs to the *R. nebula* group, but it shows no sign of sculpture, either longitudinal or transverse. It is probably the same as that mentioned by Forbes as "a small tapering smooth species from Wexford," and is certainly that included in Mr. Bell's report on the Manure Gravels to the meeting of the British Association at Leeds (*op. cit.*). It comes to me from the British Museum, where it is labelled "St. Erth," but as soon as Mr. Bell saw it he recognised it without hesitation as his original specimen from Wexford, which he afterwards sent to Mr. Warburton, from whom the Museum purchased it.

There is a specimen in the British Museum labelled "*Pleurotoma communis*, Etheridge and Bell," which I consider should be referred to *R. Keepingi*, described in Vol. I, p. 388, of this work.

Raphitoma lævigata (Philippi). Plate XLVII, fig. 9.

1915. *Raphitoma lævigata*, F. W. Harmer, Plioc. Moll. Gt. Brit., vol. i, pt. ii, p. 274, pl. xxx, figs. 35–37.

Distribution.—Fossil: Selsey (additional).

Remarks.—A small but well-marked specimen of this southern shell, which was found at Selsey, has recently reached me from the York Museum.

Genus **MANGILIA**, Risso (*continued from Vol. I, p.* 382).

Mangilia indistincta, Monterosato. Plate XLVII, fig. 11.

1915. *Mangilia indistincta*, F. W. Harmer, Plioc. Moll. Gt. Brit., vol. i, p. 250, pl. xxix, fig. 19.

Distribution.—Fossil: Selsey.

Remarks.—The specimen now given under this name corresponds more nearly

with the one belonging to Mr. Tomlin, received from the Marchese di Monterosato, which I was allowed to figure as above, than with anything else I can find. It seems specially characterised by its distinct labial sinus. My specimen belongs to the York Museum, where it is called *Clavatula* sp., and was found at Selsey. It is possibly the same as that given by Alfred Bell in his paper of 1893 as *Pleurotoma striolata*.[1]

Genus **ADMETE,** Kröyer (*continued from Vol. I, p.* 411).

Admete Sheppardi, A. Bell. Plate XLIX, fig. 9.

1919. *Admete viridula*, var. *Sheppardi*, A. Bell, The Naturalist, p. 57, fig. 1.

Specific Characters.—Shell thin, oval, turreted; whorls 6, decidedly convex, the last tumid, much the largest, two-thirds the total length; ornamented by inconspicuous longitudinal costæ extending to the base, and by delicate but distinct spiral ridges which cross them; spire elongated, ending in a blunt point; suture fairly deep; mouth ovate, angulate above; canal short, bending to the left; outer lip thin, regularly curved; inner lip forming a thin callus upon the columella.

Dimensions.—L. 15 mm. B. 8 mm.

Distribution.—Not known living.

Fossil: Bridlington.

Remarks.—The shell figured under this name is one of three discovered by Mr. A. Bell in Mr. Headley's collection of Bridlington fossils, which he considers a new species. The sculpture is more delicate and less conspicuous than in the typical *A. viridula*. Its discoverer now considers that it deserves a distinctive specific name.

Admete contabulata, Friele. Plate XLIX, figs. 10.

1879—1901. *Admete contabulata*, Friele, Jahrb. Deutsch. Malak. Gesell., vol. vi, p. 276, 1879; Norsk. Nordhav. Exp., Mollusca, pt. ii, p. 24, pl. viii, figs. 31, 32, 1886; pt. iii, p. 85, 1901.

Specific Characters.—Shell minute, thin, strongly angulate, with a flattened ledge below the suture; whorls 5, rapidly increasing; ornamented by well-marked ribs which cross the ledge obliquely, dying out on the last whorl, and by spiral ridges which are continuous to the base; apex smooth, obtuse and mammiform; columella straight, with two inconspicuous folds; canal short; base pointed.

Dimensions.—L. 8 mm. B. 5 mm.

Distribution.—*Recent;* Norwegian coast, Spitzbergen.

Fossil: Bridlington.

[1] Rep. Yorks. Phil. Soc., p. 70, 1893.

Remarks.—This interesting shell was also discovered by Mr. Bell when examining Mr. Headley's collection, where he noticed about 8 specimens of it. I am not aware that it has been reported as recent except by Mr. Friele among the mollusca of the North Sea Norwegian Expedition. That author remarks: it may be easily distinguished from *Admete viridula* by its strongly angulated whorls, which, when crossed by its standing ribs, become almost nodulous, and by its smooth mammiform apex.

Genus **BITTIUM** (*continued from Vol. I, p.* 419).

Bittium crassicostatum (Etheridge and Bell). Plate XLVII, fig. 4.

1898. *Cerithium* (*Bittium*) *reticulatum*, var. *crassicostata*, A. Bell, Trans. Roy. Geol. Soc. Cornwall, vol. xii, p. 143.

Specific Characters.—Shell strong and solid, slender, subcylindrical; whorls convex; suture deep and channelled; spire slender, elongate, gradually tapering; ornamented by 5 or 6 rounded and projecting ribs continuous from apex to base, except as interrupted by the suture, with wide interspaces, and by coarse spiral ridges which cross the ribs; mouth small, oval, angulate above, rounded below.

Dimensions.—(Broken specimen) L. 12 mm. B. 3 mm.

Distribution.—Not known living.

Fossil: St. Erth.

Remarks.—Of this form Mr. Bell reports he obtained 3 or 4 specimens at St. Erth. I think it may be regarded as a new as well as an interesting species, as do MM. Dollfus and Dautzenberg. It is somewhat similar to the *B. robustum* of the Anglo-Belgian Crag described in Vol. I, p. 417, of this Memoir, but differs materially from it both in form and sculpture.

The specimen here figured is from the Warburton Collection in the British Museum, where it is regarded as a variety of *C.* (*Bittium*) *reticulatum*. I prefer to consider it specifically distinct.

Bittium incile, Watson. Plate XLVII, fig. 7.

1897. *Bittium incile*, Watson, Journ. Linn. Soc. (Zoology), vol. xxvi, p. 246, pl. xix, figs. 14, 14*a*.

Specific Characters.—Shell small, solid, conical; whorls 8—9, nearly flat; spire elongate, regularly but slowly tapering upwards; suture deep, channelled; ornamented by 3 spiral rows of well-marked rounded nodules on each of the lower whorls, arranged also in longitudinal lines, the base having 3 sharp and strong ridges; mouth ovate, angulate above.

Dimensions.—L. 7 mm. B. 2·5 mm.

Distribution.—*Recent:* Madeira, Porto Santo, Selvagens, Grand Canary.
Fossil: St. Erth.

Remarks.—I am indebted to my good friend M. Dautzenberg for identifying the charming St. Erth fossil from the British Museum here figured (which there bears the name of *Cerithium tuberculatum*, no. 18156), with a specimen of *Bittium incile* he received in 1898 from Canon Norman. The Rev. R. Boog Watson, who first described this species, states that it is very common in the waters of the Madeira Sea. Our shell is quite fresh and perfect, and does not seem to have been carried far from its original home. The occurrence of this and other distinctly southern species in the St. Erth bed is not only interesting but suggestive. Two other fossil species of *Bittium* are also known from that locality which are unrecorded as living forms.

Bittium dissimile, sp. nov. Plate XLVII, fig. 5.

1898. *Cerithium reticulatum*, var. *punctulum* (not *C. variculosum*, Nyst), A. Bell, Trans. Roy. Geol. Soc. Cornwall, vol. xii, p. 144, pl. i, fig. 12.

Specific Characters.—Shell small, turreted, fairly solid; whorls 9 or 10, slightly convex; ornamented by about 10 rounded and rather prominent longitudinal costæ intersected by spiral ridges, 4 on each whorl, which become granulate at the point of contact; spire forming an elongated cone, regularly diminishing in size to a blunt point; mouth small, subovate.

Dimensions.—L. 5 mm. B. 2 mm.

Distribution.—Not known living.
Fossil: St. Erth.

Remarks.—The St. Erth fossil, here figured as a new species, is also from the Warburton Collection, where it is labelled "*Cerithium punctulum*"—a name given by Wood in 1842 to a shell from Walton,[1] which was afterwards identified by him, but I think in error, with an Oligocene species, the *C. variculosum* of Nyst.[2] In Vol. I, p. 418, Pl. XLI, fig. 5, I described and refigured Wood's Walton shell, which is still in the British Museum under its original specific name of *punctulum*, reporting it also from St. Erth on the strength of Mr. Bell's identification given above. Comparing the two specimens and the two figures from Walton and St. Erth respectively, however, I find they are not the same; I therefore describe the latter as a new species, *B. dissimile*, with which view MM. Dollfus and Dautzenberg concur.

[1] Ann. Mag. Nat. Hist. [1], vol. ix, p. 538, 1842.
[2] Mon. Crag Moll., pt. i, p. 69, pl. viii, fig. 3, 1848.

Genus **CERITHIOPSIS**, Forbes and Hanley (*continued from Vol. I, p. 424*).

Cerithiopsis tubercularis, var. **subulata** (S. V. Wood). Plate XLVII, fig. 6.

1848. *Cerithium tuberculare*, var. *subulatum*, S. V. Wood, Mon. Crag Moll., pt. i, p. 70, pl. viii, fig. 5 *b*.
1865. *Cerithiopsis acicula*, Brusina, Couch. Dalm. ined., p. 17.
1884. *Cerithiopsis tubercularis*, var. *subulata*, Bucquoy, Dautzenberg et Dollfus, Moll. mar. Rouss., vol. i, p. 205, pl. xxvii, fig. 3.
1898. *Cerithiopsis minutum*, A. Bell, Trans. Roy. Geol. Soc. Cornwall, vol. xii, p. 144.

Varietal Characters.—Differs from the type in its slender, elongated and subcylindrical spire and in its flattened whorls.

Dimensions.—L. 5 mm. B. 1 mm.

Distribution.—Recent: Guernsey, Bantry Bay and elsewhere. Mediterranean, Adriatic.

Fossil: St. Erth. Coralline Crag: Sutton.

Remarks.—This well-marked variety was first described by Wood from the Coralline Crag. The specimen now figured is from the Warburton Collection of St. Erth fossils in the British Museum, where it is labelled *Cerithium minimum*. The species reported by me, however, under that name in Vol. I of the present work, p. 423, Pl. XLI, figs. 22, 23, is a shorter and wider shell and is the variety *nana* of Wood.

Genus **SCALA**, Klein, 1753.

The use of the generic term *Scalaria* (Lamarck, 1801), by which the group of mollusca described below was so long known, has been recently discontinued in favour of the earlier and pre-Linnean one given above. The Scalidæ, moreover, have been of late much subdivided, and the names of many new sub-genera are now found in recent conchological works.

The nomenclature here used is in the main that adopted by M. Cossmann in the ninth volume of his "Essais de Paléoconchologie comparée" (1912), in collaboration with M. de Boury of Paris, who has devoted many years to the study of the Scalas, upon which he is regarded as a distinguished authority. As no less than sixteen of these subdivisions are represented in the English Crag, and there are some other points which deserve discussion, it seems desirable in the present memoir to deal with the Crag Scalas as a whole.

It is not practicable, however, that the characteristic features of these different groups can be fully given here; a reference, therefore, to M. Cossmann's work is recommended to those who desire a more detailed knowledge of the subject.

A recent author remarks as to the various species of the Scalidæ that for the most part they are "tres difficiles à determiner." I am the more fortunate, therefore, that in studying this group I have been able to avail myself of the special knowledge and experience of such an expert as M. de Boury. [Since this was written I have heard with deep regret that my good friend has passed away.]

Dr. W. H. Dall proposes to use the generic term *Epitonium* (Bolten, 1798), instead of *Scala*,[1] but so far as I know the former has not been adopted by European conchologists. The alteration seems to me undesirable, as *Scala* forms the root-word of most of the new sub-generic names of the present group.

Unfortunately there has been, and still is, considerable difference of opinion as to the use, generic and sub-generic, of some of the names which have been adopted by our best authorities. As the present memoir is intended primarily for the use of geologists, and specially for students of the Crag, to whom as a rule such controversies have but little interest, it seems desirable to retain the old generic name of *Scala* (*Scalaria*), by which they have been known for so long, for all the species here dealt with, using the subsidiary names as sub-generic only.

As urged in my first volume, the introduction of new generic names, now so much in vogue, is bewildering and not helpful to the geological student who has the old text-books to work with and the old lists of fossils to consult. It should be avoided so far as practicable in works like the present, though each case must be decided on its own merits.

Sub-genus **SPINISCALA**, de Boury, 1910.

Scala (Spiniscala) Trevelyana (Leach). Plate XLVIII, figs. 13, 14.

1822. *Scalaria Trevelyana* (Leach) in Winch, Ann. Phil., vol. xx, p. 434.
1846. *Scalaria Trevellyana*, Lovén, K. Svensk. Vet.-Akad. Förh., vol. iii, p. 88, no. 118.
1853. *Scalaria Trevelyana*, Forbes and Hanley, Brit. Moll., vol. iii, p. 213, pl. lxx, figs. 7, 8.
1859. *Scalaria Trevelyana*, G. B. Sowerby, Ill. Ind. Brit. Shells, pl. xv, fig. 19.
1867—84. *Scalaria Trevelyana*, Jeffreys, Brit. Conch., vol. iv, p. 93, 1867; vol. v, p. 209, pl. lxxi, fig. 4, 1869; in Prestwich, Quart. Journ. Geol. Soc., vol. xxvii, p. 491, 1871; Proc. Zool. Soc., p. 137, 1884.
1873—6. *Scalaria Trevelyana*, Seguenza, Boll. R. Com. Geol. Ital., vol. iv, p. 356, no. 324, 1873; vol. v, p. 282, no. 117, 1874; vol. vii, p. 98, no. 617, 1876.
1890. *Scalaria Trevelyana*, de Boury, Boll. Soc. Malac. Ital., vol. xiv, p. 291, no. 68.
1890. *Scalaria Trevelyana*, Carus, Prod. Faun. Medit., vol. ii, p. 293.
1890—1. *Fuscoscala Turtonis*, var. *Trevelyana*, Sacco, Boll. Soc. Geol. Ital., vol. ix, p. 316, no. 5140, 1890; *Fuscoscala Trevelyana*, Moll. Terr. Terz. Piem., pt. ix, p. 19, 1891.
1892. *Scalaria Trevelyana*, Locard, Coq. mar. Côtes de France, p. 127.
1901. *Scalaria Trevelyana*, Brøgger, Norges geol. Undersøgelse, no. 31, p. 661, pl. xvi, fig. 18.
1903. *Scalaria* (*Linctoscala*) *trevelyana*, Kobelt, Icon. schalentrag. europ. Meeresconch., vol. iii, p. 20, pl. lxi, figs. 11—13.
1912. *Scala* (*Spiniscala*) *Trevelyana*, Cossmann, Ess. Paléoconch. compar., vol. ix, p. 32.

[1] Proc. U.S. Nat. Mus., vol. liii, no. 2217, p. 471, 1917.

Specific Characters.—Shell conical, rather thin; whorls convex, disjoined; ornamented by about 16 narrow and flattened longitudinal ridges, oblique and usually continuous, occasionally varicose, the upper part of them expanding into a small and short spine-like projection; spire elongate, slender, regularly tapering to a fine point; suture fairly deep; mouth subcircular, angulate above; outer lip thickened by the last rib; umbilicus and basal ridge wanting.

Dimensions.—L. 25 mm. B. 8 mm.

Distribution.—Recent: British coasts from the Land's End to Shetland, the Moray Firth and Berwick to Scarborough; Cork to Londonderry. West Atlantic, Naples (Carus). Dogger Bank; Christiania fiord, Bergen, Christiansund, Bohuslän, Cattegat.

Fossil: Estuarine clays: Belfast. Holocene: Portrush.

Miocene: Piedmont.

Lower Pliocene: Biot, Piedmont, Genoa.

Upper Pliocene: Italy—Piedmont, Bologna, Val d'Era, Cornarè. Sicily—Altavilla, Caltabiano, Messina.

Pleistocene: Valle Biaia, Ficarazzi, Castroreale. Norway—*Tapes*-banks: Christiania.

Remarks.—This species, widely diffused as recent, being reported to range from British seas in one direction into Scandinavia and in another to the Mediterranean, has been recorded as fossil from a number of southern localities, especially from the Pliocene and Pleistocene of Italy and Sicily. In Great Britain it occurs in the estuarine clays of Belfast and in the Holocene of Portrush, while Prof. Brøgger has figured a typical example from the post-glacial *Tapes*-banks of the Christiania fiord. As to its position as a Crag shell, however, some difference of opinion has existed. In 1848 Wood figured a unique and imperfect specimen from the Newbournian Crag of Sutton, which, having compared it with a recent shell in his collection, he referred to the present species. Prof. Sacco accepts this view, but he distinguishes Wood's Sutton fossil by the varietal name of *cragtrevelyana*. Up to the present no other specimen of this form has been recognised in the Crag since 1848, so that the existence of the typical *S. trevelyana* in our Pliocene deposits must be considered doubtful.

In his first Supplement of 1872, however, Wood figured another and I think different shell under the present name, which M. de Boury regarded as specifically distinct. It is described in the next paragraph as *S. aldebiana*.

The sub-genus *Spiniscala*, of which M. de Boury took the Italian *S. frondicula* as the type, was considered by him to include a group of Scalas turriculate and generally more or less slender, of moderate size, having an elongate spire, a deep suture, convex and slightly disjoined whorls, numerous ribs, lamelliform and reflexed, the upper part of the latter being somewhat enlarged and spinous, with an imperforate base and without a basal disc.

Var. **cragtrevelyana**, Sacco. Plate XLIX, fig. 3.

1848. *Scalaria Trevelyana*, S. V. Wood, Mon. Crag Moll., pt. i, p. 94, pl. viii, fig. 20.
1891. *Scalaria* (*Fuscoscala*) *Trevelyana*, var. *cragtrevelyana*, Sacco, Moll. Terr. Terz. Piem , pt. ix, p. 19.

Varietal Characters.—Smaller and more fragile than the type, with finer and more numerous costæ.

Dimensions.—L. 10 mm. B. 4 mm.

Distribution.—Not recorded living.

Fossil: Newbournian Crag: Sutton. Icenian: Bramerton.

Remarks.—Accepting the view of Prof. Sacco and M. de Boury that the specimen figured by Wood in 1848 as *S. Trevelyana* should be regarded, not as the typical form, but as a variety of that species, I figure one from the Sedgwick Museum at Cambridge, which M. de Boury considered to be the same.

Scala (**Spiniscala**) **aldebiana** (Sacco). Plate XLVIII, fig. 31; Pl. XLIX, fig. 1.

1870. *Scalaria Trevelyana*, S. V. Wood and F. W. Harmer, Rep. Brit. Assoc. (Liverpool), p. 90.
1872. *Scalaria Trevelyana*, S. V. Wood, Mon. Crag Moll., 1st Suppl., pt. i, p. 58, pl. iv, fig. 6.
1872. *Scalaria Trevelyana*, A. and R. Bell, Proc. Geol. Assoc., vol. ii, pp. 214, 216.
1874. *Scalaria Trevellianum*, Van den Broeck, Ann. Soc. malac. Belg., vol. ix, p. 292.
1879. *Scalaria Trevelyana*, J. Reeve, Proc. Norwich Geol. Soc., vol. i, p. 79.
1891. *Scalaria* (*Fuscoscala*) *Trevelyana*, var. *aldebiana*, Sacco, Moll. Terr. Terz. Piem., pt. ix, p. 21.
1912. *Scalaria Trevelyana*, Tesch, Med. v. d. Rijks. v. Delfstoffen, No. 4, p. 70, no. 161.
1918. *Scala* (*Spiniscala*) *aldebiana*, de Boury MS.

Specific Characters.—Shell allied to *S. Trevelyana*, but much smaller; whorls convex, rounded; spire short; suture deep; base enlarged; mouth subcircular; umbilicus and basal ridge wanting.

Dimensions.—L. 5 mm. B. 3 mm.

Distribution.—Not recorded living.

Fossil: Icenian Crag—Norwich zone: Bramerton, Aldeby, Beccles, Yarn Hill, Easton Bavent. Weybourne zone: Weybourne. Middle Glacial Sands: Billockby.

Scaldisien: Belgium, Holland.

Remarks.—The shell described under this name differs essentially both from the recent *S. Trevelyana* of British seas and from Wood's Sutton fossil, described in the last paragraph. It was originally based on an imperfect specimen obtained from the Icenian Crag of Aldeby by Messrs. Crowfoot and Dowson. I have since found a good many others, some perfect, one of which, from Bramerton, I have here figured. Prof. Sacco, regarding it as allied to *S. Trevelyana,* proposed to call it a variety of that species from the locality at which it was first noticed, but M. de Boury, agreeing that it is not the typical *S. Trevelyana*, preferred to regard the name *aldebiana* as specific rather than varietal, with which I agree. Comparing my figs. 13, 14 and 31 of Plate XLVIII, I think this view will seem not

unreasonable. *S. aldebiana* seems to be met with generally, though not very abundantly, in the various localities of the Icenian Crag. Dr. Tesch has been kind enough to send me some of the specimens included in his list of shells from the Dutch borings under the name of *S. Trevelyana*. They belong to this form, as may probably do those from Antwerp recorded by M. Van den Broeck.

Scala (Spiniscala) oakleyensis, sp. nov. Plate XLIX, fig. 5.

Specific Characters.—Shell of moderate size, turreted, conical; whorls 7 or 8, convex, disjoined, the last expanded, nearly half the total length; ornamented by about 12 thin, narrow, distant, rather oblique and nearly continuous ribs, a few of them, rather larger than the others, subvaricose, the upper part widening into a short spine-like projection; spire elongate, regularly tapering upwards; suture deep; mouth subcircular, angulate below; base excavated; basal ridge wanting.

Dimensions.—L. 14 mm. B. 6 mm.

Distribution.—Not reported living.

Fossil: Waltonian Crag: Little Oakley.

Remarks.—This is another specimen that M. de Boury was kind enough to examine for me, but without being able to identify it with any species known to him, either recent or fossil. He thought it belonged to the subgenus *Spiniscala*, but as it was not perfect he hesitated to express a decided opinion. It comes from Oakley, the prolific locality from which I have obtained so many interesting things, including a number of fragmentary Scalas. Possibly, now that attention is drawn to this shell, a more satisfactory example of it should be found. There may be other Crag localities from which, if carefully worked, equally good results might be obtained as from that locality.

Sub-genus **LINCTOSCALA**, de Boury, 1891.

Scala (Linctoscala) frondicula (S. V. Wood). Plate XLVIII, figs. 19, 20.

1842—48. *Scalaria frondicula*, S. V. Wood, Ann. Mag. Nat. Hist. [1], vol. ix, p. 535, 1842; Mon. Crag Moll., pt. i, p. 92, pl. viii, fig. 16, 1848.

1843—81. *Scalaria frondosa*, Nyst, Coq. foss. Terr. tert. Belg., p. 393, pl. xxxviii, fig. 7, 1843; *S. frondicula*, Ann. Soc. malac. Belg., vol. vi, p. 108, no. 118, 1871; Conch. Terr. tert. Belg., p. 87, pl. vi, fig. 15, 1881.

1870. *Scalaria frondicula*, A. Bell, Journ. de Conch., vol. xviii, p. 351, no. 369.

1871. *Scalaria frondicula*, Jeffreys in Prestwich, Quart. Journ. Geol. Soc., vol. xxvii, p. 145.

1872. *Scalaria frondicula*, A. and R. Bell, Proc. Geol. Assoc., vol. ii, p. 204.

1874—92. *Scalaria frondicula*, Van den Broeck, Ann. Soc. malac. Belg., vol. ix, pp. 120 *et seq.*, 1874; vol. xii, p. 70, 1877; vol. xvi, p. 76, 1879; vol. xix, p. 26, 1884; Bull. Soc. Belge Géol., vol. vi (Mémoires), pp. 123, 133, 147, 1892.

1876. *Scalaria frondicula*, Seguenza, Boll. R. Com. Geol. Ital., vol. vii, p. 98, no. 613.

1890. *Scalaria frondicula*, Carus, Prod. Faun. Medit., vol. ii, p. 293.

1890—91. *Linctoscala (?) frondicula*, Sacco, Boll. Soc. Geol. Ital., vol. ix, p. 317, no. 5157, 1890; *Scalaria (Linctoscala) frondicula*, Moll. Terr. Terz. Piem., pt. ix, p. 26, pl. i, fig. 38, 1891.

1890–91. *Scalaria frondicula*, de Boury, Boll. Soc. Malac. Ital., vol. xiv, p. 297, no. 72, 1890; *Linctoscala frondicula*, vol. xv, p. 194, pl. iv, fig. 4, 1891.
1896. *Scalaria frondicula*, Bernays, Bull. Soc. Belge Géol., vol. x (Mémoires), p. 129.
1907. *Scalaria frondicula*, Ravn, Danske Kgl. vid. Selsk. Skrift. [7], vol. iii, p. 295, pl. iii, fig. 14.
1912. *Scalaria frondicula*, Tesch, Med. v. d. Rijks. v. Delfstoffen, No. 4, p. 70, no. 159.
1912. *Scala* (*Spiniscala*) *frondicula*, Cossmann, Ess. Paléoconch. compar., vol. ix, p. 30, pl. i, figs. 28, 29.
1914. *Scala* (*Spiniscala*) *frondicula*, Cerulli-Irelli, Palaeont. Ital., vol. xx, p. 221, pl. xx, figs. 21, 22, 25.

Specific Characters.—A species variable both in form and in the number of its costæ, not unlike *S. frondosa*, but having a narrower base and a more elongate spire; the whorls are convex and slightly disjoined, the spinous termination of the ribs being less marked and prominent than in that shell; the suture is deep and, as in *S. frondosa*, a basal ridge is wanting.

Dimensions.—L. 20 mm. B. 8 mm.

Distribution.—*Fossil:* Coralline Crag: Gedgrave, Sutton, Boyton. Waltonian: Little Oakley. Newbournian: Waldringfield.

Miocene: Belgium, Denmark.

Lower Pliocene: Biot, northern Italy (very common), Tuscany.

Upper Pliocene—Casterlien (zone *à Isocardia cor*): Antwerp.

Scaldisien: Belgium, Holland. Italy—Asti, Bologna, Monte Mario. Sicily—Caltabiano, Messina.

Remarks.—*S. frondicula* is common in the Coralline Crag of Sutton and Gedgrave, occurring also, though rarely, in the Waltonian and Newbournian zones of the Red Crag. It seems to be widely diffused in the Italian Pliocene, specimens from which are regarded by M. Cossmann as the typical form of this species. Sign. Cerulli-Irelli figures several varieties of it from Monte Mario, but their costæ are not so numerous as in the Crag fossils.

A nearly allied form from the Mediterranean under the present name has been identified by Jeffreys and the Marchese di Monterosato with our Crag shell, but M. de Boury doubted whether they are the same.

He considered, moreover, that the Mediterranean form of *S. frondicula* differs from Wood's species, proposing to call it *S. frondiculoides*.

Sub-genus **LAMELLISCALA**, de Boury, 1910.

Scala (**Lamelliscala**) **frondosa** (J. Sowerby). Plate XLVIII, figs. 21, 22.

1829. *Scalaria frondosa*, J. Sowerby, Min. Conch., vol. vi, p. 149, pl. dlxxvii, fig. 1.
1842–48. *Scalaria frondosa*, S. V. Wood, Ann. Mag. Nat. Hist. [1], vol. ix, p. 535, 1842; Mon. Crag Moll., pt. i, p. 92, pl. viii, fig. 15, 1848.
1871. *Scalaria frondosa*, Nyst, Ann. Soc. malac. Belg., vol. vi, p. 108, no. 119.
1871–84. *Scalaria soluta*, Jeffreys in Prestwich, Quart. Journ. Geol. Soc., vol. xxvii, p. 145, 1871; Proc. Zool. Soc., p. 136, 1884.

1872. *Scalaria frondosa*, A. and R. Bell, Proc. Geol. Assoc., vol. ii, p. 204.
1890. *Scalaria frondosa*, de Boury, Boll. Soc. Malac. Ital., vol. xiv, p. 295, no. 70.
1890. *Scalaria frondosa*, C. Reid, Plioc. Dep. Brit., p. 256.
1911. *Scalaria frondosa*, A. Bell, Journ. Ipswich Field Club, vol. iii, p. 16.
1914. *Scala* (*Spiniscala*) *frondosa*, Cerulli-Irelli, Palaeont. Ital., vol. xx, p. 226, pl. xx, fig. 41.
1918. *Scala* (*Lamelliscala*) *frondosa*, de Boury, MS.

Specific Characters.—Shell rather small, fragile, imperforate, conical, turreted; whorls 8—9, convex, disjoined, the last much the largest; ornamented by 9 to 10 thin, sharply edged, lamellar and membranaceous costæ, reflexed, distinctly spinous and projecting above; spire conical, short, rapidly diminishing in size upwards; mouth subovate; basal ridge wanting.

Dimensions.—L. 12—20 mm. B. 6—10 mm.

Distribution.—Not known living.

Fossil: Coralline Crag: Gedgrave, Sutton, Boyton.

Upper Pliocene: Monte Mario. Scaldisien: Holland (?).

Remarks.—*S. frondosa* may be easily distinguished from other Crag species by its texture and sculpture, its sharply-edged and spinous costæ and its comparatively short and conical spire. A difference of opinion has existed, however, as to its relation to some nearly allied forms with which it has been occasionally identified. By Jeffreys (*op. cit.*) it was referred to a recent Mediterranean species —*S. soluta*, Tiberi—but this view is not accepted by M. Cossmann, who places the latter in a different group, *Parviscala*.[1] At one time M. de Boury referred it doubtfully to *S. muricata*, Risso,[2] but in a letter recently received from him he now expresses the opinion that, although similar, the Crag *S. frondosa* is specifically distinct. Nyst figured in 1843 a specimen under the present name, but if it is correctly drawn it is not the same as our shell[3]; indeed in 1881 he identified it with an allied Crag form, *S. frondicula*.[4]

Wood stated in 1848 that he had only four specimens of *S. frondosa* in his collection from the Coralline Crag of Gedgrave and Sutton, but Mr. Bell informs me he has since obtained it from Boyton. A few examples of it may be found in our museums, principally smaller than Wood's type, but it must be still regarded as a rare Coralline Crag shell. I have not found it at Oakley, nor has it been reported from any other locality in the Red Crag.

Dr. Tesch records it from the Scaldisien of Grave-Oss in Holland, but, as stated above, it seems doubtful whether the typical *S. frondosa* has been found in the Netherlands. Seguenza gives it from the Upper Pliocene of Sicily and the Pleistocene of Livorno, but as he identifies his fossils from those localities with *S. celesti*, Aradas, *S. pumila*, Libassi, some other Mediterranean species, his

[1] Ess. Paléoconch. compar., vol. ix, p. 36, 1912.
[2] Hist. nat. de l'Eur. mérid., vol. iv, p. 113, pl. iv, fig. 45, 1826.
[3] Coq. foss. Terr. tert. Belg., p. 393, pl. xxxviii, fig. 7, 1843.
[4] Conch. Terr. tert. Belg., p. 87, 1881.

references can hardly be relied on. The specimen from the Upper Pliocene of Monte Mario, however, figured by Sign. Cerulli-Irelli as *S. frondosa*, seems to be the true Crag shell.

Sub-genus **CLATHRUS**, Oken, 1815.

Scala (Clathrus) communis (Lamarck). Plate XLVII, figs. 28, 29.

1819. *Scalaria communis*, Lamarck, Anim. sans Vert., vol. vi, p. 228, no. 5.
1836—43. *Scalaria communis*, Philippi, Enum. Moll. Sic., vol. i, p. 167, pl. x, fig. 3, 1836; vol. ii, p. 144, 1843.
1846. *Scalaria clathrus*, Lovén, K. Svensk. Vet.-Akad. Förh., vol. iii, p. 88.
1853. *Scalaria communis*, Forbes and Hanley, Brit. Moll., vol. iii, p. 206, pl. lxx, figs. 9, 10.
1859. *Scalaria communis*, G. B. Sowerby, Ill. Ind. Brit. Shells, pl. xv, fig. 16.
1867—71. *Scalaria communis*, Jeffreys, Brit. Conch., vol. iv, p. 91, 1867; vol. v, pl. lxxi, fig. 3, 1869; Quart. Journ. Geol. Soc., vol. xxvii, p. 491, 1871.
1871. *Scalaria communis*, Nyst, Ann. Soc. malac. Belg., vol. vi, p. 98, no. 59.
1872. *Scalaria communis*, A. and R. Bell, Proc. Geol. Assoc., vol. ii, p. 210.
1873—76. *Scalaria communis*, Seguenza, Boll. R. Com. Geol. Ital., vol. iv, p. 354, no. 320, 1873; vol. v, p. 282, no. 115, 1874; vol. vii, p. 98, no. 618, 1876.
1874. *Scalaria communis*, S. V. Wood, Mon. Crag Moll., 1st Suppl., pt. ii, p. 183, add. pl., fig. 5.
1884. *Scalaria (Clathrus) communis*, Bucquoy, Dautzenberg et Dollfus, Moll. mar. Rouss., vol. i, p. 240, pl. xxiii, figs. 14—17.
1890. *Scalaria (Clathrus) communis*, Carus, Prod. Faun. Medit., vol. ii, p. 291.
1892. *Scalaria communis*, Locard, Coq. mar. Côtes de France, p. 126, fig.111.
1892. *Scalaria communis*, A. Bell, Rep. Yorks. Phil. Soc., p. 63.
1901. *Scalaria communis*, Brøgger, Norges geol. Undersøgelse, no. 31, p. 661, pl. xvii, fig. 18.
1905. *Scala (Clathrus) communis*, Kobelt, Icon. schalentrag. europ. Meeresconch., vol. iii, p. 4, pl. lix, figs. 1—11, 14—19.
1907. *Scalaria (Clathrus) communis*, Scalia, Att. Accad. Gioen. Sci. Nat. Catania [4], vol. xx, p. 33, no. 251.
1912. *Scala (Clathrus) communis*, Cossmann, Ess. Paléoconch. compar., vol. ix, p. 36, pl. i, fig. 40.

Specific Characters.—Shell solid, imperforate, conical, turriculate; whorls convex, disjoined, with a smooth surface; ornamented by longitudinal costæ, about 9 on the body-whorl, distant, slightly curved and reflected, not flattened, rarely varicose, rather broader above, each cemented to that on the succeeding whorl so as to form a continuous and oblique series; spire tapering regularly to a blunt and slightly inflected apex; sutures fairly deep; mouth subelliptical, angulated above and below; peristome continuous, thickened by the labial rib and by the inner lip, which is broad at the base.

Dimensions.—L. 30—40 mm. B. 10—15 mm.

Distribution.—*Recent:* British coasts, Finmark to the Canary Islands, Mediterranean, Adriatic, Ægean.

Fossil: Waltonian Crag: Little Oakley. Newbournian: Waldringfield.

Pleistocene: March gravels, Selsey, Torbay, Cheshire, Strethill, Lilleshall, Cumbrae, Shewalton.

Pliocene: Roussillon, Altavilla, Livorno.

Pleistocene: Sicily—Messina, Ficarazzi, Monte Pellegrino, Catania, Castroreale. Calabria—Reggio, Gravina. Christiania—*Tapes*-banks.

Remarks.—The sub-genus *Clathrus*, of which the present species is taken as the type, includes a group of imperforate Scalas, solid, conical and turreted, with smooth, convex, disjoined whorls, and lamelliform costæ, cemented at the suture and having a rounded base.

S. communis has rather a wide range as a recent shell, but as a fossil seems characteristic of Pleistocene rather than of Pliocene deposits. It has been but rarely recorded from the English Crag, but is reported by Prof. Brøgger from the Pleistocene *Tapes*-banks of the Christiania fiord, and by Seguenza from a number of Sicilian and Calabrian localities. Dr. Scalia has found it in the comparatively recent sub-Etnaen beds of the Catania region, as I have done in the March gravels and Mr. Bell at Selsey and elsewhere.

In the Min. Conch., vol. i, p. 49, Sowerby, referring to another Crag species of *Scala*, remarks that specimens of it are generally so brittle that they are apt to fall to pieces. My own experience is similar as to those found in the Red Crag[1]: out of a hundred in my collection from Oakley almost all are imperfect, owing probably to the disjoined character of the whorls, many of them being composed of a single whorl only. In the Icenian or Norwich Crag, on the contrary, complete examples of *Scala*, most frequently those of *S. grœnlandica*, a non-disjoined species, are the rule rather than the exception. It is possible, therefore, that in the Red Crag some species of *Scala* may have been more common than we have been accustomed to suppose, fragmentary specimens of them having been passed over by collectors without notice. The importance of preserving imperfect specimens when collecting, for subsequent and more careful examination, cannot be too strongly insisted on. As far as the present species is concerned, M. de Boury recognised among some broken fragments of *Scala* from Oakley, hardly good enough to figure, one or two which he considered the true *S. communis*.

I am figuring a recent specimen of *S. communis* for purposes of comparison, together with another from the York Museum, which was found at Waldringfield and has been identified with it.[2]

[1] Perfect specimens are more frequently met with in the Coralline Crag, the molluscan fauna of which was evidently accumulated under different conditions.

[2] M. de Boury doubted whether this identification was correct. I suggest, however, that the latter specimen may probably represent a Crag form of the present species.

Scala (Clathrus) Harmeri, de Boury, MS. Plate XLVII, fig. 30.

Specific Characters.—Shell differing from *S. proxima* in its more concave whorls, its deeper suture, in the form of its mouth and in the character of its costæ.

Distribution.—Not known living.

Fossil: Waltonian Crag: Little Oakley.

Remarks.—When examining my collection of Scalas from Little Oakley, M. de Boury selected one or two imperfect fragments which he could not identify with any species known to him, proposing to call it *S. Harmeri*, remarking it was "*assez voisin*" to an Italian fossil he had described in 1890 as *C. proximus*—a form Prof. Sacco considered to be a variety of *S. communis*, but which some other writers considered as specifically distinct from the latter. With the Oakley fragments referred to, M. de Boury sent me a similar specimen of *S. proxima* from the Pliocene of Castel Arquato. While greatly appreciating the compliment, I preferred at first to associate the two shells (figs. 30 and 31) as varieties of one of them, viz. of *S. proxima* (fig. 31), and when my plate was printed described them as such. M. de Boury, however, retained his opinion, and in the present year renewed his very kind offer, which under the circumstances it would have been ungracious to decline for a second time.

Scala (Clathrus) proxima, de Boury. Plate XLVII, fig. 31.

1890. *Clathrus proximus*, de Boury, Boll. Soc. Malac. Ital., vol. xiv, p. 250, no. 51, pl. iv, fig. 9.

1890—1. *Clathrus communis*, var. *proxima*, Sacco, Boll. Soc. Geol. Ital., vol. ix, p. 317, no. 5147, 1890; Moll. Terr. Terz. Piem., pt. ix, p. 23, 1891.

1903. *Scalaria* (*Clathrus*) *proxima*, Dollfus, Cotter et Gomez, Moll. Tert. Portugal, p. 10, pl. xxxiii, fig. 12.

1905. *Scala* (*Clathrus*) *proximus*, Kobelt, Icon. schalentrag. europ. Meeresconch., vol. iii, p. 8, pl. lix, fig. 10.

1912. *Scala* (*Clathrus*) *proxima*, Cossmann, Ess. Palæoconch. compar., vol. ix, p. 36, pl. i, figs. 38, 39.

Specific Characters.—Shell elongate, smaller and more slender than *S. communis*, fairly solid, imperforate; whorls convex, disjoined; spire conical, regularly and gradually diminishing in size upwards; ornamented by 8 or 9 narrow longitudinal costæ, prominent, reflexed, slightly oblique; mouth oval to circular, rather small; peristome continuous, foliaceous; outer lip varicose, thickened by the last rib; basal ridge wanting.

Dimensions.—L. 30 mm. B. 10 mm.

Distribution.—Not known living.

Fossil: Miocene: Portugal.

Lower and Upper Pliocene: northern Italy.

Remarks.—In the last clause I have explained why the present species, which

has no certain connection with the British Scalas, has been figured in this memoir. Should any further and more perfect specimens of either of the shells referred to be found hereafter in the Crag, it may be useful for comparison. As to the relation of *S. proxima* and *S. communis*, M. de Boury remarks that in the former the costæ are more numerous, somewhat irregular and unequal, while the whorls increase in size more gradually.

Scala (Clathrus) subulata (J. Sowerby). Plate XLVII, figs. 26, 27.

1823. *Scalaria subulata*, J. Sowerby, Min. Conch., vol. iv, p. 125, pl. cccxc, fig. 1.
1842—72. *Scalaria subulata*, S. V. Wood, Ann. Mag. Nat. Hist. [1], vol. ix, p. 535, 1842; Mon. Crag Moll., pt. i, p. 93, pl. viii, fig. 18, 1848; 1st Suppl., pt. i, p. 98, 1872.
1843—81. *Scalaria subulata?*, Nyst, Coq. foss. Terr. tert. Belg., p. 394, pl. xxxviii, fig. 8, 1843; Ann. Soc. malac. Belg., vol. vi, p. 136, no. 302, 1871; Conch. Terr. tert. Belg., p. 89, pl. vi, fig. 17, 1881.
1870. *Scalaria subulata*, A. Bell, Journ. de Conch., vol. xviii, p. 351, no. 370.
1871. *Scalaria foliacea*, var., Jeffreys in Prestwich, Quart. Journ. Geol. Soc., vol. xxvii, p. 145; *S. subulata*, p. 496.
1872. *Scalaria subulata*, A. and R. Bell, Proc. Geol. Assoc., vol. ii, pp. 204, 210, 214.
1874—92. *Scalaria subulata*, Van den Broeck, Ann. Soc. malac. Belg., vol. ix, pp. 187, 356, 1874; vol. xiv, pp. 71, 76, 1879; Bull. Soc. Belge Géol., vol. vi (Mémoires), pp. 123, 147, 1892.
1890. *Scalaria subulata*, C. Reid, Plioc. Dep. Brit., p. 256.
1896. *Scalaria subulata*, Bernays, Bull. Soc. Belge Géol., vol. x (Mémoires), p. 129.
1912. *Scalaria subulata*, Tesch, Med. v. d. Rijks. v. Delfstoffen, no. 4, p. 70, no. 157.
1912. *Scala (Clathrus) subulata*, Cossmann, Ess. Paléoconch. compar., vol. ix, p. 37.

Specific Characters.—Shell slender, turreted, elongate, subulate; whorls about 10, disjoined, convex, smooth; ornamented by fine longitudinal costæ, lamelliform and oblique, 8 to 10 on the last whorl, a few occasionally varicose; suture deep; mouth subovate; base imperforate; outer lip thickened by the labial rib; peristome reflected, continuous.

Dimensions.—L. 16 mm. B. 5 mm.

Distribution.—Not known living.

Fossil: Coralline Crag: Gedgrave, Sutton. Waltonian: Walton-on-Naze, Beaumont, Little Oakley. Newbournian: Sutton.

Casterlien (zone *à Isocardia cor.*), Scaldisien: Belgium. Scaldisien: Holland.

Remarks.—This form was at first regarded by Jeffreys as a variety of *S. foliacea*, but afterwards, having been dredged as he believed by McAndrew off Teneriffe, he reverted to Wood's original description of it as specifically distinct. Nyst states (*op. cit.*, p. 89), that the identification of the Teneriffe shell with *S. subulata* was, "*sans doute*," incorrect. The present species may be distinguished from *S. foliacea* by its slender and more elongate spire and the less fimbriated foliation of its costæ.

M. de Boury informed me that, in his opinion, the present species is not represented in Italy.

Sub-genus **NOBILISCALA**, de Boury, 1917.

Scala (Nobiliscala) foliacea (J. Sowerby). Plate XLVII, fig. 25.

1823. *Scalaria foliacea*, J. Sowerby, Min. Conch., vol. iv, p. 125, pl. cccxc, fig. 2.
1842—48. *Scalaria foliacea*, S. V. Wood, Ann. Mag. Nat. Hist. [1], vol. ix, p. 535, 1842; Mon. Crag Moll., pt. i, p. 93, pl. viii, fig. 17, 1848.
1870. *Scalaria foliacea*, A. Bell, Journ. de Conch., vol. xviii, p. 351, no. 373.
1871. *Scalaria frondosa*, var., Jeffreys in Prestwich, Quart. Journ. Geol. Soc., vol. xxvii, pp. 145, 491.
1871—81. *Scalaria foliacea*, Nyst, Ann. Soc. malac. Belg., vol. vi, p. 108, no. 113, 1871; Conch. Terr. tert. Belg., p. 86, pl. vi, fig. 14, 1881.
1872. *Scalaria foliacea*, A. and R. Bell., Proc. Geol. Assoc., vol. ii, pp. 204, 210, 214.
1873. *Scalaria foliacea*, Seguenza, Boll. R. Com. Geol. Ital., vol. iv, p. 356, no. 327.
1874—92. *Scalaria foliacea*, Van den Broeck, Ann. Soc. malac. Belg., vol. ix, p. 292, 1874; Bull. Soc. Belge Géol., vol. vi (Mémoires), pp. 133, 143, 147, 1892.
1889. *Scalaria foliacea*, De Gregorio, Ann. Géol. Paléont., vol. vi, p. 6, pl. i, fig. 32.
1890—1917. *Scalaria foliacea*, de Boury, Boll. Soc. Malac. Ital., vol. xiv, p. 281, 1890; *Clathrus* (*?*) *foliaceus*, vol. xv, p. 189, 1891; *S.* (*Nobiliscala*) *foliacea*, Journ. de Conch., vol. lxiii, p. 60, 1917.
1912. *Scala* (*Clathrus*) *foliacea*, Cossmann, Ess. Paléoconch. compar., vol. ix, p. 37.
1912. *Scalaria foliacea*, Tesch, Med. v. d. Rijks. v. Delfstoffen, no. 4, p. 70, no. 158.
1914. *Scala* (*Clathrus*) *foliacea* and vars., Cerulli-Irelli, Palaeont. Ital., vol. xx, p. 233, pl. xxi, figs. 3—7.

Specific Characters.—Shell turreted, imperforate; whorls smooth, convex, disjoined; ornamented by 5 to 7 longitudinal ribs, oblique, lamelliform, thin, distant, reflected; spire conical, elevated, regularly diminishing in size upward; mouth circular, angulate above; peristome reflected; base rounded, without a basal ridge.

Dimensions.—L. 25 mm. B. 10 mm.

Distribution.—Not known living.

Fossil: Coralline Crag: Gedgrave, Sutton, Boyton. Waltonian: Walton-on-Naze, Beaumont, Little Oakley. Newbournian: Waldringfield, Sutton, Felixstowe.

Scaldisien: Belgium, Holland.

(?) Pliocene: Biot, Asti, Monte Mario, Farnesina, Pisa.

(?) Pleistocene: Reggio.

Remarks.—*S. foliacea* has been reported from several localities in the Coralline Crag, where it is rather abundant, and from the earlier part of the Red Crag, where it is less so. It is a special form, easily recognised by its foliaceous costæ, which are not so numerous as they are in other allied Crag species. Nyst gives it from the Scaldisien of Belgium. His non-photographic figure, however, supposing it to be accurate, which at present I have no means of ascertaining, gives the impression of its being somewhat different from the Crag shell. It has been called var. *belgica* by Prof. Sacco. Signor Cerulli-Irelli, moreover, figures some specimens under the same varietal name, but these do not correspond

accurately with the typical English *S. foliacea*, nor do those which he identifies with *S. septemcostata* of Conti. M. de Boury reported *S. foliacea* from Asti, but with hesitation, and the Marquis de Gregorio a multicostate variety of that species from Pisa. On the whole, I am compelled to doubt whether the true *S. foliacea* of the Crag occurs in Italy. In any case Sowerby's name stands good for the English fossil.

In a letter recently received from him, M. de Boury proposed the new sub-generic name *Nobiliscala* for this and some allied species.

Scala (Nobiliscala) belgica (Sacco). Plate XLVIII, fig. 26.

1881. *Scalaria foliacea*, Nyst, Conch. Terr. tert. Belg., p. 86, pl. vi, fig. 14.
1891. *Scalaria foliacea*, var. *belgica*, Sacco, Moll. Terr. Terz. Piem., pt. ix, p. 27.
1892. *Scalaria foliacea*, A. Bell, Rep. Yorks. Phil. Soc., p. 67, pl. i, fig. 29.
1912. *Clathrus belgicus*, Cossmann, Ess. Paléoconch. comp., vol. ix, pp. 37, 171, pl. ii, figs. 1, 2.
1914. *Scala* (*Clathrus*) *foliacea*, Cerulli-Irelli, Palaeont. Ital., vol. xx, p. 233, pl. xxi, figs. 6, 7.
1917. *Scala* (*Nobiliscala*) *belgica*, de Boury, Journ. de Conch., vol. lxiii, pp. 36, 60.

Specific Characters.—Shell small, solid, conical, turreted; spire pyramidal; whorls convex, disjoined, the last two-fifths the total length; ornamented by 9 longitudinal costæ, slightly oblique, joined at the suture so as to be continuous from base to summit; mouth oval.

Dimensions.—L. 10—24 mm. B. 5—11 mm.

Distribution.—Not known living.

Fossil: Selsey. Scaldisien: Belgium. Italy—Monte Mario.

Remarks.—The fossil here figured was found many years ago at Selsey and belongs to the York Museum. A photograph of it was submitted to M. de Boury and identified by him with Prof. Sacco's var. *belgica* of *S. foliacea*. In its general appearance it corresponds very closely with the one represented by M. Cossmann as *Clathrus belgicus*, though it is smaller and possibly immature, but not so nearly with Nyst's figure of the Belgian shell from which it takes its name. At first considered by M. Cossmann to belong to *Clathrus*, it has been more recently referred by M. de Boury to a new sub-genus, *Nobiliscala*. Signor Cerulli-Irelli reports it from the Upper Pliocene of Monte Mario, but it is unknown from the English Pliocene.

Sub-genus **LEPIDOSCALA**, de Boury, MS., 1919.

Scala (Lepidoscala) Cavelli, sp. nov. Plate XLVII, fig. 24.

Specific Characters.—Shell turreted; whorls about 8, convex and rounded; ornamented by fine lamelliform and oblique costæ, 16 on the body-whorl; suture deep; spire elongate, regularly increasing in size; mouth subcircular; peristome continuous.

Dimensions.—L. 24 mm. B. 10 mm.

Distribution.—Not recorded living.

Fossil: Newbournian Crag: Waldringfield.

Remarks.—The fossil described under this name was discovered by Mr. Bell in the Cavell Collection at Framlingham College, and is now figured by the permission of the Principal of that institution. In the default of finding anything recent or fossil with which it might be identified, I have named it after the late Mr. Cavell, of Saxmundham, formerly a zealous collector from the Crag deposits of Suffolk. I submitted a photograph to M. de Boury, who agreed with me that it is new, and that it should be referred to a special sub-genus, *Lepidoscala*.

Sub-genus **FUSCOSCALA**, Monterosato, 1890.

Scala (Fuscoscala) tenuicosta (Michaud). Plate XLVIII, figs. 17, 18.

1819. *Turbo Turtonis*, Turton, Conch. Dict., p. 208, pl. xxvii, fig. 97.
1829. *Scalaria tenuicosta*, Michaud, Bull. Soc. Linn. Bordeaux, vol. iii, p. 260, fig. 1.
1836–44. *Scalaria planicosta*, Philippi, Enum. Moll. Sic., vol. i, p. 168, pl. x, fig. 4, 1836; *S. tenuicosta*, vol. ii, p. 145, 1844.
1853. *Scalaria Turtonis*, Forbes and Hanley, Brit. Moll., vol. iii, p. 204, pl. lxx, figs. 1, 2.
1859. *Scalaria Turtonis*, G. B. Sowerby, Ill. Ind. Brit. Shells, pl. xv, fig. 18.
1867–69. *Scalaria Turtonæ*, Jeffreys, Brit. Conch., vol. iv, p. 89, 1867; vol. v, pl. lxxi, fig. 2, 1869.
1871. *Scalaria tenuicosta*, Nyst, Ann. Soc. malac. Belg., vol. vi, p. 138, no. 312
1873–76. *Scalaria Turtonæ* var. *tenuicosta*, Seguenza, Boll. R. Com. Geol. Ital., vol. iv, p. 354, no. 321, 1873; vol. vii, p. 96, no. 609, 1876.
1878. *Scalaria Turtonæ*, G. O. Sars, Moll. Reg. arct. Norv., p. 359.
1884. *Scalaria tenuicosta*, Bucquoy, Dautzenberg et Dollfus, Moll. mar. Rouss., vol. i, p. 243, pl. xxiii, figs. 12, 13.
1889–91. *Scalaria tenuicosta*, Sacco, Boll. Soc. Geol. Ital., vol. viii, p. 352, no. 1883, 1889; *Scalaria* (*Fuscoscala*) *Turtonis* and vars., Moll. Terr. Terz. Piem., pt. ix, p. 15, pl. i, figs. 16–21, 1891.
1890. *Scalaria tenuicosta*, de Boury, Boll. Soc. Malac. Ital., vol. xiv, p. 282, no. 66.
1890. *Scalaria tenuicostata*, Carus, Prod. Faun. Medit., vol. ii, p. 291.
1892. *Scalaria tenuicosta*, Locard, Coq. mar. Côtes de France, p. 126.
1892. *Scalaria turtonæ*, Praeger, Proc. Roy. Irish Acad. [3], vol. ii, p. 262.
1905. *Scala* (*Fuscoscala*) *tenuicostata*, Kobelt, Icon. schalentrag. europ. Meeresconch., vol. iii, pp. 9, 11, pl. lxi, figs. 1–5.
1912. *Scala* (*Fuscoscala*) *tenuicosta*, Cossmann, Ess. Paléoconch. compar., vol. ix, p. 38.
1914. *Scala tenuicosta*, Cerulli-Irelli, Palaeont. Ital., vol. xx, p. 235, pl. xxi, figs. 10, 11.

Specific Characters.—Shell slender, conical; whorls 14–18, slightly convex; ornamented by discontinuous costæ, about 12 on the body-whorl, sinuous or oblique and rather irregular, occasionally varicose, extending to the base of the shell, also by excessively fine inconspicuous spiral striæ; spire elongato-subulate, regularly diminishing in size towards the apex; suture well-marked, but not deep; mouth subcircular; peristome continuous; without basal ridge.

Dimensions.—L. 25—45 mm. B. 8—15 mm.

Distribution.—*Recent:* British seas, chiefly southern and western, Mediterranean, Adriatic, Ægean. North Atlantic from Norway to Madeira.

Fossil: Pleistocene: Torbay, Bute, Ayr, estuarine clays of Belfast, Limavady.

Upper Pliocene: Monte Mario, northern Italy, Rhone Valley, Altavilla.

Pleistocene: Calabria; Sicily—Messina, Catania, Ficarazzi, Monte Pellegrino.

Remarks.—The specific name of *Turtonæ* or *Turtonis* has been rejected of late years in favour of *tenuicosta* on the ground that an author has no right to describe a new species under his own name or that of any member of his family. In the opinion of M. de Boury, the form figured by Wood as *S. Turtoni* is not the typical British shell, but a different species which he proposed to call *S. inclusa* as explained in the following paragraph. *S. tenuicosta* (*Turtonis*) has not been satisfactorily identified from the English Crag, but it occurs in some of our Pleistocene deposits, as in the estuarine clays of Belfast, as well as in those of several English and Scottish localities. It seems to be a variable form, one variety being subulate and comparatively slender, corresponding with the figures given by MM. Bucquoy, Dautzenberg and Dollfus (*op. cit.*, pl. xxiii, figs. 12 and 13), the other having a broader base as represented by Forbes and Hanley. One of the specimens now figured (Pl. XLVII, fig. 18) is from the estuarine clays of Belfast, the other (fig. 17) is a recent example from Exmouth.

S. tenuicosta ranges as a recent shell from Great Britain and the Norwegian coast to Madeira. As a fossil it is reported from the Pliocene of the Rhone valley and of Italy and Sicily, as well as from the Pleistocene of the last-named district and of Calabria.

Scala (Fuscoscala) Moorei, sp. nov. Plate XLVIII, fig. 32.

Specific Characters.—Shell conical, turreted, with a wide base; whorls 6 or 7, convex, the last expanded, much the largest; ornamented by about 12 narrow costæ, somewhat oblique, which reach the base, not so large as the intervening spaces; suture rather deep; spire rapidly diminishing upwards; mouth subcircular; outer lip thickened by the labial rib.

Dimensions.—L. 20 mm. B. 10 mm.

Distribution.—Not known living.

Fossil: Newbournian Crag: Felixstowe.

Remarks.—The shell here figured was found in the Newbournian Crag at Felixstowe by Major Moore, to whom I venture to dedicate it. M. de Boury considered it a new species. It is one of two specimens obtained at the same place, the other being more worn.

Sub-genus **LINCTOSCALA**, Monterosato, 1890.

Scala (Linctoscala) inclusa, de Boury, MS. Plate XLVIII, fig. 27.

1870. *Scalaria Turtonis*, A. Bell, Ann. Mag. Nat. Hist. [4], vol. vi, p. 216.
1871. *Scalaria Turtonæ*, Jeffreys, in Prestwich, Quart. Journ. Geol. Soc., vol. xxvii, p. 491.
1872. *Scalaria Turtoni*, S. V. Wood, Mon. Crag Moll., 1st Suppl., pt. i, p. 58, pl. iv, fig. 7.
1872. *Scalaria Turtonis*, A. and R. Bell, Proc. Geol. Assoc., vol. ii, p. 216.
1890. *Scalaria Turtonis*, C. Reid, Plioc. Dep. Brit., p. 256.
1891. *Scalaria* (*Fuscoscala*) *Turtonis*, var. *angliorum*, Sacco, Moll. Terr. Terz. Piem., pt. ix, pp. 18, 21.

Specific Characters.—Shell fairly large, turreted; whorls convex and rounded, regularly increasing in size; ornamented by rather fine costæ, oblique or curved and somewhat irregular; spire elongate, with an acute apex; suture deep; mouth subcircular; peristome continuous; basal ridge wanting.

Dimensions.—L. 30 mm. B. 11 mm.

Distribution.—Not reported living.

Fossil: Icenian Crag: Sudbourne Church-walks, Beccles.

Remarks.—As stated in the last paragraph, M. de Boury proposed to separate the shell described and figured by Wood (*op. cit.*) as *S. Turtoni* from that form. It differs materially both from the *S. tenuicosta* of foreign authors and from the recent shell of our British coasts. In a letter received from the first-named authority in January, 1918, he suggested for it the name of *S. inclusa*, in which I follow him. The specimen here figured under that name is the one found by Alfred Bell in the now inaccessible section of the Icenian Crag at Sudbourn Church-walks, and was afterwards included in Jeffreys' list. M. de Boury says it resembles *S. trinacria*, Phil., but that it is not the same.

Sub-genus **CIRSOTREMA**, Mörch, 1853.

Scala (Cirsotrema) fimbriosa (S. V. Wood). Plate XLVIII, figs. 1, 2, 6.

1842—79. *Scalaria fimbriosa*, S. V. Wood, Ann. Mag. Nat. Hist. [1], vol. ix, p. 535, 1842; Mon. Crag Moll., pt. i, p. 91, pl. viii, fig. 12, 1848; 2nd Suppl., p. 25, pl. iii, fig. 17, 1879.
1871. *Scalaria lamellosa*, var., Jeffreys in Prestwich, Quart. Journ. Geol. Soc., vol. xxvii, pp. 145, 491.
1871—81. *Scalaria fimbriosa*, Nyst, Ann. Soc. malac. Belg., vol. vi, p. 128, no. 113, 1871; Conch. Terr. tert. Belg., p. 89, pl. vi, fig. 18 *a*, 1881.
1872. *Scalaria fimbriosa*, A. and R. Bell, Proc. Geol. Assoc., vol. ii, pp. 204, 210.
1874—92. *Scalaria lamellosa*, var. *fimbriosa*, Van den Broeck, Ann. Soc. malac. Belg., vol. ix, pp. 120, 136; *S. fimbriosa*, p. 292, 1874; Bull. Soc. Belge Géol., vol. vi (Mémoires), p. 147, 1892.

1890. *Scalaria fimbriosa*, C. Reid, Plioc. Dep. Brit., p. 256.
1891. *Scalaria* (*Cirsotrema*) *lamellosum*, var. *post-fimbriosa*, Sacco, Moll. Terr. Terz. Piem., pt. ix, p. 48.
1896. *Scalaria fimbriosa*, Bernays, Bull. Soc. Belge Géol., vol. x (Mémoires), p. 129.
1911. *Scalaria fimbriosa*, A. Bell, Journ. Ipswich Field Club, vol. iii, p. 16.

Specific Characters.—Shell imperforate, turriculate, thick and solid; spire elongate, regularly conical; whorls convex, subdisjoined; ornamented by longitudinal costæ, lamelliform and reflected, of unequal size, irregularly varicose, and by strong and rather distant spiral ridges, with others excessively fine in the interspaces; basal ridge well marked, crossed obliquely by the longitudinal costæ; suture deep; mouth subcircular; peristome thickened, continuous; outer lip wide, varicose.

Dimensions.—L. 30—40 mm. B. 13—16 mm.

Distribution.—Not known living.

Fossil: Coralline Crag: Gedgrave, Sutton, Ramsholt, Boyton. Waltonian: Walton-on-Naze, Beaumont, Little Oakley. Newbournian: Waldringfield, Newbourn, Bentley.

Bolderien (Van den Broeck), Casterlien (Bernays), Scaldisien (Nyst): Belgium.

Remarks.—This somewhat variable species is one of the most common of the Crag Scalas. I have obtained more than 100 specimens of it from Oakley, most of them, however, imperfect.

It has been regarded by Jeffreys, Van den Broeck and Prof. Sacco as a variety of the *S. lamellosa* of Brocchi, but their view has not been generally accepted. Its most characteristic feature seems to be, that a varying number of the longitudinal costæ are coarsely and irregularly varicose. In one specimen here given (Pl. XLVIII, fig. 1) there is one varix on each whorl, in others there may be 3 or even 6. Very occasionally, such varices are absent as in Pl. XLVIII, fig. 3. This is also the case in the typical *S. lamellosa*, an imperfect specimen of which from the Miocene of Antwerp I have here figured to show the points of resemblance and of difference between the two forms. On the whole I follow Wood, de Boury and others in regarding *S. fimbriosa* as a distinct species, peculiar to the Anglo-Belgian deposits.

var. **exfimbriosa** (Sacco). Plate XLVIII, figs. 3, 4.

1881. *Scalaria fimbriosa*, Nyst, Conch. Terr. tert. Belg., p. 89, pl. vi, fig. 18 *b*.
1891. *Cirsotrema exfimbriosum*, Sacco, Moll. Terr. Terz. Piem., pt. ix, p. 48.

Varietal Characters.—Differs from the type form in size, its finer and more cancellate sculpture and its less prominent varices.

Dimensions.—L. 24—26 mm. B. 10 mm.

Distribution.—Not reported living.

Fossil : Waltonian Crag : Little Oakley. Newbournian : Waldringfield, Brightwell (probably elsewhere). Scaldisien : Antwerp.

Remarks.—Prof. Sacco has pointed out that the two specimens described by Nyst as *S. fimbriosa* are not alike, proposing to call the smaller of them *Cirsotrema exfimbriosum*. I have found at Oakley some broken specimens of what is evidently the same shell, and there are others, fortunately fairly perfect, in the museums at South Kensington and at York, which I am permitted to figure. I venture to regard them, however, as varieties of the Anglo-Belgian *S. fimbriosa* rather than of the allied Italian species *S. lamellosa* as proposed by Prof. Sacco.

Scala (Cirsotrema) lamellosa (Brocchi). Plate XLVIII, fig. 5.

1814. *Turbo lamellosus*, Brocchi, Conch. foss. subap., vol. ii, p. 379, pl. vii, fig. 2.
1843—71. *Scalaria lamellosa*, Nyst, Coq. foss. Terr. tert. Belg., p. 393, no. 336, 1843; Ann. Soc. malac. Belg., p. 116, no. 170, 1871.
1856. *Scalaria lamellosa*, Hörnes, Foss. Moll. Tert. Wien., vol. i, p. 474, pl. xlvi, fig. 7.
1870. *Scalaria lamellosa*, A. Bell, Journ. de Conch., vol. xviii, p. 351, no. 366.
1876. *Scalaria lamellosa*, Seguenza, Boll. R. Com. Geol. Ital., vol. vii, p. 96, no. 612.
1880. *Scalaria lamellosa*, Fontannes, Moll. plioc. Vall. du Rhone, vol. i, p. 123, pl. vii, fig. 17.
1890. *Cirsotrema lamellosum*, de Boury, Boll. Soc. Malac. Ital., vol. xiv, p. 199, no. 20.
1890—1. *Cirsotrema lamellosum* and vars., Sacco, Boll. Soc. Geol. Ital., vol. ix, p. 319, no. 5207, 1890 Moll. Terr. Terz. Piem., pt. ix, p. 47, 1891.
1912. *Cirsotrema lamellosum*, Cossmann, Ess. Paléoconch. compar., vol. ix, p. 50, pl. ii, figs. 27, 28.

Specific Characters.—Differs from *S. fimbriosa* in sculpture; the longitudinal costæ are stronger, equally prominent and regular, and are not interrupted by prominent varices.

Dimensions.—L. 32 mm. B. 12 mm.

Distribution.—Not known living.

Fossil : Miocene : Belgium, Piedmont, Vienna basin.

Lower Pliocene : Biot, Piedmont, Ligurian coast—Savona, Albenga.

Upper Pliocene : Piedmont, Parma, Bologna, Orciano, Reggio, Altavilla.

Remarks.—At first I was inclined to regard the Sutton specimen (Pl. XLVIII, fig. 6), from which the varices, generally so characteristic of *S. fimbriosa*, are absent, as a variety of the Italian *S. lamellosa*. I am now disposed to agree with M. de Boury that it should be rather considered an abnormal specimen of the former, more or less intermediate between the two species.

Scala (Cirsotrema) funiculus (S. V. Wood). Plate XLVIII, fig. 8.

1842—74. *Scalaria fimbriata*, S. V. Wood, Ann. Mag. Nat. Hist. [1], vol. ix, p. 535, 1842; *S. varicosa*, Mon. Crag Moll., pt. i, p. 90, pl. viii, fig. 14, 1848; *S. funiculus*, 1st Suppl., pt. i, p. 98, 1872; pt. ii, p. 207, 1874.

1870. *Scalaria varicosa*, A. Bell, Ann. Mag. Nat. Hist. [4], vol. vi, p. 216.
1871. *Scalaria fimbriosa*, var., Jeffreys in Prestwich, Quart. Journ. Geol. Soc., vol. xxvii, p. 145.
1872. *Scalaria varicosa*, A. and R. Bell, Proc. Geol. Assoc., vol. ii, pp. 204, 210.
1890. *Scalaria fimbriata*, de Boury, Boll. Soc. Malac. Ital., vol. xiv, p. 282.
1890. *Scalaria funiculus*, C. Reid, Plioc. Dep. Brit., p. 256.
1891. *Cirsotrema varicosum*, var. *ligustica* (?), Sacco, Moll. Terr. Terz. Piem., pt. ix, p. 52, pl. ii, fig. 33.
1911. *Scalaria funicula*, A. Bell, Journ. Ipswich Field Club, vol. iii, p. 16.
1912. *Scalaria funicula*, Tesch, Med. v. d. Rijks. v. Delfstoffen, no. 4, p. 70, no. 162.

Specific Characters.—Shell elongate, turreted, imperforate; whorls disjoined, decidedly convex; ornamented by very fine net-like cancellation, the transverse and longitudinal ridges being nearly equal in size, together with a few strong and prominent varices; suture deep, channelled; mouth subcircular, with a strong basal ridge.

Dimensions.—L. 25—30. B. 10 mm.

Distribution.—Not known living.

Fossil: Coralline Crag: Sudbourn, Gomer, Sutton, Boyton. Waltonian: Walton-on-Naze (Kendall), Little Oakley. Newbournian: Waldringfield, Sutton, Felixstowe.

Scaldisien: Dutch borings (Tesch).

Miocene: Piedmont (de Boury).

Remarks.—This seems to me a distinct form allied to *S. fimbriosa*, but smaller and more slender, with much finer sculpture, the varices standing out prominently from the fine intervening cancellation. Originally referred by Wood to the *S. varicosa* of Lamarck, it was afterwards regarded by him as a separate species under the present name. As to this shell, Jeffreys remarked in 1871 (*op. cit.*, p. 491) "not *Turbo varicosus*, Brocchi, nor *S. varicosa*, Lamarck," regarding it in a different list (p. 145) as a variety of *S. fimbriosa*, but he afterwards identified it with a shell figured by G. O. Sars as *S. varicosa* (*op. cit.*, pl. xxxiv, fig. 9). Subsequently, however, in 1884, the latter described it, together with another species —the *S. obtusicostata* of the same author (pl. xxii, fig. 9)—as new, under the name of *S. coarctata*.[1] In the face of this conflict of opinion I have no hesitation in adopting for the present form Wood's name of *S. funiculus* as that of a distinct species. Prof. Sacco describes a somewhat similar fossil from the Italian Pliocene as *Cirsotrema varicosum* var. *ligustica*[2]; he notes its resemblance to our Crag shell, but does not consider it the same, nor do I.

Scala (Cirsotrema) hamulifera (S. V. Wood). Plate XLVIII, fig. 12.

1848. *Scalaria hamulifera*, S. V. Wood, Mon. Crag Moll., pt. i, p. 91, pl. viii, fig. 13.
1871. *Scalaria fimbriosa*, var., Jeffreys in Prestwich, Quart. Journ. Geol. Soc., vol. xxvii, p. 145.

[1] Proc. Zool. Soc. London (1884), p. 139.

[2] Moll. Terr. Terz. Piem., pt. ix, p. 52, pl. ii, fig. 33.

1871. *Scalaria hamulifera*, Nyst, Ann. Soc. malac. Belg., vol. vi, p. 112, no. 140.
1872. *Scalaria hamulifera*, A. and R. Bell, Proc. Geol. Assoc., vol. ii, p. 204.
1890. *Scalaria hamulifera*, C. Reid, Plioc. Dep. Brit., p. 256.
1912. *Boreoscala hamulifera*, Cossmann, Ess. Paléoconch. compar., vol. ix, p. 56.
1918. *Scalaria (Cirsotrema) hamulifera*, de Boury, MS.

Specific Characters.—Shell minute, turriculate, imperforate; whorls 8 or 9, convex; ornamented by numerous, very fine, closely-set, longitudinal and lamelliform costæ, occasionally varicose, acutely pointed or hook-shaped at the suture, with delicate spiral ridges; spire regularly tapering; suture distinct; basal ridge nearly obsolete; mouth subcircular.

Dimensions.—L. 17 mm. B. 6 mm.

Distribution.—Not known living.

Fossil: Coralline Crag: Sutton. Gourbesville, Normandy (*fide* de Boury).

Remarks.—Only one example of this small and delicate species was known to Wood. M. Cossmann groups it with *Boreoscala*, but in a private letter received from M. de Boury the latter informed me that, having examined the type-specimen in the British Museum, he adopted Wood's view and associated it with the *fimbriosa* (*Cirsotrema*) group. Jeffreys regarded it as a variety of that species—a view, however, I am unable to accept. M. Cossmann reports it from the Crag of Gourbesville in Normandy, on the authority of M. de Boury.

The imperfect specimen now figured belongs to the Reed Collection at the York Museum. It is probably the one identified some years ago by Mr. A. Bell. Although not very satisfactory I do not know any other Crag *Scala* to which it can be more probably referred. The fine transverse lines characteristic of this species, which do not appear on my figure, are distinctly though somewhat obscurely shown in the specimen itself. The figure hardly does justice to the latter. It ought to have been enlarged, but unfortunately it was broken in the process of figuring. The identification must therefore remain a doubtful one. It is to be hoped that another specimen may turn up hereafter.

Scala (Cirsotrema) signata, de Boury, MS. Plate XLVIII, figs. 15, 16.

1879. *Scalaria geniculata* (Brocchi), S. V. Wood, Mon. Crag Moll., 2nd Suppl., p. 26, pl. iv, fig. 11.
1890. *Scalaria geniculata ?*, C. Reid, Plioc. Dep. Brit., p. 256.

Specific Characters.—Shell small, rather fragile; whorls distinctly convex; ornamented by numerous fine but prominent longitudinal costæ, placed obliquely, and by short well-marked spiral ridges in the interspaces, with a small basal disc; spire short, regularly tapering; suture deep.

Dimensions.—(Of Crag specimen) L. 6 mm. B. 3 mm.

Distribution.—Not known living.

Fossil: Coralline Crag: Sutton.

Remarks.—The specimens represented under this name are probably the same as that figured by Wood and identified by him, though doubtfully, with Brocchi's species.[1] One of them (fig. 15) belongs to the Wood Collection in the Castle Museum at Norwich, where it bears, in his well-known writing, the name *S. geniculata*. In a letter recently received from M. de Boury the latter expressed a strong opinion that Wood's shell is not that described by Brocchi, but an undescribed form which he suggested may be called *S.* (*Cirsotrema*) *signata*.

The specimen, no. 16, belongs to the Reed Collection at York, where it bears the name of *S. funiculus*. I do not think it is that species, which is, in my opinion, more correctly represented in my Plate XLVIII, fig. 8.

Sub-genus **BOREOSCALA**, Kobelt, 1905.

Scala (Boreoscala) grœnlandica (Chemnitz). Plate XLVII, figs. 13—16.

1795. *Turbo* (*Clathrus*) *grœnlandicus*, Chemnitz, Conch. Cab., vol. xi, p. 155, pl. cxcv *a*, figs. 1873—79.
1841—70. *Scalaria grœnlandica*, Gould, Rep. Inv. Mass., ed. 1, p. 249, fig. 170, 1841; ed. 2, p. 314, fig. 582, 1870.
1846. *Scalaria grönlandica*, Lovén, K. Svensk. Vet.-Akad. Förh., vol. iii, p. 88.
1848—72. *Scalaria grœnlandica*, S. V. Wood, Mon. Crag Moll., pt. i, p. 90, pl. viii, fig. 11 *b*, 1848; 1st Suppl., pt. i, p. 59, 1872.
1859. *Scalaria grœnlandica*, G. B. Sowerby, Ill. Ind. Brit. Shells, pl. xv, fig. 17.
1864. *Scalaria grœnlandica*, S. P. Woodward in Gunn's Hist. of Norfolk, ed. 3, p. 117.
1870. *Scalaria grœnlandica*, S. V. Wood, jnr., and F. W. Harmer, Rep. Brit. Assoc. (Liverpool), p. 90.
1871—84. *Scalaria grœnlandica*, Jeffreys in Prestwich, Quart. Journ. Geol. Soc., vol. xxvii, p. 491, 1871; Proc. Zool. Soc., p. 137, 1884; Quart. Journ. Geol. Soc., vol. xl, p. 319, 1884.
1872. *Scalaria grœnlandica*, A. and R. Bell, Proc. Geol. Assoc., vol. ii, pp. 214, 216.
1874. *Scalaria grœnlandica*, Reeve, Conch. Icon., vol. xix, pl. xiv, fig. 107 *a*.
1878. *Scalaria grœnlandica*, G. O. Sars, Moll. Reg. arct. Norv., pp. 194, 359, pl. x, fig. 15.
1879. *Scalaria grœnlandica*, Jas. Reeve, Proc. Norwich Geol. Soc., vol. i, p. 71.
1899. *Scalaria grœnlandica*, Posselt, Medd. om Grønl., vol. xxiii, p. 233.
1901. *Scalaria grœnlandica*, Friele og Greig, Norske Nordh. Exped., pt. iii (Mollusca), p. 79.
1905. *Scala* (*Boreoscala*) *grœnlandica*, Kobelt, Icon. schalentrag. europ. Meeresconch., vol. iii, p. 24, pl. lxii, figs. 1—3.
1910. *Scalaria grœnlandica*, Odhner, Archiv Zool., K. Svensk. Vet.-Akad., vol. vii, no. 4, p. 10, pl. i, fig. 1 *b*.
1912. *Boreoscala grœnlandica*, Cossmann, Ess. Paléoconch. compar., vol. ix, p. 54.
1915. *Scalaria grœnlandica*, A. Bell, Geol. Mag. [6], vol. ii, p. 168.
1915. *Epitonium* (*Arctoscala*) *greenlandicum*, Johnson, Bost. Soc. Nat. Hist., Occas. Papers, vol. vii, Fauna of New England, no. xiii, p. 103.

Specific Characters.—Shell imperforate, thin, rather fragile, slender, elongate, conical; whorls convex, contiguous, not disjoined; ornamented by obtuse longi-

[1] *Turbo geniculatus*, Conch. foss. subap., vol. ii, p. 659, pl. xvi, fig. 1.

tudinal ribs, not very prominent nor soldered together, varying in number, occasionally varicose, oblique on the lower whorls, as well as by flattened, closely-set spiral ridges; spire varying in length, subulate; suture fairly deep, obscured by the ribs; mouth ovate, somewhat angulate above; outer lip strengthened by the last rib; inner lip thickened at the base; basal ridge not so strongly marked as in *S. similis*.

Dimensions.—L. 30—35 mm. B. 10—12 mm.

Distribution.—Recent: doubtfully British. Norwegian coast—Christiania fiord to Finmark, Lofoten Islands. Circumpolar—Iceland, Faroe Channel, Spitzbergen, Murman coast, Barentz Sea, Arctic shores of Siberia, Behring Strait, Greenland, eastern and western North America.

Fossil: Butleyan Crag: Butley. Icenian: *Norwich zone*, generally diffused. *Weybourne zone*—Belaugh, North Walsham boring, Runton, Weybourne. Pleistocene: Middle Glacial—Billockby, Bridlington, Dimlington, Kelsey Hill, King Edward, Clyde beds, Fairlie, Uddevalla, north coast of Russia.

Remarks.—This characteristically northern and circumpolar form seems to have been one of the latest species of *Scala* to establish itself in the Crag basin. An occasional specimen has been found at Butley, but I have no note of a verified example of it from earlier horizons of the Red Crag, any which may have been so reported being probably *S. similis*, Sowerby, to be described in the next paragraph, and this, for reasons there given, I consider should be regarded as specifically distinct. *S. grœnlandica* is, however, a characteristic species of the British Pleistocene.

It seems to be a species variable in size and in the number of its ribs. At the Jermyn Street Museum, for example, there are two typical specimens from Bridlington, one of them having 14 ribs and measuring 20 mm. by 8 mm., the other is broken, with only 9 ribs, but having been, when perfect, about 30 mm. in length by 12 mm. in breadth. Generally, however, they maintain their distinctive character.

M. de Boury considered that one of the specimens I have referred to *S. grœnlandica* (Pl. XLVII, fig. 13) resembles more nearly the typical *S. similis*. It might be regarded, I think, as a variety of either species.

Var. **crebricostata**, G. O. Sars. Plate XLVII, fig. 17.

1872. *Scalaria grœnlandica*, Dawson, Canadian Nat. [n.s.], vol. vi, p. 394, pl. vi, fig. 11.
1874. *Scalaria grœnlandica*, Reeve, Conch. Icon., vol. xix, pl. xiv, fig. 107 *b*.
1878. *Scalaria grœnlandica*, var. *crebricostata*, G. O. Sars, Moll. Reg. arct. Norv., p. 194, pl. xxiii, fig. 1.
1887. *Scalaria grœnlandica*, Tryon, Man. Conch., vol. ix, pl. xvi, fig. 91.
1901. *Scalaria grœnlandica*, var. *crebricostata*, Friele og Grieg, Norske Nordhav. Exped., pt. iii (Mollusca), p. 79.

1905. *Scala grœnlandica*, Kobelt, Icon. schalentrag. europ. Meeresconch., vol. iii, p. 25, pl. lxii, fig. 1.
1917. *Scalaria grœnlandica*, var. *crebricostata*, A. Bell, Naturalist, no. 723, p. 96.

Varietal Characters.—Shell larger than the typical Crag form, with a much broader base, a less slender spire, more tumid and rounded whorls and a deeper suture. Usually the longitudinal ribs are finer, less prominent, more numerous and curved or sigmoid on the lower whorls, the spiral ridges being coarser and more distinct.

Dimensions.—L. 45 mm. B. 16 mm.

Distribution.—Recent: Norwegian Coast between North Cape and Bear Island. Greenland. Banks of Newfoundland.

Fossil: Bridlington. Canadian Pleistocene: Rivière du Loup.

Remarks.—The large and ventricose form of *S. grœnlandica* described by Prof. G. O. Sars as var. *crebricostata*, seems to have had a rather wide distribution in circumpolar regions as a recent and Pleistocene shell, being reported as living from Bear Island south of Spitzbergen, Finmark and Greenland, and as fossil from the Rivière du Loup in Canada, as well as from Bridlington. While examining Mr. Headley's collection from the latter place my colleague Mr. A. Bell noticed a specimen of it, and I have since found another in the British Museum which I am permitted to figure. It differs essentially from the typical Crag variety of *S. grœnlandica*, which is a more slender shell having fewer longitudinal ribs.

Scala (Boreoscala) similis (J. Sowerby). Plate XLVII, figs. 18–22.

1812. *Scalaria similis*, J. Sowerby, Min. Conch., vol. i, p. 49, pl. xvi, figs. 1, 2.
1842–48. *Scalaria similis*, S. V. Wood, Ann. Mag. Nat. Hist. [1], vol. ix, p. 534, 1842; *S. grœnlandica*, Mon. Crag Moll., pt. i, p. 90, pl. viii, fig. 11*a*, 1848.
1871. *Scalaria similis*, Nyst, Ann. Soc. malac. Belg., vol. vi, p. 132, no. 277.
1871. *Scalaria grœnlandica* (pt.), Jeffreys in Prestwich, Quart. Journ. Geol. Soc., vol. xxvii, p. 491.
1872. *Scalaria grœnlandica*, A. and R. Bell, Proc. Geol. Assoc., vol. ii, p. 210.
1890. *Scalaria grœnlandica* (pt.), C. Reid, Plioc. Dep. Brit., p. 256.
1912. *Boreoscala grœnlandica*, var. *similis*, Cossmann, Ess. Paléoconch. compar., vol. ix, p. 54, pl. iii, fig. 4.

Specific Characters.—Shell belonging to the same group as *S. grœnlandica*, but much stronger and more solid, with coarser and more prominent sculpture, more convex whorls, a deeper suture and a less slender and elongate spire—generally it is not varicose, and the basal ridge is more strongly marked.

Dimensions.—L. 30—40 mm. B. 12—15 mm.

Distribution.—Not known living.

Fossil: Coralline Crag: Boyton. Waltonian: Little Oakley. Newbournian: Holywell, Sutton, Newbourn, Waldringfield. Butleyan: Butley. Icenian: Bramerton. Wexford gravels.

Remarks.—My attention was called to the essential difference between the present shell and the recent and northern *S. grœnlandica* by M. de Boury, who expressed a strong opinion that Sowerby's specific name *similis*, by which it was originally described and was at first known to Wood and to Nyst, should be revived. The fossil distribution of these shells tends to support that view, showing that *S. similis* is a characteristic though not a very abundant Red Crag species, appearing first, so far as my experience goes, in the Coralline Crag of Boyton and the Waltonian of Little Oakley and found not infrequently at later horizons of the Red Crag. Generally it is unknown from the Pleistocene, either of Great Britain or of Norway, though a few examples, broken or imperfect, have been obtained from the Wexford gravels. It is a strong and solid shell and in marked contrast with *S. grœnlandica*, which is thin and fragile. The latter and its variety *crebricostata* are typical circumpolar species with a wide northern range, the first being the most abundant *Scala* of our Icenian and Pleistocene deposits, but unrecorded from the earlier horizons of the Red Crag. Hence these shells seem to have distinctly a zonal value. Moreover they differ in form and sculpture and are not the same, though they belong to the same group. Whether the difference should be regarded as specific or varietal may be left, perhaps, as a matter of opinion.

Sub-genus **TURRISCALA**, de Boury, 1890.

Scala (Turriscala) anglorum, Sacco. Plate XLVIII, figs. 33; Plate XLIX, fig. 4.

1871. *Scalaria torulosa*, Nyst, Ann. Soc. malac. Belg., vol. vi, p. 140, no. 321.
1874. *Scalaria torulosa*, Van den Broeck, Ann. Soc. malac. Belg., vol. ix, p. 119.
1879. *Scalaria torulosa*, S. V. Wood, Mon. Crag Moll., 2nd Suppl., p. 25, pl. ii, fig. 13.
1890. *Scalaria torulosa*, C. Reid, Plioc. Dep. Brit., p. 256.
1891. *Turriscala torulosa*, var. *anglorum*, Sacco, Moll. Terr. Terz. Piem., pt. ix, pp. 77, 79.
1911. *Scalaria* (*Acirsa*) *torulosa*, A. Bell, Journ. Ipswich Field Club, vol. iii, p. 16.
1918. *Scala* (*Turriscala*) *anglorum*, de Boury, MS.

Specific Characters.—Shell turreted, thick, imperforate; whorls but slightly convex; spire elongate, subconical; ornamented by well-marked longitudinal costæ not so wide as the interspaces, and by very fine spiral lines; suture slight; base angulated; mouth subcircular; peristome continuous with a strongly thickened margin.

Dimensions.—L. 25—28 mm. B. 8—9 mm.

Distribution.—Not recorded living.

Fossil: Coralline Crag: Boyton. Newbournian: Waldringfield.

Remarks.—A single specimen of *Scala* from the Coralline Crag of Boyton, obtained by Mr. Charlesworth some years ago, was described by Wood under

Van den Broeck's specific name of *torulosa*. It cannot now be traced, but it is quite perfect, and judging from Wood's figure seems to have been a genuine Crag shell and not derivative.

S. torulosa appears to have been a variable form, Prof. Sacco having figured seven distinct and named varieties of it as Italian fossils. He considers that the Boyton shell, although "*assai vicina al typo*," is different from any of them, proposing to call it var. *anglorum*. M. de Boury, however, preferred to retain that name as that of a distinct species.[1]

There is an imperfect specimen from Waldringfield in the British Museum of Natural History, now figured, which seems to be the same as Wood's shell. M. Van den Broeck states that *S. torulosa* is common in the Bolderien (Miocene) of Antwerp.

Sub-genus **CLATHROSCALA**, de Boury.

Scala (Clathroscala) cancellata (Brocchi). Plate XLVIII, fig. 9.

1814. *Turbo cancellatus*, Brocchi, Conch. foss. subap., vol. ii, p. 377, pl. vii, fig. 8.
1826. *Turritella cancellata*, Risso, Hist. nat. Eur. mérid., vol. iv, p. 110, pl. iv, fig. 40.
1870. *Scalaria cancellata*, A. Bell, Journ. de Conch., vol. xviii, p. 351, no. 364.
1871. *Scalaria cancellata*, Nyst, Ann. Soc. malac. Belg., vol. vi, p. 96, no. 46.
1872. *Scalaria cancellata*, S. V. Wood, Mon. Crag Moll., 1st Suppl., pt. i, p. 59, pl. iv, fig. 2.
1876. *Scalaria cancellata*, Seguenza, Boll. R. Com. Geol. Ital., vol. vii, p. 96, no. 611.
1878. *Cirsotrema cancellata*, de Stefani e Pantinelli, Boll. Soc. Malac. Ital., vol. iv, p. 85.
1898–91. *Scalaria cancellata*, Sacco, Boll. Soc. Geol. Ital., vol. viii, p. 352, no. 1870, 1889; vol. ix, *Clathroscala cancellata* and vars., p. 322, no. 5268, 1890; Moll. Terr. Terz. Piem., pt. ix, p. 84, pl. ii, figs. 93, 94, 1891.
1890. *Clathroscala cancellata*, de Boury, Boll. Soc. Malac. Ital., vol. xiv, p, 216, no. 31.
1912. *Clathroscala cancellata*, Cossmann, Ess. Paléoconch. compar., vol. ix, p. 70, pl. iii, fig. 25, 26.

Specific Characters.—Shell fairly solid, imperforate, turreted, subulate; spire slender, elongate; whorls about 12, with an occasional varix, slightly convex, regularly diminishing upwards, the last about one-third the total length; ornamented by numerous fine longitudinal and spiral ridges extending obscurely to the base, which is obtusely angulate and flattened; suture well-marked but not deep; peristome continuous; mouth subovate.

Dimensions.—L. 33 mm. B. 10 mm.

Distribution.—Not known living.

Fossil: Coralline Crag: Orford.

Miocene: Turin, Tortona.

Lower Pliocene: Biot, Ligurian coast, Siena.

[1] In a recent letter M. de Boury expressed a doubt whether this species might not belong to the sub-genus *Hemiacirsa*.

Upper Pliocene—Astiano: Orciano, Val d'Era, Bologna, Livorno. Sicily—Altavilla.

Remarks.—The specimen figured by Wood in his 1st Supplement under this name seems to have been sent to him by the late H. B. Woodward as having been obtained from the Coralline Crag in the neighbourhood of Orford, probably from Gedgrave. It is a very different form from that next described, being larger, stronger and less delicately sculptured. As I cannot trace the original, I have figured a typical example of *S. cancellata* from the Pliocene of Altavilla near Palermo which seems to me to correspond satisfactorily with Wood's Orford shell and may be identified with it. It is evidently a very rare form in the Crag.

Scala (Clathroscala) Woodi, Deshayes. Plate XLVIII, figs. 10, 11.

1842—48. *Scalaria decussata,* S. V. Wood, Ann. Mag. Nat. Hist. [1], vol. ix, p. 535, 1842; *S. cancellata,* Mon. Crag Moll., pt. i, p. 95, pl. viii, fig. 22, 1848.
1864. *Scalaria Woodi,* Deshayes, Descrip. Anim. sans Vert., vol. ii, p. 339.
1871. *Scalaria Woodi,* Nyst, Ann. Soc. malac. Belg., vol. vi, p. 146, no. 357.
1872. *Scalaria cancellata* (Wood, not Brocchi), Jeffreys in Prestwich, Quart. Journ. Geol. Soc., vol. xxvii, p. 145.
1872. *Scalaria cancellata,* A. and R. Bell, Proc. Geol. Assoc., vol. ii, p. 204.
1891. *Clathroscala cancellata,* var. *Woodi,* Sacco, Moll. Terr. Terz. Piem., pt. ix, p. 85.
1912. *Clathroscala Woodi,* Cossmann, Ess. Paléoconch. compar., vol. ix, p. 71.
1919. *Scala (Clathroscala) Woodii,* de Boury, MS.

Specific Characters.—Shell much smaller than the typical *S. cancellata,* elongate, tapering to a fine point, thin and fragile; whorls 9 or 10, slightly convex; ornamented with fine longitudinal costæ and delicate transverse striæ ending abruptly at the peristome; mouth subcircular; peristome continuous.

Dimensions.—L. 12—14 mm. B. 4—5 mm.

Distribution.—Not known living.

Fossil: Coralline Crag: Sutton, Gomer.

Remarks.—The present form was originally identified by Wood with *S. cancellata,* Brocchi, but this view has not been generally adopted, though Prof. Sacco considered our shell might be a variety of that species. By most authorities it has been regarded as specifically distinct under the name *S. Woodi,* proposed for it in 1864 by Deshayes. It is smaller and more fragile than *S. cancellata,* with very delicate sculpture. Wood stated that he had obtained many specimens of it at Sutton, all of them being more or less broken.

The very different fossil described in the last paragraph, figured by Wood in his 1st Supplement, was recognised in 1891 by Prof. Sacco as a typical *S. cancellata.* It does not appear that this specimen was known to Deshayes, Nyst or Jeffreys. *S. Woodi* was not noticed by anyone prior to Sacco in the paper and on the date named above.

Sub-genus **GYROSCALA,** de Boury, 1887.

Scala (Gyroscala) Canhami, sp. nov. Plate XLVII, fig. 23.

Specific Characters.—Shell coarse and solid, turreted, imperforate; whorls convex, not disjoined; ornamented with about 12 strong longitudinal costæ, slightly oblique, lamelliform and reflexed; base of the last whorl with a conspicuous and wide basal disc; suture deep; spire slender, elongate, regularly diminishing in size upwards; mouth subovate; outer lip thickened by the labial rib; peristome continuous; base narrowed; spiral sculpture inconspicuous or wanting.

Dimensions: L. 30 mm. B. 10 mm.

Distribution.—Not recorded living.

Fossil: Newbournian Crag: Foxhall.

Remarks.—The shell now figured belongs to the York Museum, where it has remained for some years undescribed. It bears Brocchi's specific name of *pseudo-scalaris*, but has, it seems to me, but a slight resemblance to the figures of that species, either of its original describer or of subsequent writers. M. de Boury, to whom I submitted a photograph, believed it to be new. I dedicate it, therefore, to the memory of the Rev. H. Canham, who for many years resided at Waldringfield in the centre of the Newbournian district, and was a zealous collector of Crag fossils.

The sub-generic term *Gyroscala* was proposed by M. de Boury for a division of the Scalidæ, of which the recent Mediterranean form *S. commutata* was taken as the type. The special characteristics of this group are fully described by MM. Cossmann and himself in the works before alluded to.

Scala (Gyroscala) inedita, sp. nov. Plate XLVII, fig. 23.

Specific Characters.—Shell turreted, elongato-conical; whorls decidedly convex, regularly diminishing upwards to a blunt apex; ornamented by fine, rather distant ribs, placed somewhat obliquely; suture deep; basal disc well marked, multicostate; mouth subcircular.

Dimensions.—(Of imperfect specimen) L. 8 mm. B. 4 mm.

Distribution.—Not recorded living.

Fossil: Sudbourn Church-walks.

Remarks.—The imperfect fossil figured under this name belongs to the York Museum where it is also labelled *S. pseudo-scalaris*. It differs materially, however, from that species, and M. de Boury, to whom I submitted a photograph of it, considered it a new and undescribed form.

Scala (Gyroscala) pseudo-Turtoni (S. V. Wood). Plate XLIX, fig. 2.

1870. *Scalaria pseudo-scalaris*, A. Bell, Ann. Mag. Nat. Hist. [4], vol. vi, p. 216.

1872. *Scalaria Turtoni*, var. *pseudo-Turtoni*, S. V. Wood, Mon. Crag Moll., 1st Suppl., pt. i, p. 58, pl. iv, fig. 5.

1872. *Scalaria pseudo-scalaris*, A. and R. Bell, Proc. Geol. Assoc., vol. ii, p. 216.

Distribution.—Not known living.

Fossil: Icenian Crag: Sudbourn Church-walks.

Remarks.—The imperfect specimen here alluded to, now in the York Museum, was figured by Wood as a variety (*pseudo-Turtoni*) of *S. Turtoni* (*op. cit.*). M. de Boury pointed out, however, that the presence of a thin basal ridge, alluded to by Wood and clearly though faintly marked in his drawing, shows it to belong to a different group of the Scalidæ, viz. to *Gyroscala*. He did not agree with Mr. Bell's reference of it to *S. pseudo-scalaris*, but considered it new and a distinct species. He retained Wood's varietal name *pseudo-Turtoni* as specific, in which I follow him.

Sub-genus **PLICISCALA**, De Boury, 1887.

Scala (Pliciscala) obtusicostata (S. V. Wood). Plate XLVIII, figs. 24, 25.

1842—48. *Scalaria obtusicostata*, S. V. Wood, Ann. Mag. Nat. Hist. [1], vol. ix, p. 535, 1842; Mon. Crag Moll., pt. i, p. 95, pl. viii, fig. 21, 1848.
1871. *Scalaria obtusicostata*, Jeffreys in Prestwich, Quart. Journ. Geol. Soc., vol. xxvii, p. 145.
1872. *Scalaria obtusicostata*, A. and R. Bell, Proc. Geol. Assoc., vol. ii, p. 204.
1890. *Scalaria obtusicostata*, C. Reid, Plioc. Dep. Brit., p. 256.
1918. *Scalaria* (*Pliciscala*) *obtusicostata*, de Boury, MS.

Specific Characters.—Shell minute, fragile; whorls 8 or 10, convex; spire regularly tapering to a sharp point; ornamented by numerous and fine longitudinal ribs and by delicate and inconspicuous spiral ridges; suture well marked; base marginated, flattened; mouth sub-circular; peristome continuous.

Dimensions.—L. 6—8 mm. B. 2—3 mm.

Distribution.—Not known living.

Fossil: Coralline Crag: Sutton.

Remarks.—This small shell, originally described by Wood in 1848, has only been recorded from the Coralline Crag of Sutton, from which locality there are a fair number of specimens in his collection at the Norwich Museum. In 1878 Prof. G. O. Sars described some small *Scalas* from Finmark and the Norwegian coast, one of which, on the authority of Jeffreys, he identified with the Crag *S. obtusicostata*,[1] and the other with that originally referred by Wood to *S. varicosa*, Lamarck (afterwards *S. funiculus*[2]). In 1884 (*op. cit.*) Jeffreys stated that in consultation with Prof. Sars and after further examination of his specimens, he had come to the conclusion that both of these shells belonged to the same species, which he considered new and named *S. coarctata*.[3] They may belong to the same group as the Crag *S. obtusicostata*, having a marginated and flattened base and numerous costæ, but I do not think they are the same as the Crag shell.

[1] Moll. Reg. Arct. Norw. (1878), pp. 195, 348, pl. xxii, figs. 9 *a*, 9 *b*; pl. xxxiv, fig. 9.
[2] Mon. Crag Moll., 1st Suppl., pt. i, p. 98, 1872; pt. ii, p. 207, 1874.
[3] Proc. Zool. Soc. Lond. (1884), p. 139.

Sub-genus **HYALOSCALA,** de Boury, 1890.

Scala (Hyaloscala) minuta (J. Sowerby). Plate XLVIII, figs. 34—37.

1823. *Scalaria minuta*, J. Sowerby, Min. Conch., vol. iv, p. 125, pl. cccxc, figs. 3, 4.
1833. *Scalaria minuta*, S. Woodward, Geol. Norfolk, p. 44.
1842—48. *Scalaria clathratula*, S. V. Wood, Ann. Mag. Nat. Hist. [1], vol. ix, p. 535 (pt.), 1842; Mon. Crag Moll., pt. i, p. 94, pl. viii, fig. 19 *b*, 1848.
1871. *Scalaria clathratula*, Jeffreys in Prestwich, Quart. Journ. Geol. Soc., vol. xxvii, pp. 145, 491.
1871—81. *Scalaria clathratula*, Nyst, Ann. Soc. malac. Belg., vol. vi, p. 108, no. 56, 1871; Conch. Terr. tert. Belg., p. 88, pl. vi, fig. 16, 1881.
1872. *Scalaria clathratula*, A. and R. Bell, Proc. Geol. Assoc., vol. ii, pp. 204, 210, 214.
1874—92. *Scalaria clathratula*, Van den Broeck, Ann. Soc. malac. Belg., vol. ix, p. 292, 1874; vol. xvii, p. 154, 1883; Bull. Soc. Belge Géol., vol. vi (Mémoires), pp. 123, 147, 1892.
1885. *Scalaria clathratula*, Lorié, Arch. Mus. Teyler [2], vol. ii, pp. 184, 230.
1890. *Scalaria clathratula*, C. Reid, Plioc. Dep. Brit., p. 256.
1911. *Scalaria minuta*, A. Bell, Journ. Ipswich Field Club, vol. iii, p. 16.
1912. *Scalaria clathratula*, Tesch, Med. v. d. Rijks. v. Delfstoffen, no. 4, p. 70, no. 156.
1912. *Hyaloscala minuta*, Cossmann, Ess. Paléoconch. compar., vol. ix, p. 40, pl. i, fig. 45.

Specific Characters.—Shell imperforate, varying in size both in length and comparative width, subulate, turreted; whorls 8, convex, contiguous, the last not much expanded; ornamented by numerous delicate and lamelliform costæ, variable in number, slightly pointed above; suture rather deep; spire slender and elongate; mouth subcircular, outer lip reflected, with an elevated margin.

Dimensions.—L. 5—12 mm. B. 2—5 mm.

Distribution.—Not recorded living.

Fossil: Lenham. Coralline Crag: Sutton, Gomer, Boyton. Newbournian: Newbourn. Icenian: Thorpe near Norwich, Yarn Hill.

Scaldisien: Holland. Casterlien (zone *à Isocardia cor*), Scaldisien, Poederlien: Belgium.

Remarks.—The Crag shells originally described by Sowerby as a new species under the name of *S. minuta*, have been for many years identified with the recent *Turbo clathratulus* of G. Adams. M. de Boury and M. Cossmann, however, have recently urged that this has been a mistake, proposing to revive for them Sowerby's original name of *S. minuta*. M. de Boury believes, indeed, that the recent *S. clathratula* is unknown as a Pliocene fossil.

As stated above, *S. minuta*, which is exceedingly common in the Coralline Crag, varies both in length and width, as shown in the figures here given (Pl. XLVIII, figs. 34 to 37); all of these have been submitted to and approved by M. de Boury as typical specimens of that species. Sowerby's figure is that of a minute form not unlike my fig. 37. One of Wood's, which is much larger, corresponds more nearly with my fig. 34. The latter writer says, moreover, that the shells have a varying

number of ribs, from 14 to 21. The *S. minuta* of Sign. Cerulli-Irelli is considered by M. de Boury to be a different species, for which he proposes the specific name *tubulata*. I am informed that the Belgian shells are the same as those from the English Crag.

Scala (Hyaloscala) clathratula (G. Adams). Plate XLVIII, figs. 28—30.

1798. *Turbo clathratulus*, G. Adams, Ess. Micros., ed. 2, p. 637, pl. xiv, fig. 19.
1803—8. *Turbo clathratulus*, Montagu, Test. Brit., vol. ii, p. 297, 1803; Suppl., p. 124, 1808.
1819. *Turbo clathratulus*, Turton, Conch. Dict., p. 208.
1853. *Scalaria clathratula*, Forbes and Hanley, Brit. Moll., vol. iii, p. 209, pl. lxx, figs. 3, 4.
1859. *Scalaria clathratula*, G. B. Sowerby, Ill. Ind. Brit. Shells, pl. xv, fig. 20.
1867—69. *Scalaria clathratula*, Jeffreys, Brit. Conch., vol. iv, p. 96, 1867; vol. v, p. 210, pl. lxxi, fig. 5, 1869.
1890. *Scalaria clathratula*, Carus, Prod. Faun. Medit., vol. ii, p. 293.
1890. *Hyaloscala clathratula*, de Boury, Boll. Soc. Malac. Ital., vol. xiv, p. 247.
1892. *Scalaria clathratula*, Locard, Coq. mar. Côtes de France, p. 127.
1912. *Scalaria* (*Hyaloscala*) *clathratula*, Cossmann, Ess. Paléoconch. compar., vol. ix, p. 39.

Remarks.—It may be interesting to illustrate the difference between the Crag *S. minuta* and the recent *S. clathratula* by comparing some verified specimens of the latter with those of the former already figured.

Fig. 30 in my plate represents a recent and minute *S. clathratula* from the Gironde, which I received from M. Dautzenberg; fig. 28 is a much larger and also recent variety of that species from the Holmes Collection at the Norwich Museum; fig. 29 is taken from one preserved at the York Museum, which was dredged from the Dogger-bank. It is of the minute type.

Both species vary considerably in size; otherwise they are considered to maintain the same general character.

S. clathratula has been recorded from the Miocene of Messina by Seguenza and from the Pliocene of Biot by Alfred Bell, but the specimens cannot now be traced.

Sub-genus **ACRILLA**, H. Adams, 1860.

Scala (Acrilla) exsemicostata (Sacco). Plate XLVIII, fig. 7.

1874. *Scalaria semicostata*, S. V. Wood, Mon. Crag Moll., 1st Suppl., pt. ii, p. 183, add. pl., fig. 1.
1891. *Scalaria* (*Acrilla*) *exsemicostata*, Sacco, Moll. Terr. Terz. Piem., pt. ix, pp. 60, 67.
1918. *Scala* (*Acrilla*) *exsemicostata*, de Boury, MS.

Specific Characters.—Shell slender, subulate; whorls about 12, convex; ornamented by numerous thin and delicate costæ with sharp edges smaller than the intervening spaces, and by exceedingly fine and inconspicuous spiral lines, the last

whorl being margined by a well-marked ridge; suture rather deep; spire elongate, gradually and regularly diminishing in size upwards to a sharp point; mouth small, subcircular.

Dimensions.—L. 19 mm. B. 6 mm.

Distribution.—Not known living.

Fossil: Red Crag: Woodbridge district (probably Sutton).

Remarks.—The specimen here represented is unique and is the one described by Wood. It came from the Whincopp Collection and belongs to the York Museum. It was at first identified with an Eocene shell, *S. semicostata*, figured by Sowerby, but this view is not now accepted. Prof. Sacco, regarding it as a new and distinct species, has named it *S.* (*Acrilla*) *exsemicostata*, in which he was followed by M. de Boury. The specimen is fragile, quite perfect, and does not seem to me to show any signs of being derivative.

Sub-genus **PLESIOACIRSA,** de Boury, MS., 1909.

Scala (Plesioacirsa) Chatwini, de Boury, MS. Plate XLVIII, figs. 38, 39.

1872—79. *Turritella ? penepolaris*, S. V. Wood, Mon. Crag Moll., 1st Suppl., p. 53, pl. iv, fig. 20, 1872; *T.* (*Mesalia*) *penepolaris*, 2nd Suppl., p. 26, pl. ii, fig. 14, 1879.
1890. *Turritella ? penepolaris*, C. Reid, Plioc. Dep. Brit., p. 260.

Specific Characters.—Shell imperforate, turreted, subcylindrical, whorls contiguous, slightly convex; spire slender, elongate, gradually but regularly diminishing in size upwards; ornamented by delicate, inconspicuous spiral striæ and by faint oblique lines of growth; suture distinct; mouth subcircular.

Dimensions.—L. 20 mm. B. 5 mm.

Distribution.—Not known living.

Fossil: Coralline Crag: Sutton, Boyton. Waltonian: Little Oakley.

Scaldisien: Dutch borings.

Remarks.—The worn specimens now figured have been identified with the *Turritella penepolaris* of Wood. M. de Boury referred them, however, to a subgenus *Plesioacirsa*, asking me to adopt the specific name *Chatwini* as a compliment to the late Librarian of the Geological Society, whose friendly assistance from time to time we have been glad to acknowledge.

S. Chatwini is not unlike a variety of *Acirsa decussata* from the Italian Pliocene described by Prof. Sacco,[1] but M. de Boury considered it to be both generically and specifically distinct from the latter, proposing the name here

[1] Moll. Terr. Terz. Piem., pt ix, p. 93, pl. ii, fig. 104.

adopted in preference. It is not a common Crag shell, but has been obtained from the Coralline Crag of Boyton and Sutton, from the Waltonian of Little Oakley by myself, and from one of the Dutch borings by Dr. Tesch.

Genus **ACIRSA**, Mörch, 1857.

Acirsa Eschrichti (Holböll). Plate XLIX, figs. 6, 7.

1838. *Scalaria* (*Acirsa*) *borealis*, Beck in Lyell, Phil. Trans. [1], p. 37, pl. ii, fig. 11.
1842. *Scalaria Eschrichti*, Holböll in Möller, Ind. Moll. Groenl., p. 10.
1858. *Scala* (*Acirsa*) *Eschrichti*, H. and A. Adams, Gen. Rec. Moll., vol. ii, p. 621.
1863—77. *Mesalia borealis*, Jeffreys, Rep. Brit. Assoc. (Newcastle), p. 78, 1863; *Acirsa Eschrichti*, Proc. Roy. Soc., vol. xxv, no. 173, pp. 193, 194, 1876; Ann. Mag. Nat. Hist. [4], vol. xix, p. 241, 1877.
1872. *Acirsa Eschrichti*, Dawson, Canad. Nat. [n.s.], vol. vi, p. 394.
1876. *Scala* (*Acirsa*) *Eschrichti*, Mörch in Rink. Dan. Groenl., p. 436.
1890. *Acirsa borealis*, A. Bell, Rep. Brit. Assoc. (Leeds), p. 415.
1898. *Scalaria* (*Acirsa*) *borealis*, Posselt, Medd. om Grönl., vol. xxiii, p. 232.

Specific Characters.—Shell turreted, solid; whorls but slightly convex; ornamented by exceedingly fine spiral lines, sometimes inconspicuous or wanting, and, on all but the last, by rather irregular, flattened costæ, with a slight constriction below the suture; suture distinct, but not deep; spire regularly diminishing upwards; mouth oval, angulate above, expanded below; outer lip thin.

Dimensions.—L. 16 mm. B. 8 mm.

Distribution.—*Recent:* Spitzbergen, Iceland, Greenland, Newfoundland, Canada, Eastport (Maine).

Fossil: Turbot-bank, Co. Antrim; Aberdeen; Uddevalla. Canada—Quebec, Montreal, Rivière du Loup.

Remarks.—This arctic and circumpolar species, originally identified, though in error, with the *Scalaria borealis* of Beck, is now generally known under the above name. It has been recorded, probably as a fossil, from the Turbot-bank and from the coasts of Aberdeenshire. One of the specimens now figured is from the Pleistocene of the Canadian Rivière du Loup, where Sir J. W. Dawson said it was abundant; the other is from the Turbot-bank and belongs to the Belfast Museum. The latter is without sculpture and is slightly smaller than the Canadian fossil.

Genus **PYRAMIDELLA**, Lamarck, 1799.

Pyramidella læviuscula, S. V. Wood. Plate XLIX, fig. 8.

1842—74. *Pyramidella læviuscula*, S. V. Wood, Ann. Mag. Nat. Hist. [1], vol. ix, p. 537, 1842; Mon. Crag Moll., pt. i, p. 77, pl. ix, fig. 2, 1848; 1st Suppl., pt. i, p. 57, 1872; pt. ii, p. 182, 1874.
1871. *Pyramidella uniplicata*, Jeffreys in Prestwich, Quart. Journ. Geol. Soc., vol. xxvii, pp. 145, 490.
1872. *Pyramidella plicosa*, A. and R. Bell, Proc. Geol. Assoc., vol. ii, pp. 204, 210.
1874. *Pyramidella plicosa*, Van den Broeck, Ann. Soc. malac. Belg., vol. ix, pp. 120, 135.

1874—76. *Pyramidella plicosa*, Seguenza, Boll. R. Com. Geol. Ital., vol. v, p. 282, no. 113, 1874; vol. vii, p. 94, no. 580, 1876.
1878. *Obeliscus plicosus*, de Stefani e Pantinelli, Bull. Soc. Malac. Ital., vol. iv, p. 152.
1881. *Pyramidella plicosa*, Nyst, Conch. Terr. tert. Belg., p. 71, pl. vi, fig. 1.
1890. *Pyramidella plicosa*, C. Reid, Plioc. Dep. Brit., p. 254.
1892. *Pyramidella plicosa*, var. *lævinscula*, Sacco, Moll. Terr. Terz. Piem., pt. xi, p. 28.
1896. *Pyramidella plicosa*, Bernays, Bull. Soc. Belge Géol., vol. x (Mémoires), p. 128.
1903. *Pyramidella læviuscula*, Johnson, Geol. Mag. [4], vol. x, p. 26.
1912. *Pyramidella plicosa*, Tesch, Med. v. d. Rijks. v. Delfstoffen, no. 4, p. 74, no. 173.
1915. *Pyramidella plicosa*, R. B. Newton, Journ. of Conch., vol. xv, p. 71.

Specific Characters.—Shell solid, elongato-turriculate; whorls about 9, flattened, smooth; spire conical, regularly tapering, with an obtuse apex; suture well-marked, subcanaliculate; mouth subovate; outer lip sharp, distinctly toothed within; columella straight, with three folds, the upper one much the strongest.

Dimensions.—L. 7 mm. B. 2·5 mm.

Distribution.—Not known living.

Fossil: Lenham. St. Erth. Coralline Crag: Gedgrave, Sutton, Boyton. Waltonian: Walton-on-Naze, Beaumont, Little Oakley. Newbournian: Newbourn.

Bolderien, Casterlien (*zone à Isocardia cor*), Scaldisien, Poederlien: Belgium.

Scaldisien: Holland.

Pliocene: Biot. Italy—Piedmont, Piacenziano, Astiano, Bologna, Livorno, Orciano, Siena, Val d'Era; Sicily—Altavilla, Caltabiano.

Pleistocene: Sicily—Naso.

Remarks.—This species is recorded in Belgium as a fossil, ranging from the Miocene (Bolderien) deposits of Antwerp to the Poederlien, and in our own country from Lenham and St. Erth to Newbourn. It is very common in the Coralline Crag, fairly so in the Waltonian of Walton and Oakley, dying out and disappearing at the later horizons.

It was originally described by Wood in 1842 as distinct under the name here adopted. Although Jeffreys referred it in 1871 to a Miocene species, *P. unisulcata* (*uniplicata*, Jeffr.) of Dujardin, which he identified also with *P. plicosa* of Bronn, Wood continued, in 1872, to hold to his original specific name of *lævinscula*. Prof. Sacco, moreover, expressed an opinion in 1892 (*op. cit.*) that the English fossil was a distinct form, proposing it should be called *P. plicosa* var. *lævinscula*. As the matter is doubtful I retain Wood's name for the Crag shell.

Genus **TURBONILLA**, Risso, 1826.

Turbonilla lactea (Linné). Plate XLIX, figs. 17, 18.

1758. *Turbo lacteus*, Linné, Syst. Nat., ed. x, p. 765, no. 551.
1803—8. *Turbo elegantissimus*, Montagu, Test. Brit., pt. i, p. 298, pl. x, fig. 2, 1803; Suppl., p. 124 1808.

1836—44. *Melania Campanella*, Philippi, Enum. Moll. Sic., vol. i, p. 156, pl. ix, fig. 5, 1836; *Chemnitzia elegantissima*, vol. ii, p. 136, 1844.

1848—84. *Odostomia lactea*, Jeffreys, Ann. Mag. Nat. Hist. [2], vol. ii, p. 348, 1848; Brit. Conch., vol. iv, p. 164, 1867; vol. v, p. 213, pl. lxxvi, fig. 3, 1869; Proc. Zool. Soc. London, p. 357, 1884.

1853. *Chemnitzia elegantissima*, Forbes and Hanley, Brit. Moll., vol. iii, p. 242, pl. xciii, figs. 1, 2.

1859. *Chemnitzia elegantissima*, G. B. Sowerby, Ill. Ind. Brit. Shells, pt. xvi, fig. 1.

1873—76. *Turbonilla lactea*, Seguenza, Boll. R. Com. Geol. Ital., vol. iv, p. 354, no. 311, 1873; vol. vii, p. 92, no. 544, 1876.

1878—84. *Odostomia (Turbonilla) elegantissima*, Monterosato, Enum. e Sinon. Conch. Medit. (Giorn. Soc. Scien. Nat. Palermo, vol. xiii, p. 93), 1878; Nomen. Gen. e Spec. Conch. Medit., p. 91, 1884.

1883. *Turbonilla lactea*, Bucquoy, Dautzenberg et Dollfus, Moll. mar. Rouss., vol. i, p. 178, pl. xxi, figs. 6, 7.

1890. *Turbonilla lactea*, Carus, Prod. Faun. Medit., vol. ii, p. 283.

1892. *Turbonilla lactea*, Locard, Coq. mar. Côtes de France, p. 139, fig. 123.

1892. *Turbonilla lactea* and vars., Sacco, Moll. Terr. Terz. Piem., pt. xi, pp. 72 *et seq.*, pl. ii, figs. 44—57.

1892. *Odostomia lactea*, Praeger, Proc. Roy. Irish Acad. [3], vol. ii, p. 264.

1892. *Chemnitzia lactea*, A. Bell, Rep. Yorks. Phil. Soc., p. 63.

1900. *Odostomia lactea*, Marshall, Journ. of Conch., vol. ix, p. 333.

1901. *Turbonilla lactea*, Brøgger, Norges geol. Undersøgelse, No. 31, p. 661, pl. xvi, fig. 17.

1901. *Turbonilla lactea*, Conch. Soc. List, Journ. of Conch., vol. x, p. 20, no. 455.

1905. *Turbonilla lactea*, Kobelt, Icon. schalentrag. europ. Meeresconch., p. 139, pl. lxxii, figs. 17, 18.

1913. *Turbonilla lactea*, Dautzenberg et Durouchoux, Feuille des Jeunes Natur., vol. xliv, p. 38.

1914. *Turbonilla lactea*, Cerulli-Irelli, Palaeont. Ital., vol. xx, p. 267, pl. xxiii, figs. 20—25.

1920. *Turbonilla lactea*, Dautzenberg, Journ. de Conch., vol. lxv, p. 54.

Specific Characters.—Shell rather solid, slender, much elongated; whorls 10—12, moderately convex, gradually enlarging; the last one-third to one-fourth the total length; ornamented by clearly marked, strong and more or less flexuous, closely-set ribs which terminate abruptly just below the periphery, the base being smooth; spire tapering to a rounded point; suture narrow and rather deep, slightly oblique; mouth small, subrhomboidal, angulate above, a little expanded at the base; outer lip gently rounded; inner lip nearly straight below; umbilicus none.

Dimensions.—L. 7—9 mm. B. 1·75—2·25 mm.

Distribution.—English, Bristol and St. George's Channels, Ireland, west coast of Scotland, Aberdeen, Sandwich, Essex coast. Widely distributed from Finmark to the Canaries, Mediterranean, Adriatic, Ægean.

Fossil: St. Erth, Selsey, Largo Bay, Estuarine clays—Belfast.

Holocene: Portrush.

Italian Pliocene: Piedmont, Monte Mario, Livorno; Sicily—Altavilla.

Pleistocene: Messina, Monte Pellegrino, Taranto, Livorno, Valle Biaia. *Isocardia*- and *Tapes*-banks, Christiania fiord.

Remarks.—This species has been taken as the type form of the genus *Turbonilla*, which includes shells with an elongated spire, longitudinally costated, without or with only microscopical spiral sculpture and wanting the characteristic tooth of *Odostomia*, or having merely a minute or nearly obsolete fold.

Some difference of opinion has existed as to whether or not the typical *T. lactea* occurs in the Crag. The shell which at first, in 1848, Wood identified with the *Turbo elegantissimus* of Montagu (now regarded as the equivalent of the *Turbo lacteus* of Linné), was afterwards considered by Wood as a distinct species, adopting for it in his 1st Supplement of 1872 (*op. cit.*, p. 60) the name of *Chemnitzia elegantior*.

The specimens from St. Erth now figured (Pl. XLIX, figs. 17, 18) have been recognised by M. Dautzenberg as the true *T. lactea*. They belong to the British Museum. A similar form occurs also at Selsey, and it is said to be very abundant in the Estuarine clays of Belfast. At present neither Mr. A. Bell nor I have been able to find in any of the collections known to us any specimen from the Crag that we can consider typical of the present shell. The difference between the two forms may be seen by comparing Wood's figure of *T. elegantior* with those of *T. lactea* from St. Erth here given.

Turbonilla paucistriata (Jeffreys). Plate XLIX, fig. 11.

1884. *Odostomia paucistriata*, Jeffreys, Proc. Zool. Soc., p. 361, pl. xxvii, fig. 6.
1905. *Turbonilla paucistriata*, Kobelt, Icon. schalentrag. europ. Meeresconch., vol. iii, p. 152, pl. lxxii fig. 10.
1897. *Turbonilla paucistriata*, Locard, Exped. scient. Trav. et Talism., Moll. Test., vol. i, p. 440.

Specific Characters.—Shell rather small, thick and solid, forming an elongated cone; whorls nearly flat, gradually and regularly tapering to a twisted apex; ornamented by straight, slight, inconspicuous and irregular ribs; spire produced; suture fairly deep; mouth pear-shaped, angulate above, rounded below; outer lip thin, not expanded; inner lip thickened; base obtusely keeled.

Dimensions.—L. 9 mm. B. 4 mm.

Distribution.—Recent: Bay of Biscay (Travailleur Exp.), Palermo (Monterosato), west coast of Africa (Talisman Exp.), Azores.

Fossil: Waltonian Crag: Walton-on-Naze. Altavilla (Monterosato), Messina (Seguenza).

Remarks.—There is a specimen in my collection of Walton fossils which, though somewhat worn, seems to correspond with the figure and description of this species given by Jeffreys. The latter authority recorded it in the Report of the "Challenger" Expedition as having been found in the Danish West Indies, but the Rev. R. Boog Watson, the author of that work, thought this was a mistake.

Turbonilla Kendalli, sp. nov. Plate XLIX, fig. 12.

1898. *Chemnitzia euterpe* (?), A. Bell, Trans. Roy. Geol. Soc. Cornwall, vol. xii, p. 148.

Specific Characters.—Shell small, strong and solid, turreted, sub-cylindrical; whorls slightly convex, with an angulated base; ornamented by strong, wide and

flattened costæ, occasionally varicose, with fine, distinct spiral lines; spire elongate, gradually tapering; suture well marked; mouth oval, angulate above; outer lip gently rounded, inflected at the periphery; inner lip straight below, forming an angle at the base.

Dimensions.—L. 10 mm. B. 2·5 mm. (when perfect).

Distribution.—Not known living.

Fossil: St. Erth.

Remarks.—This imperfect fossil has been identified by Mr. Bell as equivalent to the one originally described by him as *Chemnitzia euterpe*, Semper, an Oligocene species. He now considers that to be a mistake, suggesting instead the name of Prof. Kendall, one of the earliest investigators of the St. Erth deposits.

Turbonilla post-acuticostata, Sacco. Plate XLIX, fig. 13.

1873—84. *Odostomia (Chemnitzia) acutecostata*, Jeffreys, Rep. Brit. Assoc., Sections (Bradford), p. 112, 1873; Proc. Zool. Soc. London, p. 359, pl. xxvii, fig. 2, 1884.

1876. *Turbonilla acuticostata*, Seguenza, Boll. R. Com. Geol. Ital., vol. vii, p. 92, no. 540, 1876.

1890. *Turbonilla acuticostata*, Carus, Prod. Faun. Medit., vol. ii, p. 284.

1892. *Turbonilla post-acuticostata*, Sacco, Moll. Tert. Terz. Piem., pl. xi, p. 76.

1905. *Turbonilla acuticostata*, Kobelt, Icon. schalentrag. europ. Meeresconch., vol. iii, p. 151, pl. lxxii, fig. 1.

Specific Characters.—Shell small, imperforate, obeliscal, solid, opaque; whorls about 9, slightly convex, the last one-third the total length; spire slender, elongate, turreted, gradually tapering; ornamented by strong, equal-sized, oblique costæ, equal to the intervening spaces, which do not extend below the periphery, where they are intercepted by a fine spiral ridge; apex intorted and with the base smooth; suture well defined; mouth small, subquadrangular; outer lip contracted above, rounded below; inner lip and columella thickened.

Dimensions.—L. 7 mm. B. 2 mm.

Distribution.—Recent: Bay of Biscay. Mediterranean—Palermo, Gabes, Rasel, Amoush.

Fossil: Coralline Crag: Sutton.

Upper Pliocene: Altavilla.

Remarks.—There are two specimens in the British Museum from St. Erth (no. 10291) bearing the name of *T. acuticostata*, but M. Dautzenberg thinks they have been wrongly identified. The one now figured, which corresponds more nearly with that originally described by Jeffreys, belongs to the York Museum and was obtained from the Coralline Crag of Sutton; it seems a distinct form, which may be separated from other species of the same group by the wide intervals between its longitudinal costæ.

Prof. Sacco, however, objects to the use of the specific term *acuticostata* (*op. cit.*, p. 76) on the ground that the latter name had been used in 1870 by Speyer for another shell, proposing to use *post-acuticostata* for it instead.

Turbonilla pusilla (Philippi). Plate XLIX, fig. 14.

1844. *Chemnitzia pusilla*, Philippi, Enum. Moll. Sic., vol. ii, p. 224, pl. xxviii, fig. 21.
1859. *Chemnitzia pusilla*, G. B. Sowerby, Ill. Ind. Brit. Shells, pl. xvi, fig. 3.
1873. *Turbonilla pusilla*, Seguenza, Boll. R. Com. Geol. Ital., vol. iv, p. 354, no. 313.
1878. *Turbonilla pusilla*, de Stefani e Pantinelli, Bull. Soc. malac. Ital., p. 155.
1878—84. *Odostomia (Turbonilla) pusilla*, Monterosato, Enum. e Sinon. Conch. Medit. (Giorn. Soc. Sci. Nat. Palermo, vol. xiii, p. 93), 1878; Nomen. Gen. e Spec. Conch. Medit., p. 92, 1884.
1883—98. *Turbonilla pusilla*, Bucquoy, Dautzenberg et Dollfus, Moll. mar. Rouss., vol. i, p. 181, pl. xx, fig. 16, 1883; vol. ii, p. 812, 1898.
1890. *Turbonilla pusilla*, Carus, Prod. Faun. Medit., vol. ii, p. 283.
1892. *Odostomia pusilla*, Praeger, Proc. Roy. Irish Acad. [3], vol. ii, p. 264.
1892. *Turbonilla pusilla*, Sacco, Moll. Terr. Terz. Piem., pt. xi, p. 81.
1892. *Turbonilla pusilla*, Locard, Coq. mar. Côtes de France, p. 140.
1894—1900. *Odostomia pusilla*, Marshall, Journ. of Conch., vol. vii, p. 384, 1894; vol. ix, p. 334, 1900.
1901. *Turbonilla pusilla*, Conch. Soc. List, Journ. of Conch., vol. x, p. 20, no. 456.
1905. *Turbonilla pusilla*, Kobelt, Icon. schalent. europ. Meeresconch., vol. iii, p. 141, pl. lxxiii, fig. 5; pl. lxxiv, figs. 18—23.
1914. *Turbonilla pusilla*, Cerulli-Irelli, Palaeont. Ital., vol. xx, p. 269, pl. xxiii, figs. 36—40.

Specific Characters.—Shell small, slender, fairly solid; whorls about 10, nearly flat, varying considerably in width when compared with the total length; ornamented by delicate closely-set costæ, nearly vertical or but slightly oblique; spire elongate, subcylindrical, not strictly conical from base to summit, but compressed as it approaches the apex, which is finely pointed; mouth small, subovate, angulated above, rounded below; outer lip following the slope of the spire, not expanded.

Dimensions.—L. 6 mm. B. 1 mm.

Distribution.—*Recent:* Channel Islands, Torbay, Exmouth; West European, Mediterranean.

Fossil: Selsey.

Pliocene: Siena, Monte Mario, Farnesina.

Pleistocene: Messina, Taranto, Livorno, Valle Biaia.

Remarks.—*T. pusilla* is unknown from the Anglo-Belgian Crag, but Mr. A. Bell has obtained a specimen of it from Selsey, which is here figured. This seems to correspond with the one given by Philippi except that the spire is considerably longer, but as to this the present species is a variable form. The shells described by Forbes and Hanley as *Chemnitzia pusilla* and *Odostomia pusilla* by Jeffreys differ materially from Philippi's type. These writers appear to group *T. pusilla* with *Chemnitzia lactea*, *C. elegantissima* and *C. gracilis*, but this view I cannot accept. As to his specimens of *T. pusilla*, Jeffreys says the sides are always curved, but in Philippi's shell, and in mine, which has been identified by M. Dautzenberg, they are straight or nearly so. The most distinctive feature of the latter seems to be the compressed and not strictly conical form of the upper portion of the spire. My specimen from Selsey measures 6 mm. in length; Philippi's is 4 mm.

Var. **grossa**, Marshall. Plate XLIX, fig. 15.

1894—1900. *Odostomia pusilla*, var. *grossa*, Marshall, Journ. of Conch., vol. vii, p. 384, 1894; vol. ix, p. 334, 1900.

Varietal Characters.—Less cylindrical, shorter and broader than the type, with somewhat coarser sculpture.

Dimensions.—L. 4 mm. B. 1 mm.

Distribution.—*Recent:* Stornoway, Loch Inver, Gairloch, Torbay.

Fossil: Selsey.

Remarks.—M. Dautzenberg has been kind enough to identify the specimen figured under this name, which was found at Selsey and belongs to the York Museum, with Marshall's var. *grossa*. The author says that it might easily be taken for *O. lactea*, but it is never conical like that species, the lower whorls being of the same width and rounder at the base. He considers that it is the same as the var. *sinuosa* of Jeffreys,[1] but that the specimen of the latter was not quite mature.

Turbonilla recta (Etheridge and Bell). Plate XLIX, fig. 16.

1898. *Chemnitzia recta*, A. Bell, Trans. Roy. Geol. Soc. Cornwall, vol. xii, p. 147.

Specific Characters.—Shell small, allied to *T. obliqua*, but having straighter costæ, somewhat more compressed whorls and a slightly shallower suture.

Dimensions.—L. 6 mm. B. 2 mm. (when complete).

Distribution.—Not recorded living.

Fossil: St. Erth.

Remarks.—The imperfect specimen figured under this name is one of several small *Turbonillæ* from St. Erth in the British Museum, which were regarded as new by Messrs. Etheridge and Bell. A similar shell in the Warburton Collection was identified doubtfully by them with the *Turbo gracilis* of Brocchi, but it seems to me that the figure of this species given by the latter author has but slight resemblance to our fossil.

Turbonilla expallida, sp. nov. Plate XLIX, fig. 19.

Specific Characters.—Shell of medium size, subcylindrical, turreted; whorls slightly convex, gradually but regularly increasing; ornamented by rather strong sinuous costæ as wide as the interspaces, hardly reaching the base; spire elongate, subcylindrical; suture well-marked, slightly channelled but not deep; mouth short, compressed, angulate and narrowed above, rounded and expanded below.

Dimensions.—L. 10 mm. B. 2·5 mm.

[1] Moll. "Lightning" and "Porcupine" Exped., Proc. Zool. Soc., 1884, p. 358, pl. xxvii, fig. 1.

Distribution.—Not recorded living.

Fossil: St. Erth.

Remarks.—The shell figured under the present name is from the St. Erth Collection in the British Museum, where it has been identified with *Turbo plicatulus* of Brocchi, but though belonging to a similar group it is not the same, nor is it the *Chemnitzia plicatula* of Wood. The nearest thing I can find to it is one of the fossils from Monte Mario, described by Sign. Cerulli-Irelli as *Turbonilla pallida*, Phil.[1], but our specimen shows no trace of the spiral sculpture of Philippi's species. It is an interesting form, differing from anything else I know from St. Erth, and deserves notice. I figure it, therefore, as new, suggesting it should be called *T. expallida*.

Turbonilla obliqua, Degrange-Touzin.[2] Plate XLIX, fig. 20.

1893—98. *Chemnitzia Warringtoni*, A. Bell, Proc. Roy. Irish Acad. [3], vol. ii, p. 628, 1893; Trans. Roy. Geol. Soc. Cornwall, vol. xii, p. 147, 1898.

1895. *Turbonilla obliqua*, Degrange-Touzin, Orthez, p. 70, pl. ix, fig. 4.

1917. *Turbonilla obliqua*, Cossmann et Peyrot, Actes Soc. Linn. Bordeaux, vol. lxx, p. 357, pl. x, figs. 35, 69.

Specific Characters.—Shell small, slender, elongato-conical; whorls 10, slightly convex; ornamented by longitudinal ribs, regular and oblique, which do not reach the base, with narrow interspaces, without spiral sculpture, the last whorl about one-third the total length; mouth short, subquadrangular, slightly angulate above.

Dimensions.—L. 6 mm. B. 1·5 mm.

Distribution.—Not known living.

Fossil: St. Erth.

Miocene (Helvétien): Orthez, Basses-Pyrenees.

Remarks.—The specimen here figured is from St. Erth and belongs to the British Museum. It was originally but not sufficiently described or figured by Mr. Bell in 1893 under the name of *C. Warringtoni*. Submitting a photograph of it to M. Dautzenberg, he remarks that it is probably identical with the *T. obliqua* of Degrange-Touzin (1895), subsequently refigured and described by MM. Cossmann and Peyrot in 1917.

Turbonilla dubiosa, sp. nov. Plate XLIX, fig. 21.

1886. *Odostomia* (*Chemnitzia*) *costellata*, Kendall and R. G. Bell, Quart. Journ. Geol. Soc., vol. xlii, p. 212.

1893-98. *Chemnitzia costellata*, A. Bell, Proc. Roy. Irish Acad. [3], vol. ii, p. 628, 1893; Trans. Roy. Geol. Soc. Cornwall, vol. xii, p. 148, 1898.

[1] Palaeont. Italica, vol. xx, p. 274, pl. xxiii, fig. 58, 1914.

[2] As Mr. Bell did not adequately describe *C. Warringtoni*, the name afterwards adopted by M. Degrange has therefore the priority.

Specific Characters.—Shell small, solid, turreted; whorls 8, slightly convex, the last about three-eighths the total length; ornamented by strong, prominent, rounded costæ which do not quite reach the base, equal in width to the spaces between them; spire long, slender, gradually tapering to a blunt twisted point; suture fairly deep; mouth small, oval, slightly compressed above, expanded below.

Dimensions.—L. 4 mm. B. 1 mm.

Distribution.—Not known living.

Fossil: St. Erth.

Remarks.—The shell now figured, which is not very rare at St. Erth, was at first thought to be identical with a Miocene species—the *Auricula costellata* of Grateloup, but this view was objected to by M. Dollfus and was probably a mistake. Grateloup says the mouth of his species was "*intus substriato*," and of this the St. Erth specimen, though apparently unworn, shows no trace. As I cannot find anything to which I can with certainty refer it, it may be desirable to give it provisionally a distinctive name. It is an interesting form, and the specimen now figured is so beautifully perfect that it deserves notice. It comes from the Wood Collection at the British Museum.

Turbonilla parvula, sp. nov. Plate XLIX, figs. 22, 23.

Specific Characters.—Shell short, minute, regularly conical; whorls 6 or 7, nearly flat, the last about one-third the total length, excavated below; ornamented by about a dozen strong, rounded and oblique costæ; spire short, regularly diminishing towards a rounded point; suture distinct, somewhat channelled; mouth small, angulated above.

Dimensions.—L. 2·5 mm. B. 1 mm.

Distribution.—Not known living.

Fossil: St. Erth.

Remarks.—The two fossils now represented are from the British Museum, where they have been identified with *Chemnitzia gracilis* and with *Ch. pusilla*, Phil., respectively. Comparing them, however, with the figures given by that author it seems to me, first that they both belong to the same species, and next, that they differ materially from either of those named in the length of the spire and the coarseness and number of the longitudinal costæ. As I cannot find any other form to which they can be satisfactorily referred, I describe them as new, under the name given above.

Sub-genus **PYRGOSTELIS**, Monterosato, 1884.

Turbonilla (Pyrgostelis) densecostata (Philippi). Plate XLIX, figs. 24, 25.

1844. *Chemnitzia densecostata*, Philippi, Enum. Moll. Sic., vol. ii, p. 137, pl. xxiv, fig. 9.

1848. *Chemnitzia densecostata*, S. V. Wood, Mon. Crag Moll., pt. i, p. 82, pl. x, fig. 8.

1870. *Chemnitzia densecostata*, A. Bell, Journ. de Conch., vol. xviii, p. 350, no. 330.

1871—84. *Odostoma rufa*, var., Jeffreys in Prestwich, Quart. Journ. Geol. Soc., vol. xxvii, pp. 143, 487, 1871; *O. rufa*, var. *densicostata*, Proc. Zool. Soc. London, p. 356, 1884.

1872. *Chemnitzia densecostata*, A. and R. Bell, Proc. Geol. Assoc., vol. ii, p. 203.

1873—76. *Turbonilla densecostata*, Seguenza, Boll. R. Com. Geol. Ital., vol. iv, p. 354, no. 310, 1873; vol. v, p. 282, no. 112, 1874; vol. vii, p. 92, no. 539, 1876.

1878—84. *Odostomia* (*Turbonilla*) *rufa*, var. *exigua*, Monterosato, Enum. e Sinon. Conch. Medit. (Giorn. Soc. Scien. Nat. Palermo, vol. xiii), p. 93, 1878; *Pyrgulina* (*Pyrgostelis*) *densecostata*, Nomen. Gen. e Spec. Conch. Medit., p. 90, 1884.

1883—98. *Turbonilla densecostata*, Bucquoy, Dautzenberg et Dollfus, Moll. mar. Rouss., vol. i, p. 183. pl. xxi, fig. 11, 1883; vol. ii, p. 812, 1898.

1890. *Parthenina* (*Pyrgostelis*) *densecostata*, Carus, Prod. Faun. Medit., vol. ii, p. 281.

1892. *Turbonilla densecostata*, Locard, Coq. mar. Côtes de France, p. 140.

1905. *Turbonilla* (*Pyrgostelis*) *densecostata*, Kobelt, Icon. schalentrag. europ. Meeresconch., vol. iii, p. 158, pl. lxxiii, figs. 1, 28, 29.

1912. *Turbonilla densecostata*, Tesch, Med. v. d. Rijks. v. Delfstoffen, No. 4, p. 74, no. 170.

1914. *Turbonilla densecostata*, Cerulli-Irelli, Palaeont. Ital., vol. x, p. 270, pl. xxiii, figs. 41—43.

Specific Characters.—Shell small, slender, subcylindrical; whorls 9 or 10, nearly flat; spire elongate, turriculate, regularly diminishing in size upwards; ornamented by numerous closely-set and nearly straight costæ, wider than the interspaces, and by excessively fine spiral striæ; suture well marked but not very deep, rather oblique; mouth ovate, angulated above.

Dimensions.—L. 4—4·5 mm. B. 1 mm.

Distribution.—*Recent:* Mediterranean, Adriatic.

Fossil: St. Erth. Coralline Crag: Sutton. Amstelien: Holland.

Lower Pliocene: Biot.

Upper Pliocene: Monte Mario, Bologna.

Pleistocene: Taranto, Livorno, Valle Biaia.

Remarks.—There seems considerable difference of opinion as to which of the many allied forms of this group should be included under Philippi's name, *Chemnitzia* (*Turbonilla*) *densecostata*. Prof. Sacco, for example, considers Wood's *C. densecostata* to be different, proposing to call it *T.* (*Pyrgostelis*) *rufa*, var. *adensecostata*,[1] while he thinks the *T. densecostata* of Messrs. Bucquoy, Dautzenberg and Dollfus belongs to a different sub-genus, *Strioturbonilla*.[2] As I have no sufficient information at my disposal to enable me to express an independent opinion, I content myself with describing and figuring specimens of the Crag fossil, using for it provisionally Wood's specific name given above. Unfortunately but few of those who have written on the subject have given figures by which we might have been guided. The specimens here figured have been submitted to M. Dautzenberg for verification. They belong to the St. Erth Collection in the British Museum, where they bear the name here adopted.

[1] Moll. Terr. Terz. Piem., pt. xii, p. 4. [2] *Op. cit.*, pt. xi, p. 96.

Turbonilla (Pyrgostelis) varicula (S. V. Wood). Plate XLIX, fig. 26.

1848. *Chemnitzia varicula*, S. V. Wood, Mon. Crag Moll., pt. i, p. 84, pl. x, fig. 10.
1871. *Cerithium variculum*, Jeffreys in Prestwich, Quart. Journ. Geol. Soc., vol. xxvii, p. 143.
1872. *Cerithium variculum*, A. and R. Bell, Proc. Geol. Assoc., vol. ii, p. 203.

Specific Characters.—Shell small, turreted, conical; whorls slightly convex, the last nearly half the total length; spire elongate, regularly increasing in width; suture distinct; ornamented by fine longitudinal costæ not so wide as the interspaces, tending to die out towards the base, and by fine, rather inconspicuous or obsolete spiral lines; mouth short, subcircular; outer lip acute, smooth within.

Dimensions.—L. 5 mm. B. 2 mm.

Distribution.—Not known living.

Fossil: Coralline Crag: Sutton. Waltonian: Walton-on-Naze.

Remarks.—Of this very distinct form Wood states he had obtained about a dozen specimens from the Coralline Crag of Sutton. There are several under the same name in the York Museum from Walton, not exactly alike, one of them, at least, corresponding fairly well with Wood's type except that it is somewhat wider, and that the costæ extend nearly to the base of the shell. Another described in my next paragraph as a variety (*expansa*) has a still wider body-whorl and more numerous ribs.

Var. **expansa**, nov. Plate XLIX, fig. 27.

Varietal Characters.—Somewhat larger and wider than the type, with rather more numerous costæ.

Dimensions.—L. 5 mm. B. 2 mm.

Distribution.—Not known living.

Fossil: Waltonian Crag: Walton-on-Naze.

Remarks.—The specimen here described as a variety of *T. varicula* departs still more widely from Wood's type than does the one last described. It seems to belong, however, to the same group.

Turbonilla (Pyrgostelis) filosa (S. V. Wood). Plate XLIX, fig. 28.

1842—72. *Turbonilla filosa*, S. V. Wood, Ann. Mag. Nat. Hist. [1], vol. ix, p. 536, 1842; *Chemnitzia filosa*, Mon. Crag Moll., pt. i, p. 82, pl. x, fig. 7, 1848; 1st Suppl., pt. i, p. 60, 1872.
1871. *Odostomia filosa*, Jeffreys in Prestwich, Quart. Journ. Geol. Soc., vol. xxvii, p. 143.
1872. *Chemnitzia filosa*, A. and R. Bell. Proc. Geol. Assoc., vol. ii, p. 203.
1881. *Turbonilla filosa*, Nyst, Conch. Terr. Tert. Belg., p. 74, pl. vi, fig. 4.
1890. *Chemnitzia filosa*, C. Reid, Plioc. Dep. Brit., p. 241.
1896. *Turbonilla filosa*, Bernays, Bull. Soc. Belg. Géol., vol. x (Mémoires), p. 129.
1912. *Turbonilla filosa*, Tesch, Med. v. d. Rijks. v. Delfstoffen, No. 4, p. 72, no. 169, p. 129.

Specific Characters.—Shell small, slender, subulate; whorls 8—10, flattened, ornamented by numerous inconspicuous costæ and thread-like spiral lines; spire elongate, regularly tapering; suture well-marked, oblique, slightly channelled but not deep; mouth small, short, subcircular, angulate above; outer lip thickened, smooth within.

Dimensions.—L. 7—8 mm. B. 1·5 mm.

Distribution.—Not known living.

Fossil: Coralline Crag: Sutton. Casterlien, Scaldisien: Belgium. Scaldisien: Holland.

Remarks.—In the Museum at York there are two very similar specimens, one of them marked *T. filosa* and the other *T. similis*. They were both found in the Coralline Crag at Sutton, the first having come to that institution through the late Edwd. Charlesworth, the second through Alfred Bell. They are very nearly alike—indeed, Jeffreys regarded *T. similis* as a variety of *T. filosa*. Wood, however, with the two authorities named, who were at the time in close correspondence with him, regarded them as specifically distinct. Our specimen is somewhat worn, but under a microscope the spiral markings are clearly shown to be simple and equidistant, and to extend over the base of the shell. In *T. similis*, on the contrary, they are usually double, as stated below. Wood states he had obtained about twelve specimens from the Coralline Crag of Sutton, doubtless from the bed of small shells often here alluded to, and that the longitudinal costæ are often nearly obsolete. The mouth is shorter and more nearly circular in *T. filosa* than in *T. similis*.

Prof. Ed. Forbes identified this form with *Parthenina varicosa*, an Ægean shell described by him in 1843,[1] but Wood doubted the correctness of this view, as apparently did Jeffreys, who in 1871 adopted Wood's name without comment.

Turbonilla (Pyrgostelis) formosa (Jeffreys). Plate XLIX, fig. 30.

1848—67. *Odostomia formosa*, Jeffreys, Ann. Mag. Nat. Hist. [2], vol. ii, p. 347, 1848; Brit. Conch., vol. iv, p. 164, 1867.
1853. *Chemnitzia formosa*, Forbes and Hanley, Brit. Moll., vol. iii, p. 248, pl. xciii, fig. 5.
1859. *Chemnitzia formosa*, G. B. Sowerby, Ill. Ind. Brit. Shells, pl. xvi, fig. 6.
1892. *Chemnitzia formosa*, A. Bell, Rep. Yorks. Phil. Soc., pp. 63, 76.
1892. *Turbonilla formosa*. Locard, Coq. mar. Côtes de France, p. 142.

Specific Characters.—Shell of moderate size, slender, turreted; whorls flattened; ornamented by closely-set straightish costæ and by well-marked spiral ridges; suture oblique, distinctly channelled; mouth about a sixth of the entire length.

Dimensions.—L. 8 mm. B. 1·5 mm.

[1] Rep. Brit. Assoc. (Cork), p. 189, 1843.

Distribution.—*Recent:* Oxwich Bay near Swansea. Shellness, Kent. Bantry Bay.

Fossil: Selsey.

Remarks.—Mr. Bell reports an imperfect fossil specimen of this rare shell which he found many years ago at Selsey, remarking that so far as it goes its sculpture closely resembles the recent one figured by Forbes and Hanley. It had been previously obtained from several British localities by G. B. Sowerby, Jeffreys and McAndrew. The Selsey fossil is now in the York Museum.

Turbonilla (Pyrgostelis) similis (S. V. Wood) and var. **ecostata.** Plate XLIX, figs. 31, 32.

1848. *Chemnitzia similis* and var., S. V. Wood, Mon. Crag Moll., pt. i, p. 84, pl. x, fig. 11.
1871. *Odostomia filosa*, var. *similis*, Jeffreys in Prestwich, Quart. Journ. Geol. Soc., vol. xxvii, p. 143.
1890. *Chemnitzia similis*, C. Reid, Plioc. Dep. Brit., p. 242.

Specific Characters.—Shell slender, subulate; whorls 10—12, flattened; ornamented by inconspicuous costæ, sometimes obsolete, and by fine spiral thread-like lines, closely duplicate, extending to the base; spire elongate, regularly tapering to a sharp point; suture slightly channelled, well-marked but not deep; mouth oval, angulate above, longer than in *T. filosa*.

Dimensions.—L. 8 mm. B. 2 mm.

Distribution.—Not known living.

Fossil: Coralline Crag: Sutton.

Remarks.—As stated on p. 569, this form is closely allied to *T. filosa*, but in the specimen here figured the spiral lines are closely duplicate, a feature which my artist has failed to show, but which is visible under the microscope. Wood states that in an example in his collection the longitudinal costæ are absent, the spiral markings only being shown. I have found a similar one myself (var. *ecostata*, fig. 31), also at Sutton.

Turbonilla (Pyrgostelis) rufescens (Forbes). Plate XLIX, fig. 29.

1845. *Chemnitzia rufescens*, E. Forbes, Trans. Brit. Assoc. (Cambridge), p. 66.
1847—84. *Chemnitzia rufescens*, Jeffreys, Ann. Mag. Nat. Hist. [1], vol. xix, p. 311, 1847; *Odostomia scalaris*, var. *rufescens*, Brit. Conch., vol. iv, p. 161, 1867; Proc. Zool. Soc., London, p. 355, 1884.
1853. *Chemnitzia rufescens*, Forbes and Hanley, Brit. Moll., vol. iii, p. 251, pl. xciv, fig. 1.
1859. *Chemnitzia rufescens*, G. B. Sowerby, Ill. Ind. Brit. Shells, pl. xvi, fig. 8.
1872. *Chemnitzia rufescens*, A. and R. Bell, Proc. Geol. Assoc., vol. ii, p. 203.
1873. *Turbonilla scalaris*, var. *rufescens*, Weinkauff, Cat. europ. Meeresconch., p. 25.
1892. *Chemnitzia rufescens*, A. Bell, Rep. Yorks. Phil. Soc., p. 63.
1900. *Odostomia scalaris*, var. *rufescens*, Marshall, Journ. of Conch., vol. ix, p. 296.

1901. *Pyrgostelis scalaris*, var. *rufescens*, Conch. Soc. List, Journ. of Conch., vol. x, p. 20.
1905. *Parthenina* (*Pyrgostelis*) *rufescens*, Kobelt, Icon. schalentrag. europ. Meeresconch., vol. iii, p. 130, pl. lxxi, figs. 19, 20.

Specific Characters.—Shell slender, elongate, rather thin ; whorls 8—10, convex, not angulated ; ornamented by numerous fine inconspicuous longitudinal costæ closely crowded together, which do not reach the base, with fine spiral lines extending to it ; spire regularly diminishing upwards to a fine point ; suture deep, slightly oblique ; mouth oval, angulate above, rounded below ; outer lip somewhat expanded, incurved above ; inner lip thickened and reflected below ; umbilicus none.

Dimensions.—L. 5—7 mm. B. 1—1·5 mm.

Distribution.—*Recent :* Lough Strangford, co. Antrim, Aberdeenshire, west coast of Scotland, Hebrides. Scandinavian coasts—Finmark, Bohuslän.

Fossil : Coralline Crag (Jeffreys). Selsey.

Remarks.—This shell, which is nearly allied to *T. rufa*, although it is shorter in the spire and its sculpture is much finer and less conspicuous, has been regarded by Jeffreys and some other recent authorities as a variety of *T. scalaris*, but this view has not been universally accepted. It differs from the latter both in form and sculpture, the whorls are convex, not angulate as in that species.

The subgenus *Pyrgostelis* was proposed by the Marchese di Monterosato in 1884 to include *T. rufa* and some allied forms having fine ridges in the intercostal spaces ; by Kobelt it has been grouped with *Parthenina*, while in the Conchological Society's list it is regarded as a variety of *Pyrgostelis scalaris*.

The specimen here figured is from the York Museum, where it bears the name of *Odostomia rufescens*.

Turbonilla (Pyrgostelis) tenuissima (Etheridge and Bell, MS.). Plate XLIX, fig. 42.

1898. *Chemnitzia tenuissima*, A. Bell, Trans. Roy. Geol. Soc. Cornwall, vol. xii, p. 148.

Specific Characters.—Shell minute, slender, turreted ; whorls 7 or 8, slightly convex, gradually and regularly enlarging ; spire elongate, tapering to a compressed point ; ornamented by excessively fine and numerous longitudinal ribs, crowded together, and by very delicate spiral ridges ; suture clearly marked, but not deep ; mouth narrow, short, angulated above ; outer and inner lips forming a thin, continuous peristome.

Dimensions.—L. 3 mm. B. 1 mm.

Distribution.—Not known living.

Fossil : St. Erth.

Remarks.—This delicately sculptured little shell, one of the smallest of the group reported by Mr. Bell from St. Erth, is regarded by him as new and at present unique. It comes from the Warburton Collection at the British Museum. The sculpture is but indistinctly shown, even when examined under a microscope.

Turbonilla (Pyrgostelis) ignota, sp. nov. Plate XLIX, fig. 41.

Specific Characters.—Shell minute, slender, oblongo-conical; whorls 8, flattened, slightly compressed at the apex, gradually increasing downwards, the last whorl about one-third the total length; ornamented by straight longitudinal costæ which die out before reaching the base, and by fine inconspicuous striæ in the interspaces between the ribs; suture oblique, well-marked, but not deep; mouth oval, small.

Dimensions.—L. 3 mm. B. 1 mm.

Distribution.—Not observed living.

Fossil: Coralline Crag: Gedgrave.

Remarks.—The specimen here given belongs to the York Museum where it bears Wood's name of *Chemnitzia elegantior*, to which species it presents a superficial resemblance. When examined under the microscope, however, our shell may be seen to be distinctly marked with short ridges in the interspaces, which do not cross the ribs—a feature entirely absent from the figure of the fossil represented in Wood's Monograph. Many specimens from the Crag are considerably worn so that the finer part of the sculpture is obliterated. It is possible, therefore, that the present form may occur in other localities where it has escaped notice.

Sub-genus **PYRGOLIDIUM,** Monterosato, 1884.

Turbonilla (Pyrgolidium) internodula (S. V. Wood). Plate XLIX, figs. 33, 34.

1848—72. *Chemnitzia internodula*, S. V. Wood, Mon. Crag Moll., pt. i, p. 81, pl. x, fig. 6, 1848; 1st Suppl., pt. i, p. 60, 1872.

1864. *Chemnitzia corbis*, Conti, Il Monte Mario ed i suivi foss. subap., p. 30.

1870. *Chemnitzia internodula*, S. V. Wood, Jr., and F. W. Harmer, Trans. Brit. Assoc. (Liverpool), p. 90.

1871—73. *Chemnitzia internodula*, Jeffreys in Prestwich, Quart. Journ. Geol. Soc., vol. xxvii, pp. 143, 487, 1871; Rep. Brit. Assoc. (Bradford), p. 114, 1873.

1872. *Chemnitzia internodula*, A. and R. Bell, Proc. Geol. Assoc., vol. ii, pp. 203, 209, 216.

1873—76. *Turbonilla internodula*, Seguenza, Boll. R. Com. Geol. Ital., vol. iv, p. 354, no. 312, 1873; vol. vii, p. 92, no. 542, 1876.

1879. *Chemnitzia internodula*, Jas. Reeve, Proc. Norwich Geol. Soc., vol. i, p. 70.

1881. *Turbonella internodula*, Nyst, Conch. Terr. tert. Belg., p. 73, pl. vi, fig. 3.

1892. *Turbonilla internodula*, Van den Broeck, Bull. Soc. Belg. Géol., vol. vi (Mémoires), pp. 122, 132.

1892—1904. *Turbonilla (Pyrgolidium) internodulum* and vars., Sacco, Moll. Terr. Terz. Piem., pt. xi, p. 84, 1892; pt. xxx, p. 109, pl. xxiv, figs. 16, 17, 1904.

1896. *Turbonilla internodula*, Bernays, Bull. Soc. Belg. Géol., vol. x (Mémoires), p. 131.

1912. *Turbonilla internodula*, Tesch, Med. v. d. Rijks. v. Delfstoffen, No. 4, p. 72, no. 167.

1914. *Turbonilla (Pyrgolidium) internodula*, Cerulli-Irelli, Palaeont. Ital., vol. xx, p. 277, pl. xxiii, figs. 68, 69.

Specific Characters.—Shell small, slender, subulate, subcylindrical; whorls about 12, flattened; ornamented by numerous longitudinal costæ, varying in

number, sometimes nearly straight, at others more or less oblique, interrupted by the suture, which is generally deep and channelled, the costæ being connected by a transverse band of nodules, placed especially on the upper part of the shell and in the centre of each whorl; spire elongato-conical, regularly diminishing in size to a blunt point; mouth oval, angulate above, rounded below; base excavated, without sculpture below the periphery.

Dimensions.—L. 7—12 mm. B. 2—3 mm.

Distribution.—Not known living.

Fossil: Coralline Crag: Sutton, Gedgrave. Waltonian: Walton-on-Naze, Beaumont, Little Oakley. Newbournian: Bentley, Waldringfield, Newbourn, Ramsholt, Felixstowe, Sutton. Butleyan: Butley, Bawdsey, Hollesley. Icenian: Bramerton, Beccles. Middle Glacial: Billockby, Gorleston cliff.

Casterlien, Scaldisien, Poederlien: Belgium. Scaldisien: Holland. Miocene: Piedmont (var. *miocenica*). Lower Pliocene—Piacenziano.

Upper Pliocene: Astigiano, Monte Mario, Livorno, Altavilla.

Pleistocene: Monte Pellegrino, Taranto, Livorno, Valle Biaia.

Remarks.—This form, easily recognised by its spiral band of nodules and known in 1848 from the Red and Coralline Crag only, has since been reported from other East Anglian horizons, especially from one locality at Bramerton, where many years ago it was found, rather abundantly, by Mr. James Reeve, of the Norwich Museum, and myself. It occurs also in the Belgian and Dutch beds (*q.v.*), in the Pliocene of Italy and Sicily and the Pleistocene of the latter. Prof. Sacco records one variety (*miocenica*) from the Italian Miocene. It has been doubtfully identified with the recent Mediterranean species, *Turbonilla rosea*, Monterosato, described below, but Sign. Cerulli-Irelli considers this to be a mistake.

In one of the specimens here given (fig. 33), which is from the Sedgwick Museum, the costæ are unusually numerous, the intervening spaces are narrower and the nodules less conspicuous.

Var. **ligata** (J. Reeve). Plate XLIX, fig. 35.

1878. *Chemnitzia ligata*, Jas. Reeve, Proc. Norwich Geol. Soc., vol. i, p. 70.
1879. *Chemnitzia internodula* var. *ligata*, S. V. Wood, Mon. Crag Moll., 2nd Suppl., p. 24, pl. ii, fig. 11.

Varietal Characters.—Specially distinguished from the type by a more distinctly marked spiral line in the centre of the whorls, connecting the longitudinal costæ.

Dimensions.—L. 10 mm. B. 3·5 mm.

Distribution.—Not reported living.

Fossil: Icenian Crag: Bramerton.

Remarks.—The specimen from which this shell takes its name was obtained by Mr. Jas. Reeve at Bramerton more than forty years ago and sent to Wood for description. Strictly speaking, the name should be attributed to the former investigator, as it was first published by him in 1878, a year before the 2nd Supplement to Wood's Monograph of the Crag Mollusca. Mr. Reeve's work on the Bramerton Crag was so painstaking and long-continued that it will give everyone who knew of it pleasure to find that this well-deserved though long-overlooked compliment should be paid him.

Var. **acuminata,** nov. Plate XLIX, fig. 36.

Varietal Characters.—Differs from the type form in size and in its more slender and acuminate spire.

Dimensions.—L. 7 mm. B. 1·75 mm.

Distribution.—Not known living.

Fossil: Little Oakley.

Remarks.—This shell differs sufficiently, I think, from the form generally found in the Crag to deserve a distinct varietal name.

Var. **conica,** nov. Plate XLIX, figs. 37, 38.

1871. *Odostomia (Chemn.) internodula*, A. Bell, Ann. Mag. Nat. Hist. [4], vol. vii, p. 359.

Varietal Characters.—Differs from the type in its conical spire, which is shorter, and less slender and elongate than in the type.

Dimensions.—L. 5—7 mm. B. 2—2·5 mm.

Distribution.—Not known living.

Fossil: Waltonian Crag: Walton-on-Naze. Icenian: Bramerton.

Remarks.—The distribution of this variety has not been worked out, but it might be found, not improbably, at most localities from Boyton to Bramerton where the type form is present. The only reference to it I can find is that of Mr. Bell, who, in the paper given above, speaks of a short conical variety of *Odostomia internodula* up to that time unnoticed by Wood, which he remarked was not uncommon in both the Coralline and Red Crags.

Turbonilla (Pyrgolidium) rosea (Monterosato). Plate XLIX, fig. 39.

1873. *Turbonilla internodula* (*nec* Wood), Weinkauff, Cat. europ. Meeresconch., p. 25, no. 437.

1877—84. *Odostomia (Turbonilla) internodula*, Monterosato, Journ. de Conch., vol. xxv, p. 39, pl. iii, fig. 1 (*nec* Wood), 1877; *T. rosea*, Journ. de Conch., vol. xxv, p. 40, 1877; Enum. Gen. e. Spec. Conch. Medit., p. 89, 1884.

1890. *Parthenina* (*Pyrgolidium*) *rosea*, Carus, Prod. Faun. Medit., vol. ii, p. 281.
1905. *Turbonilla* (*Pyrgolidium*) *rosea*, Kobelt, Icon. schalentrag. europ. Meeresconch., vol. iii, p. 160, pl. lxxiv, figs. 7—11.
1917. *Pyrgolidium roseum*, Dautzenberg, Journ. de Conch., vol. lxiii, p. 68.

Specific Characters.—Shell small, elongate, ovato-conical, thin; whorls 8—9, flat or nearly so, the last one-third the total length, ornamented by inconspicuous ribs, interrupted by the suture, with one or more spiral rows of punctures in the interspaces, placed near the centre of each whorl; suture distinct, channelled; spire slender, subcylindrical, regularly but gradually diminishing in size towards a blunt and rounded apex; mouth small, ovate, angulate above.

Dimensions.—L. 6 mm. B. 2 mm.

Distribution.—*Recent:* Mediterranean (rare), Sicily, Algeria to Tunis, Morocco.
Fossil: Coralline Crag: Boyton.

Remarks.—The interesting specimen figured under this name is from the Coralline Crag of Boyton. It is new to our deposits, but seems to correspond with a rare Mediterranean form originally described by the Marchese di Monterosato as equivalent to our *T. internodula*, to the type of which, however, it bears but little real resemblance. Subsequently it was considered specifically distinct by the latter authority and called *T. rosea*, in which he has been followed by Kobelt and some others. It may be distinguished by its sculpture, which shows one or two transverse rows of intercostate punctures placed nearly in the centre of the whorls.

Our fossil has been submitted to M. Dautzenberg, who confirms my reference of it to *T.* (*Pyrgolidium*) *rosea*.

Turbonilla (Pyrgolidium) columnaris (Bonelli). Plate XLIX, fig. 40.

—— *Turbonilla columnaris*, Bonelli, MS.
1842—47. *Melania columnaris*, Sismonda, Syn. Meth., ed. 1, p. 31, 1842; *Chemnitzia columnaris*, ed. 2, p. 52, 1847.
1852. *Turbonilla columnaris*, D'Orbigny, Prod. Pal. strat., vol. iii, p. 167.
1890—92. *Turbonilla columnaris*, Sacco, Boll. Soc. Geol. Ital., vol. ix, p. 185, no. 2021, 1890; *Turbonilla* (*Pyrgostelis*) *columnaris*, Moll. Terr Terz. Piem., pt. xii, p. 6, pl. ii, fig. 131.

Specific Characters.—Shell elongato-turreted; whorls subcylindrical, flattened, excavated at the suture; ornamented by numerous closely-set and straight longitudinal costæ which do not reach the base, with firm incised lines and one or two rows of distinct punctures in the interspaces near the sutures; spire gradually diminishing in size upwards; suture channelled, well-marked; mouth pyriform, angulated above.

Dimensions.—L. 9 mm. B. 3 mm.

Distribution.—Not recorded living.
Fossil: Coralline Crag: Boyton. Selsey. Italian Pliocene—Astiano.

Remarks.—The interesting and unique fossil from Selsey, belonging to the York Museum and given under the above name, corresponds closely with a rare form from the Italian Pliocene figured by Prof. Sacco, but it has two spiral lines of conspicuous punctures, instead of one as shown in his figure. It is said to be rare in the Astian deposits. I only know of one specimen from the English Crag, but Mr. Bell considers he has obtained another from Selsey.

Genus **PYRGULINA**, A. Adams, 1863.

Pyrgulina interstincta (Montagu). Plate XLIX, fig. 48.

1803. *Turbo interstinctus*, Montagu, Test. Brit., pt. ii, p. 324, pl. xii, fig. 10.
1848. *Odostomia pupa*, S. V. Wood, Mon. Crag Moll., pt. i, p. 86, pl. ix, fig. 5.
1853. *Odostomia interstincta*, Forbes and Hanley, Brit. Moll., vol. iii, p. 296, pl. xcvii, fig. 1.
1859. *Odostomia interstincta*, G. B. Sowerby, Ill. Ind. Brit. Shells, pl. xvii, fig. 26.
1848—84. *Odostomia interstincta*, Jeffreys, Ann. Mag. Nat. Hist. [2], vol. ii, p. 343, 1848; Brit. Conch., vol. iv, p. 151, 1867; vol. v, p. 213, pl. lxxv, fig. 2, 1869; Proc. Zool. Soc., p. 353, 1884.
1873—76. *Turbonilla interstincta*, Seguenza, Boll. R. Com. Geol. d'Ital., vol. iv, p. 354, no. 304, 1873; *T. Pyrgulina interstincta*, vol. vii. p. 92, no. 551, 1876.
1878. *Parthenia interstincta*, G. O. Sars, Moll. Reg. arct. Norv., pp. 200, 360, 400, pl. xi, fig. 2, pl. xxii, fig. 14.
1878—1884. *Parthenina interstincta*, Monterosato, Enum. e Sinon. Conch. Medit. (Giorn. Soc. Sci. Nat. Palermo, vol. xiii), p. 92, 1878; *Pyrgulina interstincta*, Nom. Gen. e Spec. Conch. Medit., p. 86, 1884.
1883. *Turbonella* (*Parthenina*) *interstincta*, Bucquoy, Dautzenberg et Dollfus, Moll. mar. Rouss., vol. i, p 169, pl. xx, fig. 7.
1886. *Odostomia interstincta*, Kendall and R. G. Bell, Quart. Journ. Geol. Soc., vol. xlii, p. 212.
1890. *Parthenina* (*Pyrgulina*) *interstincta*, Carus, Prod. Faun. Medit., vol. ii, p. 277.
1892. *Pyrgulina interstincta*, Sacco, Moll. Terr. Terz. Piem., pt. xi, p. 66.
1892. *Parthenina interstincta*, Locard, Coq. mar. Côtes de France, p. 144.
1892—98. *Chemnitzia interstincta*, A. Bell, Rep. Yorks. Phil. Soc., p. 63, 1892; Proc. Roy. Irish Acad. [3], vol. ii, p. 628, 1893; Trans. Roy. Geol. Soc. Cornwall, vol. xii, p. 148, 1898.
1900. *Odostomia interstincta*, Marshall, Journ. of Conch., vol. ix, p. 292.
1901. *Pyrgulina interstincta*, Conch. Soc. List, Journ. of Conch., vol. x, p. 20, no. 448.
1901. *Parthenia interstincta*, Brøgger, Norges geol. Undersøgelse, No. 31, p. 661, pl. xvii, fig. 6.
1905. *Parthenina interstincta*, Kobelt, Icon. schalentrag. europ. Meeresconch., vol. iii, p. 114, pl. lxx, figs. 1, 2.
1913. *Pyrgulina interstincta*, Dautzenberg et Durouchoux, Feuille Jeunes Natur., vol. xliv, p. 37, pl. iii, fig. 13.
1914. *Parthenina interstincta*, Cerulli-Irelli, Palaeont. Ital., vol. xx, p. 260, pl. xxii, figs. 61, 66.

Specific Characters.—Shell minute, oblongo-conical, rather solid; whorls 5—6, compressed, shelving abruptly towards a narrow and excavated suture; the last about one-half the total length; ornamented by numerous closely-set costæ with rows of obscure spiral striæ below the periphery, marked by inconspicuous punctures at the base of the whorls, and a smooth base; spire more or less elongate, tapering to a blunt point; mouth oval, angulate above, expanded below.

Dimensions.—L. 2 mm. B. 1 mm.

Distribution.—Recent : British seas, generally diffused. Lofoten Islands, Norwegian and French Coasts, Canary Islands, Mediterranean as far east as Tunis, Adriatic.

Fossil : St. Erth. Coralline Crag : Sutton. Irish estuarine clays. Pliocene : Altavilla. Pleistocene : Sicily, Calabria, Tuscany. *Tapes*-banks : Christiania (Brøgger), Trondhjem (Øyen).

Remarks.—The specimens figured under this name, including the var. *terebellum*, have been identified by M. Dautzenberg as belonging to the present species. As a British fossil it was reported from St. Erth by Messrs. Kendall and Bell, as *Odostomia pupa* from the Coralline Crag of Sutton by S. V. Wood in 1848, and more recently by A. Bell from the estuarine clays of Belfast. Originally grouped with *Odostomia* it has been widely known as *Parthenina*, (*Parthenia*), but for some years the use of that generic name has been more or less discontinued in favour of *Pyrgulina*, which has now been adopted for the present species and for some forms closely allied to it.

Var. **terebellum** (Philippi). Plate XLIX, fig. 49.

1844. *Chemnitzia terebellum*, Philippi, Enum. Moll. Sic., vol. ii, p. 138, pl. xxiv, fig. 12.
1867. *Odostomia interstincta*, var. *terebellum*, Jeffreys, Brit. Conch., vol. iv, p. 152.
1873. *Turbonilla interstincta*, var. *terebellum*, Weinkauff, Cat. europ. Meeresconch., p. 25.
1900. *Odostomia interstincta*, var. *terebellum*, Marshall, Journ. of Conch., vol. ix, p. 292.
1905. *Parthenina interstincta*, var. *terebellum*, Kobelt, Icon. schalentrag. europ. Meeresconch., vol. iii, p. 115.
1913. *Pyrgulina interstincta*, var. *terebellum*, Dautzenberg et Durouchoux, Feuille Jeunes Natur. vol. xliv, p. 37.
1920. *Pyrgulina interstincta*, var. *terebellum*, Dautzenberg, Journ. de Conch., vol. lxv, p. 54.

Varietal Characters.—Somewhat larger, with an elongate and more slender spire. The suture seems to be more distinctly channelled.

Dimensions.—L. 3 mm. B. 1 mm.

Distribution.—Recent : Oxwich Bay, Swansea ; Cork, Channel Islands, Torbay, Plymouth. Bay of Saint Malo.

Fossil : St. Erth, Sicily, Panormus.

Remarks.—Although originally described by Philippi as specifically distinct, the present shell has been generally regarded as a variety of *Pyrgulina interstincta*. The difference between our two specimens seems but slight, but it has been recognised by M. Dautzenberg.

Pyrgulina scalaris (Philippi). Plate XLIX, fig. 43.

1836—44. *Melania scalaris*, Philippi, Enum. Moll. Sic., vol. i, p. 157, pl. ix, fig. 9, 1836 ; *Chemnitzia scalaris*, vol. ii, p. 137.
1848—84. *Odostomia scalaris*, Jeffreys, Ann. Mag. Nat. Hist. [2], vol. ii, p. 346, 1848 ; Brit. Conch., vol. iv, p. 160, 1867 ; vol. v, p. 213, pl. lxxv, figs. 7, 8, 1869 ; Proc. Zool. Soc. London, p. 355, 1884.

1853. *Chemnitzia scalaris*, Forbes and Hanley, Brit. Moll., vol. iii, p. 251, pl. xciv, fig. 5.
1859. *Chemnitzia scalaris*, G. B. Sowerby, Ill. Ind. Brit. Shells, pl. xvi, fig. 9.
1868. *Turbonilla scalaris*, Weinkauff, Cat. europ. Meeresconch., no. 442, p. 25.
1873—76. *Turbonilla scalaris*, Seguenza, Boll. R. Com. Geol. Ital., vol. iv, p. 354, no. 307, 1873; (*Pyrgulina*), vol. vii, p. 92, no. 548, 1876.
1878. *Turbonilla scalaris*, G. O. Sars, Moll. Reg. arct. Norv., p. 360.
1878. *Odostomia* (*Pyrgostelis*) *scalaris*, Monterosato, Enum. e. Sinon. Conch. Medit. (Giorn. Soc. Sci. Nat. Palermo, vol. xiii), p. 93.
1883. *Odostomia scalaris*, Bucquoy, Dautzenberg et Dollfus, Moll. mar. Rouss., vol. i, p. 175, pl. xxi, figs. 4, 5.
1892. *Parthenina scalaris*, Locard, Coq. mar. Côtes de France, p. 143.
1892—93. *Chemnitzia scalaris*, A. Bell, Rep. Yorks. Phil. Soc., p. 63, 1892; *Odostomia scalaris*, Roy. Phys. Soc. Edin., vol. xii, p. 25, 1893.
1901. *Pyrgostelis scalaris*, Conch. Soc. List, Journ. of Conch., vol. x, p. 20, no. 453.
1905. *Parthenina* (*Pyrgostelis*) *scalaris*, Kobelt, Icon. schalentrag. europ. Meeresconch., vol. iii, p. 129, pl. lxxiii, figs. 6, 8, 20—21.
1913. *Pyrgulina scalaris*, Dautzenberg et Durouchoux, Feuille Jeunes Natur., vol. xliv, p. 38, pl. iii, fig. 15.

Specific Characters.—Shell small, lanceolate, subscalariform, slender; whorls compressed, more or less distinctly angulate above; upper ones without sculpture, the others ornamented by laminar longitudinal ribs, varying in number, generally straight, extending to the suture but not to the base, with fine and closely-set lines in the interspaces; suture deep, rather oblique; spire gradually tapering towards a blunt apex; mouth oval, contracted above, rounded below; outer lip angulated by the keel, incurved below the periphery; inner lip slightly reflected towards the base; umbilicus none.

Dimensions.—L. 5 mm. B. 1·5 mm.

Distribution.—*Recent:* British coasts, principally west and south; Norway; from Cherbourg to Vigo Bay and Gibraltar, Mediterranean, Adriatic.

Fossil: Selsey, Largo Bay.

Pliocene: Altavilla.

Pleistocene: Messina, Livorno.

Remarks.—This species, unknown from St. Erth, has been reported by Mr. A. Bell from Selsey and Largo. It seems a distinct though somewhat variable form, some of the figures given by the authors quoted above, as, for example, that of Forbes and Hanley, being more distinctly angulate and scalariform than others. It has been referred by the Conchological Society, the Marchese di Monterosato, Herr Kobelt and some others to *Pyrgostelis*.

Pyrgulina spiralis (Montagu). Plate XLIX, figs. 44–47.

1803. *Turbo spiralis*, Montagu, Test. Brit., pt. ii, p. 323, pl. xii, fig. 9.
1846. *Turbonilla spiralis*, Lovén, K. Svensk. Vet.-Akad. Förh., vol. iii, p. 91.
1848. *Odostomia spiralis*, Jeffreys, Ann. Mag. Nat. Hist. [2], vol. ii, p. 342, 1848; Brit. Conch., vol. iv, p. 154, 1867; vol. v, p. 213, pl. lxxv, fig. 3, 1869; Proc. Zool. Soc. London, p. 352, 1884.

1853. *Odostomia spiralis*, Forbes and Hanley, Brit. Moll., vol. iii, p. 299, pl. xcvii, fig. 2.
1859. *Odostomia spiralis*, G. B. Sowerby, Ill. Ind. Brit. Shells, pl. xvii, fig. 29.
1878. *Parthenia spiralis*, G. O. Sars, Moll. Reg. arct. Norv., pp. 200, 360, 400, pl. xi, fig. 4.
1886. *Odostomia spiralis*, Kendall and R. G. Bell, Quart. Journ. Geol. Soc., vol. xlii, p. 212.
1890. *Parthenina spiralis*, Carus, Prod. Faun. Medit., vol. ii, p. 279.
1892. *Parthenina spiralis*, Locard, Coq. mar. Côtes de France, p. 145, fig. 126.
1892—98. *Chemnitzia spiralis*, A. Bell, Rep. Yorks. Phil. Soc., p. 63, 1892; *Odostomia* (*Rissoa*) *spiralis*, Trans. Roy. Geol. Soc. Cornwall, vol. xii, p. 149, 1898.
1898. *Odostomia* (*Parthenina*) *spiralis*, Bucquoy, Dautzenberg et Dollfus, Moll. mar. Rouss., vol. ii, p. 794.
1900. *Odostomia spiralis*, Marshall, Journ. of Conch., vol. ix, p. 295.
1901. *Parthenia spiralis*, Brøgger, Norges geol. Undersøgelse, no. 31, p. 657, pl. v, fig. 14.
1901. *Parthenia spiralis*, Friele og Grieg, Norske Nordhav. Exped., no. 3 (Mollusca), p. 81.
1901. *Spiralinella spiralis*, Conch. Soc. List, Journ. of Conch., vol. x, p. 20, no. 451.
1905. *Parthenina spiralis*, Kobelt, Icon. schalentrag. europ. Meeresconch., vol. iii, p. 128, pl. lxxi, figs. 11, 12.
1914. *Parthenina spiralis*, Cerulli-Irelli, Palaeont. Ital., vol. xx, p. 264, pl. xxiii, figs. 9—14.
1913. *Pyrgulina spiralis*, Dautzenberg et Durouchoux, Feuille Jeunes Natur., vol. xliv, p. 38, pl. iii, fig. 12.
1920. *Pyrgulina spiralis*, Dautzenberg, Journ. de Conch., vol. lxv, p. 54.

Specific Characters.—Shell minute, rather solid, ovato-conical; whorls 5—6, flattened, rapidly enlarging, the last about three-fifths of the total length; ornamented by numerous rather inconspicuous ribs which are cut off at the periphery by a series of spiral ridges generally continuous over the base; spire short, pyramidal, ending in a blunt point; suture narrow, excavated, nearly straight; mouth ovate, angulate above, rounded below.

Dimensions.—L. 2 mm. B. 1·25 mm.

Distribution.—Recent: British Seas, widely distributed. Norwegian Coasts from the Christiania fiord to Finmark. Lofoten Islands, Sweden, West Atlantic, Mediterranean.

Fossil: St. Erth. Selsey.

Pleistocene: Dalmuir and elsewhere in Scotland.

Holocene: Portrush, *Mya*-, *Isocardia*- and *Tapes*-banks, Christiania fiord.

Remarks.—This variable species, which has a wide range as a recent shell and is very common in the Pleistocene beds of Scotland, has not been met with in the Anglo-Belgian Crag, though it has been reported by Messrs. Kendall and R. G. Bell and by Mr. A. Bell from St. Erth, and by the latter from Selsey. The four specimens here figured are from the Museums at South Kensington, Jermyn St. and York respectively, two of them bearing the name of *Odostomia eximia* and a third of *O. interstincta*. More correctly, I consider, they should be all identified with *Pyrgulina spiralis*, a species the type of which is conical in form, and specially distinguished by its sculpture, which shows the longitudinal costæ of the upper part of the shell to be cut off abruptly at the periphery by a series of spiral ridges, generally continuous to the base. The three figures here given vary in form, but

conform more or less nearly to these details. M. Dautzenberg has kindly verified my specimens, and has identified one of them (fig. 47) with var. *elongata*, Philippi. Mr. Marshall records the existence of a variety which has the longitudinal costæ obsolete on the last whorl, the result, he thinks, of a fresh start in growth after a breakdown or rest.[1]

Genus **MIRALDA**, A. Adams, 1863.

Miralda excavata (Philippi). Plate XLIX, fig. 50.

1836—44. *Rissoa excavata*, Philippi, Enum. Moll. Sic., vol. i, p. 154, pl. x, fig. 6, 1836; vol. ii, p. 128, 1844.
1848—84. *Odostomia excavata*, Jeffreys, Ann. Mag. Nat. Hist. [2], vol. ii, p. 345, 1848; Brit. Conch., vol. iv, p. 158, 1867; vol. v, p. 213, pl. lxxv, fig. 6, 1889; Proc. Zool. Soc. Lond., p. 352, 1884.
1853. *Odostomia excavata*, Forbes and Hanley, Brit. Moll., vol. iii, p. 305, pl. xcvii, figs. 3, 4.
1859. *Odostomia excavata*, G. B. Sowerby, Ill. Ind. Brit. Shells, pl. xvii, fig. 31.
1873—76. *Turbonilla excavata*, Seguenza, Boll. R. Com. Geol. Ital., vol. iv, p. 354, no. 299, 1873; *T.* (*Pyrgolina*) *excavata*, vol. vii, p. 92, no. 554, 1876.
1883. *Odostomia excavata*, Bucquoy, Dautzenberg et Dollfus, Moll. mar. Rousillon, vol. i, p. 177, pl. xix, figs. 16, 17.
1884. *Miralda excavata*, Monterosato, Nomen. Gen. e Spec. Conch. Medit., vol. xiii, p. 85.
1890. *Odostomia excavata*, A. Bell, Proc. Roy. Phys. Soc. Edinb., vol. x, p. 296.
1890. *Parthenina* (*Miralda*) *excavata*, Carus, Prod. Faun. Medit., vol. ii, p. 276.
1892. *Parthenina excavata*, Locard, Coq. mar. Côtes de France, p. 145.
1892. *Pyrgolina* (*Miralda*) *excavata*, Sacco, Moll. Terr. Terz. Piem., pt. xi, p. 70.
1901. *Miralda excavata*, Conch. Soc. List, Journ. of Conch., vol. x, no. 452, p. 20.
1905. *Parthenina excavata*, Kobelt, Icon. schalentrag. europ. Meeresconch., vol. iii, p. 132, pl. lxxi, figs. 21—25.
1913—17. *Miralda excavata*, Dautzenberg, Feuille Jeunes Natur., vol. xliv, p. 37, pl. iii, figs. 16, 17, 1913; *Funicularia excavata*, Journ. de Conch., vol. lxiii, p. 68, 1917.

Specific Characters.—Shell small, pyramidal, solid; whorls 6, turreted, flattened, sharply angulate with a distinct shelf below the suture, gradually enlarging, the last about half the total length; ornamented by spiral ridges, strong and prominent, three on the body-whorl, two on the others, the upper one just below the suture, crossed obliquely by sharp and raised longitudinal ribs which extend to the base and give the shell a strongly cancellated appearance, the points of intersection being nodulous; spire rather short, tapering to a rounded and blunt apex; suture deep and wide, slightly oblique; mouth oval, squarely angulate above, expanded below; outer lip abruptly recurved on the peripheral ridge.

Dimensions.—L. 3 mm. B. 1·5 mm.

[1] Journ. of Conch., vol. ix, p. 295, 1900.

Distribution—Recent: Guernsey, Falmouth, Exmouth, co. Clare, Turbot-bank, Lamlash Bay, N.B. French Coast, Mediterranean, Adriatic, Morocco.

Fossil: Portrush.

Upper Pliocene: Astiano, Monte Mario (Ponzi), Altavilla.

Pleistocene: Livorno, Messina, Monte Pellegrino, Reggio, San Giovanni.

Remarks.—The specimen of the charming and easily recognised shell now figured was sent to Mr. A. Bell by Mr. Kennard, having been obtained from the Holocene deposit at Portrush. I am not aware that it has been verified as a fossil from any other British locality.[1]

Genus **MENESTHO**, Möller, 1842.

Menestho albula (Fabricius). Plate L, fig. 2.

1780. *Turbo albulus*, Fabricius, Faun. Groenl., p. 394.
1842. *Menestho albula*, Möller, Ind. Moll. Groenl., p. 10.
1858. *Monoptygma* (*Menestho*) *albula*, H. and A. Adams, Gen. Rec. Moll., vol. i, p. 235.
1871. *Menestho albula*, Crosskey and Robertson, Trans. Geol. Soc. Glasgow, vol. iii, p. 335.
1871—84. *Menestho albula*, Jeffreys in Prestwich, Quart. Journ. Geol. Soc., vol. xxvii, p. 489, 1871; *Odostomia albula*, Ann. Mag. Nat. Hist. [4], vol. xix, p. 242, 1877; *M. albula*, in Lamplugh, Quart. Journ. Geol. Soc., vol. xl, p. 319, 1884.
1877. *Menestho albula*, Mörch in Rink, Dan. Groenl., p. 436.
1877. *Menestho albula*, Etheridge in Jas. Geikie, Gt. Ice Age, ed. 2, p. 596.
1883. *Menestho albula*, Bush, Proc. U.S. Nation. Mus., vol. vi, p. 242, pl. ix, fig. 11.
1887. *Eulimella* (*Menestho*) *albula*, P. Fischer, Man. Conch., p. 789.
1898. *Menestho albula*, Posselt, Medd. om Grönl., vol. xxiii, p. 234.

Specific Characters.—Shell minute, fairly solid, ovate; whorls 5, convex, the upper one small, twisted; ornamented by strong and prominent spiral ridges, seven or eight on the last whorl, reaching the base; suture deep and channelled; spire elongate, regularly diminishing upwards; mouth small, oval, angulate above; outer lip gently rounded, not expanded; inner lip reflected on the pillar.

Dimensions.—L. 4 mm. B. 2 mm.

Distribution.—Recent: Greenland, Spitzbergen—Ice fiord. Labrador, Grand Banks, Halifax, North Japan (St. John).

Fossil: Waltonian Crag: Walton-on-Naze.

Pleistocene: Bridlington, Paisley, Montreal.

Remarks.—The genus *Menestho*, of which the present arctic species is taken as the type, appears to have been rather better represented as a British fossil than is

[1] Jeffreys reported it from the Coralline Crag in his Zool. Soc. paper (*op. cit.*, p. 352), but this I think, must have been a mistake—possibly "Coralline Crag" should be read "Coralline zone" as in the Brit. Conch., vol. iv, p. 159.

generally supposed. Beside the cases of its occurrence that have been somewhat casually described, several others have lately turned up, forming an interesting group of about 9 distinct English species. The specimen now figured belongs to Mr. Headley, in whose collection it bears, in Jeffreys' writing, the name *M. albula*.

Some difference of opinion exists as to what should be regarded as the most important characteristics by which the genus *Menestho* may be distinguished. The Marchese di Monterosato thinks it should be used for a group of shells with the apex of the Pyramidellidæ and the folded columella of *Actæon*. On the other hand, Reeve and P. Fischer consider that its columella should be entirely free from teeth or folding. In Fischer's Manuel de Conchologie it is said to be a subgenus of *Eulimella*, specially distinguished by its spiral or latticed sculpture. If all the species described here as *Menestho* are correctly identified, such features are not constant.

Menestho suttonensis, S. V. Wood. Plate L, fig. 1.

1882. *Menestho suttonensis*, S. V. Wood, Mon. Crag Moll., 3rd Suppl., p. 9, pl. i, fig. 11.
1890. *Menestho suttonensis*, C. Reid, Plioc. Dep. Brit., p. 247.

Specific Characters.—Shell minute, ovato-turreted; whorls 5, slightly convex, the last about half the total length; ornamented by 3 to 4 distinct spiral ridges; spire regularly decreasing in size upwards; suture well marked; mouth small, ovate, angulated above, rounded below.

Dimensions.—L. 2·5 mm. B. 1 mm.

Distribution.—*Recent:* Not recorded living.

Fossil: Coralline Crag: Sutton.

Remarks.—This shell, known to Wood in 1882 by a unique and somewhat imperfect specimen, was referred by him with some doubt to the genus *Menestho*. It has not been met with since. My figure is photographed from the one published after his death in the last Supplement to the 'Monograph of the Crag Mollusca.'

Menestho truncata, Etheridge and Bell. Plate L, fig. 3.

1898. *Menestho truncata*, A. Bell, Trans. Roy. Geol. Soc. Cornwall, vol. xii, p. 154.

Specific Characters.—Shell minute, ovate; whorls 5, slightly convex, the last tumid, much the largest, three-fourths the total length; spire short, regularly diminishing upwards to a rounded and truncated point; ornamented by well-defined spiral ridges which extend to the base; suture slight; mouth ovate; outer lip gently rounded, incurved at the periphery; umbilical chink small, inconspicuous.

Dimensions.—L. 2 mm. B. 1 mm.

Distribution.—Not recorded living.

Fossil: St. Erth.

Remarks.—Mr. Bell states (*op. cit.*) that there is a specimen of this shell from St. Erth in the Warburton Collection, but I have not seen it. Comparing the one from the British Museum now figured with that next to be described, which belongs to a similar group, but is not the same, it is interesting to find these two distinct forms, one from St. Erth and the other from Bridlington, representing deposits widely different both as to age and locality, which are yet closely allied.

Menestho derivata (S. V. Wood). Plate L, fig. 4.

1878. *Rissoa sulcosa*, Leche, not Mighels (*fide* Odhner), K. Svensk. Vet.-Acad. Handl., vol. xvi, p. 39.
1879. *Odostomia derivata*, S. V. Wood, Mon. Crag Moll., 2nd Suppl., p. 40 (fig.).
1884. *Amaura sulcosa*, Jeffreys in Lamplugh, Quart. Journ. Geol. Soc., vol. xl, p. 319.
1915. *Menestho truncatula*, Odhner, K. Svensk. Vet.-Akad. Handl., vol. liv, p. 175, pl. i, figs. 13–16.

Specific Characters.—Shell small, ovato-elongate; whorls 4—5, compressed, squarely turreted, the last much the largest, two-thirds the total length; ornamented by fine and more or less inconspicuous spiral lines extending to the base; spire elevated, diminishing rapidly in size upwards to a rounded and truncated point; suture deep, somewhat channelled; mouth ovate, equal to the spire, angulate above, rounded and a trifle expanded below; umbilical chink very slight.

Dimensions.—L. 4 mm. B. 2 mm.

Distribution.—*Recent:* East Greenland, Spitzbergen, Nova Zembla.

Fossil: Icenian Crag: Bramerton. Bridlington.

Remarks.—The minute fossils here described, several specimens of which were found by Mr. Bell when examining Mr. Headley's Collection, are, I think, the same as the one from Bramerton figured by Wood in 1879 (*op. cit.*) as *Odostomia derivata*. The latter had been discovered by Mr. Jas. Reeve among a quantity of small shells he had extracted from the sand of the Bramerton pit, being afterwards sent for examination to the former, who considered they were not genuine Crag fossils but might have been introduced from some Upper Eocene or Oligocene deposit, once existing in North-Eastern Norfolk, through which a stream had discharged into the Fluvio-marine (Icenian) estuary. The presence of similar forms now existing near Spitzbergen and formerly in the glacial deposits of Bridlington seems to me unfavourable to the derivative hypothesis. In 1884 Jeffreys referred our fossils to the *Rissoa sulcosa* of Leche, but that specific name had been already used by Mighels (1843) for what Dr. Odhner states was a different shell.[1] In 1915 the latter authority proposed to call the former *Menestho trun-*

[1] See *Phasianella sulcosa* in Gould's Inv. Mass., ed. 2, p. 297, fig. 565, 1870.

catula, but if we consider it identical with Wood's *O. derivata*, that name (1879), although, as I think, unsuitable, has the priority. The *M. truncatula* of Odhner and the *O. derivata* of Wood correspond closely both in form and sculpture, though in our specimen the spiral marking seems somewhat finer.

Menestho Stefanisi (Jeffreys). Plate L, fig. 5.

1842—72. *Rissoa costulata* (pt), S. V. Wood (non Alder), Ann. Mag. Nat. Hist. [1], vol. ix, p. 533, 1842 ; Mon. Crag Moll., pt. i, p. 106, pl. xi, fig. 12 *a*, 1848 ; *R. Stefanisi*, 1st. Suppl., pt. i, p. 73, 1872.
1869—84. *Rissoa Stefanisi* (pt.), Jeffreys, Brit. Conch., vol. v, p. 208, 1869 ; in Prestwich (pt.), Quart. Journ. Geol. Soc., vol. xxvii, pp. 145, 491, 1871 ; Proc. Zool. Soc., p. 123, 1884.
1870. *Rissoa Stefanisi*, A. Bell, Journ. de Conch., vol. xviii, p. 355.
1872. *Rissoa Stefanisi*, A. and R. Bell, Proc. Geol. Assoc , vol. ii, pp. 204, 210.
1890. *Rissoa Stefanisi*, C. Reid, Plioc. Dep. Brit., p. 255.

Specific Characters.—Shell small, elongato-turreted ; whorls 6, compressed, squarely angulate below the suture ; ornamented by numerous longitudinal costæ, slightly nodulous on the keel, with narrow interspaces, and by delicate spiral lines ; suture deep, slightly channelled ; spire gradually decreasing upwards towards a small and rounded point ; mouth ovate, angulate above, rounded below, striated within ; umbilicus small.

Dimensions.—L. 6 mm. B. 2 mm.

Distribution.—Recent : Mediterranean (rare). Teneriffe.

Fossil : Coralline Crag : Gedgrave, Sutton. Waltonian : Walton-on-Naze, Little Oakley. Newbournian : Waldringfield. Biot. Sicily.

Remarks.—Two shells, differing materially in form and sculpture, were described in 1848 by Wood as *Rissoa costulata*. At present they are both known generically as *Menestho*, but specifically are regarded as distinct, the larger of the two, the one here figured as *M. Stefanisi* (Pl. L, fig. 5), retaining that name, which was suggested by Jeffreys as the result of an examination of General Stefani's Collection at Naples[1] where he found a specimen of the shell in question said to have been obtained in Sicily, though the precise locality from which it came is not stated. The supposed occurrence of this species at Waldringfield is somewhat doubtful.

Menestho Jeffreysii, A. Bell. Plate L, fig. 6.

1842—74. *Rissoa costulata* (pt.), S. V. Wood (not Alder), Ann. Mag. Nat. Hist. [1], vol. ix, p. 533, 1842 ; Mon. Crag Moll., pt. i, p. 106, pl. xi, fig. 12 *b*, 1848 ; *Menestho Jeffreysii*, 1st Suppl., pt. ii, pp. 185, 208, 1874.
1871—1911. *Menestho Jeffreysii*, A. Bell, Ann. Mag. Nat. Hist. [4], vol. vii, p. 360, 1871 ; Journ. Ipsw. Field Club, vol. iii, p. 15, 1911.

[1] Brit. Conch., vol. v, p. 208.

1872. *Menestho Jeffreysii*, A. and R. Bell, Proc. Geol. Assoc., vol. ii, p. 209.
1882. *Rissoa Stephanisi*, Nyst, Conch. Terr. tert. Belg., p. 96, pl. xxviii, fig. 12.
1882. *Rissoa Stephanisi*, Van den Broeck, Ann. Soc. malac. Belg., vol. xvii, p. 204.
1890. *Menestho Jeffreysii*, C. Reid, Plioc. Dep. Brit., p. 246.

Specific Characters.—Shell small, oblongo-turreted; whorls 5, convex, obtusely but slightly shouldered above, gradually and regularly diminishing upwards to an abrupt and bluntly pointed apex; ornamented by strong well-marked costæ, about 15 on the body-whorl, nearly reaching the base of the shell, about equal in width to the interspaces; also by fine but distinct spiral ridges; spire elongate, with a rather deep suture; mouth suboval, obtusely angulate above, rounded and slightly projecting below.

Dimensions.—L. 3·5 mm. B. 1·5 mm.

Distribution.—*Recent:* Greenland (Jeffreys).

Fossil: Coralline Crag: Sutton, Boyton. Waltonian: Walton-on-Naze, Little Oakley.

Remarks.—As stated above, Wood described in 1844 two shells as *Rissoa costulata* (*op. cit.*, pl. xi, figs. 12*a* and 12*b*). In 1869 the name of the former was changed by Jeffreys (Brit. Conch., p. 208) to *R. Stefanisi*. In 1871, however, A. Bell proposed the generic term *Menestho* for both, which has since been generally accepted. The smaller of the two he considered to be a different species, calling it *M. Jeffreysi*—a compliment which Jeffreys accepted.

The specimen now figured under the latter name was found in the Coralline Crag of Sutton. The one described by Nyst (*op. cit.*) is evidently the same.

Menestho britannica, A. Bell. Plate L, figs. 7, 8.

1871. *Menestho britannica*, A. Bell, Ann. Mag. Nat. Hist. [4], vol. vii, p. 360.
1872. *Menestho Brittanica*, A. and R. Bell, Proc. Geol. Assoc., vol. ii, p. 203.
1874. *Menestho Britannica*, S. V. Wood, Mon. Crag Moll., 1st. Suppl., pt. ii, p. 185, add. pl., fig. 21.
1890. *Menestho britannica*, C. Reid, Plioc. Dep. Brit., p. 246.

Specific Characters.—Shell slender, turreted; whorls 8—9, convex, without spiral sculpture; spire elongate, somewhat compressed at the apex, base rounded; suture oblique, slightly channelled; mouth oval, short, about one-fourth the total length, angulated above.

Dimensions.—L. 8 mm. B. 2 mm.

Distribution.—Not known living.

Fossil: Coralline Crag: Sutton.

Remarks.—Some difference of opinion exists as to the identification of this little shell. There are two specimens under this name in the York Museum, one of them bearing the small red tablet, indicating that it is the one originally received

by Wood from R. G. Bell, figured as the typical form. This is my fig. 7. Wood's figure is similar in form but considerably shorter. There is another in the York Collection with a much longer and conical spire (fig. 8), which I suggest may be called var. *elongata*. This, I believe, has been generally known as *M. lævigata*, but it differs widely from that represented as such in the first part of the first Supplement of the Mon. Crag Moll. I have no specimen of this, and must refer the student to the drawing of it and to the description given in my next paragraph.

Menestho lævigata, S. V. Wood.

1872. *Menestho lævigata*, S. V. Wood, Mon. Crag Moll., 1st Suppl., pt. i, p. 57, pl. iv, fig. 19.
1890. *Menestho lævigata*, C. Reid, Plioc. Dep. Brit., p. 246.

Specific Characters.—Shell elongate, turreted, smooth, with a rather obtuse apex; whorls 8—9, flattened; mouth ovate, angulate above, a fifth part of the total length. Columella incurved; outer lip simple, acute.

Dimensions.—L. 9 mm. B. 4 mm.

Distribution.—Not known living.

Fossil: Coralline Crag: Sutton.

Remarks.—Wood informs us that only a few imperfect specimens, and one perfect, had been found by him in the Coralline Crag, and that the latter was destroyed while in the hands of the artist. If the only figure we possess is correctly drawn—which seems to me somewhat doubtful—it differs from the *M. britannica* of A. Bell. Further inquiry may decide.

Menestho basistriata, Etheridge and Bell. Plate L, fig. 9.

1893—98. *Menestho basistriata*, A. Bell, Proc. Roy. Irish Acad. [3], vol. ii, p. 627, 1893; Trans. Roy. Geol. Soc. Cornwall, vol. xii, p. 154, 1898.

Specific Characters.—Shell minute, fairly solid, slender; whorls 5, but slightly convex, the last more than half the total length, ornamented by fine spiral striæ on the lower part; suture well marked; spire elongate, regularly tapering; mouth ovate, narrow; somewhat expanded below, angulate above.

Dimensions.—L. 2·5 mm. B. 1 mm.

Distribution.—Not known living.

Fossil: St. Erth.

Remarks.—This minute shell has only been reported from St. Erth. It is specially characterised, as the name denotes, by the fine but distinct striation of the basal part of the body-whorl.

Genus **EULIMA**, Risso, 1826.

Eulima polita (Linné). Plate L, fig. 10.

1758. *Turbo politus*, Linné, Syst. Nat., ed. 10, p. 767, no. 570.
1836—44. *Melania Boscii*, Philippi, Enum. Moll. Sic., vol. i, p. 157, 1836; *Eulima polita*, vol. ii, p. 134, 1844.
1853. *Eulima polita*, Forbes and Hanley, Brit. Moll., vol. iii, p. 229, pl. xcii, figs. 1, 2.
1859. *Eulima polita*, G. B. Sowerby, Ill. Ind. Brit. Shells, pl. xv, fig. 22.
1867—84. *Eulima polita*, Jeffreys, Brit. Conch., vol. iv, p. 201, 1867; vol. v, p. 214, pl. lxxvii, fig. 3, 1869; in Prestwich, Quart. Journ. Geol. Soc., vol. xxvii, pp. 143, 488, 1871; Proc. Zool. Soc. London, p. 366, 1884.
1870—98. *Eulima polita*, A. Bell, Journ. de Conch., vol. xviii, p. 350, no. 335, 1870; Proc. Roy. Phys. Soc. Edinb., vol. x, p. 296, 1890; Proc. Roy. Irish Acad. [3], vol. ii, p. 628, 1893; Trans. Roy. Geol. Soc. Cornwall, vol. xii, p. 146, 1898.
1872. *Eulima polita*, A. and R. Bell, Proc. Geol. Assoc., vol. ii, pp. 203, 209, 213.
1873—76. *Eulima polita*, Seguenza, Boll. R. Com. Geol. Ital., vol. iv, p. 352, no. 268, 1873; vol. vii, p. 12, no. 509, 1876.
1878. *Eulima polita*, G. O. Sars, Moll. Reg. Arct. Norv., p. 360.
1883. *Eulima polita*, Bucquoy, Dautzenberg et Dollfus, Moll. mar. Rouss., vol. i, p. 188, pl. xxi, figs. 17, 18.
1884. *Eulima polita*, Monterosato, Nomen. Gen. e Spec. Conch. Medit., p. 100.
1886. *Eulima polita*, Kendall and R. G. Bell, Quart. Journ. Geol. Soc. vol. xlii, p. 212.
1890—92. *Eulima polita*, Sacco, Boll. Soc. Geol. Ital., vol. ix, p. 185, no. 2007, 1890; Moll. Terr. Terz. Piem., pt. xi, p. i, pl. i, fig. 1, 1892.
1892. *Eulima polita*, Locard, Coq. mar. Côtes de France, p. 133, fig. 117.
1905. *Eulima polita*, Kobelt, Icon. schalentrag. europ. Meeresconch, vol. iii, p. 188, pl. lxxvii, fig. 1.
1914. *Eulima polita*, Cerulli-Irelli, Palaeont. Ital., vol. xx, p. 244, pl. xxi, figs. 42–45.

Specific Characters.—Shell strong, solid, and opaque, glossy, elongato-conical; whorls nearly flat, compact, gradually enlarging, the last about one-third the total length, sculpture microscopical; spire long, cylindrical, regularly tapering, the upper part occasionally curved; suture linear, slightly oblique; mouth ovate, angulate above, rounded below, a trifle expanded; outer lip gently curved; inner lip rather wide, thickened behind the pillar; base rounded, not angulate.

Dimensions.—L. 7—15 mm. B. 3—5 mm.

Distribution.—*Recent:* British seas, from Jersey to Unst, generally distributed. Finmark, Norwegian coast to the Mediterranean, Adriatic and Ægean.

Fossil: St. Erth. Coralline Crag: Sutton, Boyton. Waltonian: Walton-on-Naze, Little Oakley. Newbournian: Waldringfield, Sutton. Butleyan: Butley. Icenian: Bramerton, Portrush.

Lower Pliocene: Biot.

Upper Pliocene: Astiano, Monte Mario, Val d'Era, Bologna, Livorno.

Pleistocene: Messina, Ficarazzi, Livorno, Valle Biaia. Christiania—*Isocardia* and *Tapes*-banks.

Remarks.—Two varieties of this widely diffused and abundant recent form were recorded by Wood from the English Crag in 1848, one of them (*op. cit.* pl. xix, fig. 1 *b*) having a contorted, the other (fig. 1 *a*) a straight spire, but in his tabular list of 1874 (p. 208) he referred the latter to *E. intermedia*. Both as a recent and a fossil shell *E. polita* appears to vary considerably in form, size, the number of its whorls and the curvature of the spire.[1]

The specimen from Oakley here figured agrees closely with Wood's shells, including a slightly bent spire. Mr. A. Bell also states (*op. cit.*, p. 146) that there is a perfect example similarly curved in the Warburton Collection of St. Erth fossils.

Eulima stenostoma, Jeffreys. Plate L, fig. 11.

1858—84. *Eulima stenostoma*, Jeffreys, Ann. Mag. Nat. Hist. [3], vol. ii, p. 128, pl. v, fig. 7, 1858; Brit. Conch., vol. iv, p. 207, 1867; vol. v, p. 215, pl. lxxvii, fig. 6, 1869; Ann. Mag. Nat. Hist. [4], vol. xix, p. 317, 1877; Proc. Zool. Soc. London, p. 371, 1884.

1859. *Eulima stenostoma*, G. B. Sowerby, Ill. Ind. Brit. Shells, pl. xv, fig. 24.

1873. *Eulima stenostoma*, Weinkauff, Cat. europ. Meeresconch., p. 23, no. 398.

1878. *Eulima stenostoma*, G. O. Sars, Moll. Reg. Arct. Norv., pp. 211, 360, vol. xi, fig. 21.

1884. *Italiella stenostoma*, Monterosato, Nomen. Gen. e Spec. Conch. Medit., p. 104.

1890. *Eulima (Italiella) stenostoma*, Carus, Prod. Faun. Medit., vol. ii, p. 290.

1893—98. *Eulima stenostoma*, A. Bell, Proc. Roy. Irish Acad. [3], vol. ii, p. 629, 1893; Trans. Roy. Geol. Soc. Cornwall, pl. xii, p. 146, 1898.

1898. *Eulima (Italiella) stenostoma*, Bucquoy, Dautzenberg et Dollfus, vol. ii, p. 795.

1898. *Eulima stenostoma*, Posselt, Medd. om Grönl., vol. xxiii, p. 222.

1901. *Eulima stenostoma*, Conch. Soc. List, Journ. of Conch., p. 21, no. 472.

1905. *Eulima (Italiella) stenostoma*, Kobelt, Icon. schalentrag. europ. Meeresconch., vol. iii, p. 203, pl. lxxviii, figs. 12, 13.

1915. *Melanella (Eulima) stenostoma*, Johnson, Bost. Soc. Nat. Hist., Occ. papers, vol. vii, Fauna of New England, No. 13, p. 91.

Specific Characters.—Shell thin, slender, elongate, subulate; whorls 9, smooth, compressed, gently swelling downwards, the last much the largest, nearly one-half the total length; spire attenuate, drawn out, ending abruptly in a blunt and semi-globular point; suture oblique, well defined; mouth long, narrow, acutely angulate above, round and expanded below; outer lip thin, expanded towards the base; inner lip reflected, covering the lower part of the pillar.

Dimensions.—L. 8 mm. B. 2 mm.

Distribution.—Recent: Shetland (rare), Lofoten Islands, Norwegian coast, Finmark to the Christiania fiord, Greenland. New England—St. Lawrence. Bay of Biscay, Mediterranean.

Fossil: St. Erth, Coralline Crag: Sutton. Waltonian: Walton-on-Naze.

[1] Kobelt figures 8 specimens (*op. cit.*) under this name differing widely from each other.

Remarks.—Two specimens of this shell are to be found at the British Museum both of them obtained from St. Erth, one labelled "*E. gracilis*" probably by mistake (no. 18204), which M. Dautzenberg considers to approach the typical *E. stenostoma*, another, imperfect, under the latter name (no. 18208), which I think may be referred to the same species. The present shell seems nearly to approach the one figured and described in the next paragraph as *E. bilineata*. I have, however, submitted drawings of both to M. Dautzenberg, and by his advice adopt the identification here proposed. My specimen of *E. stenostoma* seems to be more slender in form than my *E. bilineata*.

Eulima bilineata, Alder. Plate L, fig. 12.

1848. *Eulima bilineata*, Alder, Trans. Tynes. Nat. Field Club, p. 47.
1853. *Eulima bilineata*, Forbes and Hanley, Brit. Moll., vol. iii, p. 237, pl. xcii, fig. 9.
1859. *Eulima bilineata*, G. B. Sowerby, Ill. Ind. Brit. Shells, pl. xv, fig. 26.
1867—69. *Eulima bilineata*, Jeffreys, Brit. Conch., vol. iv, p. 210, 1867; vol. v, p. 215, pl. lxxvii, fig. 8, 1869.
1873—76. *Eulima bilineata*, Seguenza, Boll. R. Com. Geol. Ital., p. 352, no. 273, 1873; vol. v, p. 280, no. 110, 1874; vol. vii, p. 12, no. 511, 1876.
1878. *Eulima bilineata*, G. O. Sars, Moll. Reg. Arct. Norv., pp. 210, 360, pl. xi, fig. 22.
1884. *Subularia bilineata*, Monterosato, Nom. Gen. e Spec. Conch. Medit., p. 103.
1890. *Eulima bilineata*, Carus, Prod. Faun. Medit., vol. ii, p. 290.
1892. *Eulima* (*Leiostraca*) *bilineata*, Locard, Coq. mar. Côtes de France, p. 135.
1892. *Eulima bilineata*, Praeger, Proc. Roy. Irish Acad. [3], vol. ii, p. 264.
1898. *Eulima bilineata*, Bucquoy, Dautzenberg et Dollfus, Moll. mar. Rouss., vol. ii, p. 795.
1901. *Eulima bilineata*, Brøgger, Norges geol. Undersøgelse, no. 31, p. 661, pl. xix, fig. 14.
1901. *Eulima* (*Leiostraca*) *bilineata*, Conch. Soc. List, Journ. of Conch., vol. x, p. 21, no. 476.

Specific Characters.—Shell somewhat less slender than *E. subulata*, fairly solid; whorls 10—14, compressed, regularly diminishing in size to an acute point, the last nearly half the total length; spire tapering, long, narrow, acuminate; suture slight, oblique; mouth acutely angulate above, rounded below; outer lip nearly straight.

Dimensions.—L. 8 mm. B. 2 mm.

Distribution.—*Recent:* British seas, local but widely dispersed from low-water mark at Jersey to east coast of Shetland at 82 feet. Norway from Finmark and the Lofoten Islands to the Christiania fiord. West European, Mediterranean, Adriatic.

Fossil: St. Erth. Estuarine clays—Belfast.

Upper Pliocene: Messina.

Pleistocene: Niso, Reggio, Monte Pellegrino. *Tapes*-banks—Christiania.

Remarks.—There is a specimen from St. Erth in the Warburton Collection at the British Museum under the name of *E. subulata* which M. Dautzenberg

has informed me belongs to the present species. *E. bilineata* was formerly considered a variety of the former, which it nearly resembles, but it is more solid and not quite so slender. Jeffreys remarks that it bears a miniature resemblance to *E. subulata*. The Marchese di Monterosato regards it as belonging to a new and distinct group, *Subularia*. Prof. Seguenza has reported it as fossil from two or three Pleistocene and Pliocene localities in Sicily and Calabria and Prof. Brøgger from the post-glacial *Tapes*-banks of the Christiania fiord.

In the fourth volume of his British Conchology, p. 209, Jeffreys gives an opinion that the specimens figured by Wood and by Nyst as *E. subulata* are not Donovan's shell, but are in all probability the *E. bilineata* of Alder, adding that in their opinion all reported from northern localities should be referred to the latter. This view seems supported by the fact that Prof. G. O. Sars gives *E. bilineata* as a Norwegian species but not *E. subulata*.

On the other hand Prof. Sacco figures fifteen widely different and named varieties of *E.* (*Subularia*) *subulata* from the Italian Pliocene, which show at least that it is a very variable form.

Eulima minima, sp. nov. Plate L, fig. 13.

Specific Characters.—Shell minute, slender, smooth; whorls 5—6, flattened, the last about half the total length, regularly increasing; spire elongate, ending in an acute point, suture slight; mouth small, acutely angulate above, rounded below.

Dimensions.—L. 2 mm. B. 1 mm.

Distribution.—Not recorded living.

Fossil: St. Erth.

Remarks.—The minute specimen here given belongs to the Wood Collection of St. Erth shells in the British Museum, where it has been labelled *E. Stalioi*. It differs materially, however, from the figures of that species which have been represented in the text-books, nor can I find anything else to which it can be satisfactorily referred. I describe it provisionally therefore as new.

Eulima subuliformis, A. Bell, MS. Plate L, fig. 14.

Specific Characters.—Shell slender, subulate, smooth and polished; whorls flat, the last more than half the total length, obtusely but slightly keeled at the periphery; spire elongated; suture slight; mouth long, slender, acutely angulate above.

Dimensions.—L. 8 mm. B. 1·75 mm.

Distribution.—Not known living.

Fossil: St. Erth.

Remarks.—The St. Erth specimen here figured is from the Warburton Collection at the British Museum, and was found some years ago, but not described, by Mr. A. Bell. Although imperfect its distinctive features seem sufficiently shown to entitle it to be considered new. It is specially characterised by the length of the body-whorl and of the mouth.

Eulima fusco-apicata, Jeffreys. Plate L, fig. 15.

1884. *Eulima fusco-apicata*, Jeffreys, Proc. Zool. Soc. London, p. 369, pl. xxviii, fig. 5.
1905. *Eulima fusco-apicata*, Kobelt, Icon. schalentrag. europ. Meeresconch., vol. iii, p. 180, pl. lxxvi, fig. 10.

Specific Characters.—Shell minute, thin, subulate, smooth and glossy; whorls nearly flat; spire slender, elongate, finely tapering to a rounded and twisted apex; suture shallow; mouth oval, acutely angulate above, obtusely angulate below; outer and inner lips straight; periphery sometimes keeled.

Dimensions.—L. 3 mm. B. 0·75 mm.

Distribution.—*Recent:* Bay of Biscay, West Coast of Africa, Cape de Verd islands.

Fossil: St. Erth.

Remarks.—The slightly imperfect specimen from St. Erth figured under the above name is from the British Museum, where it has been doubtfully identified with a minute shell described by Jeffreys, obtained during the "Porcupine" Expedition. So far as it goes our fossil appears to correspond generally with that originally figured by him (*loc. cit.*).

Eulima tenuissima, sp. nov. Plate L, fig. 16.

Specific Characters.—Shell minute, very slender, acutely conical; whorls about 10, flattened, regularly diminishing to a sharp point, the last about one-third the total length, having a distinct keel near the periphery; spire elongated, subulate; suture slight; mouth narrow, acutely angulate above; outer lip straight.

Dimensions.—L. 4 mm. B. 1 mm.

Distribution.—Not recorded living.

Fossil: Coralline Crag: Boyton.

Remarks.—The specimen figured under this name was found by Mr. Bell among some unexamined shelly material obtained some years ago from the Coralline Crag at Boyton. At first he thought it might have been the *Eulima Frielei* of Jordan, described by the latter as having been obtained during the "Triton" Expedition and by Hermann Friele at several places off the coasts of Norway.[1] The periphery of that species, however, was said to have been

[1] Proc. Malac. Soc., vol. i, p. 267, pl. xvi, fig. 6, 1895.

rounded and not keeled, whereas our shell is shown under the microscope to be distinctly angulated. M. Dautzenberg thought it might be the same as the one described by Wood in his first Supplement, pt. i, p. 67, pl. vii, fig. 4, as *E. glabella*, but the original type of that species given in his Monograph of 1848, pt. i, p. 98, pl. xix, fig. 2, is very different, to which our present specimen has but little resemblance and cannot be affiliated.[1] The only solution of the difficulty is to give the latter a new and distinctive name, which it well deserves. It is a special and interesting form.

Eulima robusta, A. Bell, MS. Plate L, fig. 17.

1879. *Eulima robusta,* S. V. Wood, Mon. Crag Moll., 2nd Suppl., p. 28, pl. iv, fig. 17.

Specific Characters.—Shell strong and solid, elongato-conical; whorls about 7, gradually increasing, very slightly convex, the last somewhat less than one-half the total length, with a rounded base; spire comparatively short, regularly tapering to a blunt and twisted apex; suture slight, rather oblique; mouth ovate, acutely angulate above, rounded below; outer lip nearly straight, not expanded; inner lip reflected on the pillar.

Dimensions.—L. 10 mm. B. 3 mm.

Distribution.—Not known living.

Fossil: Coralline Crag: Boyton. Waltonian: Little Oakley. Newbournian: Waldringfield.

Remarks.—This fossil was considered by A. Bell and recognised by Wood as a new and distinct species on the strength of a specimen the former had found at Waldringfield, which the latter regarded as derivative from some older deposit. I have since obtained half a dozen more at Oakley precisely similar, which lead me to the conclusion that at that place at least it is a genuine Crag shell. It is a strong, coarse form with a short truncated spire, apparently distinct from any other of the Crag species of *Eulima*. Wood remarked that the whorls of the Waldringfield fossil were convex, but to neither his specimen nor to mine is this remark altogether applicable, and it was probably an oversight.

Sub-genus **ACICULARIA,** Monterosato, 1884.

Eulima (Acicularia) intermedia (Cantraine). Plate L, figs. 21, 22.

1835. *Eulima intermedia,* Cantraine, Bull. Acad. Roy. Sci. Brux., p. 14.

1848—72. *Eulima polita,* S. V. Wood, Mon. Crag Moll., pt. i, p. 97, pl. xix, fig. 1 *a*, 1848; *E. intermedia,* 1st Suppl., pt. i, p. 67, 1872.

1867—84. *Eulima intermedia,* Jeffreys, Brit. Conch., vol. iv, p. 203, 1867; vol. v, p. 214, pl. lxxvii, fig. 4, 1869; in Prestwich, Quart. Journ. Geol. Soc., vol. xxvii, p. 488, 1871; Proc. Zool. Soc. Lond., p. 366, 1884.

[1] Jeffreys identified Wood's *E. glabella* with *E. Stalioi,* Brusina—a different and distorted species.

1873—76. *Eulima intermedia*, Seguenza, Boll. R. Com. Geol. Ital., vol. iv, p. 352, no. 270, 1873; vol. vii, p. 12, no. 507, 1876.
1878. *Eulima intermedia*, G. O. Sars, Moll. Reg. Arct. Norv., pp. 210, 360, pl. xi, fig. 20.
1878—84. *Eulima intermedia*, Monterosato, Enum. e Sinon., p. 36, 1878; *E.* (*Acicularia*) *intermedia*, Nomen. Gen. e Spec. Conch. Medit., p. 102, 1884.
1886. *Eulima intermedia*, Kendall and R. G. Bell, Quart. Journ. Geol. Soc., vol. xlii, p. 212.
1890. *Eulima* (*Acicularia*) *intermedia*, Carus, Prod. Faun. Medit., vol. ii, p. 289.
1892. *Eulima intermedia*, Locard, Coq. mar. Côtes de France, p. 134.
1892. *Eulima intermedia*, Van den Broeck, Bull. Soc. Belg. Géol., vol. vi (Mémoires), pp. 122, 132.
1893—98. *Eulima intermedia*, A. Bell, Proc. Roy. Irish Acad. [3], vol. ii, p. 628, 1893; Trans. Roy. Geol. Soc. Cornwall, vol. xii, p. 146, 1898.
1901. *Eulima intermedia*, Conch. Soc. List, Journ. of Conch., vol. x, p. 21, no. 469.
1901. *Eulima intermedia*, Marshall, Journ. of Conch., vol. x, p. 122.
1905. *Eulima* (*Acicularia*) *intermedia*, Kobelt, Icon. schalentrag. europ. Meeresconch., vol. iii, p. 181, pl. lxxvii, figs. 9—11.
1914. *Eulima intermedia*, Cerulli-Irelli, Palaeont. Ital., vol. xx, p. 247, pl. xxi, pp. 60—63.

Specific Characters.—Shell more slender than *E. polita*, not so solid, with a narrower, rounded, not angulated base; whorls compact, smooth, flattened; spire elongated, regularly tapering to a rounded (not twisted) point; suture slight; mouth oval, compressed above; inner lip narrow.

Dimensions.—L. 7—15 mm. B. 3—5 mm.

Distribution.—*Recent:* British seas, Guernsey to Shetland, Cork, Galway. North Atlantic. Finmark to Canary Islands, Mediterranean, Adriatic, Ægean.

Fossil: St. Erth. Coralline Crag: Sutton, Boyton. Waltonian: Walton-on-Naze, Little Oakley. Newbournian: Waldringfield, Felixstowe. Butleyan: Butley. Pleistocene: Shewalton.

Lower Pliocene: Biot.

Upper Pliocene (Scaldisien): Belgium. Sicily—Messina, Caltabiano.

Pleistocene: Monte Pellegrino, Ficarazzi, Gravina, Livorno.

Remarks.—Judging from the specimens figured by the authors quoted above, *E. intermedia* appears to be a very variable form. My imperfect specimen from Boyton corresponds closely, however, with a recent shell received from one of my foreign correspondents as typical of *E. intermedia*. Jeffreys remarks that the latter is generally smaller than *E. polita*, having a narrower base, and that it is intermediate between that species and *E. distorta*.

Genus **HEMIACLIS**, G. O. Sars, 1878.

Hemiaclis elongata (Etheridge and Bell). Plate L, fig. 53.

1893—98. *Aclis elongata*, A. Bell, Proc. Roy. Irish Acad. [3], vol. ii, p. 628, 1893; Trans. Roy. Geol. Soc. Cornwall, vol. xii, p. 148, 1898.

Specific Characters.—Shell minute, turreted, smooth; whorls 8, convex, the last considerably enlarged, obtusely angulate at the periphery, about one-half the total length and excavated at the base; spire elongate, gradually diminishing upwards to a small, compressed and acute apex; suture well marked; mouth short, ovate, acutely angulate above, rounded below; outer lip expanded, gently rounded.

Dimensions.—L. 2·5 mm. B. 1 mm.

Distribution.—Not known living.

Fossil: St. Erth.

Remarks.—The specimen here figured was obtained by Mr. A. Bell at St. Erth and described by him in 1893 as a new species. At first he referred it to the *Aclis* of Loven, but it appears to belong rather to an allied genus, *Hemiaclis*, proposed by Prof. G. O. Sars for a small group of Norwegian shells without spiral sculpture. At present our fossil seems to be unique.

Hemiaclis attenuans (Jeffreys). Plate L, fig. 54.

1878. *Aclis* (*Hemiaclis*) *attenuans*, Jeffreys, Ann. Mag. Nat. Hist. [5], vol. xi, p. 396, pl. xvi, fig. 3.
1890. *Aclis attenuans*, Carus, Prod. Faun. Medit., vol. ii, p. 297.
1905. *Aclis* (*Hemiaclis*) *attenuans*, Kobelt, Icon. schalentrag. europ. Meeresconch., vol. iii, p. 59, pl. lxv, figs. 8, 9.

Specific Characters.—Shell minute, smooth, delicate, elongato-conical; whorls 7—8, but little convex, the last less than half the total length: spire regularly diminishing in size upwards; somewhat attenuate near the apex; apex acute; suture well marked, but not deep; mouth small, angulate above, rounded below, laterally expanded; peristome continuous.

Dimensions.— L. 2·5 mm. B. 1 mm.

Distribution.—*Recent:* Crete, south coast.

Fossil: Coralline Crag: Sutton.

Remarks.—The specimen here figured belongs to the York Museum, having been obtained from the Coralline Crag of Sutton. It bears the name of *Alvania* (*? Aclis*) *supranitida*. It does not agree with that species, however, either in form or sculpture, the latter being distinctly striated spirally. The nearest thing I can find to it is the *Aclis attenuans* of Jeffreys—a Mediterranean species, to which I refer it provisionally.

Genus **EULIMENE**, S. V. Wood, 1872.

Eulimene terebellata (Nyst). Plate L, fig. 23.

1835—81. *Melania terebellata*, Nyst, Coq. foss. d'Anvers, p. 24, pl. iv, fig. 9, 1835; Coq. foss. Terr. tert. Belg., p. 413, pl. xxxviii, fig. 12, 1844; *Littorina ? terebellata*, Conch. Terr. tert. Belg., p. 95, pl. vi, fig. 22, 1881.

1848—72. *Paludestrina terebellata*, S. V. Wood, Mon. Crag Moll., pt. i, p. 109, pl. xii fig. 7, 1848; *Eulimene terebellata*, 1st Suppl., pt. i, p. 65, 1872.

1871. *Paludestrina terebellata*, Jeffreys in Prestwich, Quart. Journ. Geol. Soc., vol. xxvii, p. 493.

1872. *Paludestrina terebellata*, A. and R. Bell, Proc. Geol. Assoc., vol. ii, p. 209.

1874—92. *Paludestrina* (*Eulimene*) *terebellata*, Van den Broeck, Ann. Soc. malac. Belg., vol. ix, p 273, 1874; *Littorina terebellata*, Bull. Soc. Belge Géol., vol. vi (Mémoires), p. 133, 1892.

1886. *Hydrobia terebellata*, Kendall and R. G. Bell, Quart. Journ. Geol. Soc., vol. xlii, p. 211.

1893—98. *Eulimene terebellata*, A. Bell, Proc. Roy. Irish Acad. [3], vol. ii, p. 629, 1893; Trans. Roy. Geol. Soc. Cornwall, vol. xii, p. 150, 1898.

1912. *Littorina terebellata*, Tesch, Med. v. d. Rijks. v. Delfstoffen, No. 4, p. 64, no. 137.

1915. *Littorinopsis terebellata*, Cossmann, Paléoconch. comp., vol. x, p. 63, pl. iii, figs. 11, 12.

Specific Characters.—Shell elongato-conical, turreted, strong and solid; whorls 7 or 8, flattened and smooth, with a subangulate base; spire regularly tapering to a blunt and twisted point; suture channelled, but not deep; mouth ovate, angulated above; inner lip slightly reflected, covering the umbilicus.

Dimensions.—L. 16 mm. B. 8 mm.

Distribution.—Not known living.

Fossil: St. Erth. Waltonian Crag: Walton-on-Naze, Beaumont, Little Oakley. Newbournian: Waldringfield, Sutton, Ramsholt, Newbourn, Felixstowe. Butleyan: Hollesley, Butley. Scaldisien: Belgium, Holland.

Remarks.—The genus *Eulimene* was proposed by Wood for the two species here described, which he considered allied to *Niso*, but differing from it by the absence of a large open umbilicus. The present form, recorded only from St. Erth and the Anglo-Belgian basin, is fairly abundant at all the Waltonian localities, but is less so at the later horizons of the Red Crag. It is unknown, however, from the Coralline, and seems to have disappeared from these regions before the commencement of the Icenian period. Although apparently a rather strong and solid form, specimens are so fragile that, as Wood remarks, it is very difficult to obtain any from the Crag that are perfect or unworn, but it is so generally diffused in our Red Crag deposits that it is difficult to regard it as derivative. Examples of the allied species *E. pendula*, which are also common in the earlier part of the Red Crag, although thinner and more delicate, are, on the contrary, generally in a better state of preservation.

Beside the typical form, well represented in Wood's figure, Mr. Bell has described two varieties from St. Erth, one having an elongate and more slender spire, his var. *acuminata*, and another, var. *conica*, which is shorter and more distinctly conical.

E. terebellata, with its varieties, may be distinguished from *E. pendula* by its rather strong, though obtusely, angulated base.

M. Cossmann has rejected Wood's genus *Eulimene* (1872) for the present species, referring it to *Littorinopsis*, Beck (*fide* Mörch, 1876). Nyst's original name for it was *Melania terebellata*.

Var. **acuminata,** Etheridge and Bell. Plate L, fig. 24.

1893—98. *Eulimene terebellata*, var. *acuminata*, A. Bell, Proc. Roy. Irish Acad. [3], vol. ii, p. 629, 1893; *E. acuminata*, Trans. Roy. Geol. Soc. Cornwall, vol. xii, p. 150, pl. iii, fig. 7, 1898.

Varietal Characters.—Shell smaller, more slender and delicate than the type; whorls 7—8, flattened, the last distinctly angulate; faintly ornamented by the lines of growth; spire elongate, regularly diminishing in size upwards to an acute point; suture well defined but not deep; mouth oval, angulated above, patulous below; inner lip reflected on the pillar, obscuring a shallow groove behind.

Dimensions.—L. 14 mm. B. 5 mm.

Distribution.—Not known living.

Fossil: St. Erth. Coralline Crag: Boyton. Scaldisien: Holland.

Remarks.—This shell was originally described by Mr. A. Bell from a specimen obtained by him at St. Erth; when found it was of a deep reddish colour with a bright yellow stripe round the base, but it soon faded and assumed the usual hue of the present fossils. A specimen of this variety was also sent me by Dr. Tesch, from the Scaldisien of one of the Dutch borings at Oploo, which is here represented (fig. 24).

Var. **conica** (R. G. Bell, MS.). Plate L, fig. 25.

1886. *Hydrobia terebellata*, var. *conica*, Kendall and R. G. Bell, Quart. Journ. Geol. Soc., vol. xlii, p. 211.

1893—98. *Eulimene terebellata*, var. *conica*, A. Bell, Proc. Roy. Irish Acad. [3], vol. ii, p. 629, 1893; Trans. Roy. Geol. Soc. Cornwall, vol. xii, p. 150, pl. iii, fig. 2, 1898.

Varietal Characters.—Differs from the type *E. terebellata* in size and in its shorter, wider and more abruptly conical spire.

Dimensions.—L. 8 mm. B. 5 mm.

Distribution.—Not known living.

Fossil: St. Erth. Waltonian Crag: Little Oakley; probably at other localities, with the type form, in the lower horizons of the Crag.

Remarks.—The specimen figured under this name belongs to the British Museum. It differs in no essential respect from the Crag *E. terebellata*, except in its abruptly tapering spire, and may be regarded, I think, as a variety of that species.

Eulimene pendula (S. V. Wood). Plate L, figs. 26, 27.

1842—72. *Eulima pendula*, S. V. Wood, Ann. Mag. Nat. Hist. [1], vol. ix, p. 534, 1842; *Paludestrina pendula*, Mon. Crag Moll., pt. i, p. 109, pl. xii, fig. 6, 1848; 1st Suppl., pt. i, p. 65, 1872.

1871. *Paludestrina terebellata*, var., Jeffreys in Prestwich, Quart. Journ. Geol. Soc., vol. xxvii, p. 493.
1872. *Paludestrina pendula*, A. and R. Bell, Proc. Geol. Assoc., vol. ii, p. 209.
1898. *Eulimene pendula*, A. Bell, Trans. Roy. Geol. Soc. Cornwall, vol. xii, p. 150.
1912. *Littorina pendula*, Tesch, Med. v. d. Rijks. v. Delfstoffen, No. 4, p. 64, no. 138.

Specific Characters.—Shell slender, thinner, smaller and more delicate than *E. terebellata*, with a rounded or only slightly angulated base; whorls 8 or 9, smooth and somewhat convex; spire elongate, regularly tapering to an acute point; suture slight; mouth ovate, compressed above, projecting below; periphery continuous; inner lip narrow, nearly covering a small umbilicus.

Dimensions.—L. 14 mm. B. 6 mm.

Distribution.—Not known living.

Fossil: Waltonian Crag: Walton-on-Naze, Beaumont, Little Oakley. Newbournian: Bentley, Waldringfield, Sutton, Newbourn, Felixstowe. Butleyan: Bawdsey, Alderton, Butley.

Remarks.—As stated above this is generally a more slender and delicate shell than *E. terebellata*. Like that species it seems to be almost entirely confined to the Red Crag and, rather doubtfully, to beds of similar age in Belgium and Holland, occurring, however, as does the former, though not abundantly, at St. Erth. Dr. Tesch reports it from one of the Dutch borings at Oploo as *E. pendula*, but a specimen he has kindly sent me (fig. 24) seems nearly allied to *E. terebellata*, and may be an intermediate form.

Var. **parva**, nov. Plate L, fig. 28.

Dimensions.—L. 9 mm. B. 4 mm.

Distribution.—Not known living.

Fossil: Waltonian Crag: Little Oakley; probably elsewhere in the Red Crag.

Remarks.—The specimen figured under this name is not uncommon in the Waltonian of Oakley. It appears to be full grown and may be regarded as a dwarf variety of the typical *E. pendula*. Its distribution has not been worked out at present.

Eulimene turgida (Etheridge and Bell). Plate L, fig. 29.

1893—98. *Eulimene pendula*, var. *turgida*, A. Bell, Proc. Roy. Irish Acad. [3], vol. ii, p. 629, 1893; Trans. Roy. Geol. Soc. Cornwall, vol. xii, p. 150, 1898.

Specific Characters.—Shorter and wider than the type form of *E. pendula*; whorls slightly convex, the last tumid, rounded at the base; spire abruptly tapering to a very small and pointed apex; suture deeper.

Dimensions.—L. 8 mm. B. 4 mm.

Distribution.—Not known living.

Fossil: St. Erth.

Remarks.—I describe and figure this specimen as a separate species under Mr. Bell's varietal name. It does not approach very nearly to the type form of *E. pendula* and I am inclined to regard it as specifically distinct. In such case it may be known as *E. turgida*.

Eulimene bithynæformis, Etheridge and Bell. Plate L, fig. 30.

1893—98. *Eulimene bithynæformis*, A. Bell, Proc. Roy. Irish Acad. [3], vol. ii, p. 629, 1893; Trans. Roy. Geol. Soc. Cornwall, vol. xii, p. 151, 1898.

Specific Characters.—Shell ovato-conical; whorls 5, slightly convex, rapidly increasing in size, the last tumid, much the largest; without sculpture; spire very short, ending in a blunt point; suture distinct but not deep; mouth ovate, compressed and angulate above, rounded below; inner lip slightly reflected, forming a well-marked ridge.

Dimensions.—L. 8 mm. B. 5 mm.

Distribution.—Not known living.

Fossil: St. Erth.

Remarks.—The fossil from St. Erth here figured seems a distinct form, being specially characterised by a raised ridge inside the mouth, parallel with the edge of the peristome. In Mr. Bell's paper he says it resembles a *Bithynia*, but he considers its generic relations are doubtful. Our specimen belongs to the British Museum of Natural History.

Eulimene grandis, A. Bell, MS. Plate L, fig. 31.

Specific Characters.—Shell strong, conical, with a rounded base; whorls 5, slightly convex; spire short, tapering to a blunt point; suture slight; mouth oval, angulate above, rounded below; peristome continuous; outer lip gently curved; inner lip narrow, clearly marked.

Dimensions.—L. 10 mm. B. 6—7 mm.

Distribution.—Not known living.

Fossil: Waltonian Crag: Walton-on-Naze, Little Oakley.

Remarks.—The present form is an undescribed species of Mr. Bell's, allied to *E. terebellata*, but the body-whorl is rounded and not distinctly angulate as in that species. The specimen now figured is from the York Museum, where it bears Mr. Bell's name, having been found by him in the basement bed at Walton. Another, showing curiously imbricated and oblique lines of growth on the body-whorl, probably abnormal, was obtained by myself at Oakley.

Genus **ODOSTOMIA**, Fleming, 1828.

Odostomia conoidea (Brocchi). Plate L, fig. 33.

1814. *Turbo conoidea*, Brocchi, Conch. foss. subap., vol. ii, p. 660, pl. xvi, fig. 2.
1835—44. *Auricula conoidea*, Philippi, Enum. Moll. Sic., vol. i, p. 143, 1836; vol. ii, p. 119, 1844.
1842. *Odostomia plicata*, S. V. Wood, Ann. Mag. Nat. Hist. [1], vol. ix, p. 536, 1842; Mon. Crag Moll., pt. i, p. 85, pl. ix, fig. 3 *a*, 1848; *O. conoidea*, 1st Suppl., pt. i, p. 63, 1872.
1843—81. *Tornatella conoidea*, Nyst, Coq. foss. Belg., p. 428, pl. xxxvii, fig. 27, 1843; *O. conoidea*. Conch. Terr. tert. Belg., p. 71, pl. vi, fig. 2, 1881.
1846. *Turbonella plicata*, Lovén, K Svensk. Vet.-Akad. Förh, vol. iii, p. 91.
1848—84. *Odostomia conoidea*, Jeffreys, Ann. Mag. Nat. Hist. [2], vol. ii, p. 340, 1848; Brit. Conch., vol. iv, p. 127, 1867; vol. v, p. 211, pl. lxxiii, fig. 6, 1869; in Prestwich, Quart. Journ. Geol. Soc., vol. xxvii, pp. 144, 490, 1871; Proc. Zool. Soc. London, p. 347, 1884.
1853. *Odostomia conoidea*, Forbes and Hanley, Brit. Moll., vol. iii, p. 260, pl. xcv, fig. 6.
1859. *Odostomia conoidea*, G. B. Sowerby, Ill. Ind. Brit. Shells, pl. xvii, fig. 8.
1870—92. *Odostomia conoidea*, A. Bell, Journ. de Conch., vol. xviii, p. 349, no. 324, 1870; Rep, Yorks. Phil. Soc., p. 63, 1892.
1872. *Odostomia conoidea*, A. and R. Bell, Proc. Geol. Assoc., vol. ii, pp. 203, 209, 213.
1873—76. *Odostomia conoidea*, Seguenza, Boll. R. Com. Geol. Ital, vol. iv, p. 352, no. 275, 1873; vol. v, p. 282, no. 111, 1874; vol. vii, p. 94, no. 574, 1876.
1874—92. *Odostomia conoidea*, Van den Broeck, Ann. Soc. malac. Belg., vol. ix, pp. 120, 135, 272, 1874; Bull Soc. Belge Géol., vol. vi (Mémoires), pp. 122, 133, 1892.
1878. *Odostomia conoidea*, Sars, Moll. Reg. Arct. Norv., p. 360.
1882. *Odontostomia conoidea*, Von Koenen, Gastr. Norddeutsch. Mioc., pl. ii, p. 245, no. 156.
1883. *Odostomia conoidea*, Bucquoy, Dautzenberg et Dollfus, Moll. mar. Rouss., vol. i, p. 159, pl. xxi, figs. 1—3.
1890—1904. *Odostomia conoidea*, Sacco, Boll. Soc. Geol. Ital., vol. ix, p. 186, no. 2025, 1890; Moll. Terr. Terz. Piem., pt. xxx, p. 108, pl. xxiv, figs. 7, 8, 1904.
1892. *Ptychostomon conoideum*, Locard, Coq. mar. Côtes de France, p. 149, fig. 129.
1901. *Odontostoma conoidea*, Brøgger, Norges geol. Undersøgelse, no. 31, p. 661, pl. xix, fig. 24.
1903. *Odostomia conoidea*, Johnson, Geol. Mag. [4], vol. x, p. 26.
1905. *Ptychostomon conoideum*, Kobelt, Icon. schalentrag. europ. Meeresconch., vol. iii, p. 78, pl. lxvi, figs. 12, 15.
1912. *Odostomia conoidea*, Tesch, Med. v. d. Rijks. v. Delfstoffen, No. 4, p. 74, no. 175.
1914. *Odostomia conoideum*, Cerulli-Irelli, Palaeont. Ital., vol. xx, p. 252, pl. xxii, figs. 14—19, figs. 22, 25.

Specific Characters.—Shell of fair size, solid, opaque and polished, oblongo-conical; whorls 8, nearly flat, gradually enlarging, the last obtusely angulate, about half the total length; spire regularly tapering; suture narrow, slightly channelled; mouth short, oval, contracted above, somewhat expanded; outer lip gently curved, inflected just below the periphery, grooved inside, usually in the direction of the spire; inner lip adhering to the pillar above the tooth, reflected and curved below it; tooth strong, prominent and conspicuous; umbilicus small but deep.

Dimensions.—L. 5—7 mm. B. 2·5—3 mm.

Distribution.—Recent: Isle of Man, Scotland, Shetland, locally abundant in the Clyde district and the Hebrides; a smaller variety (*australis*) has a more southern range (Jeffreys). Norwegian coast. Atlantic coast from Brittany to Gibraltar. Canaries, Mediterranean, Adriatic, Ægean.

Fossil: St. Erth. Coralline Crag: Sutton, Gedgrave, Gomer, Ramsholt. Waltonian: Walton-on-Naze (Kendall).

Pleistocene: Selsey, Estuarine clays—Belfast, Lochgilphead.

Miocene: North Germany (Von Koenen), Belgium.

Lower Pliocene: Piacenziano, Biot.

Upper Pliocene: Monte Mario, Siena, Altavilla, Val d'Era, Bologna, Livorno, Caltabiano. Scaldisien: Belgium, Holland.

Pleistocene: Ficarazzi, Monte Pellegrino, Gravina, Livorno, Valle Biaia, Naso. *Isocardia*- and *Tapes*-banks, Christiania.

Remarks.—The present shell was described by Wood at first under the name of *O. plicata*, but he afterwards identified it with the *O. conoidea* of Brocchi—a variable species having a wide range both in time and space. It has been recorded as a fossil from the Miocene deposits of Belgium and Germany, from the Pliocene of Great Britain, Belgium, Holland and the Mediterranean region, as well as from the Pleistocene of a few Sicilian and Italian localities. It occurs also in the later post-glacial *Tapes*-banks of Christiania, while Prof. Brøgger includes it among the Lusitanian species of that horizon.

It is not an abundant form either at St. Erth, in the English Crag or at Selsey.

As a recent shell it has a wide distribution, though Jeffreys, who took the British variety as characteristic of northern regions, states that the southern form, for which he proposed the varietal name of *australis*, was smaller and narrower. The Crag shells seem to agree most nearly with the former. In the specimens here figured the internal grooving is absent, probably from abrasion.

Mr. Marshall remarks that *O. conoidea* is a very variable species, few of its characters being strongly marked, except the grooved mouth, which is only visible, however, in about 30 per cent. of a number of specimens, and the tooth, which is always strong and conspicuous. He states also that the convexity of the whorls, the depth of the suture and the keeled periphery are exceedingly variable.[1]

Odostomia polita (Bivona). Plate L, fig. 34.

1832. *Ovatella polita*, Bivona, Eff. scient. Sicil., p. 4, pl. i, fig. 7; pl. ii, fig. 7.

1873–76. *Odostomia polita*, Seguenza, Boll. R. Com. Geol. Ital., vol. iv, p. 352, no. 276, 1873; vol. vii, p. 94, no. 564, 1876.

1884. *Odostomia polita*, Monterosato, Nom. Gen. e Spec. Conch. Medit., p. 93.

[1] Journ. of Conch., vol. ix, p. 230, 1899.

1905. *Ptychostomon politum*, Kobelt, Icon. schalentrag. europ. Meeresconch., vol. iii, p. 79, pl. lxvi, figs. 16, 17.

1914. *Odostomia polita*, Cerulli-Irelli, Palaeont. Ital., vol. xx, p. 254, pl. xxii, figs. 28—32.

Specific Characters.—Shell moderately large, solid, oblongo-conical; whorls 8, nearly flat, gradually and regularly enlarging, the last rounded, not angulate, about half the total length; suture slight, not channelled; mouth short, oval; outer lip contracted at the periphery or just below it; usually grooved inside; inner lip adhering to the pillar above the tooth; tooth conspicuous, placed just behind the umbilicus.

Dimensions.—L. 5—7 mm. B. 2·5—3 mm.

Distribution.—Recent: Isle of Man, Scotland, from the Clyde district to the Hebrides. A smaller variety has a more southern range.

Fossil: St. Erth. Coralline Crag: Sutton, Gedgrave, Boyton. Waltonian: Walton-on-Naze. Butleyan: Butley (A. Bell). Holocene: Portrush.

Remarks.—I retain the division between *O. conoidea* and *O. polita* with many apologies to my good friend M. Dautzenberg, who seems inclined to regard all the English fossil specimens of *E. conoidea* I have submitted to him as belonging to the latter species, while the Marchese di Monterosato considers the one a littoral variety of the other. Apparently they are both variable forms. The name *O. conoidea* is better known to students of the Crag than is *O. polita*. For the present, at least, I think it may be desirable, especially for the sake of those who may have occasion to consult the lists of fossils issued during many past years, to retain the old nomenclature. I prefer also to continue the use of the old generic term *Odostomia* rather than of *Odontostomia*, as recently proposed.

Odostomia densa, sp. nov. Plate L, fig. 32.

Specific Characters.—Shell small, solid; whorls 6, slightly convex, the last rather more than half the total length; spire short, subcylindrical, gradually increasing upwards to a blunt, compressed point; suture slight; mouth small, ovate, angulate above, rounded below; inner lip with a prominent, projecting tooth; base rounded.

Dimensions.—L. 5 mm. B. 2 mm.

Distribution.—Not known living.

Fossil: Newbournian Crag: Waldringfield.

Remarks.—The specimen here figured was sent to Mr. Bell by Mr. A. S. Kennard who had obtained it at Waldringfield. As we cannot find any recorded species of *Odostomia* to which it can be satisfactorily referred, I adopt the specific name *densa* for it, in accordance with Mr. Bell's suggestion.

Odostomia eulimoides, Hanley. Plate L, fig. 35.

1844. *Odostomia eulimoides*, Hanley, Proc. Zool. Soc., p. 273.
1848—67. *Odostomia Eulimoides*, Jeffreys, Ann. Mag. Nat. Hist. [2], vol. ii, 1848; *O. pallida* (not Mont.), Brit. Conch., vol. iv, p. 127, 1867.
1853. *Odostomia eulimoides*, Forbes and Hanley, Brit. Moll., vol. iii, p. 273, pl. xcv, figs. 1, 2.
1912. *Odostomia eulimoides*, H. Martel, Coq. de Cancale (Feuille des Jeunes Nat.), vol. xliiᵉ, pp. 1—3, fig.
1913. *Odostomia eulimoides*, Dautzenberg et Durouchoux, Feuille des Jeunes Nat., vol. xliv, p. 36, pl. iii, fig. 2.

Specific Characters.—Shell minute, somewhat spindle-shaped, rather solid; whorls 6—7, slightly compressed, the last much the largest, nearly two-thirds the total length; spire tapering to a blunt point; suture not deep but distinct; mouth oblong, contracted above, expanded and angulated below; outer lip gently curved; tooth placed in the middle of the inner lip, which is very slight on the upper part.

Dimensions.—L. 3 mm. B. 2 mm.

Distribution.—Recent: British seas, widely distributed, rather common. French coasts.

Fossil: St. Erth.

Remarks.—Considerable difference of opinion has existed as to the correct nomenclature of this little shell, which has been sometimes identified with and sometimes separated from *O. pallida*. In a recent paper, however (*op. cit.*, p. 36), M. Dautzenberg states that Col. Martel has shown that the *Turbo pallidus* of Montagu was a *Rissoa*, and that therefore it is necessary to revert to Hanley's original specific name of *eulimoides*.

The specimen here figured under that name is from the Warburton Collection of St. Erth fossils at the British Museum no. 18167, where it is labelled *O. rissoides*. Having submitted a photograph of it to my friend M. Dautzenberg he says he considers it a typical example of the species here discussed. As I do not pretend to have an expert acquaintance with these minute and often worn or imperfect fossils, I consider myself fortunate to be permitted to consult so good an authority as himself in cases where I have found myself in doubt.

Odostomia fastigiata, sp. nov. Plate L, fig. 36.

Specific Characters.—Shell slender, solid and opaque; whorls 8, but slightly convex, the last three-eighths the total length; spire elongate, tapering to a blunt point, showing indistinct lines of growth; suture rather oblique; mouth small, rounded below, acutely angulate above; outer lip but little expanded, not grooved internally; inner lip thickened in the lower part, hardly visible above;

tooth strong and conspicuous, extending spirally into the interior, with an umbilicus behind it.

Dimensions.—L. 8 mm. B. 3 mm.

Distribution.—Not recorded living.

Fossil: Coralline Crag: Boyton.

Remarks.—The shell from Boyton here figured is from Mr. Bell's Collection; he considers it a new species.

Odostomia Normani, Friele. Plate L, fig. 37.

1886. *Odostomia Normani,* Friele, Norske Nordh. Exped. (Mollusca), pt. ii, p. 29, pl. xi, fig. 12.

1905. *Ptychostomon normani,* Kobelt, Icon. schalentrag. europ. Meeresconch., vol. iii, p. 111, pl. lxxv, fig. 27.

Specific Characters.—Shell small, oblong, rather thin, smooth; whorls 5, slightly convex, the last much the largest, about two-thirds the total length; spire short, elongate, rapidly diminishing upwards; mouth comparatively large, oblong, expanded, angulate above, rounded below.

Dimensions.—L. 4 mm. B. 2 mm.

Distribution.—*Recent.*—Norwegian Coast, 30—40 fath. (rare).

Fossil: Newbournian Crag: Sutton.

Remarks.—The figure here given was copied from a specimen belonging to the York Museum, which was unfortunately broken while in the artist's hands. It seems to correspond with one described by Mr. Friele, who remarks its nearest relation was the *O. diaphana* of Jeffreys. In form, however, it agrees more closely with the *O. obliqua* of Alder, to which at first I was disposed to refer it. Our fossil was obtained from the Red Crag of Sutton.

Odostomia elongata, A. Bell. Plate L, fig. 38.

1892. *Odostomia elongata,* A. Bell, Rep. Yorks. Phil. Soc., pp. 63, 76.

Specific Characters.—Shell small, slender, smooth, elongato-conical; whorls 7, slightly convex, the last nearly half the total length; suture distinct, rather oblique; spire attenuate, regularly diminishing in size upwards to a short compressed point; mouth ovate, angulate above, expanded below; outer lip gently rounded; inner lip straight, oblique, with a small conspicuous tooth.

Dimensions.—L. 4 mm. B. 1 mm.

Distribution.—Not recorded living.

Fossil: Selsey.

Remarks.—The specimen figured under this appropriate name belongs to the York Museum, and was obtained at Selsey by Mr. A. Bell, who has described it as a new species.

Odostomia magna, Etheridge and Bell, MS. Plate L, fig. 39.

1893—98. *Odostomia magna*, A. Bell, Proc. Roy. Irish Acad. [3], vol. ii, p. 628, 1893; Trans. Roy. Geol. Soc. Cornwall, vol. xii, p. 146, pl. ii, fig. 15, 1898.

Specific Characters.—Shell small, slender, ovate, conical, smooth, polished; whorls 8, convex, the last about half the total length, much the largest; spire elongate, regularly diminishing in size to a pointed, compressed apex; suture well marked, channelled; mouth ovate, angulate above, rounded and expanded below; outer lip gently curved; inner lip oblique, slight, with an inconspicuous tooth.

Dimensions.—L. 6 mm. B. 2 mm.

Distribution.—Not known living.

Fossil: St. Erth.

Remarks.—The shell here represented belongs to the Jermyn Street Museum, where it bears the note, "Presented by Mr. E. T. Newton," together with a green label signifying it is the figured specimen of this species.[1] By some mysterious mistake a different form has been published under the present name in Mr. A. Bell's paper of 1898, for which the latter disclaims all responsibility, as it was issued without any reference to himself.

Genus **JEFFREYSIA,** Alder, 1849.

Jeffreysia opalina (Jeffreys). Plate L, fig. 18.

1848—69. *Rissoa (?) opalina*, Jeffreys, Ann. Mag. Nat. Hist. [2], vol. ii, p. 351, 1848; *Jeffreysia opalina*, Brit. Conch., vol. iv, p. 60, 1867; vol. v, p. 209, pl. lxix, fig. 6, 1869.
1853. *Jeffreysia opalina*, Forbes and Hanley, Brit. Moll., vol. iii, p. 154, pl. lxxvi, figs. 3, 4; vol. iv, p. 267, pl. cxxxiii, fig. 6.
1859. *Jeffreysia opalina*, G. B. Sowerby, Ill. Ind. Brit. Shells, pl. xiv, fig. 14.
1884. *Jeffreysia opalina* var. *minor*, Monterosato, Enum. e Sinon. Conch. Medit., p. 75.
1890. *Jeffreysia opalina*, Carus, Prod. Faun. Medit., vol. ii, p. 345.
1892. *Jeffreysia opalina*, Locard, Coq. mar. Côtes de France, p. 180.
1892. *Jeffreysia opalina*, Praeger, Proc. Roy. Irish Acad. [3], vol. ii, p. 278.
1901. *Jeffreysia opalina*, Conch. Soc. List, Journ. of Conch., vol. x, p. 18, no. 363.

Specific Characters.—Shell minute, oval, very thin, semitransparent, whorls $3\frac{1}{2}$, convex, rapidly enlarging, the last much the largest, ventricose, three-fourths the length of the shell; sculpture inconspicuous; spire short, with an abrupt and blunt point; suture deep; mouth oval, about half the total length; peristome continuous; outer lip sharp, thin, incurved above, expanded below; inner lip thickened on the lower part of the pillar with a narrow umbilical chink.

[1] Dr. Kitchin informs me that the specimen in question was presented to the Jermyn Street Museum on December 12th, 1898.

Dimensions.—L. 1—2 mm. B. 1—2 mm.

Distribution.—*Recent:* Local, Channel Islands, Falmouth, Clyde district, Skye, Shetland. North-west coast of France, Mediterranean.

Fossil: St. Erth, Selsey, Irish estuarine clays.

Remarks.—Of the three species of this interesting group of minute shells reported by Jeffreys as found at present in British seas, all have been obtained from St. Erth and two from Selsey. They are unknown, however, from the Anglo-Belgian Crag. *J. opalina* has a rather wide range, from the Shetland Islands to the Mediterranean, and is said to be abundant in places though very local.

Jeffreysia diaphana (Alder). Plate L, fig. 20.

1844—48. *Rissoa (?) glabra*, Alder, Ann. Mag. Nat. Hist., vol. xiii, p. 325, pl. viii, figs. 1—4, 1844; *R. diaphana*, Trans. Tynes. Nat. Field Club, p. 55, 1848.
1853. *Jeffreysia diaphana*, Forbes and Hanley, Brit. Moll., vol. iii, p. 152, pl. lxxvi, fig. 1.
1859. *Jeffreysia diaphana*, G. B. Sowerby, Ill. Ind. Brit. Shells, pl. xiv, fig. 13.
1867—69. *Jeffreysia diaphana*, Jeffreys, Brit. Conch., vol. iv, p. 59, 1867; vol. v, pl. lxix, fig. 5, 1869.
1878. *Jeffreysia diaphana*, G. O. Sars, Moll. Reg. Arct. Norv., p. 359.
1886. *Jeffreysia diaphana*, Kendall and R. G. Bell, Quart. Journ. Geol. Soc., vol. xlii, p. 211.
1893—98. *Jeffreysia diaphana*, A. Bell, Proc. Roy. Irish Acad. [3], vol. ii, p. 629, 1893; Trans. Roy. Geol. Soc. Cornwall, vol. xii, p. 149, 1898.
1901. *Jeffreysia diaphana*, Conch. Soc. List., Journ. of Conch., vol. x, p. 18, no. 362.

Specific Characters.—Shell minute, thin, ovato-conical; whorls $4\frac{1}{2}$, convex, the last three-fifths of the total length; spire regularly diminishing in size upwards to a blunt and abrupt point; suture deep; mouth ovate, angulate above, rounded below; umbilical chink narrow.

Dimensions.—L. 2 mm. B. 1 mm.

Distribution.—*Recent:* British coasts in certain places from the Shetlands to the Channel Islands, Dublin, Cullercoates, coast of Norway, Cherbourg, Spezzia.

Fossil: St. Erth, Selsey.

Remarks.—The specimen of *J. diaphana* here figured was obtained from St. Erth and belongs to the British Museum of Natural History.

Jeffreysia globularis, Jeffreys, MS. Plate L, fig. 19.

1853. *Jeffreysia globularis*, Jeffreys in Forbes and Hanley, Brit. Moll., vol. iv, Appendix, p. 268, pl. cxxxiii, fig. 5.
1859. *Jeffreysia globularis*, G. B. Sowerby, Ill. Ind. Brit. Shells, pl. xiv, fig. 15.
1867—69. *Jeffreysia globularis*, Jeffreys, Brit. Conch., vol. iv, p. 62, 1867; vol. v, pl. lxix, fig. 7, 1869.
1878. *Jeffreysia globularis*, G. O. Sars, Moll. Reg. Arct. Norv., pp. 347, 359, pl. xxxiv, fig. 8.
1886. *Jeffreysia globularis*, Kendall and R. G. Bell, Quart. Journ. Geol. Soc., vol. xlii, p. 211.
1892. *Jeffreysia globularis*, Locard, Coq. mar. Côtes de France, p. 180.

1893—98. *Jeffreysia globularis*, A. Bell, Proc. Roy. Irish Acad. [3], vol. ii, p. 629, 1893; Trans. Roy. Geol. Soc. Cornwall, vol. xii, p. 149, 1898.

1901. *Jeffreysia globularis*, Conch. Soc. List, Journ. of Conch., vol. x, p. 18, no. 364.

Specific Characters.—Shell minute, thin, obliquely orbicular; whorls 3, tumid, the last much the largest, three-fourths the total length; spire very short, compressed; apex blunt; suture deep; mouth oval, half the length of the shell, expanded; outer lip incurved above, rounded below; inner lip separated from the pillar; peristome entire, distinct; umbilicus deep.

Dimensions.—L. 1—2 mm. B. 1—2 mm.

Distribution.—*Recent:* Skye, Shetlands, English Channel (Locard), Norwegian coast, Finmark.

Fossil: St. Erth.

Remarks.—The specimen of *J. globularis* here figured is from the Wood Collection at the British Museum, and is probably the one reported by Messrs. Kendall and R. G. Bell in their paper of 1886.

Genus **ALVANIA**, Risso, 1826.

Alvania Whitleyi (A. Bell). Plate L, fig. 40.

1898. *Rissoa Whitleyi*, A. Bell, Trans. Roy. Geol. Soc. Cornwall, vol. xii, p. 153.

Specific Characters.—Shell minute, rather solid; whorls 6—7, convex, obtusely subangulate in the centre; ornamented by about 12 strongly-marked rounded costæ which do not reach the base; crossed by fine, conspicuous spiral ridges; spire short, rapidly and regularly diminishing to a rounded apex; suture deep; mouth short, oval, angulated above; outer lip thickened by the labial rib.

Dimensions.—L. 2 mm. B. 1 mm.

Distribution.—Not known living.

Fossil: St. Erth.

Remarks.—The present specimen, which belongs to the British Museum, was found by Mr. A. Bell in some unexamined material left at his brother's death. He described it as a new species, remarking that it was nearly allied to a Miocene fossil, the *Rissoa clotho* of Hörnes, with which at first we were disposed to associate it, as a closely-related variety.[1] On further comparison with Hörnes' figure, however, we now prefer to regard it as specifically distinct, both from that species or from any other with which we are acquainted. It is a beautiful shell and quite fresh and perfect.

[1] Foss. Moll. Tert. Wien, vol i, p. 574, pl. xlviii, p. 20.

Alvania cimex (Linné). Plate L, fig. 43.

1758. *Turbo cimex*, Linné, Syst. Nat., ed. x, p. 761, no. 530.
1808. *Turbo calathiscus*, Montagu, Test. Brit., Suppl., p. 132, pl. xxx, fig. 5.
1826. *Alvania europæa*, Risso, Hist. nat. Eur. mérid., vol. iv, p. 142, pl. ix, fig. 116.
1858. *Alvania calathiscus*, H. and A. Adams, Gen. Rec. Moll., vol. i, p. 331, pl. xxxv, fig. 3 *a*.
1859. *Rissoa* (*Alvania*) *europæa*, Chenu, Man. Conch., vol. i, p. 307, fig. 2185.
1873. *Rissoa* (*Alvania*) *cimex*, Weinkauff, Cat. europ. Meeresconch., vol. ii, p. 303.
1874—76. *Rissoa* (*Alvania*) *cimex*, Seguenza, Boll. R. Com. Geol. Ital., vol. v, p. 4, no. 374; p. 282, no. 128, 1874; vol. vii, p. 102, no. 673, 1876.
1878. *Rissoa europæa*, Reeve, Conch. Icon., vol. xx, pl. i, fig. 2.
1878—84. *Rissoa* (*Alvania*) *cimex*, Monterosato, Enum. e Sinon. Conch. Medit. (Giorn. Soc. Sci. Nat. Palermo, vol. xiii, 1878), p. 84; *Alvania* (*Acinus*) *cimex*, Nom. Gen. e Spec. Conch. Medit., p. 62, 1884.
1889—95. *Rissoa cimex*, Sacco, Boll. Soc. Geol. Ital., vol. viii, p. 355, no. 1988, 1889; *Alvania* (*Acinus*) *cimex*, Moll. Terr. Terz. Piem., pt. xviii, p. 24, 1895.
1890. *Rissoa* (*Alvania*) *cimex*, Carus, Prod. Faun. Medit., vol. ii, p. 331.
1892. *Alvania cimicina*, Locard, Coq. mar. Côtes de France, p. 156, fig. 135.
1892. *Rissoa cimex*, A. Bell, Rep. Yorks. Phil. Soc., p. 63, pl. i, fig. 21.
1901—7. *Rissoia* (*Alvania*) *cimex*, Scalia, Att. Accad. Gioen. Sci. Nat. Catania [4], vol. xiv, p. 7, no. 90, 1901; vol. xx, p. 32, no. 228, 1907.
1914. *Rissoia* (*Alvania*) *cimex*, Cerulli-Irelli, Palaeont. Ital., vol. xx, p. 198, pl. xv, figs. 68, 69.

Specific Characters.—Shell thick and solid, ovate; whorls 6, slightly convex, the last ventricose, two-thirds the total length; spire regularly conical, with a minute rounded apex; ornamented by numerous longitudinal costæ and by spiral ridges nearly equal in size, which become more or less tuberculate where they intersect; suture channelled, but not deep; mouth rather short, ovate-angulate above; outer lip thickened, ridged internally; inner lip strong; peristome continuous.

Dimensions.—L. 5 mm. B. 3 mm.

Distribution.—*Recent:* Isle of Jura, Cumbrae (Jeffreys). Mediterranean (widely distributed), Adriatic, Ægean, Crete, Lycia. West Atlantic (Carus).

Fossil: Selsey.

Upper Pliocene: Monte Mario, Astiano, Val d'Era, Altavilla.

Pleistocene: Messina, Monte Pellegrino, Ficarazzi, Sciacca, Reggio, Taranto, Gravina, Livorno. Sub-Etnean beds: Salustri, Cibali, Catira, Nizzeti, San Paulo.

Remarks.—This very distinct and southern shell has been reported by Mr. Bell as a British fossil from Selsey only, where he informs me that years ago it was fairly common. In the south of Europe it occurs in the Upper Pleistocene of Asti, Monte Mario and Altavilla, while Seguenza gives it from a number of Italian and Sicilian localies and Dr. Scalia from the fossiliferous deposits on the flanks of Etna.

Jeffreys points out *op. cit.*, vol. iv, p. 11) that the *Turbo cimex* of Donovan and Montagu is a different species.

Alvania fenestrata (Etheridge and Bell). Plate L, fig. 46.

1878—78. *Rissoa fenestrata*, A. Bell, Proc. Roy. Irish Acad. (3), vol. ii, p. 629, 1893; Trans. Roy. Geol. Soc. Cornwall, vol. xii, p. 152, 1898.

Specific Characters.—Shell minute, ovate, fairly strong and solid; whorls convex, the last tumid, much the largest, two-thirds the total length; ornamented by numerous distinct and rounded costæ, placed close together, occupying the upper part only of the body-whorl, and by strong spiral ridges below; spire very short, rapidly diminishing upwards to a blunt and rounded point; suture deep; mouth ovate, expanded, large in proportion to the size of the shell; base of inner lip furnished with a prominent umbilical chink.

Dimensions.—L. 1 mm. B. 1 mm.

Distribution.—Not known living.

Fossil: St. Erth.

Remarks.—The St. Erth fossil here figured is from the Warburton Collection at the British Museum, and has been identified by Mr. A. Bell as the one found by him and described by Mr. Etheridge and himself under the above name. It is a distinct form with comparatively coarse sculpture; in Mr. Bell's opinion it is the only example that has been found.

Alvania Cossmanni, A. Bell, MS. Plate L, fig. 47.

Specific Characters.—Shell minute, ovate, solid; whorls convex, the last ventricose, much the largest; ornamented by very fine but distinct reticulate sculpture on the upper part of the last whorl; on the base and on the lower part by rather strong spiral ridges; spire short; mouth subcircular, expanded; suture clearly marked.

Dimensions.—L. 1 mm. B. 1 mm.

Distribution.—Not recorded living.

Fossil: St. Erth.

Remarks.—The shell figured under this name was found by Mr. Bell, but has been left unrecorded in his collection at the British Museum. It is one of the smallest of the St. Erth *Rissoas*, but it looks like a mature specimen.

Alvania crassi-striata (S. V. Wood). Plate L, fig. 49.

1842—48. *Rissoa crassi-striata*, S. V. Wood, Ann. Mag. Nat. Hist. (1), vol. ix, p. 533, 1842; Mon. Crag Moll., pt. i, p. 106, pl. xi, p. 13, 1848.

1871. *Rissoa crassi-striata*, Jeffreys in Prestwich, Quart. Journ. Geol. Soc., vol. xxvii, p. 145.
1872. *Rissoa crassi-striata*, A. and R. Bell, Proc. Geol. Assoc., vol. ii, p. 204.
1890. *Rissoa crassi-striata*, C. Reid, Plioc. Dep. Brit., p. 255.

Specific Characters.—Shell small, turriculate, solid; whorls 6 or 7, distinctly convex; ornamented by about 12 strong, obtuse longitudinal costæ which reach the base of the shell, and by well-marked spiral ridges in the interspaces of the ribs; spire elongated, ending in an acute point; suture deep; mouth subcircular, obtusely angulate above; outer lip thickened and marginated, striated within.

Dimensions.—L. 3·5 mm. B. 1·5 mm.

Distribution.—Not known living.

Fossil: Coralline Crag: Sutton.

Remarks.—This fossil from the Coralline Crag was regarded by Wood, Jeffreys and the brothers Bell as a distinct species, unknown either as living or as fossil, otherwise than from the English Crag. It belongs to the group known under the generic or subgeneric name of *Alvania*, oval in form, having a short spire, clathrated sculpture and a mouth internally grooved. Wood states it is an abundant species at Sutton.

Alvania Montagui (Payraudeau). Plate L, fig. 50.

1826. *Rissoa Montagui*, Payraudeau, Moll. de Corse, p. 111, pl. v, fig. 14.
1836—44. *Rissoa Montagui*, Philippi, Enum. Moll. Sic., vol. i, p. 153, 1836; vol. ii, p. 126, 1844.
1856. *Rissoa Montagui*, Hörnes, Foss. Moll. Tert. Wien., vol. i, p. 569, pl. xlviii, fig. 13.
1858. *Alvania Montagui*, H. and A. Adams, Gen. Rec. Moll., vol. i, p. 331.
1876. *Rissoa* (*Alvania*) *Montagui*, Seguenza, Boll. R. Com. Geol. Ital., vol. vii, p. 102, no. 686.
1878. *Rissoa Montagui*, Reeve, Conch. Icon., vol. xx, pl. i, fig. 3.
1884. *Rissoa Montacuti*, Jeffreys, Proc. Zool. Soc. London, p. 122.
1884. *Rissoa Montagui*, Bucquoy, Dautzenberg et Dollfus, Moll. mar. Rouss., vol. i, p. 285, pl. xxxiii, figs. 1—6.
1884. *Alvania Montagui*, Monterosato, Nom. Gen. e Spec. Conch. Medit., p. 58.
1886. *Rissoa Montagui*, Kendall and R. G. Bell, Quart. Journ. Geol. Soc., vol. xlii, p. 211.
1890. *Rissoa* (*Alvania*) *Montagui*, Carus, Prod. Faun. Medit., vol. ii, p. 328.
1892. *Alvania Montagui*, Locard, Coq. mar. Côtes de France, p. 158, fig. 136.
1892—98. *Rissoa Montagui*, A. Bell, Rep. Yorks. Phil. Soc., pp. 63, 76, pl. i, fig. 20, 1892; Proc. Roy. Irish Acad. [3], vol. ii, p. 629, 1893; Trans. R. Geol. Soc. Cornwall, vol. xii, p. 151, pl. ii, fig. 11, 1898.
1895. *Alvania Montagui*, Sacco, Moll. Terr. Terz. Piem., pt. xviii, p. 23.
1907. *Rissoa* (*Alvania*) *Montagui*, Scalia, Att. Accad. Gioen. Sci. Nat. Catania [4], xx, p. 33.

Specific Characters.—Shell small, solid, ovato-conical, whorls but slightly convex; ornamented by strong, straight, rounded costæ which die out on the last whorl, and by strong spiral ridges covering the base of the shell, producing slight granulations at the points of contact; suture deep, channelled; mouth oval; outer lip thickened, sulcated within, not denticulate.

Dimensions.—L. 5 mm. B. 3 mm.

Distribution.—Recent: Atlantic coasts of Spain, Madeira, Mediterranean (widely diffused), Asiatic, Ægean.

Fossil: St. Erth. Pleistocene: Selsey.

Miocene: Touraine, Anjou, Vienna basin.

Pliocene: Astiano, Altavilla, Messina.

Pleistocene: Livorno, Rhodes. Sub-Etnaen beds: Nizzeti.

Remarks.—This southern species has been found rather commonly at St. Erth by S. V. Wood, Messrs. Kendall and R. G. Bell and by Mr. A. Bell, having been also reported by the latter from Selsey in a deposit the fauna of which is distinctly of a southern character. It may be easily recognised by its form and its strong sculpture. It is unknown from the Anglo-Belgian Crag, though it had a wide range in time from the Miocene of France and Vienna to the sub-Etnaen beds of Sicily.

The specimen from St. Erth now figured is from the Wood Collection at the British Museum of Natural History.

Alvania Wyville-Thomsoni (Jeffreys). Plate LI, fig. 18.

1877—84. *Rissoa wyville-thomsoni*, Jeffreys in Friele, Nyt Mag. Natur., p. 3, 1877; *R. Wyville-Thomsoni*, in Lamplugh, Quart. Journ. Geol. Soc., vol. xl, p. 321, pl. xv, fig. 3; Proc. Zool. Soc. London, p. 122, no. 29, 1884.

1893—1917. *Rissoa Wyville-Thomsoni*, A. Bell, Proc. Roy. Irish Acad. [3], vol. ii, p. 635, 1893; Naturalist (Yorkshire), no. 723, p. 96, 1917.

1901. *Rissoa wyville-thompsoni*, Friele og Grieg, Norske Nordhav. Exped., Mollusca, pt. iii, p. 73.

Specific Characters.—Shell ovate, small, turreted; whorls 5, convex, the last much the largest, ventricose, the upper ones without sculpture, the lower ornamented by numerous longitudinal costæ, distinct but not prominent, which hardly reach the base, and by fine, well-marked spiral ridges; spire short, ending in a small flattened apex; suture deep; mouth subcircular with a small umbilicus; outer lip thin, regularly rounded, slightly expanded.

Dimensions.—L. 3 mm. B. 1·5 mm.

Distribution.—Recent: "Lightning" and "Porcupine" Exped. (560 f.), Nöringen Exped., cold area (488—510 f.).

Fossil: Bridlington.

Remarks.—The Bridlington fossil here figured is one of a number found by Mr. Bell among some loose stuff received from Mr. Headley.

It agrees with Jeffreys' drawing of the original specimen which is in Mr. Headley's Collection, bearing the identification of the author. I believe these are the only fossil representatives of the species that have been recorded, but being a minute form it may have escaped notice elsewhere. Mr. Bell informs me that it is one of the most common of the Bridlington *Rissoas* in Mr. Headley's Collection.

Alvania densecostata (Etheridge and Bell, MS.). Plate LI, fig. 22.

1893—98. *Rissoa densecostata*, A. Bell, Proc. Roy. Irish Acad. [3], vol. ii, p. 629, 1893; Trans. Roy. Geol. Soc. Cornwall, vol. xii, p. 152, 1898.

Specific Characters.—Shell solid, minute, elongato-turreted; whorls convex; ornamented by numerous fine, nearly straight ribs, crowded closely together, intersected by spiral striæ which become stronger and more prominent below the periphery.

Dimensions.—L. 3 mm. B. 1 mm.

Distribution.—Not known living.

Fossil: St. Erth.

Remarks.—Mr. Bell informs me that this fossil is the same upon which his *R. densecostata* was originally founded. It was then perfect, but unfortunately the apex is now missing.

Alvania Bellii, sp. nov. Plate LI, fig. 23.

Specific Characters.—Shell minute, solid, ovato-conical; whorls 5, the last ventricose, much the largest, three-fourths the total length, obtusely angulate at the periphery and contracted below it; ornamented by strong and prominent longitudinal ribs, which terminate suddenly on the body-whorl and are replaced by well-marked spiral ridges with fairly wide interspaces, also by exceedingly fine striæ on the upper part of the shell; spire short, rapidly diminishing upwards towards a blunt and truncated apex; suture well marked and somewhat channelled; mouth large in proportion, expanded, angulate above and rounded below; outer lip thin; lower part of the inner lip reflected on the columella, which is nearly straight.

Dimensions.—L. 2·5 mm. B. 1 mm.

Distribution.—*Recent:* Not reported living.

Fossil: St. Erth.

Remarks.—The fossil figured under this name is from the British Museum where it has been labelled "*R. clathrata*," probably by an oversight—it is not the *R. clathrata* of Philippi. As I cannot find anything else to which I can satisfactorily refer it I dedicate it to my colleague, often named in this work, to whom students of the St. Erth fauna are much indebted.

Alvania curta (Dujardin). Plate LI, figs. 24, 25.

1837. *Rissoa curta*, Dujardin, Mém. Soc. Géol. France, vol. ii, p. 279, pl. xix, fig. 5.

1856. *Rissoa curta*, Hörnes, Foss. Moll. Tert. Wien., vol. i, p. 571, pl. xlviii, fig. 15.

1886. *Rissoa (Alvania) curta*, Dollfus et Dautzenberg, Feuille Jeunes Natur., vol. xvi, p. 15.

1890—95. *Rissoa curta*, var., Sacco, Boll. Soc. Geol. Ital., vol. lx, p. 325, no. 5343, 1890; *Alvania curta*, Moll. Terr. Terz. Piem., pt. xviii, p. 23, 1895

1893—98. *Rissoa intusstriata*, A. Bell, Proc. Roy. Irish Acad. [3], vol. ii, p. 629, 1893; *R. curta*, Trans. Roy. Geol. Soc. Cornwall, vol. xii, p. 151, pl. ii, fig. 8, 1898.

1919. *Alvania curta*, Cossmann et Peyrot, Actes Soc. Linn. Bordeaux, vol. iii, pt. ii, p. 582, pl. xvii, figs. 43—46.

Specific Characters.—Shell small, fairly solid, ovato-conical; spire rather short; whorls 6, slightly convex, the last much the largest; ornamented by about twelve strong costæ which extend nearly to the base of the shell, and by very fine spiral striæ; mouth ovate; outer lip thickened without, distinctly ridged within; umbilicus distinct.

Dimensions.—L. 4·5 mm. B. 2 mm.

Distribution.—Not known living.

Fossil: St. Erth.

Miocene: Touraine, Vienna basin, Italy—Tortoniano.

Remarks.—One of the specimens here figured was found by Mr. Bell at St. Erth. It was originally described by himself and Mr. Etheridge as a new species under the name of *R. intusstriata*, but has been since referred by the former to the *R. curta* of Dujardin. If this identification is correct it is not only interesting, but, as bearing upon the probable age of the St. Erth beds, important; *R. curta* is an extinct form, having had a wide distribution in Miocene times, but I cannot find that it has been recorded otherwise from any Pliocene horizon.

Alvania partim-cancellata (S. V. Wood, MS.). Plate LI, figs. 26, 27.

1886. *Rissoa partim-cancellata*, S. V. Wood in Kendall and R. G. Bell, Quart. Journ. Geol. Soc., vol. xlii, p. 211.

1893—98. *Rissoa partim-cancellata*, A. Bell, Proc. Roy. Irish Acad., vol. ii, p. 629, 1893; *R. Lanciæ*, Trans. Roy. Geol. Soc. Cornwall, p. 151, pt. ii, fig. 7, 1898.

Specific Characters.—Shell minute, ovate; whorls 5, slightly convex, regularly diminishing in size upwards, the last much the largest; spire about one-third the total length; ornamented by numerous longitudinal costæ disappearing towards the periphery against a series of spiral ridges which continue to the base of the shell, with a single line near the suture; suture slightly channelled; mouth oval.

Dimensions.—L. 3 mm. B. 1·5 mm.

Distribution.—Not known living.

Fossil: St. Erth.

Remarks.—This interesting little fossil, belonging to the Warburton Collection at the British Museum of Natural History, where it has been referred in error to

the *Rissoa Lanciæ* of Calcara, was originally discovered by Wood, whose name I now adopt.

It belongs to a group of *Rissoas* rather distinctive of, and common, according to Mr. A. Bell, at St. Erth, in which the upper part of the whorls are covered by fine longitudinal costæ and the lower by distinctly-cut spiral ridges. It is specially characterised by the single row of the latter on each whorl near the suture. Our shell is not so tumid as the one figured by Mr. Bell, but he considers it to be the same.

Alvania obeliscus (Etheridge and Bell, MS.). Plate LI, fig. 28.

1898. *Rissoa obscura*, A. Bell, Trans. Roy. Geol. Soc. Cornwall, vol. xii, p. 153.

Specific Characters.—Shell small, conical; whorls about 7, nearly flat; ornamented by strong longitudinal costæ, 15 or 16 on the last whorl, and by well-marked spiral ridges, specially conspicuous near the base; suture distinct but not deep; spire somewhat elongate, regularly diminishing upwards; mouth ovate, compressed and angulated above, rounded below; outer lip thin.

Dimensions.—L. 4 mm. B. 3 mm.

Distribution.—Not recorded living.

Fossil: St. Erth.

Remarks.—The fossil figured under the specific and MS. name *obeliscus*, Etheridge and Bell, was referred by Mr. A. Bell to the *R. obscura* of Philippi,[1] but our shell is strongly ridged transversely and of this Philippi's figure shows no trace. He (A. Bell) remarks that it may be a variety of *R. parva*, the var. *interrupta* of which, except for its strong sculpture, it somewhat resembles. On the whole, however, I prefer to regard it as specifically distinct. It is of a St. Erth type, and in some respects not unlike several shells from that place which are here figured.

Alvania erecta, A. Bell, MS. Plate LI, fig. 29.

Specific Characters.—Shell minute, ovato-conical; whorls 6, convex, the last rather tumid, much the largest; ornamented by numerous fine longitudinal costæ which die out at the periphery, and by delicate spiral lines which become somewhat stronger below it; suture distinct and slightly channelled, with a spiral line immediately above it; spire short, regularly diminishing in size towards an acute point; mouth rather small, oval; outer lip gently rounded, incurved above, not much expanded; inner lip somewhat reflected; peristome continuous.

Dimensions.—L. 2 mm. B. 1 mm.

[1] See Philippi, Enum. Moll. Sic., vol. ii, p. 127, pl. xxiii, fig. 10, 1844.

Distribution.—Not known living.

Fossil: St. Erth.

Remarks.—This specimen from St. Erth belongs to the British Museum, where it bears Mr. Bell's name of *R. erecta*. He considers it a distinct species and so far as he knows unique.

Alvania Enysii (A. Bell). Plate LI, fig. 30.

1898. *Rissoa Enysii*, A. Bell, Trans. R. Geol. Soc. Cornwall, vol. xii, p. 151, pl. ii, fig. 12.

Specific Characters.—Shell small, elongato-conical; whorls 7—8, nearly flat, slightly angulate or constricted immediately below the suture; spire regularly tapering to a blunt point; suture well marked; ornamented by numerous straight costæ which die out on the last whorl, hardly extending to the base, and by distinct spiral ridges which are continuous beyond the termination of the ribs, crossing the latter, producing slight tuberculation where they intersect, and are prominent at the base of the shell; mouth ovate, angulate, with a small chink above; outer lip roundly lunate; peristome continuous; inner lip slightly deflected in front of a minute perforation.

Dimensions.—L. 6 mm. B. 3 mm.

Distribution.—Not known living.

Fossil: St. Erth.

Remarks.—This species, which Mr. Bell considered a distinct form, was originally described from a specimen found by him now in the Museum of the Royal Geological Society at Penzance. Others have been found since, one of them being in the Sedgwick Museum at Cambridge (here figured) and another in the British Museum of Natural History. It was named after Mr. J. D. Enys, who was President of the above-named Society when Mr. Bell's paper was submitted to it.

Alvania dubiosa, Etheridge and Bell, MS., sp. nov. Plate LI, fig. 31.

Specific Characters.—Shell minute, solid, ovato-conical; whorls 5, convex, the last tumid, about two-thirds the total length, the three lower ones ornamented by well-marked longitudinal ribs, nearly straight, which die out or are cut off by strong spiral ridges, continuous to the base; upper whorls without sculpture; spire turreted, decreasing in size, compressed above, ending in a blunt rounded point; suture deep; mouth oval, rather short, expanded below, outer and inner mouth thickened.

Dimensions.—L. 3·5 mm. B. 2 mm.

Distribution.—Not known living.

Fossil: St. Erth.

Remarks.—The unique specimen figured under the above name belongs to the Warburton Collection at the British Museum of Natural History, and was described by Messrs. Etheridge and Bell as a new species. It belongs to the type before mentioned in which the longitudinal costæ are cut off by conspicuous spiral ridges, continuous to the base, with generally a distinct transverse line at the suture.

Alvania punctura (Montagu). Plate LI, fig. 32.

1803. *Turbo punctura*, Montagu, Test. Brit., pt. ii, p. 320, pl. xii, fig. 5.
1853. *Rissoa punctura*, Forbes and Hanley, Brit. Conch., vol. iii, p. 89, pl. lxxx, figs. 8, 9.
1859. *Rissoa punctura*, G. B. Sowerby, Ill. Ind. Brit. Shells, pl. xiii, fig. 13.
1867—69. *Rissoa punctura*, Jeffreys, Brit. Conch., vol. iv, p. 17, 1867; vol. v, p. 207, pl. lxvi, fig. 8, 1869.
1870—90. *Rissoa punctura*, A. Bell, Journ. de Conch., vol. xviii, p. 352, no. 394, 1870; Proc. Roy. Soc. Edin., vol. x, p. 296, 1890.
1873. *Rissoa (Alvania) punctura*, Weinkauff, Cat. europ. Meeresconch., vol. ii, p. 19, no. 308.
1874—76. *Rissoa (Alvania) punctura*, Seguenza, Boll. R. Com. Geol. Ital., vol. v, p. 4, no. 384; p. 282, no. 134, 1874; vol. vii, p. 102, no. 679, 1876.
1890. *Rissoa punctura*, Carus, Prod. Faun. Medit., vol. ii, p. 330.
1892. *Alvania puncturata*, Locard, Coq. mar. Côtes de France, p. 162.
1898. *Rissoa (Alvania) punctura*, Bucquoy, Dautzenberg et Dollfus, Moll. mar. Rouss., vol. ii, p. 797.
1901. *Alvania punctura*, Conch. Soc. List, Journ. of Conchology, vol. x, p. 18, no. 341.
1913. *Rissoa (Alvania) punctura*, Dautzenberg et Durouchoux, Feuille des Jeunes Natur., vol. xliv, p. 30.

Specific Characters.—Shell minute, ovato-conical; whorls 6, convex and rounded, the last about three-fifths the total length; ornamented by numerous fine longitudinal and transverse thread-like striæ or ribs, forming delicate and closely-set cancellation; the longitudinal ribs do not, however, reach the base; in worn specimens the surface appears to be indented with a series of delicate punctures; suture deep, but not excavated; mouth oval, rounded, but little expanded; outer lip thin, with a thickened labial rib; inner lip reflected on the pillar.

Dimensions.—L. 2 mm. B. 1 mm.

Distribution.—Recent: Widely distributed in British seas from Guernsey to Unst. Norwegian coast from the Christiania fiord to Finmark and the Lofoten Islands. Brittany, Provence, Canary Islands, Mediterranean, Adriatic, Ægean.

Fossil: Coralline Crag: Sutton. Waltonian: Walton-on-Naze. Selsey, Shewalton. Irish estuarine clays. Holocene: Portrush.

Pliocene: Biot.

Pleistocene: Sicily—Monte Pellegrino, Ficarazzi, Messina. Calabria—Reggio, Taranto. Tuscany—Livorno, Valle Biaia. Uddevalla. Christiania fiord—*Tapes*-banks.

Remarks.—This well-known British shell, widely distributed according to

Jeffreys from Guernsey to Unst, has been reported as a fossil from the Coralline Crag of Sutton, from Walton-on-Naze, from the Pleistocene deposits of Selsey and elsewhere, and from Portrush. The Sutton specimen here figured agrees in form with the type shell, but was unfortunately broken by accident while in the artist's custody and does not show very clearly the longitudinal sculpture; there is another, however, in the York Museum from Portrush in which both it and the transverse markings are distinctly exhibited.

R. punctura has been obtained by A. Bell from the Pliocene deposits of Biot, and is reported by Seguenza from various Pleistocene localities in Sicily and Calabria, by Malm from Uddevalla and from the *Tapes*-banks of the Christiania fiord by Prof. Brøgger. As a recent shell it ranges from Finmark to the Canaries.

Alvania multistriata (A. Bell). Plate LI, fig. 33.

1892. *Rissoa multistriata*, A. Bell, Rep. Yorks. Phil. Soc., pp. 62, 67, 76, pl. i, fig. 26.

Specific Characters.—Shell minute, conical, rapidly tapering; whorls 5, convex, the last more than half the total length; ornamented by well-marked, closely set spiral ridges, and the lower whorls and the upper part of the last by rather swollen ribs which do not extend far below the suture; mouth oval; outer and inner lips thin; umbilicus minute but deep.

Dimensions.—L. 3 mm. B. 1·5 mm.

Distribution.—Not recorded living.

Fossil: Selsey.

Remarks.—This beautiful fossil, to which the artist has hardly done credit, is another unique form obtained by Mr. A. Bell during his long-continued investigation of the Selsey bed, a work extending over a period of nearly twenty years, and resulting in the discovery of an unexpectedly rich, distinct and interesting molluscan fauna of more than 200 species, some of them new to science, which, although of Pleistocene age, seem to be of a comparatively southern type. A detailed list of the mollusca of the Selsey deposit was published by him on page 62 of the Report of the Yorkshire Philosophical Society for 1892. The Selsey fauna appears to differ from that of any other of the fossiliferous horizons of Great Britain and deserves more attention than it has hitherto received.

Alvania subperforata (Jeffreys). Plate LI, fig. 19.

1884. *Rissoa subperforata*, Jeffreys in Lamplugh, Quart. Journ. Geol. Soc., vol. xl, pp. 319, 320, pl. xv, fig. 2.

1893. *Rissoa subperforata*, A. Bell, Proc. Roy. Irish Acad. [3], vol. ii, p. 635.

Specific Characters.—Shell minute, pyramidal, rather thick; whorls 6, the last much the largest, nearly two-thirds the total length; ornamented by numerous very fine ribs, nearly straight, which do not reach the base; the labial rib is thickened, crossed by closely-set spiral striæ, much less prominent than the ribs, except near the base, where they are well marked, the lowest forming a strong ridge enclosing a basal groove; the two first whorls smooth; spire rather short, pointed; suture distinct; mouth oval, obscurely notched inside; outer lip thin; incurved inner lip folded back, adhering to the pillar, continuous with the outer one; behind the pillar, as stated above, there is a rather deep and narrow groove.

Dimensions.—L. 3·5 mm. B. 2 mm.

Distribution.—Not known living.

Fossil: Bridlington.

Remarks.—The specimen now given is from Mr. Headley's Collection, and is the one originally figured by Jeffreys and bears his writing. He states it is the only species, living or fossil, known to him which possesses the basal groove referred to.

Alvania textiliformis, A. Bell, MS. Plate LI, figs. 20, 21.

Specific Characters.—Shell minute, ovato-conical; whorls 5 or 6, slightly convex, the last tumid, much the largest, three-fourths the total length; ornamented by numerous exceedingly fine and delicate closely set longitudinal ribs, hardly reaching the base of the shell, clathrated by equally fine and inconspicuous spiral lines which are continuous and stronger towards the lower end; suture clearly marked, but not deep; spire short, conical, regularly diminishing towards the apex; mouth ovate to subcircular, about half the total length, angulate above, rounded below, sometimes a little expanded.

Dimensions.—L. 2—2·5 mm. B. 1 mm.

Distribution.—Not known living.

Fossil: St. Erth.

Remarks.—These two charming and delicately sculptured shells belonging to the Warburton Collection, now figured under Mr. Bell's MS. name, were obtained by him many years ago, but have since remained unnoticed at the British Museum. They might almost be regarded as specifically distinct, differing as they do considerably in form, but although the sculpture of one of them is less clearly marked than that of the other, it may be seen, under a microscope, to be so nearly the same that I prefer to regard them as varieties of one species.

Alvania reticulata (Montagu). Plate L, fig. 45.

1807. *Turbo reticulatus*, Montagu, Test. Brit., pt. ii, p. 322, pl. xxi, fig. 1.

1853. *Rissoa Beanii*, Forbes and Hanley, Brit. Moll., vol. iii, p. 84, pl. lxxix, figs. 5, 6.

1867—84. *Rissoa reticulata*, Jeffreys, Brit. Conch., vol iv, p. 12, 1867; vol. v, p. 207, pl. lxvi, fig. 5, 1869; *R. (Alvania) reticulata*, Proc. Zool. Soc. London, p. 112, 1884.

1874—76. *Rissoa (Alvania) reticulata*, Seguenza, Boll. R. Com. Geol. Ital., vol. v, p. 4, no. 377; p. 282, no. 130, 1874; vol. vii, p. 102, no. 676, 1876.

1878—84. *Rissoa (Alvania) reticulata*, Monterosato, Enum. e Sinon. Conch. Medit. (Giorn. Soc. Sci. Nat. Palermo, vol. xiii, p. 24), 1878; *Alvania (Acinus) reticulata*, Nom. Gen. e Spec. Conch. Medit., p. 62, 1884.

1884. *Rissoa (Alvania) reticulata*, Bucquoy, Dautzenberg et Dollfus, Moll. mar. Rouss., vol. i, p. 290, pl. xxxvi, figs. 4—6.

1886. *Rissoa reticulata*, Kendall and R. G. Bell, Quart. Journ. Geol. Soc., vol. xlii, p. 211.

1890. *Rissoa (Alvania) reticulata*, Carus, Prod. Faun. Medit., vol. ii, p. 332.

1892. *Alvania reticulata*, Locard, Coq. mar. Côtes de France, p. 160, fig. 137.

1892—98. *Rissoa reticulata*, A. Bell, Rep. Yorks. Phil. Soc., p. 63, 1892; Proc. Roy. Irish Acad. [3], vol. ii, p. 629, 1893; Trans. Roy. Geol. Soc. Cornwall, vol. xii, p. 151, 1898.

1895. *Alvania (Acinus) reticulata*, Sacco, Moll. Terr. Terz. Piem., pt. xviii, p. 24, pl. i, figs. 57—59.

1901. *Alvania reticulata*, Conch. Soc. List, Journ. of Conch., vol. x, p. 18, no. 339.

1901. *Alvania reticulata*, Brøgger, Norges geol. Undersøgelse, No. 31, pp. 588, 660, pl. xix, fig. 3.

1907. *Rissoa (Alvania) reticulata*, Scalia, Att. Accad. Gioen. Sci. Nat. Catania [4], vol. xx, p. 32, no. 229.

1912. *Rissoa reticulata*, Tesch, Med. v. d. Rijks. v. Delfstoffen, No. 4, p. 68, no. 153.

1913. *Rissoa (Alvania) reticulata*, Dautzenberg et Durouchoux, Feuille des Jeunes Natur., vol. xliv, p. 30, pl. ii, fig. 9.

1914. *Rissoa (Alvania) reticulata*, Cerulli-Irelli, Palaeont. Ital., vol. xx, p. 202, pl. xvi, figs. 4—9.

Specific Characters.—Shell minute, oblong, solid; whorls 6—7, but slightly convex, the last much the largest, three-fourths the total length; ornamented by obscure and rather inconspicuous longitudinal ribs, hardly reaching the base of the shell, and by strong conspicuous spiral ridges giving the shell a fine and regularly reticulated appearance, the upper whorls being smooth; suture slight, narrowly excavated; spire regularly diminishing upwards to a sharp point; mouth ovate, furrowed on the inside of the outer lip; inner lip reflected on the pillar, with a narrow groove behind it but no umbilicus.

Dimensions.—L. 3 mm. B. 2 mm.

Distribution.—Recent: British coasts in 7—50 fathoms, generally diffused. North Atlantic from Norway to Gibraltar and the Canaries, Mediterranean, Adriatic, Ægean.

Fossil: St. Erth. Waltonian Crag: Walton-on-Naze (Kendall). Selsey.

Pleistocene: Scotland, fairly general. Ireland—Estuarine clays, Belfast. Holocene: Portrush.

Upper Pliocene: Monte Mario, Val d'Era.

Pleistocene: Messina, Reggio, Ficarazzi, Monte Pellegrino, Catania.

Remarks.—This British species was obtained at St. Erth by Mr. A. Bell and has been reported also from that place and from Walton by his brother R. G. Bell and Prof. Kendall. The specimen figured and described with some

doubt by Wood from the Coralline Crag of Sutton seems to have been a different species. *A. reticulata* has been found by Sign. Cerulli-Irelli at Monte Mario, and is given by Seguenza from various Pliocene and Pleistocene localities in Italy and Sicily. Dr. Scalia reports it also from the sub-Etnaen beds of Nizzeti near Catania.

Sub-genus **ACINOPSIS**, Monterosato, 1884.

Alvania (Acinopsis) cancellata (Da Costa). Plate L, fig. 42.

1779. *Turbo cancellatus*, Da Costa, Brit. Conch., p. 104, pl. viii, figs. 6, 9.
1799. *Turbo cimex*, Donovan (not Linné), Brit. Shells, vol. i, pl. ii, fig. 1.
1853. *Rissoa crenulata*, Forbes and Hanley, Brit. Moll., vol. iii, p. 80, pl. lxxix, figs. 1, 2.
1859. *Rissoa crenulata*, G. B. Sowerby, Ill. Ind. Brit. Shells, pl. xiii, fig. 8.
1867—84. *Rissoa cancellata*, Jeffreys, Brit. Conch., vol. iv, p. 8, 1867; vol. v, p. 207, pl. lxvi, fig. 3, 1869; *R. (Alvania) cancellata*, Proc. Zool. Soc., p. 111, 1884.
1874—76. *Rissoa (Alvania) cancellata*, Seguenza, Boll. R. Com. Geol. Ital., vol. v, p. 4, no. 372; p. 282, no. 129, 1874; vol. vii, p. 102, no. 680, 1876.
1884. *Rissoa (Acinopsis) cancellata*, Bucquoy, Dautzenberg et Dollfus, Moll. mar. Rouss., vol. i, p. 294, pl. xxxiv, figs. 18—21.
1890. *Rissoa cancellata*, A. Bell, Rep. Brit. Assoc. (Leeds), p. 420.
1892. *Alvania cancellata*, Locard, Coq. mar. Côtes de France, p. 157.
1901. *Alvania cancellata*, Conch. Soc. List, Journ. of Conch., vol. x, p. 14, no. 338.
1913. *Rissoa (Acinopsis) cancellata*, Dautzenberg et Durouchoux, Feuille des Jeunes Natur., vol. xliv, p. 29.
1914. *Rissoa (Acinopsis) cancellata*, Cerulli-Irelli, Palaeont. Ital., vol. xx, p. 204, pl. xvi, figs. 16—20.

Specific Characters.—Shell small, solid, conical; whorls 6—7, convex, the last two-thirds the total length; spire short, turreted; suture wide, excavated; ornamented by longitudinal and spiral ribs of equal strength, squarely intersecting, with raised and rather sharp tubercles at the points of contact; base furnished with an angular projection on the columella; mouth oblong, oval, angulated above, subcanaliculate; outer lip varicose; inner lip thickened at the base.

Dimensions.—L. 5 mm. B. 2 mm.

Distribution.—Recent: British seas, southern and western; Ireland; Hebrides. Atlantic coast to Madeira, the Azores, and the Canary Islands. Mediterranean, Adriatic, Ægean.

Fossil: Selsey, Loch Larne, Portrush.

Miocene: Azores, Madeira.

Upper Pliocene: Italy—Bologna, Monte Mario. Sicily—Messina.

Pleistocene: Italy—Reggio, Taranto, San Giovanni, Monteleone, Livorno, Valle Biaia. Sicily—Naso, Messina, Monte Pellegrino.

Remarks.—This characteristically southern form has not been obtained from the English Pliocene, either of the Crag or at St. Erth. Mr. A. Bell reports it,

however, from the Pleistocene of Selsey and Loch Larne, and from the Holocene of Portrush.

It resembles *Manzonia zetlandica* in sculpture, but has been separated from that and other similar species by the Marchese di Monterosato on account of its canaliculate base and the prominent tuberculation of its inner lip. He regarded it as a distinct sub-genus (*Acinopsis*), in which he has been followed by the authors of the Mollusca of Roussillon. By the Conchological Society of Great Britain and some others it is grouped with *Alvania*.

Sub-genus **GALEODINA**, Monterosato, 1884.

Alvania (Galeodina) carinata (Da Costa). Plate L, fig. 44.

1779. *Turbo carinatus*, Da Costa, Brit. Conch., p. 102, pl. xiii, fig. 10.
1803. *Turbo striatulus*, Montagu (*non* Linné), Test. Brit., vol. ii, p. 306, pl. x, fig. 5.
1836—44. *Rissoa labiata*, Philippi, Enum. Moll. Sic., vol. i, p. 155, pl. x, fig. 7, 1836; vol. ii, p. 127, 1844.
1853. *Rissoa striatula*, Forbes and Hanley, Brit. Moll., vol. iii, p. 73, pl. lxxix, figs. 7, 8.
1859. *Rissoa striatula*, G. B. Sowerby, Ill. Ind. Brit. Shells, pl. xiii, fig. 5.
1867—69. *Rissoa striatula*, Jeffreys, Brit. Conch., vol. iv, p. 5, 1867; vol. v, p. 206, pl. lxvi, fig. 1, 1869.
1876. *Rissoa carinata*, Seguenza, Boll. R. Com. Geol. Ital., vol. vii, p. 102, no. 670.
1878. *Rissoa striatula*, Reeve, Conch. Icon., vol. xx, pl. ii, fig. 16.
1878—84. *Rissoa* (*Alvania*) *carinata*, Monterosato, Enum. e Sinon. Conch. Medit. (Giorn. Soc. Sci. Nat. Palermo, vol. xiii, p. 84), 1878; *Galeodina striatula*, Nom. Gen. e Spec. Conch. Medit., p. 65, 1884.
1884. *Rissoa* (*Galeodina*) *carinata*, Bucquoy, Dautzenberg et Dollfus, Moll. mar. Rouss., vol. i, p. 302, pl. xxxv, figs. 1, 2.
1890. *Rissoa* (*Galeodina*) *striatula*, Carus, Prod. Faun. Medit., vol. ii, p. 335.
1892. *Alvania carinata*, Locard, Coq. mar. Côtes de France, p. 163, fig. 138.
1892. *Rissoa striatula*, A. Bell, Rep. Yorks. Phil. Soc., p. 63.
1901. *Galeodina carinata*, Conch. Soc. List, Journ. of Conch., vol. x, p. 18, no. 355.

Specific Characters.—Shell oval, turreted and solid; whorls 5—6, convex, angulated, the last much the largest, more than two-thirds the total length; ornamented by numerous exceedingly fine and gently curved longitudinal ribs, which hardly reach the base of the shell, and by prominent spiral ridges, stronger than the former, which produce delicate reticulation on the upper whorls, where they intersect them. The transverse ridges are unequal in size, those below the suture being the strongest and those on the base much finer; spire rapidly diminishing upwards to a sharp apex; suture well marked, but not channelled; mouth large, ovate, angulated above, rounded below; outer lip semicircular, thickened or varicose; inner lip broad, reflected on the pillar.

Dimensions.—L. 4 mm. B. 3 mm.

Distribution.—Recent: Coasts of Great Britain and Ireland, mostly southern and western (littoral zone, not common).

Atlantic coast from the English Channel to Gibraltar, Mediterranean and Adriatic, generally diffused.

Fossil: Selsey.

Upper Pliocene: Val d'Era, Legoli.

Pleistocene: Rhodes (B.D.D.).

Remarks.—This is another characteristically southern and Mediterranean species which as an English fossil has been reported from Selsey only. Considerable difference of opinion exists as to whether it should be known under Montagu's specific name of *striatula* or Da Costa's of *carinata*. As to this I refer students of the Crag to the various works quoted above. The subgeneric (or generic) name of *Galeodina* proposed by the Marchese di Monterosato in 1884 has been accepted by most recent authorities and by the Conchological Society of Great Britain.

Sub-genus **MASSOTIA**, Dautzenberg and Dollfus, 1884.

Alvania (Massotia) lactea (Michaud). Plate L, fig. 41.

1832. *Rissoa lactea*, Michaud, Descr. du Genus *Rissoa*, p. 9, figs. 11, 12.
1836—44. *Rissoa lactea*, Philippi, Enum. Moll. Sic., vol. i, p. 152, 1836; vol. ii, p. 129, 1844.
1853. *Rissoa lactea*, Forbes and Hanley, Brit. Moll., vol. iii, p. 76, pl. lxxix, figs. 3, 4.
1859. *Rissoa lactea*, G. B. Sowerby, Ill. Ind. Brit. Shells, pt. xiii, fig. 12.
1867—69. *Rissoa lactea*, Jeffreys, Brit. Conch., vol. iv, p. 7, 1867; vol. v, p. 206, pl. lxvi, fig. 2, 1869.
1868. *Rissoa* (*Alvania*) *lactea*, Weinkauff, Conch. Mittelm., vol. ii, p. 309.
1874. *Rissoa* (*Alvania*) *lactea*, Seguenza, Boll. R. Com. Geol. Ital., vol. iv, p. 4, no. 371.
1878—84. *Rissoa* (*Alvania*) *lactea*, Monterosato, Enum. e Sinon. Conch. Medit. (Giorn. Soc. Sci. Nat., Palermo, vol. xiii), p. 84, 1878; *Massotia lactea*, Nom. Gen. e Spec. Conch. Medit., p. 65, 1884.
1884. *Rissoa* (*Massotia*) *lactea*, Bucquoy, Dautzenberg et Dollfus, Moll. mar. Rouss., vol. i, p. 298, pl. xxxv, figs. 7—13.
1889—95. *Rissoa textilis*, Sacco, Boll. R. Com. Geol. Ital., vol. viii, p. 356, no. 1998, 1889; *Alvania* (*Massotia*) *lactea*, Moll. Terr. Terz. Piem., pt. xviii, p. 28, 1895.
1890 *Rissoa* (*Massotia*) *lactea*, Carus, Prod. Faun. Medit., vol. ii, p. 334.
1892. *Alvania lactea*, Locard, Coq. mar. Côtes de France, p. 157.
1892. *Rissoa lactea*, A. Bell, Rep. Yorks. Phil. Soc., p. 63.
1907. *Rissoia* (*Alvania*) *lactea*, Scalia, Att. Accad. Gioen. Sci. Nat. Catania [4], vol. xx, p. 33, no. 230.
1913. *Rissoa* (*Massotia*) *lactea*, Dautzenberg, Feuille des Jeunes Natur., vol. xliv, p. 30, pl. ii, fig. 15.

Specific Characters.—Shell oval, compressed towards the mouth; whorls 5—6, rather convex, the last tumid, three-fourths the total length, the first two minute; ornamented by numerous fine, curved, longitudinal ribs, closely set, dying out on the body-whorl with an occasional varix, and by delicate spiral striæ, extending to the base, which cross the ribs, but do not become nodulous where they inter-

sect; suture slight but distinct; spire short, abruptly pointed; mouth oval, angulated above, not expanded nor toothed inside; outer lip thickened where it joins the inner one.

Dimensions.—L. 4 mm. B. 2·5 mm.

Distribution.—Recent: Jersey, North Devon (rare). Atlantic coast, from France to Morocco. Mediterranean, Adriatic.

Fossil: Selsey.

Lower Pliocene: Piacenziano (frequent).

Upper Pliocene: Astiano (not rare).

Pleistocene: Sicily—Messina. Catania—Sallustro, Nizzeti. Calabria—Reggio.

Remarks.—This characteristically southern form is included in our lists of British shells on the strength of a few specimens found in Jersey and off the northern coast of Devonshire. As a British fossil it has been reported only from Selsey, the molluscan fauna of which, as pointed out by Wood and A. Bell,[1] has a strongly marked Lusitanian and Mediterranean character—a fact which deserves more general recognition than it has hitherto received.

The subgenus *Massotia* was proposed in 1884 by Messrs. Dautzenberg and Dollfus for a group of *Rissoæ* having an oval form, a short spire, the last whorl being tumid and the sculpture feebly reticulate. This subgeneric name has been adopted by several subsequent writers.

Genus **MANZONIA**, Brusina, 1870.

Manzonia zetlandica (Montagu). Plate L, figs. 51, 52.

1811. *Turbo zetlandica*, Montagu, Trans. Linn. Soc., vol. xi, p. 194, pl. xiii, fig. 3.

1842—48. *Rissoa zetlandica*, S. V. Wood, Ann. Mag. Nat. Hist. [1], vol. ix, p. 533, 1842; Mon. Crag Moll., pt. i, p. 101, pl. xi, fig. 7, 1848.

1853. *Rissoa Zetlandica*, Forbes and Hanley, Brit. Moll., vol. iii, p. 78, pl. lxxx, figs. 1, 2.

1856. *Rissoa Zetlandica*, Hörnes, Foss. Moll. Tert. Wien, vol. i, p. 566, pl. xlviii, fig. 11.

1859. *Rissoa zetlandica*, G. B. Sowerby, Ill. Ind. Brit. Shells, pl. xiii, fig. 7.

1867—84. *Rissoa Zetlandica*, Jeffreys, Brit. Conch., vol. iv, p. 20, 1867; vol. v, p. 207, pl. lxvii, fig. 1, 1869; Quart. Journ. Geol. Soc., vol. xxvii, pp. 145, 491, 1871; *R.* (*Flemingia*) *zetlandica*, Proc. Zool. Soc. Lond., p. 116, 1884.

1872. *Rissoa zetlandica*, A. and R. Bell, Proc. Geol. Assoc., vol. ii, pp. 204, 210.

1874—76. *Rissoa* (*Alvania*) *zetlandica*, Seguenza, Boll. R. Com. Geol. Ital., vol. v, p. 4, no. 392; p. 282, no. 135, 1874; vol. vii, p. 102, no. 683, 1876.

1877. *Rissoa zetlandica*, Dollfus, Bull. Soc. Géol. Normandie, vol. vi, p. 516.

1878. *Alvania zetlandica*, de Stefani e Pantinelli, Bull. Soc. Malac. Ital., vol. iv, p. 174.

1878. *Alvania zetlandica*, G. O. Sars, Moll. Reg. arct. Norv., pp. 177, 359, vol. x, fig. 7.

1878. *Rissoa zetlandica*, Reeve, Conch. Icon., vol. xx, pl. iii, fig. 26.

1878—84. *Rissoa* (*Alvania*) *zetlandica*, Monterosato, Enum. e Sinon. Conch. Medit. (Giorn. Soc. Sci. Nat. Palermo, vol. xiii, p. 85), 1878; Nom. Gen. e Spec. Conch. Medit., p. 64, 1884.

[1] *Loc. cit.*, p. 61.

1886. *Rissoa* (*Alvania*) *zetlandica*, Dollfus et Dautzenberg, Feuille des Jeunes Natur., vol. xvi, p. 139.
1895. *Rissoia* (*Flemingia*) *zetlandica*, Sacco, Moll. Terr. Terz. Piem., pl. xviii, p. 30.
1901. *Alvania zetlandica*, Brøgger, Norges geol. Undersøgelse, no. 31, pp. 405, 660.
1901. *Manzonia zetlandica*, Conch. Soc. List, Journ. of Conch., vol. x, p. 18, no. 344.
1904. *Rissoa* (*Flemingia*) *zetlandica*, Cerulli-Irelli, Palaeont. Ital., vol. xx, p. 194, pl. xv, figs. 48, 49.
1912. *Rissoa zetlandica*, Tesch, Med. v. d. Rijks. v. Delfstoffen, No. 4, p. 68, no. 155.

Specific Characters.—Shell small, oval, turreted, strong and solid; whorls 5 or 6, convex, tumid, angulated above; coarsely sculptured with strong longitudinal ribs, which do not quite reach the base of the shell but are cut off in the body-whorl by a distinct spiral keel and decussated by prominent spiral ridges; between the latter and the mouth there is a rather deep depression; labial rib thick and prominent; suture deep and channelled; mouth subcircular, expanding somewhat outwards; outer and inner lips forming a continuous and slightly elevated rim.

Dimensions.—L. 4 mm. B. 3 mm.

Distribution.—*Recent:* British seas from Guernsey to the Shetlands, principally western, sparingly found in the coralline and deep-sea zones. Lofoten Islands, Norwegian coasts, south of Sweden. Cherbourg, Vigo Bay, Mediterranean.

Fossil: Coralline Crag: Sutton. Waltonian: Walton-on-Naze, Little Oakley. Newbournian: Sutton, Waldringfield. Butleyan: Butley. Pleistocene: Firth of Forth. Holocene: Portrush.

Miocene: Touraine, Vienna basin.

Lower Pliocene: Piacenziano—Zinola, Bordighera, Siena, Normandy.

Upper Pliocene: Messina, Altavilla, Bologna, Monte Mario.

Pleistocene: Messina, Ficarazzi, Monte Pellegrino, Reggio, Livorno.

Isocardia- and *Tapes*-banks, Christiania fiord.

Remarks.—This very distinct form has been grouped by some writers with *Alvania*. In 1884 Jeffreys proposed for it the subgeneric name of *Flemingia*, but this was superseded in 1870 by the Conchological Society of Great Britain, as well as by M. Dautzenberg and others on grounds of priority by *Manzonia*, a name which it seems likely will be adopted for it in future. *M. zetlandica* has a wide range in time and space, having been reported from the Miocene of France and Vienna as well as from the Pliocene and Pleistocene of the Mediterranean area, where it is still found living. Prof. Brøgger gives it also from the post-glacial beds of Christiania.

It is not very common in the Crag, though it has been found sparingly from the Coralline to the Butleyan zone. It is specially characterised by its coarse and vigorous sculpture and its angulated whorls. It has been figured in most of our works of reference.

Specimens from the Crag of Oakley have a more slender and elongated spire and a deeper suture than those from Portrush.

Manzonia costata (Adams). Plate L, fig. 48.

1796. *Turbo costatus*, Adams, Trans. Linn. Soc., vol. iii, p. 65, pl. xiii, figs. 13, 14.
1803. *Turbo costatus*, Montagu, Test. Brit., vol. ii, p. 311, pl. x, fig. 6.
1836—44. *Rissoa carinata*, Philippi (not Da Costa), Enum. Moll. Sic., vol. i, p. 150, pl. x, fig. 10, 1836; *R. exigua*, vol. ii, p. 125, 1844.
1853. *Rissoa costata*, Forbes and Hanley, Brit. Moll., vol. iii, p. 92, pl. lxxviii, figs. 6, 7.
1859. *Rissoa exigua* and *R. carinata*, Chenu, Man. Conch., vol. i, p. 307, figs. 2178, 2179.
1859. *Rissoa costata*, G. B. Sowerby, Ill. Ind. Brit. Shells, pl. xiii, fig. 14.
1867—84. *Rissoa costata*, Jeffreys, Brit. Conch., vol. iv, p. 22, 1867; vol. v, p. 207, pl. lxvii, fig. 2, 1869; Proc. Zool. Soc., p. 116, 1884.
1874—76. *Rissoa* (*Alvania*) *costata*, Seguenza, Boll. R. Com. Geol. Ital., vol. v, p. 4, no. 393, 1874; vol. vii, p. 102, no. 684, 1876.
1878. *Onoba costata*, G. O. Sars, Moll. Reg. Arct. Norv., p. 359.
1878—84. *Rissoa* (*Alvania*) *costata*, Monterosato, Enum. e Sinon. Conch. Medit. (Giorn. Soc. Sci. Nat. Palermo, vol. xiii, p. 85), 1878; *Manzonia costata*, Nom. Gen. e Spec. Conch. Medit., p. 64, 1884.
1884. *Rissoa* (*Manzonia*) *costata*, Bucquoy, Dautzenberg et Dollfus, Moll. mar. Rouss., vol. i, p. 300, pl. xxxvi, figs. 20—22.
1890. *Rissoa* (*Manzonia*) *costata*, Carus, Prod. Faun. Medit., vol. ii, p. 326.
1892. *Alvania costata*, Locard, Coq. mar. Côtes de France, p. 164, fig. 139.
1892. *Rissoa costata*, A. Bell, Rep. Yorks. Phil. Soc., p. 63.
1901. *Manzonia costata*, Conch. Soc. List, Journ. of Conch., vol. x, p. 18, no. 345.
1907. *Rissoia* (*Manzonia*) *costata*, Scalia, Att. Accad. Gioen. Sci. Nat. Catania [4], vol. xx, p. 33, no. 238.
1913. *Rissoa* (*Manzonia*) *costata*, Dautzenberg et Durouchoux, Feuille des Jeunes Natur., vol. xliv, p. 30, pl. ii, fig. 16.
1914. *Rissoia* (*Manzonia*) *costata*, Cerulli-Irelli, Palaeont. Ital., vol. xx, p. 193, pl. xv, figs. 43—47.

Specific Characters.—Shell very small, oblong, slender, solid, obliquely twisted; whorls 6, compressed, the first minute and rounded, the last the largest, three-fifths of the total length; spire long and pointed; suture deep; ornamented by strong, prominent and flexuous longitudinal ribs which do not quite reach the base, being cut off by a well-marked spiral ridge starting from the top of the mouth, followed closely by a deep spiral groove or depression; the shell is also covered by extremely delicate transverse lines, hardly visible without the aid of a lens; mouth oval, with a wide, strong and continuous margin; outer lip thickened by the labial rib, finely grooved inside.

Dimensions.—L. 3 mm. B. 1·5 mm.

Distribution.—Recent: British coasts from the English Channel to the Shetland islands, not common. North Atlantic, as far south as Madeira and the Canaries. Christiania fiord (G. O. Sars).

Fossil: Bridlington, Gloppa. Selsey. Irish estuarine clays. Scotland—Garvel Park.

Upper Pliocene: Monte Mario, Altavilla.

Pleistocene: Monte Pellegrino, Taranto, Livorno, Valle Biaia, sub-Etnaen beds—Nizzeti. Rhodes.

Remarks.—This little shell, easily recognisable, is as a fossil known from Selsey, Bridlington, Gloppa and several other British localities; it seems, however, to be for the most part a southern form. It is grouped by the Conchological Society with *R. zetlandica* as generically distinct.

Genus **RISSOA** Frémenville, 1813.

Rissoa membranacea (A. Adams). Plate LI, fig. 1.

1797. *Turbo membranaceus*, A. Adams, Trans. Linn. Soc., vol. v, p. 2, pl. i, figs. 12, 13.
1846. *Rissoa membranacea*, Lovén, K. Svensk. Vet.-Acad. Förh., vol. iii, p. 96.
1867—69. *Rissoa membranacea*, Jeffreys, Brit. Conch., vol. iv, p. 30, 1867; vol. v, p. 208, pl. lxvii, fig. 8, 1869.
1873. *Rissoa membranacea*, Weinkauff, Cat. europ. Meeresconch., p. 18, no. 278.
1878. *Rissostomia membranacea*, G. O. Sars, Moll. Reg. Arct. Norv., p. 359.
1878—84. *Rissoa membranacea*, Monterosato, Enum. e Sin. Conch. Medit. (Giorn. Soc. Sci. Nat. Palermo, vol. xiii, p. 83), 1878; *Zippora fragilis*, Nom. Gen. e Spec. Conch. Medit., p. 54, 1884.
1892. *Rissoa membranacea*, Praeger, Proc. Roy. Irish Acad. [3], vol. ii, p. 260.
1892—98. *Rissoa membranacea* (pt.), A. Bell, Rep. Yorks. Phil. Soc., p. 63, 1892; Proc. Roy. Irish Acad. [3], vol. ii, p. 630, 1893; Trans. Roy. Geol. Soc. Cornwall, vol. xii, p. 153, 1898.
1901. *Zippora membranacea*, Conch. Soc. List, Journ. of Conch., vol. x, p. 18, no. 326.
1913. *Rissoa membranacea*, Dautzenberg et Durouchoux, Feuille des Jeunes Natur., vol. xliv, p. 28.

Specific Characters.—Shell rather thin, semitransparent, oblongo-conical; whorls 7, somewhat compressed, the last much the largest, expanded below, half to two-thirds the total length; ornamented on the three lower whorls by prominent, somewhat flexuous ribs, which do not reach the base, the upper ones being without such sculpture, the labial rib being thick and broad, also by exceedingly delicate spiral lines; spire elongated, with a sharp point; mouth oval, expanded; inner lip reflected on the pillar and on the base.

Dimensions.—L. 8 mm. B. 4 mm.

Distribution.—Recent: British coasts from low-tide mark to a few fathoms, local; Atlantic from Norway and Denmark to France, Spain and the Canaries. Mediterranean, Ægean, Adriatic.

Fossil: St. Erth.

Pleistocene: Selsey, Bute, Clyde beds, Largo, Kelsey Hill, Estuarine clays of Belfast. Uddevalla, Norwegian coast.

Remarks.—This common British species has not been reported from the English Crag, though there is a rather unsatisfactory specimen in the British Museum from St. Erth which has been identified with it. Those of the type and its varieties now figured are from the estuarine beds of Belfast, where it is said

to be very abundant; in Largo Bay Mr. Bell informs me there is a thick shell-bed of Pleistocene age which deserves the attention of collectors.

I have received from M. Dautzenberg some Danish specimens of *R. membranacea* which correspond satisfactorily with the Belfast fossil now figured.

Var. **labiosa** (Montagu). Plate LI, fig. 2, 3.

1803. *Helix labiosa*, Montagu, Test. Brit., pt. ii, p. 400, pl. xiii, fig. 7.
1853. *Rissoa labiosa*, Forbes and Hanley, Brit. Moll., vol. iii, p. 109, pl. lxxvi, fig. 5; pl. lxxvii, figs. 1, 2.
1858. *Rissoa labiosa*, H. and A. Adams, Gen. Rec. Moll., vol. i, pl. xxxv, fig. 2.
1867. *Rissoa membranacea*, var. *venusta*, Jeffreys, Brit. Conch., vol. iv, p. 31.
1892. *Rissoa membranacea*, Locard, Coq. mar. Côtes de France, p. 166, fig. 143.
1892. *Rissoa membranacea*, var. *venusta*, Praeger, Proc. Roy. Irish Acad. [3], vol. ii, p. 260.
1893. *Rissoa membranacea*, A. Bell (pt.), Proc. Roy. Irish Acad. [3], vol. ii, p. 630.
1901. *Zippora membranacea*, var. *labiosa*, Conch. Soc. List, Journ. of Conch., vol. x, p. 18.
1913. *Rissoa membranacea*, var. *labiosa*, Dautzenberg et Durouchoux, Feuille des Jeunes Natur., vol. xliv, p. 28, pl. ii, fig. 1.

Varietal Characters.—Smaller, shorter and more solid than the type with rather stronger ribs.

Dimensions.—L. 6 mm. B. 3 mm.

Distribution.—Recent: British coasts—principally southern. South Wales, West of Scotland, Irish coasts. Norway to Mediterranean.

Fossil: Estuarine clays, Belfast; elsewhere in Pleistocene deposits with the type form.

Remarks.—It seems probable that the specimen of *R. labiosa*, originally described by Forbes and Hanley and H. and A. Adams, copied afterwards by Locard, was incorrectly drawn. It shows a tumid shell with very oblique costæ, the like of which M. Dautzenberg informs me he has never seen elsewhere during the whole of his experience. As this mistake must have been a source of difficulty to others beside myself, I now give a verified specimen of the recent form received from M. Dautzenberg, for comparison with Forbes and Hanley's shell on the one hand and our Belfast fossil, with which it closely corresponds, on the other.

Rissoa elata, Philippi. Plate LI, fig. 4.

1844. *Rissoa elata*, Philippi, Enum. Moll. Sic., vol. ii, p. 124, pl. xxiii, fig. 3.
1853. *Rissoa labiosa*, Forbes and Hanley, Brit. Moll., vol. iii, p. 111, pl. lxxvii, fig. 3; pl. lxxxi, fig. 3.
1867. *Rissoa membranacea*, var. *elata*, Jeffreys, Brit. Conch., vol. iv, p. 31.
1873. *Rissoa elata*, Weinkauff, Cat. europ. Meeresconch., p. 18, no. 276.
1874—76. *Rissoa elata*, Seguenza, Boll. R. Com. Geol. Ital., vol. v, p. 4, no. 356, 1874; vol. vii, p. 102, no. 665, 1876.
1878. *Rissoa membranacea*, Reeve, Conch. Icon., vol. xx, pl. viii, fig. 67.

1884. *Zippora elata*, Monterosato, Nom. Gen. e Spec. Conch. Medit., p. 54.
1890. *Rissoa* (*Zippora*) *elata*, Carus, Prod. Faun. Medit., vol. ii, p. 323.
1892—98. *Rissoia membranacea*, var. *elata*, A. Bell, Rep. Yorks. Phil. Soc., p. 63, 1892; Proc. Roy. Irish Acad. [3], vol. ii, p. 630, 1893; Trans. Roy. Geol. Soc. Cornwall, vol. xii, p. 153, 1898.
1892. *Rissoia elata*, Locard, Coq. mar. Côtes de France, p. 167.
1898. *Rissoa elata*, Bucquoy, Dautzenberg et Dollfus, Moll. mar. Rouss., vol. ii, p. 799.
1901. *Zippora membranacea*, var. *elata*, Conch. Soc. List, Journ. of Conch., vol. x, p. 18.

Specific Characters.—Shell elongato-turreted, with an acute apex; whorls about 10, the upper ones flattened, the lower ones somewhat more convex; spire regularly conical; suture slight, rather oblique, marked by numerous but not prominent ribs or lines of growth and by more or less obsolete spiral lines; mouth oval, rounded and expanded below; inner lip expanded, forming a small umbilical chink.

Dimensions.—L. 10 mm. B. 4 mm.

Distribution.—Recent: British Seas, estuaries and brackish water (Jeffreys). Mediterranean, Adriatic, Black Sea. Atlantic coasts of Spain.

Fossil: St. Erth. Selsey. Belfast clays.

Pliocene: Livorno, Altavilla.

Pleistocene: Livorno, Monte Pellegrino.

Remarks.—This form was originally considered by Philippi and since then by other writers as specifically distinct. By Jeffreys, and more recently by the Conchological Society, however, it has been regarded as a variety of *R. membranacea.* Jeffreys describes it as thinner than the latter, with a longer spire and often ribless. In Philippi's figure it is shown to be slender, elongated, with inconspicuous and nearly straight ribs, approaching one of the Belfast fossils alluded to above, but having a longer spire. Two of the specimens of *R. labiosa* figured by Forbes and Hanley (pl. lxxvii, fig. 3; pl. lxxxi, fig. 3) seem to belong to this form. There are recent examples in the Holmes Collection at the Norwich Museum which correspond exactly with it. Mr. A. Bell reports it from St. Erth and Selsey, and Seguenza from the Upper Pliocene and Pleistocene of Livorno and Sicily.

Rissoa venusta, Philippi. Plate LI, fig. 14.

1844. *Rissoa venusta*, Philippi, Enum. Moll. Sic., vol. ii, p. 124, pl. xxiii, fig. 4.
1867. *Rissoa membranacea* var. *venusta*, Jeffreys, Brit. Conch., vol. iv, p. 31.
1890. *Rissoa venusta*, Carus, Prod. Faun. Medit., vol. ii, p. 323.
1892. *Rissoa venusta*, Locard, Coq. mar. Côtes de France, p. 170.
1892. *Rissoa membranacea* var. *venusta*, A. Bell, Rep. Yorks. Phil. Soc., p. 63.
1892. *Rissoa membranacea* var. *venusta*, Praeger, Proc. Roy. Irish Acad. [3], vol. ii, pp. 260, 277.
1898. *Rissoa venusta*, Bucquoy, Dautzenberg et Dollfus, Moll. mar. Rouss., vol. ii, p. 796.

Specific Characters.—Shell solid, ovate; whorls but slightly convex, the last two-thirds the total length; ornamented by strong longitudinal costæ, which die

out on the body-whorl; suture well marked but not deep; spire conical, ending in a sharp point; mouth oblong, acutely angulate above, rounded and produced below.

Dimensions.—L. 8 mm. B. 3 mm.

Distribution.—*Recent:* Poole (Jeffreys). Coasts of Provence.

Fossil: Selsey; estuarine clays—Belfast.

Remarks.—The specimen here figured was found by Mr. Bell in his collection of Selsey fossils. It is a special form and may be easily identified with Philippi's shell. Originally described by that authority as specifically distinct, in which he was followed by Carus, Locard and the authors of the Mollusca of Rousillon, it was regarded by Jeffreys as a variety of *R. membranacea*. I venture to agree with Philippi's view.

Rissoa lineolata, Michaud. Plate LI, fig. 7.

1832. *Rissoia lineolata,* Michaud, Descr. esp. Rissoa, p. 9, no. 5, figs. 13, 14.
1844. *Rissoa Ehrenbergi,* Philippi, Enum. Moll. Sic., vol. ii, p. 127, pl. xxiii, fig. 9.
1873. *Rissoa lineolata,* Weinkauff, Cat. europ. Meeresconch., p. 18, no. 289.
1878. *Rissoa lineolata,* Monterosato, Enum. e Sinon. Conch. Medit. (Giorn. Soc. Sci. Nat. Palermo, vol. xiii), p. 83.
1884. *Rissoa lineolata,* Bucquoy, Dautzenberg et Dollfus, Moll. mar. Rouss., vol. i, p. 271, pl. xxxi, figs. 16—20.
1890. *Rissoa lineolata,* Carus, Prod. Faun. Medit., vol. ii, p. 318.
1892. *Rissoa lineolata,* Locard, Coq. mar. Côtes de France, p. 168.
1893—98. *Rissoa Ehrenbergi,* A. Bell, Proc. Roy. Irish Acad. [3], vol. ii, p. 629, 1893; Trans. Roy. Geol. Soc. Cornwall, vol xii, p. 151, 1898.

Specific Characters.—Shell minute, ovato-oblong, thin; whorls 7, slightly convex, the last ventricose, much the largest; the upper whorls without sculpture, the others ornamented by 14—18 longitudinal costæ, strong and rounded, reaching the obtusely angulated periphery but not the base of the shell which is smooth, spiral striations or ridges wanting; spire short, regularly conical, with an acute apex; suture well-marked; mouth rounded.

Dimensions.—L. 4 mm. B. 2 mm.

Distribution.—*Recent:* Mediterranean.

Fossil: St. Erth.

Pliocene: Tuscany (Pantinelli).

Remarks.—The specimen from St. Erth figured under this name is from the British Museum, where it has been identified with the *Rissoa Ehrenbergi* of Philippi (*q.v.*), but the authors of the Marine Mollusca of Rousillon consider that *R. Ehrenbergi* was founded on a young example of *R. lineolata*, Michaud, whose name they adopt, and this view has been followed by subsequent writers.

R. lineolata is said to be a fairly common Mediterranean species, having a short conical spire, with an enlarged, obtusely angulated base and strong longitudinal costæ. These features are well shown in our own specimen from St. Erth and in the one figured by Philippi (*q.v.*).

Rissoa Guerini, Recluz. Plate LI, figs. 9, 10.

1843. *Rissoa Guerini*, Recluz, Rev. zool. Soc. Cuv., p. 7.
1844. *Rissoa costulata*, Alder (not Wood), Ann. Mag. Nat. Hist., vol. xiii, p. 324, pl. viii, figs. 8, 9.
1853. *Rissoa costulata*, Forbes and Hanley, Brit. Moll., vol. iii, p. 103, pl. lxxvii, figs. 4, 5.
1859. *Rissoa costulata*, G. B. Sowerby, Ill. Ind. Brit. Shells, pl. xiii, fig. 19.
1867—84. *Rissoa costulata*, Jeffreys, Brit. Conch., vol. iv, p. 35, 1867; vol. v, p. 208, pl. lxviii, fig. 1, 1869; *R. similis* var., Proc. Zool. Soc. London, p. 117, 1884.
1878—84. *Rissoa costulata*, Monterosato, Enum. e Sinon. Conch. Medit. (Giorn. Soc. Sci. Nat. Palermo, vol. xiii), p. 84, 1878; *Apicularia Guerini*, Nomen. Gen. e Spec. Conch. Medit., p. 56, 1884.
1879. *Rissoa costulata*, S. V. Wood, Mon. Crag Moll., 2nd Suppl., p. 29, pl. iv, fig. 23.
1884—98. *Rissoa Guerini*, Bucquoy, Dautzenberg et Dollfus, Moll. mar. Rouss., vol. i, p. 267, pl. xxxii, figs. 4, 5, 1884; vol. ii, p. 771, 1898.
1890. *Rissoa costulata*, Carus, Prod. Faun. Medit., vol. ii, p. 320.
1892. *Rissoa costulata*, A. Bell, Rep. Yorks. Phil. Soc., p. 63.
1892. *Rissoa Guerini*, Locard, Coq. mar. Côtes de France, p. 171, fig. 147.
1901. *Rissoa Guerini* var. *costulata*, Conch. Soc. List, Journ. of Conch., vol. x, p. 18, no. 336.
1913. *Rissoa Guerini*, Dautzenberg et Durouchoux, Feuille des Jeunes Natur., vol. xliv, p. 28, pl. ii, fig. 2.

Specific Characters.—Shell fusiform, oblong, conical, somewhat spindle-shaped, rather solid; whorls 8, convex; ornamented by strong and prominent longitudinal ribs, 10 on the last whorl, and usually by fine spiral ridges in the interspaces, disappearing on the last, but they are variable in strength and sometimes quite obliterated; spire elongate, tapering to a fine point; suture well marked; mouth oval, contracted and incurved above, strengthened by a rib or callus near the mouth; inner lip reflected on the pillar and towards the base.

Dimensions.—L. 5—6 mm. B. 2—2·5 mm.

Distribution.—*Recent:* Channel islands, southern and western coasts of England and Ireland, Scarborough. Atlantic coasts of France and Spain. Mediterranean.

Fossil: St. Erth. Coralline Crag: Sutton. Selsey. Estuarine clays of Belfast, Portrush.

Remarks.—The specimens from St. Erth and Selsey here represented seem to agree very closely with Alder's original figure of *R. costulata*, but not with the *R. costulata* of Risso, which Jeffreys says is the *R. costata* of Desmarest. The authors of the Memoir on the Marine Mollusca of Rousillon in their first volume identify Alder's shell with *R. Guerini* of Recluz, of which the Conchological Society considers it a variety. Jeffreys, however, regards it as a varietal form of *R. similis*,

Scacchi. While, however, there has been considerable difference of opinion as to its relation to *R. Guerini*, there can be little doubt, I think, that it agrees with Alder's *R. costulata*. I venture, however, to retain the former name for our shells, if only provisionally.

The *Rissoa costulata* of the first part of Wood's Monograph of 1848 (p. 106, pl. xi, fig. 12) is evidently a different species, *R. Stefanisi* (Jeffreys), *Menestho Stefanisi* (nobis), as indeed he pointed out in his 1st Suppl., p. 73, 1872.

Rissoa dissimilis, sp. nov. Plate LI, figs. 5, 6.

1898. *Rissoa obscura*, A. Bell, Trans. Roy. Geol. Soc. Cornwall, vol. xii, p. 153.

Specific Characters.—Shell minute, elongato-conical, obtusely angulate at the periphery; whorls 6 or 7, nearly flat; ornamented by about 12 longitudinal ribs, strong, rounded and prominent on the last, less so on the upper ones, ending at the angulated base, and by fine spiral ridges which are more strongly marked below the angulation; spire regularly diminishing in size to a blunt point; suture well marked, but not deep; mouth ovate, angulate above.

Dimensions.—L. 3 mm. B. 2 mm.

Distribution.—Not known living.

Fossil; St. Erth.

Remarks.—The specimens from the British and Cambridge Museums figured under this name, both obtained at St. Erth, were at first identified by Mr. Bell with the *R. obscura* of Philippi, but they are now considered both by him and by myself as belonging to a different species. As to the latter, he remarks that in his shell the whorls are "*valde converis*," and they are shown to be so in his illustration, whereas in our fossil they are nearly flat. The one from the British Museum (no. 18106) is there named *R. radiata*, but I doubt whether this is correct. It seems to me that they are both the same, and I prefer to regard them as new.

Rissoa parva (Da Costa). Plate LI, figs. 11, 12.

1779. *Turbo parvus*, Da Costa, Brit. Conch., p. 104.

1801. *Turbo lacteus*, Donovan, Nat. Hist. Brit. Shells, vol. iii, pl. xc.

1853. *Rissoa parva*, Forbes and Hanley, Brit. Moll., vol. iii, p. 100, pl. lxxvi, fig. 6.

1859. *Rissoa parva*, G. B. Sowerby, Ill. Ind. Brit. Shells, pl. xiii, fig. 16.

1867—84. *Rissoa parva*, Jeffreys, Brit. Conch., vol. iv, p. 24, 1867; vol. v, p. 207, pl. lxvii, fig. 3, 1869; Quart. Journ. Geol. Soc., vol. xl, p. 319; Proc. Zool. Soc. London, p. 118, 1884.

1870—98. *Rissoa parva*, A. Bell, Journ. de Conch., vol. xviii, p. 351, no. 390, 1870; Proc. Roy. Phys. Soc. Edinb., vol. x, pp. 292, 296, 1890; Proc. Yorks. Phil. Soc., p. 63, 1892; Proc. Roy. Irish Acad. [3], vol. ii, p. 629, 1893; Trans. Roy. Geol. Soc. Cornwall, vol. xii, p. 153, 1898.

1874—76. *Rissoa parva*, Seguenza, Boll. R. Com. Geol. Ital., vol. v, p. 4, no. 359, 1874; vol. vii, p. 162, no. 680, 1876.

1878. *Rissoa parva*, Monterosato, Enum. e Sinon. Conch. Medit. (Giorn. Soc. Sci. Nat. Palermo, vol. xiii), p. 83.
1878. *Rissoa parva*, Reeve, Conch. Icon., vol. xx, pl. iv, fig. 36.
1879. *Rissoa parva?*, S. V. Wood, Mon. Crag Moll., 2nd Suppl., p. 29, pl. iv, fig. 21.
1884. *Rissoa* (*Turbella*) *parva*, Bucquoy, Dautzenberg et Dollfus, Moll. mar. Rouss., vol. i, p. 272, pl. xxxii, figs. 11, 12.
1890. *Rissoa* (*Turbella*) *parva*, Carus, Prod. Faun. Medit., vol. ii, p. 324.
1892. *Rissoia parva*, Locard, Coq. mar. Côtes de France, p. 173, fig. 148.
1895. *Rissoia* (*Turbella*) *parva*, Sacco, Moll. Terr. Terz. Piem., pt. xviii, p. 22.
1901. *Rissoa parva*, Brøgger, Norges geol. Undersøgelse, No. 31, pp. 380, 513, 660, pl. xviii, fig. 11.
1901. *Rissoa parva*, Conch. Soc. List, Journ. of Conch., vol. x, p. 17, no. 332.
1913. *Rissoa* (*Turbella*) *parva*, Dautzenberg et Durouchoux, Feuille des Jeunes Natur., vol. xliv, p. 29, pl. ii, fig. 3.
1914. *Rissoia* (*Turbella*) *parva*, Cerulli-Irelli, Palaeont. Ital., vol. xx, p. 191, pl. xv, figs. 32—34.

Specific Characters.—Shell small, oval, rather solid; whorls 6—7, decidedly convex, the last nearly two-thirds the total length, the lower ones ornamented by strong curved ribs which hardly reach the base, their termination defined more or less distinctly by spiral striæ, the upper whorls without sculpture; spire short, regularly diminishing to a slightly compressed apex; suture distinct; mouth oval, expanded below; outer lip incurved and contracted above; inner lip reflected, without umbilicus.

Dimensions.—L. 4 mm. B. 2 mm.

Distribution.—*Recent:* British seas, widely distributed. Norwegian coast, Sweden, Denmark, Holland. Atlantic coasts of France, Spain and Portugal to the Canaries. Mediterranean, Adriatic, Ægean.

Fossil: St. Erth. Coralline Crag: Sutton.

Pleistocene: Bridlington, Kelsey Hill, Portland, Selsey, Largo Bay, Irish estuarine clays and Scottish drift (*passim*). Holocene: Portrush.

Pliocene: Biot, Monte Mario, Altavilla.

Pleistocene: Reggio, Christiania fiord—*Ostrea*-, *Isocardia*- and *Tapes*-banks.

Remarks.—This species, which is a common and widely spread British form, ranging both to the north and south of our shores, has been doubtfully reported from the Coralline Crag of Sutton; there is an imperfect specimen, however, from St. Erth in the British Museum which was obtained some years ago by Mr. Bell. He informs me it is very common in many of our Pleistocene deposits. The perfect example here figured is from the estuarine clays of Belfast.

It has been reported from a few localities in the Pliocene and Pleistocene of Italy and Sicily and from the post-glacial beds of the Christiania fiord.

Var. **interrupta** (A. Adams). Plate LI, fig. 13.

1799. *Turbo interruptus*, A. Adams, Trans. Linn. Soc., vol. v, p. 3, pl. i, figs. 16, 17.
1803. *Turbo interruptus*, Montagu, Test. Brit., p. 329, pl. xx, fig. 8.

1803. *Turbo interruptus*, Donovan, Nat. Hist. Brit. Shells, vol. v, pl. clxxviii, fig. 2.
1853. *Rissoa parva*, var. *interrupta*, Forbes and Hanley, Brit. Moll., vol. iii, p. 100.
1859. *Rissoa parva*, var. *interrupta*, G. B. Sowerby, Ill. Ind. Brit. Shells, pl. xiii, fig. 17.
1863—84. *Rissoa parva*, var. *interrupta*, Jeffreys, Rep. Brit. Assoc. (Newcastle-on-Tyne), p. 78, 1863; Brit. Conch., vol. iv, p. 24, 1867; vol. v, p. 207, pl. lxvii, fig. 4, 1869; Quart. Journ. Geol. Soc., vol. xl, p. 319, 1884.
1871. *Rissoa parva*, var. *interrupta*, F. W. Harmer, Trans. Norf. Norw. Nat. Soc., vol. i, pt. 3, p. 46.
1878. *Rissoa parva*, Monterosato, Enum. e Sin. Conch. Medit. (Giorn. Soc. Sci. Nat. Palermo, vol. xiii), p. 83.
1878. *Rissoa interrupta*, G. O. Sars, Moll. Reg. Arct. Norv., pp. 180, 359, pl. x, fig. 9.
1884—98. *Rissoa* (*Turbella*) *parva*, var. *interrupta*, Bucquoy, Dautzenberg et Dollfus, Moll. mar. Rouss., vol. i, p. 274, pl. xxxii, figs. 13—15, 1884; vol. ii, p. 787, 1898.
1890. *Rissoa interrupta*, Carus, Prod. Faun. Medit., vol. ii, p. 325.
1890—92. *Rissoa parva*, var. *interrupta*, A. Bell, Proc. Roy. Phys. Soc. Edin., vol. x, p. 292, 1890; Rep. Yorks. Phil. Soc., p. 63, 1892.
1892. *Rissoa interrupta*, Locard, Coq. mar. Côtes de France, p. 173.
1901. *Rissoa interrupta*, Brøgger, Norges geol. Undersøgelse, No. 31, p. 657, pl. xvii, fig. 12.
1901. *Rissoa parva*, var. *interrupta*, Conch. Soc. List, Journ. of Conch., vol. x, p. 17, no. 9.
1910. *Rissoa interrupta*, Øyen, Kongl. Norske Vid. Selsk. Skrift., pp. 34 *et seq.*
1912. *Rissoa* (*Turbella*) *parva*, var. *interrupta*, Dautzenberg et Fischer, Camp. scient. Prince de Monaco, vol. xxxvii (Mollusques), p. 208.
1913. *Rissoa* (*Turbella*) *parva*, var. *interrupta*, Dautzenberg et Durouchoux, Feuille des Jeunes Natur., vol. xliv, p. 29, pl. ii, fig. 4.

Varietal Characters.—Shell minute, more slender and elongate than the type form; whorls less convex and without or with a few longitudinal ribs; suture slight.

Dimensions.—L. 3 mm. B. 1·5 mm.

Distribution.—*Recent:* British seas, coast of Western Europe as far north as Finmark and the Lofoten Islands. St. Malo, Mediterranean—Rousillon, Cartagena.

Fossil: Waltonian Crag: Little Oakley.

Pleistocene: Bridlington, Selsey, Largo Bay, Caithness and elsewhere in Scotland (common). Estuarine clays, Belfast. Holocene: Portrush, Larne.

Pleistocene: Uddevalla, *Isocardia*- and *Tapes*-banks of Christiania (Brøgger), Trondhjem (Øyen).

Remarks.—Formerly regarded as specifically distinct, the present form is now more often considered as a variety of *R. parva*. It generally differs from the latter in the absence of the strong longitudinal costæ generally characteristic of that species. I have found it as recent on the Norfolk coast, and Dr. Gwyn Jeffreys informed me it had been dredged from the Lynn deeps. It has been recorded also from one or two points in the Mediterranean, but its range seems to be mainly northern.[1] Dr. Øyen has compared my Oakley fossil with specimens in the Museum at Christiania and reports that they are identical.

[1] Jeffreys, *op. cit.*, vol. iv, p. 25.

Rissoa inconspicua (Alder). Plate LI, fig. 39.

1844. *Rissoa inconspicua*, Alder, Ann. Mag. Nat. Hist. [1], vol. xiii, p. 323, pl. viii, figs. 6, 7.
1853. *Rissoa inconspicua*, Forbes and Hanley, Brit. Moll., vol. iii, p. 113, pl. lxxxii, figs. 5—9.
1859. *Rissoa inconspicua*, G. B. Sowerby, Ill. Ind. Brit. Shells, pl. xiii, fig. 22.
1867—84. *Rissoa inconspicua*, Jeffreys, Brit. Conch., vol. iv, p. 26, 1867; vol. v, p. 207, pl. lxvii, fig. 5, 1869; Proc. Zool. Soc. London, p. 120, 1884.
1872. *Rissoa inconspicua*, A. and R. Bell, Proc. Geol. Assoc., vol. ii, p. 204.
1874—76. *Rissoa inconspicua*, Seguenza, Boll. R. Com. Geol. Ital., vol. v, p. 4, no. 362, 1874; vol. vii, p. 102, no. 661, 1876.
1878. *Rissoa inconspicua*, Reeve, Conch. Icon., vol. xx, pl. iv, fig. 34.
1878. *Rissoa inconspicua* and vars., G. O. Sars, Moll. Reg. Arct. Norv., pp. 182, 359, pl. x, fig. 11; pl. xxii, figs. 5, 6.
1884. *Sabanea inconspicua*, Monterosato, Nom. Gen. e Spec. Conch. Medit., p. 55.
1890. *Rissoa* (*Turbella*) *inconspicua*, Carus, Prod. Faun. Medit., vol. ii, p. 324.
1892. *Rissoa inconspicua*, Locard, Coq. mar. Côtes de France, p. 173.
1892—98. *Rissoa inconspicua*, A. Bell, Rep. Yorks. Phil. Soc., p. 63, 1892; Trans. Roy. Geol. Soc. Cornwall, vol. xii, p. 152, 1898.
1898. *Rissoa inconspicua*, Bucquoy, Dautzenberg et Dollfus, Moll. mar. Rouss., vol. ii, p. 797.
1901. *Rissoa inconspicua*, Brøgger, Norges geol. Undersøgelse, No. 31, pp. 513, 660, pl. xvii, fig. 11.
1901. *Rissoa inconspicua*, Conch. Soc. List, Journ. of Conch., vol. x, p. 18, no. 333.
1910. *Rissoa inconspicua*, Øyen, Kongl. Norske Vid. Selsk. Skrift., No. 9, pp. 34 *et seq.*
1912. *Rissoa* (*Turbella*) *inconspicua*, Cerulli-Irelli, Palaeont. Ital., vol. xx, p. 192, pl. xv, figs. 35—42.
1913. *Rissoa* (*Turbella*) *inconspicua*, Dautzenberg et Durouchoux, Feuille des Jeunes Natur., vol. xliv, p. 29, pl. ii, fig. 5.

Specific Characters.—Shell minute, conical, rather solid; whorls 6—7, convex but not tumid; ornamented by curved fine and inconspicuous longitudinal ribs which do not extend to the base, and by delicate spiral lines, stronger where they define the termination of the ribs; spire short; suture well marked but not deep; mouth oval; outer lip contracted above; inner lip thickened, expanded and reflected below with a small umbilicus.

Dimensions.—L. 2 mm. B. 1 mm.

Distribution.—Recent: British seas, coralline zone (*passim*). Lofoten islands, Finmark, Cattegat, Sweden, Norwegian coast, French coast to Canaries and Madeira, Mediterranean, Ægean, Tangier.

Fossil: St. Erth, Coralline Crag (Bell), Selsey, Irish estuarine clays, Jordan Hill, Largo Bay.

Pliocene: Monte Mario, Farnesina, Altavilla.

Pleistocene: Ficarazzi, Monte Pellegrino, Reggio, Taranto, Livorno, Christiania fiord—*Isocardia*- and *Tapes*-banks (Brøgger), Trondhjem (Øyen).

Remarks.—This minute British shell, which ranges also from Finmark and the Lofoten Islands in one direction to the Mediterranean and the Canaries in another, has been reported by Mr. Bell from St. Erth, Selsey, and the Coralline Crag.

The fossil here represented is from the British Museum of Natural History, where it bears the above name. It is worn and shows but little indication of what the sculpture may have been, but in form corresponds fairly well with the figures in some of our text-books. I accept, provisionally and with some doubt, the British Museum identification of our specimen in the hope that a more satisfactory one may turn up hereafter.

Rissoa semicostata (S. Woodward). Plate LI, figs. 16, 17.

1833. *Turbo semicostatus*, S. Woodward, Geol. of Norfolk, p. 44, pl. iii, fig. 19.
1842—72. *Rissoa semicostata*, S. V. Wood, Ann. Mag. Nat. Hist. [1], vol. ix, p. 533, 1842; Mon. Crag Moll., pt. i, p. 102, pl. xi, fig. 10; *R. pulchella* (not Phil.), p. 104, pl. xi, fig. 9; *R. curticostata*, pt. i, p. 102, 1848; *R. semicostata*, 1st Suppl., pt. i, p. 72, 1872.
1864. *Rissoa inconspicua*, S. P. Woodward in White's Hist. of Norfolk, ed. 3, p. 118.
1871. *Rissoa curticostata*, Jeffreys in Prestwich, Quart. Journ. Geol Soc., vol. xxvii, p. 490 (not *R. pulchella*, Phil.).
1872. *Rissoa curticostata*, A. and R. Bell, Proc. Geol. Assoc., vol. ii, pp. 210, 214.
1879. *Rissoa curticostata*, J. Reeve, Trans. Norwich Geol. Soc., vol. i, p. 70.
1890. *Rissoa curticostata*, C. Reid, Plioc. Dep. Brit., p. 255.
1912. *Rissoa semicostata*, Tesch, Med. v. d. Rijks. v. Delfstoffen, No. 4, p. 68, no. 154.

Specific Characters.—Shell small, ovato-conical; whorls 5 or 6, convex, the last tumid, much the largest; ornamented by about 20 longitudinal costæ, not very prominent, which do not reach the base, and by inconspicuous spiral lines, rather stronger, near the periphery; spire short; suture fairly deep; mouth irregularly oval; outer lip thickened, denticulated within.

Dimensions.—L. 4—5 mm. B. 2·5—3 mm.

Distribution.—Not known living.

Fossil: Waltonian Crag: Walton-on-Naze, Little Oakley. Newbournian: Sutton, Kesgrave, Bentley. Butleyan: Butley. Icenian: Bramerton, Yarn Hill. Middle Glacial sands: Billockby.

Remarks.—This little shell may be found at a number of localities in the East Anglian deposits, and especially in the more recent part of the Red Crag at Butley and in the Icenian of Bramerton; at both of these horizons it is fairly abundant. I figure a specimen from each which may be taken as more or less typical. The sculpture varies considerably from that shown in my fig. 17 from Butley to that of fig. 16 from Bramerton, in which the costæ are less distinct and more numerous. Other varieties occur occasionally in which the ribs are nearly and sometimes quite obsolete. It was first noticed in 1833 by Samuel Woodward, of Norwich, who identified it with the *Turbo semicostatus* of Montagu; the correctness of this view Wood doubted, proposing to call it *R. curticostata*, in which he was followed by Jeffreys, the brothers Bell and C. Reid. Having found, however, that the

T. semicostatus of Montagu was the equivalent of *R. striata*, Adams, Wood reverted in 1872 (*op. cit.*, p. 72) to Woodward's specific name of *semicostata*, which I now adopt. With this M. Dollfus associated a shell figured by Philippi in 1836 as *R. pulchella* (Enum. Moll. Sic., vol. i, p. 155, pl. x, fig. 12), but he afterwards considered the latter, as Jeffreys did, a different species. The name of our Crag shell may therefore be definitely fixed as *R. semicostata*, S. Woodward.

Rissoa scutula, A. Bell. Plate LI, fig. 40.

1892. *Rissoa scutula*, A. Bell, Rep. Yorks. Phil. Soc., pp. 63, 67, 75, pl. i, fig. 22.

Specific Characters.—Shell minute, elongato-conical; whorls 6 to 7, convex, the last about half the total length; ornamented by bifid longitudinal ribs, depressed lengthwise in the centre, which die out at the periphery and are separated by rather wide interspaces; spire regularly diminishing upwards towards a blunt apex; suture well-marked; mouth ovate; outer lip but slightly rounded, thickened externally; inner lip slight; peristome continuous; umbilical chink distinct but narrow.

Dimensions.—L. 3 mm. B. 1·5 mm.

Distribution.—Not known living.

Fossil: Selsey.

Remarks.—This interesting fossil, known only by a unique specimen discovered many years ago by Mr. A. Bell at Selsey, belongs to the York Museum. Differing in sculpture from anything known to him, he described it in 1892 under the above name. It may be easily distinguished by the curious bifid character of its longitudinal costæ.

Rissoa basi-sulcata, Etheridge and Bell. Plate LI, fig. 15.

1898. *Rissoa basi-sulcata*, A. Bell, Trans. Roy. Geol. Soc. Cornwall, vol. xii, p. 151, pl. ii, fig. 9.

Specific Characters.—Shell small, broad, thick, conical, with 6 rounded whorls, a rather deep suture, prominent ribs and very finely striated interspaces; mouth broad and expanded; outer lip varicose, internally grooved; pillar straight, expanded at the base with a deep sulcus below the periphery, extending from behind the pillar round the base of the shell.

Dimensions.—L. 5 mm. B. 3 mm.

Distribution.—Not recorded living.

Fossil: St. Erth.

Remarks.—This shell, regarded by Messrs. Etheridge and Bell as new, was described and figured by Mr. A. Bell in 1898. It is somewhat larger and stronger than most of the St. Erth *Rissoæ*; the costæ extend nearly to the base of the

shell, but are cut off abruptly by a fine marginal ridge, the inside of the outer lip is distinctly grooved, the suture is well-marked but not deep, and the whorls but slightly convex. The specimen here figured belongs to the British Museum. Mr. Bell reports it also from that of the Royal Geological Society of Cornwall at Penzance.

Sub-genus **PERSEPHONA**, Leach, MS., 1852.

Rissoa (Persephona) violacea (Desmarest). Plate LI, fig. 8.

1814. *Rissoa (Persephona) violacea*, Desmarest, Bull. Soc. philom. Paris, p. 8, pl. i, fig. 1.
1826. *Rissoa violacea*, Risso, Hist. natur. Europ. mérid., vol. iv, p. 120, pl. v, fig. 58.
1836—44. *Rissoa violacea*, Philippi, Enum. Moll. Sic., vol. i, p. 150, 1836; vol. ii, p. 124, 1844.
1844. *Rissoa rufilabrum*, Alder, Ann. Mag. Nat. Hist. [1], vol. xiii, p. 325, pl. viii, figs. 10, 11.
1853. *Rissoa rufilabrum*, Forbes and Hanley, Brit. Moll., vol. iii, p. 106, pl. lxxvii, figs. 8, 9.
1867–69. *Rissoa violacea*, Jeffreys, Brit. Conch., vol. iv, p. 33, 1867; vol. v, p. 208, pl. lxvii, fig. 9, 1869.
1868–73. *Rissoa violacea*, Weinkauff, Conch. Mittelm., vol. ii, p. 300, 1868; Catal., p. 19, no. 296, 1873.
1874. *Rissoa violacea*, Seguenza, Boll. R. Com. Geol. Ital., vol. v, p. 4, no. 370.
1878. *Rissoa violacea*, G. O. Sars., Moll. Reg. Arct. Norv., pp. 180, 359, pl. x, fig. 8.
1878—84. *Persephona violacea*, Monterosato, Enum. e Sinon. Conch. Medit., p. 24, 1878; Nom. Gen. e Spec. Conch. Medit., p. 58, 1884.
1884. *Rissoa (Persephona) violacea*, Bucquoy, Dautzenberg et Dollfus, Moll. mar. Rouss., vol. i, p. 280, pl. xxxiv, figs. 18—22.
1890. *Rissoa (Persephona) violacea*, Carus, Prod. Faun. Medit., vol. ii, p. 321.
1892. *Rissoia violacea*, Locard, Coq. mar. Côtes de France, p. 170, fig. 146.
1901. *Rissoa violacea*, Brøgger, Norges geol. Undersøgelse, No. 31, pp. 513, 660.
1913. *Rissoa (Persephona) lilacina*, Dautzenberg et Durouchoux, Feuille des Jeunes Natur., vol. xliv, p. 29, pl. ii, fig. 6.

Specific Characters.—Shell small, solid, ovato-conical; whorls 7, slightly convex, the upper ones smooth, the penultimate ornamented on both sides and on the under side of the last whorl by strong and prominent longitudinal ribs; the upper part of the last and the base by many minute and regular punctures, together with fine spiral ridges; mouth ovate, angulate above, the outer lip thickened outside; suture slight; spire short, regularly tapering to a fine point.

Dimensions.—L. 6 mm. B. 3 mm.

Distribution.—Recent: British Seas, south and west, from Guernsey to Shetland. Connemara, Belfast. Lough Strangford. From the Lofoten Isles, Finmark, Cattegat, to the coasts of France and as far south as Vigo. Mediterranean, Adriatic.

Fossil: Pleistocene: Belfast. *Tapes*-banks: Christiania fiord. Messina, Nice, Livorno, Rhodes.

Remarks.—This species seems to be known as a British fossil from the Belfast

clays only. The specimen now figured has been kindly lent by Mr. Deane, the curator of the Public Art Gallery and Museum of that city. As a Continental fossil it is reported from the post-glacial banks of the Christiania fiord and from the Pleistocene deposits of the Mediterranean region.

The sub-genus *Persephona* is used for species of *Rissoa* having finely punctuated sculpture, of which *R. violacea* has been taken as the type.

Genus **CINGULA**, Fleming, 1828.

Cingula pentodonta (S. V. Wood, Jr., MS.), Kendall and R. G. Bell. Plate LI, fig. 34.

1886. *Rissoa pentodonta*, S. V. Wood, Jr., in Kendall and R. G. Bell, Quart. Journ. Geol. Soc., vol. xlii, p. 211.

1893–98. *Rissoa pentodonta* and vars., A. Bell, Proc. Roy. Irish Acad. [3], vol. ii, p. 630, 1893; Trans. Roy. Geol. Soc. Cornwall, vol. xii, p. 152, pl. ii, fig. 13, 1898.

Specific Characters.—Shell small, smooth, conically ovate; spire short, apex blunt; whorls 6—7, ornamented with horizontal bands; mouth ovate to round; pillar lip well developed; outer lip furnished internally with five teeth; umbilical chink well marked (A. Bell).

Dimensions.—L. 5 mm. B. 2 mm.

Distribution.—Not known living.

Fossil: St. Erth.

Remarks.—This small species was first recognised and named but not described or figured by S. V. Wood, Jr., in a preliminary list accompanying a paper read before the Geological Society in November, 1884. As he hoped largely to add to the number of species he withdrew this for further investigation. At Wood's death, which took place in December of the same year, his collection of St. Erth fossils, together with his notes and the list referred to, was handed over to the late R. G. Bell, who, in a subsequent paper by himself and Mr. (now Prof.) P. F. Kendall, published in 1886, adopted some of Wood's names, the present among them.

In addition to the latter investigators, Messrs. E. T. Newton, Keeping and Alfred Bell collected from St. Erth, the results being placed in the Museums at South Kensington, Jermyn Street, Cambridge and elsewhere, all of the specimens being afterwards re-examined by the latter. Much more may be found by further work at this most interesting and important locality, which contains a molluscan fauna of a type different from that of any other of the fossiliferous deposits of Great Britain, or, so far as I know at present, of the Continent.

R. pentodonta is specially characterised by five well-marked denticulations inside the outer lip—a feature peculiar to it—and by its well-marked umbilical chink.

Mr. Bell has described a variety (*rigida*), also from St. Erth, without teeth, and with a slighter umbilicus; this, he thinks, may be immature.

Var. **picta** (Etheridge and Bell). Plate LI, fig. 35.

1893–98. *Rissoa pentodonta*, var. *picta*, A. Bell, Proc. Roy. Irish Acad. [3], vol. ii, p. 630, 1893; Trans. Roy. Geol. Soc. Cornwall, vol. xii, p. 153, 1898.

Remarks.—This specimen is the one originally described by Mr. Bell as a variety of *R. pentodonta*. When first found it was characterised by colour-bands and irregular streaks which have now disappeared though they are still represented by inconspicuous and nearly obsolete costæ. From this variety and from the var. *rigida* the five teeth of the type form are wanting.

Var. **rigida** (Etheridge and Bell). Plate LI, fig. 36.

1893–98. *Rissoa pentodonta*, var. *rigida*, A. Bell, Proc. Roy. Irish Acad. [3], vol. ii, p. 630, 1893; Trans. Roy. Geol. Soc. Cornwall, vol. xii, p. 153, 1898.

Remarks.—Mr. Bell has described this specimen, which is from the British Museum, as a variety of *R. pentodonta*. It wants the teeth characteristic of the type, the umbilical chink is smaller, and when first found it had a colour-band on the periphery.

Cingula conuloidea (Etheridge and Bell). Plate LI, fig. 44.

1898. *Rissoa (Onoba) conuloidea*, A. Bell, Trans. Roy. Geol. Soc. Cornwall, vol. xii, p. 154.

Specific Characters.—Shell minute, solid, forming a truncated cone with an exceedingly small, isolated and pointed apex; whorls 4, smooth, flattened; spire elongate, sub-cylindrical, regularly tapering; suture slight; mouth ovate, angulated above, peristome well marked, continuous.

Dimensions.—L. 2 mm. B. 1 mm.

Distribution.—Not known living.

Fossil: St. Erth.

Remarks.—The specimen here figured is the one obtained by Mr. A. Bell at St. Erth, and described by him under the above name. It seems to be a new and distinct form. It belongs to the British Museum.

Cingula substriata (Philippi). Plate LI, fig. 45.

1844. *Rissoa substriata*, Philippi, Enum. Moll. Sic., vol. ii, p. 132, pl. xxiii, fig. 20.

1873. *Rissoa (Cingula) substriata*, Weinkauff, Cat. europ. Meeresconch., p. 20, no. 330.

1874. *Alvania substriata*, Seguenza, Boll. R. Com. Geol. Ital., vol. v, p. 6.
1884. *Rissoa substriata*, Jeffreys, Proc. Zool. Soc. London, p. 126.
1890. *Rissoa (Cingula) substriata*, Carus, Prod. Faun. Medit., vol. ii, p. 337.
1893—98. *Rissoa substriata*, A. Bell, Proc. Roy. Irish Acad. [3], vol. ii, p. 629, 1893; Trans. Roy. Geol. Soc. Cornwall, vol. xii, p. 152, 1898.
1898. *Rissoa (Cingula) substriata*, Bucquoy, Dautzenberg et Dollfus, Moll. mar. Rouss., vol. ii, p. 797.

Specific Characters.—Shell minute, smooth, ovate; whorls 5, the last ventricose; the upper ones without or with inconspicuous longitudinal sculpture, otherwise ornamented throughout by excessively fine striation (hardly visible without the aid of a lens) extending to the base, where it is rather stronger; suture slight; mouth large, ovate; umbilical fissure very small.

Dimensions.—L. 2·5 mm. B. 1·25 mm.

Distribution.—Recent: Gulf of Lyons, Marseilles. "Porcupine" Expedition.—Atlantic, Tangier, Mediterranean.

Fossil: St. Erth.

Pleistocene: Livorno, Calabria, Reggio. Sicily—Ficarazzi, Monte Pellegrino.

Remarks.—The specimen figured under this name is from the British Museum, and was obtained at St. Erth, I believe, by Mr. A. Bell. *C. substriata* is a recent and rare form distinguished by its excessively fine spiral sculpture, a single specimen of which was found originally by Philippi at Panormi in Sicily, and since then in the Pleistocene of Ficarazzi and Monte Pellegrino, in Tuscany by de Stefani, and in Calabria by Tiberi.

Cingula semistriata (Montagu). Plate LI, fig. 46.

1808. *Turbo semistriatus*, Montagu, Test. Brit., Suppl., p. 136.
1844. *Rissoa subsulcata*, Philippi, Enum. Moll. Sic., vol. ii, p. 129, pl. xxiii, fig. 16.
1853. *Rissoa semistriata*, Forbes and Hanley, Brit. Moll., vol. iii, p. 117, pl. lxxx, figs. 4, 7.
1859. *Rissoa semistriata*, G. B. Sowerby, Ill. Ind. Brit. Shells, pl. xiii, fig. 25.
1867—84. *Rissoa semistriata*, Jeffreys, Brit. Conch., vol. iv, p. 46, 1867; vol. v, p. 208, pl. lxviii, fig. 8, 1869; in Lamplugh, Quart. Journ. Geol. Soc., vol. xl, p. 319, 1884.
1874. *Rissoa (Cingula) semistriata*, Seguenza, Boll. R. Com. Geol. Ital., vol. v, p. 6, no. 204.
1878. *Rissoa semistriata*, Reeve, Conch. Icon., vol. xx, pl. iii, fig. 28.
1878. *Cingula semistriata*, G. O. Sars, Moll. Reg. Arct. Norv., p. 359.
1878—84. *Rissoa (Cingula) semistriata*, Monterosato, Enum. e Sinon. Conch. medit. (Giorn. Soc. Sci. Nat. Palermo), vol. xiii, p. 85, 1878; Nom. Gen. e Spec. Conch. Medit., p. 66, 1884.
1884. *Rissoa (Cingula) semistriata*, Bucquoy, Dautzenberg et Dollfus, Moll. mar. Rouss., vol. i, p. 306, pl. xxxvii, figs. 1, 2.
1886—92. *Cingula semistriata*, Locard, Exped. Scient. Travailleur et Talisman (Mollusques), vol. i, p. 463, 1886; Coq. mar. Côtes de France, p. 175, 1892.
1892—98. *Rissoa semistriata*, A. Bell, Proc. Yorks. Phil. Soc., p. 63, 1892; Proc. Roy. Irish Acad. [3], vol. ii, p. 629, 1893; Trans. Roy. Geol. Soc. Cornwall, vol. xii, p. 152, 1898.
1901. *Cingula semistriata*, Conch. Soc. List, Journ. of Conch., vol. x, p. 18, no. 353.
1913. *Rissoa (Cingula) semistriata*, Dautzenberg et Durouchoux, Feuille des Jeunes Natur., vol. xliv, p. 31, pl. ii, fig. 14.

Specific Characters.—Shell minute, ovato-conical, rather solid; whorls 6, rounded, not convex, the last sub-ventricose, two-thirds the total length; ornamented by faint inconspicuous spiral striæ and by a few below the suture, the upper two being stronger, the others with a dozen similar ones below the periphery and sometimes by faint or nearly obsolete longitudinal wrinkles; suture slight; spire short, with a sharp point; mouth ovate, slightly angulate above; outer lip thin; inner lip reflected on the pillar, peristome continuous.

Dimensions.—L. 2·5 mm. B. 1·25 mm.

Distribution.—Recent: British coasts, from the Outer Hebrides and Shetland, littoral and laminarian zones. Norway. West European. Mediterranean, Adriatic, Algeria.

Fossil: St. Erth. Selsey, Bridlington, Largo Bay. Irish estuarine clays.

Pliocene: Cotentin (Dollfus).

Pleistocene: Messina, Calabria, Livorno.

Remarks.—This British species, ranging also from Norway to the Mediterranean, has been reported by Mr. Bell from St. Erth and Selsey, but it is unknown from the East Anglian Crag. The Selsey specimen here figured is from the York Museum, where it bears the name of *R. semistriata*. It agrees in form with the typical shell, but its usual and faint sculpture is either obsolete or has been removed by abrasion.

Cingula bicarinata (A. Bell). Plate LI, fig. 37.

1892. *Rissoa bicarinata*, A. Bell, Rep. Yorks. Phil. Soc., pp. 63, 67, 75, pl. i, fig. 23.

Specific Characters.—Shell minute, elongato-conical, without sculpture; whorls 6, but slightly convex, the last half the total length, having a double inconspicuous ridge at the periphery, and below the suture; suture well marked; mouth oval; peristome continuous; outer lip thickened by a labial rib; inner lip thin.

Dimensions.—L. 3 mm. B. 1·5 mm.

Distribution.—Not recorded living.

Fossil: Selsey.

Remarks.—The figure here given is from the unique specimen discovered by Mr. Bell, now in the York Museum, and described by him in 1892 as a new species. It is easily distinguished by the double angulation of the body-whorl.

Cingula cingillus (Montagu). Plate LI, fig. 38.

1803—08. *Turbo cingillus*, Montagu, Test. Brit., pt. ii, p. 328, pl. xii, fig. 7, 1803; Suppl., p. 125, 1808.
1853. *Rissoa cingillus*, Forbes and Hanley, Brit. Moll., vol. iii, p. 122, pl. lxxix, figs. 9, 10.
1858. *Cingula cingillus*, H. and A. Adams, vol. i, p. 334, pl. xxxv, fig. 8.
1859. *Rissoa cingillus*, G. B. Sowerby, Ill. Ind. Brit. Shells, pl. xiii, fig. 26.

1867—84. *Rissoa cingillus*, Jeffreys, Brit. Conch., vol. iv, p. 48, 1867; vol. v, p. 208, pl. lxviii, fig. 9 1869; Proc. Zool. Soc. London, p. 127, 1884.
1878. *Rissoa cingillus*, Reeve, Conch. Icon., vol. xx, pl. ii, fig. 15.
1884. *Cingula (Cingilla) trifasciata*, Monterosato, Nom. Gen. e Spec. Conch. Medit., p. 67.
1884. *Rissoa (Cingula) cingillus*, Bucquoy, Dautzenberg et Dollfus, Moll. mar. Rouss., vol. i, p. 305.
1890. *Rissoa (Cingula) cingillus*, Carus, Prod. Faun. Medit., vol. ii, p. 336.
1892. *Cingula vittata*, Locard, Coq. mar. Côtes de France, p. 175.
1893—98. *Rissoa cingillus*, A. Bell, Proc. Roy. Irish Acad. [3], vol. ii, p. 630, 1893; Trans. Roy. Geol. Soc. Cornwall, vol. xii, p. 153, 1898.
1901. *Cingula trifasciata*, Conch. Soc. List, Journ. of Conch., vol. x, p. 18, no. 354.
1913. *Rissoa (Cingula) cingillus*, Dautzenberg et Durouchoux, Feuille des Jeunes Natur., vol. xliv, p. 31, pl. ii, fig. 12.

Specific Characters.—Shell small, oblong, conical, rather solid; whorls 6—7, flattened, the last slightly angulate; ornamented by spiral ridges, distinct below the periphery, obsolete or nearly so above it, crossed by numerous fine and inconspicuous lines of growth; suture slightly channelled; spire elongate, regularly tapering; mouth ovate, angulate above; outer lip not thickened or varicose; inner lip joined to the latter, forming a narrow glaze on the pillar.

Dimensions.—L. 4—5 mm. B. 2—2·5 mm.

Distribution.—Recent: British shores, between tide-marks, generally diffused. Norway from Bergen southwards, coasts of France, Spain and Italy. Mediterranean, Ægean.

Fossil: St. Erth. Pleistocene: Dalmuir, Largo Bay. Estuarine clays, Larne. Holocene: Portrush.

Remarks.—There seems no doubt but that the present species is identical with the *Turbo trifasciatus* of Adams and the *T. rittatus* of Donovan, both of those names being slightly older than the *T. cingillus* of Montagu. This was known in 1867 to Jeffreys, who, dealing with the matter, remarked (*op. cit.*, p. 49): "Names in general use should be preferred to those that are obsolete . . . while the imperious demand of public convenience is ringing in our ears." For reasons I have before urged (Vol. I, pp. 370, 376), I again submit that when a name has been used for a century, almost without protest, it should be allowed to stand; moreover, the time of the overworked curators of our museums is too valuable to be employed in the unasked-for relabelling of hundreds of specimens. In many cases probably this would never be even attempted.

C. cingillus is a widely diffused and recent species, but so far as I know it has only been reported as a Pliocene fossil from St. Erth.

Genus **ONOBA**, H. and A. Adams, 1854.

Onoba striata (J. Adams). Plate LI, fig. 42.

1795. *Turbo striatus*, J. Adams, Trans. Linn. Soc., vol. iii, p. 66, pl. xiii, figs. 25, 26.
1803. *Turbo striatus*, Montagu, Test. Brit., pt. ii, p. 312.

1842—48. *Rissoa striata*, S. V. Wood, Ann. Mag. Nat. Hist. [1], vol. ix, p. 534, 1842; Mon. Crag Moll., pt. i, p. 100, pl. xi, fig. 1, 1848.
1853. *Rissoa striata*, Forbes and Hanley, Brit. Moll., vol. iii, p. 94, pl. lxxviii, figs. 8, 9.
1858. *Onoba striata*, H. and A. Adams, Gen. Rec. Moll., vol. i, p. 332, pl. xxxv, fig. 4.
1859. *Rissoa striata*, G. B. Sowerby, Ill. Ind. Brit. Shells, pl. xiii, fig. 15.
1867—84. *Rissoa striata*, Jeffreys, Brit. Conch., vol. iv, p. 37, 1867; vol. v, p. 208, pl. lxviii, fig. 2, 1869; in Prestwich, Quart. Journ. Geol. Soc., vol. xxvii, pp. 145, 491, 1871; *R.* (*Cingula*) *striata*, Proc. Zool. Soc. London, p. 123, 1884; *R. striata*, in Lamplugh, Quart. Journ. Geol. Soc., vol. xl, p. 319, 1884.
1871. *Rissoa striata*, F. W. Harmer, Trans. Norf. Norw. Nat. Soc., vol. i, pt. iii, p. 46.
1872. *Rissoa striata*, A. and R. Bell, Proc. Geol. Assoc., vol. ii, pp. 204, 216.
1874. *Rissoa* (*Cingula*) *striata*, Seguenza, Boll. R. Com. Geol. Ital., vol. v, p. 6, no. 415.
1877. *Rissoa striata*, Dollfus, Mém. Soc. géol. Normandie, vol. vi, p. 517.
1878. *Onoba striata*, G. O. Sars, Moll. Reg. Arct. Norv., pp. 172, 358, pl. xxii, fig. 3.
1878. *Rissoa striata*, Reeve, Conch. Icon., vol. xx, pl. v, fig. 40.
1879. *Rissoa striata*, Jas. Reeve, Trans. Norwich Geol. Soc., vol. i, p. 70.
1884. *Onoba striata*, Monterosato, Nom. Gen. e Spec. Conch. Medit., p. 67.
1890. *Rissoa* (*Folinia*) *striata*, Carus, Prod. Faun. Medit , vol. ii, p. 327.
1892—98. *Rissoa striata*, A. Bell, Rep. Yorks. Phil. Soc., p. 63, 1892; *R.* (*Onoba*) *striata*, Trans. Roy. Geol. Soc. Cornwall, vol. xii, p. 153, 1898.
1901. *Onoba striata*, Conch. Soc. List, Journ. of Conch., vol. x, p. 18, no. 347.
1901. *Onoba striata*, Brøgger, Norges geol. Undersøgelse, No. 31, pp. 241, 549, 657, pl. v, fig. 13.
1913. *Rissoa* (*Onoba*) *striata*, Dautzenberg et Durouchoux, Feuille des Jeunes Natur., vol. xliv, p. 30, pl. ii, fig. 17.

Specific Characters.—Shell minute, oblong, subcylindrical; whorls 6, somewhat compressed, the two lower ones being nearly equal in width, the others gradually diminishing in size upwards, the last much the largest; the uppermost without sculpture, the rest being ornamented by numerous, exceedingly fine spiral lines, and by a few short and slightly flexuous ridges on the upper part only of each whorl, below the suture; spire elongated, ending abruptly in a blunt point; suture distinct, rather deep; mouth small, sub-ovate, angulate above; outer lip thin; inner lip reflected; peristome continuous.

Dimensions.—L. 3—4 mm. B. 1—1·5 mm.

Distribution.—*Recent:* British seas, widely diffused from the littoral to the coralline zones. Spitzbergen, Greenland, Iceland, Russian Lapland, Sea of Okhotsk, Lofoten Islands, Norwegian coast. Atlantic—Heligoland to Teneriffe. Mediterranean, Ægean.

Fossil: St. Erth. Coralline Crag: Sutton. Icenian: Aldeby, Beccles.

Pleistocene: Bridlington, Clyde beds, Fort William. Selsey. Irish estuarine clays. Glacial and post-glacial: Christiania fiord. Norwegian shell-banks up to 460 feet.

Remarks.—This very distinct and easily recognisable species, formerly grouped with *Rissoa*, was referred to a sub-genus *Cingula* by Jeffreys and some other writers, but is now generally regarded as belonging to the genus *Onoba* of H. and A. Adams.

It was known to Wood from the Coralline Crag only. Jeffreys reports it from the Red Crag, probably in error, as he gives no locality, and in Lamplugh's paper of 1884 from Bridlington, while A. Bell records it from St. Erth, the Icenian Crag of Aldeby and Beccles, and from Selsey.

Onoba aculeus (Gould). Plate LI, fig. 43.

1841—70. *Cingula aculeus*, Gould, Inv. Mass., ed. 1, p. 266, fig. 172, 1841; *Rissoa aculeus*, ed. 2, p. 299, fig. 568, 1870.
1843. *Cingula aculeus*, De Kay, N.Y. Moll., p. iii, pl. vi, fig. 115.
1846. *Rissoa arctica*, Lovén, K. Svensk. Vet.-Akad. Förh., vol. iii, p. 96.
1867. *Rissoa striata*, var. *arctica*, Jeffreys, Brit. Conch., vol. iv, p. 37.
1878. *Onoba aculeus*, G. O. Sars, Moll. Reg. arct. Norv., pp. 172, 359, pl. ix, fig. 12.
1883. *Rissoa aculeus*, Scott and Steele, Trans. Geol. Soc. Glasgow, vol. vii, p. 279.
1899. *Rissoa* (*Onoba*) *aculeus*, Posselt, Medd. om Grönl., vol. xxiii, p. 227.
1901. *Onoba aculeus*, Brøgger, Norges geol. Undersøgelse, No. 31, p. 657, pl. xix, fig. 28.
1901. *Onoba striata*, var. *aculeus*, Conch. Soc. List, Journ. of Conch., vol. x, p. 18.
1910. *Onoba aculeus*, Odhner, K. Svensk. Vet.-Akad. Handl., Stockholm, vol. vii, p. 9.
1915. *Onoba aculeus*, Johnson, Bost. Soc. Nat. Hist., Occ. papers, vol. vii, Faun. New England, No. 13, p. 118.

Specific Characters.—Shell small, rather solid, ovato-cylindrical; spire elongated; whorls 6, convex, the last much the largest, two-thirds the total length, ornamented by delicate spiral lines which reach the base, and by a few inconspicuous longitudinal ridges near the apex; suture deep; mouth ovate, expanded below.

Dimensions.—L. 4 mm. B. 1·5 mm.

Distribution.—*Recent:* British Seas, with *O. striata*, but more generally northern. Spitzbergen, Greenland, Iceland, Norwegian coast—Christiania fiord to the Lofoten Islands and Finmark. New England coast.

Fossil: Belfast estuarine clays, Clyde beds—Paisley. Garvel Park, Fort William.

Isocardia- and *Tapes*-banks, Norway.

Remarks.—The specimen given under this name from the Pleistocene deposits of Garvel Park seems to agree with the American shell described by Gould and with the Norwegian form figured by Profs. G. O. Sars and Brøgger. According to Jeffreys it is the *Rissoa arctica* of Lovén.

The first notice of our shell as a British fossil appeared in a paper published by the Geological Society of Glasgow in 1883 by Messrs. Scott and Steele (*loc. cit.*). The specimen now figured was obtained by Mr. Bell from a collection of shelly stuff sent him from Garvel Park.

Genus **CERATIA**, H. and A. Adams, 1854.

Ceratia proxima (Alder MS.). Plate LI, fig. 41.

1847. *Rissoa (Cingula) proxima*, Alder, MS. in Thompson, Ann. Mag. Nat. Hist. [1], vol. xx, p. 174.
1853. *Rissoa proxima*, Forbes and Hanley, Brit. Moll., vol. iii, p. 127, pl. lxxv, figs. 7, 8.
1858. *Ceratia proxima*, H. and A. Adams, Gen. Rec. Moll., vol. i, p. 333, pl. xxxv, fig. 6.
1859. *Rissoa proxima*, G. B. Sowerby, Ill. Ind. Brit. Shells, pl. xiii, fig. 28.
1867—71. *Rissoa proxima*, Jeffreys, Brit. Conch., vol. iv, p. 39, 1867; vol. v, p. 208, pl. lxviii, fig. 3, 1869; in Prestwich, Quart. Journ. Geol. Soc., vol. xxvii, p. 145, 1871.
1872. *Rissoa proxima*, S. V. Wood, Mon. Crag Moll., 1st Suppl., pt. i, p. 71, pl. iv, fig. 17.
1872. *Rissoa proxima*, A. and R. Bell, Proc. Geol. Assoc., vol. ii, p. 204.
1873. *Rissoa (Cingula) proxima*, Weinkauff, Cat. europ. Meeresconch., p. 20, no. 324.
1874—76. *Rissoa (Cingula) proxima*, Seguenza, Boll. R. Com. Geol. Ital., vol. v, p. 6, no. 416, 1874; vol. vii, p. 180, no. 695, 1876.
1878. *Rissoa proxima*, Reeve, Conch. Icon., vol. xx, pl. ii, fig. 18.
1878. *Onoba proxima*, G. O. Sars, Moll. Reg. arct. Norv., pp. 173, 359, pl. xxii, fig. 4.
1878. *Cingula proxima*, de Stefani e Pantinelli, Bull. Soc. Malac. Ital., vol. iv, p. 174.
1879—92. *Rissoa proxima*, Van den Broeck, Ann. Soc. malac. Belg., vol. xiv, p. 71, 1879; vol. xix, p. 26, 1884; Bull. Soc. Belge Géol., vol. vi (Mémoires), pp. 123, 133, 1892.
1882. *Rissoa proxima*, Nyst, Conch. Terr. tert. Belg., p. 96, pl. xxviii, fig. 13.
1884. *Ceratia proxima*, Monterosato, Nomen. Gen. e Spec. Conch. Medit., p. 71.
1890. *Rissoa proxima*, C. Reid, Plioc. Dep. Brit., p. 255.
1890. *Rissoa (Ceratia) proxima*, Carus, Prod. Faun. Medit., vol. ii, p. 327.
1892. *Cingula proxima*, Locard, Coq. mar. Côtes de France, p. 176, fig. 151.
1896. *Rissoa proxima*, Bernays, Bull. Soc. Belge Géol., vol. x (Mémoires), p. 129.
1898. *Rissoa (Cingula) proxima*, Bucquoy, Dautzenberg et Dollfus, Moll. mar. Rouss., vol. ii, p. 797.
1901. *Ceratia proxima*, Conch. Soc. List, Journ. of Conch., vol. x, p. 18, no. 348.
1913. *Rissoa (Cingula) proxima*, Alder MS., Dautzenberg et Durouchoux, Feuille des Jeunes Natur., vol. xliv, p. 31.
1914. *Rissoia (Ceratia) proxima*, Cerulli-Irelli, Palaeont. Ital., vol. xx, p. 196, pl. xv, figs. 58—62.

Specific Characters.—Shell small, slender, subcylindrical; whorls 5, convex, the last more than half the total length; ornamented by fine, regular and delicate spiral striæ; spire elongate, gradually tapering, ending abruptly in a bluntly truncated apex; suture deep, oblique; mouth slightly expanded; outer lip thin, recurved; inner lip reflected on the pillar.

Dimensions.—L. 5 mm. B. 2 mm.

Distribution.—Recent: Coasts of Devonshire and Cornwall, Cork, Bantry and Dublin. France and Spain, diffused but not abundant, Teneriffe, Mediterranean. Norwegian coast, Lofoten Islands (Carus).

Fossil: Coralline Crag: Sutton. Pleistocene: Largo Bay, Loch-gilphead, Garvel Park. Casterlien, Scaldisien, Poederlien: Belgium.

Upper Pliocene: Monte Mario, Legoli, Siena.

Pleistocene: Monte Pellegrino, Ficarazzi.

Remarks.—This shell, rather rare as a fossil, though widely diffused as a recent form, was recorded by Wood from the Coralline Crag of Sutton only. Abroad it is given by Cerulli-Irelli from the Pliocene of Monte Mario, and by Seguenza from the Pleistocene of Sicily. The specimen here given was obtained from Garvel Park. The generic term *Ceratia* was proposed by H. and A. Adams for a small group of shells distinguished by certain anatomical characters, of which *C. proxima* was taken as the type. The Marchesi de Monterosato states that these differences separate it from all other forms of the Rissoidæ.

Genus **BARLEEIA**, Clarke, 1855.

Barleeia cingulata, A. Bell. Plate LI, fig. 47.

1892. *Barleeia cingulata*, A. Bell, Rep. Yorks. Phil. Soc., p. 76, pl. i, fig. 17.

Specific Characters.—Shell small, solid, conical; whorls 6—7, flattened, smooth, the last strongly angulated; spire short, acute, with a blunt apex; suture well marked, slightly channelled; mouth oval, angulated above, patulated below.

Dimensions.—L. 4 mm. B. 1·5 mm.

Distribution.—Not known living.

Fossil : Selsey.

Remarks.—I figure this Selsey specimen under the name given to it with some doubt by Mr. A. Bell, who remarks that it differs from any species of *Barleeia* he knows, though it is close to some of them, its chief characteristics being the flatness of the whorls, the angulation of the last, and its patuliform mouth. The artist has failed to show the angulated whorl in the Selsey paper, but Mr. Bell says this was due to a mistake.

Genus **LITTORINA**, Férussac, 1821.

Littorina littorea (Linné). Plate LII, figs. 1—8.

1758. *Turbo littoreus*, Linné, Syst. Nat., ed. x, p. 761, no. 528.
1833. *Turbo littoreus*, S. Woodward, Geol. of Norfolk, p. 44.
1842–48. *Littorina littorea*, S. V. Wood, Ann. Mag. Nat. Hist. [1], vol. ix, p. 532, 1842; Mon. Crag Moll., pt. i, p. 118, pl. x, figs. 14—14*k*, 1848.
1846. *Littorina litorea*, Lovén, K. Svensk. Vet.-Akad. Förh., vol. iii, p. 94.
1859. *Littorina littorea*, G. B. Sowerby, Ill. Ind. Brit. Shells, pl. xii, figs. 14, 15.
1853. *Littorina littorea*, Forbes and Hanley, Brit. Moll., vol. iii, p. 29, pl. lxxxiii, figs. 7, 8.
1865—71. *Littorina litorea*, Jeffreys, Brit. Conch., vol. iii, p. 368, 1865; vol. v, p. 206, pl. lxv, fig. 4, 1869; in Prestwich, Quart. Journ. Geol. Soc., vol. xxvii, p. 489, 1871.
1870. *Littorina litorea*, Gould and Binney, Rep. Inv. Mass., ed. 2, p. 308, fig. 577.

1872. *Littorina littorea*, A. and R. Bell, Proc. Geol. Assoc., vol. ii, pp. 209, 213, 216.
1878. *Littorina littorea*, G. O. Sars, Moll. Reg. arct. Norv., pp. 164, 358.
1892. *Littorina littorea*, Locard, Coq. mar. Côtes de France, p. 189, fig. 165.
1894. *Littorina littorea*, Munthe, Bull. Geol. Inst. Univ. Upsala, vol. ii, p. 2.
1901. *Littorina littorea*, Brøgger, Norges geol. Undersøgelse, No. 31, p. 657, pl. ix, fig. 12; pl. xii, figs. 6, 8, 10, 11.
1908. *Littorina littorea*, Kobelt, Icon. schalentrag. europ. Meeresconch., vol. iv, p. 55, pl. cx, figs. 1—5.
1912. *Littorina littorea*, Dautzenberg et Fischer, Camp. Scient., Prince de Monaco, vol. xxxvii (Mollusques), p. 181.
1915. *Littorina litorea*, Johnson, Bost. Soc. Nat. Hist., Occ. papers, vol. vii, Fauna of New England, No. 13, p. 120.

Specific Characters.—Shell strong and solid, whorls in the type form regularly conical, the last ventricose, much the largest, more convex in the female; spire short; apex pointed; suture indistinct; mouth angulate above, expanded below; outer lip thickened, with a thin edge; pillar short, thick, shelving inwards.

Dimensions.—L. 30 mm. B. 24 mm.

Distribution.—Recent: British coasts, locally abundant. Norwegian coast from Finmark to Christiania, Lofoten Islands, West European as far south as Gibraltar, Russian Lapland, White Sea, Icy Cape, Greenland, Canada, Newfoundland, New England coasts, Alaska.

Fossil: Red Crag (rare)—Newbournian: Waldringfield, Ramsholt, Newbourn, Sutton. Butleyan: Bawdsey, Hollesley, Butley. Icenian: *passim.* Isle of Man, Wexford.

Pleistocene: British Isles, widely diffused. Christiania region from *Mya*-beds to *Tapes*-banks (Brøgger), Trondhjem (Øyen). Uddevalla. Baltic—Littorina sea region.

Remarks.—This well-known littoral species made a late appearance in the Pliocene deposits of the East of England having been found but rarely in the upper part of the Red Crag; it is more abundant in the Norwich and Weybourne zones of the Icenian, as at Bramerton. It is, however, a characteristic form of the British Pleistocene, but I am not aware that it has been recorded as a fossil from any locality to the south of these islands. Prof. Brøgger gives it from the upper zones of the Christiania deposit, and Dr. Øyen from those of Trondhjem. It lived, moreover, at the head of the Gulf of Bothnia (where it does not now exist) during what is known to Scandinavian geologists as the "Litorina-time"—an indication, in their opinion, that the salinity of the water in that region was greater then than it is now.

As a recent shell the range of *L. littorea* is mainly to the north and northwest of the British Isles, extending as far in the latter direction as Alaska. It extends to the south also, as stated above, along the Atlantic coasts of Western Europe to the straits of Gibraltar, though not abundantly.

Fossil specimens of *Littorina littorea* departing widely and in various directions both in form and sculpture from the typical shell, as will be seen by some of those figured on Plate LII, have been found locally in the Icenian Crag, and especially at Thorpe, Postwick and Bramerton near Norwich. By Samuel Woodward, who described some of them in 1833, they were regarded as specifically distinct, but in 1848 S. V. Wood grouped them all as varieties of the present species. In 1872, however, in the 1st Supplement (pt. i, p. 79), he suggested that some of them might be varietal forms of an allied but different species, *L. rudis*, as to which, however, Jeffreys says that *L. littorea* may be known by being usually twice its size, having a much slighter suture, a more elongated and sharply pointed spire, and a straight upper lip.

Assuming that the many widely differing shells referred to may represent varietal forms of *L. littorea*, locally developed at a certain stage of the Crag history, it may be asked why did not some of them succeed in establishing themselves as distinct species. So far as I know, only one or two have been recorded from our Pleistocene deposits, or as now living in British seas.

In Vol. i, p. 413, of this Monograph I have attempted to explain the increasing poverty and the decreasing vigour of the molluscan fauna of the Crag Sea during the Icenian period[1] by the view that the advance of the glacial ice cut off the communication of that region with northern seas while fresh water continued to pour into it from the south. Such conditions would have diminished the salinity of the water, gradually changing the marine conditions of the Red Crag first into a brackish and eventually into a fresh-water lake in which marine mollusca could not have existed; these anomalous Littorinas having been only locally developed could not have been reintroduced when the ice disappeared. Whether this hypothesis be accepted or not the introduction and subsequent extinction of such shells is interesting and deserves the attention of conchologists.

Var. **vulgaris**, S. V. Wood. Plate LII, figs. 9—11.

1814. *Turbo littoreus*, J. Sowerby, Min. Conch., vol. i, p. 163, pl. lxxi, fig. 1.
1848. *Littorina littorea*, var. *vulgaris*, S. V. Wood, Mon. Crag Moll., pt. i, p. 118, pl. x, fig. 14.
1871. *Littorina littorea*, Mörch, Geol. Mag. [1], vol. viii, p. 396.

Varietal Characters.—Differs from the typical form of British seas in its smaller size, and its distant and well-marked coloured bands, the sculpture approaching that of the var. *nigrolineata* of *L. rudis*.

[1] At the Norwich stage of the Icenian Crag the species of mollusca were less numerous and generally of a more fragile character than those of the Red Crag, while during the Weybourne period they numbered not more than about 50 altogether, most of the specimens being the shells of a small bivalve, *Tellina balthica*.

Dimensions.—L. 16—20 mm. B. 14—18 mm.

Distribution.—*Recent:* British seas.

Fossil: Icenian Crag—Bramerton and elsewhere.

Remarks.—This form, given by Wood as typical of the var. *vulgaris* of the present species, agrees also with Sowerby's specimen (*op. cit.*). Mörch records a single example from the Iceland Crag, smooth and banded, which he says "exactly corresponds" with that figured by Wood.

Var. **parva,** nov. Plate LII, fig. 12.

Varietal Characters.—Much smaller than the type, with a somewhat deeper suture, often of a dark ferruginous colour.

Dimensions.—L. 10—15 mm. B. 8—12 mm.

Distribution.—*Recent:* British seas.

Fossil: Icenian Crag: Bramerton and elsewhere.

Remarks.—These shells, which have sometimes been mistaken for *L. rudis*, seem to be a dwarfed form of *L. littorea*. Jeffreys describes several recent varieties, one of which (*paupercula*) he says is somewhat dwarfed, with the whorls more convex, of a dusky hue, and another (*brevicula*) as smaller and ventricose, with a short spire, which are probably similar. He remarks they are found on mud flats, in estuaries and tidal inlets. Our fossil is very common at Bramerton—much more so, in fact, than is the type form. The specimen here figured is dark and ferruginous in colour.

Var. **antiqua,** S. V. Wood. Plate LII, fig. 13.

1848. *Littorina littorea*, var. *antiqua*, Mon. Crag Moll., pt. i, pl. x, fig. 14 *a*.
1916. *Littorina littorea*, var. *antiqua*, Marshall, Journ. of Conch., vol. xv, p. 44.

Varietal Characters.—Shell turreted, irregularly conical; whorls 5 or 6, flattened, squarely angulate above, obtusely angulate below, the last three-fourths the total length, compressed in the middle; ornamented by delicate spiral lines which extend to the base; suture well-marked, slightly channelled; spire elongate, gradually tapering upwards, mouth obliquely ovate; outer lip projecting, straight, angulate above, rounded below.

Dimensions.—L. 20 mm. B. 12 mm.

Distribution.—*Recent:* Ythan estuary, Aberdeen (Marshall).

Fossil: Icenian Crag: Bramerton.

Remarks.—The specimen from Bramerton here figured is from the collection at the Norwich Museum, agreeing with that given by Wood. It is an interesting form, allied to S. Woodward's *Turbo sulcatus*. Wood seems to have regarded it as a variety distinct from the latter and deserving a separate name. It belongs,

however, to the *sulcata* group. It has been reported recently by Mr. J. T. Marshall, from Aberdeenshire, as "not uncommon."

Var. **sulcata,** S. Woodward. Plate LII, figs. 14, 15.

1833. *Turbo sulcatus*, S. Woodward, Geol. of Norfolk, p. 44, pl. iii, figs. 14, 15.
1848. *Littorina littorea*, var. *sulcata*, S. V. Wood, Mon. Crag Moll., pt. i, pl. x, fig. 14 *b*.
1864. *Littorina litorea*, var. *sulcata*, S. P. Woodward, in White's Hist. of Norfolk, ed. 3, p. 118.

Dimensions.—L. 28 mm. B. 15 mm.

Distribution.—Not recorded living.

Fossil: Icenian Crag: Bramerton, Thorpe.

Remarks.—One of the specimens of the shell here figured was found at Bramerton by the late T. G. Wigham; it very nearly corresponds to Wood's varietal type (fig. 14 *b*); the other is larger with a broader base. Both agree also with that one originally described by S. Woodward as *Turbo sulcatus*. His son, Dr. S. P. Woodward, considered, as did Wood, that it should be regarded as a variety of *L. littorea*.

Var. **distorta,** nov. Plate LII, fig. 16.

1872. *Littorina rudis* (distorted), S. V. Wood, Mon. Crag Moll., 1st Suppl., pt. i, p. 79, pl. v, fig. 10.

Distribution.—*Recent:* Southend (Jeffreys).

Fossil: Icenian Crag: Bramerton and elsewhere.

Remarks.—This form differs from the variety *deformis* of Wood, the latter being probably, as suggested below, a variety of his var. *elegans*. The malformation of the present specimen seems to have been due to a fracture of the shell at an early stage in the life of the animal and a subsequent regrowth at a different angle. In Wood's opinion such irregularities may have been caused by variation in the conditions under which these molluscs lived, and by a different amount of salinity due to the daily ebb and flow of the tides, or a variable temperature of the water. Jeffreys states that at one part of the Thames, at Southend, he found most of the specimens of *Littorina* more or less eroded and in some cases distorted. This would hardly explain, however, the extraordinary difference in form and sculpture of the various fossils which our best Crag authorities have grouped as varieties of the recent *L. littorea*. In his 1st Supplement (*loc. cit.*) Wood expresses the opinion that some of these distorted shells may belong to *L. rudis*.

Var. **conica,** nov. Plate LII, fig. 17.

Varietal Characters.—Shell conical, trochiform; whorls flattened; ornamented by fine spiral lines which extend to the base, and by a strong rib above the suture

and the periphery; spire of moderate length, regularly diminishing upwards, ending in a fine point; suture slightly channelled; mouth ovate, angulate above; base rounded.

Dimensions.—L. 20 mm. B. 15 mm.

Distribution.—Not recorded living.

Fossil: Icenian Crag: Bramerton, possibly elsewhere.

Remarks.—This specimen from the Norwich Museum differs from anything figured by Wood or otherwise recorded, and deserves notice. It belongs to the *sulcata* group but differs from that variety in its regular and triangularly-conical form and in the strong and prominent rib on the periphery.

Var. **elegans,** S. V. Wood. Plate LII, fig. 18.

1848. *Littorina littorea,* var. *elegans,* S. V. Wood, Mon. Crag Moll., pt. i, p. 118, pl. x, fig. 14 *d.*
1916. *Littorina littorea,* var. *elegans,* J. T. Marshall, Journ. of Conch., vol. xv, p. 44.

Dimensions.—L. 20 mm. B. 14 mm.

Distribution.—*Recent:* British coasts (Marshall).

Fossil: Icenian Crag: Bramerton.

Remarks.—Resembles the var. *sulcata* in form but the sculpture is more delicate, the whorls are more regularly convex, not compressed, and the suture is deeper. Wood's var. *deformis* seems a distorted specimen of the same shell. Our specimen is from the Fitch Collection at the Norwich Museum. It has been regarded by Mr. J. T. Marshall as a British shell, and as the equivalent of the var. *turrita* of Jeffreys.

Var. **delphinula,** S. V. Wood.

1848. *Littorina littorea,* var. *delphinula,* S. V. Wood, Mon. Crag Moll., pt. i, pl. x, fig. 14 *g.*

Remarks.—The specimen figured by Wood under this name may be a misshapen form of the typical *L. littorea,* having a wide base, a large and projecting mouth and a deep umbilicus.

Var. **elongata** (S. Woodward).

1833. *Turbo elongatus,* S. Woodward, Geol. of Norfolk, p. 44, pl. iii, figs. 16—18.
1842—48. *Littorina elongata,* S. V. Wood, Ann. Mag. Nat. Hist. [1], vol. ix, p. 532, 1842; *L. littorea,* var. *elongata,* Mon. Crag Moll., pt. i, pl. x, fig. 14 *k,* 1848.
1864. *Litorina litorea,* var. *elongata,* S. P. Woodward in White's History of Norfolk, ed. 3, p. 118.

Dimensions.—L. 16 mm. B. 8 mm.

Distribution.—Not known living.

Fossil: Icenian Crag: Bramerton, Thorpe.

Remarks.—Specimens under this name have been figured both by Samuel Woodward and by S. V. Wood. They are not identical with the var. *sulcata*, but belong to the same group, being, however, much smaller, more slender and more strongly sculptured than that variety.

Var. **complanata**, nov. Plate LII, figs. 19, 20.

Varietal Characters.—Shell wide, large, thick and strong; whorls 5, the last much the largest, three-fourths the total length, flattened and angulated above; ornamented on the lower part of the whorls by fine spiral sculpture, and on the upper by one or two rounded and prominent ridges which are continuous to the apex; spire short; mouth very large, projecting; outer lip thickened outside.

Dimensions.—L. 24 mm. B. 24 mm.

Distribution.—Not known living.

Fossil: Icenian Crag: Bramerton, Thorpe and elsewhere.

Remarks.—Several examples of this fine shell belonging to the *carinata* group, but distinct from other varieties of it, have been found by Mr. Jas. Reeve at Bramerton and Thorpe. One of our specimens (fig. 19) belongs to the Sedgwick Museum at Cambridge.

Var. **pyramidata**, S. V. Wood.

1848. *Littorina littorea*, var. *pyramidata*, S. V. Wood, Mon. Crag Moll., pt. i, pl. x, fig. 14 *f*.

Dimensions.—L. 18—22 mm. B. 10—12 mm.

Distribution.—Not known living.

Fossil: Icenian Crag: Bramerton.

Remarks.—Belongs to the *sulcata* group, but having stronger spiral ridges with an elongated spire.

I am unable to procure a specimen of this rather distinct variety, and must therefore suggest a reference to the one figured by Wood.

Var. **carinata** (S. Woodward). Plate LII, figs. 21, 22.

1833. *Turbo carinatus*, S. Woodward, Geol. of Norfolk, p. 44, pl. iii, fig. 11.
1848. *Littorina littorea*, var. *carinata*, S. V. Wood, Mon. Crag Moll., pt. i, p. x, fig. 14 *i*.
1864. *Litorina litorea*, var. *carinata*, S. P. Woodward in White's History of Norfolk, ed. 3, p. 118.

Varietal Characters.—Having a short pointed spire, with fine spiral sculpture and one or more strong ridges on the body-whorl.

Dimensions.—L. 18 mm. B. 16 mm.

Distribution.—Not recorded living.

Fossil: Icenian Crag: Bramerton and elsewhere.

Remarks.—This shell may be taken as typical of a short-spired and strongly-carinated group, not uncommon at Bramerton, departing widely from the variety *sulcata*. Originally regarded by S. Woodward as specifically distinct, it was subsequently considered by Wood and others as a variety of *L. littorea*.

Var. **bicarinata** (S. Woodward). Plate LII, figs. 23, 24.

1833. *Turbo bicarinatus*, S. Woodward, Geol. of Norfolk, p. 44, pl. iii, fig. 13.
1848. *Littorina littorea*, var. *bicarinata*, S. V. Wood, Mon. Crag Moll., pt. i, p. 118, pl. x, fig. 14 *e*.
1864. *Litorina litorea*, var. *bicarinata*, S. P. Woodward in White's History of Norfolk, ed. 3, p. 118.

Varietal Characters.—Shell of moderate size, ornamented by strong and prominent ribs (generally two), having a spire varying in length, and in the type form an expanded base; suture deeper than in the variety *carinata*.

Dimensions.—L. 18 mm. B. 12 mm.

Distribution.—Not recorded living.

Fossil: Icenian Crag: Bramerton.

Remarks.—This variety is most nearly allied to the *carinata* group, from which it differs in its stronger ribs, its longer spire and its deeper suture.

Var. **angulata,** nov. Plate LII, fig. 25.

Varietal Characters.—Shell of moderate size, thin and delicate; whorls 6, convex, angulated, with a wide sloping shelf below the suture, the last whorl much the largest; ornamented by fine spiral lines and two or three distinct ridges; spire elongate, rapidly diminishing upwards to a sharp point; suture deep; mouth rather large, somewhat expanded, angulated by one of the spiral ridges; outer lip thin; inner lip widened.

Dimensions.—L. 18 mm. B. 14 mm.

Distribution.—Not known living.

Fossil: Icenian Crag: Bramerton.

Remarks.—This charming little shell seems to differ from anything figured by Wood. Our specimen belongs to the collection of Bramerton fossils at the Norwich Castle Museum.

Var. **truncata,** nov. Plate LII, fig. 26.

Dimensions.—L. 20 mm. B. 15 mm.

Distribution.—Not recorded living.

Fossil: Icenian Crag: Bramerton.

PLATE XLV.

Harmer, Crag Mollusca.

PLATE XLV

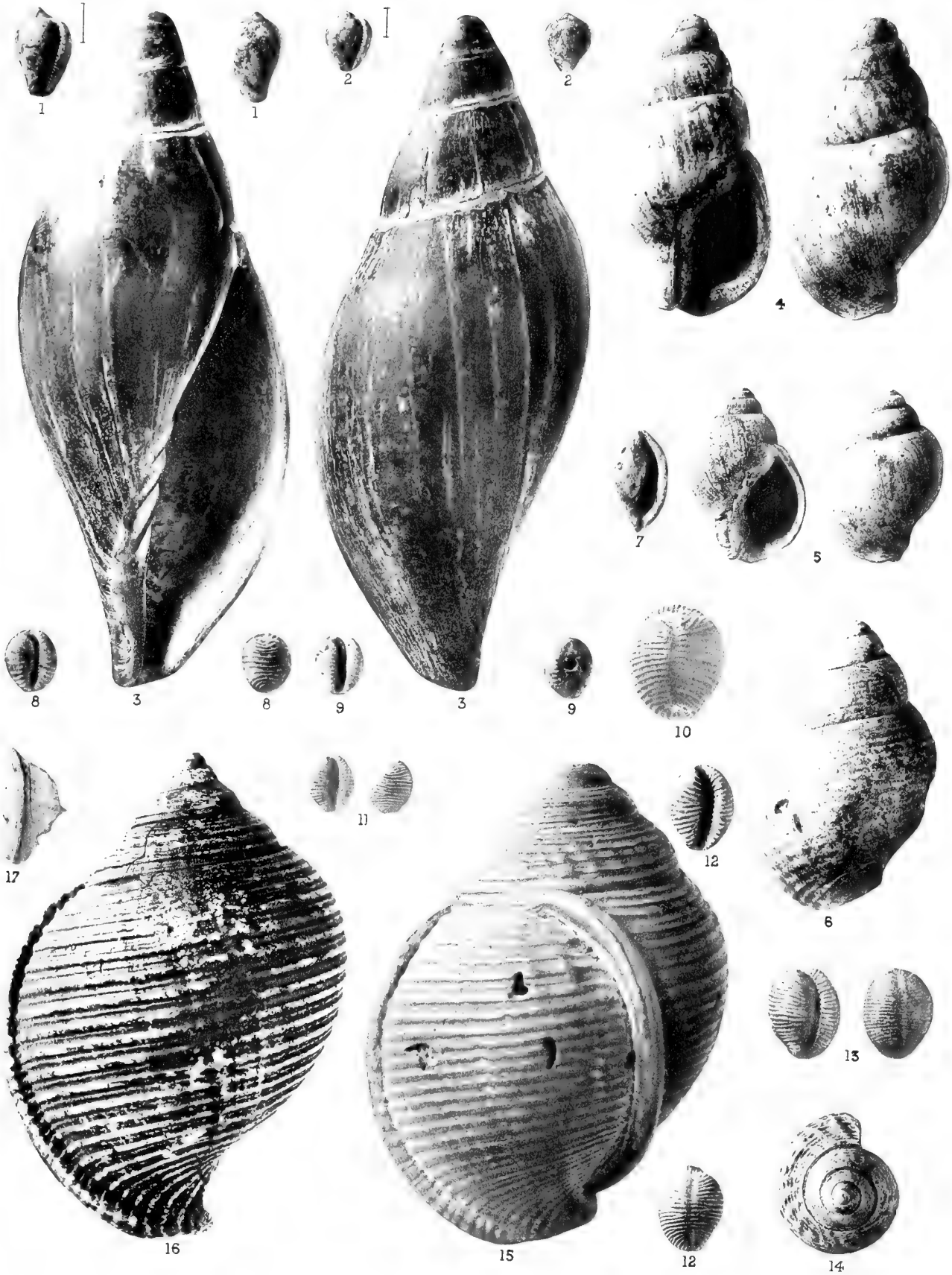

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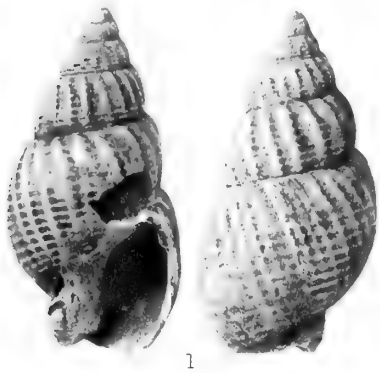
PLATE XLVI.

Harmer, Crag Mollusca.

PLATE XLVI.



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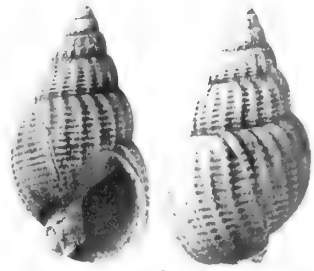

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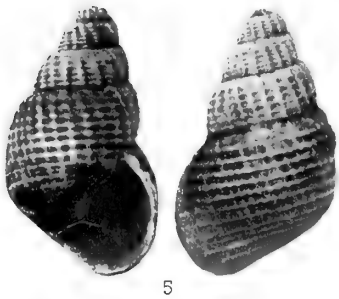

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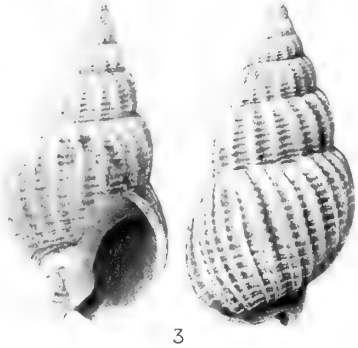

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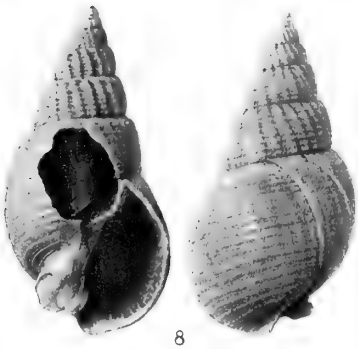

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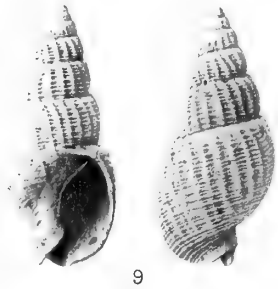

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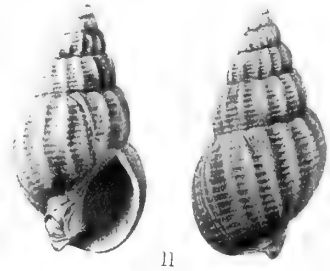

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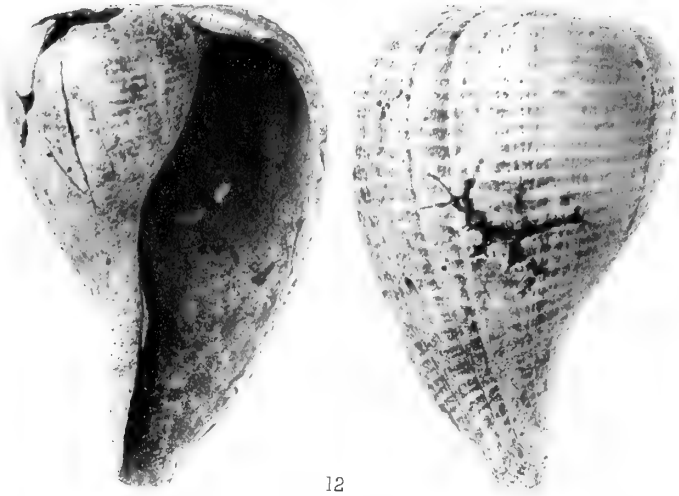

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PLATE XLVII.

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PLATE XLVII

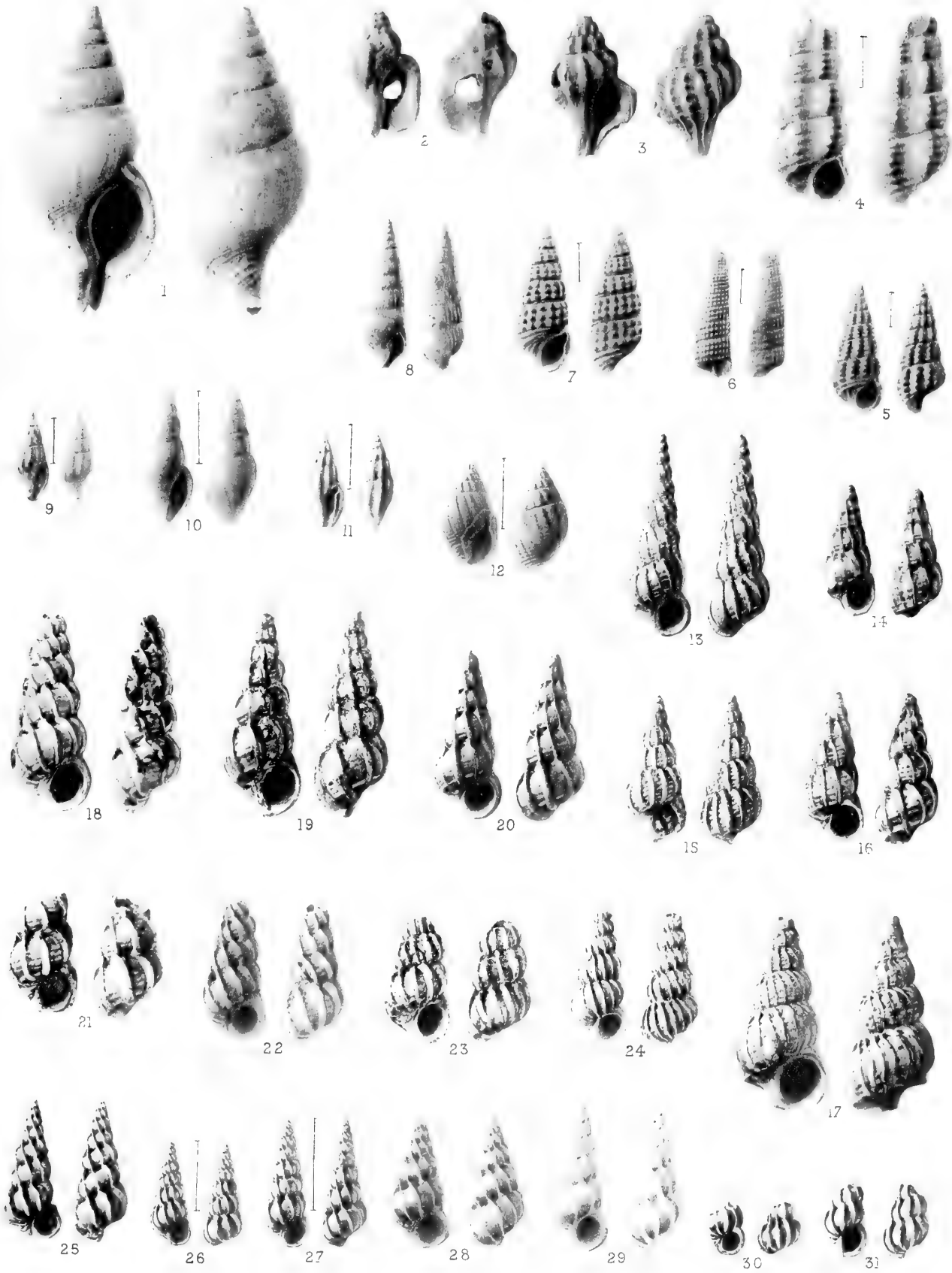

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PLATE XLVIII.

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PLATE XLIX.

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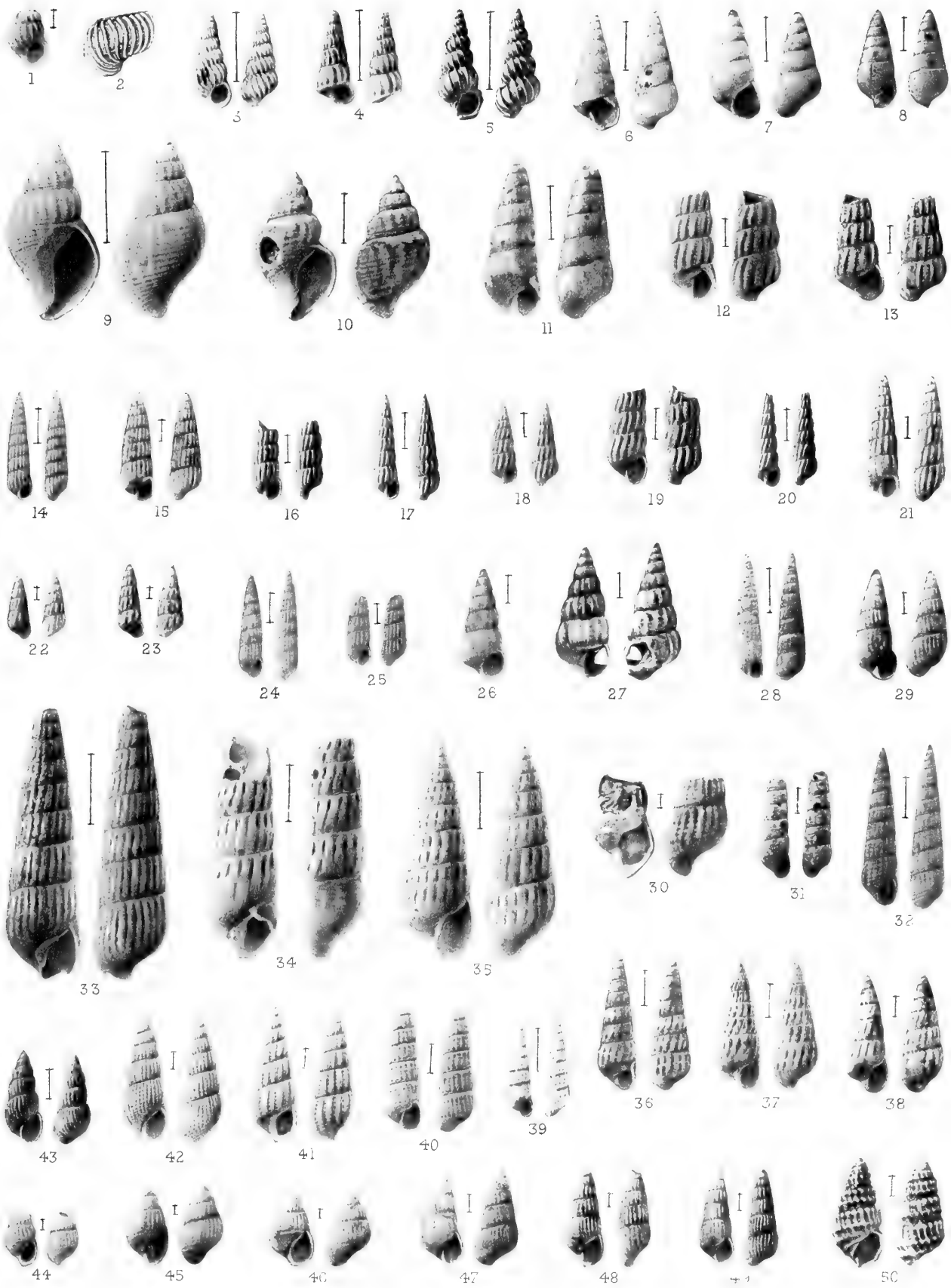

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PLATE L.

Harmer, Crag Mollusca.

PLATE L

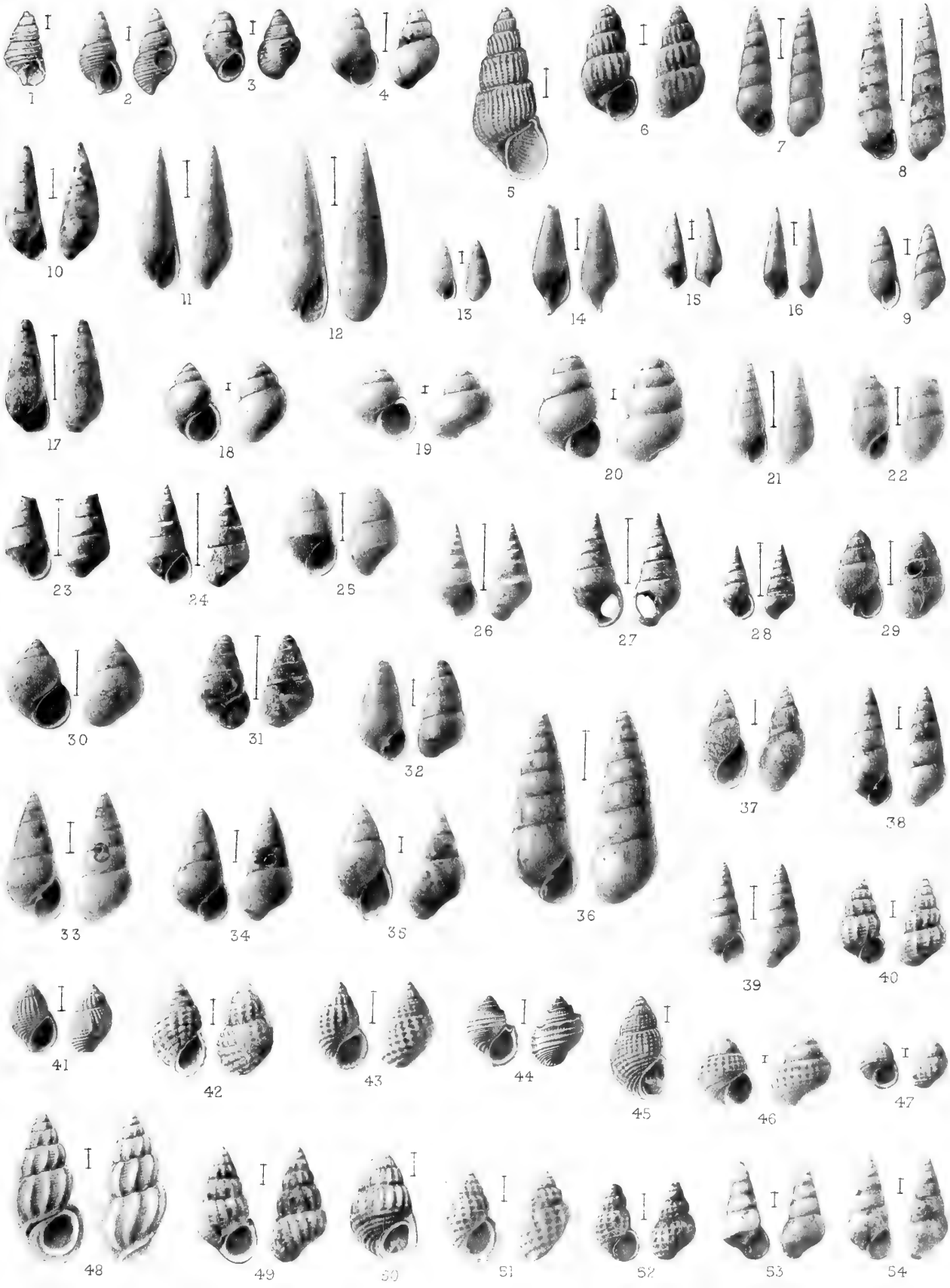

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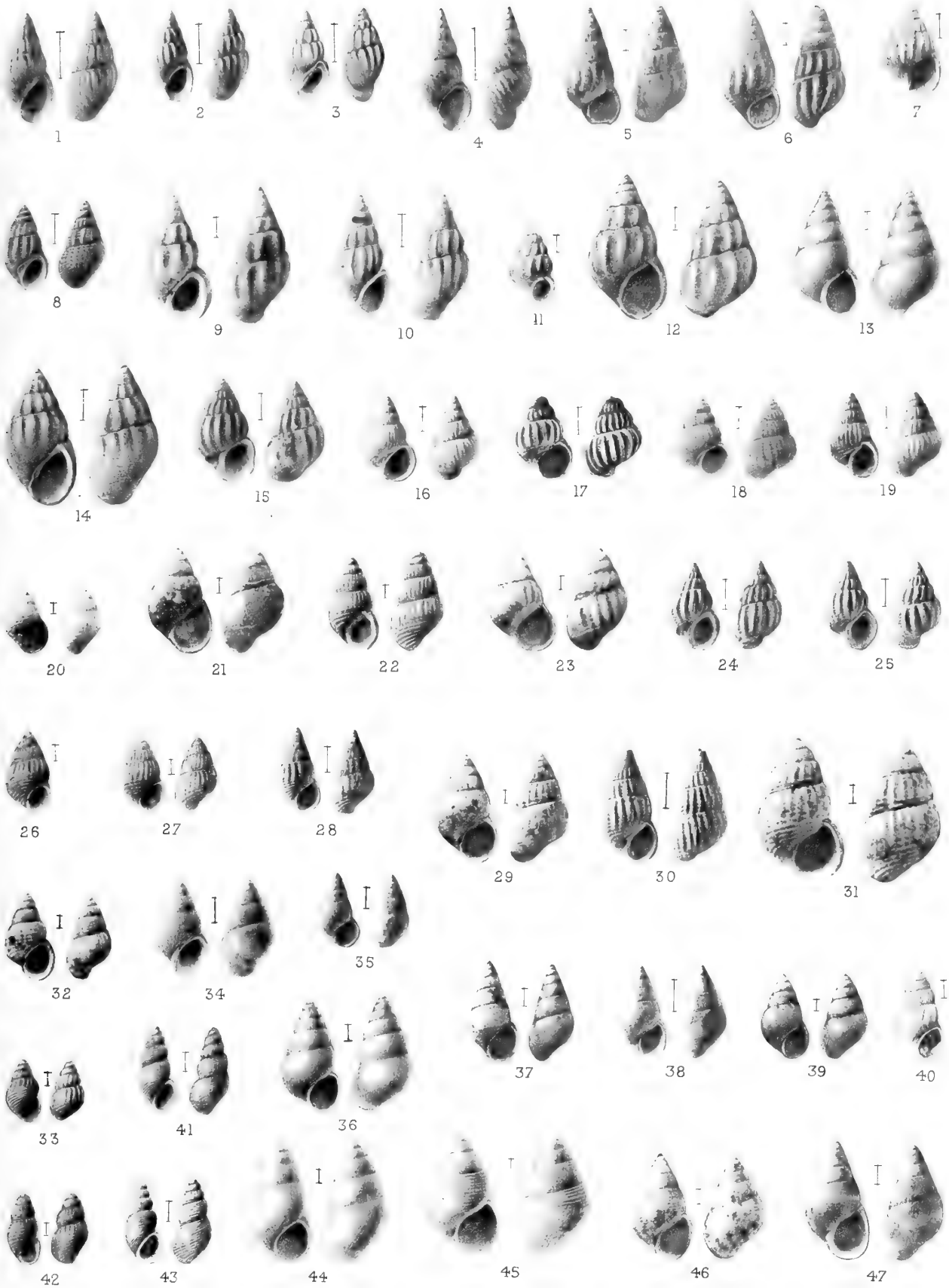
PLATE LI.

Harmer, Crag Mollusca.

PLATE LI



J. Green, del

London Stereoscopic Co. Imp.

PLATE LII.

Harmer, Crag Mollusca.

PLATE LII

J. Green, del

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Palæontographical Society, 1918.

A MONOGRAPH

OF THE

BRITISH ORDOVICIAN AND SILURIAN BELLEROPHONTACEA.

BY

F. R. COWPER REED, M.A., Sc.D., F.G.S.

PART I.

PAGES 1—48; PLATES I—VIII.

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BRITISH ORDOVICIAN AND SILURIAN BELLEROPHONTACEA.

INTRODUCTORY REMARKS.

There has been no recent detailed study of the species of the Bellerophontacea occurring in the British Ordovician and Silurian rocks, and the existing nomenclature, particularly of the genera, is in a state of considerable confusion.

The poorness of most of the material has always proved a serious obstacle to the satisfactory determination of British species, and this difficulty has only been partly removed by the author's examination of a large number of specimens. The types of Sowerby's species have been re-examined, and a revised and fuller description of them has been drawn up with the additional aid of further examples from the original localities, whenever such has been possible.

The material from Girvan which has been submitted to me by Mrs. Gray, is occasionally in a good state of preservation and comprises many new forms. Mr. Turnbull's collection from Haverfordwest has also proved of considerable interest. But apart from Mrs. Gray's collection the majority of the fossils which have been studied are in the Sedgwick Museum, Cambridge, the Museum of Practical Geology, Jermyn Street, London, and the British Museum (Nat. Hist.), South Kensington, and my thanks are due to the authorities, who have given me every assistance in studying the specimens.

CLASSIFICATION.

Our knowledge of the structure of this interesting group of Mollusca as represented in Ordovician and Silurian beds, has been much advanced of late years by the labours of Koken,[1] Lindström,[2] Ulrich and Scofield,[3] and Perner,[4] while

[1] Koken, 'Neues Jahrb. f. Miner.,' suppl. vol. vi (1889), pp. 375—395; 'Die Leitfossilien' (Leipzig, 1896), pp. 100, 392, 393; "Die Gastrop. Balt. Untersilurs." ('Bull. Acad. Imp. Sci. St. Petersburg' [v], vol. vii, no. 2, 1897), pp. 115—143; and 'Neues Jahrb. f. Miner.,' 1898, vol. i, pp. 3—11.

[2] Lindström, "Silur. Gastrop. Pterop. Gotland" ('Kongl. Svensk. Vet.-Akad. Handl.,' vol. x, no. 6, 1884), pp. 69—88.

[3] Ulrich and Scofield, "Lower Silur. Gastrop. Minnesota" ('Final Rep. Geol. Nat. Hist. Surv. Minnesota,' vol. iii, pt. ii, 1897), pp. 844—929.

[4] Perner, 'Syst. Silur. Bohême,' vol. iv, Gastrop. I (1903), pp. 54—162.

reference must be made to the work of Clarke,[1] Knod,[2] Spitz,[3] and others in connection with the usage of the generic names.

We need not here concern ourselves with the earlier views on the classification of the group, or with the discussion of its true zoological affinities and position. If we follow the last edition (1913) of Zittel-Eastman's 'Text-book of Palæontology' we place it in the vicinity of the Pleurotomariidæ. Ulrich and Scofield instituted a separate sub-order for the group and called it Bellerophontacea, and this seems a convenient, if not quite natural, method of designating an assemblage of gastropods possessing certain distinctive features in common.

The further division into two sections or groups characterised by the absence or presence of a slit-band, was adopted by Perner (*op. cit.*, pp. 58, 59), and seems more suited to the present imperfect state of our knowledge than the elaborate arrangement into families which is employed in Zittel-Eastman's 'Text-book.'

The group-names chosen by Perner for the two sections are unfortunate, and do not express the fundamental feature on which his classification is based. If names are required we might suggest Integridorsata as more suitable than his Cyrtolitoidea, and Fissidorsata in place of his Bucanioidea, for neither *Cyrtolites* nor *Bucania* are the originally described or characteristic representatives of the groups. A third section or sub-group is required for those in which the slit is replaced by a chain of pores, and the name Terebridorsata might be applied to it.

The following are the British Genera so far recognised from Ordovician and Silurian beds:

Group I.

Integridorsata (dorsum without median fissure, band, or row of perforations).

Sinuites.	*Cyrtolites.*
Sinuitopsis.	*Bucaniella.*
Oxydiscus.	

Group II.

Fissidorsata (dorsum with median fissure or band).

Bellerophon sens. str.	*Temnodiscus.*
Bucania.	*Bucaniopsis.*
Kokenospira.	*Cymbularia.*
Tetranota.	*Zonidiscus.*
Conradella. (= *Phragmolites*)	[*Salpingostoma.*]

Sub-Group II a.

Terebridorsata (dorsum with median row of perforations).

Trematonotus.	*Phragmostoma.*

Incertæ sedis. *Carinaropsis.*

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[1] Clarke, "Palæozoic Faunas of Para" ('Arch. Mus. Nac. Rio de Janeiro,' vol. x, 1899), English edition, 1900, pp. 34—43; "Foss. Devon. Parana" ('Mon. Serv. Geol. Minèr. Brasil,' vol. i, 1913, Rio de Janeiro), pp. 165—175.

[2] Knod, 'Neues Jahrb. f. Miner.,' suppl. vol. xxv (1908), pp. 503—508.

[3] Spitz, "Gastrop. Karnischen Unterdevons" ('Beitr. Palæont. Geol. Oesterr. u. Orients,' vol. xx, 1907, p. 124).

HISTORICAL REVIEW OF BRITISH SPECIES.

J. de C. Sowerby in 1839 (Murchison's 'Silurian System') described and figured the following new species[1]:

Bellerophon bilobatus.
„ *acutus.*
[*Euomphalus*] *perturbatus.*
[„] *tenuistriatus.*
Bellerophon wenlockensis.
„ *dilatatus.*
„ *apertus* (*non* Sowerby, 1820).
Bellerophon aymestriensis.
„ *globatus.*
„ *carinatus.*
„ *expansus.*
„ *striatus* (*non* Bronn).
„ *trilobatus.*
„ „ var.

J. E. Portlock in 1843 ('Geological Report on Londonderry, Tyrone, and Fermanagh') described the following species from the Ordovician rocks of Tyrone:

Bellerophon bilobatus, var. nov. *compressus.*
„ *elongatus*, Portlock.
„ *gibbus*, Portlock.
Bellerophon dilatatus, Sow. var.
„ *alatus*, Portlock.

F. McCoy in 1846 ('Synopsis of Silurian Fossils of Ireland') described a species as *Euomphalus furcatus*, but it has subsequently been regarded as identical with *B. perturbatus*, Sow. He also recorded many of Sowerby's and Portlock's species from Irish localities.

J. Phillips in 1848 ('Mem. Geol. Surv.,' vol. ii, pt. i, p. 356) established a new species under the name of *Bellerophon obtectus* for a shell from the Silurian of Marloes Bay.

J. W. Salter in 1851 ('Quart. Journ. Geol. Soc.,' vol. vii, p. 172) recorded several of Sowerby's species from the Lower Palæozoic of the Girvan district, and figured one from Drummuck as *B. acutus*, Sowerby (*op. cit.*, pl. ix, fig. 18).

J. W. Salter in 1854 ('Quart. Journ. Geol. Soc.,' vol. x, p. 74) described a Bala species from Shropshire as *Bellerophon* (*Bucania*) *sulcatinus*, Emmons?, but the name *lingualis* was proposed for it. The name *B. nodosus* was applied to another species previously described by McCoy as *B. ornatus* (Conrad).

F. McCoy in 1851—4 ('Synopsis of the British Palæozoic Fossils in the Woodwardian Museum, Cambridge,' pp. 308—311) redescribed several of Sowerby's species, and established a new species under the name *Bellerophon subdecussatus*. *Bellerophon ornatus* (Conrad) was also recorded.

J. W. Salter in 1866 ('Mem. Geol. Surv.,' vol. iii, p. 350, pl. xi B, fig. 2) described a new Arenig species as *Bellerophon hippopus*.

J. W. Salter in 1873 ('Catalogue of the Cambrian and Silurian Fossils in the Woodwardian Museum') introduced the name *Bellerophon Ruthveni* for a species

[1] The original generic names in square brackets are now regarded as erroneous or proved to be preoccupied.

from the Ludlow beds, and he recorded most of Sowerby's Ordovician and Silurian species from various localities.

H. Hicks in 1873 ('Quart. Journ. Geol. Soc.,' vol. xxix, p. 50) briefly described and figured two new species from the "Tremadoc" beds of the St. David's district under the names *Bellerophon solvensis* and *B. ramseyensis*.

H. Hicks in 1875 ('Quart. Journ. Geol. Soc.,' vol. xxxi, p. 318) described and figured a new Arenig species from Wales under the name *Bellerophon llanvirnensis*.

R. Etheridge in 1877 ('Proc. Roy. Phys. Soc., Edinburgh,' vol. iv, p. 175) described a fossil from Drummuck, Girvan, as *Bellerophon* cf. *subdecussatus*, McCoy.

In 1878 was published the 'Catalogue of the Cambrian and Silurian Fossils in the Museum of Practical Geology, Jermyn Street,' and the following MS. names were recorded (without descriptions) for various Ordovician and Silurian species:

Bellerophon bilobatus, var. *anceps*	Ordovician.	*Bellerophon discus*, Edgell, MS.	Silurian.
„ *Griffithi*, MS.		„ *falcatus*, MS.	
„ *lingualis*, MS.		„ *ionicus*, Salt., MS.	
„ *semirugosus*, Salt., MS.		„ *ventriculatus*, Edgell, MS.	

R. B. Newton in 1892 ('Geol. Mag.' [3], vol. ix, p. 339) described a Wenlock species as *Trematonotus britannicus*.

F. R. C. Reed in 1901 ('Geol. Mag.' [4], vol. viii, p. 358) described and figured the species to which Salter had applied the MS. name *Bellerophon Ruthveni*.

F. R. C. Reed in 1906 ('Geol. Mag.' [5], vol. iii, pp. 363—367) defined four new species from the Bala beds of the Haverfordwest district under the names *Bellerophon* (*Sinuites*) *crypticus*, *Bellerophon? multirugatus*, *Bellerophon* (*Bucaniopsis*) *secundus*, and *Conradella*, sp.

Group I. Integridorsata.

Genus **SINUITES**, Koken.

Generic Characters.—Shell involute, composed of few whorls overlapping and embracing; umbilicus closed or very small. Dorsum rounded or flattened, not carinated. Aperture not abruptly expanded, with dorsal margin excavated by more or less deep rounded or **V**-shaped sinus and lateral margins projecting forwards as rounded or subangular lobes ("apertural lobes"). Interior of outer whorl with one or more transverse thickenings of shell.

The name *Sinuites*[1] is here adopted in place of Ulrich and Scofield's *Protowarthia*[2] because of its priority. The genotype is *Bellerophon bilobatus*, Sowerby, sens. str.

[1] Koken, 'Leitfossilien' (Leipzig, 1896), p. 392.

[2] Ulrich and Scofield, *op. cit.*, pp. 848, 867.

Perner[1] and Bassler[2] have employed this generic name. Unfortunately the species *B. bilobatus* has been made to comprise a somewhat miscellaneous assortment of forms, and the customary usage of the specific name has become loose and unsatisfactory, as the author[3] pointed out in 1906.

The chief criteria of the various species included in this genus lie in the shape of the transverse section of the whorl, the height of the umbilicus, the internal thickenings of the shell, and the outline of the apertural lobes and shape of the dorsal sinus. The expression "apertural curve" is used below to indicate the curve described by the lateral margin of the mouth (= apertural lobe) in relation to a straight line let fall vertically through the umbilicus from the base of the dorsal sinus. The external ornamentation would be more often useful as a distinguishing specific feature if more generally preserved.

1. **Sinuites anceps** (Salter, MS.). Plate I, figs. 1—3.

1878. *Bellerophon bilobatus*, Sowerby, var. *anceps*, Salter, MS., Catalogue of Cambrian and Silurian Fossils in the Museum of Practical Geology, Jermyn Street, p. 57.

Specific Characters.—Shell somewhat compressed laterally, outer whorl embracing all the inner whorls; umbilicus closed, minute, subcentral, situated at rather less than half height of shell. Outer whorl gradually increasing in height to mouth, with early part of whorl rounded and subparabolic in section and very faintly trilobed, but becoming subrhomboidal in section towards mouth; sides steep, gently convex below, but excavated above, so as to meet the dorsum at right angles; dorsum becoming increasingly flattened and elevated towards mouth, broad, with sharp, subrectangular lateral edges. Mouth subrhomboidal, with lateral lobes large, angulated (?) and projecting, and with a deep **U**-shaped sinus occupying the whole flattened dorsum. Surface of shell marked with fine, gently sigmoidal transverse striæ curving back concentric to sinus on dorsum, and with a few stronger transverse ridges. Traces of weak, narrow, internal thickenings crossing sides and dorsum.

Horizon.—Middle Bala Beds (Soudley Sandstone).

Locality.—Horderley; Soudley Quarry, Craven Arms.

Dimensions.—Height, about 23 mm. Thickness at umbilicus, about 12 mm.

Remarks.—The original specimen [28025] named by Salter is in the Jermyn Street Museum. There is some variation in the degree of globosity of the shell and in the excavation of the sides, for in another specimen [28027] (from the same locality) in Jermyn Street these features are more pronounced than in the

[1] Perner, *op. cit.*, p. 59.

[2] Bassler, 'Bibliogr. Index Amer. Ordov. Silur. Foss.' (Bull. 92, U.S. Nat. Mus. 1915), vol. i, p. 1159.

[3] Reed, 'Geol. Mag.' [5], vol. 3, 1906, p. 364.

type. Three specimens in the Sedgwick Museum show similar variation. With regard to affinities, the flattened dorsum recalls the species *Sinuites planodorsatus*, Ulr.,[1] from Kentucky, but the shape of the sides, height of the outer whorl, and depth of the sinus forbid us considering it identical. The apertural curve is in no specimen perfectly preserved.

2. **Sinuites balclatchiensis,** sp. nov. Plate I, figs. 4—7.

Specific Characters.—Shell subglobose, rounded. Outer whorl completely embracing inner whorls, increasing slightly in height and more rapidly in width to mouth, with dorsum high, rounded, strongly arched, but becoming obtusely angulated towards mouth. Mouth about one and a half times as wide as high, slightly expanded at sides, with rounded, U-shaped sinus in outer lip and rounded apertural lobes strongly arched forwards. Apertural curve rounded, not angulated. Umbilicus closed; situated at about half the height of the shell or below the middle.

Surface with very faint transverse striæ near lip, but elsewhere smooth. Interior of shell finely granulose, generally without any marginal thickening of lips but with one transverse internal thickening on dorsum some distance behind mouth. Shell-substance thin.

Dimensions.—Height of shell, 18·0 mm.; height of outer whorl above umbilicus, 11·0 mm.; height of outer whorl below umbilicus, 7·0 mm.; width of outer whorl above umbilicus, 14·5 mm.; width of outer whorl below umbilicus, 9·5 mm.

Horizon.—Lower Ordovician: Balclatchie Group.

Locality.—Balclatchie, Girvan.

Remarks.—The relations of this species to the typical *S. bilobatus* (Sowerby)[2] are close, but the Girvan form differs by having a more sharply and narrowly arched back, parabolic rather than semi-elliptical in cross-section, and a more rapid increase in the width of the whorls towards the mouth. As mentioned below, the name *bilobatus* has been applied in a very loose and indefinite manner, and several species have been included by British palæontologists under this specific designation, while its varied usage by foreign geologists has still further increased the confusion.

In all of the specimens from Balclatchie in Mrs. Gray's collection the shell is very thin, and has a shining, black, corneous appearance, which seems to be due to its natural and original character, and not to secondary changes or to the state or method of preservation.

The holotype is in Mrs. Gray's collection.

[1] Ulrich & Scofield, *op. cit.*, p. 871, pl. lxiii, figs. 31—35.

[2] Sowerby in Murchison's 'Silur. Syst.,' p. 643, pl. xix, fig. 13.

3. **Sinuites bilobatus** (Sowerby). Plate I, fig. 8.

1839. *Bellerophon bilobatus*, Sowerby, in Murchison's Silurian System, p. 643, pl. xix, fig. 13.
1848. *Bellerophon bilobatus*, Sowerby, Férussac et D'Orbigny, Hist. Nat. Cephal., vol. i, p. 188, pl. viii, figs. 2, 3.
1852. *Bellerophon bilobatus*, Sowerby, McCoy (pars), Syn. Brit. Pal. Foss. Woodw. Mus. fasc. ii, p. 308.
? 1843. *Bellerophon gibbus*, Portlock, Geol. Rep. Londond., p. 398, pl. xxix, fig. 5.

Specific Characters.—Shell subglobose, outer whorl completely embracing all inner whorls; umbilicus minute or closed, subcentral, situated at a little less than half the height of the shell; dorsum and sides rounded. Mouth transverse, wider than high, with prominent sharply rounded or almost bluntly rectangular apertural lobes projecting forwards; dorsal sinus **U**-shaped or bluntly **V**-shaped, open, deep; base of mouth scarcely expanded, not reflexed. Surface of shell with fine, regular, transverse arched striæ, distinct near mouth, concentric to edges of lips, sharply arched forward on apertural lobes, well marked behind sinus on dorsum and having a few stronger striæ between them. Interior of shell with faint traces of low, broad, transverse thickenings of shell, usually one or two developed close to oral margins, most distinct on dorsum, obsolete on sides of whorl.

Dimensions.—(Type specimen [6850]). Height, about 35 mm. Thickness, about 25 mm.

Horizon.—Bala Series.

Localities.—(1) Horderley; Cynwyd; Corwen?

Remarks.—The above description is based on Sowerby's type [6850] in the Jermyn Street Museum. The apertural lobes in this specimen have their anterior ends imperfect, but judging from the curve of the striæ must have been bluntly rectangular or obtuse rather than broadly rounded. The ornament is rarely preserved in the majority of specimens, but shows well in the type.

So much confusion has arisen from an indiscriminate use of this specific name that its strict limitation is necessary. Sowerby's original description, which is too brief to be satisfactory, is as follows; "Nearly globose, smooth; aperture two-lobed. Diameter 1½ inch, width of aperture 1 inch 3 lines." The first locality which he gives is Horderley, and then follow Wistanstow, Welch Pool; Michaelwood Chase; Tortworth and Berwyns. Horderley is a Bala locality, and it is highly doubtful if the Silurian localities, Tortworth and Michaelwood Chase, should stand. The Horderley Ordovician shell will therefore be considered the type of the species, which has been re-defined above. A large number of specimens from this locality and its immediate neighbourhood have been examined, but only some have been found to possess the typical characters; many of those identified by Salter and McCoy as *S. bilobatus* must be removed from association with them. McCoy's[1] definition is too comprehensive, as he included more than one species under Sowerby's name.

[1] McCoy, 'Syn. Brit. Pal. Foss. Woodw. Mus.,' p. 308.

The true *S. bilobatus* is more allied to the species *S. subrectangularis*, sp. nov., from Girvan in respect of the shape of the apertural lobes than to *S. soudleyensis*, sp. nov., which has been frequently confused with it. But it differs from the Scottish form in the absence of internal thickenings of the same strength, and in possessing a more rounded dorsum.

In the shell from the Ordovician of Spain attributed by De Verneuil[1] to Sowerby's *S. bilobatus* the presence of two or three concentric internal transverse thickenings is represented in the figure and especially noticed in the description, though owing to the fossil being in the condition of an internal cast they appear as grooves instead of ridges, and are described as such.

4. **Sinuites crypticus**, Reed.

1906. *Bellerophon* (*Sinuites*) *crypticus*, Reed, Geol. Mag. [5], vol. iii, p. 363, pl. xx, figs. 12—14.

Specific Characters.—Shell closely coiled, subglobose, sides somewhat flattened, greatest thickness at umbilicus, back narrowly rounded; outer whorl completely embracing and hiding inner whorls and increasing rather rapidly in size to mouth; umbilicus minute (exposed in casts); section of whorls semi-elliptical to parabolic; aperture higher than wide, not expanded laterally; outer lip thin; inner lip more or less reflexed and thickened; dorsal sinus moderately deep, broadly **V**-shaped; apertural lobes gently rounded below, but angulated obtusely at origin of sinus, where the margin is rather suddenly and sharply curved inwards. Surface of shell ornamented with rather strong concentric growth-lines and ridges on apertural lobes, and generally with one rather strong internal thickening a little inside margin of mouth; general surface of shell ornamented with a minute regular cancellation composed of equal-sized, fine revolving striæ closely placed and crossed by similar transverse, slightly flexuous striæ.

Dimensions.—Height (average) about 20 mm., diameter (average) about 8—10 mm.

The affinities of this shell were discussed by me in the original description of the species, and it only remains to be added that the Girvan form *Sinuites discoides*, sp. nov., appears to resemble it somewhat in ornamentation, and that a similar cancellation of the surface is found in *S. reticulatus*, Perner.[2] The holotype is in the Sedgwick Museum.

Horizons.—(1) Redhill Beds; (2) Slade Beds (Upper Ordovician).

Localities.—(1) Prendergast Place and Lane; (2) Lane near Crundale; Robeston Wathen.

Remarks.—The internal surface of the shell on and near the concentric thickening is covered densely with small granules showing as pits in internal casts.

[1] De Verneuil, 'Bull. Soc. Géol. France' [2], vol. xii (1855), p. 984, pl. xxvii, fig. 1.

[2] Perner, *op. cit.*, p. 64, pl. lvi, figs. 42, 43; pl. lxxxvi, figs. 33, 34; text-figs. 37—40.

5. **Sinuites discoides,** sp. nov. Plate I, figs. 9—11.

Specific Characters.—Shell much compressed laterally, lenticular; outer whorl almost completely enveloping inner whorls and very rapidly increasing in height; umbilicus very small, nearly closed, situated at about one-third the height of shell; umbilical edge angular to subangular. Outer whorl with very gently convex or flattened sides; dorsum sharp, acute, except near mouth, where it becomes narrowly rounded. Mouth high, narrow, not expanded laterally, widest at base, about twice as high as wide, with deep, narrow, acutely V-shaped sinus in upper lip and large projecting subparallel angular apertural lobes, their inner and outer edges meeting at about 75°; base of lips slightly reflected over umbilicus. Surface of shell covered with very fine transverse striæ bending back to meet the sharp dorsal edge at about 30° or less, with very delicate revolving lines decussating them on sides of whorl. Interior with one or two short rounded submarginal thickenings behind sinus on dorsum dying out on sides.

Dimensions.—

	I	II
Height of shell	15	13 mm.
Height of outer whorl above umbilicus	10	9 „

Horizon.—Lower Ordovician: Balclatchie Group.

Localities.—Balclatchie; Ardmillan; Dow Hill.

Remarks.—This shell must be referred to the genus *Sinuites*, in spite of its compressed shape and sharp dorsal edge. The apertural lobes, the small or closed umbilicus, the internal ridges, and the embracing whorls indicate its affinities. The revolving lines are rarely visible, but the ornament on the whole reminds us of *S. crypticus*. If the umbilicus were open and larger, and the whorls only just in contact, we might consider its reference should be to *Temnodiscus*, Perner. The shell is thin and corneous in appearance, like that of *S. balclatchiensis*.

There are two specimens [28100, 28101] in the Jermyn Street Museum from the Arenig of White Grit Mine, Shelve, which may be doubtfully referred to this species. They show the general characters and fine revolving lineation of *S. discoides*, but are much crushed and distorted, so that their precise identification is almost impossible.

6. **Sinuites elongatus** (Portlock). Plate I, figs. 12—14.

1843. *Bellerophon elongatus*, Portlock, Geol. Rep. Londond., p. 397, pl. xxix, figs. 4 *a*, 4 *b*.

Specific Characters.—Shell somewhat compressed, outer whorl completely embracing inner whorls. Umbilicus closed, situated at less than half height of shell. Outer whorl very rapidly increasing in height to mouth, and much less rapidly in width; dorsum narrow, rounded. Mouth higher than wide,

with large, prominent, subangular apertural lobes projecting far forwards; upper lip with deep, U-shaped dorsal sinus. Interior of shell with two principal strong rounded transverse thickenings, both well developed on dorsum, but dying out nearly completely on sides of whorl, one submarginal and the other a little distance behind it, both concentric to margins of apertural lobes. External surface of shell with fine transverse striæ strongly arched back to form sinus on dorsum [and crossed by very delicate revolving lines most distinct on apertural lobes, producing minute cancellation].

Dimensions.—Height of shell, about 30 mm.; thickness at umbilicus, about 11 mm.

Horizon.—Bala Series.

Locality.—Tyrone.

Remarks.—The shape of the apertural lobes is like that in *S. subrectangularis;* but the two strong internal transverse thickened bands on the dorsum having their course concentric to the angulated apertural lobes, and gradually disappearing on the sides of the whorl, as well as the external ornament, distinguish this species. For in *S. subrectangularis* there is only one transverse thickening, and it is not concentric with the margin, and it is strongest on the sides of the whorl instead of on the dorsum. The supposed types of *S. elongatus* [27991 and 27990] which are in the Jermyn Street Museum, are distorted. Another fragment [28031] in the same museum shows the external ornament well as in *S. crypticus.* Some doubtful examples occur in the Starfish Bed, Girvan.

7. **Sinuites maccallumi,** sp. nov. Plate II, figs. 1—4, ? 5.

Specific Characters.—Shell somewhat compressed laterally, with back more or less narrowly rounded and whorls higher than wide. Umbilicus minute or closed, situated at about two-fifths, or less than half the height of shell. Outer whorl completely enveloping inner whorls, higher than wide, increasing more rapidly in height than width, with semi-oval cross-section. Mouth not expanded laterally, semi-oval in shape, higher than wide, with deep U-shaped sinus in outer lip more than one-third width of back and with bluntly pointed, obtuse, subangular, apertural lobes projecting sharply forwards with inner and outer edges inclined at 90°—130°. Surface of shell with very fine transverse growth-striæ concentric with apertural margin. Interior with two successive low-rounded transverse U-shaped marginal thickenings concentric with sinus (but suddenly ending laterally), and placed close together, corresponding with constrictions (represented by shallow rounded broad grooves) on surface of shell.

Dimensions.—Height of shell, 14·0 mm.; height of outer whorl above umbilicus, 9·0 mm.; width of outer whorl above umbilicus, 8·75 mm.; width of outer whorl below umbilicus, 6·0 mm.

Horizon.—Lower Ordovician: Balclatchie Group.

Localities.—Ardmillan; Balclatchie (?), Girvan.

Remarks.—The shape and cross-section of the shell resemble *S. sowerbyi*, Perner,[1] but the angulated apertural lobes are similar to those in *S. rectangularis* (Ulr. and Scof.).[2] From *S. balclatchiensis* it differs in shape, the more rapid increase in height of the whorls, the broader sinus, and angulated apertural lobes and pair of marginal internal thickenings. Similar internal transverse ridges are met with in *S. obesus* (Ulrich)[3] from the Ordovician of America and in "*Bellerophon*" *strangulatus*, Barrande,[4] as well as in De Verneuil's "*Bellerophon bilobatus*" from Spain[5] and Eichwald's *Bellerophon navicula*[6] from the Lyckholm Beds of Dago. Many of the British species described in this memoir possess such thickenings.

This species is dedicated to Dr. Alexander MacCallum, who was one of the earliest geologists to pay attention to the Girvan area.

The types are in Mrs. Gray's Collection.

8. **Sinuites pseudocompressus,** sp. nov. Pl. II, figs. 6—8.

1852. *Bellerophon bilobatus*, Sowerby, McCoy (pars), Syn. Brit. Palæoz. Foss. Woodw. Mus., fasc. ii, p. 308.

Specific Characters.—Shell compressed, rounded; back narrowly rounded, sides somewhat flattened; umbilicus closed or very small, situated at about one-third the height of the shell. Outer whorl increasing rapidly in height to mouth. Mouth higher than wide, widest at base, semi-oval to parabolic, with large sub-angular lateral lobes projecting forwards, and large deep, blunt, V-shaped sinus in outer lip; base of lip slightly reflexed at umbilicus. Surface of lateral lobes marked with fine lines parallel and close to edge of lip; rest of surface of shell smooth?. Interior of shell with weak, broad, rounded, transverse internal thickening forming a rounded band running up from umbilicus with slight sigmoidal curve and touching base of sinus on dorsum. Occasionally traces of similar but weaker posterior transverse narrow internal thickenings are present near the umbilicus and on the sides of the outer whorl at about half to three-fourths the height of shell.

Horizon.—Middle Bala.

Localities.—Cheney Longville; Horderley.

[1] Perner, *op cit.*, p. 61, pl. lxxxvi, figs. 27—32, text-figs. 28—36.

[2] Ulrich and Scofield, *op. cit.*, p. 868, pl. lxiii, figs. 15—20.

[3] *Ibid.*, p. 874, pl. lxiii, figs. 45—47.

[4] Perner, *op. cit.*, p. 159, pl. lxxxvii, figs. 12—14.

[5] De Verneuil, 'Bull. Soc. Géol France,' [2] vol. xii, 1855, p. 984, pl. xxvii, fig. 1.

[6] Eichwald, 'Urwelt Russlands,' pt. 2 (1840), p, 57, pl. iii, fig. 3; Koken, 'Gastrop, Balt. Untersilurs,' p. 120.

Dimensions.—	I	II
Height of shell	27	34·0 mm.
Height of whorl at mouth	20	25·0 „
Diameter at umbilicus	8	11·5 „

Remarks.—Shells of this type have been usually ascribed to *S. bilobatus*, but their more compressed shape, narrower dorsum, more rapid increase in the height of the outer whorl, lower position of the umbilicus and semi-oval or semi-elliptical cross-section of the whorls, distinguish them. *S. sowerbyi*, Perner, is more closely allied, but it has not the internal transverse thickenings. My *S. crypticus* from Haverfordwest is closely allied, but differs in the ornamentation and shape of the apertural lobes. We may also compare the American species *S. subcompressus* (Ulr. and Scof.)[1] and *S. concinnus* (Ulr. and Scof.).[2] The co-types are in the Sedgwick Museum.

9. **Sinuites pusgillensis,** sp. nov. Plate II, figs. 9—12.

Specific Characters.—Shell rounded; outer whorl wider than high, rapidly increasing in size, especially in width, and completely embracing inner whorls; dorsum of proximal part narrowly rounded, strongly arched, becoming broader, lower and less arched towards mouth. Umbilicus small, deep, situated at rather more than one-third the height of shell; umbilical slopes small, steeply bevelled, with distinctly marked umbilical edge. Mouth transverse, nearly twice as wide as high, with very shallow broad emargination in upper lip and short broad, rounded lateral lobes. Internal thickenings absent. External ornament unknown.

Dimensions.—	S.M. 116.	[G. 22066.]	[G. 22064.]
Height of shell	24·5	22·0	14·0 mm.
Height of umbilicus	9·0	7·0	5·0 „

Horizon.—Lower Ordovician: Corona Beds.

Locality.—Pusgill, near Dufton, Cumberland.

Remarks.—All the specimens are internal casts. The type is in the Sedgwick Museum, and the paratypes in the British Museum. The outer whorl expands more rapidly in width than it does in *S. soudleyensis*, and its narrowly arched dorsum becomes lower and broader towards the mouth. The umbilicus also is situated below the centre of the shell, and there are no internal thickenings. In the shape of the shell and the general characters of mouth, sinus and lateral lobes, *S. cancellatus* (Hall),[3] from the Black River and Trenton groups, appears to be closely similar.

[1] Ulrich and Scofield, *op. cit.*, p. 873, pl. lxiii, figs. 40—44.

[2] *Ibid.*, p. 874, pl. lxiii, figs. 36—39.

[3] *Ibid.*, p. 872, pl. lxiii, figs. 1—14.

10. **Sinuites semirugosus** (Salter MS.). Plate II, figs. 13—17.

1878. *Bellerophon semirugosus*, Salter MS., Cat. Camb. Silur. Foss. Mus. Pract. Geol., p. 57.

Specific Characters.—Shell globose to subglobose; outer whorl completely enveloping inner whorls, transverse, inflated, with convex sides and dorsum, increasing in size to mouth; dorsum broad, marked off from sides by narrow revolving raised line, against which thick, low, rounded, equidistant and equal transverse rugæ or ribs on the sides of the whorl end rather abruptly. Umbilicus closed, rather deep, subcentral. Surface of shell covered with fine, closely-placed, small thread-like granulated transverse lines bending back acutely on the dorsum to form a broad, U-shaped sinus, and with minute revolving lines on sides of whorl crossing the transverse ones, so as to cause their granulation and the fine cancellation of the surface.

Dimensions.—Height, about 25 mm.; maximum width, about 19 mm.

Horizon.—Bala Series.

Localities.—Tyn y twyl, Grweiddeau; Vyrnwy Dam, Llanwddyn.

Remarks.—There are only four specimens of this form known to me, three [28039, 28040, and 28041] in the Jermyn Street Museum from Tyn y twyl and one in the Sedgwick Museum from the Vyrnwy Dam. It is an interesting and peculiar species, for the ornamentation is unlike that in any other species of *Sinuites* with which I am acquainted. The shape and sinuation of the mouth are unfortunately unknown, the margins not being preserved, but from the course of the striæ on the dorsum it is probable that there was a broad, U-shaped sinus. The size of the Llanwddyn fragment in the Sedgwick Museum indicates that the shell grew to a larger size than is shown by Salter's type specimens.

11. **Sinuites soudleyensis,** sp. nov. Plate II, figs. 18, 19; Plate III, figs. 1—3.

1884. *Bellerophon bilobatus*, Sowerby, J. D. La Touche, Handbook to the Geology of Shropshire, p. 59, pl. v, fig. 99.

Specific Characters.—Shell globose to subglobose; outer whorl completely enveloping inner whorls; umbilicus subcentral, minute or closed. Outer whorl transverse, broad, low, rounded, slowly increasing in size to mouth; dorsum broadly convex, sometimes rather flattened. Mouth slightly expanded at base; dorsal sinus shallow, open, rounded, broadly U-shaped; apertural lobes short, rounded, simply arched, not subangular. Shell composed of thin smooth outer layer and thicker second layer ornamented with closely-placed regular transverse rounded lines concentric with margin of mouth, crossed by very delicate revolving lines, most distinct near umbilicus; on the dorsum the transverse lines become finer, more closely placed, and bend back rather suddenly to form a U-shaped curve less open than dorsal marginal sinus. Occasionally a few low,

transverse, rounded rugæ are present near umbilicus, but die out on sides. Third or inner layer of shell smooth. Interior of shell with broad, low, rounded, marginal thickening on edge of dorsal lip, dying out laterally.

Dimensions.—Height, 22 mm.; thickness at umbilicus, 16 mm.

Horizon.—Bala Series.

Localities.—Soudley, near Craven Arms; Hope Bowdler; Horderley; Meifod ?.

Remarks.—The presence of three layers to the shell is well seen in some specimens, but the species is usually represented by internal casts. It differs from the true *S. bilobatus* in being more globose, in having rounded apertural lobes to the mouth, and a shallower, more open dorsal sinus. The ornament on the second layer is well seen in a specimen [28026] from Horderley in the Jermyn Street Museum, and this has the outer smooth layer also partly preserved, as well as showing the smooth surface of the innermost layer. This species, which is abundant at Soudley, seems allied to *S. cancellatus* (Hall),[1] but less so than *S. pusgillensis*. *S. balclatchiensis*, above described, has a closely similar apertural curve, but is less globose and differs also in the ornamentation.

The co-types are in the Sedgwick Museum and in Jermyn Street.

12. **Sinuites subrectangularis,** sp. nov. Plate III, figs. 4—11.

Specific Characters.—Shell subglobose or somewhat compressed, higher than wide, with dorsum strongly arched and whorls increasing more rapidly in width than height. Umbilicus closed, situated at rather less than half the height of shell. Outer whorl completely enveloping inner ones, increasing in width to mouth and more slowly in height, with cross-section transverse and dorsum usually becoming broadly rounded towards mouth. Mouth with broad, deep, V-shaped sinus in outer lip and subangular prominent large somewhat flattened apertural lobes, the inner and anterior edges meeting at 75°—90°; base of lip somewhat swollen and decurrent at sides. Surface of shell marked with transverse growth-striæ and ridges somewhat irregular in strength and strongest near apertural margin. Interior of shell with low rounded transverse thickening, situated a little distance behind base of sinus and only weakly sinuated in middle, forming a shallow, rounded, median lobe and a broad, low lateral saddle on each side, making an acute angle with the growth-striæ and continued with somewhat diminished strength down to umbilicus. General surface of interior finely granulose, with coarser granulation on the internal thickening.

Dimensions.—

		(Narrow variety.)
Height of shell . . .	21—28 mm.	. 34 mm.
Width at mouth . . .	25—30 „	. 26 „

Horizon.—(1) Upper Ordovician: Drummuck Group. (2) Bala Series.

[1] Ulrich and Scofield, *op. cit.*, p. 872, pl. lxiii, figs. 1—14.

Localities.—(1) Thraive Glen, Girvan. (2) Tyrone ?

Remarks.—The degree of convexity and rotundity of the dorsum and the breadth and height of the shell vary within somewhat wide limits, some specimens being almost globose and others somewhat laterally compressed, with almost a tectiform dorsum; but as all intermediate stages seem to be present, and the apertural and internal characters completely agree, it is not possible to separate them as definite varieties. One specimen (M. 2888B Geol. Surv. Mus. Edinb.), shows internal transverse thickenings near the umbilical edge.

The general shape of the shell approaches *S. bilobatus* (Sow.) and the angularity of the apertural lobes is almost identical with *S. rectangularis* (Ulr. and Scof.),[1] which has been also compared with *S. maccallumi* from Ardmillan. A similar internal thickening is found in *S. crypticus*, Reed,[2] and in *B.* (*S.*?) *strangulata*, Barr,[3] and in other species of *Sinuites*, as above mentioned.

Ulrich and Scofield have stated (*op. cit.*) that the rectangular outline of the apertural lobes in *S. rectangularis* is not possessed by any other species of the same suborder, and is quite distinct from the true *S. bilobatus*. But our species differs from the American one by the closed umbilicus and the transverse internal thickening. *S. elongatus*, Portl., is closely allied. It appears to occur in Tyrone, judging from poor specimens in the Sedgwick and Jermyn Street Museums.

13. **Sinuites ? ramseyensis** (Hicks).

1873. *Bellerophon ramseyensis*, Hicks, Quart. Journ. Geol. Soc., vol. xxix, p. 50, pl. iii, figs. 30—32.

Specific Characters.—Shell laterally compressed, acutely carinated; outer whorl embracing inner whorls and rapidly increasing in height to mouth. Umbilicus small, situated at about one-third the height of shell. Mouth high triangular, not expanded. Dorsal sinus **V**-shaped ? Surface smooth.

Dimensions.—Height about 6—9 mm.

Horizon.—Arenig Series.

Localities.—Ramsey Island; Tremanhire, Pemb.

Remarks.—This small species, which was obtained from beds referred to the Tremadoc by Hicks but now known to be of Arenig age, was briefly described by its founder as follows: "Broad, involute, with the outer whorl greatly expanded and ridged on the back; $\frac{1}{4}$ inch in diameter. Surface smooth." The type specimen and other examples of the species are very poor, but the species may be related to *S. discoides* from the Balclatchie Group of Girvan. Perhaps *Bellerophon shinetonensis*, Callaway,[4] from the Shineton Shales, is also allied to it. Hicks's original specimen of *B. ramseyensis* is in the Sedgwick Museum.

[1] Ulrich and Scofield, *op. cit.*, p. 868, pl. lxiii, figs. 15—20.

[2] Reed, 'Geol, Mag.,' [5] vol. iii (1906), p. 363, pl. xx, figs. 12—14.

[3] Perner, *op. cit.*, p. 159, pl. lxxxvii, figs. 12—14.

[4] Callaway, 'Quart. Journ. Geol. Soc.,' vol. xxxiii (1881), p. 668, pl. xxiv, fig. 10.

14. **Sinuites? separatus,** sp. nov. Plate III, fig. 12.

Specific Characters.—Shell subdiscoidal, somewhat compressed, high, with rather flattened sides and narrowed, flattened dorsum, nearly involute, the outer whorl almost entirely enveloping the others, thickest at umbilicus. Outer whorl higher than wide, rhomboidal in transverse section, narrowing dorsally, slowly increasing in height, with sides somewhat flattened, and having a shallow revolving groove immediately below the edge of the flattened dorsum. Umbilicus minute, deep, situated below middle of shell. Apertural edge and surface unknown.

Dimensions.—Height of shell, 21·0 mm.; height of outer whorl above umbilicus, 13·0 mm.; thickness of shell at base of mouth, about 10·0 mm.; thickness of outer whorl at dorsum, about 4·0 mm.

Horizon.—Lower Ordovician: Balclatchie Group [conglomerate].

Locality.—Balclatchie, Girvan.

Remarks.—Only one specimen of this shell is known to me, and it is in Mrs. Gray's Collection. The true generic position is rather doubtful, and in cross-section the outer whorl with its lateral revolving groove suggests *Bucaniella*; but a somewhat similar groove is seen in some specimens of *Sinuites sowerbyi*, Perner (non *B. Sowerbyi*, D'Orb.) and in *Temnodiscus platynotus*, Perner,[1] the resemblance to the latter species being somewhat close, but the umbilicus in our form is much smaller and placed higher, and the outer whorl increases more slowly in height.

15. **Sinuites sphæroidalis,** sp. nov. Plate III, figs. 13, 14.

Specific Characters.—Shell globose; whorls transverse, more than twice as wide as high; outer whorl completely enveloping inner ones and rather rapidly increasing in size to mouth; umbilicus closed, deep. Dorsum of outer whorl convex. Surface of shell ornamented with fine, sinuous, granulated transverse lines, interlacing and forming a fine reticulation. Mouth with simple rounded apertural lobes and open **V**-shaped dorsal sinus.

Dimensions.—Height, about 8 mm.; thickness at umbilicus, about 6 mm.; width at mouth, about 7·5 mm.

Horizon.—Lower Ordovician: Balclatchie Group [conglomerate].

Locality.—Balclatchie, Girvan.

Remarks.—None of the specimens, including the type in Mrs. Gray's Collection, are well preserved, most of them being imperfect internal casts. The margins of the mouth are not well preserved, but the ornament shows up clearly in some parts. Perhaps the American *S. granistriata* (Ulrich)[1] is allied to this Girvan species.

[1] Perner, *op. cit.*, p. 76, text-fig. 51 *a*—*c*.

16. **Sinuites** sp.

Certain specimens $\left(\frac{a}{161}\right)$, from the Middle Bala of the Teirw River, in the Sedgwick Museum, do not seem strictly referable to *S. bilobatus* (though they were thus labelled by Salter), or to any of the above described species, but their poor state of preservation and the broken apertural margins do not allow of a specific diagnosis. The umbilicus is situated below the middle of the shell as in *S. balclatchiensis*, and the shell has similarly a more sharply arched and parabolic dorsum than *S. bilobatus*. From both of these it differs by the possession of a strong transverse internal thickening continuous from the umbilicus on one side to that on the other side, gently arched forward laterally and curved back in a broad, shallow, rounded lobe on the dorsum; it is situated at about half the length of the outer whorl, and there are traces of other weaker internal thickenings on the sides of this whorl, but they are not continued across the dorsum between it and the mouth. We may perhaps compare it with *S. subcompressus* (Ulrich),[2] *S. obesus* (Ulrich),[3] and *S. strangulatus* (Barrande).[4]

Dimensions.—Height, about 30 mm.

Horizon.—Middle Bala Beds.

Locality.—Teirw River, S. of Llangollen.

Genus **SINUITOPSIS**, Perner.

Generic Characters.—Shell completely symmetrical, discoidal, of 2—3 whorls, which touch and partly embrace one another. Dorsum of last whorl rounded, but in internal casts carinated or sharply ridged. Transverse section of last whorl subquadrangular. Umbilicus not very deep, partly covered by a callosity. Mouth not much enlarged, with shallow rounded sinus. No slit-band. Test thick, specially thickened in several places.

This genus[5] does not seem to rest on a very firm foundation, and it combines the features of several pre-established ones. Perner himself says that it represents a transitional form of *Sinuites*, connected on one side with *Cyrtolites*, and on the other with *Temnodiscus*. The one Girvan form here described under this generic name may almost equally well be referred to *Temnodiscus*, if we follow Perner in

[1] Ulrich and Scofield, *op. cit.*, p. 870, pl. lxiii, figs. 28—30.

[2] *Ibid.*, p. 873, pl. lxiii, figs. 40—44.

[3] *Ibid.*, p. 874, pl. lxiii, figs. 45—47.

[4] Perner, *op. cit.*, p. 159, pl. lxxxvii, figs. 12—14.

[5] *Ibid.*, p. 67.

regarding as of little importance the umbilical ridge and the lateral notch near the mouth mentioned by Koken[1] in his original definition of the latter genus.

1. **Sinuitopsis congruens,** sp. nov. Plate III, fig. 15.

Specific Characters.—Shell high, coiled in rather loose spiral, composed of about three rounded whorls in contact but scarcely overlapping, rapidly increasing in size, subcircular to elliptical in section, rather higher than wide; dorsum rounded, not compressed. Umbilicus open, exposing inner whorls, with its centre situated at about one-fourth the height of shell; umbilical edges rounded. Mouth not expanded, with deep **U**-shaped sinus in outer lip, followed by obscure broad median band of same width as sinus, dying out at about half the length of outer whorl. Surface of shell with a few transverse growth-lines and stronger ridges close to apertural margin, curving back to meet band on dorsum at about 10°—15°.

Dimensions.—Height of shell, 8·0 mm.; width of mouth, 5·0 mm.

Horizon.—Lower Ordovician: Balclatchie Group.

Locality.—Balclatchie, Girvan.

Remarks.—The open umbilicus, the rapid rate of increase in the size of the whorls, the small degree of overlapping, and the band-like structure on the last half of the outer whorl resemble *Sinuitopsis neglecta* (Barr),[2] but the deeper **U**-shaped sinus in the lip is more like that in *Temnodiscus platynotus,* Perner.[3] As above stated there is some doubt as to the genus to which the Girvan species should be referred. The holotype is in Mrs. Gray's Collection.

Genus **OXYDISCUS,** Koken.

Generic Characters.—Shell strongly compressed, disciform; whorls embracing very little, expanding gradually to the aperture, sharply keeled, lanceolate or subtrigonal in cross-section; dorsal lip with deep **V**-shaped sinus; no slit-band. Umbilicus large, open, exposing most of the whorls. Surface with transverse growth-lines bending backward on the keel.

The definition given by Koken[4] is inadequate, and he mentions the occurrence of traces of a slit-band which seems certainly absent in the British Lower Palæozoic shells here referred to this genus. Shells with a similar external appearance, but possessing a slit-band, are now put in the genus *Zonidiscus,* Spitz (see below). Ulrich and Scofield's[5] definition likewise seems to include species

[1] Koken, 'Gastrop. Balt. Untersilurs,' p. 129.

[2] Perner, *op. cit.,* p. 68, pl. lxxxv, fig. 11; pl. lxxxviii, figs. 28—30, 38—40; pl. xcvii, figs. 39—41; text-figs. 42, 46.

[3] *Ibid.,* p. 76, text-fig. 51.

[4] Koken, 'Neues Jahrb. f. Min.,' suppl. vol. vi (1889), pp. 390, 392, pl. xii, fig. 4; *id.* 'Die Leitfossilien' (1896), pp. 100, 393.

[5] Ulrich and Scofield, *op. cit.,* pp. 852, 912.

possessing a slit-band. The original type chosen preferably by Koken for the genus, is the Middle Devonian shell *O. imitator*, Koken, from the Eifel, instead of *B. curvilineatus*, Conrad, of the Corniferous Limestone, which is the type of Meek's distinct genus *Tropidodiscus*,[1] about which there has been unwarranted confusion. Perner's[2] subgenus of *Oxydiscus*, named *Cyrtodiscus*, is not here regarded as well established.

1. **Oxydiscus acutus** (Sowerby). Plate IV, figs. 1, 2.

1839. *Bellerophon acutus*, Sowerby in Murchison's Silurian System, p. 643, pl. xix, fig. 14.
1848. *Bellerophon acutus*, Férussac et D'Orbigny, Hist. Nat. Ceph., vol. i, p. 208, pl. viii, figs. 10—11.
1852. *Bellerophon carinatus*, Sowerby, McCoy (pars), Syn. Brit. Pal. Foss. Woodw. Mus., fasc. ii, p. 309.

Specific Characters.—Shell lenticular, composed of few whorls; umbilicus about one-third or rather less than one-third the diameter of the shell, with subangular umbilical edges and short steep umbilical slope. Whorls triangular in cross-section, higher than wide; outer whorl large, increasing rather slowly in size, with sharply carinated acute dorsum and more or less flattened sides. Mouth oblique to vertical axis, high, narrow. Surface of shell covered with fine, transverse, oblique striæ, very slightly arched back.

Dimensions.—Height (average), 10—40 mm.; thickness (average), 4—5 mm.

Horizon.—Bala Series.

Localities.—(1) Horderley [6916]; (2) Onny River and Ticklerton [28021—28024, Jermyn Street Mus.]; (3) Twll-du.

Remarks.—The type of this species is from the "upper beds of the Caradoc Sandstone" of Horderley, and Sowerby (*op. cit.*) described it as follows: "Compressed, smooth, umbilicated; whorls keel-shaped, acute: umbilicus broad; aperture triangular, longer [= higher] than wide. Diameter nearly half an inch, width of aperture about two lines."

The original specimen [6916] is in the condition of an internal cast, and there is no sign of a slit-band on it or on any other specimens which I have seen. For this reason it seems necessary to refer the species to the genus *Oxydiscus* rather than to *Zonidiscus*, though the shells bear a considerable resemblance to *Z. grayi* and *Z. shallochensis* from the Girvan area. We may, however, call attention to the resemblance of *O. acutus* to *O. hunteri* and the other species with which the latter is compared. Only in one specimen [28024] have I seen the surface-ornament preserved.

McCoy (*op. cit.*) included *O. acutus* with his *B. carinatus*, putting them both under the name *Bellerophon carinatus*, Sowerby; and consequently his specific diagnosis is based on two distinct forms.

[1] Clarke, 'Palæoz. Faunas of Para' (1900), p. 40; *id.* 'Foss. Devon. Parana' (1913), pp. 390, 391.

[2] Perner, *op. cit.*, p. 72.

2. **Oxydiscus bougangensis,** sp. nov. Plate IV, fig. 3.

Specific Characters.—Shell high, narrow, lenticular, much compressed, of 3—4 whorls, dorsally acute. Umbilicus small, moderately deep, about one-fifth the diameter of the shell and situated at less than half its height. Outer whorl rapidly increasing in height, large, embracing fully three-fourths of preceding whorl, more than twice as high as wide; sides gently convex, more or less flattened, rising to a much compressed very acute sharp dorsal ridge; umbilical edge abruptly subrectangular; umbilical slope short, vertical. Surface smooth?

Dimensions.—Height of shell about 30 mm.

Horizon.—Lower Ordovician: Stinchar Limestone Group.

Locality.—Bougang, Knockdolian, Ayrshire.

Remarks.—This shell may be compared with *O. subacutus*, Ulrich,[1] but in ours the outer whorl is larger and embraces the preceding whorl to a greater extent. The surface is not sufficiently preserved to determine the character of the ornamentation. The type specimens are in Mrs. Gray's Collection.

3. **Oxydiscus hunteri,** sp. nov. Pl. IV, figs. 4–8.

Specific Characters.—Shell lenticular, dorsally acute, composed of 4—5 whorls. Umbilicus large, rather shallow, exposing all the inner whorls, about two-fifths the diameter of the shell and with its centre situated below the middle of the shell; umbilical edge abruptly rounded to subrectangular; umbilical slope vertical. Whorls scarcely overlapping; higher than wide, subtriangular; outer whorl large, gradually increasing in size to mouth, embracing less than half height of preceding whorl, sublanceolate in cross-section, swollen towards base, then becoming slightly concave at base of high narrow compressed solid carina. Surface of shell ornamented with closely-placed transverse lines of somewhat unequal strength strongly arched back, oblique to umbilical edge, and meeting carinal edge at about 30°—45°, having somewhat irregularly developed short fine wrinkles set at right angles to them in interspaces, producing a minute cancellation. Mouth sloping obliquely backwards.

Dimensions.—	I	II
Height of shell . .	26·0 mm.	about 17·0
Height of outer whorl without carina at mouth	12·0 „	(ditto with carina) . 7·0
Width of ditto at mouth,	about 10·0 „	. . . about 5·5

Horizons.—Lower Ordovician: (1) Balclatchie Group (conglom.); (2) ? Stinchar Limestone Group.

Localities.—(1) Balclatchie, Girvan; (2) Aldons, near Girvan.

[1] Ulrich and Scofield, *op. cit.*, p. 913, pl. lxii, figs. 62—65; pl. lxxxii, figs. 23—25.

Remarks.—Most of the Balclatchie specimens occur as internal casts and in such the solid carina is not represented, but in one specimen (fig. 4) in Mrs. Gray's Collection the shell is fortunately preserved and we see the nature and relations of the carina and the character of the ornamentation. The affinities of the shell are undoubtedly with *O. subacutus*, Ulrich,[1] and probably with *O. annularis*, Perner,[2] though in the high narrow carina it is more like *O.* (*Cyrtodiscus*) *procer*, Barr.[3] The course of the transverse lines is like that of *O. subacutus*, but the fine cross wrinkles are more like those of *Cyrtolites subplanus*, Ulrich,[4] and *Cyrtolitaria nitidula*, Ulrich.[5] There is no slit-band visible on the keel, and this separates it from *Zonidiscus* to which at first sight it might be thought to belong.

The typical examples of *O. hunteri* are in Mrs. Gray's Collection from Balclatchie.

4. **Oxydiscus ? perturbatus** (Sowerby).

? 1839. *Euomphalus tenuistriatus*, Sowerby in Murchison's Silurian System, p. 641, pl. xxii, fig. 14.
1839. *Euomphalus perturbatus*, Sowerby, *ibid.*, p. 641, pl. xxii, fig. 15.
? 1846. *Euomphalus furcatus*, McCoy, Syn. Silur. Foss. Ireland, p. 13, pl. i, fig. 11.
1859. *Bellerophon perturbatus*, Sowerby in Murchison's Siluria, 2nd edit., p. 218, Foss. 39, fig. 6.
1866. *Bellerophon perturbatus*, Sowerby, Salter, Mem. Geol. Surv., vol. iii, p. 350, woodcut 16; *ibid.*, 2nd edit. (1881), p. 557.
1884. *Bellerophon perturbatus*, Sowerby, J. D. La Touche, Handbook to the Geology of Shropshire, p. 57, pl. ii, fig. 46.

Specific Characters.—Shell coiled rather loosely, discoidal, composed of about five whorls in contact but scarcely overlapping each other, enlarging gradually, the outer whorl more rapidly increasing in height to mouth. Umbilicus open, rather shallow, exposing all the inner whorls, situated rather below centre of shell. Whorls higher than wide; sides rounded, somewhat swollen at base; dorsum subangular and weakly carinate in early part of outer whorl but becoming less so towards mouth. Mouth high, with very shallow open dorsal sinus. Surface of shell crossed by closely-placed equidistant or subequidistant regular equal transverse strong lines arched back gently in simple curve obliquely directed to dorsal carina, which they meet at about 75° or less, uniting with those of opposite side; interspaces occasionally show several fine intermediate striæ.

Dimensions.—Height, about 10 mm.

Horizon.—(1) Lower Bala (Llandeilo Flags); (2) Arenig Series.

Localities.—(1) Pensarn, Caermarthen; Middleton, Corndon; ? Shelve; (2) Bath House, Bangor; Long Plantation cutting, Haverfordwest.

[1] Ulrich and Scofield, *op. cit.*, p. 913, pl. lxii, figs. 62—65.
[2] Perner, *op. cit.*, p. 74. pl. lxxxvi, figs. 1—3.
[3] *Ibid.*, p. 74, pl. lxxxviii, figs. 22—24, text-fig. 50.
[4] Ulrich and Scofield, *op. cit.*, pl. lxii, figs. 40—44.
[5] *Ibid.*, p. 866, pl. lxii, figs. 53—55.

Remarks.—The original specimens of *Euomphalus tenuistriatus* [p. 63] and *E. perturbatus* [6964] are in the Jermyn Street Museum. Both are in a poor state of preservation, the latter being especially poor as well as distorted, so that a satisfactory diagnosis of specific characters is impossible. It has generally been considered that these two species are identical, and owing to the pre-occupation of the name *tenuistriatus* by a Carboniferous species of *Bellerophon*, the name *perturbatus* is usually applied to this fossil. It is a common and well-marked species in the Upper Arenig and especially the Llandeilo of Wales, but it is very rare to find a well-preserved and uncrushed example. Salter says that it is one of the most characteristic shells of the Llandeilo Flags in North and South Wales.

The type-specimen of *E. tenuistriatus* [p. 63] consists merely of the impression of the exterior of an imperfect shell. The umbilicus is open and shallow. The whorls rapidly increase in size and are higher than wide, with gently convex sides; the dorsum seems to have been subangular and carinated; the transverse lines are equal, equidistant, and closely-placed and arch back simply but obliquely and seem to meet the carina at about 30°. No slit-band can be detected.

The type-specimen of *E. perturbatus* [6964] is an internal cast, which accounts for its smooth appearance, and is much crushed and distorted. The umbilicus seems to be larger and the whorls to increase more slowly in height than in *E. tenuistriatus*, though this may be due to the distortion which the shell has suffered. The type of *E. perturbatus* was obtained from the Llandeilo Flags of Pensarn, Caermarthen.

In some questionable specimens from Shelve there are 2—4 very fine transverse lines between the stronger ones, the latter being further apart than in the type, though they are closely crowded near the mouth.

The true generic position of these shells is somewhat doubtful, but they are most perhaps referable to *Oxydiscus*, agreeing in general shape, degree of enrolment of the whorls, open umbilicus, and ornamentation. Salter's reference of them to the genus *Bellerophon* is certainly incorrect, for this name, as now understood, is restricted to another group of shells with completely different characters.

Considerable doubt must still exist as to the identity of Sowerby's *E. tenuistriatus* with *E. perturbatus*, the rapid enlargement of the whorls, large round aperture, and angle at which the striæ meet the dorsal edge, being points of difference. The poor condition of the types renders an accurate diagnosis impossible.

5. **Oxydiscus ? llanvirnensis** (Hicks). Plate IV, figs. 9—11.

1875. *Bellerophon llanvirnensis*, Hicks, Quart. Journ. Geol. Soc., vol. xxxi, p. 188, pl. xi, figs. 1, 2.

Specific Characters.—Shell sublenticular, compressed, of 4—5 whorls, the outer whorls rapidly increasing in size and height, scarcely overlapping; dorsum

angulated and sides gently convex. Umbilicus open, shallow, exposing all inner whorls. Whorls crossed by regular strong equidistant thin transverse prominent lamellæ, in places minutely fimbriated, and having several very fine transverse striæ in interspaces; lamellæ more crowded and slightly sigmoidal near mouth, being arched gently back on sides of whorls and then forwards, but apparently sharply bent back close to dorsal keel so as to meet it at about 45°. Slit-band absent?

Dimensions.—Height about 30 mm.

Horizons.—(1) Upper Arenig; (2) Llandeilo Flags.

Localities.—(1) Llanvirn Quarry; (2) Abereiddy Bay; Traethllwyn, Llanrhian, St. Davids.

Remarks.—Hicks's definition of this species was as follows: "Spire of three very rapidly increasing whorls. Outer whorl greatly expanded, but compressed. Lines of growth strongly marked, arched backwards and approximating to each other more closely in the expanded outer portion. Diameter $1\frac{1}{3}$ inch." Neither the type [28001] in the Jermyn Street Museum nor the counterpart of the type in the Sedgwick Museum are well preserved, both being flattened and somewhat distorted, but in the latter we seem to be able to detect a sharp bending of the transverse lines close to the dorsal edge, and also the presence of intermediate striæ.

The specimens [28018, 28019, 28020] from the Llandeilo beds of Abereiddy Bay in the Jermyn Street Museum are better preserved than the type, but were labelled *B. perturbatus* [= *E. tenuistriatus*], from which they differ considerably in ornamentation.

The generic reference of this species is a matter of uncertainty, the rapid enlargement of the outer whorl and the ornamentation being unlike that of *Oxydiscus*, and if a slit-band is present it may be referred to *Conradella*.

Genus **CYRTOLITES**, Conrad.

Generic Characters.—Shell composed of few whorls (2—3), not overlapping, scarcely contiguous, the last occasionally free, enlarging rapidly to mouth; dorsum carinated; whorls occasionally with weak lateral carina on each side giving a broadly lanceolate or subquadrate section; no apertural sinus; mouth simple, entire; sides of whorls usually with transverse swellings or ribs more or less developed, or transverse lines meeting the keel at a large angle.

The type of this genus is *Cyrtolites ornatus*, Conrad,[1] and Koken's[2] definition of the genus in 1896 agrees with this form, whereas Ulrich and Scofield's[3] is too wide and includes species probably referable to Koken's *Temnodiscus* (1897 *non* 1896). Perner[4] has remarked that the genus *Cyrtolites* contains a rather heterogeneous assemblage of species, and the Bohemian forms do not appear to

[1] Conrad, 'Ann. Rept. Nat. Hist. Surv., New York,' 1838, p. 118.

[2] Koken, 'Die Leitfossilien' (1896), p. 100. [3] Ulrich and Scofield, *op. cit.*, pp. 846, 858.

[4] Perner, *op. cit.*, p. 79.

conform closely to the above definition. The entire and scarcely sinuated mouth seems a character of primary importance.

1. **Cyrtolites budleighensis,** sp. nov. Plate IV, figs. 12—14.

Specific Characters.—Shell high, somewhat compressed, composed of 2—3 whorls rather higher than wide, in contact with but not overlapping each other, the last whorl rapidly increasing in size. Umbilicus large, open, shallow, completely exposing all the whorls, with centre situated below centre of shell. Whorls broadly lanceolate to subrhomboidal in cross-section, widest at about one-third their height; dorsum narrow, subangular, becoming somewhat rounded near mouth; sides convex, swelling out to maximum diameter below middle, then forming obtuse subangular umbilical edges and sloping inwards to umbilicus. Mouth vertical, rhomboidal in shape, subangular above and widest at umbilical edges; lateral margins obtusely angulated and projecting forwards, with upper edges inclined to dorsum at about 60°. Surface of whorls with faint traces of transverse lines and growth ridges; and with some weak transverse broad ribs or swellings on upper part near mouth.

Dimensions.—

Height of shell	28·0 mm.
Height of outer whorl near mouth . . .	17·0 „
Width of outer whorl near mouth . . .	1·00 „

Horizon.—Ordovician pebbles in Triassic conglomerate.

Locality.—Budleigh Salterton.

Remarks.—Towards the mouth the dorsum almost loses its carination. The specimens [G. 15296, 15298, 15299, 15301], all of which are in the British Museum, are in the state of internal casts and so do not show the external ornament, and the transverse ribs or swellings in any part are somewhat indistinct. The cross-section and enrolment of the shell resemble *C. subplanus*, Ulrich[1] and *C. retrorsus*, Ulrich var. *fillmorensis*,[2] from the Ordovician of Minnesota.

2. **Cyrtolites craigensis,** sp. nov. Plate IV, fig. 15.

Specific Characters.—Shell of 3—4 whorls in contact, but not overlapping, rapidly increasing in size, but more rapidly in height than width, subtriangular to subrhomboidal in section, dorsally carinate, and sharply angular; sides of whorls convex; umbilical edge subangular; umbilical slope steep or almost vertical. Umbilicus wide, deep, open, exposing all inner whorls; centre of umbilicus situated at rather more than one-third the height of shell. Mouth not expanded, higher than wide, oblique, sloping backwards; lateral edges arched gently forwards. Surface unknown (smooth?).

[1] Ulrich and Scofield, *op. cit.*, p. 862, pl. lxii, figs. 40–44. [2] *Ibid.*, p. 861, pl. lxii, figs. 38, 39.

Dimensions.—Height of shell, about 32 mm.; width of outer whorl near mouth, about 10—12 mm.

Horizon.—Lower Ordovician: Stinchar Limestone Group.

Localities.—Craighead, Girvan; (?) Minuntion, Ayrshire.

Remarks.—Only internal casts of this species have been found; so that the surface-ornament is unknown. From the shape of the cross-section, umbilical edge, rate of increase in size of whorls, and general characters there is considerable resemblance exhibited to *C. subplanus*, Ulrich,[1] of the Trenton Formation and to *C. dilatatus* U. and S.[2] of the Black River Group. The types are in Mrs. Gray's Collection.

3. **Cyrtolites nodosus** (Salter). Plate V, figs. 1—2.

1852. *Bellerophon ornatus*, Conrad, McCoy, Syn. Brit. Pal. Foss. Woodw. Mus., fasc. ii, p. 310.
1854. *Bellerophon nodosus*, Salter, Quart. Journ. Geol. Soc., vol. x, p. 73.
1866. *Bellerophon nodosus*, Salter, Mem. Geol. Surv., vol. iii, p. 349, woodcut 15; *ibid.*, 2nd edit. (1881), p. 555.

Specific Characters.—"Spire exposed, of about three rapidly increasing whorls which are half as thick as broad, and of a subrhombic section; the umbilical faces rounded and much shorter than the other flattened ones. Sides marked by thick raised [transverse] ridges which are not so broad as the intervening hollows; they are curved backward towards the flattened dorsal keel and nearly meet it, and extend over the rounded edge of the steep umbilicus. The lines of growth are beautifully regular, and they take a decided curve backward along with the ridges. They are closely crenulate over the sides and back, and on the umbilical face reticulate with each other. Their reticulated appearance arises from the close approximation of the raised crenulate edges which thus decussate each other, and become in some parts connected into a network. The ridges or plaits vary in their distance from each other, but are very prominent."

Dimensions.—	I	II
Height of shell	26 mm.	22 mm.
Height of outer whorl at mouth	14 „	12 „
Width of outer whorl at mouth	12 „	13 „

Horizon.—Bala Series.

Localities.—Soudley; Onny River; Horderley; Llwyn-yr-hwch; Maen Bras, N. of Bala; Cefn Llwydlo.

Remarks.—The above is Salter's description of the species, and he points out the characters by which *C. ornatus*, Conrad, differs from it. In the American species the lines of growth are direct across, the umbilicus has a sharper edge, and the plaits do not go beyond it. The localities which he gives are Teirw River,

[1] Ulrich and Scofield, *op. cit.*, p. 862, pl. lxii, figs. 40—44.
[2] *Ibid.*, p. 865, pl. lxii, figs. 20—23.

South of Llangollen; Llwyn-yr-hych, Beddgelert; near Llanfyllin; Hope Bowdler, Shropshire.

4. **Cyrtolites nodosus,** var. **llandoveriana,** nov. Plate V, figs. 3—6.

Varietal Characters.—Shell of about three whorls in contact but scarcely overlapping, the outer one rapidly increasing in size to mouth, bluntly carinated, somewhat higher than wide, broadly lanceolate to subcordiform in cross-section, with obtuse umbilical edge at less than half height of whorl. Umbilicus open, deep, exposing all the inner whorls; umbilical slope smooth, without ribs, rather steep. Upper portion of sides of outer whorl ornamented with regular strong subangular transverse slightly oblique and very weakly-arched ribs, set at equal distances apart, separated by gently concave wide interspaces and nearly or quite meeting the corresponding ribs of the opposite side (without any bending back) on the carina. Mouth bell-shaped with margins slightly and suddenly everted.

Dimensions.—

	I	II
Height of shell	13 mm.	25 mm.
Height of outer whorl at mouth .	7 „	14 „

Horizon.—Lower Llandovery.

Localities.—Blaen-y-cwm, Nantyr, Glyn Ceiriog [28050—52]; ? Sevin Llettyrhyddod.

Remarks.—This shell seems to have the transverse ribs rather sharper and narrower than in the type-form, and those of the opposite sides nearly or quite unite on the carinated dorsum. There are three internal casts of this form [28050—52] in the Jermyn Street Museum which have come under my notice, and one from the same locality in the Sedgwick Museum, Cambridge. Another specimen in the latter Museum from the Lower Llandovery of Sevin Llettyrhyddod, which probably belongs to the same species, shows the distal portion of the outer whorl ornamented with equidistant granulated thread-like transverse lines covering the ribs and interspaces and having the same general course as the former so as to meet the carina at an angle of 75°.

This Llandovery form here regarded as a variety of *C. nodosus*, Salter, seems more to resemble *C. retrorsus*, Ulrich,[1] than *C. ornatus*, Conr., and may prove to be specifically distinct from Salter's shell.

5. **Cyrtolites thraivensis**, sp. nov. Plate V, figs. 7—10.

Specific Characters.—Shell of three whorls, coiled discoidally; whorls in contact, not overlapping, rounded, subcircular in section, with weak dorsal carination, rather rapidly increasing in size, without umbilical edge or lateral angulation; outer whorl crossed by 15—20 coarse broad low rounded to

[1] Ulrich and Scofield, *op. cit.*, p. 861, pl. lxii, figs. 32—37.

subangular equidistant transverse ribs, becoming weaker on dorsum and near suture line, set at right angles to dorsal carina, and separated by wider shallow concave interspaces occupied by 10—15 fine concentric lines, not fimbriated but cancellated by fine obliquely spiral lines. Dorsum very obtusely angulated by weak low carina. Umbilicus large, wide, open, exposing all the whorls; centre situated at about one-third the height of shell. Mouth vertical with whole peristome somewhat thickened near edge and inner lip somewhat expanded and reflexed.

Dimensions.—Height of shell, about 30 mm.; width of mouth, about 17 mm.

Horizon.—Upper Ordovician: Drummuck Group (Starfish Bed).

Locality.—Thraive Glen, Girvan.

Remarks.—The shell named *Bellerophon nodosus*, Salter,[1] from the Teirw River, near Llangollen, much resembles this species, but the whorls increase more rapidly in size and have fewer and coarser ribs and fimbriated lines in the interspaces. *Cyrtolites ornatus*, Conrad,[2] has the sides angulated with an umbilical ridge at which the ribs end, but is an allied species.

Genus **ISOSPIRA**, Koken.

Generic Characters.—Shell symmetrically coiled, with rapidly enlarging rounded whorls; growth-striæ pass over dorsum without sinus or bending. No keel. Mouth simple, entire.

Koken's[3] definition of this genus is accepted by Perner (*op. cit.*, p. 88). It appears to be allied to *Cyrtolites*, but we have not a full knowledge of its characters, and its position amongst the Bellerophontacea is open to doubt.

1. **Isospira huttoni**, sp. nov. Plate V, fig. 11.

Specific Characters.—Shell composed of loosely coiled whorls, $1\frac{1}{2}$—3 in number, contiguous, not overlapping, rounded, subcircular in section, rapidly increasing in size; umbilicus situated at about one-third to one-fourth the height of shell. Mouth not expanded, circular, without sinuation of lip. Surface of whorls covered with numerous regular equidistant fine transverse lamellæ, minutely fimbriated, without sinuation except near beginning of outer whorl, separated by rather wider interspaces crossed by faint spiral lines in continuation of fimbriations on transverse lines.

Dimensions.—Height of shell, about 14·0 mm.; height of mouth, about 9·0 mm.

[1] Salter, 'Mem. Geol. Surv. Gt. Brit.,' vol. iii, p. 555, text-fig. 15.

[2] Ulrich and Scofield, *op. cit.*, p. 860, pl. lxii, figs. 27—29.

[3] Koken, 'Gastrop. Balt. Untersilurs' (1897), p. 137.

Horizon.—Middle Ordovician: Whitehouse Group.

Locality.—Shalloch Mill, near Girvan.

Remarks.—All the specimens available are more or less crushed and distorted, but the reference to the genus *Isospira* seems certain. The shell is not unlike *I. bucanioides*, Koken.[1] *C. planicosta*, Perner,[2] *C. tuboides*, Barr.,[3] *C. kokeni*, Perner,[4] and *C. eximius*, Barr.,[5] are comparable in shape or ornamentation.

Genus **BUCANIELLA**, Meek.

Generic Characters.—Shell involute, subglobose with volutions rounded, rapidly enlarging; dorsum trilobate or quadrilobate owing to presence of revolving grooves. Umbilicus more or less open, usually deep; mouth transverse; outer lip sinuate. No slit-band. Surface with fine growth-striæ and occasionally revolving lines.

The name *Bucaniella* was proposed in 1870 by Meek[6] for broad-backed trilobed Silurian species of *Bellerophon* without a slit-band; and the present author follows Clarke[7] in thus restricting the use of the term. Koken[8] would include forms possessing a slit-band, but Ulrich and Scofield[9] (who write the name of the genus *Bucanella*) definitely state that in the type species there is no slit-band and they put it in the same family as *Sinuites* [= *Protowarthia*].

The type species is *B. nana*, Meek.

1. **Bucaniella trilobata** (Sowerby). Plate V, fig. 12; Plate VI, figs. 1—3.

1839. *Bellerophon trilobatus*, Sowerby in Murchison's Silurian System, p. 604, pl. iii, fig. 16.

1848. *Bellerophon trilobatus*, Sowerby, Ferussac et D'Orbigny, Hist. Nat. Cephal., p. 209, pl. vii, figs. 24—27 (? pl. viii, fig. 16).

1852. *Bellerophon trilobatus*, Sowerby, McCoy, Syn. Brit. Palæoz. Foss. Woodw. Mus., fasc. ii, p. 311.

? 1852. *Bucania trilobata* (Conrad), Hall, Palæont. New York, vol. ii, p. 13, pl. iv *bis*.

1884. *Bellerophon trilobatus*, Sowerby, Lindström, Silur. Gastrop. Pterop. Gotland, p. 80, pl. iv, figs. 13—15.

? 1901. *Bucania trilobata* (Conrad), Grabau, Bull. New York State Mus., no. 45, vol. ix, p. 213, fig. 114.

? 1909. *Bellerophon trilobatus*, Sowerby, Moberg and Grönwall, Om Fyledalens Gotlandium, Kungl. Fysiogr. Sällsk. Handl., vol. xx, no. 1, p. 44, pl. iii, figs. 13, 14.

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[1] Koken, *op. cit.* (1897), p. 137, text-fig. 10.

[2] Perner, *op. cit.*, p. 82, pl. lxxxix, figs. 9—11, text-fig. 56 *a*, *b*.

[3] *Ibid.*, p. 85, pl. lxxxviii, figs. 4—5, text-figs. 58, 59.

[4] *Ibid.*, p. 87, pl. lxxxix, figs. 12, 13, text-fig. 61.

[5] *Ibid.*, p. 84, pl. lxxxvii, figs. 5—8, text-fig. 57 *a*, *b*.

[6] Meek, 'Proc. Amer. Phil. Soc.,' vol. v (1870), p. 426.

[7] Clarke, "Foss. Devon. Parana" ('Mon. Serv. Geol. Mineral. Brasil,' vol. i, 1913), pp. 168—170.

[8] Koken, 'Die Leitfossilien' (1896), p. 100.

[9] Ulrich and Scofield, *op. cit.*, p. 848.

Specific Characters.—The original description of this species, the type of which came from the Upper Ludlow Passage Beds of Felindre, is as follows: "Convoluted, smooth, 3-lobed, central lobe largest; inner whorls small, visible; aperture about twice as wide as long; length and breadth four lines." McCoy (*op. cit.*) described it more fully as follows: "Globose, umbilicus small, deep; whorls trilobed by two deep spiral furrows, the lateral lobes half the width of the mesial one; very convex, mesial lobe most prominent, slightly flattened. Width of small specimens three lines, length the same; proportional width of umbilicus $\frac{32}{100}$ as compared with the diameter of the shell." McCoy's specimens are poor internal casts from the Tilestones (Upper Ludlow) of Storm Hill, Llandeilo, which is the only locality he mentions for this species.

Remarks.—There is some doubt as to whether the Wenlock shells attributed to this species ought to be separated as a variety or even distinct species; they agree with those from Gotland figured by Lindström (*op. cit.*) in possessing a very wide flattened back with an unusually broad non-elevated median lobe, such as is found in *Bucania trilobata* (Conrad) from the Niagara Formation in America. One of the Wenlock specimens (a/870) in the Sedgwick Museum, from Dudley, was stated by Salter[1] to be the largest specimen known and measures 45 mm. across the mouth and about 32 mm. in height (Pl. VI, fig. 1).

The specimens from the Upper Ludlow of Storm Hill and of the Kendal district (Pl. VI, figs. 2, 3) have the median lobe relatively more elevated and more convex, and the whole shell seems more laterally compressed and less globose, thus resembling some Lower Devonian species from South America.

All the specimens occur as internal casts, and as the correct generic position of the species depends on the presence or absence of a slit-band, which the state of preservation does not prove, there has been much difference of opinion on this point. As mentioned above, the name *Bucaniella* was proposed by Meek for broad-backed, trilobed Silurian species of *Bellerophon* without a slit-band. For certain early Devonian similarly trilobed shells possessing a slit-band, Clarke[2] suggested the name *Plectonotus*, and he has recently[3] reviewed the whole question of the validity of these genera. Clarke (*op. cit.*, 1900, p. 36) was of the opinion that Sowerby's *Bellerophon trilobatus* was a Devonian shell; but this is erroneous, Sowerby having founded the species on a Silurian specimen. But as no slit-band has been definitely proved to exist in the British Silurian *B. trilobatus* it appears best to refer this species to *Bucaniella*, in the strict sense in which Meek used the term. Many of the Devonian forms described by Sandberger and others from Europe, America, and South Africa bear an external resemblance to this Silurian species, and Whidborne[4] has described a British Upper Devonian shell as *Tropidodiscus*

[1] Salter, 'Cat. Cambr. Silur. Foss. Woodw. Mus.,' p. 157.

[2] Clarke, 'Palæoz. Faunas of Para' (1900), p. 40.

[3] *Id.*, "Foss. Devon. Parana" ('Mon. Serv. Geol. Miner. Brasil,' vol. i, 1913), pp. 168—170.

[4] Whidborne, 'Mon. Brit. Devon. Fauna' (Palæont. Soc.), vol. iii, (1896), p. 68.

trilobatus (Sow.) ? var. *bisulcatus*, Roem., and somewhat superficially discussed the question of its reference to Sowerby's species. But the affinities of the Devonian forms cannot be discussed here.

Horizons.—(1) Upper Ludlow; (2) Wenlock Series; (3) Upper Llandovery; (4) Lower Ludlow.

Localities.—(1) Felindre; Storm Hill, Llandeilo; Kendal; (2) Dudley; (3) Eastnor Park [28061]; Tonlegee, Galway; (4) Freshwater East, Pembrokeshire.

2. **Bucaniella quadrisulcata,** sp. nov. Plate VI, figs. 4, 5.

Specific Characters.—Shell involute, subglobose. Outer whorl nearly completely embracing inner whorls, broader than high, increasing rather rapidly in size towards mouth; dorsum narrowly rounded, strongly convex, separated from lateral portions of whorl by deep revolving groove on each side, and itself divided into three portions by pair of weaker revolving furrows, the median portion of dorsum being the widest; lateral portions of whorl swollen below outermost revolving grooves. Umbilicus deep, small, situated below centre of shell.

Dimensions.—Height, 6 mm.; width of mouth, 5 mm.

Horizon.—Llandovery Series.

Localities.—The Frolic, Haverfordwest; ? Tonlegee, Galway.

Remarks.—This shell differs from *B. trilobata* (Sow.) by possessing two pairs of revolving grooves, but otherwise it closely resembles that species. Only internal casts are known. There is no trace of a slit-band. In the Jermyn Street Museum one of the specimens labelled *B. trilobatus*, from Tonlegee, Co. Galway, shows similar weak additional revolving grooves. The type-specimens are in the Turnbull Collection in the Sedgwick Museum, and come from the Llandovery of Haverfordwest.

Group II. Fissidorsata.

Genus **BUCANIA,** Hall (restr.).

Generic Characters.—Shell involute, composed of few (3—5) whorls; umbilicus large, more or less open. Aperture usually transverse, not abruptly expanded; dorsal sinus broad **V**-shaped with central slit. Slit-band distinct, raised or depressed. Surface of shell ornamented with equal or unequal revolving lines or riblets crossed by oblique transverse growth-lines parallel with the margin of the aperture, the intersections of the two sets of lines being nearly always rectangular.

The definition and limitations of this genus as laid down by Ulrich and Scofield[1] are here followed. The type is *Bellerophon sulcatinus*, Emmons,[2] of the Chazy Limestone.

[1] Ulrich and Scofield, *op. cit.*, pp. 850, 883—886.

[2] Emmons, 'Geol. Rep., 2nd. Distr., New York,' 1842, p. 312, fig. 4.

1. **Bucania evoluta,** sp. nov. Plate VI, fig. 6.

Specific Characters.—Shell composed of 3—4 whorls rather loosely coiled, scarcely overlapping, rapidly increasing in size, rather higher than wide, subelliptical in section. Outer whorl rather rapidly increasing in height to mouth, with dorsum bearing narrow, strongly elevated keel; sides gently convex, with no umbilical edge. Umbilicus shallow, exposing all the whorls, with centre situated at about one-third height of shell. Surface cancellated, being marked with thick, low rounded, oblique spiral lines closely placed, directed forwards to meet slit-band at 45°—30°, and crossed by a few widely separated transverse sublamellose ridges (? fimbriated) and by finer lines arched back and meeting slit-band at about 60°—75°.

Dimensions.—Height of shell, 14·0 mm.; width of whorl near mouth, 7·5 mm.

Horizon.—Lower Ordovician: Balclatchie Group (Conglomerate).

Locality.—Balclatchie, Girvan.

Remarks.—There is only one specimen of this species, and the ornament is only partially preserved. It seems to resemble *B. subangulata*, Ulrich,[1] but is higher and more compressed, and the whorls overlap less than in that species.

2. **Bucania gravida,** sp. nov. Plate VI, figs. 7—9.

Specific Characters.—Shell discoidal, subglobose, composed of 3—4 low transverse whorls slowly increasing in size to mouth. Umbilicus subcentral, deep, exposing inner whorls, with sharp angular umbilical edges and steep flattened umbilical slopes. Whorls transverse, wider than high; dorsum broad, gently convex or somewhat flattened, with the umbilical edges limiting it and situated at about half the height of the whorl. Slit-band narrow, slightly raised. Surface of whorls crossed by transverse strong subequidistant rather remote growth-ridges or lines meeting the slit-band at about 60°, with the broad interspaces occasionally crossed by very delicate minute and somewhat sinuous striæ at right angles to the transverse ridges and interrupted by them.

Dimensions.—Height of shell, 12—14 mm.; width of whorl near mouth, 11—12 mm.

Horizons.—(1) Lower Ordovician: Stinchar Limestone Group; (2) Lower Ordovician: Balclatchie Group.

Localities.—(1) Craighead, Girvan; (2) Balclatchie, Girvan.

Remarks.—This species seems related to *Bucania contorta* (Eichw.)[2] in shape and general characters from stages C and D in the Baltic Provinces. The

[1] Ulrich and Scofield, *op. cit.*, p. 891, pl. lxvi, figs. 20—23.

[2] Eichwald, 'Leth. Ross.,' vol. i, pt. ii (1860), p. 1072, pl. xli, figs. 3 *a*, *b*; Koken, 'Gastrop. Balt. Untersilurs,' p. 123.

American species *B. emmonsi*, Ulr. and Scof.,[1] and *B. halli*, Ulr. and Scof.,[2] may also be compared. The fine ornament in the interspaces is rarely preserved in our specimens, and Eichwald does not show any trace of it in his figures of *B. contorta*.

3. **Bucania playfairi**, sp. nov. Plate VI, fig. 10.

Specific Characters. — Shell subglobose, composed of 3—4 low transverse whorls, broader than high; umbilicus deep, rather more than one-third the diameter of shell, with centre situated at more than one-third the height. Outer whorl gradually increasing in width, swollen and overhanging umbilicus laterally, with convex dorsum, and narrowly rounded umbilical edge; umbilical slope steep, high. Slit-band narrow, with strong raised edges. Mouth slightly expanded at sides, transverse. Surface of shell marked by equidistant coarse imbricated transverse lamellæ, set rather close together, fimbriated at their edges and meeting slit-band at about 60°—75°, with low rounded spiral ridges in interspaces corresponding to fimbriations of lamellæ and interrupted by them, set slightly oblique to slit-band.

Dimensions.—Height of shell, about 16 mm.; width at mouth, about 15 mm.

Horizon.—Middle Ordovician: Whitehouse Group.

Locality.—Shalloch Mill, Girvan.

Remarks.—The affinities of this species seem to be with *Bucania halli*, Ulrich and Scof.,[2] and probably with *B. radiata* (Eichw.).[3] It is dedicated to the famous Scottish geologist, Playfair.

4. **Bucania** *cf.* **punctifrons** (Emmons). Plate VI, fig. 11.

One fragment of the dorsum of the outer whorl of a distorted shell shows an ornamentation apparently identical with that of *B. punctifrons* (Emmons)[4] of the Trenton Formation. The small oval pits on the surface seem formed by the contact of fimbriated lamellose lines, and these pits appear to be arranged in indistinct transverse lines inclined back to the narrow carina at about 45°. The slit-band is not clearly visible, probably owing to the state of preservation and slight crushing of the dorsum, but there is a narrow elevated ridge probably representing it on the broad flattened back.

[1] Ulrich and Scofield, *op. cit.*, p. 887, pl. lxvi, figs. 1—3.

[2] *Ibid.*, p. 886, pl. lxvi, figs. 4—8.

[3] Koken, 'Gastrop. Balt. Untersil.,' p. 121, fig. 5.

[4] Emmons, 'Geol. Rep., 2nd Distr., New York,' 1842, p. 392, fig. 5 (*Bellerophon punctifrons*); Hall, 'Palæont. N.Y.,' vol. i, p. 187, pl. xl A, figs. 1 *a—e*; Ulrich and Scofield, *op. cit.*, p. 894, pl. xlvii, figs. 41—44.

Dimensions.—Height of shell (estimated), about 11 mm.
Horizon.—Lower Ordovician : Stinchar Limestone Group.
Locality.—Craighead, Girvan.

5. **Bucania,** sp.

1873. *Bellerophon subdecussatus* (*pars*), McCoy, Salter, Cat. Cambr. Silur. Foss. Woodw. Mus., p. 68 (*non* pp. 97, 83), ref. No. $^{a}/_{163}{}^{*}$.

Specific Characters.—Shell subdiscoidal, of 3—4 transverse whorls in contact, scarcely overlapping, slowly increasing in size to mouth. Umbilicus deep, exposing all inner whorls; umbilical edge subangular; umbilical slope rather steep. Whorls wider than high, with gently convex or slightly flattened dorsum. Slit-band narrow, slightly raised. Mouth not expanded, with short, broadly **V**-shaped dorsal sinus. Surface ornamented with regular fine transverse lines, meeting slit-band at 75°—90° [with small oval pits between them?].

Dimensions.—Height of shell, about 8·0 mm.; width near mouth, about 6·0 mm.

Horizon.—Middle Bala Beds.

Locality.—Allt yr Anker, Meifod.

Remarks.—This specimen, which is in the Sedgwick Museum, is completely distinct from the typical *Bellerophon subdecussatus*, McCoy,[1] from the Denbighshire Flags of Llanrwst, described below under the genus *Kokenospira*, the wide open umbilicus exposing all the inner whorls, and the ornamentation entirely marking it off. The appearance of pits between the transverse striæ does not seem to be due to the texture of the rock, and may be an original character, but the imperfect character of the surface (the specimen being an internal cast) renders the true nature of the ornament rather uncertain. If the pitted appearance is trustworthy, we may compare this shell with *Bucania punctifrons*, Emmons[2]; the shape and general features of our specimen support this comparison, and the whole appearance of the shell recalls that species.

Genus **KOKENOSPIRA**, Bassler.

Generic Characters.—Shell globose or subglobose, involute; umbilicus open, rather large; aperture not expanded; lips thin; dorsal margin deeply excavated. Slit-band wide, flat, elevated, having usually a broad concave space on each side. Surface ornamented with straight uninterrupted revolving lines or ribs, strong on the lateral parts of the dorsum, fine on the slit-band; transverse growth-lines generally very delicate.

[1] McCoy, 'Syn. Brit. Palæoz. Foss. Woodw. Mus.,' p. 311, pl. i L, fig. 25*a* (*non* fig. 25).

[2] Ulrich and Scofield, *op. cit.*, p. 894, pl. lxvii, figs. 41—44.

Ulrich and Scofield,[1] in 1897, separated off the species described by Koken[2] as *Bucanella* [sic] *esthona* under the generic name *Kokenia*, and referred to it also a new American species *Kokenia costalis*, Ulr. & Scof. Unfortunately the generic name was pre-occupied, having been used by Holzapfel in 1895,[3] as Bassler[4] has pointed out, and the latter author has suggested the name *Kokenospira* in its place. Perner does not record any members of it from Bohemia. The genus *Kokenia* is mentioned amongst the Bucaniidæ in Zittel-Eastman's 'Text-book of Palæontology' (2nd edit., 1913, p. 522).

1. **Kokenospira credibilis,** sp. nov. Plate VI, figs. 12—14.

Specific Characters.—Shell globose, whorls broader than high. Umbilicus deep, more than one-third the height of the shell in diameter; umbilical edges subangular; umbilical slopes very steep. Outer whorl large, rapidly increasing in size, about three times as wide as high, laterally overhanging but not concealing most of the inner whorls; dorsum broad, gently convex, more or less flattened. Slit-band wide. Mouth transverse, as wide as, or wider, than total height of shell. Surface of shell ornamented with revolving thread-like lines, parallel to slit-band, near which they are crowded and faint, but becoming stronger and wider apart towards and upon umbilical edge.

Dimensions.—Height of shell, 12—15 mm.

Horizon.—Llandovery Series.

Localities.—Gas Works, Haverfordwest; ? The Frolic, Haverfordwest.

Remarks.—This species is allied to the better known *K. lingualis* and *K. mullochensis* from Girvan (see below). All the specimens, except a few internal casts, are more or less crushed and distorted, and it does not seem possible to separate those from the Gas Works and the Frolic. All the material was obtained by Mr. Turnbull, and is in the Sedgwick Museum.

2. **Kokenospira euphemoides,** sp. nov. Plate VI, fig. 15.

Specific Characters.—Shell subglobose, composed of a few transverse rounded whorls. Umbilicus deep, rather less than one-third the diameter of the shell. Outer whorl rounded, convex, wider than high, with strongly arched

[1] Ulrich and Scofield, *op. cit.*, pp. 849, 882.

[2] Koken, 'Neues Jahrb. f. Miner.,' suppl. vol. vi (1889), p. 389, pl. xiii, figs. 1, 1*a*.

[3] Holzapfel, "Obere Mitteldevon Rhein. Geb." ('Abhandl. k. preuss. geol. Landesanst.,' n.s., pt. 16, 1895), p. 159.

[4] Bassler, Bull. 92, U.S. Nat. Mus., 'Bibliogr. Index Amer. Ordov. Silur. Foss.,' vol. i, 1915, p. 687.

dorsum, subangular? umbilical edge, and short rather steep umbilical slope. Slit-band broad, slightly raised, with 18—20 closely-placed, regular, thick, revolving parallel lines on each side of it, rather smaller and more crowded close to it, 4—5 lines lying in a space equal to its width. No revolving lines on umbilical slope. A few concentric transverse growth-lines are developed close to the apertural margin.

Dimensions.—Height of shell, about 15 mm.

Horizon.—Llandovery Series: Camregan Group.

Locality.—Cuddystone Glen, near Girvan.

Remarks.—Though this species is based on only one specimen in Mrs. Gray's Collection, yet the characters are sufficiently well marked and distinctive as to prove that it cannot be placed in any previously described species, though it is allied to several of the other Girvan forms defined below.

3. **Kokenospira latidorsata,** sp. nov. Plate VII, fig. 2.

Specific Characters.—Shell subglobose, of 3–4 low transverse whorls. Umbilicus very large, conical, deep, about four-fifths the diameter of the shell. Outer whorl increasing slowly in width to mouth, with very transverse cross-section. Dorsum broad, slightly convex; umbilical edge subangular. Slit-band somewhat elevated, broad, not well preserved. Umbilical slope flattened, making an angle of about 30° with dorsum.

Dimensions.—Height of shell, 19 mm.; width of umbilicus, 14 mm.

Horizon.—Bala Series.

Locality.—Cardington, Shropshire. [G. 20706 Brit. Mus.]

Remarks.—Only one internal cast of this species is known, but it shows the entire shell with the dorsum and the wide-open umbilicus. It is uncertain if the surface has any ornament, and the details of the slit-band cannot be observed. The allied species, *K. maccullochi*, from the Balclatchie Beds, differs by possessing a less acute umbilical edge and more rounded whorls.

4. **Kokenospira lingualis** (Salter). Plate VI, fig. 16; Plate VII, fig. 1.

1854. *Bellerophon (Bucania) sulcatinus*, Emmons?, Salter, Quart. Journ. Geol. Soc., vol. x, pp. 68, 74, (nom. prop. *B. lingualis*).

? 1884. *Bellerophon sulcatinus*, Emmons, J. D. La Touche, Handbook to the Geology of Shropshire, p. 59, pl. v, fig. 101.

Specific Characters.—Shell subglobose, discoid, of few whorls. Umbilicus deep, about three-fifths the diameter of the shell; umbilical edges narrow, subangular; umbilical slopes steep. Whorls transverse, more than twice as wide as high, very slowly increasing in size; dorsum gently convex, becoming

flattened towards mouth. Slit-band wide, slightly sunken between raised edges. Surface of dorsum ornamented with fine revolving lines, about 10 on each side of slit-band, adjoining which they are more crowded, and all decussated by very fine transverse striæ; umbilical slopes smooth?

Dimensions.—	I	II
Height	about 10 mm.	about 13 mm.
Thickness	,, 8 ,,	,, 10 ,,

Horizon.—Bala Series.

Localities.—Onny River, Shropshire; Tyrone.

Remarks.—There are four specimens of this species (Nos. 28006, 28007), three on one piece of rock, in the Jermyn Street Museum, from the Onny River; and these are the shells, so far as can be ascertained, which Salter described in 1854 (*loc. cit.*) as *Bellerophon* (*Bucania*) *sulcatinus*, Emmons?, suggesting the name *lingualis* if they should turn out to be a different species. The specific diagnosis was given in the following words: "B. uncialis et ultra, convolutus, anfractibus a dorso convexiusculo depressis, striatis. Carina lata, plana (sublævis?), marginata, vix elevata. Striæ concentricæ fortes, circiter 10 (ad carinam sæpissime interstriatæ et in ætate plurimæ), a lineis crebris valde reflexis undigue decussatæ. Apertura lata, expansa, semi profundo. This very beautiful shell differs from *B. sulcatinus*, as figured by Hall, in having regular ribs towards the angular edge, which become interlined and form a broad band of close striæ as the shell grows older. The umbilical face, too, is free from ribs, which I have some reason to think is not the case with *B. sulcatinus*. The striæ, too, on that shell appear to meet at a very much more obtuse angle than in ours. It should be called *B. lingualis* if the above characters are sufficient to separate it. It must have been a very thin shell." Salter adds (p. 68) that this shell is also found in Tyrone.[1]

This Onny River species cannot be referred to *Bucania* as now interpreted and restricted, of which genus *B. sulcatina* is the type, and it is obviously referable to *Kokenospira*. The species from the Redhill Beds described by me in 1906 as *Bellerophon* (*Bucanopsis*) *secundus*[2] may be identical (see p. 39).

Bucan[*i*]*ella esthona* Koken,[3] which Ulrich and Scofield have chosen as the type of their genus *Kokenia*, bears a considerable resemblance to Salter's species, and *K. costalis*, Ulr. & Scof.,[4] is also closely allied. Probably *B. lateralis*, Eichw.,[5] is also allied.

[1] 'Cat. Camb. Silur. Foss. Mus. Pract. Geol. Lond.' (1878), p. 57.

[2] Reed, 'Geol. Mag.' [5], vol. iii (1906), p. 366, pl. xx, figs. 15, 15 *a*.

[3] Koken, 'Neues Jahrb. f. Miner.,' suppl. vol. vi (1889), p. 389, pl. xiii, figs. 1, 1 *a*.

[4] Ulrich and Scofield, *op. cit.*, p. 882, pl. lxiv, figs. 46—49.

[5] Eichwald, 'Leth. Ross.,' vol. i, pt. ii (1860), p. 1083, pl. xl, fig. 28; Koken, 'Gastrop. Balt. Untersilurs,' p. 127.

5. **Kokenospira lingualis,** var. **girvanensis,** nov. Plate VII, figs. 3—8.

1877. *Bellerophon* cf. *subdecussatus,* McCoy, Etheridge, Proc. Roy. Phys. Soc. Edinb., vol. iv, p. 175, pl. ii, figs. 9, 10.

Specific Characters.—Shell subglobose, of 3—4 whorls rather closely enrolled. Umbilicus deep, about two-fifths to one-half the diameter of the shell. Whorls transverse, wider than high, subreniform in section, increasing slowly in width and height. Outer whorl embracing about half of preceding one, with rounded convex dorsum, bearing rather broad, slightly elevated slit-band with thin raised edges and very fine closely-placed lunulæ; umbilical edges narrowly rounded; umbilical slope short, steep. Mouth transverse, not expanded (except slightly towards base), with short, broad, V-shaped sinus in outer lip. Surface of dorsum ornamented with 16—28 strong revolving regular longitudinal lines on each side of slit-band and parallel to it, becoming more widely separated outside the inner 8—16, which are rounded, thick, and closely placed, the outer ones being thinner, sharper, and twice as far apart; umbilical edge and slope with 6—10 similar thin widely separated revolving lines; interspaces concave, occupied by fine, regular, equidistant transverse lines at right angles to the revolving ones except near the slit-band, where they bend back and meet it at about 30°—45° A few strong arched growth-ridges concentric with apertural margin near lip meet the slit-band at about 45°.

Dimensions.—	I	II
Height of shell	14·0 mm.	23·0 mm.
Width near mouth	14·5 ,,	about 23·0 ,,

Horizon.—Upper Ordovician: Drummuck Group (Starfish Bed).

Locality.—Thraive Glen, near Girvan.

Remarks.—Among the examples of this shell in Mrs. Gray's Collection there is some variation with regard to the number and closeness of the revolving striæ and the transverse growth-lines on the surface; and it seems impossible to consider these Girvan shells as more than a variety of Salter's *K. lingualis* when a comparison is made with a large number of specimens from the same bed. The crushed specimen with unusually strong growth-ridges, which Etheridge described and figured in 1877 (*op. cit.*) as *Bellerophon* cf. *subdecussatus*, McCoy, shows how misleading imperfect and distorted specimens may be.

6. **Kokenospira maccullochi,** sp. nov. Plate VII, figs. 9—12.

Specific Characters.—Shell composed of 4—5 low transverse whorls. Umbilicus very deep, about three-fourths the diameter of the shell, with its centre situated at about two-fifths the height of shell, exposing all the whorls, which only

embrace one another for about half their height. Outer whorl transverse, more than twice as wide as high, with more or less flattened broad dorsum, increasing rather rapidly in size to the mouth; umbilical edges subangular, situated a little below middle of whorl; umbilical slope steep. Slit-band narrow, slightly elevated, with sharp narrow edges. Surface of dorsum with 8—10 thick, low, rounded, equal revolving lines on each side and 6—8 on umbilical slope, becoming rather further apart laterally. Transverse striæ indistinct.

Dimensions.—Height of shell, about 21 mm.; width at mouth, about 18 mm.

Horizon.—Lower Ordovician: Balclatchie Group (Conglomerate).

Locality.—Balclatchie, near Girvan.

Remarks.—This species exposes the inner whorls more than any of the others from Girvan, but it is allied to *K. nicholsoni* and *K. lingualis* var. *girvanensis* in most respects. The wider and more open umbilicus and the sharper angulated umbilical edge in the adult are distinguishing marks. Owing to the state of preservation the transverse striæ are not clearly visible, but the revolving lines seem so close together as to leave little room for them in the interspaces. The types occur in Mrs. Gray's Collection, and the species is dedicated to the Scottish geologist, James MacCulloch.

7. **Kokenospira mullochensis,** sp. nov. Plate VIII, figs. 1, 2.

Specific Characters.—Shell subglobose, of 3 transverse rounded whorls. Umbilicus deep, small, about one-fourth the diameter of the shell. Outer whorl rather rapidly increasing in size and embracing three-fourths of preceding whorl, wider than high, with broad convex dorsum and rounded umbilical edge. Slit-band narrow, not elevated. Mouth slightly expanded at base, wider than high, with broad, shallow, V-shaped sinus in outer lip. Surface of whorl ornamented with closely placed, low, thick, rounded revolving spiral lines parallel to the slit-band, 12—14 on each side of it on dorsum, crossed by obliquely transverse delicate striæ meeting slit-band at 45°—60°.

Dimensions.—	I	II
Height of shell . . .	about 14 mm.	28 mm.
Width of mouth . . .	„ 16 „	32 „

Horizon.—Lower Llandovery: Mulloch Hill Group.

Locality.—Mulloch Hill, near Girvan.

Remarks.—The dorsum is more convex, the umbilicus smaller, the slit-band narrower, and the revolving lines thicker and closer than in *K. lingualis* var. *girvanensis.* The interspaces are also much narrower on the dorsum than in that species, and the revolving lines seem to be equal and equally spaced, with the transverse lines crossing them, thus producing a marked cancellation. As in the case

of the Drummuck species, there seems to be a globose variety with more numerous revolving lines. Most of the specimens in Mrs. Gray's Collection occur as internal casts, but the shell is occasionally preserved both in the case of the type and the variety.

8. **Kokenospira nicholsoni,** sp. nov. Plate VIII, fig. 3.

Specific Characters.—Shell subglobose, of 3 transverse rounded whorls. Umbilicus deep, about one-third the diameter of the shell. Outer whorl large, embracing fully three-fourths of preceding whorl; wider than high, subreniform in section, with dorsum broad, gently convex; umbilical edges narrowly rounded; umbilical slopes short, steep, rounded. Slit-band broad, slightly elevated, with 8—10 strong low revolving lines parallel to it on each side and a few successively wider apart on the umbilical slopes; fine transverse, regular, closely-placed lines crossing them at right angles are present in the larger interspaces.

Dimensions.—Height of shell, about 12·5 mm.; width of mouth, about 15 mm.

Horizon.—Lower Ordovician: Stinchar Limestone Group.

Locality.—Craighead, near Girvan.

Remarks.—This somewhat imperfectly known species appears to be separable from *K. macculloch*i on account of its smaller umbilicus, the more rounded umbilical edges and the more embracing whorls. The mouth is not preserved, and no perfect specimens are available, the only examples of the shell which I know occurring in Mrs. Gray's Collection.

9. **Kokenospira secunda** (Reed).

1906. *Bellerophon* (*Bucanopsis*) *secundus*, Reed, Geol. Mag. [5], vol. iii, p. 366, pl. xx, figs. 15, 15 *a*.

Specific Characters.—"Shell subglobose, with broad rounded back; of few volutions; whorls transversely subquadrate, broader than high; umbilicus moderately large, deep, with subangular margins [= umbilical edges], exposing inner whorls; aperture transverse, more or less expanded; inner lip reflexed on inner end of last whorl; slit-band rather broad, with narrow raised margins, not depressed, and fine gently curved lunulæ; surface of shell on each side of band marked with rather strong, regular, straight, parallel, subequal, revolving raised lines, about 24 in number, closely crowded near band but becoming more widely separated laterally, crossed at right angles by very fine, transverse, slightly wavy striæ."

Dimensions.—Height, about 15 mm.

Horizon.—Upper Ordovician: Redhill Beds.

Localities.—Prendergast Place and Lane, near Haverfordwest.

Remarks.—No further specimens of this Welsh species have been found since the above description was given by me in 1906. The true generic position of this shell is in *Kokenospira* as now established, and its nearest affinities are with *K. lingualis* var. *girvanensis* from the Drummuck Group, as above mentioned in the description of that species, and with the type of *K. lingualis* (Salter), with which it may prove to be identical.

10. **Kokenospira subdecussata** (McCoy). Plate VIII, fig. 4.

1852. *Bellerophon subdecussatus*, McCoy, Syn. Brit. Pal. Foss. Woodw. Mus., fasc. ii, p. 311, pl. i L, fig. 25 *a* (*non* fig. 25),

1873. *Bellerophon subdecussatus*, McCoy, Salter, Cat. Camb. Silur. Foss. Woodw. Mus., p. 97 (Lower Wenlock Group [Denbighshire Flags], Llanrwst, Denbigh), *a*/612 (*non* pp. 68, 83).

Specific Characters.—"Globose, of one and a half or two very rapidly enlarging whorls, subcompressed towards the very obtusely angular or rounded circumference; sides gibbous, umbilicus small, deep, partially exposing the whorls; surface with strong transverse ridges, circling backward from the umbilicus to the undefined band, forming a wide **V**-shaped sinus (about four or five of these transverse ridges in the space of one line near the mouth); they are crossed by much finer spiral striæ, about the same distance apart, from one to three of which are usually stronger than the rest near the band. . . . Rare in the schists of Llanrwst; and fine Bala Sandstone, Mulock [*sic*] Quarry, Dalquorhan, near Girvan, Ayrshire; not very uncommon in the Upper Bala rock of Allt yr Anker, Meifod, Montgomeryshire."

Horizon.—Wenlock Series: Denbighshire Flags.

Locality.—Llanrwst. [*a*/612, Sedgw. Mus. Camb.]

Remarks.—The above is McCoy's diagnosis of the species, but it is a composite one based on specimens from the three different localities and horizons. The type of the species should apparently be the specimen from Llanrwst (*a*/612, pl. i L, fig. 25*a*), of which McCoy only figures a portion of the ornament; Llanrwst is the first locality mentioned and the description of the ornament is undoubtedly derived from this shell. Unfortunately the specimen only consists of the hollow impression of the exterior of a portion of the outer whorl, but it shows the shape of the whorl, the slit-band, and transverse and spiral striæ. The Mulloch specimen (pl. i L, fig. 25) is a nearly complete shell, but is much crushed and distorted; it shows a rather different ornament and a very narrow slit-band poorly preserved, and the shell seems to have been more globose with a broader and less arched dorsum; it was not collected from the Mulloch Hill Group (Llandovery) judging from the character

of the rock, but probably was obtained from the Drummuck Group (Up. Bala). The Allt yr Anker specimen (*a*/163*) recorded also by Salter in his 'Catalogue,' is completely distinct from the Llanrwst shell and has been described on p. 33 of this memoir as an undefined species of *Bucania*.

As here stated, McCoy's definition of the species is made up from the combined characters of the three specimens, and is consequently not applicable strictly to any one; the species, therefore, rests on an insecure foundation, though probably the Mulloch Hill as well as the Llanrwst specimen is referable to the genus *Kokenospira*. The Llanrwst specimen has a rather narrow, strongly-arched dorsum, and the shell could not have been globose as McCoy describes it, the section of the outer whorl being apparently parabolic; the slit-band is of moderate width, well defined by raised edges, between which it is sunken; the revolving lines are strong, equidistant, and few in number, four or five lying on each side of the slit-band on the dorsum, and between these lines are very delicate revolving striæ; the transverse striæ are as strong or rather stronger than the revolving lines, are nearly equidistant, and lie about the same distance apart as the latter, but are rather less regularly placed, and curve back to meet the slit-band at about 45°.

Genus **TETRANOTA**, Ulrich and Scofield.

Generic Characters.—Shell thin, involute; whorls transverse, dorso-ventrally compressed; umbilicus open, large; aperture moderately expanded, chiefly laterally, transverse, wider than high; inner lip without callosity; dorsal sinus more or less deep with a short central slit. Slit-band wide, elevated, bordered on each side by a more or less raised edge; about midway between it and the narrowly rounded or angular umbilical edges there is a marked lateral ridge on each side, occasionally dying out near aperture. Surface-ornamentation composed of rather delicate sublamellose regular transverse lines of growth, often crossed at right angles by another set of minute lines.

No representative of this genus seems to have been previously described from British strata. It was originally described from America by Ulrich and Scofield,[1] with *Bucania bidorsata*, Hall, from the Trenton Formation, as its type-species. The error made by Koken in connecting generically several established European Silurian and Devonian species with this American shell has been pointed out by Ulrich and Scofield (*op. cit.*).

1. **Tetranota carrickensis,** sp. nov. Plate VIII, figs. 5—11.

Specific Characters.—Shell subglobose, composed of 4—5 broad convex whorls, scarcely overlapping. Umbilicus deep, exposing all the whorls, more

[1] Ulrich and Scofield, *op. cit.*, pp. 849, 875—877.

than one-third the diameter of the shell. Outer whorl large, gradually increasing in size and more rapidly in width than height towards mouth, becoming twice as broad as high; umbilical edges acute or subangular, becoming rounded or obtuse near mouth and in old shells; umbilical slopes steep, high; dorsum strongly arched, convex, becoming lower and flattened towards mouth; centre of dorsum raised into a low, broad, rounded, gently elevated revolving ridge carrying slit-band; a narrow, sharp, revolving lateral keel is situated on each side at about three-fifths the distance between the slit-band and the umbilical edge, becoming obtuse or nearly obsolete near mouth; interspaces between central ridge, keels and umbilical edges more or less concave. Slit-band well-marked, gently concave, with sharply raised edges and crossed by strong equidistant regular lunulæ. Mouth transverse, very slightly expanded at sides, with short broad median slit and gently rounded apertural lobes. Surface of shell crossed by regular closely-placed, strong, arched transverse minutely granulated thread-like lines, bending back to meet slit-band at about 30°.

Dimensions.—Height of shell, 13·0 mm; width of mouth, 15·0 mm.

Horizon.—Lower Ordovician: Balclatchie Group.

Localities.—Balclatchie and Ardmillan, Girvan.

Remarks.—The affinities of this species with *Tetranota sexcarinata*, Ulr. & Scof.,[1] are close. The ornamentation in our species is rather finer, and the dorsum is more arched, except towards the mouth. Apparently this is the form which has been frequently entered as "*Bellerophon trilobatus*, Sowerby," in lists of Girvan fossils. The type specimens are in Mrs. Gray's Collection.

2. **Tetranota carrickensis,** var. **craigensis,** nov. Plate VIII, figs. 12, 13.

Varietal Characters.—The only difference between the Craighead and Ardmillan specimens of *T. carrickensis* seems to lie in the position of the lateral keels, which in the Craighead form are placed rather nearer the slit-band, being about half-way between it and the umbilical edges. But none of the Craighead specimens in Mrs. Gray's Collection are well preserved or perfect. It is, however, possible that this form is a distinct species.

Horizon.—Lower Ordovician: Stinchar Limestone Group.

Locality.—Craighead, near Girvan.

3. **Tetranota carrickensis,** var. **etheridgei,** nov. Plate VIII, figs. 14, 15.

Varietal Characters.—Slit-band narrower than in *T. carrickensis*, and surface of shell with the transverse lines crossed by finer ones, causing a minute cancellation of the surface.

[1] Ulrich and Scofield, *op. cit.*, p. 878, pl. lxv, figs. 3—9.

Dimensions.—	I (No. 593 Roy. Scott. Mus.)	II (Young)
Height of shell . . .	19·0 mm.	8·0 mm.
Width of whorl at mouth . .	18·0 „	7·5 „

Horizon.—Upper Ordovician: Drummuck Group.

Locality.—Thraive Glen, Girvan.

Remarks.—The specimens are poor, two of the three in the Geological Survey Collection at Edinburgh being in the condition of internal casts of old shells, the third specimen having part of the shell preserved. The single example in Mrs. Gray's Collection is a young individual and accordingly has the lateral revolving keels sharper, whereas in the older individuals they are almost obsolete. The cancellation of the surface recalls *T. bidorsata* (Hall).[1]

The co-types are in the Royal Scottish Museum, Edinburgh.

4. **Tetranota hippopus** (Salter). Plate VIII, fig. 16.

1866. *Bellerophon hippopus*, Salter, Mem. Geol. Surv., vol. iii, p. 350, pl. ii B, fig. 2; *ibid.*, 2nd edit. (1881), p. 557.

Specific Characters.—Shell subglobose, composed of low transverse whorls much wider than high, with broad flattened dorsum divided into a gently raised median portion bearing broad slit-band, and outer low, rounded convex lateral portions separated from the median elevation by broad, shallow, revolving depressions. Umbilicus large, open?; umbilical edges sharp or subangular. Slit-band with faintly raised edges, and crossed by strong equidistant lunulæ. Mouth with deep U-shaped dorsal sinus and strongly arched lateral lobes. Surface of dorsum ornamented with strong transverse, sublamellose, equidistant lines arching back sharply to meet the slit-band at 20°—30°, with 2—3 finer lines between them.

Horizon.—Arenig Series.

Locality.—Ritton Castle, west of the Stiper Stones, Shropshire.

Remarks.—A fuller diagnosis than the above is not possible owing to the lack of perfect specimens. Salter's figure (*op. cit.*) gave a fair idea of the general characters, but did not sufficiently emphasise the lobation of the dorsum.

The description which he gave of the species was as follows: "B. latissimus, uncialis, striatus, vix costatus, anfractu ultimo maximè dilatato, striis inequalibus conspicuis. Carina lata prominens. Apertura paullulum contracta. Umbilicus profundus." In addition he makes the following remarks: "Broad-involute, the outer whorl very wide, and rather depressed on the back with something of a furrow on each side of the broad band, which is rather prominent and well-defined in all ages. Striæ arched backward, every third or fourth one stronger than the

[1] Ulrich and Scofield, *op. cit.*, p. 877, pl. lxv, fig. 16

rest but not producing prominent ridges as in *B. arfonensis;* nor do they form conspicuous ridges on the band as in that species. Umbilicus open, broad, deep."

The only two specimens (nos. 28008, 28009) of this species are in the Jermyn Street Museum and correspond to Salter's figures; but they are fragmentary, the larger specimen (28009) showing the dorsum of the terminal portion of the outer whorl with the surface ornament, slit-band, dorsal sinus, and part of the lip. The other specimen is a less perfect but larger portion of a smaller shell.

This species appears to belong to the genus *Tetranota* as defined by Ulrich and Scofield, and it seems to be the only English species so far discovered. Its nearest ally appears to be *T. obsoleta*, Ulr. & Scof.,[1] which occurs in several Ordovician beds in Minnesota.

Genus **CONRADELLA**, Ulrich and Scofield.

Generic Characters.—Shell coiled symmetrically; whorls in contact but scarcely overlapping, enlarging gradually, strongly keeled dorsally. Umbilicus open. Aperture oval or subcordiform, widest in middle or below, entire, with margins abruptly expanded and inner lip reflexed, without dorsal sinus or callosities, but having long narrow median dorsal slit with raised edges extending about half the length of outer whorl and followed by elevated slit-band. Surface of shell ornamented with imbricating transverse lamellæ, having their edges often plicated so as to form revolving ridges; fine transverse growth-lines generally present.

The type of this genus is *C. obliqua*, Ulrich and Scofield,[2] from the Black River Group. A species ascribed to this genus has been described by the author[3] from the Slade Beds of the Haverfordwest area, but otherwise it does not seem to have been recorded from the British Isles. Perner (*op. cit.*, p. 158) recognises one species from Etage Ee in Bohemia. Ulrich and Scofield's definition of the genus is here strictly followed. Bassler[4] prefers to use the name *Phragmolites*, Conrad, 1838, in place of *Conradella*, but the type of *Phragmolites* is not the same species, being *P. compressus*, Conrad,[5] from the Trenton Formation.

1. **Conradella girvanensis,** sp. nov. Plate IX, fig. 1.

Specific Characters.—Shell high, subdiscoidal, composed of 3—4 subtriangular rounded whorls, higher than wide. Umbilicus wide, more than one-third the

[1] Ulrich and Scofield, *op. cit.*, p. 880, pl. lxv, figs. 19—23.

[2] Ulrich and Scofield, *op. cit.*, pp. 851, 904, 906, pl. lxvii, figs. 1—6.

[3] Reed, 'Geol. Mag.' [5], vol. iii (1906), p. 367, pl. xx, figs. 5, 5 *a*, *b*.

[4] Bassler, 'Bibliogr. Index Amer. Ordov. Silur. Foss.,' vol. ii, p. 971 (Bull. 92, U.S. Nat. Mus., 1915).

[5] Conrad, '2nd Ann. Rep. New York Geol. Surv.,' 1838, p. 119; Hall, 'Pal. New York,' vol i 1847), p. 188, pl. xl A, figs. 2 *a—f* [*Cyrtolites compressus*].

diameter of the shell, with centre situated at less than half the height. Outer whorl with swollen rounded sides, broadest at base; umbilical edge subangular; umbilical slope steep, short, abrupt; dorsum with high, narrow, suddenly elevated prominent carina bearing slit-band having sharp edges and strong distinct lunulæ. Surface of shell crossed by numerous sharp, regular, concentric imbricating lamellæ, equidistant and finely fimbriated, meeting carina nearly at right angles; interspaces with very delicate revolving interrupted lines.

Dimensions.—Height of shell, 14—15 mm.

Horizon.—Middle Ordovician: Whitehouse Group.

Locality.—Shalloch Mill, near Girvan.

Remarks.—We may compare this species with *C. triangularis*, Ulrich and Scofield,[1] and *C. fimbriata*, Ulr. & Scof.[2] The lamellæ are less numerous, more coarsely fimbriated, and further apart than in the form described below as *Conradella ? multilineata*, sp. nov., from the same Girvan beds, but otherwise the species seem allied to each other. The type specimens are in Mrs. Gray's Collection.

2. **Conradella sladensis,** sp. nov. Plate IX, fig. 2.

1906. *Conradella ?* sp., Reed, Geol. Mag. [5], vol. iii, p. 367, pl. xx, figs. 5, 5 *a*, 5 *b*.

Specific Characters.—Shell of few whorls, coiled in the same plane; whorls higher than wide, carinated, with upper portion compressed, lower portion swollen, with rounded inflated sides. Umbilicus small; umbilical slope steep, short, rounded. Carina elevated and occupied by slit-band, crossed by rather distant strong lunulæ. Sides of whorls ornamented by rather coarse raised fimbriated lines, equidistant and equal in size, curving back in a gentle sigmoidal manner to meet the slit-band at about 75°, and connected by less prominent, short, straight lines at right angles to them and alternately arranged, not forming continuous revolving spirals but making a fairly regular honeycomb pattern.

Dimensions.—Height about 6 mm.

Horizon.—Upper Ordovician: Slade Beds.

Locality.—Upper Slade, Haverfordwest.

Remarks.—No better examples of this small shell have been discovered than those described in 1906, from which the above diagnosis has been drawn up. As then remarked, this species seems allied to *Conradella dyeri* var. *cellulosa*, Ulrich,[3] but the keel seems to be more elevated and the inner whorls less exposed. We may distinguish our species by the name *C. sladensis*.

[1] Ulrich and Scofield, *op. cit.*, p. 908, pl. lxvii, figs. 19—22.

[2] *Ibid.*, p. 907, pl. lxii, fig. 66; pl. lxvii, figs. 7—10.

[3] Ulrich and Scofield, *op. cit.*, p. 910, pl. lxvii, figs. 27—29.

3. **Conradella ? multilineata,** sp. nov. Plate IX, figs. 3, 4.

Specific Characters.—Shell discoidal, composed of 3—4 whorls; umbilicus large, fully half the diameter of the shell; whorls slightly overlapping, very slowly increasing in size, subtriangular in cross-section. Outer whorl with sides somewhat inflated at base; dorsum compressed, subangular, bearing high keel [and slit-band ?]; umbilical edge subangular; umbilical slope steep. Surface ornamented with numerous regular closely-placed, equidistant fine thread-like transverse lines, minutely fimbriated, scarcely arched, meeting keel at about 75°.

Dimensions.—Average height about 12·0 mm.

Horizon.—Middle Ordovician: Whitehouse Group.

Locality.—Shalloch Mill, near Girvan.

Remarks.—None of the available specimens are well preserved, and it is doubtful if a slit-band is present, but it appears probable that this species should be referred to the genus *Conradella* rather than to *Cyrtolites*, for it much resembles *C. girvanensis* from the same horizon and locality, differing chiefly in the ornamentation. All the examples are in Mrs. Gray's Collection.

4. **Conradella fimbriata,** Ulrich and Scofield. Plate IX, fig. 5.

1897. *Conradella fimbriata*, Ulrich and Scofield, Final Rep. Geol. Nat. Hist. Surv. Minnesota, vol. iii, pt. 2, p. 907, pl. lxii, fig. 66, pl. lxvii, figs. 7—10.

Specific Characters.—"Shell discoid, from 18 mm. to 25 mm. in diameter. Volutions about three, enlarging more rapidly than usual for the genus, very strongly and rather abruptly carinate, broadly subcordate in section, wider than high, narrowly rounded in the lower part of the sides; umbilicus comparatively small, equalling two-fifths of the diameter of the shell; slit extending nearly half a volution posterior to the apertural margin. Aperture abruptly expanded at frequent intervals, the expansion left behind forming transverse, imbricating folded lamellæ, the anterior edges of which are strongly serrated and project, collar-like, 3 or 4 mm. forward and outward from the surface of the last volution. Each expansion has seven folds, the lower one faint, the upper one strong. Occasionally a smaller one is developed between each pair of the latter. The entire surface is covered with very fine longitudinal and transverse lines. All the transverse markings cross the volutions obliquely. When, as is generally the case, the projecting lamellæ are broken away the surface presents two or three more or less obscure revolving ribs on each side of the prominent keel" (Ulrich and Scofield).

Horizon.—Upper Ordovician: Drummuck Group (Starfish Bed).

Locality.—Thraive Glen, near Girvan.

Remarks.—The foregoing description is that given by Ulrich and Scofield for *C. fimbriata*, and it appears to apply very closely to a Girvan specimen in Mrs. Gray's collection of which only the impression of part of the outer whorl is preserved. The shell must have measured about 15 mm. in height (*i. e.* diameter), and the outer whorl, which was subcordate in transverse section, rather higher than wide, increases rather rapidly in size towards the mouth, and is crossed by transverse undulated projecting lamellæ, rather oblique to the whorl and set at equal distances apart; the fimbriations are 7–8 in number and form minute rounded saddles and lobes, while in the interspaces between the lamellæ are delicate transverse concentric lines.

Genus **TEMNODISCUS**, Koken.

Generic Characters.—"Symmetrically involute small thin shells consisting of one and a-half or two rapidly enlarging, contiguous or free volutions, with rounded sides and a more or less well-developed slit-band; aperture higher than wide, sinuate dorsally, and somewhat deeply emarginated in front of the slit-band; marks of growth curving strongly backward, more or less distinctly lamellose, with crenulated edges, and, when distant enough, traversed by small longitudinal riblets" (Ulrich and Scofield).

In 1896 Koken[1] gave this name to a genus of Bellerophontacea with the type species, *Cyrtolites lamellifer*, Lindström,[2] but he had already, in 1889[3] grouped this species with four others, *C. pharetra*, *C. arrosus*, *C. obliquus* and *C. euryomphalus*, as a subgenus of *Cyrtolites*, though without defining it by a name. Ulrich and Scofield in 1897[4] chose the same species as the type of their genus *Cyrtolitina*, being apparently in ignorance of Koken's earlier name, *Temnodiscus*. We must, by the rules of priority, use Koken's designation for this group of Silurian shells. But subsequently Koken,[5] in 1897, in describing certain Ordovician shells under this name gave a fresh definition of its characters, in which he stated that it had no slit-band, whereas Ulrich and Scofield distinctly state that there is a "more or less well developed slit-band," such as Lindström clearly describes and figures in the type species. The American authors, moreover, do not include Lindström's *C. euryomphalus* in their genus, but only *C. lamellifer*, *C. pharetra*, *C. arrosus* and *C. obliquus*. Further, they say that in America the European genus *Cyrtolitina* is only repre-

[1] Koken, 'Die Leitfossilien' (1896), p. 100.

[2] Lindström, 'Silur. Gastrop. Pterop. Gotland,' p. 82, pl. vi, figs. 31—38.

[3] Koken, 'Neues Jahrb. f. Miner.' suppl. vol. vi (1889), p. 393.

[4] Ulrich and Scofield, *op. cit.*, p. 847.

[5] Koken, 'Gastrop. Balt. Untersilurs' (1897), p. 129.

sented by the Trenton species *Cyrtolites nitidulus*, Ulrich,[1] and Bassler in 1915 (*op. cit.*, p. 368) has adopted their views. If their generic name has therefore any independent right to stand, the latter species must be its type.

1. **Temnodiscus fletcheri,** sp. nov. Plate IX, fig. 6.

Specific Characters.—Shell lenticular, much compressed, acutely carinated; composed of few (2—3) whorls in contact but not overlapping, rapidly increasing in size but more in height than width, lanceolate in cross-section; sides of outer whorl very gently convex (? becoming flattened towards mouth), meeting at very acute angle (15°—20°) in carina. [Slit-band very narrow.] Umbilicus open, shallow, about one-third or one-fourth the maximum diameter of the shell, with centre situated at about one-third its height; umbilical edges subangular; umbilical slopes very short, vertical. Surface of whorls ornamented with regular, equidistant, narrow, transverse sublamellose ribs, nearly straight on sides but curving back and becoming weaker and closer near carina, which they meet at 30°—45° but do not cross; edges of ribs fimbriated; interspaces slightly concave, crossed by regular, equidistant, raised spiral lines, alternating in successive interspaces and bearing closely-placed small granules; near apertural margins the transverse ribs and spiral lines become finer, less regular and more closely placed.

Dimensions.—Height of shell about 14 mm.; height of mouth about 9 mm.

Horizon.—Wenlock Shale.

Locality.—Dudley.

Remarks.—Only the one specimen [27995] in the Jermyn Street Museum is known to me, but it exhibits such marked characters as to merit a distinct specific name. The mouth is not preserved, nor the slit-band. In shape, but not precisely in ornamentation, the shell resembles *T. pharetra* (Lindström)[2] from the Silurian of Gotland. The ornament, however, is more like that of some American Ordovician species of *Conradella*.

2. **Temnodiscus monilifer,** sp. nov. Plate IX, fig. 7.

Specific Characters.—Shell high, narrow, compressed, sharply angulated on dorsum, cornuate, composed of 1—1½ free curved whorls with the umbilicus open and perforated. Whorl very rapidly increasing in size to mouth, lanceolate in cross-section, with gently convex sides meeting at an acute angle on the dorsum. Mouth oblique, about 1½ times as high as wide. Slit-band flattened, becoming narrower and completely (?) closed to form an acute keel in proximal part of shell. Sides of whorl crossed by regular equidistant thick lamellæ, gently arched

[1] Ulrich, 'Journ. Cincinnati Soc. Nat. Hist.,' vol. ii (1897), p. 12.

[2] Lindström, *op. cit.*, p. 83, pl. vi, figs. 39—51.

PLATE I.

FIG. PAGE

1. *Sinuites anceps* (Salter MS.). Side view. × 1½. Middle Bala, Horderley. Mus. Pract. Geol. [28025]. 5.

1*a*. Dorsal view. × 1½. 1*b*. Front view. × 1½.

2. Ditto. Internal cast. Side view. × 1½. Same horizon and locality. Mus. Pract. Geol. [28027]. 5.

2*a*. Dorsal view. × 1½.

3. Ditto. Internal cast. Dorsal view. × 1½. Bala Series, Soudley Quarry. Sedgwick Mus. 5.

4. *Sinuites balclatchiensis*, sp. nov. Internal cast with portion of shell preserved. Side view. × 1½. Balclatchie Group, Balclatchie. Mrs. Gray's Coll. 6.

4*a*. Front view. × 1½.

5. Ditto. Side view of internal cast, showing transverse groove. × 1½. Same horizon, locality and collection. 6.

5*a*. Sinus view. × 1½.

6. Ditto. Dorsal view. × 1½. Same horizon, locality and collection. 6.

7. Ditto. Restored outline of sinus view. × 1½. 6.

8. *Sinuites bilobatus* (Sow.). Side view of type. Nat. size. Middle Bala, Horderley. Mus. Pract. Geol. [6850]. 7.

8*a*. Sinus view. Nat. size. 8*b*. Front view. Nat. size.

9. *Sinuites discoides*, sp. nov. Internal cast. Side view. × 2. Balclatchie Group, Ardmillan. Mrs. Gray's Coll. 9.

9*a*. Dorsal view. × 2. 9*b*. Ornament. × 20.

10. Ditto. Internal cast. Side view. × 2. Same horizon, locality and collection. 9.

11. Ditto ?. Internal cast. Side view. × 2. Same horizon, locality and collection. 9.

11*a*. Dorsal view. × 2.

12. *Sinuites elongatus* (Portl.). Internal cast. Side view of supposed type. × 1¼. Bala Series, Tyrone. Mus. Pract. Geol. [27990]. 9.

12*a*. Sinus view. × 1¼.

13. Ditto. Side view, showing ornament. × 1½. Same horizon, locality and collection [27991]. 9.

13*a*. Portion of ornament. × 10.

14. Ditto ?. Internal cast. Side view. × 1¼. Starfish Bed, Thraive Glen, Girvan. Mrs. Gray's Coll. 10.

Reed, Bellerophontacea.

PLATE 1

SINUITES.

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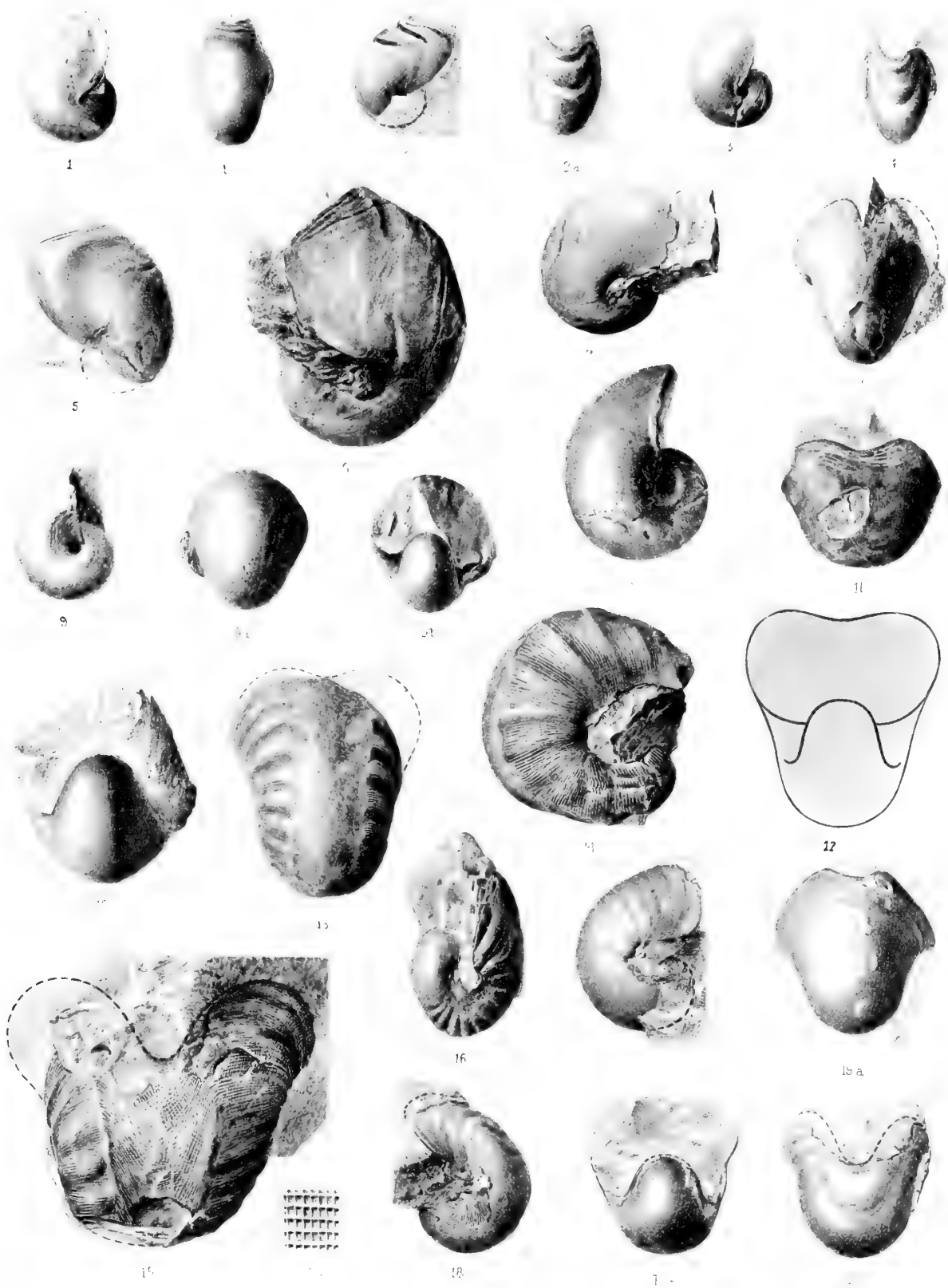
PLATE II.

Fig.		Page.
1.	*Sinuites maccallumi*, sp. nov. Internal cast. Side view. × 1½. Balclatchie Group, Ardmillan. Mrs. Gray's Coll.	10.
1*a*.	Dorsal view. × 1½.	
2.	Ditto. Internal cast. Side view. × 1½. Same horizon, locality and collection.	10.
2*a*.	Sinus view. × 1½.	
3.	Ditto. Internal cast. Side view. × 1½. Same horizon, locality and collection.	10.
4.	Ditto. Internal cast. Sinus view. × 1½. Same horizon, locality and collection.	10.
5.	Ditto ?. Internal cast. Side view. × 2½. Same horizon, locality and collection.	10.
6.	*Sinuites pseudocompressus*, sp. nov. Internal cast. Side view. × 1¼. Middle Bala. Long Lane Quarry, Craven Arms. Sedgwick Mus.	11.
7.	Ditto. Internal cast. Side view. × 1¼. Same horizon, locality and collection.	11.
8.	Ditto. Internal cast. Sinus view. × 1¼. Same horizon, Horderley. Sedgwick Mus.	11.
9.	*Sinuites pusgillensis*, sp. nov. Internal cast. Side view. × 1½. Corona Beds, Pusgill. British Mus. (G. 22064).	12.
9*a*.	Dorsal view. × 1½. 9*b*. Front view. × 1½.	
10.	Ditto. Internal cast. Side view. × 1¼. Same horizon and locality. Sedgwick Mus.	12.
11.	Ditto. Internal cast. Sinus view. × 1¼. Same horizon, locality and collection.	12.
12.	Ditto. Internal cast. Front view. × 1¼. Same horizon, locality and collection.	12.
13.	*Sinuites semirugosus* (Salter MS.). Dorsal view. × 1½. Bala Series, Tyn y twyl. Mus. Pract. Geol. [28039].	13.
14.	Ditto. Side view. × 2. Same horizon, locality and collection [28040].	13.
15.	Ditto. Sinus view. × 2. Bala Series, Vyrnwy Dam. Sedgwick Mus.	13.
15*a*.	Portion of ornament. × 10.	
16.	Ditto. Internal cast. Three-quarter front view. × 1½. Bala Series, Tyn y twyl. Mus. Pract. Geol. [28041].	13.
17.	Ditto. Restored outline of front view.	
18.	*Sinuites soudleyensis*, sp. nov. Internal cast. Side view, with portion of shell showing ornament. Nat. size. Bala Series, Horderley. Mus. Pract. Geol. [28026].	13.
18*a*.	Front view. Nat. size. 18*b*. Sinus view. Nat. size.	
19.	Ditto. Internal cast. Side view. × 1¼. Bala Series, Soudley. Sedgwick Mus.	13.
19*a*.	Dorsal view. × 1¼.	

Reed. Bellerophontacea.

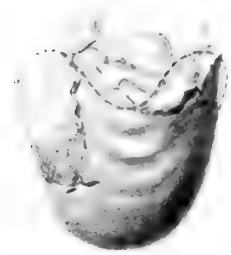


SINUITES.

PLATE III.

Reed, Bellerophontacea.

PLATE III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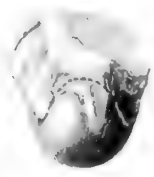
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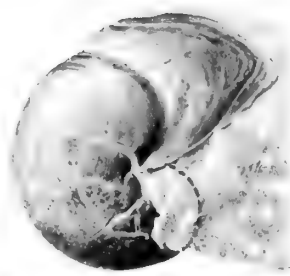
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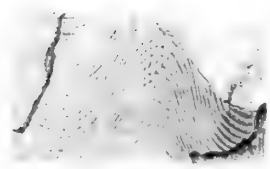
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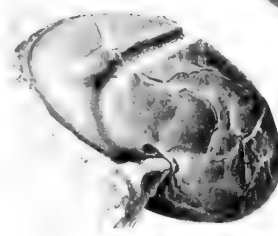
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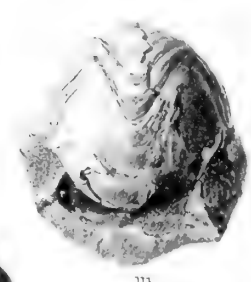
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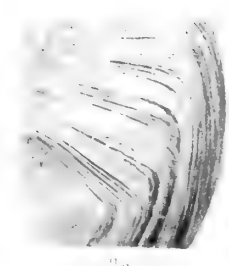
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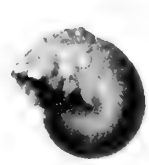
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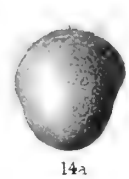
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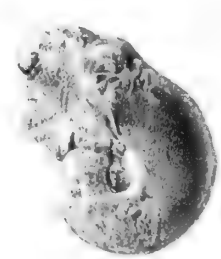
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1-14. SINUITES.

15 SINUITOPSIS.

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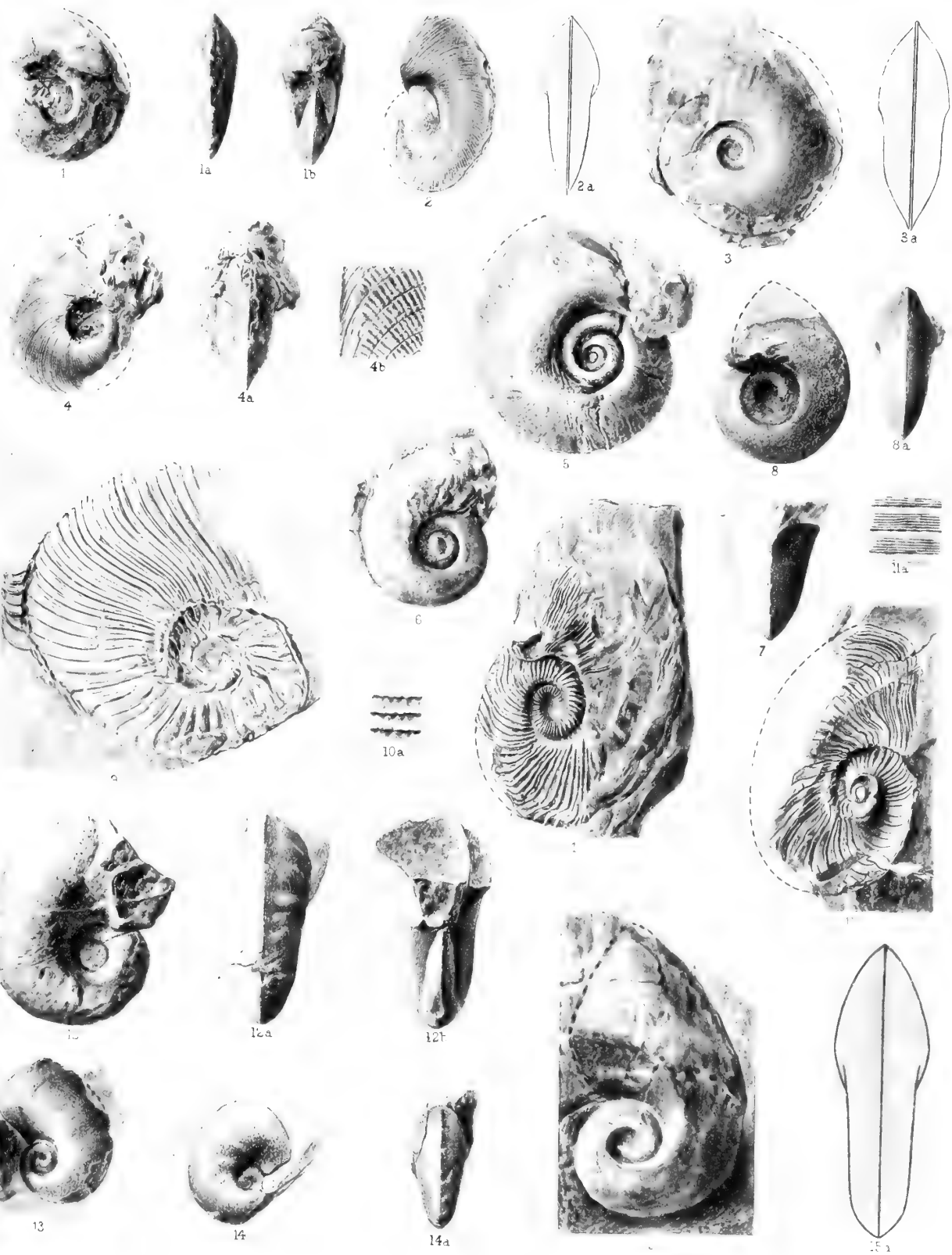
PLATE IV.

Reed, Bellerophontacea.

PLATE IV



1-11. OXYDISCUS. 12-15. CYRTOLITES.

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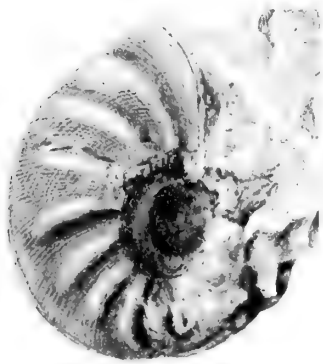
PLATE V.

Reed, Bellerophontacea.

PLATE V



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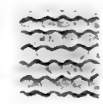

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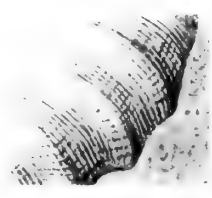

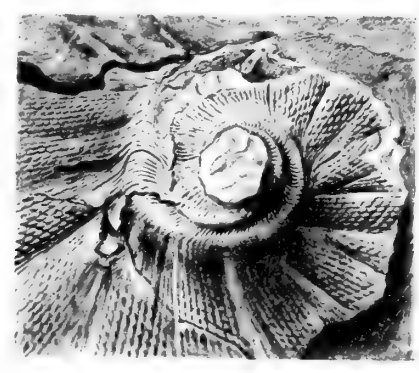

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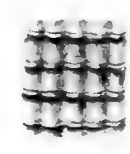

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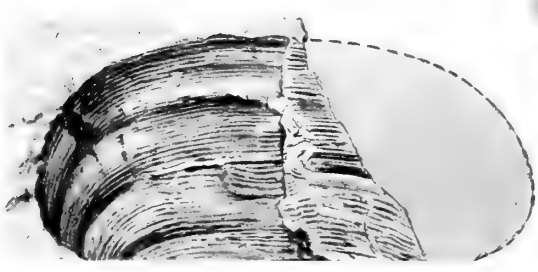

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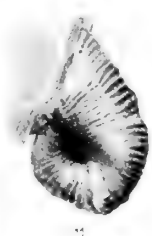

11

11a

12

1-10. CYRTOLITES. 11. ISOSPIRA.

12. BUCANIELLA.

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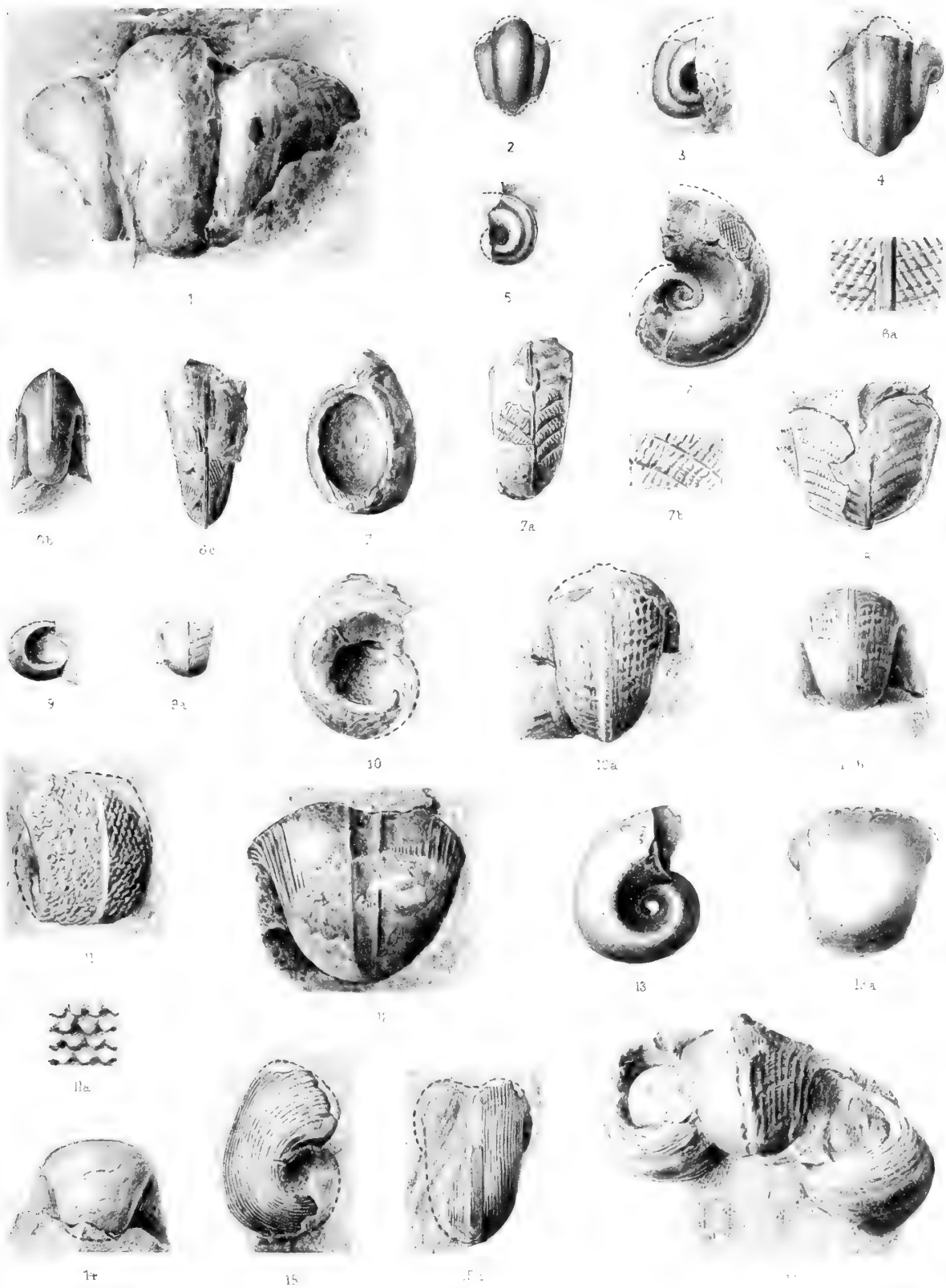
PLATE VI.

Reed, Bellerophontacea.

PLATE VI



1-5. BUCANIELLA.

6-11. BUCANIA.

12-16. KOKENOSPIRA.

PLATE VII.

FIG. PAGE.

1. *Kokenospira lingualis* (Salter). Side view of one of Salter's original specimens. × $2\frac{1}{2}$. Bala Series, Onny River. Mus. Pract. Geol. [28007]. 35.

1*a*. Dorsal view. × $2\frac{1}{2}$. 1*b*. Inferior view. × $2\frac{1}{2}$.

2. *Kokenospira latidorsata*, sp. nov. Internal cast. Side view. × $1\frac{1}{2}$. Bala Series, Cardington, Shropshire. British Mus. [G. 20706]. 35.

2*a*. Dorsal view. × $1\frac{1}{2}$. 2*b*. Front view. × $1\frac{1}{2}$.

3. *Kokenospira lingualis* var. *girvanensis*, nov. Dorsal view. × 2. Drummuck Group, Thraive Glen. Mrs. Gray's Coll. (Figd. Etheridge, *op. cit.*, 1877.) 37.

3*a*. Ornament. × 4.

4. Ditto. Side view of specimen with part of shell preserved. × $1\frac{1}{2}$. Same horizon, locality and collection. 37.

4*a*. Sinus view. × 4.

5. Ditto. Dorsal view. × 2. Same horizon, locality and collection. 37.

6. Ditto. Side view. × 2. Same horizon, locality and collection. 37.

7. Ditto. Dorsal view. × $2\frac{1}{2}$. Same horizon, locality and collection. 37.

8. Ditto. Internal cast. Inferior view. × 2. Same horizon, locality and collection. 37.

9. *Kokenospira maccullochi*, sp. nov. Side view. × 2. Balclatchie Group, Balclatchie. Mrs. Gray's Coll. 38.

9*a*. Inferior view. × 2. 9*b*. Dorsal view. × 2.

10. Ditto. Side view. × 2. Same horizon, locality and collection. 38.

11. Ditto. Internal cast. Side view. × 2. Same horizon, locality and collection. 38.

12. Ditto. Ditto. × 2. Same horizon, locality and collection. 38.

12*a*. Inferior view. × 2. 12*b*. Sinus view. × 2.

Reed, Bellerophontacea.

PLATE VII

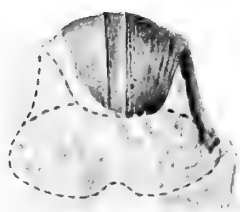

1


1a


2

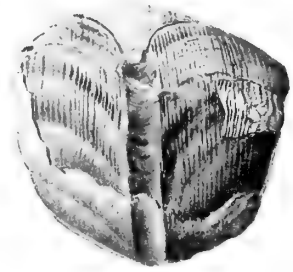

2a


2b


1b

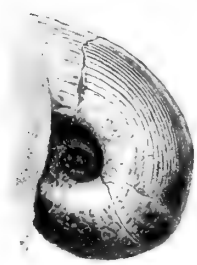

3


4


4a


5


3a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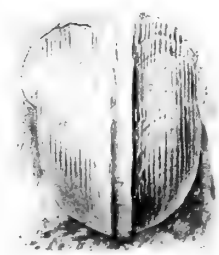
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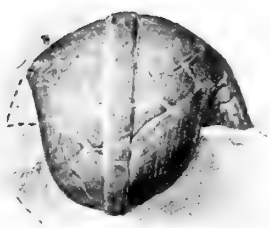
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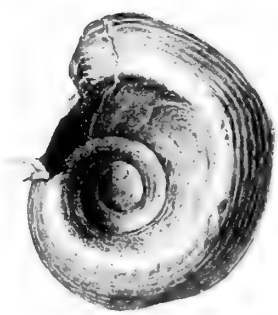
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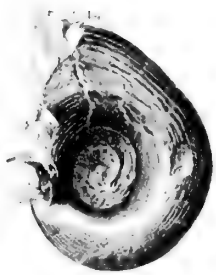
9a


9b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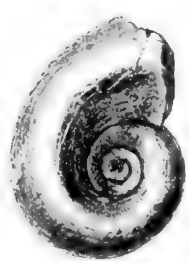
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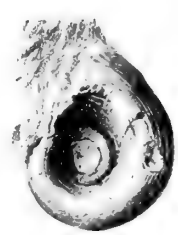
12


12a


12b

KOKENOSPIRA.

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PLATE VIII.

FIG. PAGE.

1. *Kokenospira mullochensis*, sp. nov. Internal cast. Side view. × 1½. Mulloch Hill Group, Mulloch Hill. Mrs. Gray's Coll. 38.

1*a*. Front view. × 1½.

2. Ditto. Ornament. × 6. Same horizon, locality and collection. 38.

3. *Kokenospira nicholsoni*, sp. nov. Internal cast. Side view. × 2. Stinchar Limestone, Craighead. Mrs. Gray's Coll. 39.

3*a*. Dorsal view. × 2. 3*b*. Inferior view.

4. *Kokenospira subdecussata* (McCoy). Dorsal view of squeeze from original specimen. × 4. Denbighshire Flags, Llanrwst. Sedgwick Mus. (*a*/612). 40.

5. *Tetranota carrickensis*, sp. nov. Dorsal view of crushed specimen with shell preserved. × 2½. Balclatchie Group, Ardmillan. Mrs. Gray's Coll. 41.

6. Ditto. Ditto. × 4. Same horizon, locality and collection. 41.

7. Ditto. Sinus view. × 2½. Same horizon, locality and collection. 41.

8. Ditto. Ditto. × 2½. Same horizon, locality and collection. 41.

9. Ditto. Internal cast. Dorsal view. × 2. Same horizon, locality and collection. 41.

9*a*. Front view. × 2. 9*b*. Side view. × 2.

10. Ditto. Internal cast of young shell. Dorsal view. × 3. Balclatchie Conglomerate. Mrs. Gray's Coll. 41.

11. Ditto. Outline restoration of front view. 41.

12. *Tetranota carrickensis* var. *craigensis*, nov. Internal cast. Dorsal view. × 2½. Stinchar Limestone, Craighead. Mrs. Gray's Coll. 42.

12*a*. Side view. × 2½.

13. Ditto. Internal cast. Dorsal view. × 2½. Same horizon, locality and collection. 42.

14. *Tetranota carrickensis* var. *etheridgei*, nov. Side view. × 2. Drummuck Group, Thraive Glen. Mrs. Gray's Coll. 42.

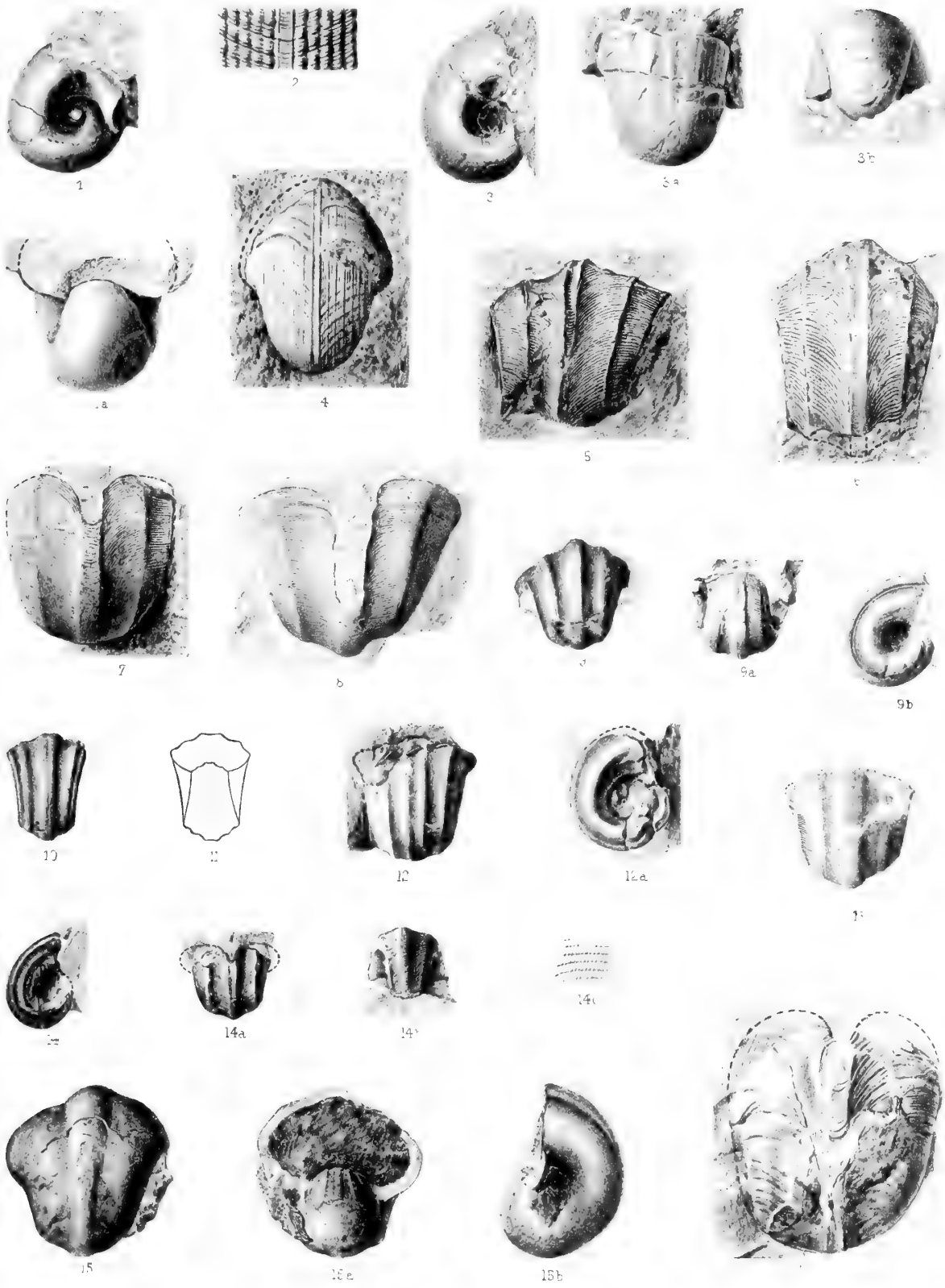
14*a*. Sinus view. × 2. 14*b*. Inferior view. × 2. 14*c*. Ornament. × 10.

15. Ditto? Internal cast of old shell. Dorsal view. × 1½. Drummuck Group, Thraive Glen. Roy. Scottish Mus. (No. 593). 42.

15*a*. Front view. × 1½. 15*b*. Side view. × 1½.

16. *Tetranota hippopus* (Salter). Sinus view of one of Salter's original specimens. × 1½. Arenig Series, Ritton Castle. Mus. Pract. Geol. [28009]. 43.

Reed, Bellerophontacea.



1-4. KOKENOSPIRA.

5-16. TETRANOTA.

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