ANGLO-BELGIAN

CARBONIFEROUS PLEUROTOMARIIDAE.

By

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Contents

I. Introduction.

The family Pleurotomariidae includes several hundred species ranging from Cambrian to Recent. They become abundant in the Lower Carboniferous of Europe and spread westwards to form a substantial proportion of the Upper Carboniferous gastropod fauna of America. An earlier paper (Trans.Geol. Soc.Glasgow,XX,part i,pp.30-72) deals with Scottish forms of shaly facies, but the species are listed again in the Distribution Table of the present paper. A discussion is included of the genus Pleurotomarium and the family Pleurotomariidae and reasons are given for restricting the former name to certain Mesozoic forms. The present paper deals with the "reef" forms of the Anglo-Belgian province. Where possible, references are made to Irish species, but much work remains to be done in this direction. The available collections are scanty and the horizons approximate.

For the sake of clarity the synonyms are brief. Only forms which are efficiently illustrated, or have been checked by photographs or examination of the actual specimens, are included.

In quotations from Koninck, apparently contradictory expressions are used, resulting from the Continental method of describing a gastropod with the base directed upwards.

The terms "upper" and "lower" face correspond respectively to the posterior and anterior aspects of the whorl.

Apical angle over all is the angle between the tangents joining/

joining the apex to the body whorl; pleural angle is the angle between the tangents to the last two whorls. The lunules are crescentic growth lines on the band.

A slit is a parallel sided opening and is indicated when the growth lines on the band are discontinuous with those on the rest of the whorl surface.

A sinus is a wide or narrow embayment without parallelism and is indicated by growth lines which curve continuously from the whorl on to the band.

~~He~~ Koninck, in a comprehensive survey, assigned about a hundred and fifty European Carboniferous species to the family.

II. History of Research on Carboniferous Species in Europe.

The earliest certain reference to a Pleurotomarioid shell is Sowerby's in 1812, when he described and figured Helix carinatus. The figure is good and readily recognisable when compared with the holotype. The same shell was used in Phillips' illustration of this species in 1836. The species was subsequently chosen by Koninck (1883) as genotype of Mourlonia. In 1817 Sowerby described and illustrated a closely related form Helix ? striatus. The Index to the Mineral Conchology, drawn up in 1835, included these two forms under the name Pleurotomaria carinata and striata.

Léveillé 1835, described and figured Trochus now Baylea yvanii.

The next contribution of importance was made by Phillips in 1836. He described about thirty species under the name Pleurotomaria, recognising that not all of them belonged there. After rejecting the obvious misplacements, twenty six species remain. Of these, P.depressa and excavata are fragmentary, but P.excavata is probably a cast of a Worthenia. P.vittata and tornatilis are synonyms of P.cirriformis Sow., and P.flammigera, although the type is lost, was probably a colour marked specimen of M.carinata. The types of P.expansa and conica are lost, but the illustrations show them to be Mourlonia. P.tumida and undulata also probably belong to this genus. P.sulcatula, sulcata and inconspicus are referable to Latischisma Thomas (1939), P.interstrialis to Phymatopleura Girty/

Girty (1939), P.atomaria to Glabrocingulum Thomas (1939), ~~P.sculpta and~~? lirata to Neilsonia Thomas (1939). P.monilifera is a Worthenia Kon. P.squamula is now placed in the genus Brookesella nov., while P.limbata and gemmulifera are referred to Luciella and Rhineoderma respectively. P.acuta is a sinistral

From the Pilton Beds, the upper part of which may be Lower Carboniferous(K), Phillips (1841) described two species -Pleurotomaria cancellata and P.aspera. The former has affinites with Glabrocingulum Thomas and the latter may be included in Worthenia.

On p.418 Portlock referred to P.cancellata Phillips, ~~but there is no species of that name in Phillips' works.~~ Both of Portlock's specimens are preserved in the Museum of Practical Geology. In the same year Koninck published a Memoir on Belgian forms, which was later, (1883) supplemented and enlarged.

Following Portlock's "Report", came the next contribution on Irish forms, by M^{c}Coy (1844). In his "Synopsis" he defined Pleurotomaria as "Trochiform, generally imperforate; whorls frequently carinated; a deep linear sinus in the middle of the right lip". He described fifteen species, four of which were Phillips'. Two are Baylea, P.canaliculata, a synonym of B.concentrica (Phill.) and P.multicarinata synonymous with B.yvanii (Lév.). The illustration of P.multicarinata is a composite one based on two specimens (see Pl. V fig. 3.). P.clathrata, filosa are fragmentary. P.decussata is probably the Mourlonia ~~Portlock's specimen of P.cancellata ? Phillips and~~/

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Portlock (1843) drew attention to a form which he called Murchisonia angulata (non M.angulata Phill.). This is, however, a synonym of Turbo tabulatus Conrad (1835) now placed in Worthenia. On p.418 Portlock referred to P.cancellata Phillips. ~~but there is no species of that name in Phillips' works.~~ Both of Portlock's specimens are preserved in the Museum of Practical Geology. In the same year Koninck published a Memoir on Belgian forms, which was later, (1883) supplemented and enlarged.

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~~and has affinities with Glabrocingulum Thomas.~~ P.hainesii is probably a synonym of M.striata (Sow.). P.griffithi is chosen as genotype of Tropidostropha by Longstaff (1912) and its relationship fully discussed.

In 1854 M'Coy described fourteen Carboniferous species. Several are redescriptions of M'Coy's earlier species. In addition he recognised P.cirriformis Sow. P.callosa Kon. angulata Kon. consobrina Kon. 1843, the last three doubtful species, for M'Coy's specimens are poor. He placed P.monilifera in synonymy with P.submonilifera d'Orb. an unsafe proceeding since d'Orbigny's description is scanty and without an illustration.

References have already been made to Armstrong, Young and Robertson (1876) in the paper on Scottish forms.

In 1881 Koninck proposed the genus Flemingia for about a dozen species of conical shells, having a trochoid appearance. He included this genus in the Trochidae, but subsequent examination has shown that about half of these shells possess a band on the undersurface and they are here placed along with Luciella and Rhineoderma, in the Pleurotomariidae. The remaining species belong to various non-banded genera. Koninck's monograph on the recognisably banded forms was issued in 1883. In it Koninck dealt with the family Haliotidae in which he grouped eleven genera of banded shells. Two of these, Murchisonia and Porcellia have since expanded to family rank. Of the nine remaining genera seven were new, Mourlonia, Gosseletia, Worthenia Baylea, Agnesia, Rhineoderma and Luciella. Most of these are useful/

useful division and need little redefinition. Some confusion exists about species placed in his Ptychomphalus and Mourlonia. Reclassification of many of these has been necessary.

Fischer (1887) summarised the characters of several Carboniferous forms and reduced most of Koninck's genera to subgeneric rank. In addition he designated genotypes where

At this date he proposed Hesperiella to receive part of Koninck's sinistral Carboniferous species, but later(1895,p.205) retracted in favour of Agnesia. Knight, believing Agnesia Koninck to be preoccupied by Agnesia Michaelsen, which in reality dates from 1898 not 1878 as stated by Knight(1937), retained the name Hesperiella. The auther followed this concept in the Scottish paper (Thomas 1939), but now considers Agnesia to be correct, with Pleurotomaria acuta as genotype.

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peculiar that it would be unwise to try to indicate its relationship. There is one new species of ~~Hesperiella~~ Agnesia called H. minor, a small shell resembling A. contraria Kon. He did not indicate any family affinities but classed these genera with Loxonema, Platyschisma, etc. in the wide group Glossophora.

Koken 1889 discussed at length genera and species which have since been removed from the family, and included in the genus many conflicting groups, such as Scalites, Pleurotomaria bicincta and coronata Ulrich & Scofield.

Subsequently Longstaff (1912) added one or two new divisions and species, Foordella, new subgenus with F.hibernica and tereticincta, new Irish forms. Trechmannia a subgenus of

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In 1889 Holzapfel described eleven Pleurotomarioid species from the Lower Carboniferous of Erdbach-Breitscheid near Herborn. ~~As Agnesia Kon. was preoccupied he proposed the name Hesperiella to replace it.~~ Three new species of Pleurotomaria were described by Holzapfel; P.lodanensis, denckmanni and duponti. The first may be a Mourlonia, the second is probably a Glabrocingulum Thomas but the illustration of duponti is so peculiar that it would be unwise to try to indicate its relationship. There is one new species of ~~Hesperiella~~ Agnesia called H. minor, a small shell resembling A.contraria Kon. He did not indicate any family affinities but classed these genera with Loxonema, Platyschisma, etc. in the wide group Glossophora.

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Mourlonia with the single species T.trochiformis. Weir in 1925 added Mourlonia monensis and Polytremani beggi.

Schmidt in 1923 (p.15$) described a new species which he called Pleurotomaria(Mourlonia) Henkei. From his description and illustration this is most probably a Semestropha, approaching S.cirriformis.

Kühne(1930) describes fifteen Pleurotomaria but adheres to the theory that all belong to the Haliotidae. He figures, among others, the familiar ?Phymatopleura variata.Kon.,Mourlonia expansa Phill. Glabrocingulum atomarium Phill. and Rhineoderma gemmulifera Kon.

III. Classification and Proposition of the Subfamily Luciellinae.

Existing classifications of the family require revision. Much of the comprehensive material included in Pleurotomariidae by Fischer's "Manuel", Zittel's "Grundzüge" and the Zittel-Eastman "Textbook" (1913,Reprinted 1927) has since been removed. The high spired Murchisonia were given family rank by Longstaff. In 1895 Koken proposed the Porcelliidae for Porcellia and its allies. The writer is not sufficiently acquainted with the Mesozoic or early Palaeozoic forms mentioned in these works to form an opinion of their position. From the work of Longstaff (1924) on Mrs.Gray's collections of Lower Palaeozoic gastropods it is inferred that she considered Ulrich and Scofield's classification of Silurian forms to be still valid. This classification leaves Lophospira, Hormotoma, Liospira, etc. in the family, but these genera do not really concern us in the present investigation.

It is now generally accepted that the genus Pleurotomarium is Mesozoic and, therefore, does not enter into modern classification of Carboniferous members. Many of the genera included in this paper were treated in the Zittel-Eastman "Textbook" (1913) as subgenera of Pleurotomaria; such as Ptychomphalus Ag.(pars) Mourlonia, Worthenia and Baylea Kon. and ~~Helicilla Holz~~. Agnesia Kon. The wide interpretation of Pleurotomarium adopted in Fischer's "Manuel" holds practically all the Carboniferous genera of European workers as well as Mesozoic and/

and early Palaeozoic genera. In addition to the five Carboniferous genera quoted above Fischer cites Gosseletina Bayle, Rhineoderma and Luciella Kon. Lately Phymatapleura Girty and Hypselentoma Weller, both based on American Pennsylvanian forms have been added to the list of Pleurotomarioid Carboniferous genera. Phanerotrema, a name widely used in American literature for certain Carboniferous shells, is dropped by the writer on the advice of J.B.Knight, Princeton. The name is based on P.labrosa Hall a species of the Silurian and Devonian. Seven new genera are proposed by the present author. Four in the earlier paper on Scottish forms (Thomas) - Glabrocingulum, comprising most of the American Phanerotrema. Latischisma, Neilsonia and Borestus. I have since realised that Borestus is a synonym of Phymatopleura Girty 1939. The other three new genera - Semestropha, Lophozone and Brookesella are proposed in the present paper. The last name covers the banded species once included under Flemingia Kon. 1881. Seme stropha includes the forms P.cirriformis Sow., P.tornatilis Kon. and Semestropha dilata sp.n. however, is created to hold a most unusual species, of which only three specimens are known. They were obtained from the Poolvash Limestone, Isle of Man. In form it resembles Tropidostropha Longstaff. It has a strongly developed spiral ornament. The band is prominent and when complete is entirely covered over by outgrowths of the keel. Tropidostropha appears to have this feature, but Longstaff, uncertain of its affinities/

affinities, included it in the Rhapistomidae. The only other known form to exhibit this feature is Mourlonia (Trechmania trochiformis Longstaff. Lopho zone is not a Mourlonia and its relationships are extremely doubtful. Provisionally it is left in the Pleurotomariidae.

Elaborate ornamentation, an uncommon feature in Palaeozoic gastropods, plays an important part in the taxonomy of the Pleurotomariidae and adds detail and variety, which have caused much confusion to earlier authors.

Subfamily Luciellinae nov.

The genera Luciella, Brookesella, ?Echinocirrus and Rhineoderma possess certain features in common which distinguish them clearly from other genera of the Pleurotomariidae. Chief among these are, the basal aspect of the band; the presence of a very short slit or more probably only a narrow sinus on the underface; the introduction of ornamental lines running forward (anteriorly) from suture to lower edge of whorl; the traversing of these by the growth increments, producing an imbricate surface. Another feature seemingly confined to the subfamily but not apparent on all its members is the peripheral undulation of the whorls. This may vary from the broad, widely spaced undulations of L.limbata to the small delicate cremulations of certain Brookesella.

All members of the group have spiral lines on the upper and lower surface, but these are not sufficiently distinctive

to/

to be of much classificatory value, except when taken in conjunction with the other characters. The same may be said for the concavo-conical shell profile a feature of Brooksella, and the comparatively broad umbilical pit of all the species.

In the early days of Phillips (1836) members of this subfamily were placed in Pleurotomaria (P.limbata, P.squamula, P.gemmulifera Phill.), while M'Coy (1844) placed Trochella prisca along with Fissurella etc. in the groups Scutibranchia and Cyclobranchia. Koninck (1881) associated T.prisca with certain high conical forms (Flemingia Kon.) in the Trochidae.

In 1883 he reviewed Phillips' species and described a new genus Luciella to receive P.limbata and squamula with some new Belgian forms, and Rhineoderma for such forms as P.gemmulifera. He recognised the significance of the basal band and placed these genera in the Pleurotomariidae.

Fischer (1887) inclined to the opinion that Flemingia belonged to the trochoid group of shells, while he placed Luciella and Rhineoderma in the Pleurotomariidae. Perner (1907) also placed Luciella in the Pleurotomariidae.

The doubtful genus Echinocirrus Ryckholt 1860 (Cirridius Kon.1881) was put in the Trochidae next to Flemingia by Koninck with the statement that E.armatus partly resembles certain Pleurotomaria of the Luciella kind such as L.eliana. The possibility of adapating the name Echinocirrus for Luciella is discussed below (p. 81.). Knight (1933) placed Flemingia/

Flemingia in synonymy with Anematina (Trochoturbinidae) but afterwards (1936) retracted.

IV. Species Groups in Certain European Carboniferous Genera.

Subdivision in the following manner of various Lower Carboniferous species in the Anglo-Belgian Province and in Scotland is suggested. The grouping is based on easily distinguishable morphological features.

GENUS PHYMATOPLEURA Girty 1939.

a) Group of P.nodosa Girty.

Coarsely built shells with height and breadth approximately equal. Tendency to formation of subsidiary keels and shouldering of the upper surface near the suture. The keels are elaborated to nodes in the type species. P.nodosa Girty, interstrialis (Phill.), insculpta and arenosa (Kon.)

Group of Phymatopleura procera Thomas.

Finely built shells, height usually greater than width. Ornament delicate, reticulate without secondary keels or nodes. P.procera, simplicita, wrighti Thomas, pagoda Newell 1935.

b) Group of Phymatopleura quadricincta (Koninck)

In the Belgian Tournaisian is found a solitary species, differing sufficiently from others of the genus to necessitate isolation. It is probably a primitive Phymatopleura. The lateral face is not distinctly developed, the upper and lower boundary edges being merely keels set back on the upper and basal aspects and equidistant from the band. Ptychomphalus quadricinctus Kon.

c)/

c) Group of Phymatopleura ? brazoensis Shumard.

This comprises three forms, a natural group, but only tentatively referred to Phymatopleura. The characters are those of P.brazoensis Shumard as emended by Girty 1939. P.brazoensis, Ptychomphalus variatus Kon. and Phymatopleura balladoolensis sp.nov.

GENUS WORTHENIA Kon.1883.

a) Group of Worthenia waageni Koninck.

Short conical shells with flattened bases. Profile interrupted slightly by projecting beaded keels with which the band coincides. A narrow groove runs immediately below the band. The base has normally a predominantly revolving ornament. W.waageni, W.munsteriana, egregia Kon., monilifera (Phill.), dunlopi Thomas, depressa sp.nov.

b) Group of Worthenia tabulata (Conrad) 1835.

Turreted shells, loosely enrolled, leaving a sharply projecting keel at about midwhorl. Band denticulate and sharp. A relatively deep and wide groove runs below the band. The surface lacks ornament. The form of the shell is unique among Carboniferous species. It is suggested that W.tabulata approaches closely to certain Lower Silurian Lophospira of the Trochonemoides section, Ulrich and Scofield (p.964), which contains three forms, L.trochonemoides and L.knoxvillensis and L.notabilis Ulr.

GENUS GOSSELETINA Bayle 1885.

a) Group of Gosseletina callosa (Kon.)

Shells with rounded whorl profiles, band smooth, on upper face of whorl. Surface very smooth, without ornament, even the growth lines are traced with difficulty. G.callosa(Kon.) and orbitosa (Kon.).

b) Group of Gosseletina portlockiana (Kon.)

Profile similar to above, but surface with strongly developed revolving ribs or costae. G.portlockiana (Kon.), tornacensis (Kon.), illusor (Kon.), scripta (Kon.).

GENUS BAYLEA Kon.1883.

The groups adopted here are two of four groups proposed by Weller (1929) for American Pennsylvanian species: Group of Baylea subconstricta Meek & Worthen and group of Baylea gurleyi Meek.

Their characters have already been described by Weller and further points concerning the European species are discussed under the appropriate headings.

GENUS LUCIELLA Kon.1883

a) Group of Luciella eliana Kon.

Squat turbinate shells or with concavo-conical profile. Base flat with band underhanging the peripheral undulation. Upper surface obliquely striated or nodiferum. L.eliana Kon. subfimbriata/

subfimbriata Kon., limbata (Phill.), prisca (M'Coy), prisca var.lenticula nov.

Group of Luciella ornatissima Kon.

The only member of this group is a small form, very much flattened, with the band upturned slightly from the basal aspect to occupy a more lateral position. The surface bears a few heavy revolving ribs, and has a tendency to formation of short spines.

V. Distribution.

The distribution of the Lower Carboniferous Pleurotomariidae in Britain and Belgium is shown in tabular form. Not all of the species included in the table are described, but their taxonomic position is indicated at appropriate places in the text. The Scottish species included here have been dealt with in the earlier paper (1939).

The majority of forms occur in the lower Dibunophyllum "reefs" of England and Isle of Man and in the Viséan of Belgium. The gastropod fauna of the lower reefs is impoverished and the earliest reported representative of Pleurotomarioid shells in Britain, come from rocks of C^1 or more likely C^2 age. These include Phillips' species, collected from Bolland (or Bowland) and Clitheroe. Bowland includes horizons from Z to E_2 but most of the gastropod material was collected from the reef limestone of upper C age (Parkinson, 1926, p.189), and some material comes from the Welton reef limestone, Staffs., which is of C^2 age. A few species are found in the Tournaisian (Z) of Belgium. Koninck reports about twenty species but many are so crushed that structure and consequently identities are difficult to establish. Phymatopleura quadricincta is an early form. Baylea is represented by B.yvanii and B.leveillei. Worthenia by two forms, W.münsteriana and egregia. Mourlonia, numerically common at all stages has six or seven species in the Tournaisian. Gosseletina and Glabrocingulum have each one representative, G.tornacensis/

G.tornacensis and G.sowerbyanus respectively. Rhineoderma radula is apparently the only Tournaisian representative of the Luciellinae.

Gosseletina and Glabrocingulum appear again in the Waulsortian reefs, Gosseletina with two species and Glabrocingulum with one. The earliest record of Brookesella comes from Drehance and Weve (Ass.III) and Pauquys (Ass.IV). It is called Flemingia carbonaria Meek & Worthen by Koninck, but it has not been possible to check the relationship. Mourlonia laevissium, subconcidea, substriata, compressa, agassizi and perstriatus are found mainly in the beds of Drehance and none of these are represented in Britain.

The Luciellinae are practically all confined to the Lower Dibunophyllum zones, although Rhineoderma gemmulifera ranges from C^2- D^2 and is one of the few Pleurotomarioids reported from S.

The Cracoe reefs and the Poolvash reefs of the Isle of Man provide abundant material. These rocks are sometimes regarded as equivalent, yet the Pleurotomarioid fauna of the Isle of Man, although offering a greater variety of most genera, lacks such forms as Mourlonia expansa (Phill.) and has few M.striata (Sow.). Both these species are plentiful in Cracoe. On the other hand, Mourlonia carinata (Sow.) with its variants gigas and turbinata is prolific in Poolvash, forming about one fourth of the Pleurotomarioid fauna, while in Cracoe it is no commoner than/

than Mourlonia striata, and does not appear to vary in form. Mourlonia conica (Phill.) is also relatively more plentiful in Isle of Man than at Cracoe. Parkinson suggests that the horizon of Cracoe is D_1 or S_2D_1, while Lewis (1930) considers the Poolvash Knolls to be D_2. Confirmation of this horizonal difference may offer a satisfactory explanation of such faunal discrepancy.

Localities with approximate Zonal Indices.

Ashford, Derbyshire. Probably Black Marble Quarry. (Ashford in the Water)	P.
Ashfell Edge, Ravenstonedale, Westmorland.	S_1.
Balladoole, Isle of Man.	D_2
Bolland (Bowland), Yorkshire.	C_1 or more probably C_2 and higher horizons.
Clitheroe — Salt Hill-Worsaw Knoll Series	$S C_2$.
Clitheroe — Copla~~q~~w Knoll Series	C
Cracoe	D_1 or possible S_2D_1
Esker House, Grassington, Yorks. Probably Stebden Knoll. (Hudson, 1933. Proc. Geol. Assoc. xlix, p.312)	Top B_2 (Top D_1)
Hammerton Hall, Slaidburn, near Clitheroe. (Longstaff, 1895. p.233)	C^2B^3
Kendal, Westmorland. ~~(Longstaff, 1895. p.233)~~ (Garwood, 1912.)	Generalised ~~D^2~~ — L. Carb. possibly up to Lower Dibunophyllum zone.
Narrowdale - wide range of Lower Carboniferous,	probably D_1
Parkhill, Longnor, Derbyshire. (Hudson, 1932. Trans. Leeds Geol. Assoc., v, p.49).	D_1
Pilsbury, Derbyshire.	D

Poolvash/

Poolvash Limestone, Isle of Man. (see Balladoole) D_2
(Lewis 1930)

Wetton, Staffs. Suggested by Professor R.G.S. Hudson in correspondance (1939) C_2?

VI. Acknowledgements.

I desire to thank Dr.J.Weir of Glasgow University for help and valuable criticism throughout the preparation of this paper, and Professor A.E.Trueman for reading the typescript and advice about text-figures.

I am indebted for loan of material to Mr.J.Begg,Glasgow, Mr.J.Wright, Edinburgh, Dr.F.W.Anderson, Scottish Survey, Edinburgh, Drs.D.Balsillie and A.C.Stephen, Royal Scottish Museum, Dr.E.Currie and Miss Allison of the Hunterian Museum, Glasgow, Dr.K.P.Oakley, British Museum, Dr.C.J.Stubblefield, Geological Survey, London, and Dr.A.G.Brighton, Sedgwick Museum.

To Professors H.P.Lewis, Aberystwyth and R.G.S.Hudson, Leeds, Drs.F.W.Cope and D.Parkinson, English Geological Survey and M.Macgregor, Scottish Survey, I am indebted for information regarding stratigraphical problems.

Dr.J.Brookes Knight, Princeton, U.S.A. has on several occasions helped me to check up preoccupation of genotype names, a service for which I am grateful.

I wish to thank Mr.A.Ferguson, Geological Department, Glasgow University, for the care taken with the photographic illustrations. Additional photographs have been supplied by the courtesy of British Museum, National Museum of Ireland, and Natural History Museum, Brussels, and to these authorities I tender my thanks.

This research has been made possible by the generosity of the Carnegie Trust.

VII. Description of Species.

Family Pleurotomariidae.

Genus Mourlonia Koninck 1883

A short discussion of the genus was given in a previous paper (Thomas, 1939). Further information, especially on the character of the band, is now added.

The group is a large one with over twentyfive species in the Lower Carboniferous of Belgium. Many of these are common to Britain. Only sixteen of Koninck's Mourlonia belong to that genus, while approximately eight of his species of Ptychomphalus are Mourlonia. In addition to those described here is a list of Belgian forms. One of the most interesting and characteristic features of many members of the group is the exaggerated development of the keels which limit the slit bands. Unfortunately, these fragile, plate like extensions are rarely present in the fossil. Some British material in an excellent state of preservation, collected from the Cracoe Knolls, affords an opportunity for study of this feature.

There is a gradation in prominence of the keels from Mourlonia (Trechmannia) Longstaff in which the band is completely enclosed to M.carinata and gigas Kon. where the keels are delicate and short. Longstaff (1912) proposed Trechmannia with its distinctive band, as a subgenus of Mourlonia. A new species/

species, M.angulata, bears on the band very thick, blunted keel stumps, which no doubt indicate substantial outgrowths. Several examples of M.striata have short intervals of the slit area preserved, where the muddy matrix has oozed through the slit, supporting the delicate keels and keeping them intact. The actual surface band-deposition is relatively wider than in M.angulata, extending nearer to the roots of keel (text-fig. 4.). The upper keel extends horizontally for a short distance (about 1 mm.) while the lower is directed upwards and outwards at about 45 degrees to the horizontal. When complete and at their greatest extension there is a gap between the keels of about half the width of the band. Longstaff (1912) suggests that well preserved specimens of M.conica Kon. might reveal extended keels, and if so, the species should be referred to the subgenus Trechmannia. One of the forms examined shows a slight, irregular extension of a small part of the lower keel. The width of the band in this species is relatively less than in other Mourlonia , and the concentric growth threads are sometimes asymmetrical, the lower (anterior) limbs being longer than the upper. A possible explanation is that the higher part of the band is deposited beneath the basal surface of the upper keel (text-fig. 3.). M.expansa (Phill.) has still shorter and more delicate outgrowths than Mourlonia conica and the lower keel is stronger than the upper one (text-fig. 2) The feeblest carinal development occurs in M.carinata and

gigas/

DIAGRAMS SHOWING RELATIONSHIPS OF BAND AND KEELS IN MOURLONIA.

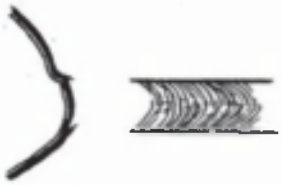

FIG. 1.

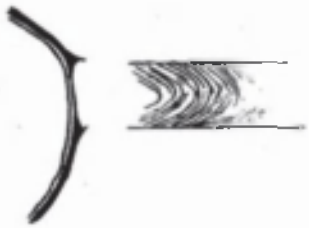

FIG. 2.

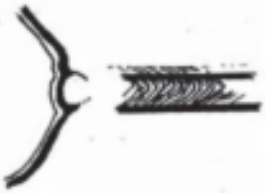

FIG. 3.

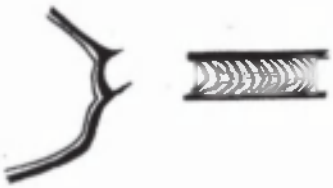

FIG. 4.

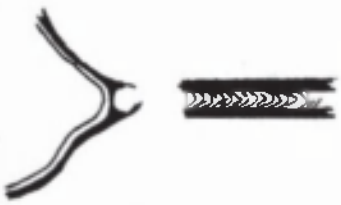

FIG. 5.

FIG. 6.

Explanation of Text figures

Fig.1. Mourlonia carinata (Sow.). Comparatively broad band raised slightly from shell surface and limited by narrow, low keels.

Fig.2. Mourlonia expansa (Phill.). Broad band lying flat on shell surface. Slender keels.

Fig.3. Mourlonia conica (Phill.). The band is narrow and concave with thin keels. The apparent asymmetry of the growth lunules occasionly found in this species is possibly due to the overlapping of the upper keel surface over the band as suggested in the figure.

Fig.4. Mourlonia striata (Sow.). A band of moderate width, concave, showing greater development of keels.

Fig.5. Mourlonia angulata sp.n. Very angular periphery and thick blunt keel bases, which may have been produced as indicated in the profile.

Fig.6. Trechmannia trochiformis Longstaff. Band is completely protected by production of the carinae.

gigas Kon. where they are almost non existent (text-fig. 1)

Accompanying the band on forms where the keels are most prominent are two sulci of varying depth, one above and one below the band. They are comparatively deep on Trechmannia and hardly perceptible on M.expansa, carinata and gigas.

Ulrich and Scofield (1897,p.955) say of the genus ".....the principal peculiarity of Mourlonia, when compared with true Pleurotomariidae, lies in the excessive development of the boundary plates of the slit band. This particular feature reminds one of Euomphalopterus Roemer..... Despite the resemblances we are firmly convinced that the genesis of the two types is quite different." Longstaff points out that Trechmannia "is distinguished from Euomphalopterus not only by the character of the lunules, but also by the keel being less prominent and being situated higher on the whorls," There is little doubt that the development of the keels in Mourlonia was an trend , culminating in Trechmannia, aiming at the protection of the delicate organs near the slit. Yet this protection does not seem to have been essential, for the most vigorous and prolific species of Mourlonia were those with least slit protection, such as M.carinata, gigas and conica. As the slit became filled up the keels were no longer necessary and probably chipped off during the lifetime of the animal. Several excellent specimens of M.striata illustrate this, for where the slit is preserved so also are the keels, but only

the/

the worn stumps are found on the band. In extreme examples such as Trechmannia and Tropidostropha Longstaff (the latter placed in Raphistomidae by Longstaff 1912,p.295) where the keels unite and the interspace is partly filled up, the resulting angularity is strong enough to withstand buffetings and is in greater part retained.

Mourlonia (Trechmannia) trochiformis, M.conica, M.angulata and M.striata tend to develop height, prominent ornament (with the exception of M.conica) and extended keels. The growth lines below the band are sinuous (in contrast to the straight basal growth lines of the carinata group), and the colour markings are relatively broad bands uncomplicated by zigzags These species appear to be more closely related to each other than to members of the carinata group.

The group of M.carinata includes such forms as M.carinata var.gigas and var.turbinata and M.expansa.

Mourlonia carinata (Sow.) and its nearest relatives exhibit variation in several features. They show every intermediate stage between the squat and perforate M.carinata to the much more acutely spired M.gigas (Kon.), in which the coiling is sometimes too close to allow for an umbilical passage. A gradual decrease in the width of the apical angle from neanic to ephebic stages is noticeable in the more depressed forms and there is a corresponding increase in the width of the apical angle in the high spired shells. Intermediate forms have a constant apical angle throughout their/

their growth.

Sculpture and ornament, when it is preserved, impart further possibilities of variation to the group. The regular transverse costae may be entirely fine as in M.gigas but often in addition there are very delicate spiral grooves which run profusely on whorl and band. In the depressed forms the normal fine transverse costae are often replaced by relatively coarser ones, which do not, however, attain the thickness of the costae on M.striata (Sow). Shells showing the coarser ornament are only half the size of full grown M.carinata. These possibly represent a distinct variety as none of the larger shells are coarsely sculptured nor do they exhibit a coarse phase in growth.

The colour marking runs obliquely across the transverse sculpture from suture to band, and has a zig-zag pattern. It is most easily seen on the upper surface of the whorl, and on the band, after which it becomes diffused and sometimes entirely disappears.

Unfortunately the holotypes of M.conica and expansa are missing. Excellently preserved specimens from Cracoe may serve as examples, the characters of the species being well established by the original figures.

The following is a list of species variously classed as Ptychomphalus and Mourlonia Kon.; Pleurotomaria Phill. and M'Coy, and Helix Sow. which are considered as true Mourlonia .

Helix/

Helix carinata Sow. (syn.Pleurotomaria carinata Phill., P.flammigera Phill., P.carinata M'Coy, Mourlonia carinata Kon., P.gigas Kon.), Helix ? striata Sow. (syn.Pleurotomaria hainesi M'Coy, Ptychomphalus hainesi Kon.)

P.conica Phill. (syn.P.conica M'Coy, P.decussata M'Coy, Ptychomphalus galaeottianus Kon., Mourlonia conica Kon.), P.expansa Phill. (syn.M.expansa Kon.), P.tumida Phill., P.sculpta Phill.

Ptychomphalus agassizi, perstriatus, conimorphus, coniformis, fimbriata, naticoides all of Koninck.

Mourlonia fascinans, cominorpha, laevissima, subconoidea, substriata, compressa, pulchra, elegantissima, laevis, placida, exarata, decipiens all of Koninck.

Trochmannia trochiformis Longstaff.

Mourlonia carinata (Sowerby 1812)

Pl.I fig. a-c text-fig. 1.

Helix carinatus Sowerby, 1812,p.34.Fig.10 upper, & lower figures.

Pleurotomaria carinata J.Sowerby,1834,Alphab.Index,p.8.

" " Phillips,1836,p.226,pl.xv,fig.1.

" flammigera Phillips,1836,p.226,pl.xv,fig.2.

" carinata Koninck,1843,p.397,pl.xxxi,fig.1.

" " M'Coy,1844,p.39.

Mourlonia carinata Koninck,1883,p.77,pl.XXXIIIbis.,figs.4,5.

Holotype. P.G.138. British Museum (Nat.Hist.), Settle,Yorks. P.G.140. Figured in Min.Conch.vii,pl.640,fig.3.

Description/

Description. A comparatively large shell, attaining a width of 5 cms. Height approximately equal to width. Aperture wider than high. Six or seven rapidly expanding whorls which become progressively flatter until the adult stage is attained. The mature whorls have slight shouldering at the suture. Base convex. The nepionic shell has an extremely wide apical angle of about 140 degs. and the pleural angle (angle between the tangents to the last two whorls) is reduced to 100 degs. Band of moderate width, 2.75 mm, flat, raised slightly above the surface of the whorl, the lower edge of the band usually coincides with the periphery of the whorl. It is sometimes completely exposed on the spire but often only the upper half is visible. Slit very long, about half the circumference of the last whorl. Delicate concrescent lines run obliquely at an angle of 45 degs. to the band, below which they run vertically to the axial region. On the more finely preserved specimens innumerable spiral grooves intersect the normal ornament. They are especially noticeable on the lower surface and a few traverse the surface of the band. The colour markings consist of dark brown zig-zag lines which tinge the band in crossing it. The figured specimen is beautifully marked and in addition to the zig-zags, growth lines at regular but narrow intervals are darkened along their length. They continue over the band and across the base.

Remarks. Sowerby's figures on Pl.10 are excellent

reproductions/

reproductions of the type and the outline illustration in Vol.VII,pl.640,fig.3 depicts the tendency to spiral grooving. Several grooves are seen passing along the band and innumeral lines ornament the upper and lower faces of the whorl. From this species, which occurs frequently in the I.O.M., there is a contemporary graduated series of forms leading to the high spired variety M.gigas (Kon.). The change is brought about by gradual increase in the relative proportion of height to width, narrowing of the umbilical passage and by changes in the apical angle. The variation of shell form is figured Pl.IV figs. 6-8.

Pleurotomaria flammigera Phillips shows from his sketch on Pl.XV fig.2 the zig-zag characteristic ornament . The holotype is apparently missing but there seems little doubt that the shell was conspecific with his M.carinata. It is doubtful whether M'Coy's shell is really synonymous. There is no illustration by which to check the description, which mentions among other things, a broad smooth band. The rest of the description is applicable. M.carinata Kon. is probably an example of the intermediate forms, in a position between the two variants described below, carinata var.gigas and var. turbinata. The shell is relatively higher, the whorls more tumid than in turbinata and the umbilicus is narrow.

The only record of M.carinata from Scotland is in a list by Armstrong, Young and Robertson (1876,p.57). Horizons and Localities C^2- D^2. Bolland; Park Hill, Longnor/

Longnor, Derbyshire; Cracoe; Isle of Man; Visé, Belgium.

Mourlonia carinata (Sow.) var. gigas (Koninck)

Pl. IV fig. 5,7.

Ptychomphalus gigas Kon., 1883, p.33, pl. XXII, figs 23-26, and pl. XXIIIbis, 1-3.

Holotype. No.941 Coll. de Koninck. Mus.Roy.d'Hist.Nat. de Belgique. Visé, Belgium.

Description. The specimen figured is from the Wright collection and is 6.5 cm.high and 5.5 cm.wide. There are eight or nine whorls which expand regularly in growth. Whorl surface slightly tumid. Base convex.

Band is almost peripheral, in some cases situated a little above midwhorl, narrow, flat and bounded by two thin keels.

Inner lip thin and partly reflected. Outer lip and slit as in M.carinata.

Ornament of fine oblique lines on upper surface of whorls, turning forward on the band and running vertically to the base.

Remarks. The species is removed from Ptychomphalus Kon. for reason given in a previous paper (Thomas 1939). The shell is too closely related to M.carinata to be specifically distinct. Contemporary intermediate forms are found linking the variety to M.carinata s.stricto and to the depressed variety, M.carinata var.turbinata. Var.gigas is higher than M.carinata/

M.carinata s.stricto, has a smaller apical angle and more convex whorl surfaces. The umbilical passage is much narrower and the shell attains greater dimensions (A specimen in Mr.Wright's collection is almost 10 cm. wide).

Both M.carinata and var.gigas are relatively shorter than M.conica and have a flat band in contrast to a narrow concave band in M.conica.

Horizons and Localities. D^2. This tall derivitive of the carinata group has only been found in Poolvash Limestone, Isle of Man and in Visé, Belgium.

Mourlonia carinata var.turbinata nov.
Pl.II Fig,4,Pl.IV Fig.8

Holotype. J.S.6758. Geological Survey, Edinburgh. Poolvash Limestone, Isle of Man.

Paratypes. J.S. 6733, 6760, 6764, 6766, 6768, 6783, Geological Survey, Edinburgh.

Description. Height 2 cm.; width 2.7 cm. Apical angle 105 degs., becoming smaller as growth proceeds.

Ornament similar to that of M.carinata s.stricto, but occasionally a little coarser. Umbilical passage open from base to apex.

Remarks. The height is roughly three fourths of the width, while height and width are about equal in var.gigas. Forms of intermediate height link these two forms to each other and to M.carinata. The umbilical passage is widest in var. turbinata.

Horizons/

Horizons and Localities. D^2. Isle of Man.

Mourlonia striata (Sowerby)

Pl.II figs.2a-b,3,5; Pl.IV fig.2; Text-fig.4.

Helix ? striatus Sowerby, 1817,p.159,pl.CLXXI,fig.1.

Pleurotomaria striata J.Sowerby,1834,Alphab.Index p.9.

" " Phillips,1836,p.226.

Ptychomphalus striatus Agassiz,1838,p.222,pl.CXV(CLXXI) figs.1-3.

Pleurotomaria hainesi M'Coy,1844,p.41,pl.III,fig.8.

Pleurotomaria striata M'Coy,1855,p.529.

Ptychomphalus striatus Koninck,1883,p.32, pl.XXII, figs 19-22.

Ptychomphalus striata Bayle,1885,(see Fischer,p.850).

Holotype. PG.141 British Museum (Nat.Hist.), Carboniferous Limestone, Derbyshire.

Description. The description given to the dwarfed Scottish specimen in a previous paper (Thomas, 1939) here emended.

Shell of six to seven whorls, which are convex in the earlier stages but become flattened above in the adult.

Base convex. Band strong prominent, defined on each side by a sharp raised thread, the remains of a thin projecting keel. Lower edge of the band coinciding with the periphery of the shell. Immediately above and below the band is a shallow spiral groove. No.67370 Gilbertson Collection, British Museum,has a small part of the slit and keel entire. The upper keel projects a little and follows the curve of the upper spiral groove. The lower one projects upwards and outwards/

outwards well above the midline of the slit. On both keels the growth lines become doubly numerous and more delicate thinning out to the edges in semicircular curves. Growth lines on the upper surface of the whorl very oblique and curved, leaving the suture at about 60 deg. and impinging on the inner edge of the upper keel at 40 deg. The lines on the base have a wide backward sinuosity but become increasingly oblique near the aperture of the mature specimens.

The peristome, judging by the growth lines, appears to have been oblique above, less oblique below but with a wide curve midway to the axis and at the angulation a parallel edged slit which was abnormally long - almost half the circumference is indicated in some specimens. Lunules strong and regular. Colour markings are elongate patches of dark brown stretching a little way forwards and fading out, reappearing near the keel with a reversed direction, pass over the band and are lost on the base. The markings are much paler on the early whorls.

Remarks. The holotype is a young specimen, and the upper surface is more convex than in the mature shells. Several paratypes in the same collection are fully developed but are not so delicately preserved as to show the keels entire. Some of the best specimens of this species are in the series 67363-70 Garwood Collection, Geological Survey Museum, collected from the Cracoe Reef Knolls, ~~B2~~? Ptychomphalus striatus ~~de~~ Koninck (Assise VI) has rather finer striations

than/

than the British specimen. The only specimen I have seen from the Poolvash Limestone, D^2, Isle of Man, differs from the Cracoe example in having more tumid upper slopes and a flatter band (138 J.Wright Coll.). P.hainesii M'Coy most probably is a flatter variant of this species. The holotype is badly preserved, only a small section of ornament being visible (pl. II fig. 5).

Horizons and Localities. ?C^2- ~~D^2~~ Millstone Grit Series. Bolland; Cracoe; Isle of Man; Visé, Belgium; Garngad Road, Glasgow, Scotland.

Mourlonia conica (Phillips)

Pl. II fig.1a-d ext-fig.3.

Pleurotomaria conica Phillips 1836,p.22,pl.XV,fig.22.

" " M'Coy,1844,p.40.

" decussata M'Coy,1844,p.40,pl.V,fig.13.

" conica M'Coy,1855,p.526.

Mourlonia conica Koninck, 1883,p.88.

Ptychomphalus galeattianus Koninck 1883,p.37,pl.XXIV,figs.15-19, ? pl.XXV, figs.45 & 46.

Holotype. Missing.

Neotype. No.67349, Garwood Collection, Geological Survey Museum. Cracoe "Reef" Knolls.

Description. The specimen may attain a height of 4.5 cm. (according to Koninck) but the largest Isle of Man specimen measures 3.5 cm. with a width of 3.2 cm. The neotype is a finely preserved shell showing part of the slit. It has nine or/

or ten regularly enlarging whorls. The apical angle of the neanic whorls is narrow, 50 degs. but increasing regularly in width at every turn until the mature condition is attained, giving a pleural angle (angle between the tangent to the last two whorls) of approximately 80 degs. The neotype has a slightly narrower pleural angle. Progressive widening of the angle of coiling, and flattening and widening of the older whorls produces a shell with a concave profile and an average apical angle (apical angle over all) varying from 65 to 70 degs.

Band narrow, bounded by a thick keel on its upper and lower edges, the lower keel coinciding on the periphery of the whorl. Compared to the width of the band the keels are relatively thick and project slightly above the whorl surface making the band appear concave. The growth lunules are not easily observed but where visible are very delicately formed, deeply recurved and regularly spaced. A few shells have a narrow inconspicuous groove running just below and adjacent to the band.

Base is tumid below the band for a short distance, then flattens out toward the axial region. Umbilical passage narrow. Inner lip slightly bevelled. Outer lip thin, the slit extending backwards for about half the circumference of the last whorl.

The surface of the whorls ornamented with a succession of obliquely curving regularly spaced transverse lines, slightly flexuous on the base and not so deeply etched as

those/

those on the upper surface; tendency to spiral grooving apparent on base. Colour markings less evident on the Isle of Man examples than on the Cracoe specimen, but the neotype has most surface details preserved. The dark pigment occupies broad curved patches from suture to periphery. Band is uniformly dark above its length.

Remarks. The third and fourth keels mentioned by early writers such as M'Coy must refer to the plicated edge of the accessory groove which sometimes formed above or below the band. P.decussata M'Coy developed spiral grooves to such an extent that M'Coy (1844) thought the form to be specifically distinct from M.conica, but after seeing some Isle of Man shells with "traces of the spiral striae on some parts of the surface, and not on other parts", he ventured (1855) to unite the forms as varieties.

M.conica Kon. is very slightly shorter than the neotype. Ptychomphalus galaeottianus Kon. figured by him on Pl.XXIV, figs.15-19 is conspecific with Mourlonia conica. The shells of P.galaeottianus are small with an acute apical angle (about 50 degs.). The band is bounded by two comparatively thick keels, under the lower of which is a narrow groove. Those figured on Pl.XXV,figs.45,46 and labelled "var." on the original label are probably specifically distinct from M.conica. They are small with a narrow apical angle an exaggeration of the state normally found in M.conica. The spire is more loosely coiled than the latter named leaving the/

the band and a much wider part of the base visible. The whorls also are more tumid and the striation on the upper and lower surfaces are of equal prominence (striations are usually finer on the base than the upper face in most Mourlonia). Specimens such as these have not yet been reported from England or Isle of Man "reefs".

Neilsonia acuminata Thomas 1939 is high spired and bears an ornament of transverse threads, but is distinguished by relatively smaller size, flattened base with subsinal groove, band enrolled to lower edge and bearing upon its surface sharply marked lunules less deeply recurved than in M.conica. The boundary keels also are very thin and sharp, while the transverse threads on its surface are relatively much thicker above, fading out towards the band.

M.decipiens Kon.1883,p.91, is probably an extremely acute variety of M.conica. Ptychomphalus conimorphus Kon. 1883,p.36, has a more tumid base. Both P.galaeottianus and conimorphus are more properly considered as Mourlonia.

Horizons and Localities. C^2 - D^2. Bolland; Wetton, Staffs.; Esher Ho., Grassington,Yorkshire; Cracoe; Isle of Man; Visé,Belgium.

Mourlonia angulata sp.nov.

Pl.VII fig.3a,b,text-fig.5.

Holotype. 67350. Garwood Collection, Geological Survey Museum. Cracoe "Reef" Knolls.

Paratype. 25520, 25522, Carrington Collection, Geological Survey Museum. B.G. 7216, James Begg Collection.

Description. Conical, flat-based, of eight or nine regularly expanding whorls, which are at first slightly convex above and below but rapidly flatten. Peripheral angle, which carries the band, sharp. Band narrow, bounded by the thick remains of two keels which together take up about two thirds of the band space. Although the complete keels have not been observed it is supposed, from the thickness of their remains, that they were considerably produced, lunules (where observed) delicate and regularly spaced. Immediately below the band which forms its upper edge lies a shallow, comparatively wide groove. Length of slit unknown. Umbilical passage narrow. Growth lines on the upper surface gently curved and oblique, approaching the band at about 45 degs. On the base they follow a wide but shallow curve in the aperture.

Remarks. This species may be confused with M.conica but is distinguished by having its whorls flattened above and below to give a prominent periphery, and the groove below the band is more developed. The remains of the bounding keels are thicker and clumsier than in M.conica. It is probable that the two species are closely related and developed fairly

rapidly/

rapidly in the Lower Carboniferous from a common ancestor. The number of whorls, apical angle, form of aperture and colour markings are similar in both species: Ptychomphalus conformis Kon. is closely related to Mourlonia conica, having straight sided whorls and flattened base. The groove below the band, however, is narrower, the apical angle smaller and the whorls more loosely coiled than in M.angulata. The apical angle, too, is smaller.

Horizons and Localities. D^1-D^2. Cracoe; Park Hill, Longnor, Derbyshire; Esker Ho., Grassington, Yorks.; Isle of Man.

Mourlonia expansa (Phillips)

Pl.IV fig.3abc4.text-fig.2.

Pleurotomaria expansa Phillips 1836, p.226, pl.xv, fig.4.

The holotype is missing.

Neotype. No.67359 Garwood Collection, Geological Survey Museum.

Description. A lenticular shell of five whorls, depressed and flattened above. Base convex, especially below the band. Last whorl loosely coiled, dipping anteriorly. Inner lip short and slightly reflected and there may have been a narrow umbilical passage. Band of moderate width, flat and situated peripherally. Bounding keels thin and were produced but slightly during the lifetime of the animal. Slit extends backwards for almost half the circumference of the last whorl. Aperture, from the growth lines oblique, with slight forward curve in the upper half.

Growth/

Growth lines fine, regular, oblique and curved as in previous species. They continue below the band, obliquely incurved to the axial region. The colour markings are irregular and blotchy but with a tendency to follow the curve of the growth line.

The neotype is a mature shell with an anterior drop in the suture line. About one third of a turn is broken away, but sufficient remains to show the parallel edges of the slit. The colour markings are shown on another example (No.6042 Garwood Coll.)

Remarks. Mourlonia expansa Kon. is not conspecific with M.expansa Phill., for the ornament is predominantly spiral and the upper surface is not so flat. M.compressa Kon.is distinguished by an almost equal convexity of upper and lower surfaces.

M.expansa Phill. was probably derived from the same root as M.carinata. In both the basal growth lines are uncurved, although in M.expansa they run obliquely to the axis, while those of M.carinata are vertical; the band is of moderate width and the bounding keels are thin and short. In colour pattern M.expansa is nearer to M.carinata than to the group of M.striata and M.conica. It may be suggested that the ancestral form had rounded whorls, slightly angular at the periphery, an almost equal convexity of upper and lower surfaces, and a simple flat band with no projecting keels. M.expansa could have been derived from such a form by compression and flattening of the upper surface.

At the upper posterior part of the peristome, a portion of/

of the inner surface is exposed, and bears a series of spiral grooves separated by broad topped ridges, each having a narrow groove along its summit (Pl.IV fig.3c.). Six are exposed reaching to the middle of the upper face and it is probable that another six traverse the concealed peripheral half of the same whorl. This feature has not been observed previously on any Mourlonia or other Pleurotomarid and its function is unknown.

Horizons and Localities. ?C^2- D^2. Bolland; Wetton, Staffs.; Cracoe.

Phymatopleura Girty

Orestes Girty,1911,p.136.

Phymatopleura Girty, 1939,p.31.

Borestus Thomas, 1939,p.35

Genotype. Orestes nodosus Girty.

Shells of this genus are generally conical with gently convex or almost flat bases. Whorls divided into three distinct areas, upper, lateral and basal. Band situated on lateral face. Ornament of spiral and transverse lines, sometimes nodiferous.

Girty proposed the name Orestes for certain Pleurotomarioid shells of the American Pennsylvanian, but Knight (1937) pointed out that it was an homonym and Dr.Girty in 1939 replaced it with the name Phymatopleura. After study of Girty's later paper (Jan.1939)/

(Jan.1939) it is considered desirable to place the British and Belgian forms previously described as Borestus (Thomas, 1939), in the genus Phymatopleura. Altogether seven European Lower Carboniferous forms can be included here. Three of these, quadricincta (Kon.), insculpta (Kon.), arenosa (Kon.) are apparently confined to Belgium, P. quadricincta being a primitive form from the Tournaisian. P.interstrialis (similis Kon.) is common to both England and Belgium; P. simplicila .n. to England and Isle of Man, while P.procera Thomas is found in the Northumberland district and P.wrighti Thomas in the Scottish Province.

American Pennsylvanian representatives are few. Girty adds Pleurotomaria brazoensis Shumard to the genus but the photograph of this species (1939) shows an evenly conical shell with an underdeveloped lateral face and a flattened base with spirals which increase in size near the axis. A resorbed area on the base near the aperture is claimed as a link between it and P.nodosa, but a resorbed area is a fairly common feature in many gastropod species and is not considered of much importance. A species resembling P.brazoensis Shumard is found in the Isle of Man, P.balladoolensis sp.nov. and another in Belgium. Ptychomphalus variatus Kon.

The shell profiles, and basal aspects are very much akin, while the position of the narrow beaded band at the whorl periphery, bounded by thin insignificant threads suggest the desirability of linking these three species. Provisionally they are retained in Phymatopleura, but may later be given

separate/

Registrar's office gives title of this thesis as :- "Carboniferous limestone foraminiferida."

11/9/40.

Roll of Maps in Flat case

separate generic or subgeneric rank.

Phymatopleura interstrialis (Phillips)

Pl. VIII fig.6a-c.

Pleurotomaria interstrialis Phillips,1836,p.227,pl.xv,fig.10.

Ptychomphalus similis Koninck,1863,p.53,pl.xxv,fig.4,5,6.

Holotype. G.137. Gilbertson Collection, British Museum (Nat. Hist.). Bolland,Yorkshire.

Description. Small shell of about six angular whorls, conical, outline broken by projecting keels. Each whorl is tripartite, consisting of an upper flat or concave face, a lateral vertical and slightly concave face and the base, which is almost flat. Whorls enrolled so that the suture coincides with the lower edge of the lateral face. Two crenulated keels limit the vertical lateral face, one on each side. Between them, occupying most of the face and limited by two plain threads, lies the band. Length of slit unknown but probably short; inner lip short and recurved.

Ornament predominantly spiral and certain of the threads on the upper surface grow stronger than others forming subsidiary keels (cf.Pl.VIIIfig. 6a.). Growth lines clearly developed, slightly oblique and curved on the upper face. They pass over the upper keel with a backward trend, forming recurved lunules on the band and sweep forward again over the lower edge to spread across the base in a wide backward curve.

Remarks. Phillips' original description states "Aperture nearly/

nearly round; base convex, spirally striated; spire conical, acute; body whorl tricarinate, two or three striae between the keels; longitudinal fimbriated striae".

His reference to a rounded aperture would only be true of the inner surface of the peristome for the outer profile is of course quadrangular owing to the presence of the lateral face. The internal case, however, is rounded and the shell wall is appropriately thickened where the keels are formed. The base, even in the holotype, is but slightly convex. The "tricarinate body whorl" describes the two bounding keels of the lateral face and a subsidiary keel on the upper face made by an overdeveloped spiral. Normally only two threads appear between the keels, these [illegible] limiting the band, but occasionally other faint spiral threads traverse the whole lateral face.

Ptychomphalus similis Kon. is merely a variety, with an exaggerated development of subsidiary keels on the upper face. The base has a slightly greater convexity. P.interstrialis Kon. non.Phill. does not belong to this genus, but is a typical Glabrocingulum, closely related to G.atomarium (Phill.). Phymatopleura wrighti (Borestus wrighti Thomas) is distinguished by a comparatively shorter upper face, lying at a gentler angle. The upper face is an almost smooth slope bearing regularly developed spirals, in contrast to the coarsely spiral upper surface of P.interstrialis.

From P.procera Thomas, P.interstrialis is distinguished by having fewer whorls, less acute apical angle and by the greater/

greater proportion of lateral face to upper face, and from P.simplicita by coarser development of spirals and a wider apical angle.

This form and P.insculpta (Kon.) come nearest in profile and general proportions to the genotype, which is, however, distinguished by the development of nodes on the upper subsidiary keel.

Horizons and Localities. ?C^2-D. Bolland and Visé, Belgium.

Phymatopleura simplicita sp.nov.

Pl. VIII fig. 3a-b.

Holotype. No.1104. James Wright Collection. Poolvash Limestone, Isle of Man.

Paratypes. BG.7248,7326, J.Begg Collection; 60432-33 Geological Survey Collection, London.

Description. A small, compactly built shell of about six whorls. Conical profile interrupted by the later faces. Base only slightly convex. The inner lip is short, straight, smooth, slightly reflected and bearing a faint longitudinal groove on its surface. Minutely phaneromphalus base.

Ornament mainly spiral, but comparatively coarse nodes appear where growth lines intersect. Upper and lower edges of the lateral face are crenulated.

Remarks. Although the relative width and position of the band are similar to P.wrighti, simplicita differs in having steeper upper faces and a smaller apical angle, 68° (75° in P.wrighti).

P.simplicita/

P.simplicita is shorter than P.procera, has fewer whorls with more steeply sloping upper faces.

Horizons and Localities. D^1- D^2. Parkhill, Longnor, Derbyshire; Isle of Man.

Phymatopleura ? balladoolensis sp.nov.

Pl. VIII fig. 8a-b.

Holotype. J.S 6915, Geological Survey, Edinburgh. Poolvash Limestone, Isle of Man.

Description. A small conical shell with flat base. Sutures shallow, giving an unbroken conical profile. Each whorl embraces the preceding as far as base of the band. Band of moderate width, bounded by two insignificant crenulated threads and bearing on its surface two beaded spirals. It is situated peripherally, lying flat on the upper face, its lower edge coinciding with the latero-basal angle. The inner lip is short, curved and reflected. Character of the outer lip and length of slit unknown.

Ornament predominantly spiral, seven threads occurring between suture and upper edge of band, and thirteen spirals cover the base becoming coarser near the axis. Growth threads sweep obliquely back on the upper face forming strong regular nodes where they intersect the spirals; on the base they pursue a shallow backward curve, nodes arising again at intersections with the spiral ornament. These nodes are larger near the axial region.

Remarks/

Remarks. P.balladoolensis resembles the Pennsylvanian P.brazoensis in form, general proportions, pattern of ornament, coarsening of nodes on the base near the axis, resorbed basal area and a nodiferus band situated low down near the periphery. The most distinctive departures are the possession of two beaded spirals on the band in the many species and the absence of strong crenulations at the suture. P.balladoolensis probably foreshadowed the Pennsylvanian P.brazoensis, for there has been little change of form, only the addition of sutural ornamentation and the reduction from two threads to one on the band.

Ptychomphalus variatus Kon. is distinguished by having but one row of beads on its band and a wider apical angle (see Pl.VIII fig.7.). On the base where the outer lip encroaches is a smooth area with less prominent nodes. From an analogy with P.brazoensis it is suggested that this is a resorbed area.

Horizon and Localities. D^2. Balladoole, Isle of Man.

Genus Semestropha nov.

Helix? Sowerby, 1817 (pars)

Pleurotomaria Phillips, 1836 (Pars)

Cirrus Agassiz, 1838 (pars)

Pleurotomaria Koninck, 1843 (pars)

Mourlonia Koninck, 1883 (pars)

Ptychomphalus Koninck, 1883 (pars)

Latischisma Thomas, 1939 (pars)

Genotype. Semestropha cirriformis (Sow.) 1817.

Description. Shell composed of simple, rounded whorls; expanding regularly. Band broad, bounded by grooves or threads. Aperture rounded, umbilical passage of varying width. Inner lip curved, smooth and reflected slightly. Outer lip thin, with parallel sided slit extending backwards about one sixth of the circumference.

Ornament predominantly spiral with two or three spiral grooves on the base.

Growth lines on upper surface of whorl curve in a wide arc from suture to band, but are not oblique. Below the band they make a shallow curve to the first basal groove then turn straight to the axial region with a slightly forward inclination.

Remarks. Only two species are known. They resemble each other fairly closely and have caused much confusion in interpretation. The genotype is widespread, occurring in the "reef" facies of England and Belgium and in the Scottish Province.

The genus is not easily confused except perhaps with S.gyrostoma next described. They are distinguished by the form of the inner lip, breadth of band and direction of the growth lines.

From Latischisma, into which cirriformis was provisionally placed, it is distinguished by possessing a comparatively broader and less globular outline, by looser coiling of the whorls/

whorls and in the direction of its growth lines. It is far removed from Mourlonia though placed in that genus by Koninck, along with several other unrelated forms.

Whether much value can be placed on the basal grooves is not yet known. The two known members of the genus possess them and have their basal growth lines deflected forwards by the outermost of the grooves.

The strength of the spiral ornament is variable. On some specimens it is strongly developed, but others have a comparatively smooth surface.

Semestropha cirriformis (Sowerby)
Pl.III fig.3a-b. 7a-b.

Helix ? cirriformis Sowerby, 1817,p.160,pl.CLXXI,fig.2.

Pleurotomaria cirriformis J.Sowerby, 1835, Alph.Index p.8.

" tornatilis Phillips, 1836,p.228,pl.XV,fig.25.

" vittata ? Phillips, 1836,p.228,pl.XV,fig.24.

Cirrus cirriformis Agassiz, 1838,p.222,pl.CXV,figs.4 & 5.

Pleurotomaria tornatilis Koninck,1843,p.376,pl.XXXI,fig.4.

" cirriformis Koninck,1851,Supplement,p.687,pl.LVIII,fig.8.

" " M'Coy,1955,p.526,non M'Coy 1844.

Mourlonia " Koninck,1883,p.95,pl.XXIV,figs.4-6.

Latischisma tornatilis Thomas, 1939,p.62, pl.III, fig.5.

Holotype. No.43637. British Museum (Nat.Hist.). Carboniferous Limestone, Derbyshire.

Description. A shell of six to seven whorls rounded at all stages. Convexity of upper face and base of whorl almost equal. Band broad, flat, following the curve of the whorl surface/

surface, bounded above and below by grooves.

The shell is enrolled so that the lower edge of the band coincides with the suture. Aperture rounded, and a little broader than high. Inner lip short, curved, smooth and slightly reflected. Outer lip thin, curving smoothly into the base posteriorly and joining the inner lip without a break. Slit (not preserved in the holotype) parallel-edged and about one sixth of the circumference of the body whorl in length. Shell clearly phaneromphalus.

On the base at regular intervals, occur three grooves, broader and deeper than the interspiral grooves. The growth lines on the upper face make wide arcs from suture to band, with no perceptible obliquity in direction. Growth lines on the band are broad, moderately recurved crescents, reappearing again from beneath the lower bounding groove, with a forward sweep, then curving back almost immediately to the outermost spiral groove, whence they trend slightly forward and incurved to the axial region.

Remarks. The holotype is an incomplete shell with several of its apical whorls destroyed. It bears however the broad flat band, the lower edge of which coincides with the suture. The whorls are slightly broader than high and the spiral grooves are just visible. The ornament is unusual, comprising a reticulum of spirals and growth lines, but in all the specimens examined the ornament is variable. For example, the shell figured to show the basal grooves (W.968) is almost devoid/

devoid of spirals on the base while another (BG.7206) has all the spirals distinctly crenulated by growth lines.

The grooving on the base was probably represented in the outer lip by wedge shaped excisions, because the growth lines, which always have a forward trend are bent backwards at each groove.

Phillips' figure of Pleurotomaria tornatilis is rather poor, but the specimen regarded as the holotype is conspecific with Sowerby's shell.

In the Gilbertson Collection are three shells marked G.147 and labelled Pleurotomaria vittata. Two of these have transverse striations and narrow bands and are probably Mourlonia. Unfortunately one of these two is indicated as holotype, but the band is much narrower than shown by Phillips in his illustration (XV,fig.24). The third shell almost satisfies the description "Turrito-conical, whorls convex, band very broad, and flat; striae slightly oblique". It differs from the description and figure by the absence of any recognisable surface markings. It is almost completely recrystallised and the surface much worn. The form of the band is still visible but scratches and pittings on the surface probably led Phillips to misinterpret them as oblique striae. The form of this shell, however, is that of Helix ? cirriformis Sowerby and of Phillips' tornatilis. Assuming it to be the type, then P.vittata is a synonym of cirriformis.

The description given by M'Coy is fitting in most respects

but/

but it is based on a Scottish specimen. Most Scottish material suffers somewhat from the "reef" facies a fact which may explain certain divergences in M'Coy's description.

Semestropha cirriformis is distinguished from S.gyrostoma by wider, flatter whorls, tighter coiling and more pronounced spiral grooves on the base.

Horizon and Localities. C^2 - Coal Measures. Bolland; Mendip Hills, Somerset; Isle of Man; Coalbrookdale, Shropshire; Craigie, Kilmarnock; Visé, Belgium.

Semestropha gyrostoma sp.nov.

Pl.III fig.2a-b..4a-b..6.

Ptychomphalus tornatilis Koninck,1883,p.45,pl.XXXII bis, figs.25-27.
non Phillips.

Holotype. No. 3440 Coll. Kon. Musée Roy. d'Hist. Nat.de Belgique. Visé, Belgium.

Description. Shell slightly higher than wide, loosely coiled, with gradually expanding whorls. The early whorls appear to flatten laterally due to the relatively great width of the band but the mature whorls are rounded. Band broad, flattened, and limited on each side by a thread or a groove. The band and an equivalent width of base are visible on the spire. Aperture almost round. Inner lip thin, smooth and reflected, almost covering the minutely phaneromphalus axis. Outer lip thin, slit probably quite short.

Spiral lines cover all the whorl except the band.

Spiral/

Spiral grooves on the base very faint, but one at least is decipherable on the figured specimen. Growth lines directed forward from the suture and back to the band in shallow convex arcs. They form broad clearly incised lunules on the band and pass over the base to the axis with hardly perceptible curvature.

Remarks. The basal grooves are not so evident as in Semestropha cirriformis. The whorls are deeper and rounder, apical angle smaller and umbilicus narrower. The looser coiling, which contributed to the relatively greater height, also exposes part of the base, which is not visible on the spire of S. cirriformis.

Koninck appreciated the specific differences between S. cirriformis and gyrostoma, especially the apparent lack of umbilicus in the latter, but confused it with tornatilis Phill.

Horizon and Localities. D^2. Longnor, Derbyshire; Isle of Man; Visé, Belgium.

Semestropha dilata sp.nov.

Pl.III fig. 1a-b.

Holotype. No.1105 J.Wright Collection. Poolvash,Isle of Man.

Paratypes. No.971, J.Wright Collection; BG. 7220, 7221, James Begg Collection.

Description. A small shell of five rapidly expanding whorls, enrolled to expose part of the base in addition to the band.

They/

They are rounded at all stages, although in the mature condition the upper faces are flattened. Band moderately broad, limited by two delicate threads. It is situated peripherally and higher than midwhorl due to flattening and consequent foreshortening of the upper half of the body whorl.

Aperture elongate oval and slightly flattened above. Inner lip long and slightly curved, sometimes completely reflected. Occasionally the inner lip is flattened by a median longitudinal groove. Outer lip thin, curved slightly forward at the upper, posterior half and obliquely backwards below this. Slit a little less than one fourth of the circumference of the body whorl. In holotype slit = 9 mm. Circumference of body whorl 38mm. Shell minutely phaneromphalus.

Fine spiral lines cover upper and lower surfaces. Growth lines arcuate above the band on which they form moderately deep lunules. They run obliquely backwards from the band to the axial region.

Remarks. semestrophadilata differs from the previous two species in having the band placed slightly above midwhorl, in having a longer slit and in the lack of the prominent basal grooves. The whorls, also, expand more rapidly. Only four examples have been examined and the differences cited above may have more than specific value. Until additional material is studied, however, it is better to include this species provisionally in Semestrophila.

Horizon and Localities. D^2. Isle of Man.

Genus Latischisma Thomas, 1939.

Genotype/

Genotype. Latischisma globosa Thomas.

A description of Latischisma has appeared previously (Thomas, 1939, p. 59).

The shells are globose, deeply sutured, and with a comparatively broad band situated peripherally. Coarse spiral ornament on upper and basal surfaces. Length of slit roughly one sixth of the circumference.

The genus comprises only three species and one variety, L.globosa and var.nitida.are confined to Scotland. L.sulcatula and sulcata appear to be confined to the English "reefs" for I have observed none in the comprehensive Isle of Man Collections, though Phillips reports L.sulcatula from that locality. It is doubtful whether there are any Belgian representatives. Ptychomphalus turbinatus and dives may belong here but the shells are small with indistinct bands, which are difficult to interpret. There is also a form (Mourlonia portlockiana de Kon.) closely similar in size and shape to L.globosa but on examination it proved to be a Gosseletina with the band placed well above the shell periphery.

Latischisma sulcatula (Phill.)

Pleurotomaria sulcatula Phillips, 1836, p. 226, pl. XX, fig. 5.

Pl. VIII fig. 10.

Holotype. No.G.123 Gilbertson Coll., British Museum (Nat.Hist.). Bolland, Yorks.

Description. Depressed, globular shell of about five rapidly expanding whorls, rounded in early stages but slightly depressed in/

in maturity. Band of moderate width, flat, bounded by two thin threads and situated at the periphery of the whorl. It is very slightly raised above the shell surface. Aperture elliptical and oblique. Inner lip unknown, but shell probably narrowly phaneromphalus. Outer lip and length of slit unknown. Prominent spiral threads traverse the upper and lower faces, in some specimens reticulating with the growth lines, which are oblique above and below the band. A few spirals sometimes traverse the band and occasionally small beads are formed at their intersections with the growth lunules.

Remarks. This species attains the same size as L.globosa the Scottish species, but the latter is distinguished by a more globular form and usually coarser spiral ornament, and a normally concave band. From L.sulcata (Phill.) it is distinguished by more lenticular form, finer ornament and more prominent band.

Horizons and Localities. $C^2 - D^2$. Bolland; Wetton,Staffs.; Thorp, Derbyshire.

Genus Worthenia Koninck

Turbo Conrad, 1835 (pars)

Murchisonia Portlock 1843 (pars)

Genotype. W.münsteriana Kon.

Description. A short conical or turreted shell of eight to ten whorls, upper surface of whorls flat to concave, base flat or convex. Periphery of whorl angular. A subsidiary keel commonly on the basal surface but occasionally on the upper surface/

surface. Band peripheral, narrow, trilineate, usually denticulate, due to the sharply prominent beads which interrupt the median keel.

Remarks. Koninck described four species, Worthenia tabulata (Con.), W.münsteriana, waageni and egregia de Kon., and stated that he did not known of any Lower Palaeozoic species which could be referred to the genus.

Fischer (1887) suggested that Worthenia was represented in the Silurian by Pleurotomaria bicincta Hall.

Longstaff (1895) cited Worthenia and Lophospira as two of four genera intermediate between Murchisonia and Pleurotomaria. She described and figured W.tabulata (Con.) but did not make a comparison between the two genera.

Worthenia and Lophospira were later (Ulrich and Scofield,1897) included in the ? Pleurotomariidae and Worthenia distinguished "by the denticulate band, strong spiral ornamentation and in having a true slit". Lophospira was at the same time split into four sections: perangulata, bicincta, robusta and trochonemoides. The strong resemblance of Worthenia to the second of these groups was noted by Ulrich and Scofield with the suggestion that it may sometime be traced back to some member of that section. Koken (1898) stated that the reasons for separating Worthenia from Lophospira are inadmissable, and Perner (1907) included in Worthenia the bicinta section of Ulrich and Scofield. The robusta section he raised to generic rank with the name of Coronella (T.Pleurotomaria robusta Lindstrom), and reserved the name/

name Lophospira for the perangulata section.

Longstaff stated (1906,p.556) that the four divisions of Lophospira were hardly all of the same value, and that they might not all stand ultimately, yet in 1924 she placed several new Scottish species in the old Lophospirid section of the American writers and made no comment on Perner's emendations. In the same publication she included her species of Lophospira in the Pleurotomariidae but omitted to mention Worthenia.

It is probable that the Carboniferous species of Worthenia are derived from some members of the bicincta section, but until further study of intermediate Devonian forms has been made the name Worthenia cannot with certainty be applied to the whole of the bicincta section. The genotype, W.münsteriana, possesses a keel only on the upper surface of each whorl and several strong spiral costae on the base. W.tabulata has a basal keel but neither have the two keels characteristic of the bicincta section. W.waagenia, with one basal keel and an almost flat base is still further removed. Ulrich and Scofield stated that Worthenia possessed a slit of one fourth to one third of the circumference. I have not seen an example with slit complete and it must have been very short if present at all.

In the present paper seven species of Worthenia are recognised, W.münsteriana Kon., egregia and waageni Kon., W.tabulata Con., W.monilifera (Phill.), W.depressa sp.n., and a Scottish form W.dunlopi Thomas described in a previous paper (Thomas 1939). W.münsteriana and egregia are apparently confined/

confined to Belgium. W.gairensis (Thomas 1939) is probably derived from a member of the robusta section of Ulrich and Scofield, and therefore is not a true Worthenia. The name Coronella was proposed by Perner 1907 for the robusta section and if Coronella cannot be used for "Worthenia" gairensis and other Carboniferous derivatives, a new genus may have to be erected.

Worthenia monilifera (Phill.)

Pleurotomaria monilifera Phill., 1836,p.227,pl.15,f.10a,left hand illustration.

Holotype. G.129 British Museum (Nat.Hist.). Bolland, Yorks.

Many Scottish shells with little resemblance to the holotype have been referred to this species. The shell marked "holotype" in the Gilbertson Collection is pictured in the left hand illustration of Fig.10a. The right hand illustration is a different species.

Description. A worn shell with several of the apical whorls missing. Only four of Phillips' specimens are preserved. They are conical with an apical angle of about 45 degs. The whorls have an angular profile, being slightly tumid below the suture, flattening out and projecting at the periphery. On the base of the shell is a fairly broad, shallow sulcus bounded on the upper side by the band and on its lower side by a keel-like beaded thread. Band peripheral and though fragmentary seems to consist of two contiguous threads, which, at a cursory glance appear as one thread, such as Phillips has drawn. A short area

of/

of band on the second whorl from the apex, is sufficiently complete to exhibit its bilinear character. The whorls are not deeply enrolled, for the band and an equivalent width of the base is exposed. The outer lip is broken for a quarter of a turn, the inner lip is slightly reflexed and there is a deep narrow umbilicus free from callus. The upper surface of the shell is stripped of ornament but the base is covered with concentric rows of small coarse nodes, which become finer as they pass into the umbilical depression.

Remarks. The Isle of Man and English shells called P.monilifera by some authors, have a single beaded thread running centrally on the band, while the whorls are flat to concave above and an umbilicus is normally only present in the neanic stage. These features distinguish W.waageni Kon.from W.monilifera (Phill.). The other three specimens labelled W.monilifera in Phillips' Collection bear little resemblance to his holotype, some of them in fact belong to another genus. Two are Worthenia waageni Kon. and nowhere has the author examined forms which are conspecific with P.monilifera. Indeed the type is an anomalous shell, possibly an unusual variety or a freak of W.waageni. On this assumption the Isle of Man forms are placed in W.waageni Kon.

Worthenia waageni Koninck

Pl. VIII fig. 2a-b..5.

Pleurotomaria excavata Phillips, 1836,p.228,pl.xv,fig.20.

Worthenia waageni Koninck, 1883,p.67,pl.XXVII,figs.32-34.

Holotype. No.999 Coll.Koninck, Mus.Roy.d'Hist.Nat.de Belgique. Visé,Belgium.

Description. Shell small, conical, of seven to eight evenly expanding whorls. Shell profile almost straight, broken only by the projection of the keeled band. Upper surface of each whorl prominent just below the suture, then flattened until it curves out to the peripheral keel. Base horizontal, interrupted near its periphery by a subsidiary keel which limits the inner edge of a shallow underhanging sulcus. Band narrow, peripheral, prominent with shallow lunules beaded at their intersection with a median thread.

Ornament on the upper surface consists of five to six revolving lines diminishing in strength from above and beaded at the intersection of numerous oblique and less prominent transverse lines. On the base revolving threads are sometimes crenulated by growth lines. The oblique growth lines on the upper surface leave the suture at about 30 degrees and impinge on the upper edge of the band at about 50 degrees. This gives them a slightly curved course. The aperture is necessarily oblique.

Remarks. The holotype is distorted by crushing and therefore appears relatively higher than usual. Koninck identifies Murchisonia angulata Portlock with this species although there is little resemblance. M.angulata is a synonym of W.tabulata (Con.), a species with a wide basal sulcus, prominent basal keel and a loosely coiled spire exposing an appreciable amount/

amount of the base.

W.waageni is distinguished from W.monilifera (Phill.) by the single beaded median thread on the band, and cryptomphalus base; from W.dunlopi by a narrower basal sulcus and more prominent band.

Two specimens in the British Museum, supposed paratypes of W.monilifera (Phill.) and contained on the same slab, are referable to W.waageni Kon.

Pleurotomaria excavata Phill. is possibly an internal cast of W.waageni, but is too fragmentary for certainty.

Horizon and Localities. ?C^2- D^2. Belland; Isle of Man; Visé, Belgium.

Worthenia sp.

Pl.VIIIfig. 1a-c.

Description. The shell has an apical angle of 85°. Whorls enrolled so as to expose the band and a small part of the base. Body whorl flattened or slightly concave above and convex below. Inner lip short, curved and partly reflected. Outer lip and slit unknown. Band narrow, trilineate and bears small nodes where crescentic lunules intercept a median thread. Situated peripherally, the band forms the upper limit of a shallow but distinct sulcus, the lower edge of which is limited by a beaded thread.

Five beaded spiral threads occur on the upper face the centre one being slightly more prominent than the others.

About/

About fourteen beaded spirals traverse the base, and one smaller thread runs along the sulcus.

Remarks. I have only seen one specimen. Towards the apex it is imperfect but five or six whorls can be counted.

This shell is relatively shorter and has a wider apical angle than is common to other Worthenia . The tight enrollment of the whorls is common also to W.waageni Kon. which is distinguished by a smaller apical angle and a flat base. W.dunlopi has a flatter upper face lying at a steeper angle and the base is almost horizontal.

This specimen appears to be very different from other Worthenia , but its imperfect preservation makes it an unwise choice on which to base a new species.

Horizon. D^2. Isle of Man.

Worthenia tabulata (Conrad)

Turbo tabulatus Conrad, 1835,p.267,pl.xii,fig.1.

Pleurotomaria tabulata Conrad, 1842,p.272.

Murchisonia angulata Portlock,1843,p.418,pl.xxxi,fig.5. (non M.angulata Phill.)

Worthenia tabulata Koninck,1883,p.65,pl.xxix,figs.3 & 4.

" tabulata Longstaff,1895,p.232,pl.x,figs.2,4.

There is nothing to add to Longstaff's comprehensive description.

Horizon. D^2 & D^3.

Genus Glabrocingulum Thomas

Phanerotrema Fischer,1885 (pars)

Glabrocingulum ~~aberrans~~ aberrans sp.nov.

Pl.VIII fig.4a-c.

Holotype. BG. 9329, James Begg Collection. Poolvash Limestone, Isle of Man.

Description. A small shell, conical with shallow sutures, composed of six whorls which are angular at maturity. Upper face of each whorl convex just below the suture, flattening out and becoming concave above the band. Lower surface convex. A short distance below the band an angularity is formed by a prominent spiral thread, which constitutes the lower limit of a short, concave lateral face. Band narrow, concave, bounded by two prominent threads. It is situated at the periphery of the whorl, at the angle between the upper and lower surfaces, and is inclined downwards more steeply than the upper face.

Inner lip short, faintly curved and reflected. Outer lip broken away for about half a turn, leaving no indication of the length of the slit.

Ornament is predominantly spiral, five strong threads running round the upper face of each whorl, two on the lateral face and seven to nine on the basal surface. Spirals are faintly crenulated at the intersection of oblique curving growth lines. Growth lunules are discernable on the band.

Remarks. An unusual form which comes nearer to Glabrocingulum than to any other genus. It is exceptional in the possession of a predominantly spiral ornament, visible lunules on the band/

band.

Remarks. An unusual form which comes nearer to Glabrocingulum than to any other genus. It is exceptional in the possession of a predominantly spiral ornament, visible lunules on the band and an angularity of the basal surface. Other members of the genus, while bearing one or more spirals have sufficiently strong transverse growth threads to form nodes.at the intersection. In.G.armstrongi there is catagenesis of ornament resulting in slightly wrinkled spirals, towards the whorl periphery. In G.armstrongi also, there is a tendency to form a lateral face by flattening of the base and verticality of the surface immediately below the band. This tendency does not, however, become as extreme as in the present species. The appearance of lunules on the band of G.aberrans may be in keeping with the extreme coarseness of ornament. Scottish species of Glabrocingulum and the other reef species all have delicate reticulation of spirals and growth lines.

In size and proportions G.aberrans approaches G. atomarium (Phill.) but is distinguished by lack of nodes and the presence of a well formed lateral face. The other "reef" forms such as G.praestans, interstrialis, sowerbyanum, phillipsianum are distinguished by their much greater size.

The short concave lateral face may suggest a basal sulcus like that of Worthenia but the absence of trilineation of the band is an important distinction from this/

this genus.

Horizon and Localities. D^2. Isle of Man.

Genus Lophozone nov.

Genotype. Lophozone exaratus sp.n.

Description. Conical shells of medium height, 3.5 cm. Whorls apparently rounded in early stages but becoming strongly keeled. They are loosely coiled exposing an area of the base almost equivalent in breadth to the upper face. Base convex. Band peripheral, very prominent, situated at the shell periphery. Growth on the band lunules sharp, irregular and strongly crescentic. Clinging to the sides of the band and fitting closely over it in some places is an outer layer of shell material. Umbilical passage open to the apex. Strong spiral lines cover upper and lower surfaces. Growth lines backwardly oblique both above and below the band.

Remarks. Only one species, based on three specimens, is known of this remarkable genus. The character of the band is its most important and interesting feature. In form it closely approaches Tropidostropha Longstaff provisionally placed by that author in Raphistomidae. The phlange-like band of Lophozone differs in construction from that of Tropidostropha. It seems that the part of the mantle-surface that forms the band laid down an especially thick deposit/

deposit with a convex outer surface and this is the most important factor in the shaping of the phlange. The outer covering of the keel composed of the conjoined upper and lower whorl surfaces and fits closely over the band without any apparent exterior extension, whereas in Tropidostropha the material of the keel is excessively produced to form the phlange, the flat or concave band lying deep within the keel.

The direction of the growth lines, too, is backwardly oblique both above and below in Lophozone, while in Tropidostropha the lines sweep down vertically or with a forward direction to the axis. The latter genus has comparatively broader and flatter whorls and lacks the spiral ornament. Longstaff described minute spirals covering the surface but they are of the nature of irregular grooves rather than a well defined spiral sculpture.

Trechmannia Longstaff is distinguished by a sharper keel and flatter band, trochoid profile, shallow sutures and a clearly developed transverse ornament.

The covered band distinguishes the genus from Schizolopha Ulrich, a Silurian genus which has the same general form and a narrow slit in the outer lip.

The strongly convex, covered band, continuously oblique growth lines and mature spiral ornament is sufficient to separate/

separate it from other genera. If it is proved to have a slit of moderate length, as suggested by the direction of the growth lines and the sharply crescentic lunules of the band, this would be an additional and important factor in separating it from Tropidostropha, which has only a sinus in the outer lip. Although the affinities of Lophozone with other Pleurotomariidæ are not known, it is considered better to place it in Pleurotomariidae than with Raphistoma or Euomphalopterus which have no true band or slit.

Lophozone exarata sp.n.

Pl.V fig. 4a-b.

Holotype. No.1106, James Wright Coll. Poolvash Limestone, Isle of Man.

Paratypes. B.G.7178, J.Begg Coll.; JS 6722, Geological Survey, Edinburgh.

Description. Shell of five or six whorls, angular at the periphery. Each whorl slightly convex above, base convex. Band situated on the angular periphery, raised from the shell surface and apparently bounded by two thick keels, which, however, completely overlap the band on well preserved areas. Aperture rounded except at the outer edge where the keel is situated. Inner lip curved, scarcely reflected. Base phaneromphalus.

Strong spiral lines cover the upper and lower surfaces passing/

passing onto the enveloping keels. They are a little coarser above the band than on the base. Growth lines oblique throughout.

Remarks. Comparisons with other genera have already been made and nothing need be added regarding specific distinctions.

Horizon and Localities. All three specimens come from the Poolvash Limestone, Isle of Man. From the yellow, decomposed condition of the shell and matrix, their habitat is probably the dolomitised lower knoll group D^2 or B.

Gosseletina Bayle

Pleurotomaria Koninck, 1843 (pars)
Gosseletia Koninck, 1883, non Gosseletina Barrois, 1881.

Genotype. ~~Gosseletina~~ Pleurotomaria callosa Koninck.

Description. Shell globular, mostly smooth. Sutures shallow, whorls enrolled to about midwhorl. Base convex and usually cryptomphalus due to a pad of callus on the inner lip. The band is of moderate width and situated well about midwhorl. Sometimes spiral colour bands are present.

Remarks. The most distinctive feature of the genus is the posterior aspect of the band. It is situated on the upper part of each whorl, well above the periphery of the shell. Thus, it is clearly visible on the spire, despite the well enrolled whorls. Koninck failed to emphasise this point and/

and indeed placed several obvious Gosseletinae in other genera. He included only, G.callosa, fallax and tornacensis in the genus.

Kittl, 1894, recognised the importance of the band position and the three species described by him, although Triassic forms, have the band on the upper surface.

Fischer (1897) only says that Gosseletina differs from Ptychomphalina by carrying a strong callosity on the columella border, again ignoring the position of the band.

Perner (1907)p.42, mentions only that the band is smooth and of moderate breadth. He included here several Silurian species all of which appear from his drawings to have a peripherally placed band.

Probably Ptychomphalus frenoyana, illusor, orbitosus, and Mourlonia scripta and portlockiana of Kon. belong to this genus. They all posses the characteristic globular outline with short spire and enlarged body whorl, and a band of moderate width situated above midwhorl. Some have spiral ornament. The spirally ornamented forms resemble the immature shells of some Baylea, as suggested by Weller (1929). All the Belgian forms mentioned here are Viséan, except G.tornacensis, which is Tournaisian, and G.fallax from Dréhance, Assise III.

What is most probably G.callosa is found in Britain as low as S, but it never occurs commonly even at higher horizons/

horizons. G.orbitosa (Kon.) also occurs in Britain.

Gosseletina callosa Koninck.

Pl. II fig. 6a-b.

Pleurotomaria callosa Koninck,1843,p.406,pl.XXXVI,fig.7.

Gosseletia " Koninck,1883,p.28,pl.XXIII,figs.13-16.

Gosseletina " Bayle,1885. in Fischer,p.850.

Holotype. No. 3443 Coll. Kon.,Musee Roy.d'Hist.Nat.de Belgique. Visé, Belgium.

Description. A subglobular shell, broader than high, apical angle of 110°, of five or six smoothly rounded whorls and an apical angle of about 105 degs. Aperture rounded, broader than high. Umbilicus blocked by a pad of callus. Band situated on the upper surface, smooth, clearly defined.

No visible ornament.

Remarks. Little can be added to what is said on pp.69-70 The genotype is distinguished from the other species described below by its wider apical angle and by constant convexity of the whorls above and below the periphery. The axial callus is also more pronounced in G.callosa than in the other species.

Horizons and Localities. D.? . Kendal, Westmorland; Visé, Belgium.

Gosseletina orbitosa (Koninck)

Pl.II fig. 7

Ptychomphalus orbitosus Koninck, 1883, p.40, pl.XXIII, figs.1-5.

Holotype. No.954. Coll.Koninck, Mus.Roy.d'Hist.Nat.de Belgique. Visé, Belgium.

Description. Small shell with apical angle of 100 degs. The band appears to lie midway between the two sutures; it is raised slightly from the shell surface and is smooth with little trace of growth lunules. Body whorl deep, with greatest convexity towards the latero-basal angle. Base slightly flattened. Axial region partly covered by matrix but sufficiently exposed to show weak development of callus.

Shell surface smooth, but growth lines can be traced running with very slight backward obliquity from suture to base.

Remarks. The main difference between this form and G.callosa lies in the comparatively longer whorl of G.orbitosa, its raised band, smaller apical angle and weaker development of callus.

Horizons and Localities. D?. Kendal, Westmorland; Visé, Belgium.

Baylea Koninck. Emend.Weller.

Baylea Koninck, 1883; non Bayleia Munier-Chalmas, 1873.

Yvania Bayle, 1885.

Yvania Weller, 1929.

Genotype. Baylea yvanii Leveillé.

At the end of his generic description Weller said "This/

"This genus differs from all other angulated Carboniferous Pleurotomariidae in possessing a slit band situated upon the upper slope of the whorl, and by the form of the aperture which extends backward adjacent to the suture".

Three species are recorded from British Lower Carboniferous rocks. One, B.parva, is confined to Scotland, and the other two B.concentrica and yvanii are found in the upper reefs of England , Isle of Man and Ireland.

Weller stated that no species even suggestive of this genus had been described from the Mississippian and that apparently Baylea did not appear in America until Pennsylvanian time. As no Upper Carboniferous species have been reported from Europe it is probable that there was a westward migration of forms in mid Carboniferous times, sufficient time having elapsed to allow for the development of the more specialised form and ornament characteristic of the earliest species in America.

Baylea yvanii Léveillé

Pl.V fig. 2a-d.,3.

Trochus yvanii Leveillé,1835,p.39,pl.II,fig.24. non Armstrong,Young & Robertson.

Pleurotomaria yvanii Koninck,1843,p.390,pl.XXXVII,fig.7.

" multicarinata M'Coy,1844,p.41,pl.V,fig.16.

Baylea yvanii Koninck,1883,p.69,pl.XXVII,figs.1-5 and pl.XXXII bis.figs.8,9.

Yvania yvani Fischer,1887,p.851.

" yvanii Weller,1929,p.8.

Holotype. The "primary type" of this species according to Brookes Knight is supposed to be in Paris, and one of Koninck's specimens is chosen as a "secondary type" and may be figured by Brookes Knight instead of the primary type.

Description. A tall turreted shell of seven or eight whorls which are rounded in early stages but angular in maturity. They expand slowly and are enrolled to expose the upper two thirds of each whorl. Upper face flattened or slightly concave, sloping downward a little from the suture. Its outer limit meets the lateral face at an acute angle. Latero-basal surface strongly convex and the ill-defined lateral face becomes concave where it approaches the angular periphery. Band is relatively broader lying entirely in the plane of the upper face. It is peripheral, limited on its outer side by the edge of the upper face, and on the inner side by a thin spiral thread which appears to be part of the ornament. Aperture rounded below and flat above. Inner lip straight, smooth and recurved but not thickened. There is no apparent umbilicus. The width of the band, the weak bounding supports, and continuity of growth lines across the edge of the band suggest a deep sinus rather than a slit.

Delicate, spiral lines run over the upper face interspaced with finer threads. On the lateral face the spiral lines are more prominent and widely spaced and have from three to five finer threads intercalated between each other. The spiral ornament/

ornament becomes progressively finer and more closely spaced towards the axial region. Numerous spiral lines also run through the band but do not crenulate the lunules.

The fine growth lines are directed forward from the suture and sweep in a gentle curve to the edge of the band on which they make assymetrical lunules. From the lower edge of the band they continue forward over the lateral face and run obliquely backwards.

Remarks. I have not examined the holotype, but have seen Koninck's specimens. The English specimens described above are conspecific with Baylea yvani Kon.

Baylea yvanii is somewhat far removed from B.concentrica. It does not fit easily into any of Weller's four groups, but is more closely related to the subconstricta group than to the other three. Weller's definition of this group is "slit band is flat and continues uniformly in the slope of the concave portion of the upper surface of the whorl -------- Growth lines, represented by fine transverse costae ------- are more conspicuously developed (than in the other groups) ---- a less noticeable character, but probably more significant, is the linguliform outline of the aperture on the lateral slope which is produced by a comparatively sharp concave curvature below. The basal surface of the whorl is also considerably more convex than in any of the preceding groups".

All specimens of B.yvanii examined have a flat band lying/

lying in the plane of the upper surface, not concave and inclined downwards from the slope as in B.concentrica. The growth lines are certainly more prominent than and can be traced fairly easily on the upper and lower surfaces of the whorl. The linguliform character mentioned by Weller is not so noticably developed because the lateral face has not the degree of concavity attained by B.subconstricta and giffordi (the other member of the subconstricta group). The basal surface is strongly convex, much more so than in B.concentrica. B.yvani is, however, distinguished from the Pennsylvanian species by absence of nodose ornament near the suture and the greater delicacy and number of the spiral threads. The upper face slopes less steeply, the sutures are not so deeply incised and the lateral face is but slightly concave. It has a smaller apical angle than B.subconstricta (Meek and Worthen) and a wider one than B.giffordi (Worthen). It has been previously suggested (Thomas 1939) that B.parva. the Scottish species, belongs to the B.subconstricta group. It is distinguished from B.yvanii by relatively smaller size, ill defined turreting of the whorls, shorter latero-basal surface, flattened near the axial region, more clearly defined band.with a strong inner bounding thread.

The inclusion of P.multicarinata M'Coy in the synonymy is based on photographs of two specimens obtained from the Nat.Museum of Ireland. According to the authorities there M'Coy's/

M'Coy's figure is a composite one based on these two specimens. This has given rise to a certain amount of confusion. From the photographs (which are reproduced on Pl.V fig.3) it is seen that the whorls are still somewhat rounded, a fact which indicates that the specimens are not fully grown, but comparison with other photographs of Yvania yvanii (Pl.V fig.2) leaves little doubt as to the identity of the original specimens. After publication of Koninck's work in 1843, M'Coy recognised several of his own names as synonyms. In 1855, he described P.yvanii but failed to recognise P.multicarinata as a synonym.

Horizons and Localities. Z,C,D. Wetton,Staffs.; Isle of Man; Millicent, Clare,Ireland; Tournai ,Belgium.

Baylea concentrica (Phillips)

Pl. V fig. 1a-c.

Pleurotomaria concentrica Phillips,1836,p.228,pl.XV,figs.23. non M'Coy.

" yvanii (pars) Koninck,1843,p.390. non Leveillé.

" canaliculata M'Coy,1844,p.9.39,pl.VI,fig.3a,b.

Baylea concentrica Koninck,1883,p.72,pl.XXVIII,figs.15-18.

Holotype. Missing.

Neotype. J.S.6719 Geological Survey, Edinburgh. Poolvash Limestone, Isle of Man.

Description. A conical shell of six or seven whorls, flattened or gently concave above and convex below, base flattened making an angulation which limits a lateral face.

Band/

Band narrow, concave, bounded by a prominent thread on each side and situated at the angle between the upper and lateral faces and inclined slightly downwards from the upper face. Aperture subquadrate. Inner lip smooth and recurved over a minute umbilical opening. Outer lip thins towards its extremity; length of slit unknown.

Strong spiral threads traverse the upper and lower surfaces, and occasionally one or two may run through the band. Immediately below the band and projecting farther than the lower bounding keel is a spiral thread of an equal prominence with other ornamental threads, and just below it there is a narrow concave area devoid of threads. Obscure growth lines curve forward forming broad arcs from suture to band. Below the band they curve forward again over the lateral face, then run fairly straight to the axis.

Remarks. This species shows a certain amount of variation in shell form and ornament.

The commonest whorl contour is concave above, projects at the angle carrying the band, and below is concave, broadening out again to complete the widely rounded later-basal angle. Sometimes the lateral convexity is exaggerated by the narrowing of the lateral surface, and flattening of the upper face and basal area. Occasionally the latero-basal surface is broadly rounded with no appreciable concavity below the band. This last variety has a finer ornament than the others, the growth lines are relatively more prominent and

the lunules on the band visible. There is variation in the relative height of the shell and a corresponding size of the apical angle.

The length of the slit is not accurately known. One specimen having only about a fifth of its aperture broken away shows the band intact to that point. The band may be less than one fifth of the circumference.

M'Coy failed to recognise this species in his Pleurotomaria canaliculata. The description and figure of this species fit B.concentrica accurately and he erroneously identified as P.concentrica quite a different shell which is probably B.yvanii.

B.concentrica belongs to the group B.gurleyi Meek, established by Weller as one of the four main groups into which American Pennsylvanian Baylea[illegible] fall, and which also includes B.inclinata Weller and pusilla Weller.

B.concentrica is relatively taller than B.gurleyi and lacks the broad smooth area of the latter on the lateral face immediately below the band; B.concentrica is relatively greater in height (not always perceptible) than B.inclinata and has fuller development of the latero-basal surface, giving a slight outward slope to the lateral face, from above downward. B.pusilla, however, possesses this outward lateral slope but has in addition fewer and relatively coarser spiral threads on its upper surface, and smaller size than B.concentrica.

Horizon/

Horizon and Localities. C^2- D^2. Bolland; Park Hill, Longnor, Derbyshire; Isle of Man; Visé, Belgium.

Subfamily Luciellinae nov.

Genus Luciella Koninck

Trochella - M'Coy,1844.

? Echinocirrus - Ryckholt,1860.

? Cirridius - Koninck, 1881.

Flemingia - " 1881. non Johnson 1845.

Luciella - " 1883 (pars)

Flemingella - Knight,1936.

Genotype. L.eliana Koninck.

Description. A translation of Koninck's description will suffice for the main features.

"Shell trochiform, concial, generally depressed, umbilicated and calloused with rugged or lamellar whorls, the last whorl sharp along the whole periphery. Sometimes folded and festooned. Aperture transversely oval or subrhomboidal with a very oblique columellar margin. Sinus band situated on the upper (lower) part of the whorls of the spire and along the external border".

Remarks. As may be gathered from the description, the band on the undersurface and a depressed form are the most distinctive features. The callosity in the umbilicus, however, is poorly developed or absent. The folded edges

are/

are not confined to this genus but when found elsewhere are extremely small.

Perner (1907) included a Bohemian form Pleurotomaria (Luciella) praecursor of horizon f^2 (Lower Devonian). Six species are recorded from Belgium (Visé), L.prisca(M'Coy), (Flemingia prisca Kon.), L.eliana Kon., ornatissima Kon., limbata Kon., subfimbriata Kon.,squamula Kon. The first four occur also in Britain. L.squamula (Phill.) is better referred to Brooksella. In addition a new variety from Derbyshire is described, L.prisca var.lenticula. It is probable that Echinocirrus armatus (Koninck) belongs to the group. Koninck stated that the species resembles L.eliana but was distinguished by absence of a band on the undersurface. Examination of the holotype, which is slightly crushed, revealed a narrow band on the underside some little distance inwards from the periphery. The crushing has distorted the lunules, straightening them out on one half and changing their characteristic form. Only a few crushed examples of E.armatus are known. Should additional, better preserved material prove conclusively the presence of a band in Echinocirrus, then Luciella becomes a synonym of Echinocirrus Ryckholt 1860.

Luciella eliana Koninck

Pl. VI fig. 1a-c.

Pleurotomaria eliana Koninck,1843,p.366,pl.XXXVI,fig.1.

Luciella eliana Koninck,1883,p.108,pl.XXXI,figs.1-5.

Holotype. Coll. de Koninck, Musée Roy.d'Hist.Nat.de la Belgique. Visé, Belgium.

Description. A lenticular shell with the first few whorls forming a short spire. Profile concave due to the progressive peripheral flattening of the mature whorls. Whorls seven or eight, flattened above, slightly convex below, wider than high and edged with undulating projections, about sixteen per whorl. These undulations overlap on to each succeeding whorl for each whorl is attached to the base of the preceding. Band narrow, peripheral, bounded on the inner side by a weak spiral thread, the outer edge coinciding with the periphery of the base. The undulations may project farther to form the true periphery of the shell; but they are continuations of the material of the upper surface and are not part of the base. Aperture oblique and elliptical, peristome almost continuous. Umbilicus wide and funnel shaped. Length of slit or sinus unknown.

In addition to the pattern formed by the peripheral undulations on the upper surface, there are secondary tubular outgrowths about the middle of the upper face of each whorl. These were probably produced to form short spines. The rest of the surface is rough and scaly from the intersection of normal oblique growth lines passing backwards from the suture and anomalous ornamental threads running obliquely forward from/

from the suture. The growth increments tend to imbricate when in contact with these ornamental threads. Fine spiral threads cover the base from the band to the edge of the umbilical pit and the growth threads are curved obliquely backwards to the umbilicus. The lunules on the band are moderately crescentic.

Remarks. This species is distinguished from L.limbata and prisca by its concave profile, more numerous peripheral undulations and less developed forwardly oblique ornamental lines. From L.ornatissima it is distinguished among other things by complete absence of spiral elements on the upper surface.

Horizons and Localities. D^1- D^2. Isle of Man; Settle, Yorks.; Visé, Belgium.

Luciella limbata (Phillips)

Pl. VI fig. 6

Pleurotomaria limbata Phillips,1836,p.227,pl.XV,fig.18.

" limbata Koninck,1843,p.376,pl.XXXVII,fig.5.

Luciella limbata Koninck,1883,p.110,pl.XXXII,figs.6-9,18-20.

Holotype. G.156. British Museum (Nat.Hist.). Bolland, Yorks.

Description. A depressed turbinate shell of five or six whorls which are elliptical in section and scalloped at the outer edge, about twelve scallops per whorl. Whorls convex and shouldered near the suture but flatter at the edge/

edge to form the scalloping. Upper side of each whorl overlapped by the scalloping of the previous whorl. The undulations thus formed at the suture (cf. L.eliana) are raised from the surface to form nodes. The depressions between the nodes are usually shallow, and the nodes are rendered solid where the shell surface arches up into them.

Base of each whorl convex, the greatest convexity occurring midway between periphery and umbilicus. Band narrow, bounded by a thin thread on its inner side and by the basal edge on its outer side. The aperture has considerable obliquity above, much less so below, the growth lines indicating a forward curve below the band.

Umbilicus exceptionally wide and the deeper parts lack visible ornament. The slit or sinus was probably very short.

The predominant ornament on the upper surface consists of oblique lines, regularly spaced, and running forward from the suture. They continue on to the undulations but there straighten out a little and become coarser. They are imbricated from suture to their terminations, by the crossing of the backwardly oblique growth lines. On the base are numerous spiral lines, irregularly spaced and crenulated by the growth lines. A smooth area extends from the band across one fourth of the base, before the spirals appear. The growth lines curve forward from the band across this space then pursue a slightly oblique backward course to

the edge of the umbilicus.

Remarks. The short lunules of the band are clearly developed on the holotype, though the illustration almost fails to show it. The shell is not complete in the apertural region and the surface is stripped of the fine ornamental lines and growth lines. Specimens from the Isle of Man closely resemble the holotype in both form and ornament and are indeed better preserved, showing delicate surface ornament. They are without doubt conspecific. BG.7153, Begg Coll. from the Isle of Man has an almost complete upper lip, and only a small part of the basal edge is broken away. Yet there is no visible slit. The strong forward curve of growth lines below the band and the rather shallow lunules may indicate a deep, wedge-shaped sinus rather than a slit.

Horizons and Localities. C^2- D^2 . Isle of Man; Visé,Belgium.

Luciella prisca (M'Coy)

Pl.VI fig. 3a-b.

Trochella prisca M'Coy,1844,p.43,pl.VII,fig.1.

Holotype. Luciella prisca M'Coy. Nat.Museum of Ireland, Dublin. Millicent, Clare, Ireland.

Topotypes. Two specimens from the same locality and mounted on the same card [illegible].

Description. Shell 5 cms.wide and 15 cms.high, flat based and lenticular. Upper surface of each whorl flatter at the outer undulatory edge than at the suture. Undulation as in L.limbata. Base of each whorl slightly convex. The band, which/

which cannot be traced on the type, was probably narrow, by analogy with the English variety. Aperture lenticular, much wider than high.

Apart from nodes formed by the undulations, there is no conspicuous ornament on the upper surface. Growth lines sweep very obliquely backward from suture to edge of whorl.

Remarks. The shell is flatter than L.limbata, the basal surface of the body whorl less convex, and there seems to be a complete absence of the forwardly oblique imbricated threads, which are so evident in L.limbata. On the other hand the whorls have similar undulations and nodes.

Koninck mentions that L.subfimbriata Kon.differs from other Luciella by lack of imbricated lines on its surface, and it is distinguished from L.prisca by a much smaller apical angle (100 degs. compared with 120 degs.). L.ornatissima has a similarly apical angle, but is easily distinguished from L.prisca by having spiral ornament on its upper surface.

Horizon and Locality. Lower Limestone Group. Millicent, Clare, Ireland.

Luciella prisca var.lenticula nov.

Pl. VI fig. 2a-c.

Holotype. No.34731. Geological Survey Museum, London. Pilsbury, Derbyshire.

Description. Shell small, very flat with a wide apical angle/

angle of about 140 degs. Base slightly convex. Umbilicus very wide, shallow, smooth on its inner surface.

There are wide peripheral undulations. Oblique growth lines sweep backwards from suture to whorl periphery. Band indefinite but can be traced at the basal periphery; lunules shallow . Spiral threads occupy most of the basal surface.

Remarks. This shell differs from L.prisca mainly in possessing a wider apical angle. It appears to represent a further stage in flattening of the profile from L.limbata, through prisca to the present form.

Horizon and Locality. D^1. Park Hill, Longnor, Derbyshire; Narrowdale, Staffs.

Luciella ornatissima Koninck

Luciella ornatissima Koninck 1885, p.109, pl. xxxv, fig. 3-6

Pl. VI fig. 4.,5a-b.

Holotype. 1063 Coll. de Koninck, Musée Roy.d'Hist. Nat. de Belgique. Visé, Belgium.

Description. Shell may attain a width of 20 mm., lenticular, the peripheral region blunt and rounded, the edge of the upper surface bearing shallow undulations. Whorls five or six in number, appear almost plano-spiral in early growth stages. The mature shell has an apical angle over all of about 150 degs..Upper and lower surfaces of each whorl equally and slightly convex. Sutures well marked. Band situated vertically on the underside of the whorl immediately below the peripheral undulations. In most cases the edge of the upper/

upper surface overhangs, relegating the band to a truly basal position. The outer border of the band is limited by the undulations and the inner edge by a coarse thread. Between the thread and the basal spirals there is usually a groove, which is slightly deeper than those which divide the ornamental basal spirals. Aperture flatly oval in outline, oblique. Inner and outer lips and slit unknown. Umbilicus wide and shallow.

Three to five heavy spiral threads traversing the upper surface are roughened and crenulated at intervals by short wavy outgrowths. These are spiny, but usually broken short. Similarly crenulated spirals, without spines occupy the space between the band and the edge of the umbilicus, where they fade out. The band is defined on its inner border by the outermost of these threads. The peripheral undulations, by the curving together of their crests, form tubular features which are produced into short spires. Growth lines almost straight and directed obliquely backwards from suture to periphery. They form sharp shallow but regularly spaced lunules on the band and continue obliquely towards the axis. Remarks. In form, position and character of the band and the essential pattern of the ornament, all the British forms resemble L.ornatissima Kon. The spirals, however, are more regularly formed and the peripheral waves and surface projections are not so greatly produced as shown in Koninck's drawings. L.ornatissima as figured by Koninck has long cog-like/

cog-like projections on the edge of the whorls. Actually the holotype does not have such exaggerated features (see Pl. VI fig. 4).

Horizon and Localities. D^2. Isle of Man. The yellow powdery matrix suggests the Lower Knoll group, or B. Visé, Belgium.

Rhineoderma Koninck

Trochus Hoeninghaus, 1830 (pars)

Pleurotomaria Phillips, 1836 (pars)

Genotype. Rhineoderma gemmulifera (Phillips) 1836.

Description. Koninck's description reads - "Turbinate shell, the spire slightly obtuse, composed of whorls which are convex below (above) and more or less depressed above (below). The sinus band is relatively broad, situated on the middle part of the whorl and only uncovered on the last whorl. Aperture oblique, subrhomboidal, columellar border curved with a prominent lower edge. The slit in the outer lip shallow. Surface ornamented with numerous spiral ribs, crossed obliquely by other finer ones, rendering them rugose. Umbilicus deep and smooth, ending above (below) by a ridge which separates it clearly from the rest of the surface".

This description covers all the more important features of the genus. The obtuse profile, nodular surface and basally/

basally situated band are the most important characters. The obtuse profile alone serves to distinguish Rhineoderma from Flemingella and from Luciella with the exception of L.limbata. From the latter Rhineoderma is distinguished by its rugose nodular surface and lack of intrication. Its relation to these other two genera is difficult to indicate. The band is not so well defined in Rhineoderma while the regression of the growth lines to the band is so slight, that the sinus must be shallower than in Flemingella and Luciella. This may be a primitive feature linking these genera to Raphistomidae.

Five species are described by Koninck, R.gemmulifera, fragile, radula, concomitata and nysti. The last two are doubtfully retained here. The type of R.concomitata does not exhibit a band, due probably to the stripping of ornament, while the direction of growth lines in R.nysti appears to change so little that the presence of a sinus is doubtful.

Rhineoderma gemmulifera (Phillips)

Pl.VII fig. 2a-b.

Pleurotomaria gemmulifera Phillips,1836,p.227,pl.XV,fig.17.

" " Koninck,1843,p.370,pl.XXXI,fig.7.

Rhineoderma " Koninck, 1885, p. 104, pl. XXXII, figs. 21-25.

Holotype. PG.788. British Museum (Nat.Hist.); Bolland, Yorks.

Description/

Description. According to Phillips the shells are "Depresso-conical, whorls convex above, flat beneath; edge nodular, spiral striae, gemmuliferous above". The first half of the description indicates a turbinate shell profile on a base which is slightly rounded from the edge towards the axis. This convex profile is due, in part, to a small decrease from the apical angle of early whorls to the pleural angle (covering the last two whorls) and to the individual shape of each whorl which has its greatest convexity immediately below the suture. Band situated basally, bounded on the inner edge by a well defined spiral line, its outer edge coinciding with the periphery of the shell. It is very slightly depressed between the inner spiral and the edge of the shell. Periphery of the shell very sharp. Aperture slightly oblique, broader than high, rounded on its outer side to conform with the upper surface of the whorl and flattened below. Umbilicus smooth and funnel shaped, and a comparatively wide umbilical passage traverses the shell. Direction of growth lines indicate a sinus, not a slit.

Ornament predominantly spiral, small equidistant nodes forming where spirals are crossed by growth lines. The latter are difficult to trace, especially in young whorls, and on mature whorls, only by observing the positions of successive nodes can their direction be determined. This is curved, but not excessively oblique, leaving/

leaving the suture almost at right angles and impinging on the lower edge at about 60 degs. Spiral lines very prominent on the base and numbering about eleven, and becoming more closely set towards the axial pit. The space occupied by the band is almost double the width between any two lines of ornament. Growth lines relatively much weaker than the spiral lines, but are easily seen in the interspiral depressions. In this way they reticulate with the spirals, but are not seen to pass over them and nodes are absent. Growth lines fairly oblique from the edge of the axial pit outwards towards the periphery, straightening near the band and crossing it in very shallow lunules.

Remarks. This species may be easily confused with those of Raphistomid stock if only the upper part is preserved. The periphery is angular and the growth lines above run down to and over it as in many Raphistomids. The presence of a band, however, and less convex base serve to distinguish it.

From Luciella limbata it is distinguished by the absence of an undulating periphery, and by the presence of numerous beaded spiral lines. L.ornatissima has a predominantly spiral ornament but its profile is flat and elliptical with a clearly marked band and lunules which are more vertically placed.

The species has a long vertical range from C-D, apparently unchanged.

Nos./

Nos.60388-90, Longnor, Derbyshire; Nos.67437-43, Settle; No.64299, Ravenstonedale, in the Survey Collections, London, while Nos.JS.6784, 6913, are in the Survey Collections, Edinburgh.

Horizon and Localities. ?C, S, D. Bolland, Yorkshire; Ashfell Edge Ravenstonedale; Longnor, Derbyshire; Isle of Man; Visé, Belgium.

Genus Brookesella nov.

Pleurotomaria Phillips, 1836 (pars)

? Turritella " 1881 (pars)

Flemingia Koninck, 1883 (pars)

Luciella Koninck, 1883 (pars)

Flemmingia Kitth, 1891 (pars)

Genotype. Brookesella hisingeriana (Kon.).

Description. Trochoid shells, profile slightly concave, of eight or nine whorls. Base flattened. Aperture subquadrangular, inner lip smooth, curved. Axial depression relatively wide. Band basal, peripheral. Shallow lunules on the band usually continuous with the basal growth lines, probably indicating a shallow sinus. Surface bears traces of spiral lines and characteristic imbrications. Growth lines on upper surface very oblique and curved; on leaving the band they curve forward, then obliquely back to the axial region. Spiral threads on base fade at the edge of the umbilical pit. Colour patches commonly preserved on Isle of Man shells, and assume a pattern similar to that of/

of Mourlonia conica.

Remarks. Members of this genus are homeomorphic with the group of Mourlonia conica in respect of the slightly concave spire, flattened base, and broad zig-zag colour patches. In other respects, however, Brookesella differs radically from Mourlonia in having a basal sinus or slit band. Other significant distinctions are, an imbricate surface and the presence of spiral threads. As in Luciella, the imbricate surface is due to the introduction of an unusual element, fine lines running forward from the suture, imbricated where the growth increments cross them. The spiral threads, of primary importance, are well defined in the younger whorls, especially anterior to the suture and on the base. The spiral element in Mourlonia, as previously explained, consists of irregular spiral grooves, sometimes entirely absent.

Brookesella is more closely allied to Luciella than to other Carboniferous genera. The basal band, imbricate surface and minute peripheral scalloping in some species, indicate their close affinity.

In 1881 Koninck established a genus Flemingia for a group of high conical shells including Trochus hisingerianus Kon., T.coniformis Kon. and several new species, with Trochella prisca M'Coy as type. Basing his classification on salient features and overlooking the presence of a basal sinus, Koninck placed the genus in the Trochidae. Fischer

seemed/

seemed uncertain of its position but mentioned it along with those fossil genera "compris par les auteurs dans les familles des Trochidae, des Turbinidae, des Delphinulidae, des Cyclostrematidae et meme des Littorinidae". In brackets at the end of the description he placed the name F.hisingeriana Koninck regardless of the fact that Koninck had already made T.prisca the type species. Knight (1933) tentatively placed Flemingia in the synonymy of Anematina Knight (Trocho-turbinidae). But in 1936, basing his revised conclusions on the study of the genotype, T.prisca, he stated that Flemingia was but remotely related to Anematina. Knight adds (loc.cit.,p.527) that "Since Flemingia de Koninck, Knight overlooked the fact that Flemingia dates from 1832 ,so that Flemingia Johnston and Flemingia Koninck are both homonyms of Flemingia 1832. Previous to Knights emendation Kittl in 1891 (p.253) emended the name to Flemmingia.

profile and upper surface features seen in the photographs of T.prisca obtained from the National Museum of Ireland, reveals its very close affinity with Luciella squamula (Phill.) and its allies. Although related to some of the other Flemingia described by Koninck it is not congeneric with them. The writer is convinced therefore that T.prisca is a Luciella and it now loses its status as a genotype. The names Flemingella Flemmingia Kittl and proposed by Knight to replace Flemingia becomes a synonyms of Luciella.

The other members of the group of high conical shells assigned/

seemed uncertain of its position but mentioned it along with those fossil genera "compris par les auteurs dans les familles des Trochidae, des Turbinidae, des Delphinulidae, des Cyclostrematidae et meme des Littorinidae". In brackets at the end of the description he placed the name F.hisingeriana Koninck regardless of the fact that Koninck had already made T.prisca the type species. Knight (1933) tentatively placed Flemingia in the synonymy of Anematina Knight (Trocho-turbinidae). But in 1936, basing his revised conclusions on the study of the genotype, T.prisca, he stated that Flemingia was but remotely related to Anematina. Knight adds (loc.cit.,p.527) that "Since Flemingia de Koninck, 1881, is an homonym of Flemingia Johnston, 1845, and since it seems to have no valid synonym, I now propose the new name Flemingella to replace it as its exact synonym". Unfortunately the status quo is again upset for careful comparison of the profile and upper surface features seen in the photographs of T.prisca obtained from the National Museum of Ireland, reveals its very close affinity with Luciella squamula (Phill.) and its allies. Although related to some of the other Flemingia described by Koninck it is not congeneric with them. The writer is convinced therefore that T.prisca is a Luciella and it now loses its status as a genotype. The names Flemingia Kith and Flemingella proposed by Knight to replace Flemingia becomes a synonyms of Luciella.

The other members of the group of high conical shells assigned/

assigned to Flemingia by Koninck, are obviously not congeneric with Trochella prisca M'Coy. As a result of the taxonomic change outlined above the group is now without generic designation, so the name Brookesella is now proposed with B.hisingeriana as genotype (Art.30, Recommendations - III(n)). Of the thirteen species of Flemingia described by Koninck six can with certainty be assigned to Brookesella. F.hisingeriana Kon., coniformis Kon., fimbriata Kon., nysti Kon., obesa Kon., laqueata (Mün.) with the addition of Ptychomphalus alearius Kon., Pleurotomaria squamula Phill., Brookesella monensis sp.n. and possibly Turritella spiralis Phill.

Brookesella hisingeriana (Koninck)

Pl.VII fig. 1a-b, 6, 7.

Trochus hisingerianus Koninck,1843,p.446,pl.XXXIX,fig.1.

? Pleurotomaria angulata M'Coy, 1855,p.525.

Flemingia hisingeri angulata Koninck,1881,p.99,pl.VII,figs.38,39.

Holotype. No.783. Coll.Koninck, Musée Roy.d'Hist.Nat.de Belgique. Visé, Belgium.

Description. Little need be added to the generic description and Koninck's description includes the main features, except, of course, recognition of the band, which, as previously mentioned, is peripherally placed on the basal aspect of the shell. The band is comparatively narrow, about 2 mm. on the shells with a basal radius of 20 mm./

20 mm., and slopes a little upward and outwards from the basal plane. Inner edge limited by an insignificant spiral line, outer edge by overhanging material of the upper slope of the shell. Growth lunules on the band are shallow and more or less continuous with the basal growth lines. These run forward sharply from the band, curve back smoothly a short distance from it and run obliquely to the axial region. A sinus or very short slit is indicated.

Early whorls have well defined spiral lines, which in later whorls become less prominent. The backwardly oblique growth lines start from the suture and curve, by increase of obliquity, to the lower edge. They are more evident on the mature than the early whorls. The forwardly directed imbricating element is less developed in this species than in others but more noticeable on the body whorl than on the earlier ones. About nine broad, dark zig-zag colour patches stretch from the suture to the lower whorl edge.

Remarks. It is not surprising that Koninck failed to relate this, the commonest species of Brookesella, with Luciella and its allies. The type and several other specimens in the collection are badly preserved, sometimes recrystallised and on none is the band distinguishable. The surface features on the upper slope of the British forms described here, and on the Belgian shells, are so closely analogous that there can be little doubt of their speicific identity. Most of the material/

material examined comes from Isle of Man. Two incomplete specimens, 60382-83, Geological Survey Coll. London, collected from Park Hill, Derbyshire, are provisionally included. The surface of both is much stripped of ornament and the base cracked and broken away. It seems probable from M'Coy's description of P.angulata, that his specimens were Brookesella. The apical angle appears slightly exaggerated in his illustration.

Horizons and Localities. D_1 and D_2. Isle of Man; ? Park Hill, Longnor, Derbyshire; Visé, Belgium.

Brookesella squamula (Phillips)

Pl.IVii fig. 1.

Pleurotomaria squamula Phillips,1836,p.227,pl.XV,fig.17.

" " Koninck,1843,p.368,pl.XXXVII,fig.6.

Luciella squamula Koninck,1893,p.111,pl.XXXII,figs.26-30.

Holotype. P.G.786. British Museum (Nat.Hist.). Bolland, Yorks.

Description. According to Phillips the shell is "Conical, whorls obliquely costulated: costulae squamous, entire, or divided, or alternatively long and short". Shell acutely conical (apical angle 80 degs.). Sutures moderately impressed. Base incomplete on type.

Remarks. The Isle of Man variety figured here shows a flat base with a peripherally placed basal band. The lunules/

lunules are very shallow and uniform, indicating, no doubt, a narrow sinus rather than a slit.

The oblique "costulae" mentioned by Phillips are seen to pass forwards from suture to lower edge, a characteristic feature of the genus which is strongly emphasised in B.squamula. The "squamous" imbricate, surface results from the position of the growth increments passing almost at right angles over the costae.

Koninck included this form in Luciella, but it appears to be more nearly allied to Brookesella by possessing a high conical outline and lacking the large peripheral undulations and wide umbilicus of Luciella.

Horizon and Localities. C Bowland; Visé, Belgium.

Brookesella sp.

Pl.VII fig.5.

Holotype. BG.7219. J.Begg Collection. Poolvash Limestone, Isle of Man.

Description. Acutely conical, flat based, with peripheral band on the basal aspect. Band narrow and lunules shallow.

Surface imbricate, but growth lines are the dominant feature of the ornament.

Remarks. The apical angle is slightly narrower than in B.squamula and the surface ornament more delicate.

This form and the previous one are evidently closely related. Only one specimen is known of Brookesella sp.

Horizon and Locality. D_2. Isle of Man.

Brookesella alearia (Koninck)

Pl.VII fig.4.

Ptychomphalus alearius Koninck,1883,p.38,pl.XXX,figs.31-34,43-46.

Holotype. 949. Coll. de Koninck. Musée Roy.d'Hist.Nat. de Belgique. Visé, Belgium.

Description. Small trochoidal shells with slightly tumid whorl profile. Base gently convex, almost flat. Angle between upper slope and basal surface, rounded. Spire of six to seven whorls, the last less tightly coiled than the others. The pleural angle is smaller than the apical angle giving a very slight convexity to the shell profile (decrease from 50° to 40°). Aperture probably rhomboidal and oblique. Inner lip short and curved. Band on basal surface towards the underside of the latero-basal angle. It is ill-defined, the inner edge often recognisable only by the backward curve of the growth line, but sometimes, especially in the better preserved specimens, it is limited by a weak spiral line.

Lunules shallow and irregular and not sufficiently clear to be seen in the illustration. On specimens with little apertural damage no slit has been observed. This fact together with the presence of shallow lunules on an ill-defined and extremely oblique aperture suggest a shallow sinus rather than a slit.

The predominant ornament in the early whorls consists of five or six equidistant spiral lines which, never very strong/

strong, fade considerably on the mature whorls. Their place is taken by the oblique growth threads which become progressively stronger as the shell develops. They are straight and run from suture to lower edge of the whorl at an angle of about 45 degs. Surface imbrication is not evident in this species. The base bears twenty to thirty fine spirals covering the area between band and axis. Growth lines swing forward very slightly from the band and then run straight to the axis.

Remarks. The position of the band, the spiral ornament and the very oblique aperture, as indicated by growth lines, make it necessary to remove alearius from Ptychomphalus and place it in Brookesella. B.alearius differs from other species of this genus in having a rounded instead of an angular latero-basal angle, a more tumid shell profile and apparent lack of surface imbrication. From Luciella it differs in its higher, more trochoidal outline and complete absence of peripheral undulations and surface imbrications.

The absence of extreme features in B.alearia suggests close relations to the common ancestral stock of Luciella, Rhineoderma (described below) and Brookesella. Retaining primitive features, it appears to have coexisted with these more advanced forms into the Viséan.

The apical angle, over all of 44½ degs. given by Koninck is an underestimation and the relative width is slightly greater/

greater (Koninck Length 11 mm., width 8mm. while most of the British forms, to a similar height, have a width of 9 to 10 mm.).

There are five specimens, Nos.BG.7229, 30, 32-34, in Mr.Begg's collection.

Horizon and Localities. D. Isle of Man; Visé, Belgium.

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IX. Explanation of plates I-VIII.

PLATE I

(Allfigures natural size unless otherwise stated)

Fig.1a-d. Mourlonia carinata (Sow.) Specimen from Cracoe to show colour markings. b. Shows extent of slit. 67353,Garwood Collection,Geological Survey,London.

Fig.2a-c. Luciella limbata (Phill) Holotype x2.
C2. Bolland. G.156,British Museum(Nat. Hist.)
Photo. B.M.

PLATE II.

(All figures natural size unless otherwise stated.)

Fig.1a-d. Mourlonia conica (Phill.) Lectotype.
Showing colour markings.Cracoe.67349,Garwood Coll.
Geological Survey,London.

Fig.2a-b. Mourlonia striata (Sow.) Specimen from Cracoe showing colour markings. 67364, Garwood Coll.,Geological Survey, London.

Fig.3. Mourlonia striata (Sow.) Another specimen from the same locality,showing projecting keel(right hand side) 67370, Garwood Coll.,Geological Survey,London.

Fig.4. Mourlonia carinata var. turbinata n. Holotype.
Poolvash Limestone,Isle of Man. J.S.6758,Geological Survey, Edinburgh.

Fig.5. Mourlonia striata(Sow.) An incomplete specimen chosen by M'Coy as type for Pleurotomaria hainesii. Lower Carboniferous Limestone,Little Island,Cork. National Museum of Ireland, Dublin. Photo.Nat.Mus.Dublin.

Fig.6a-b. Gosseletina callosa (Kon.) Holotype.
Viséan.3443 Col l. de Kon. Mus.Roy.d'Hist.Nat.de Belgique. Brussels. Photo. Brussels.

Fig.7. Gosseletina orbitosa (Kon.) A specimen from Kendal, Westmoreland.D2. 60399, Geological Survey,London.

PLATE III

(All figures natural size unless otherwise stated)

Fig.1a-b. Semestropha dilata sp.n. Holotype.

b. shows extent of slit. Poolvash Limestone, Isle of Man. 1105, J.Wright Coll.

Fig.2a-b. Semestropha gyrostoma sp.n. A specimen from the Poolvash Limestone, Isle of Man. J.S.6912, Geological Survey, Edinburgh.

Fig.3a-b. Semestropha cirriformis (Sow.)

a. B.G.7206, J.Begg Coll. b. Showing basal grooves. 968, J.Wright Coll. Both from Poolvash Limestone, Isle of Man.

Fig.4a-b. Semestropha gyrostoma sp.n. Holotype.

Visé.3440 Coll.de Kon., Mus.Roy.d'Hist.Nat.deBelgique. Brussels.

Fig.5. Phymatopleura nodosa Girty. Holotype.

A reproduction of Girty's figure.

Fig.6. Semestropha gyrostoma

From D2, Longnor, Derbyshire. 34773, Geological Survey, London.

Fig.7a-b. Semestropha cirriformis (Sow.) Holotype X2.

a. Showing cross hatching on upper slopes. Bolland. 43637, British Museum(Nat.Hist.)

Photo. B.M.

PLATE IV.

(All figures natural size unless otherwise stated)

Fig.1. Brookesella squamula (Phill.) Holotype X2.
Bolland. P.G.786, British Museum.(Nat.Hist.)
Photo.B.M.

Fig.2 Mourlonia striata (Sow.) Holotype X2.
Bol land. P.G.141,British Museum (Nat.Hist.)
Photo. B.M.

Fig.3a-c. Mourlonia expansa (Phill.) Lectotype.
Cracoe. 67359, Garwood Coll.,Geological Survey, London.

Fig.4. Mourlonia expansa (Phill.) A specimen from the same locality showing faint colour markings. 60421,Garwood Coll..

Fig.5.Mourlonia carinata var. gigas (Kon.)
Poolvash Limestone ,Isle of Man. 1110 J.Wright Coll.

Fig.6. Mourlonia carinata (Sow.) Columellar section to show profile and umbilical passage. Poolvash Limestone, Isle of Man.

Fig.7. Mourlonia carinata var.gigas (Kon.)

Fig.8. Mourlonia carinata var. turbinata n.

PLATE V.

(All figures natural size unless otherwise stated)

Fig.1a-c. Baylea concentrica (Phill.) Lectotype.
Poolvash Limestone, Isle of Man. J.S.6719, Geological Survey, Edinburgh.

Fig.2a-d. Baylea yvanii (Lév.)
d. Part of upper slope of body whorl showing peripheral band.
Poolvash Limestone, Isle of Man. J.S.6718, Geological Survey, Edinburgh.

Fig.3. Baylea yvanii (Lév.) Two specimens on which M'Coy probably based his figure of Pleurotomaria multicarinata. Millicent, Clare, Ireland,
Photo. Nat.Mus. Ireland.

Fig.4a-b. Lophozone exarata sp.n. Holotype.
Poolvash Limestone, Isle of Man. 1106 J.Wright Coll.

PLATE VI.

(All figures natural size unless otherwise stated.)

Fig.1a-c. Luciella eliana Kon.

a-b. B.G.9331, J.Begg Coll. c. A specimen to show basal aspect with growth lines. J.S. 6790,Geological Survey, Edinburgh. Poolvash Limestone ,Isle of Man.

Fig.2a-c. Luciella prisca var. lenticula n. Holotype.

Pilsbury,Derbyshire. 34731 Geological Survey, London.

Fig.3a-b. Luciella prisca (M'Coy) Holotype.

Lower Carboniferous Limestone, Millicent,Clare,Ireland. Nat.Mus.Ireland.

Photo. Nat.Mus. Ireland.

Fig,4. Luciella ornatissima Kon. Holotype.

Visé. 1063,Coll.de Kon.,Mus.Roy. d'Hist.Nat.de Belgique. Brussels.

Photo. Brussels.

Fig.5a-b. Luciella ornatissima Kon. Poolvash Limestone,Isle of Man. B.G 9332,J.Begg Coll.

Fig.6. Luciella limbata (Phill.) Showing surface sculpture.

Poolvash Limestone,Isle of Man. 7153,J.Begg Coll.

PLATE VII.

(All figures natural size unless other wise stated)

Fig.1a-b. Brookesella hisingeriana (Kon.)

a1108,J.Wright Coll. b. J.S.6724,Geological Survey,Edinburgh.

Poolvash Limestone ,Isle of Man.

Fig.2a-b. Rhinocoerma gemmulifera (Phill.) Holotype X2.

b. Shows band on extreme edge of base. Bolland. P.G.788

British Museum(Nat.Hist.)

Photo.B.M.

Fig.3a-b. Mourlonia angulata sp.n. Holotype.

Cracoe. 67350,Garwood Coll.,Geological Survey,London.

Fig.4. Brookesella alearia (Kon.) Poolvash Limestone,Isle of Man.

B.G.9334,J.Begg Coll.

Fig.5. Brookesella sp. (Phill.) Poolvash Limestone,Isle of Man.

B.G.7219. J.Begg Coll.

Fig.6. Brookesella hisingeriana (Kon.) Columellar section to show wide umbilical passage.

Fig.7. Brookesella hisingeriana (Kon.) To show colour patches.

Poolvash,Isle of Man. B.G.9333,J.Begg Coll.

PLATE VIII

(All figures natural size unless otherwise stated.)

Fig.1a-c. Worthenia sp. Holotype.
Poolvash Limestone,Isle of Man. B.G.9328,J.Begg Coll.

Fig.2a-b. Worthenia waageni Kon. Poolvash Limestone,Isle of Man. B.G.9327,J.Begg Coll.

Fig.3a-b. Phymatopleura simplicita sp.n. Holotype.
Poolvash Limestone,Isle of Man. 1104,J.Wright Coll.

Fig.4a-c. Glabrocingulum abberans sp.n. Holotype.
Poolvash Limestone,Isle of Man. B.G.9329, J.Begg Coll.

Fig.5. Worthenia waageni Kon. Holotype.
Visé,999 Coll.de Kon.,Mus.Roy.d'Hist.Nat.de Belgique. Photo.Brussels.

Fig.6a-c. Phymatopleura interstrialis (Phill.) Holotype X 2.
Bolland. G.137, British Museum(Nat.Hist.)
Photo.B.M.

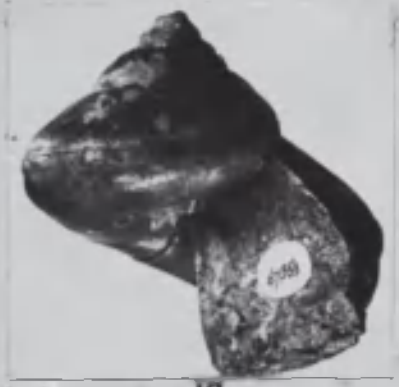
Fig.7. ?Phymatopleura variata (Kon.) Holotype.
Coll.de Kon.,Mus.Roy.d'Hist.Nat.de Belgique.
Photo.Brussels.

Fig.8a-b. ?Phymatopleura balladoolensis sp.n. Holotype.
Poolvash Limestone,Isle of Man. J.S.6915,Geological Survey, Edinburgh.

Fig.9. Glabrocingulum praestans (Kon.) Holotype.

Fig.10. Latischisma sulcatula (Phill.) 60403,Geological Survey, London.

Plate I



1a

1b

1c

2c

2a

2b

Plate II

1a

2a

1b

1c

2b

1d

3

5

4

6a

7

6b

Plate III

1a

2a

2b

1b

3a

5

4a

3b

6

4b

7a 7b

Plate IV

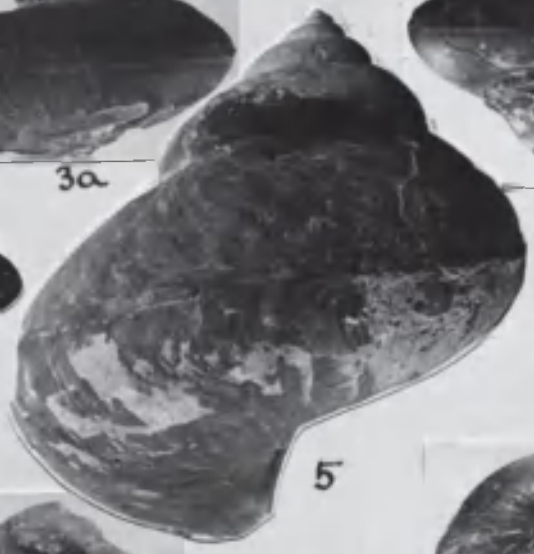
1

2

3a

3b

6



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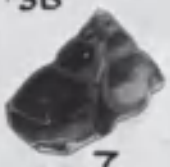


7

4

8

3c

Plate V

1a

1c

1b

2a

2c

2b

3

4a

2d

4b

Plate VI

1a

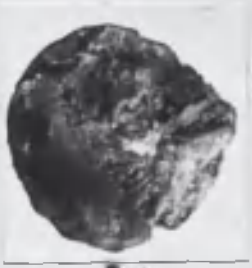
1b

1c

2a

c

2b



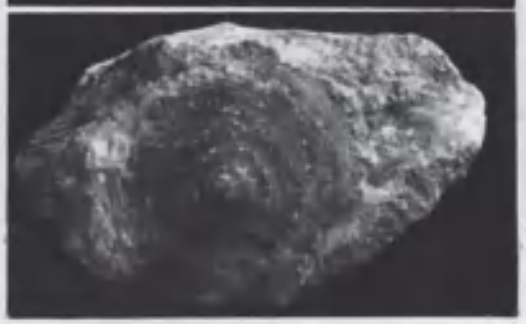
2c

4

5a

5b

3a



3b

Plate VII

1a

4

2a

5

1b

2b

6

3a

7

3b

Plate VIII


1a


2a


1c


2b


1b


3a


4a


5


4b


3b


6a


6c


6b


7


8a


8b


9


10


4c