Systematic Descriptions

By J. Brookes Knight¹, L. R. Cox², A. Myra Keen³, R. L. Batten⁴, E. L. Yochelson⁵, and Robert Robertson⁶

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¹ Honorary Research Associate, Smithsonian Institution, Washington, D.C.; Longboat Key, Fla.
² British Museum (Natural History), London, England.
³ School of Mineral Sciences, Stanford University, Stanford, Calif.
⁴ Department of Geology, University of Wisconsin, Madison, Wis.
⁵ Museum of Comparative Zoology, Harvard University, Cambridge, Mass.
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INTRODUCTION

The authorship of this section, mainly concerned with the Archaeogastropoda, is as follows: All genera with Paleozoic type species by J. B. Knight, R. L. Batten & E. L. Yochelson; all genera with Mesozoic type species by L. R. Cox; Cenozoic Pleurotomariidae, Haliotidae, and Neritopsidae by L. R. Cox; Cenozoic Fissurellidae and Scissurellidae by Myra Keen aided in part by Grace Johnson; Phasianellidae by Robert Robertson; all other genera with Cenozoic type species by Myra Keen. Contributions have been integrated by L. R. Cox.

Acknowledgments for advice on various matters relating to Recent gastropods are made to Prof. Alastair Graham, Dr. D. R. Crofts, Dr. Vera Fretter, Dr. J. E. Morton, and Dr. H. Burrington Baker. Also, appreciation is expressed to Mrs. Nancy Lou Patterson, who prepared most of the drawings on Paleozoic gastropods in systematic portions of the text and to Miss M. F. Prior, Miss L. Ripley, Mrs. Sally Kaicher, and the late Mr. G. L. Wilkins for work on other illustrations. Prof. Jean Roger of Paris kindly loaned specimens of Michaletia semigranulata and Cochlocleithus cottoidimus, Dr. N. D. Newell supplied photographs of type specimens of Paraeryudylos, Hesperocirrus, and Sororcula.

Class GASTROPODA Cuvier, 1797
[nom. correct. Duméril, 1806, pro 'gastropodes' Cuvier, 1797, invalid vernacular name, nom. auct. cons. proposed Cox, 1958 (ICZN pend.)] [==Gasteropoda+Spirarionata Rinnevees, 1815; Gasteropoda Schwedler, 1820 (also Goldfuss, 1820); Gasteropodophora GRAY, 1821; Paracaeophala parrae Blainville, 1824; Gasteropoda Beck, 1837; Psaphophala Brown, 1862; Gasterochoa Thiele, 1926]

Definition of the class has been given in a foregoing section (p. 186). L.Cam.-Rec.

Subclass PROSOBRANCHIA

Milne Edwards, 1848

Gastropoda displaying full effects of larval torsion in that auricle (or auricles), together with ctenidium (or ctenidia) when present, lie anterior to ventricle; visceral nerve cords cross, one from right pleural ganglion to left side passing above and one from left pleural ganglion to right side passing below alimentary canal; mantle cavity open to front, containing, on right side, anteriorly directed rectum and anus. Except in a few forms, mantle cavity also contains either one ctenidium and osphradium, lying on left side, or paired but rarely equal ctenidia and osphradia. Head with single pair of tentacles. Sexes distinct except in a few genera. Operculum commonly but not invariably present. Shell of many shapes, absent only rarely. Habitat marine, fresh-water, or terrestrial. L.Cam.-Rec.

Order ARCHAEOGASTROPODA

Thiele, 1925
[==Scutibranches Cuvier, 1817 (partim); Scutibranchia Golby, 1820, restricted Fischer, 1865; Aspidobranchia Schwegler, 1820, extens. Pilsbry, 1895; Diotocardia Mörch, 1865]

Prosobranchia in which ctenidia (present in all but a few genera) are "aspidobranch" (i.e., bipectinate, with filaments alternating on two sides of axis) and free at front end; ctenidia and osphradia paired in more primitive families, otherwise single. No siphon or proboscis. Heart with two auricles, except in Patellacea and Helicinidae. Kidneys two, except in Patellacea and Neritaceae, the right large, the left reduced. Gonoduct, except in Neritacea, opening in both sexes into right kidney, genital products being thence discharged by way of ureter and mantle cavity into the sea; male thus without prostate and penis. Nervous system not concentrated, pedal cords ladder-like. Inner layers of shell nacreous in many but not all genera. Habitat marine (except some Neritacea). L.Cam.-Rec.

Suborder BELLEROPHONTINA

Ulrich & Scofield, 1897
[nom. correct. Cox & Knight (ex Bellerophontina Ulrich & Scofield, 1897, subordinal name)] [==Prothopigloglossa, Amphigastropoda Simroth, 1906; Planispiralia, Belleromorpha Naeff, 1911]

Shell most commonly isostrophic, rarely slightly asymmetrical; mostly closely coiled, but in some genera clytiform; predominantly with median labral sinus or slit, or trema, probably exhalant in function and usually generating a selenizone; shell wall of variable thickness, no evidence of nacre; operculum unknown; presence of paired and equal ctenidia and osphradia, also of single pair of retractor muscles, inferred (latter from muscle scars); nothing known of other soft parts. L.Cam.-L.Trias.
Superfamily HELCIONELLACEA
Wenz, 1938
[nom. transl. Knight, Batten & Yochelson, herein (ex Helcionellidae Wenz, 1938)]

Cap-shaped to coiled bellerophoniform shells; commonly with strong rugae clearly defined on both interior and exterior; with septum or septa partitioning off the apex. L.Cam.-U.Cam.

Family HELCIONELLIDAE Wenz, 1938
[nom. transl. Knight, Batten & Yochelson herein (ex Helcionellidae Wenz, 1938)]

Elongate cap-shaped shells lacking a train; apex not central, presumably posterior. L.Cam.-U.Cam.

Helcionella Grabau & Shimer, 1909 [Metoptoma? rugosa Hall, 1847 =Helcion subrugosa d’Orbigny, 1850, pro H. rugosa (Hall) d’Orbigny, 1850, non H. rugosa J. Sowerby, 1817] [?QuicaneIIa Rusconi, 1952 (125, p. 86); ?Pichynella Rusconi, 1954 (125, p. 2)]. Shell moderately low to high cap-shaped, with very strong concentric rugae; muscle scars unknown. Cam., N.Am.-N. Afr.-NE.Asia. — Fig. 89.3. *H. subrugosa (d’Orbigny), L.Cam., N.Y.; 3a,b, individuals showing extremes in variation, X3.3.

Family COREOSPIRIDAE Knight, 1947
Shell with complete or incomplete coiling; no anal emargination; flattened, with nearly rectangular cross section; with posterior trainlike extension of shell margin. L.Cam.-U.Cam.

Latouchella Cobbold, 1921 [*L. costata] [=Oelandia Westergård, 1936]. Cap-shaped, with apex curved backward; surface with strong collabral rugae; much resembles Helcionella except for its posterior train and inferred orientation (16, p. 366). Cam., N.Am.-Eu.-NE.Asia. — Fig. 89.2. L. pauciplicata (Westergård), M.Cam., Swed.; left side; X4.

Coreospira Saito, 1936 [*C. rugosa]. Tightly coiled, loosely coiled, or whorls barely in contact; disclike, outer whorl face flattened and with protruding margin; surface with collabral rugae or growth lines. L.Cam.-M.Cam., N.Am.-NE.Asia. — Fig. 89.4. *C. rugosa, L.Cam., Korea; 4a,b, left side, anterior, both X10.

Cycloholcus Knight, 1947 [*C. nummusr]. Disc-like, possibly with pierced umbilici; sides with a rounded groove (73, p. 5). U.Cam., N.Am.—Fig. 89.1. *C. nummusr, Tenn.; X2.7.
Superfamily
BELLEROPHONTACEA
M'Coy, 1851

[nom. transl. Wenz, 1938 (ex Bellerophonlidae M'Coy, 1851)]

Characters as defined for suborder, but invariably with median emargination or tremata. *U.Cam.-L.Trias.*

Although the soft parts of bellerophont gastropods have never been observed, their shells are very similar in many respects to those of the pleurotomarians and show significant homologies with them. As with pleurotomarians, the bellerophont shell typically consists of a long narrow tube (the helicocone) which expands from a point and is coiled loosely on itself. In both groups an anal emargination occurs close to the middle of the labrum. In view of this fact, it is difficult to avoid the conclusion that the internal anatomy of the bellerophonts was very much like that of the pleurotomarians. The groups differ in that the coiling of the bellerophont shell is isostrophic, whereas the pleurotarian shell is conispiral. The living pleurotomarians retain vestiges of primitive symmetry, for both members of bilaterally paired internal organs, such as ctenidia, are in general developed, although not equally. In this respect they differ from all other living gastropods. Because the bellerophonts appear earlier in the fossil record the vestigial symmetry was probably expressed more fully in them, a view supported by the bilaterally symmetrical shell. Indeed, it seems probable that the degree of bilateral symmetry was as high as could be consistent with torsion in early ontogeny (Fig. 57, *Knightites*).

The bilateral symmetry of the shell has led some workers to infer that torsion did
not take place in the bellerophonts as it does in Pleurotomariacea and all other Anisopleura (Simroth, 1906; Wenz, 1940; Moore, in Moore, Lalicker & Fischer, 1952; Boettger, 1955). If this were true, the shell would have been carried by bellerophont gastropods with the outer lip and anal emargination behind, an orientation quite opposite to that of the pleurotomarians, which resemble the bellerophonts so closely in other respects. The massive coil, which is commonly accompanied by an even more massive parietal inductura, would then have been poised above the head, in the position termed "exogastric" by some authors. This would have presented mechanical difficulties of no small magnitude for an animal moving about with its shell, and it is hard to see how the head and foot could have been withdrawn into the shell.

Apparently these authors were misled by the belief that torsion originally took place after development of adult musculature. Crofts (1955) has shown that the larval left-hand muscle, the right-hand (culicular) muscle of the adult, had not begun to develop until after torsion had reached 90 degrees, so that torsion was not the cause of asymmetrical coiling.

For these reasons the Bellerophontacea are thought to have undergone torsion although they had a symmetrically coiled shell (76). They are here classed in the Prosobranchia and interpreted as the earliest and most primitive Archaeogastropoda. Because of their apparent affinities with the pleurotomarians, it is suggested that they were not only aspidobranch, but also rhipidoglossate, feeding chiefly on vegetable matter.

Family CYRTOLITIDAE S. A. Miller, 1889

[?] = Procariariidae Wenz, 1938]

Anal emargination a shallow sinus, commonly angular but without slit or selenizone; coiling generally open, especially in adult whorls. U.Cam.-L.Sil.

Strepsodiscus Knight, 1948 [*S. major]. Anal emargination a deep angular sinus; coiling slightly asymmetrical, with closely coiled early whorls protruding toward left, last whorl disjunct, all whorls sharply crested; has posterior train; growth lines are only surface features known (75, p. 3). U.Cam., N.Am.—Fig. 90.6. *S. major, Colo.; 6a-c, left side, apertural, anterior views, ×1.3.

Cloudia Knight, 1947 [*C. buttisi]. Anterior lip with gently curved sinus; coiling close, with wide, steep umbilic; whorl section lozenge-shaped, with sharply rounded lateral angles; ornament unknown (73, p. 5). U.Cam., N.Am.—Fig. 90.7. *C. buttisi, Ala.; 1a,b, apertural and left sides of steinkern, ×1.

Trigya Raymond, 1908 [*T. nitschii]. Anterior
emargination shallow, V-shaped; coiling disjunct; 5 strong spiral costae on outer whorl surface, comprising a single median one, 2 on outer angles, and 2 about midway between the others; surface marked by 2 sets of fine obscure threads that cross one another. M.Ord., N.Am.—Fig. 90,2. *T. ulrichi, Vt.; 2a,b, anterior and left side, ×2.

*Cyrtolites* Conrad, 1838 [*C. arnatus*] [=*Microceras*, Hall, 1845]. Anterior lip with somewhat shallow, angular sinus, aperture quadrate, whorls barely in contact or possibly disjunct in some species; with sharp median carina and pair of lateral ridges; umbilici widely open; ornament wide collateral undulations and fine cancelling threads. M.Ord.-L.Sil., N.Am.-Eu.—Fig. 90,4. *C. ornatus, U.Ord., N.Y.; 4a,b, anterior and apertural views, X2.

*Cyrtodiscus* Perner, 1903 [*Oxysticus (Cyrtodiscus) procer; SD Knight, 1937*. Anterior lip with shallow V-shaped sinus; coiling discoidal with whorls seemingly in contact; ornament spiral threads or wanting. M.Ord.-U.Ord., N.Am.-Eu.-Asia.—Fig. 90,3. *C. procer* (Perner), Ord., Czech.; 3a,b, left side and adapertural views, ×2.

?Procarinaria Perner, 1911 [*Carinaria bohemia* Perner, 1903]. Anterior lip sharply angular but without sinus; whorls enlarging very rapidly, angular above, with high, thin carina; ornament collateral undulations. V.Sil., Eu.—Fig. 90,5. *P. bohemia* (Perner), Czech.; left side, X2.

**Family SINUITIDAE** Dall in Zittel-Eastman, 1913

[*Protowarthiidae* Ulrich & Scofield, 1897 (ICZN pend.).] Anal emargination mostly an open D-shaped sinus but narrowing to a broad slit in some advanced Euphemitinae. *U. Cam.-M.Perms.

**Subfamily BUCANELLINAE** Koken, 1925

[nom. transl. Knight, Batté & Yochelson, herein (ex Bucanellidae Koken, 1925)].

Sinus relatively small; phaneromalicious; surface marked by fine, sharp collateral or spiral threads. *U. Cam.-M.Perms.

*Owenella* Ulrich & Scofield, 1897 [*Bellerophon antiquatus* Whithfield, 1878]. Rounded, as wide as long, umbilici narrow. *U. Cam., N.Am.—Fig. 91,3. *O. antiquata* (Whithfield), Wis.; 3a,b, left and anterior side, ×3.3.

*Sinuella* Knight, 1947 [*S. minuta*. Small, narrow, with shallow peripheral groove; umbilici wide (73, p. 8). *U. Cam., N.Am.—Fig. 91,4. *S. minuta*, Tex.; 1a,b, left and anterior sides, ×20.

*Bucanella* Meek, 1871 [*B. nana*. With 3 spiral lobes, the central more prominent than the lateral ones. *Ord.-Dev., N.Am.-S. Am.-Eu.-N.Afr.

**B. (Bucanella)** [≡*Bucanella Koken, 1896 (obj.); Tritonophon Opyk, 1953]. Spiral lobes clearly marked, umbilici wide. Ornament transverse in earlier species, spiral in later ones. *L. Ord.-Dev., N.Am.-Eu.—Fig. 91,6. *B. (B.) nana, L. Ord., Colo.; 6a,b, left and anterior sides, ×5.3.

*B. (Plectronotus) Clarke, 1899 [*P. derbyi; SD Clarke, 1913*. Sinus relatively narrow, pointed; pseudoselenizone bordered by faint threads; central lobe broad, indistinct; umbilici narrow; ornament unknown. Dev., N.Am.-S. Am.-Eu.-N. Afr.—Fig. 91,4. *B. (P.) derbyi* (Clarke), Brazil; anterior side of steinkern, ×1.

*Pharetrolites* Wenz, 1943 [*Cyrtolites phartra Lindström, 1884*. Anterior lip with shallow angular sinus; discoidal coil with few whorls and wide, pierced umbilici; ornament collateral imbricating lamellae (147, p. 1941). *M.Sil., Eu.—Fig. 91,2. *P. phartra* (Lindström), Gotl.; 2a,b, left and apertural sides, ×2 (90).

*Sinuitina* Knight, 1945 [*Tropidocyclus cordiformis* Newell, 1935]. Moderately narrow; central lobe narrow, not sharply delimited; a small channel within a narrow ridge surrounding the narrow open umbilici (71, p. 333). *S. M. Perms., N. Am.-Eu.—Fig. 91,5. *S. cordiformis* (Newell), U. Penn., Kan.; 5a,b, left and apertural sides, ×2.

**Subfamily SINUITINAE** Dall in Zittel-Eastman, 1913

[nom. transl. Knight, Batté & Yochelson, herein (ex Sinuitidae Dall, 1913)].

Sinus relatively wide. *U. Cam.-M. Dev.

*Anconochilus* Knight, 1947 [*A. barnesi*. Lateral
Fig. 93. Bellerophontacea Sinuitidae—Sinuitinae, Euphemitinae (p. 1175-1179).
lips merging into a posterior train; surface features unknown (73, p. 7). *U.Cam., N.Am.—Fig. 93, 2. *A. barnesi, Tex.; 2a, 2b, left and anterior sides, X1.


S. (Sinuites) [=Protowarthia ULRICH & SCOFIELD, 1897; Discolites EMMONS, 1855 (non MONTFORT, 1808)]. Relatively wide, amphalous. *Ord., N.Am.-Eu.-N.Afr.—Fig. 93.6. *S. (S.) bilobatus (SOWERBY), M.Ord., Eng.; 6a, 6b, left and anterior sides, X1.5.

S. (Sinuitopsis) PERNER, 1903 [*S. neglecta; SD COSSMANN, 1904]. Rather narrow, with shallow open umbilici. *U.Ord., Eu.-NE.Asia.—Fig. 93, 7. *S. (S.) neglecta, Czech.; 7a, 7b, left and anterior sides, X2.

Ptomatis CLARKE, 1899 [*Bellerophon patulus HALL, 1843; SD PERNER, 1903] [=Fuchsella SPIEDESTERSBACH, 1942 (133, p. 156)]. Anterior sinus shallow, wide; apertural margins widely explanate; parietal inductura (in type species) moderately thick, bearing longitudinal pustules, lacking behind, as though abraded; collabral ornament of growth lines and undulations, *M.Ord., N.Am.-S.Am.-S.Afr.—Fig. 92.1. *P. patulus (HALL), N.Y.; 1a, 1b, apertural and abapertural sides, X1.3.

Crenistriella KNIGHT, 1945 [*Bellerophon crenistria HALL, 1879]. Lateral lips gently convex in side view; shallow peripheral depression; ornament many spiral rows of fine pustules (71, p. 344). *M.Ord., N.Am.—Fig. 93.5. *C. crenistria (HALL), N.Y.; anterior side, X3.
the inductura proper within the aperture; a more or less broad selenizone occurs but is generally obscured by the perinductura. ?Dev., Miss.-Perm.

Euphemites Warthin, 1930 [pro Euphemus M'Coy, 1844 (non Laporte-Castelnau, 1836)] [*Bellerophon urii Fleming, 1828; SD Waagen, 1880]. Numerous (approximately 10) more or less strong sharp spiral cords on parietal inductura, reaching far within whorls and commonly continuing with inductura over exterior rather more than a half volution; similar cords on coinductura where this layer is present; perinductural pustules occur in some species. ?Dev., L.Carb.(Miss.)-Perm., Eu.-N.Am.-S.Am.-N.Afr.-Asia.—Fig. 93.4. *E. urii (Fleming), L.Carb., Scot.; 4a-c, left, apertural, abapertural sides, X2.7.

Warthia Waagen, 1880 [*W. brevisinuata; SD de Koninck, 1882]. Closely resembles Euphemites but lacks ornament. U.Carb.(Penn.)-M.Perm., Asia-Austral.-N.Am. — Fig. 93.3. W. polita

Fig. 96. Bellerophontacea (Bellerophontidae—Bucaniinae) (p. 1179-1180).
Archaeogastropoda—Bellerophontina—Bellerophontacea

WAAGEN, Perm., India; 3a-c, left, apertural, anterior sides, X 4.

*Stachella* WAAGEN, 1880 [*Bellerophon pseudohelix* STACHE, 1877; SD deKONINCK, 1883]. Slightly asymmetrical; no ornament except growth lines; organization of shell layers unknown. L. Perm.—M. Perm., Eu.—SE. Asia.—Fig. 93,1. *S. pseudohelix* (STACHE), M. Perm., Ger.; 1a-c, left, apertural, right sides, X 1 (134).

**Family BELLEROPHONTIDAE** M'COY, 1851

Anal emargination generally consisting of a slit. *U.Cam.—L. Trias.*

**Subfamily TROPIDODISCINAE** Knight, 1956

Coil narrow, with wide umbilici; slit deep; commonly with a definite posterior train. *U.Cam.—Dev.*

*Chalarostrepsis* KNIGHT, 1948 [*C. praecursor*]. Last half whorl disjunct; slit deep; no ornament except growth lines (76, p. 5). *U.Cam.*, N.Am.—Fig. 94,1. *C. praecursor*, Can.(Que.); 1a,b, oblique anterior, left side, X 2.7.

*Tropidodiscus* MEEK & WORTHEN, 1866 [*pro Tropidocyclops* MEEK, 1866 (non STEIN, 1855)] [*Bellera­phon curvilineatus* CONRAD, 1842] [*Tropido­cycles deKONINCK, 1882 (obj.); Oxydiscus KOKEN, 1889 (obj.); Zonidiscus SPITZ, 1907; Joleaudella PATT, 1929]. Lenticular, with acuminate periph­ery; slit deep, narrow, selenizone narrow; ornament collabral lines or imbricating lamellae. L. Ord.—Dev., N.Am.—S.Am.—Eu.—Asia.—Fig. 95,1. *T. curvilineatus* (CONRAD), L.Dev., N.Y.; 1a,b, left and apertural sides, X 1.3.

*Phragmolites* CONRAD, 1838 [*P. compressus*] [*Conradella ULRICH & SCOFIELD, 1897*]. Whorls more or less rounded; apertural margins flaring periodically to form narrow, strongly scalloped varices; deep, narrow slit between low, sharp keels which are joined at top by the selenizone; ornament obscure spiral threads. M.Ord.—U.Ord., N. Am.—Eu.—Fig. 95,2. *P. obliqua* (ULRICH & SCOFIELD), M.Ord.; 2a,b, left and anterior sides, X 2.7.

*Temnodiscus* KOKEN, 1896 [*Cyrtolites lamellifer* LINDBRÅM, 1884; SD REED, 1920] [*Cyrtolitina ULRICH in ULRICH & SCOFIELD, 1897 (obj.)]. Whorls disjunct; slit moderately deep; varices formed by rather strong foliaceous periodic ex­pansions of lateral lips; ornament numerous spiral cords. M.Ord.—Sil., N. Am.—Eu.—Fig. 95,3. *T. lamellifer* (LINDBRÅM), M.Sil., Gotl.; 3a,b, left and anterior sides, X 2.7.

**Subfamily BUCANINAE** ULRICH & SCOFIELD, 1897 [*nom. transl. KNIGHT, BATTEN & YOCHELSON, herein (ex Bucanidae ULRICH & SCOFIELD, 1897)]

Exhalant emargination a short slit. *M. Ord.—Dev.*

*Eobucania* KOBAYASHI, 1955 [*E. pulchra*]. With few rapidly expanding whorls, apertural margin but some with slit not continuing into the apertural expansion and others with a series of tremata. *L. Ord.—Dev.*

**Tribe BUCANIDES** Ulrich & Scofield, 1897 [*nom. transl. KNIGHT, BATTEN & YOCHELSON, herein (ex Bucaniidae ULRICH & SCOFIELD, 1897)]

*Eobucania* KOBAYASHI, 1955 [*E. pulchra*]. With few rapidly expanding whorls, apertural margin
with moderately deep slit, slightly concave selenizone between pair of threads on slight dorsal elevation; ill-defined angulation marking off lateral from posterior slopes; aperture flaring slightly at angulation (78, p. 404). L.Ord., N.Am.—Fig. 96.3. *E. pulchra, Can.(B.C.); 3a,b, anterior and left sides, ×4 (Kobayashi).

Bucania Hall, 1847 [*Bellerophon sulcatinus Emonds, 1812; SD Waagen, 1880] [=?Tubogyna Perner, 1903; Loxobucania Knight, 1942 (70, p. 487)]. Aperture but little, if at all, expanded, wider than long, especially at rear; ornament spiral threads, or threads normal to anterior margin and converging forward, or both types of threads crossing to form a pitted surface. M.Ord.-Sil., N.Am.-Eu.-NE.Asia.—Fig. 96.7. *B. sulcatina (Emonds), M.Ord., N.Y.; 7a,b, left and apertural sides, ×1.3.

Tetranota Ulrich & Scofield, 1897 [*Bucania bidorsata Hall, 1847]. Resembles Bucania in form but selenizone lies on low crest between pair of spiral cords; some species with additional spiral cords on slopes between crest and circum-umbilical angle; ornament collabral threads. M.Ord.-U.Ord., N.Am.-Eu.—Fig. 96.4. *T. bidorsata (Hall), M.Ord., N.Y.; 4a,b, left and anterior sides, ×2.7.

Kokeniospira Bassler, 1915 [pro Kokenia Ulrich & Scofield, 1897 (non Holzapfel, 1895)] [*Bucinella esthona Koken, 1889]. Resembles Tetranota but has higher whorls and narrower umbilicus; spiral cords more numerous and smaller. M.Ord.-U.Ord., N.Am.—Fig. 96.1. *K. esthona (Koken), Ord. (float), Ger., 1a,b, right side and anterior view of steinkern, ×1.3.

?Megalomphala Ulrich & Scofield, 1897 [*Bellerophon contortus Eichwald, 1860]. Like Bucania but lacks spiral sculpture. M.Ord.-Dev., N.Am.—Fig. 96.2. *M. contorta (Eichwald), M. Ord., Est.; 2a,b, left and apertural sides, ×1 (37).

Coelocyclus Perner, 1903 [*Bellerophon (Coelocclus) rarisinensis]. Like Bucania but with umbilical slopes conforming to uniform conical slope and without spiral ornament. M.Sil.-M.Dev., N.Am.—Fig. 96.3. C. perplexus (Walcott), M. Dev., Nev.; 5a,b, left and apertural sides, ×0.7.

Tribe SALPINGOSTOMATIDES Koken, 1925 [nom. transl. Knight, Batten & Yochelson, herein (ex Salpingostomatinae Koken, 1925)]

Exhalant orifice consisting of one or more tremata. M.Ord.-Sil.

Salpingostoma C. F. Roemer, 1876 [*Bellerophon megalostoma Eichwald, 1840]. Aperture expanded widely; slit a tremata confined to whorl side, not extending onto lip, generating a selenizone; ornament growth lines. M.Ord.-Sil., N.Am.—Fig. 96.6. S. bondi (Whitfield), M.Ord., Minn.; 6a,b, left and adapertural sides, ×0.7.

Tremanotus Hall, 1865 [*T. alpheus] [=Trematoctonotus Fischer, 1883 (obj.); Gyrotrema Lindström, 1884 (obj.); Tremagyrus Perner, 1903]. Aperture rather widely expanded at final growth stage; slit represented by a row of tremata, all but last few closed, not extending onto expanded lip; ornament spiral cords of several sizes or growth lines alone. M.Ord.-M.Sil., N.Am.-Eu.-Austral.—Fig. 97.1. *T. alpheus, M.Sil., N.Y.; 1a-c, apertural, adapertural, left sides, ×0.7.

Subfamily CARINAROSPINAENae Ulrich & Scofield, 1897

[nom. transl. Knight, Batten & Yochelson, herein (ex Carinarospidae, Ulrich & Scofield, 1897)]

Shell with tendency toward rapid expansion of whorls, reduction of coiling, and generally development of parietal lip into a plate-like extension; inner floor of whorls bearing a longitudinal keel; selenizone on a moderately developed dorsal crest. ?L.Ord., M.Ord.-Dev.

Bucanopsis Ulrich, in Ulrich & Scofield, 1897 [*B. carinifera] [=Bucaniosis Reed, 1921 (obj.)]. Longitudinal keel on floor of whorls well developed but with coiling moderately reduced and parietal extension slight; ornament fine spiral threads. M.Ord.-Sil., N.Am.—Fig. 98.1. *B. carinifera, M.Ord., Ky.; 1a-c, apertural, adapertural, left sides, ×2.7.

Sphenosphaera Knight, 1945 [*Bellerophon clausus Ulrich in Ulrich & Scofield, 1897]. Coif reduced only slightly; parietal extension moderate; longitudinal keel on floor of whorls well developed but rounded; ornament only growth lines (71, p. 334). M.Ord.-M.Sil., N.Am.—Fig. 98.2. *S. clausa (Ulrich), M.Ord., Tenn.; 2a-c, apertural, adapertural, left sides, ×1.3.

Carinopsis Hall, 1847 [*Carinariopsis carinata (Hall) Fischer, 1885; (=Cylortolites subcarinatus d’Orbigny, 1850, pro Cylortolites carinatus (Hall) Orb., 1850, non Cylortolites carinatus Sowerby, 1839); SD Fischer, 1885] [=Carinariopsis Fischer, 1885 (obj.); Phragmostoma Hall, 1861]. Coil greatly reduced, parietal extension plate-like; longitudinal keel on floor of whorls well developed; ornament growth lines. M.Ord.-U.Ord., N.Am.—Fig. 98.3. C. cymbula (Hall), M. Ord., Ky.; 3a-c, apertural, adapertural (with window), left sides, ×1.3.

Phragmosphaera Knight, 1945 [*P. miranda]. Coil somewhat reduced, parietal extension plate-like; no longitudinal keel on floor of whorls, ornament fine spiral threads (71, p. 338). Dev., N.Am.—Fig. 98.5. *P. miranda, M.Dev., N.Y.; 5a,b, apertural and adapertural sides, ×1.

Gyrosphira Boucot, 1956 [*G. tourteloti]. Disjunct after first 2 whorls with aperture flaring on sides and back; slit about 0.3 whorl in depth, a gently arched selenizone on crest of whorl; surface with obscure cobbled undulations (7, p. 46). ?Dev., S.Am.—Fig. 98.4. *G. tourteloti, Bolivia; 4a,b, right and apertural sides, ×1.3.
Subfamily PTEROTHECINAE Wenz, 1938
(nom. transl. Knight, Batten & Yochelson, herein (ex Pterothecidae Wenz, 1938))

Helicocone expanding very rapidly, coil vestigial; well-developed plate within aperture suggesting that of Crepidula and forming a chamber that protects the visceral mass in the otherwise shallow, open shell; aperture widely explanate; selenizone on dorsal crest; ornament growth lines. M.Ord.-M. Dev.

Trends initiated in the Carinaropsinae seem to be perfected in this subfamily, possibly as a result of adaptation to creeping
about on the soft surface of very fine sediments; many fossil specimens occur in rock composed of such fine sediment.

Pterotheca Salter, 1853 [*Atrypa transversa Portlock, 1843; SD S.A. Miller, 1889] (=Clioderma Hall, 1861; Aulacomera von Huene, 1900 (60, p. 210)). Shell elliptical in outline; visceral chamber triangular, with a pair of short diverging septa near apex on inner surface of the apertural plate. M.Ord.-U.Ord., N.Am.-Eu.—Fig. 99, 1. *P. transversa (Portlock), Ire.; la, b, apertural and abapertural sides, X 1.3.

Cyclotheca Teichert, 1935 [*Pterotheca bohemica Barrande, 1867]. Shell roughly diamond-shaped in outline; inner surface of visceral plate with many regular, fine, transverse striae. U.Sil., Eu.—Fig. 100, 2. *C. bohemica (Barrande), Czech.; 3a, b, abapertural and apertural sides, X 3.3.

Aspidotheca Teichert, 1935 [*A. schrieli]. Shell subcircular in outline; visceral plate longitudinally quadriraptate. L.Dev., Eu.—Fig. 100, 1. *A. schrieli, Ger.; 1a, b, apertural and abapertural sides, X 0.7.

Pedasiola Spriestersbach, 1919 [*P. rhenana; SD Knight, 1937]. Shell elliptical in outline, with raised hooklike apex; apertural plate short, stout, with median ridge and 2 lateral wings; externally with median fold bordered by a groove on each side; anal emargination and surface features not well known. M.Dev., Eu.—Fig. 100, 2. *P. rhenana, Ger.; 2a, b, apertural and abapertural sides, X 0.7.

Subfamily BELLEROPHONTINAE M'coy, 1851 [nom. transl. Knight, Battin & Yochelson, herein (ex Bellerophontidae M'coy, 1851)]

Superficially resembling Nautilus; whorls commonly broadly rounded; umbilici narrow or absent; ornament growth lines. M. Ord.-L.Trias.

Cymbularia Koken, 1896 [*C. galeata; SD Perner, 1903]. Early whorls rounded but last one strongly angulated and somewhat asymmetrical in adult stage, with narrow deep slit; umbilici closed on one or both sides. M.Ord.-M.Sil., N.Am.-Eu.—Fig. 102, 1. *C. galeata, Ord., Est.; 1a-c, left, apertural and anterior sides, X 1.3.

Liljevallospira Knight, 1945 [*Bellerophon tubulosus Lindström, 1884]. Like Bellerophon but with backward projections from each lateral lip curving into the umbilici and nearly closing them, the projections forming on each side hollow spiral tubes that open behind the aperture (71, p. 334). M.Sil.; Eu.—Fig. 102, 2. *L. tubulosus (Lindström), Gotl.; 2a-e, left and apertural sides, section, X 1.5 (90).

Prosopystchus Perner, 1903 [*Bellerophon (Prosopystchus) plebeius; SD Knight, 1937]. Like Bellerophon but final lateral lips somewhat explanate and columellar margins of lip thickened; parietal inductura moderately thick. U.Sil., Eu.—Fig. 101, 1. *P. plebeius (Perner), Czech.; 1a, b, left and abapertural sides, X 2.

Bellerophon Montfort, 1808 [*B. vasulites]. Whorls commonly broadly rounded but some may have a subdued crest. Sil.-L.Trias., cosmop.

B. (Bellerophon) [=Bellerophus deBlainville, 1825 (obj.); Moguila Waagen, 1880; Waagenia deKonincx, 1882 (non Neumayer, 1878, nec Bayle, 1879); Waagenella deKonincx, 1883 (pro Waagenia deKonincx, 1882); Sphaeroeyclus Perner, 1903). Inductura thin, in some species laterally extended over axial region; ornament commonly growth lines. Sil.-L.Trias., cosmop.—Fig. 102, 4. *B. (B.) vasulites, M.Dev., Ger.; 4a-c, apertural, anterior, left sides, X 2.

B. (Aglaoglypta) Knight, 1942 [*Bellerophon koeneni Clarke, 1904]. Like B. (Bellerophon) but ornamented with quincunxially arranged pustules (70, p. 487). M.Dev.-U.Dev., cosmop.—Fig. 102, 6. *B. (A.) koeneni (Clarke), M.Dev., N.Y., X 2.

B. (Pharkidonotus) Girty, 1912 [*Bellerophon percarninatus Conrad, 1842]. Like B. (Bellerophon) but with a strongly thickened inductura that may be padlike in shape; ornament generally collateral undulations; selenizone on crest of low dorsal ridge; no umbilici. L.Carb.(Miss.)-Perm.
N.Am.-Eu.—Fig. 102,5. *B. (P.) percarinatus (CONRAD), M Penn., Mo.; 5a-c, apertural, left, abapertural sides, ×2.

Ptychospaera PERNER, 1903 [*P. constricta]. Whorl with several asymmetrical constrictions at early growth stage and with slight asymmetry of coil at adult stage; a deep, angular sinus culminates seemingly in a short slit. U.Sil., Eu.—Fig. 102,7. *P. constricta, Czech.; apertural side, ×2.

?Ptychobellerophon DELPEY, 1941 [*P. gubleri]. Columellar fold on each side borders depression resembling siphonal channel; seemingly no anal emargination (28, p. 36). (Possibly the lateral channels functioned as inhalant canals, but it is improbable that currents passed from one side to the other as postulated by DELPEY; the path of the exhalant currents is unknown.) LPerm., SE. Asia.—Fig. 102,3. *P. gubleri, IndoChina; apertural side, ×2 (28).

Subfamily KNIGHTITINAE Knight, 1956

Strong spiral ornament; selenizone somewhat depressed, bordered by generally obscure ridges; umbilici narrow. Dev.-M. Perm.

Fig. 100. Bellerophontacea (Bellerophonidae—Pterothecinae) (p. 1182).
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The spiral ridges are the loci of a pair of shallow mantle folds within the shell that seem to have carried ciliary currents of clean oxygenated water into the inhalant chamber of the mantle cavity. From here the current passed through the ctenidia to the exhalant chamber where it picked up waste and foreign matter and passed by way of the excurrent opening (the slit) to the outside (Fig. 57).


K. (Retispira) Knight, 1945 [*R. bellireticulata*]. Lateral lips of aperture expanded only moderately or not at all; incipient channels inconspicuous; parietal inductura commonly thin; collateral ornament ranging from fine growth lines to cords and undulations (71, p. 335). Dev.-MPerm., N.Am.-S.Am.-Eu.-N.Afr.-Asia. — Fig. 103.5. *K. (R.) bellireticulata* (Knight), MPerm., Tex.; 5a,b, left and anterior sides, X5.

K. (Cymatospira) Knight, 1942 [*Bellerophon montfortianus* Norwood & Pratten, 1855]. Lateral lips of aperture strongly expanded at final growth stage; collateral undulations prominent at intermediate growth stage, especially on ridges over inhalant canals along selenizone; parietal inductura with toothlike extension into aperture (70, p. 487). U.Miss.-Penn., N.Am.—Fig. 103, 1. *K. (C.) montfortianus* (Norwood & Pratten), U.Penn., Tex.; 1a,b, apertural and abapertural sides, X1.3.

K. (Knightites). Collar elements tending periodically to form projecting tubes on inhalant ridges; lateral lips without marked final expansion. U.Penn.-MPerm., N.Am.—Fig. 103, 2. *K. (K.) multicorpus*, U.Penn., Kan.; 2a-c, abapertural side of large specimen, left and apertural sides of smaller mature specimen, X1.5.

Patellilia Knight, 1945 [*P. tentorium*]. Apertural margins progressively expanding backward and at sides; parietal inductura with forward projecting tooth; ornament numerous spiral threads (71, p. 336). Miss. (L.Carb.)-LPerm., N.Am.-S. Am.—Fig. 103, 3. *P. tentorium*, U.Penn., Mo.; 3a,b, apertural and abapertural sides, X0.7.

**?BELLEROPHONTACEA, INCERTAE SEDIS**

Isospira Koken, 1897 [*I. bucanioides*]. Isostrophic coiling but without trace of sinus or slit; ornament cancellate, of spiral and collateral cords; parietal lip unknown. U.Ord., Eu.—Fig. 103, 4. *I. bucanioides*, Est.; anterior side, X2.7 (80).

**BELLEROPHONTACEA, GENERA INQUIRENDA**

Patellostium Waagen, 1880 [*Bellerophon macrostoma* C.F.Roemer, 1844; SD Ulrich & Scottfield, 1897]. Wide expansion of apertural margins is only character surely determinable. M.Dev., Eu.

Euphemittella Tasch, 1953 [*E. emrichi*]. Based on steinkerns representing unrecognizable genus or genera (137, p. 397). U.Penn., Kan.

**Suborder MACLURITINA Cox & Knight, 1960**

Shell hyperstrophic to depressed-orthostrophic, commonly with angulation on outer part of upper whorl surface coinciding with or forming outer border of channel thought to have been exhalant; shell wall thick, outer layer calcitic, inner layers thick, argonitic but not nacreous; operculum heavy, calcareous, paucispiral in *Macurites* with attachments for 2 retractor muscles, unknown in other genera; right ctenidium inferred to have been reduced and in some forms possibly absent; nature of reproductive system and other soft parts uncertain [The outer layer may show preserved color pattern.] U.Cam.-Trias., ?U. Cret.

**Superfamily MACLURITACEA**

Fischer, 1885

[nom. transl. Knight, Batten & Yochelson, Berck (ex Macuritidae Fischer, 1885)]

Hyperstrophic (except genuinely sinistral *Omphalocirrus*), with or without umbilicus
Fig. 102. Bellerophontacea (Belleropontidae—Bellerophontinae) (p. 1182-1183).
on upper side, lower side (base) flat or more or less protruding; with conspicuous channel, presumably exhalant in function, surrounding upper side within a ridge, and marked by a sinus in some forms; abandoned tip of helicocone not closed off by septa. U.Cam.-Dev.

These gastropods are inferred to be hyperstrophic, notwithstanding their apparently sinistral coiling, from the position of the channel (presumed to be exhalant) occupying a ridge or keel around what may be assumed to be the upper side. This inference is supported strongly by the operculum of *Maclurites*, which corresponds to that of a dextral gastropod (76) with a pair of retractor muscles. Members of this superfamily probably possessed paired ctenidia

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**Fig. 103.** Bellerophontacea (Bellerophontidae—Knightitinae; incertae sedis) (p. 1184).
and other organs, like surviving Pleurotomariacea. The Macluritacea are thought, however, to have arisen from the Bellero-phontacea as an independent group, distinct from the Pleurotomariacea.

**Family ONYCHOCHILIDAE Koken, 1925**

Relatively small, with base more or less protruding, like the spire of an orthostrophic gastropod. *U.Cam.-L.Dev.*

**Subfamily ONYCHOCHILINAE Koken, 1925**

Basal “spire” high. *U.Cam.-L.Dev.*


*Lacogyra* PERNER, 1903 [*L. bohemica*]. Like *Matherella* but with deeper sutures and transverse cords; not well known. *M.Sil.*, Eu.

*Onychochilus* LINDSTROM, 1884 [*O. physa; SD COSSMANN, 1915*] [*Palaeopupa FORSTER, 1893; Onychochilus COSSMANN, 1915 (obj.)]. Subtrochi­form to pupiform; outer lip opisthocline; deeply phaneromphalous; with or without ornament. *M.Sil.*, N.Am.-Eu.—*FIG. 104,4. *O. physa*, Gotl.; X10.

*Sinistracirsa* COSSMANN, 1908 [*pro Donaldia PERNER, 1903 (non ALLAUD, 1898)] [*Donaldia altera PERNER, 1903*] [*=Boyocottia TOMLIN, 1931 (obj.)]. Basal “spire” rather high; seemingly anomphalous; outer lip gently opisthocline, with sinus in upper margin; ornament numerous very fine spiral threads. *L.Dev.*, Eu.—*FIG. 104,2. *S. altera* (PERNER), Czech.; X1.3.

**Subfamily SCAEVOGYRINAE Wenz, 1938**


*Scaveogyrus* WHITFIELD, 1878 [*S. swezeyi; SD MILLER, 1889*]. Hyperstrophic naticiform; umbilicus large and deep, with steep sides surrounded by sharp angulation that carries the exhalant channel; basal “spire” small. [Because the steinkern of this thick-shelled form was not recognized as such, a flaring aperture was attributed to the type species and the original error was exaggerated by WENZ, 1888, p. 1167.]

**Kobayashiella** ENDO, 1937 [*Straparollina circe WALCOTT, 1905*]. Much like *Scaveogyrus* but with opisthocline collapsar cords on base and whorl face and with blunter circumumbilical ridge. *U. Cam.*, NE.Asia.—*FIG. 104,6. *S. swezeyi*, Wis.; X1.3.


*Antispira* PERNER, 1903 [*A. praecox*]. Seemingly like *Scaveogyrus* but with cancellate ornament; poorly known. *M.Ord.*, Eu.

*Versispira* PERNER, 1903 [*V. contraria*]. Seemingly like *Scaveogyrus* but steinkern of type species shows bore of final whorl blocked by a septum about 0.5
volution back from aperture; poorly known. *M. Ord., Eu.

?Helicotis Koken, 1925 [*Temnodiscus rugifer Koken, 1897]. Periphery subangular; lip strongly opisthocline on outer surface, less so within umbilicus; ornament collabral cords; poorly known. *M. Ord., Eu.

**Family MACLURITIDAE** Fischer, 1885

[=Maclureidae Carpenter, 1858 (nom. correct. Koken, 1925, pro Maclureidae and "Maclureade" Carpenter, 1858); Macluritidae Pilsbry, 1888; ICZN pend.]

Relatively large; base flat or gently protruding. *L. Ord.-Dev.*

**Lecanospira** Butts, 1926 [*Ophileta compacta Salter, 1859; SD Ulrich & Bridge, 1931]. Discoidal, with flat base and wide umbilicus above; whorls with sharp crest; lip with deep angular sinus culminating at crest; ornament strongly opisthocline growth lines on upper part of outer and umbilical walls. *L. Ord., N.Am.*

**L.** (Lecanospira). Upper sutures within deep angular grooves; umbilical slope of whorls flat or slightly concave; growth lines prosocyrte on base of whorls.—Fig. 105,3. *L. (L.) compacta (Salter), Que.; X 1.3.

**L.** (Barnesella) Bridge & Cloud, 1947 [*B. lecanospiroidea*]. Differs from *L. (Lecanospira)* in having shallower upper sutures, growth lines less prosocyrte on base, and umbilical slope of whorl...
 Archaeogastropoda—Macluritina—Euomphalacea

*Macluritella* Kirk, 1927 [*M. stantoni*]. Planispiral, with obscure angulation on upper whorl surface and shallow sinus at angulation. *L. Ord.*, N.Am. *M. (Macluritella)*. Whorls slightly disjunct, base flat.—Fig. 105,2. *M. (M.) stantoni*. Colo.; ×2.7. *M. (Euomphalopsis) Ulrich & Bridge, 1931 [*E. involuta*]. Whorls in contact, base slightly concave.—Fig. 105,4. *M. (E.) involuta*, Mo.; 4a, oblique views from above and below, ×3. *Mahurites* Lesueur, 1818 [*M. magna*; SD de Koninck, 1881] [=Maclurita deBlainville, 1823 (obj.); Maclurea Emmons, 1842 (obj.); Maclurea Bronn, 1848 (obj.); Maclurina (Ulrich & Scofield, 1897)]. Shell large, heavy, with flat base; upper surface strongly convex, with deep, steep-walled umbilicus; whorls with subangular crest, locus of a slight sinus; ornament growth lines and shallow sinus at angulation. *L. Ord.*, N.Am.—NE.Asia.—Fig. 105,7. *M. logani* (Salter), M.Ord., Can.(Que.); 7a, apertural view, operculum in place, ×0.7; 7b, inner surface of operculum showing 2 muscle scars (right, below; left, above), ×0.7. *Palissoria* Wilson, 1924 [*P. robusta*] [=Metospira Kirk, 1930]. Much like *Mahurites* but base protruding as domelike "spire"; operculum unknown. *M. Ord.*, N.Am.—Fig. 105,6. *P. robusta*. Low.M.Ord., Nev.; ×0.7. *Omphalocirus* Ryckholt, 1860 [*Euomphalus goldfussii* d'Archiac & de Verneuil, 1842; SD Cossmann, 1915] [=Coelocentrus Zittel, 1882 (obj.); Polyenaulus Etheridge, 1917 (obj.); Arctomphalus Tolmächov, 1926]. Like *Mahurites* in size and shape but base generally sinistral, with shallower umbilicus and row of short spoutlike protrusions developed periodically along whorl crest. Dev., N.Am.—Fig. 105,5. *O. goldfussii* (d'Archiac & de Verneuil), M.Dev., Ger.; ×0.5. **Superfamily EUOMPHALACEA** deKoninck, 1881

[nom. transl. Wenz, 1938 (ex Euomphalidae deKoninck, 1881)]

Shell mostly discoidal; orthostrophic or hyperstrophic; commonly with channel presumed to be exhalant occupying angulation on outer part of upper whorl surface; mostly widely phaneromphalous; shell wall relatively thick, with external prismatic layer of calcite which may be pigmented and internal layer of aragonite which is lamellar but not nacreous. *L. Ord*.—U.Cret.

Because the angulation on the outer part of the upper whorl surface carries a presumably exhalant channel, and in some genera even a short slit and selenizone with ample space on its inner side, it is reasonable to suppose that the ctenidia and other organs of euomphalaceans were paired, as in other primitive Prosobranchia. The superfamly seems to have been derived from the Macluritacea.

**Family HELICOTOMIDAE** Wenz, 1938

Spire slightly elevated; umbilicus relatively narrow; shoulder angulation generally a carina, with notch or short slit and selenizone in some forms; seemingly without septa. Operculum calcareous, wedge-shaped in some genera, unknown but probably conoïdes in others. *L. Ord.*, ?*M. Jur.* (Baj.)*

*Orospira* Butts, 1926 [*O. bigranosa*]. Spire a low cone; whorls narrow, numerous (about 10), with elevated carina at outer edge of upper whorl surface; short slit and arched selenizone at crest of carina, slit at culmination of deep angular sinus; outer whorl face rounded but sloping inward below; ornament elaborate (for early Paleozone), with spiral cords on upper whorl surface and umbilicus, and transverse threads or cords forming tubercles where they cross spirals. [Small wedge-shaped calcareous opercula associated with some specimens probably belong to genus.]. *L. Ord.*, N.Am.—Fig. 106,3. *O. bigranosa*, Mo.; ×2.

*Polhemia* Cullison, 1944 [*P. taneyensis*]. Differs from *Orospira* in shape of whorls and nearly complete lack of collabral ornament; whorls with deep groove at upper suture adjoined by 2 carinae separated by concave zone, outer carina at upper-outer angulation, with shallow slit and convex selenizone; outer whorl face concave between upper-outor carina and sharp lower-outer angulation; base narrowly phaneromphalous, with low circumumbilical ridge; ornamented with growth lamellae above base, and on base with lamellae crossed by spiral threads. Operculum as in *Orospira* (25, p. 54). *L. Ord.*, N.Am.—Fig. 106,2. *P. taneyensis*, Mo.; ×2.

*?Lophonema* Ulrich in Purde & Miser, 1916 [*Helicotoma peccatonica* Sardés, 1896]. Much like *Polhemia* but angulations and carina seemingly rounded; poorly known. [When better known may prove to be senior synonym of *Polhemia.]* *L. Ord.*, N.Am.

*Helicotoma* Salter, 1859 [*H. planulata*]. [=Palaeomphalus, Koken, 1925]. Spire low,
gradate, with nearly horizontal ramp bordered at upper-outer angulation by a carina carrying a short slit that generates a convex selenizone; growth lines on sides strongly opisthochrome above and prosocyr. Operculum unknown. L.Ord.-M.Ord., N.Am.-Eu.-NE.Asia-Austral.—Fig. 106, 1. *H. planulata, M.Ord., Can.(Que.).

Ophiletina Ulrich & Scofield, 1897 [*O. sublaxa]. Coiled approximately in a plane, last half whorl in contact only with flange of previous whorl; low carina at upper-outer angulation, with short slit and selenizone; last whorl bearing wide flange near middle of outer whorl face; ornament low sharp transverse lamellae. Operculum unknown. M.Ord., N.Am.-Eu.—Fig. 106, 5. O. angularis (Ulrich & Scofield), Minn.; 5a,b, oblique views from above and below showing peripheral flange, ×2.7.

Vivianella Cox, 1958 [*pro Viviana Koken, 1896, non Bigot, 1888] [*Viviana ornata Koken, 1896]. Shell small, forming very depressed cone broadly truncated at apex owing to planispiral coiling of early whorls; upper surface of later whorls with prosocline collabral ridges and jagged median and peripheral carinae; base feebly convex, with broad umbilicus bordered by similar carina; aperture imperfectly known. U.Trias.(Nor.)-M.Jur. (Baj.), Eu.—Fig. 106, 6. *V. ornata (Koken). U.Trias., Aus.; 6a,b, ×7 (79).

Paraviviana Kutassy, 1940 [*Solarium gradatum Koken, 1897]. Shell forming depressed cone broadly truncated at apex owing to planispiral coiling of early whorls; upper surface of later whorls with angulation delimiting broad, gently sloping ramp, second angulation at periphery; base and aperture imperfectly known; ornament of close, regular collabral ridges prosocline on ramp. U.Trias.(Nor.), Aus.—Fig. 106, 4. *P. gradata (Koken); 4a,b, ×4 (79).

Colpomphalus Cossmann, 1916 [*Straparollus altus d’Orbigny, 1853]. Spire low; upper whorl surface concave or flat, extending to tuberculate periphery; outer whorl face more or less convex, inclined abapically to tuberculate angulation forming umbilical border; aperture subquadangular, peristome continuous, angular at junction of columellar and basal lips. L.Jur.(Lias.)-M.Jur. (Bathon.), Eu., N.Afr.—Fig. 106, 7. C. exertus (Hudleston), Baj., Eng.; 7a,b, ×1.7 (59).
Family EUOMPHALIDAE de Koninck, 1881

[=Schisostomiidae Eichwald, 1871 (ICZN pend.); Polytopidae Koken, 1925; Poleumidae, Ecculiomphalinae Wenz, 1938]

Shell mostly discoidal with wide umbilicus, but varying in form through wide range; abandoned early part of whorls closed off by septa; presumed exhalant channel generally present within outer-upper angulation, rarely with short slit or selenizone; outer calcitic shell layer may be pigmented and in several genera foreign materials such as other shells may be cemented to outer surface. L.Ord.-Trias., ?U.Cret.

Lytopispa Koken, 1896 [*Euomphalus angelini Lindström, 1884; SD Perner, 1907]. Openly coiled, some species hyperstrophic; broadly angular sinus in outer lip culminating at low bluntly

Fig. 107. Euomphalacea (Euomphalidae) (p. 1191-1192).
angular spiral ridge near mid-line of upper surface; some species cement shells or other foreign substances to outer surface. L.Ord.-M.Sil., N.Am.-Eu. — Fig. 107,6. *L. angelini* (Linndström), M. Ord., Swed.; 6a, apertural view, X 1.3; 6b, from above with window showing septa, X 1.3.

Ecculimphalus Portlock, 1843 [*E. bucklandii*; SD S.A. Miller, 1889] (=Eccyliomphalus Agassiz, 1846 (obj.); Ecchyliomphalus Remiéle, 1888). Much like Lytospira but with high frill-like crest at upper-outer edge; surface with sharp collateral threads. [Commonly confused with Lytospira, especially when preserved as steinkerns.] L.Ord.-Sil., N.Am.-Eu.-NE.Asia. — Fig. 107,5. *E. alatus* C.F. Roemer, M.Ord., Ire.; 5a, oblique apertural view, X 1; 5b, oblique from below, X 1.

Lesueurilla Koken, 1898 [*Maclurea infundibulum* Koken, 1896; SD Perner, 1903] (=Lesueleilla Perner, 1903 (obj.); Pachytrephia Perner, 1903). Hyperstrophic, with rounded base and shallow open umbilicus; early whorls tightly coiled but last whorl free; whorls high and sharply angular above, with narrow pseudoselenizone on crest of angulation, and rounded below. Ord., N. Am.-Eu. — Fig. 107,1. *L. infundibulum (Koken),* M.Ord., Swed.; 1a,b, oblique from above and below, X 1.3.

Poleunita Clarke & Ruedemann, 1903 [*pro Poly­ tropis deKoninck, 1881 (non Sannderger, 1874)] (*Enoumpalus discors* J.Sowerby, 1814) [*Poly­ tropina Donald, 1905 (obj.).] Shape like Straparollus (Euomphalus), but upper whorl surface bearing numerous collateral lamellae of 2 orders and faint revolving cords; upper-outer angulation with channel and small sinus over it; operculum unknown, probably corneous. [Differs from Oristoma, with which it has been long confused, in closure of abandoned whorls by septa, in lacking a nacreous inner layer, and in having no calcareous operculum.] L.Sil., N.Am.-Eu. — Fig. 107,3. *P. discors* (Sowerby), Gotl.; 3a,b, oblique from below and above, X 0.7.

Centrifugus BRonn, 1834 [*C. planorbis*] (=In­ achus Hisinger, 1837 (non Fabricius, 1798) (obj.); Hisingeria Ulrich & Scofield, 1897 (pro Inachus Hisinger, 1837) (obj.). Shell with nearly flat spire, widest at carina around base, with short narrow slit and selenizone not far from upper suture; 5 strong spiral cords above peripheral carina with weaker cord between each pair, spiral ornament on base faint. [Slit on upper whorl surface probably is exhalant opening.] U.Sil., Eu. — Fig. 107,2. *C. planorbis*, Gotl.; 2a,b, oblique from above and below, X 0.7.

Sinutropis Perner, 1903 [*S. esthetica; SD Perner, 1907]. Shape like Straparollus (Euomphalus), but with rounder whorls and no upper-outer angulation; moderately deep rounded sinus culminates at position of angulation; ornamented with numerous fine spiral and collateral threads. U.Sil., Eu. — Fig. 107,4. *S. esthetica*, Czech.; oblique from above, X 1.3.

Straparollus DEMontfort, 1810 [*S. dionyiisii].* Shape variable, with almost complete range from moderately high conispiral to discoidally hyperstrophic; channel (probably exhalant) or slight sinus on outer-upper angulation. [Restudy of original description shows that spelling Straparollus was a printing error subject to automatic correction.] Sil.-M.Perm., cosmom.

S. (Euomphalus) J.Sowerby, 1814 [*E. pentang­ latus;* SD MEEK & WORTHE, 1866] (=Schizo­ stoma BRonn, 1834; Phymatiller deKoninck, 1881; Liomphalus CHAPMAN, 1916; Amphelissa Etheridge, 1921; Paromphalus GRABAU, 1936). Subdiscoidal, with depressed, slightly elevated spire, whorls with channel-bearing angulation at upper-outer edge; sutures generally deep; base widely phaneromphalous; lower surface of whorls rounded to angular; commonly ornamented with fine collateral growth lines and faint spiral threads, some species with row of nodes on lower angulation or on both lower and upper. Sil.-M.Perm., cosmom. — Fig. 108,1. *S. (E.) pentangulatus Sowerby*, L.Carb., Eng.; 1a,b, oblique from above and below, X 1.

S. (Philoxene) Kayser, 1889 [*Euomphalus laevis d'ARCHIG & deVERNEUIL, 1842].* Trochiform to discoidal, with wide umbilicus; whorls rounded; surface commonly with scars of attached shell fragments. Dev., Eu. — Fig. 108,2. *S. (P.) laevis* (Archig & Verneuil), M.Dev., Ger.; 2a,b, oblique from above and below, X 1.7.


S. (Straparollus). Shell trochiform to discoidal, with deep, moderately wide umbilicus; whorls rounded but with slight shoulder that is locus of very shallow sinus. Carb.(Miss-Penn.), N. Am.-Eu.-Austral. — Fig. 108,4. *S. (S.) dionyiisii*, L.Carb., Belg.; 4a,b, oblique from below and above, X 1.

S. (Amphiscapha) Knight, 1942 [*Straporolus (Euomphalus) reedii* Knight, 1934]. Hyperstrophic discoidal, base flat, with spiral rib projecting very slightly beyond side, which is flat or slightly concave, to outer-upper margin where smooth or rugose ridge carried internal exhalant channel; upper whorl surface sloping inward (70, p. 488). Penn.(U.Carb.)-L.Perm., N.Am.-S.Am. — Fig. 108,10. *S. (A.) reedii* (Knight), M.Penn., Mo.; 10a,b, oblique from above and below, X 1.3.

S. (Leptomphalus) Yochelson, 1956 [*S. (Leptomphalus) micidus].* Much like S. (Euomphalus), but with coil almost symptomatically discoidal and usual angulations of both upper and lower
Fig. 108. Euomphalacea (Euomphalidae) (p. 1192-1195).
whorl surfaces much subdued (154, p. 197). *M. Perm., N.Am.-Eu.-E.Asia.—Fig. 108,5. *S. (L.) micidus, Tex.; 5a,b, apertural view and oblique from above, ×1.3.

**Pleurotonus** HALL, 1879 [*Euomphalus decewi* BILLINGS, 1861]. Like *Straparollus* (*Euomphalus*) in shape, but whorls deeper and with strong angular sinus culminating at outer-upper angulation in shallow slit that generates selenizone. Dev., N.Am.-Eu.-Austral.—Fig. 108,6. *O. decewi* (BILLINGS), M.Oev., Can.(Ont.); 7a,b, oblique from above and below, ×0.7.

**Mastigospira** LAROCQUE, 1949 [*Hyolites alatus* WHITEAVES, 1892]. Shell straight or gently curved, without coiling, roughly triangular in cross section; abandoned tip shut off by septa; upper surface with angulation which is culmination of a deep V-shaped sinus, a broader rounded sinus below; each side of aperture extended in a point (87, p. 114). *M. Dev., N.Am.—Fig. 108,7. *M. alatus* (WHITEAVES) Can.(Man.); from above, ×0.7 (87).

**Odontomaria** C.F.ROEMER, 1876 [*O. elephantina*]. Not well known but possibly senior synonym of *Mastigospira* M.Dev., Eu.—Fig. 108, 6. *O. elephantina*, Ger.; oblique from above, ×1 (123).

**Micromphalus** KNIGHT, 1945 [*M. turris*]. Trochiform, relatively high, gradate; narrowly phaneromphalous; growth lines prosocline on upper shoulder, orthocline below; with slight sinus on blunt angulation (72, p. 585). *M. Dev.-Miss., N. Am.—Fig. 108,11. *M. turris*, M.Miss., Ky.; ×2.

**Phanerotinus** J.DECSOWERBY, 1844 [*Euomphalus cristatus* PHILLIPS, 1836; SD DEKONINCK, 1881] [=*Phaneroina PAETEL, 1875 (obj.)*]. All but early whorls openly coiled; channel on anterior

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**FIG. 109. Euomphalacea (Euomphalidae) (p. I194-I196).**
face of large periodic leaflike extensions that protrude horizontally from upper part of outer whorl face. [Late Paleozoic open-coiled euomphalids lacking leaflike expansions, although commonly referred to this genus, are more properly assigned to Straparollus (Serpulospira).] L.Carb., Eu.—Fig. 109,6. *P. cristatus (Phillips), Eng.; oblique from above, X 0.5.

Cyllocosca Yochelson, 1956 [*Amphiscapha (Cyllocosca) texana]. Somewhat like S. (Amphiscapha) but with deeper umbilicus and with exhalant channel in supplemental, commonly noded angulation rising in adult above outer whorl as a spiral cord; with protruding basal cord as in S. (Amphiscapha); labrum projecting forward at primitive upper angulation and with sinus and channel at supplemental angulation (154, p. 199). M.Penn.-M.Perri., N.Am.—Fig. 108,9. *C. texana (Yochelson), U.Penn., Tex.; 9a,b, oblique from above and below, X 1.3.

Planotectus Yochelson, 1956 [*P. cymbellatus]. Upper whorl surface very gently arched within sharp carina; outer whorl face sloping inward to rounded basal surface; umbilical walls steep; labrum projecting forward at carina, with channel within (154, p. 200). M.Perri., N.Am.—Fig. 109,2. *P. cymbellatus, Tex.; 2a,b, oblique from above and basal view, X 1.5.

Discolhelix Dunker, 1848 [*D. calciformis]. Discoidal, either upper or lower face (assuming dextrality) the more impressed; protoconch deviated but not heterostrophic; whorls subquadratc in cross section, barely overlapping; ornament collabral and in some shells spiral threads, tubercles at both angulations in most species. M.Trias.-U.Cret.(Senon.), cosmop.

D. (Discolhelix). Growth lines gently opisthocyrn on outer whorl face. M.Trias.-U.Cret.(Senon.), cosmop. — Fig. 109,1. D. (D.) sinistra (d’Orbigny), M.Lias., Fr.; 1a-c, X 1 (110).

D. (Amphitomaria) Koken, 1897 [*Euomphalus cassianus (Koken), 1889]. Shell small; no ornament except growth lines, which are strongly prosocyr in slightly concave outer whorl face and have small notches where they cross its 2 well-defined bordering carinae. M.Trias.(Ladin.), Eu.—Fig. 110,6. *D. (A.) cassiana (Koken), S. Tyrol; 6a,b, X 2 (196).

Anisostoma Koken, 1889 [pro Platystoma Hönes, 1855 (non Meigen, 1803)] [*Platystoma sueci Hönes, 1855]. Shell and whorls as in Discolhelix except that last whorl bends down through right angle just before circular aperture, labrum of which has broad, flat, kidney-shaped expansion almost as wide as base of shell, in plane of which it lies. M.Trias.-U.Trias., Eu.—Fig. 110,3. *A. suessi, U.Trias.(Nor.), Aus.; 3a-c, X 2, X 3, X 2 (79).

Wochrmannia J.Bohm, 1895 [W. böhmi Kittl, 1899 (ICZN pend.)]. Shell small, discoidal; spire flat or protruding very slightly; upper surface of whorls bordered by smooth or denticulate carina, below which, on steep outer face of last whorl, are 1 or 2 further carinae; no other ornament except growth lines; umbilicus without bordering carina. M.Trias.-U.Trias., Eu.—Fig. 110,2. W. lineata (Klipstein), U.Trias.(Carn.), S.Tyrol; 2a-c, X 3 (89).

Nummocalar Cossman, 1896 [*Solarium poly-
*N. whitneyi* MCCOYi publicus, *0. publica*, (P.) pulchellus *B. carinatus* [*D. polygonium* *erratum*.] *Suciensis* [*H. lubbocki* [*C. hippocampoides* WADE, 1916]. Weeksia STEPHENSON, 1941.] *Conдонella* MCCLELLAN, 1927. Shell discoidal or with very slightly protruding spire; upper surface with regular transverse ribs ending at carinate periphery in angular projections or spines; these remain exposed by and produce undulations of suture on earlier whorls; intervals with fine cancellate ornament; umbilical border not carinate; aperture broader than high. *M. Jur.* (Baj.)—*U. Cret.* (Senon.), Eu., N.Afr. N. (Nummocalar). Shell rather small; spire protruding slightly; whorl diameter increasing relatively rapidly; outer whorl face not delimited from base; umbilicus only about 0.3 of shell diameter, with crenulations at its border. *M. Jur.* (Baj.)—*U. Cret.* (Senon.), Eu., N.Afr.—Fig. 110, 5. *N. (N.) polygonium* (ARCHIAC), Bathon., Fr.; 5a-c, ×2, ×2, ×1 (17).

*Platybasis* COSSMANN, 1916 [*Straparollus pulchellus* *O'RIBIGNY, 1850.]. Medium-sized, discoidal, whorl diameter increasing relatively slowly; ribs tuberculate; angulation separating outer whorl face from base, which appears flattened; umbilicus wide, without crenulations at border. *M. Jur.* (Baj.), Eu.—Fig. 109, 3. *N. (P.) pulchellus* (o'ORBIGNY), Baj., Fr.; 3a-c, ×2.5 (111).

Hippocampoides WADE, 1916 [*H. serratum*]. Shell subcylindrical, whorl height proportionately large for family, whorl diameter increasing rapidly; spire protruding only slightly, whorls flat, with collabral rugae that may produce jagged projections on sharply carinate periphery; unornamented or with spiral striations; outer whorl face concave, sloping inward slightly abapically toward 2nd carina forming border of umbilicus. *U. Cret.* (Campan.), Tenn.—Fig. 110, 4. *H. serratum*; 4a-c, ×1.3 (226).

?COELIDIScus BRÜSMLEN, 1909 [*Euomphalus minutus* ZIETEN, 1832]. Shell small, involute or with slightly protruding, obtuse spire; whorls evenly rounded, overlapping slightly, smooth or with parasigmoidal collabral threads; aperture ovate, higher than broad. *L. Jur.* (L. Lias.)—*M. Jur.* (Baj.), Eu.—Fig. 109, 4. *C. aratus* (TATE), L. Lias., Ger.; 4a-c, ×7 (11).

?CONDON ella MCCLELLAN, 1927 [*C. sucienis*]. Rather small, discoidal; spire flat, of slowly increasing whorls; outer whorl face convex, sloping inward abapically, limited above by peripheral and below by circumumbilical angulation; no ornament except collabral threads; aperture imperfectly known. *U. Cret.*, N. Am.—Fig. 110, 1. *C. sucienis*, San Juan L; 1a-c, ×1 (147).

?WEECKSia STEPHENSON, 1941 [*Pseudomalaxis amplifica WADE, 1926.]. Shell discoidal; whorls increasing rapidly in diameter, subrectangular in cross section, smooth; upper and circumumbalangulations obscurely nodose, outer face of shell between them almost flat; upper and umbilical surfaces shallowly concave; protoconch a smooth button projecting above level of succeeding whorls.

U. Cret., N. Am.—Fig. 109, 5. *W. lubbocki STEPHENSON, Tex.; 5a-c, ×2 (220).

Family OMPHALOTROCHIDAE Knight, 1945

[nom. transl. KNIGHT, BATTEN & YOCHELSON, herein (ex Mollusca-Gastropoda)]

Shell trochiform, with broad sinus in upper part of outer lip and forward protrusion below; narrowly to widely phaneromphalous. Dev.-M. Perm., ?U. Trias.

This family is thought to have been derived from earlier euomphalids, possibly from close allies of *Centrifugus*. If this was so, the sinus high on the outer lip may be the morphological and functional homologue of the exhalant slit in that genus. Both *Centrifugus* and omphalotrochids have a protruding section of the lip low on the whorl face; commonly this is thickened and bears within it a more or less well-marked channel. This combination of features suggests that the Omphalotrochidae may have been in the process of losing the right ctenidium and adopting an independent left-to-right flow of ciliary currents in the mantle cavity. If this was so, the channel in the forward extension may have been inhalent.

Oreocopia KNIGHT, 1945 [*Platychisma? mccoyi* WAlcott, 1884]. Base nearly flat, minutely phaneromphalous, surrounded by thick funicle; outer lip with broad rounded sinus above and forward projection at periphery; shell much thickened by secondary deposits within (72, p. 586). Dev., N. Am.—Fig. 111, 1. *O. mccoyi* (WALCOTT), U. Dev., Nev.; ×1.6.

Omphalotrochus MEEK, 1864 [*Euomphalus (Omphalotrochus) wh Penny. (U. Carb.)—M. Perm., N. Am.—Fig. 111, 4. *O. whitneyi* (MEEK), L. Perm., Calif.; ×1.3.

Discotropis YOCHELSON, 1956 [*D. publicus*]. Discoidal, with flat or gently rounded, phaneromphalous base and pair of prominent spiral ridges or carinae; shallow labral sinus above lower or peripheral carina, which forms salient (154, p. 203). U. Penn.-M. Perm., ?U. Trias, N. Am.—Fig. 111, 2. *D. publica*. M. Perm., Tex.; 2a.b, apertural view and oblique from above, ×2.

Babylonites YOCHELSON, 1956 [*B. carinatus*]. Conical, with flat phaneromphalous base; sutures shallow; outer whorl face approximately conformable to sides of cone, gently concave for its upper 0.7 with concave or convex band above periphery; shallow labral sinus above forward-projecting
OEcopio
Diploconulo
Bobylonites
Discotropis
Ompholotrochus

**Fig. 111. Euomphalacea (Omphalotrochidae) (p. 1196-1197).**

periphery (154, p. 202). M.Perm., N.Am.—Fig. 111.5. *B. carinatus*, Tex.; X 1.

Diploconula Yochelson, 1956 [*D. biconvexa*]. Spire and base conical, narrowly phaneromphalous; shell heavy; periphery subangular; labral sinus very shallow; angular umbilical funicle (154, p. 203). M.Perm., N.Am.—Fig. 111.5. *D. biconvexa*, Tex.; X 1.3.

**Suborder PLEUROTOMARIINA**

Cox & Knight, 1960

[*Fissibranchia* Swainson, 1840; *Zeugobranchia* von Hörne, 1876; *Zeugobranchia* Swainson, 1881]

Shell commonly conispiral, more rarely discoidal, auriform, patelliform, or other shapes; mostly with exhalant notch, slit, trema, or series of tremata, generating a selenizone (except in patelliform genera with apical trema); outer shell layer calcitic, inner layers aragonitic and nacreous except in patelliform genera; operculum corneous and multispiral in conispiral, absent in patelliform, genera; ctenidia paired, right ctenidium (except in Fissurellacea) reduced to varying extent; epipodium present; pallial genital organs wanting; heart with 2 auricles, ventricle traversed by rectum; radula rhipidoglossate. *U.Cam.-Rec.*

In this group the inhalant current is drawn into the mantle cavity near the mid-

dle and the exhalant current is discharged through a labral emargination, which exists in most forms, or else through a trema or series of tremata in the shell wall.

**Superfamily**

**PLEUROTOMARIACEA**

Swainson, 1840

[*nom. transl. Wenz, 1938 (ex Pleurotomariidae King, 1850, nom. correct. et transl. ex Pleurotomariae Swainson, 1840)]

Shells mostly conispiral, but rarely discoidal or auriform; inner shell layer aragonitic, nacreous. Operculum, in living representatives, corneous, multispiral. *U.Cam.-Rec.*

This ancient line first appears in late Upper Cambrian strata and is preceded in the fossil record of the Gastropoda only by the Helcionellacea, the Bellerophontacea, and the questionable Pelagiellacea. The group has much in common with bellerophontaceans, for example, in nature of the exhalant emargination, and in three of the four surviving families the presence of actual or potential paired retractor muscles. Pleu-

tomariaceans in which the shell is conispiral differ from bellerophontaceans in having an asymmetrically coiled shell with its inner layers nacreous. The superfamily is thought
to be derived from the Bellerophontacea, retaining as primitive characters paired ctenidia and other organs. The Pleurotomariacea attained the acme of their development in Paleozoic time. They are thought to have given rise directly to a number of other superfamilies belonging to the Archaeogastropoda, several of which seem to have lost the right ctenidium independently; ultimately this group seems to have been the source of other orders.

Family SINUOPEIDAE Wenz, 1938
[nom. transl. Knight, Batten & Yochelson, herein (ex Sinuopeidae Wenz, 1938)]

Shell trochiform, turbiniform, rotelliform, or naticiform; exhalant emargination in form of a U-shaped sinus. *U.Cam.-M.Perm.*

Subfamily SINUOPEINAE Wenz, 1938

Turbiniform or rotelliform; sinus wide, approximately at mid-height of labrum. *U.Cam.-U.Sil.*

Sinuopea Ulrich, 1911 [*Holopea sweeti* Whitfield, 1880]. Turbiniform, anomphalous, sutures deep; sinus relatively narrow, low on labrum. *U.Cam.-L.Ord., N.Am.—Fig. 112.5. *S. sweeti* (Whitfield), U.Cam., Wis.; X1.3.

Horiostomella Perner, 1903 [*H. otiota*]. Like Sellinema but with lower spire, larger last whorl, and wider umbilicus. *U.Sil., Eu.—Fig. 112.6. *H. otiota*, Czech.; X2.7.

Sellinema Perner, 1903 [*S. dive*; SD Perner, 1907]. Turbiniform, narrowly phaneromphalous, with deep sutures; sinus very broad. *U.Sil., Eu.—Fig. 112.3. *S. dive*, Czech.; X4.

Subfamily PLATYSCHISMATINAE Knight, 1956

Rotelliform or naticiform; sinus at or above middle of labrum. *L.Ord.-M.Perms.*

Chepultepecia Ulrich in Weller & St. Clair, 1928 [*Raphistoma leiosomella* Sarsden, 1896]. Umboniform, sutures shallow; narrowly phaneromphalous; sinus culminating at middle of labrum. *L.Ord., N.Am.—Fig. 112.1. *C. leiosomella* (Sarsden), Minn.; 1a,b, apertural view and oblique from above, X4.

Umbospira Perner, 1903 [*U. nigricans*; SD Perner, 1907]. Low rotelliform, probably phaneromphalous; with faintly arched pseudoselenizone; surface glossy. *U.Sil., Eu.—Fig. 112.8. *U. nigricans*, Czech.; oblique from above, X4.

Pycnotrochus Perner, 1903 [*P. viator*; SD Perner, 1907]. Trochiform, gradeate, moderately large, with a narrow ramp; outer lip with sinus culminating at angulation of ramp; columellar lip thickened; broad concave callus filling umbilicus. [The only known specimens, the types, are too imperfect to form a basis for restoration.] *U.Sil., Eu.*

Platschisma M'Coy, 1844 [*Amphullaria helicoides* J.deC.Sowerby, 1826; SD deKoninck, 1881]. Naticiform, narrowly phaneromphalous; sinus and faint pseudoselenizone slightly above mid-height of whorl face; columellar lip thin, slightly sinuous. *L.Carb.(Miss.), Eu.—N.Am.-Austral.—Fig. 112.2. *P. helicoides* (Sowerby), Belg., X0.7.

Colpites Knight, 1936 [*Naticopsis monilifera* White, 1880]. Naticiform, anomphalous; sinus above mid-height of whorl face; columellar and parietal lips thickened; surface glossy, with row of nodes just below upper suture. *Penn.(U.Carb.)-M.Perms., N.Am.-Eu.—Fig. 112.7. *C. monilifer* (White), Penn., Mo.; X2.7.

Subfamily TURBONELLININAE Knight, 1956

Shell turbiniform; sinus small, mostly low on labrum. *U.Sil.-L.Perms.*

Turbomaria Perner, 1907 [*Pleurotomaria sepulta* Perner, 1903]. Exhalant sinus small, low on labrum, columellar lip sinuous; fine spiral and collabral threads. *U.Sil., Eu.—Fig. 112.9. *T. sepulta* (Perner), Czech.; X2.7.

Leptozone Perner, 1907 [*Pleurotomaria (Leptozone) esthetica*]. Like Turbomaria but sinus higher on labrum and with wash of shell material within funnel-shaped umbilicus. *L.Dev., Eu.—Fig. 112.10. *L. esthetica* (Perner), Czech.; X2.7.

Rhineoderma deKoninck, 1883 [*Pleurotomaria radula* deKoninck, 1843]. Trochiform, with broadly subangular periphery; with shallow labral notch generating broad ornamented selenizone between pair of threads on periphery; umbilicus narrow, funnel-shaped and smooth; spiral threads of several orders bearing small nodes where crossed by transverse threads. *L.Carb.(Miss.), Eu.—N.Am.—Fig. 112.11. *L. radula* (deKoninck), Belg., X2.

Turbonellina deKoninck, 1881 [*Trochus lepidus* deKoninck, 1843; SD Knight, 1937]. Broadly beehive-shaped; sinus quite low on labrum, partly on base; spiral and collabral threads. *L.Carb., Eu.—Fig. 112.4. *T. lepidus* (deKoninck), Belg.; 4a,b, oblique from above and below, showing aperture and sinus, X2.

?Keeneia Etheridge, 1902 [*K. platschismoides*]. Large, rounded above, with rather flat base; sinus low, at peripheral angle; transverse threads. *L.Perms., Austral.—Fig. 112.12. *K. platschismoides*, X0.5.

Family RAPHISTOMATIDAE Koken, 1896
[nom. correct. Knight, Batten & Yochelson, herein (pro Raphiomorpha Koken, 1896)]

Shell lenticular, turbiniform, or gradeate, with angular labral sinus culminating gen-
erally at periphery in a short slit, sinus, or notch that generates a selenizone. U.Cam.-M.Per.

Subfamily OPHILETINAE Knight, 1956

Generally low-spired with wide umbilicus; labral sinus V-shaped, culminating at

Fig. 112. Pleurotomariacea (Sinuopeidae—Sinuopeinae, Platyschismatinae, Turbonellininae) (p. 1198).

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periphery in short notch that generates an obscure selenizone. U.Cam.-L.Ord.

Schizopea BUTTS, 1926 [*S. washburnei] [=Roubidouxia BUTTS, 1926; Rhachopea ULRICH & BRIDGE, 1931]. Spire low, widely phaneromphalous, sutures deep; sinus culminating at blunt angulation that forms periphery. U.Cam.-L.Ord., N.Am.—Fig. 113,1. *S. typica (ULRICH & BRIDGE), L.Ord., Mo.; X1.

Dirhachopea ULRICH & BRIDGE, 1931 [*D. normalis]. Spire low, widely phaneromphalous, last whorl disjunct; labral sinus culminating at blunt seemingly double-edged angulation that forms periphery, probably with short notch. U.Cam.-L.Ord., N.Am.—Fig. 113,5. *D. normalis, U.Cam., Mo.; X2.

Euconia ULRICH in ULRICH & SCOFIELD, 1897 [*Pleurotomaria etna BILLINGS, 1865; SD PERNER, 1907] [=Jarlopis HELLER, 1954 [1956] (55, p. 32)]. Trochiform, sutures shallow; sinus culminating at angular periphery just above upper suture, probably in short notch. L.Ord., N.Am.—Fig. 113,2. *E. etna (BILLINGS), Newf.; X1.3.

Ophileta VANUXEM, 1842 [*O. complanata; SD S.A.MILLER, 1889]. With angular labral sinus culminating at periphery in notch that generates selenizone on upper side of peripheral angle. L.Ord., N.Am.-NE.Asia.

O. (Ophileta) [=Polygyra Weller, 1903]. Whorls approximately as high as wide, umbilical sutures relatively deep. L.Ord., N.Am.-NE.Asia.—Fig. 113,4. *O. (O.) complanata, Tex.; 4a,b, aperture oblique from above and below, X1.3.

O. (Ozarkispira) WELCOTT, 1924 [*O. leo]. Whorls about twice as high as wide, umbilical slopes continuous. L.Ord., N.Am.—Fig. 113,3. *O. (O.) leo (WELCOTT), Can.(Alba.); 3a,b, aperture oblique from above and below, X2.7.

Calaurops WHITFIELD, 1886 [*C. litiformis] [=Orthostoma CONRAD, 1838 (non AUDINET-SERVILLE, 1834)]. First 3 or 4 whorls discoidal, with wide umbilicus and angular deep sinus culminating at periphery, seemingly generating a selenizone; last whorl disjunct, rodlike, with angular periphery bearing deep sinus continued into the extension; coiled whorls abandoned and filled solidly with secondary deposits that leave cast of interior of later part of shell with tapering pointed apex. L.Ord., N.Am.—Fig. 113,6. *C. litiformis, Vt.; X0.7.

Subfamily RAPHISTOMATINAE Koken, 1896

Base commonly narrow, anomphalous or narrowly phaneromphalous, upper surface more or less flattened; with deep V-shaped

**Sclites** EMMONS, 1842 [*S. angulatus*]. Resembles *Acteonina* in shape but much larger and wider, with broad ramp around low gradate spire terminating in sharp peripheral angulation; base extended, subconical; labrum with angular sinus above, culminating at periphery, where it may generate a selenizone. M.Ord., N.Am.—**Fig. 114.**

*S. angulatus*, Vt.; ×1.

**Raphistoma** HALL, 1847 [non Rafinesque, 1815, ICZN Op. 225] [*Maurea striata* EMMONS, 1842; SD DE KONINCK, 1881]. Upper surface nearly flat, base anomphalous or narrowly phaneromphalous; sinus culminating in notch that generates an angular selenizone forming periphery; upper lip sigmoid; ornamented by collabral cords. M.Ord.-Sil., N.Am.-Eu.—**Fig. 115,2.**

*R. striatum* (EMMONS), M.Ord., Vt.; 2a,b, apertural view and from above, showing characteristic bends in growth lines, ×1.5.

**Pararaphistoma** VOSTAKOVA, 1955 [*Helicites qualteriatus* SCHLOTHHEIM, 1820] [=Pararaphistoma (Climacoraphistoma) VOSTAKOVA, 1955 (144, p. 83)]. Shell lenticular to low-spired with “stair step” profile; widely phaneromphalous; growth lines sweeping back smoothly from suture, without a sigmoidal bend (144, p. 83). Ord., Eu.-N.Am.

**Buechelia** C. SCHLUTER, 1894 [*B. goldfussi*]. Shape like *Raphistoma* but with narrowing at base that suggests a canal. M.Dev., Eu.-N.Am.—**Fig. 115, 1.**

**Arizonella** STOYANOW, 1948 [*A. allecta*]. Like *Buechelia* but without canal-like narrowing at base; spire slightly gradate (135, p. 789). U.Dev., N.Am.—**Fig. 115,3.** *A. allecta*, Ariz.; ×1.3 (135).

**?Scalitina** SPIESTERSBACH, 1919 [*S. montana*] [=Ampulloscalites WENZ, 1938 (147, p. 167)]. Turbiniform except for wide ramp above, terminating at sharp angle with shallow groove just below on side; columellar lip widely arcuate; sinus probably present on labrum but unknown. Dev.-L.Carb., Eu.—**Fig. 115,4.** *S. montana*, M.Dev., Ger.; ×0.7.

**Subfamily LIOSPIRINAE** Knight, 1956

Shell lenticular, with moderately deep V-shaped sinus culminating in short slit that generates a convex selenizone mostly or entirely on its upper side. ?L.Ord., M.Ord.-M.Perm.

**Liospira** ULRICH & SCOFIELD, 1897 [*Pleurotomaria micula* HALL, 1862; SD McLEARN, 1942] [=Eocryptaenia KOKEN, 1925]. Surface glossy, without ornament; selenizone convex, forming periphery but largely on upper side; cryptomphalous. ?L.Ord., M.Ord.-Sil., N.Am.-Eu.-NE. Asia.—**Fig. 116,2.**


**?Arastra** STOYANOW, 1948 [*A. torquata*]. Shell thick, minutely phaneromphalous; base extending slightly above lower margin of selenizone, extension rhythmically bent downward to produce frilled periphery; surface undulating (135, p. 790). U.Dev., N.Am.—**Fig. 116,1.** *A. torquata*, Ariz.; ×2.


*T. (Trepospira)* [=Kansana TASCH, 1953 (137, Am.-S.Am.-Eu.-N.Afr.—**Fig. 116,4.** *T. (T.) sphaerulata* (CONRAD), U. Penn., Ill., ×2. p. 397)]. Subsutural nodes rounded, base cryptomphalous or anomphalous. Dev.-M.Perm., N. T. (Angyomphalus) COSSMANN, 1916 [*Euomphalus radians* DE KONINCK, 1843]. Subsutural nodes lengthened radially; umbilicus partly open, surrounded by narrow circumumbilical funicle. L. Carb., Eu.—**Fig. 116,3.** *T. (A.) radians* (DE KONINCK), Belg.; ×2.

**Subfamily OMOSPIRINAE** WENZ, 1938

Shell gradate, with ramp; labral slit or sinus relatively wide, shallow, generating selenizone just within outer margin of ramp. M.Ord.-L.Jur. (Lias.).

**Omospira** ULRICH in ULRICH & SCOFIELD, 1897 [*O.
1202

Mollusca—Gastropoda

**Fig. 115. Pleurotomariacea (Raphistomatidae—Raphistomatinae) (p. 1201).**

*R. laticincta.* Relatively high-spired, anomphalous; selenizone about half width of ramp, without bordering threads, sloping downward and outward; sides below selenizone rounded. *M. Ord.-Sil., N.Am.-Eu.—Fig. 116,9.* *O. laticincta,* M. Ord., Tenn.; X 1.

**Baylea** deKonick, 1883 [*Trochus yvani* Léveillé, 1835] (=*Yvania Fischer, 1885 (obj.)). Turbiniform; short labral slit on outer edge of sloping ramp, bordered by strong threads; ornamented primarily with spiral threads but with collabral threads and nodes in some species. *L. Carb.(Miss.)-M. Perm., N. Am.-EU.-SE. Asia.—Fig. 116,7.* *B. yvani* (Léveillé), L.Carb., Belg.; X 1.3.

**Hypselenoma** Weller, 1929 [*Pleurotomaria perhumerosa Meek, 1872.* Like *Omospira* but with shallow groove below periphery and spiral threads on sides. *U.Penn., N.Am.—Fig. 116,8.* *H. perhumerosa* (Meek), Neb.; X 2.25.

**Callistadia** Knight, 1945 [*C. bella.* Relatively low-spired, narrowly phaneromphalous; selenizone bordered by cords; ornamented with revolving cords (72, p. 577). *Penn.-M. Perm., N.Am.-SE. Asia.—Fig. 116,5.* *C. bella,* M.Perm., Tex.; X 2.7.

**Sisenna** Koken, 1896 [*Pleurotomaria turbinata Hönn.es, 1855; SD Cossmann, 1897.* Relatively low-spired, anomphalous or narrowly phaneromphalous, with spiral ridges, one delimiting broad, sloping ramp; collabral ornament almost confined to growth lines which are proscyrt below ramp angle at which selenizone lies. *L.Trias.-LJur. (Lias.), cosinop.—Fig. 116,6.* *S. turbinata,* U. Trias.(Car.), Aus.; X 2 (79).

**Family EOTOMARIIDAE** Wenz, 1938

[nom. transl. Knight, Batten & Youchelson, herein (ex Eotomariidae Wenz, 1938)]

Shell turbiniform to trochiform; labral slit invariably present, generating concave selenizone bordered by threads at approximately mid-height of whorl. *U.Carb.-L.Jur.(Lias.).

**Subfamily EOTOMARIINAE** Wenz, 1938

[=Ptychomphalinae, Ptychomphalininae Wenz, 1938]

Slit moderate to deep, umbilicus narrow or absent; ornament collabral and spiral elements, collabral dominant. *U.Carb.-L.Jur. (Lias.).

**Tribe PTYCHOMPHALIDES** Wenz, 1938

[nom. transl. Knight, Batten & Youchelson, herein (ex Ptychomphalininae Wenz, 1938)]

Labral slit deep, selenizone flat or concave, commonly bordered by extended cords or flanges. *U.Carb.-L.Jur.(Lias.).

**Taeniospira** Ulrich & Bridge, 1931 [*T. eminencens.* Turbiniform; labral sinus V-shaped, culminating in moderately deep slit that generates concave selenizone bordered by low threads; narrowly phaneromphalous; ornamented with col-
labral threads that are strongly prosocline above selenizone and opisthocline below it. U.Cam., N. Am.—Fig. 118.2. *T. eminencensis, Mo.; X1.

Mourlonia deKöninck, 1883 [*Helix carinatus J. Sowerby, 1812] [=Psychomphalina Fischer, 1885; Cryptaulus Foerste, 1923; Promourlonia Longstaff, 1924; Foersteria Tomlin, 1929 (pro Cryptaulus Foerste, 1923, non Bavay, 1903); Eocryptaulina Foerste, 1936 (pro Foersteria Tomlin, 1929, non Szépligeti, 1896); Spiroraphella Grabau, 1936]. Turbiniform; labral sinus relatively shallow but culminating in rather deep slit; ornament dominantly collabral but also spiral; growth lines strongly prosocline above selenizone and below it except for short distance at top; color pattern of wide transverse spots above selenizone may be preserved. M.Ord.—L.Perm., N.Am.—Eu.—Asia-Austral.—Fig. 117.1. *M. carinata (Sowerby), L.Carb., Eng.; X0.7.

Oehlerlia Perner, 1907 [*Pleurotomaria (Oehlerlia) senilis] [=?Bembexia (Pleurotobembex) Solle, 1956]. Trochiform, with moderately wide umbilicus; labral sinus shallow, culminating in fairly deep slit that generates a selenizone between pair of carinae; ornament as in Mourlonia. L. Det., Eu.—Fig. 117.2. *O. senilis (Perner), Czech.; X2.

Tropidostropha Longstaff, 1912 [*Pleurotomaria griffithii M'Coy, 1844]. Shell large, with angular periphery carrying flat or convex selenizone between pair of lamellae; slit deep; growth lines gently prosocline above selenizone and, except next to it, almost vertical below; umbilicus narrow, funnel-shaped; an obscure spiral thread around lower surface; vertical lacunae in outer shell layers. L.Carb., Eu.—Fig. 118.4. *T. griffithii (M'Coy), Ire.; X0.5.

Euconospira Ulrich in Ulrich & Scofield, 1897 [*Pleurotomaria turbiformis Meek & Worthen, 1861; SD Knight, 1937] [=Trechmannia Long-

Fig. 116. Pleurotomariacea (Raphistomatidae—Liospirinae, Omospirinae) (p. 1201-1202).
Mollusca—Gastropoda

Mourlonia

FIG. 117. Pleurotomariacea (Eotomariidae—Eotomariinae) (p. 1203).

STAFF, 1912; Pernotrochus H.CHRONIC, 1952; Pernotrochus H.CHRONIC, 1952, p. 120). Trochiform, base moderately convex to slightly concave, anomphalous or with pseudumbilicus; labral sinus shallow, culminating in deep slit that generates a selenizone between pair of carinae; ornament and color pattern as in Mourlonia. Miss. (L.Carb.)-M.Perm., N.Am.-Eu.-NC.Asia.—Fig. 119,1. *R. radians (WISSMANN), U. Trias.(Carn.), S.Tyrol; 1a,b, X 3 (64).

Euzone KOKEN, 1896 [*E. alauna; SD COSSMANN, 1897] [=Polyelasma COSSMANN, 1897 (obj.)]. Small-medium, globose-turbiniform, phaneromphalous, angulation bordering umbilicus; whorls few, convex; selenizone at periphery, slightly overlapped on earlier whorls, wide, raised, bordered by cords and with prominent wide-spaced lunulae; ornament strong collabral threads prosocline above selenizone, orthocline below. M.Trias.(Ladin.)-U.Trias.(Rhaetic), Eu.—Fig. 119,2. *E. alauna, M. Trias.(Anis.), Aus.; 2a, abapertural side, X1; 2b, growth lines, X1.5 (79).

Luciellina KITTL, 1900 [*L. contracta; SD DIENER, 1926]. Lenticular or biconical, anomphalous or cryptomphalous, with prominent carina forming periphery at mid-height; base strongly convex; ornament spiral cords; selenizone including peripher carina and a band below it, hence hidden on spire. M. Trias. (Ladin.)-U. Trias. (Carn.), Eu. (Hung.-Aust.)—Fig. 123,1. *L. contracta, M. Trias.(Ladin.), Hung.; X3 (Kittl).

Siprosca KNIGHT, 1945 [*S. pagoda]. Trochiform, with sharply conical spire; selenizone bordered by conspicuous protruding cords; base nearly flat, narrowly phaneromphalous; ornament spiral and transverse; latter dominant (72, p. 574). Miss. (L.Carb.)-M.Perm., N.Am.-Eu.-Austral.—Fig. 118,3. *S. pagoda, U.Penn., Tex.; X4.

Shwedagonia BATTEN, 1956 [*S. elegans]. Turbiniform, with spire slightly to strongly coeloconoid; phaneromphalous; slit very narrow and deep, about 0.8 of final whorl in depth; selenizone narrow, deeply embedded, both slit and selenizone bordered below by broad smooth flat area with fine opisthocline growth lines, followed by a thread, thus simulating lower part of selenizone; ornament collabral growth lines or sharp threads and faint spiral threads (5, p. 43). L.Perm.-M. Perm., cosmop.—Fig. 118,1. *S. elegans, M. Perm., Tex.; X 5.3.

Rhaphistomella KITTL, 1891 [*Pleurotomaria radians WISSMANN in MÜNSTER, 1841] [=Raphistomella DIENER, 1926 (obj.)]. Small, sublenticular, with obtuse spire, phaneromphalous, protruding periphery carrying selenizone; slit short; growth lines strongly prosocline above selenizone, prosocyrt below. M. Trias. (Ladin.)-U. Trias. (Rhaetic), Eu.—Fig. 119,1. *R. radians (WISSMANN), U. Trias.(Carn.), S.Tyrol; 1a,b, X 3 (64).

Psychomphalus ACASSIZ, 1839 [*Helicina compressa J.SOWERBY, 1813] [=Cochlicarina BROWN, 1843 (obj.); Cryptaenia EUES-DESLONGCHAMPS, 1864]. Sublenticular, cryptomphalous, umbilicus obscured by groove-encircled callous coating; spire low, obtuse, base strongly and evenly convex; surface smooth except for faint spiral threads and small nodes adjoining adanal suture in some species; selenizone peripheral, more or less overlapped on spire whorls; slit short. L.Jur., Eu.—Fig. 119,3. *P. expansus (SOWERBY), L.Lias., Fr.; 3a,b, apertural and basal views, X1 (111).

Tribe EOTOMARIIDES WENZ, 1938

[nom. transl. KNIGHT, BATTEN & YOCHELSON, herein (ex Eotomariinae WENZ, 1938)]

Labral slit only moderately deep, selenizone concave between a pair of threads, commonly with its lower border forming shell periphery. M.Ord.-M.Perm.

Eotomaria ULRICH & SCOFIELD, 1897 [*E. canalisfera ULRICH in ULRICH & SCOFIELD, 1897] [=Spororaphe PERNER, 1907]. Sublenticular, coeloconoidal, minutely phaneromphalous; deep sinus culminating in short slit that generates a selenizone just above periphery. M.Ord.-Sil., N. Am.-Eu.-NE.Asia.—Fig. 118,7. *E. canalisfera ULRICH, M.Ord., Tenn.; X 1.

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FIG. 118. Pleurotomariacea (Eotomariidae—Eotomariinae) (1202-1206).
Clathrospira Ulrich & Scofield, 1897 [*Pleurotomaria subconica Hall, 1847] [=Palaeochoasma Donald, 1902]. Turbiniform, with conical spire and shallow sutures, narrowlyphaneromphalous; growth lines strongly prosocline above selenizone and strongly opisthocline below it, but rounding to gently prosocline on base, outlining a moderately deep labral sinus that culminates in a short slit; selenizone bordered by fine threads; growth lines and lunulae periodically strengthened, very fine spiral threads numerous. M.Ord.-Sil., N.Am.-Eu.—Fig. 118,5. *P. subconica (Hall), M.Ord., N.Y.; X2.

Bembexia Oehlert, 1888 [*Pleurotomaria larteti Munier-Chalmas, 1876]. Turbiniform, slightly gradate, with moderately deep sutures, narrowlyphaneromphalous to anomphalous; labral sinus moderately deep, selenizone concave between moderately strong threads; collabral lines or lirae and a spiral thread on upper whorl surface. L.Dev.-L.Carb.(Miss.), Eu.-N.Am.—Fig. 118,11. *B. larteti (Munier-Chalmas), L.Dev., Fr.; ×1.

Glabrocingulum Thomas, 1940 [*G. beggi]. Turbiniform, spire varying from gradate to conical, conspicuously transverse and spiral threads with nodes at their intersections, ornament most prominent near upper suture and at base (140, p. 38). L.Carb.(Miss.)-M.Perm., Eu.-E.Asia-N.Am.-S.Am.


Platyteichum Campbell, 1953 [*P. costatum]. Turbiniform, anomphalous or minutely phaneromphalous; ornamented with spiral threads and cords (12, p. 23). L.Per., Austral.—Fig. 118,8. *P. costatum; ×1.

Eirlysia Batten, 1956 [*E. exquisita]. Variably turbiniform, with rounded angulation surrounding flattish phaneromphalous base and gently concave selenizone between 2 threads slightly above mid-whorl; labral slit about 0.15 whorl deep; collabral and spiral ornament variously developed, the former commonly dominant (5, p. 44). M. Perm., N.Am.—Fig. 118,9. *E. exquisita, Tex.; ×2.7.

Subfamily AGNESIINAE Knight, 1956

Coiling sinistral or hyperstrophic. L.Dev.-U.Trias.

The protoconch in some species of Agnesia seems to be sinistral, like the teleconch. The peculiar selenizone of this genus is known only in the type species. In Hesperiella, the inturned heterostrophic protoconch suggests hyperstrophy. Assuming that these genera are related, they are oriented for description as sinistral.

Hesperiella Holzapfel, 1889 [*Pleurotomaria contraria DeKoninck, 1843; SD Knight, 1937]. Pupiform, with protoconch coiling inward; selenizone low on whorls, gently arched; ornament collabral threads and cords. L.Dev.-U.Carb., Eu.—Fig. 120,1. *H. contraria (DeKoninck), L.Carb., Belg.; 1a,b, posterior and oblique view of apex, ×5.

Agnesia DeKoninck, 1883 [*Pleurotomaria acuta Phillips, 1836]. Trochiform, with convex base; selenizone showing V-shaped lunulae with notch-within-slit pattern; ornament collabral and spiral threads. Protoconch of type species unknown. L.Dev.-M.Perm., N.Am.-EU.-SE.Asia.—Fig. 120,2. *A. acuta (Phillips), L.Carb., Eng.; ×2.

Enantistoma Koken, 1896 [*Pleurotomaria pervera Hörnse, 1856]. Small, sinistral, turbiniform, broadly phaneromphalous; selenizone narrow,
Archaeogastropoda—Pleurotomariina—Pleurotomariacea

Subfamily NEILSONINAE Knight, 1956

Shell relatively high-spired. L.Carb. (Miss.)—U.Trias.

Neilsonia Thomas, 1940 [*N. roscobiensis]. Selenizone relatively broad, located low on final whorl and just above sutures on spire; ornament collabral with tendency toward nodding at upper end (140, p. 46). L.Carb.—M.Perm., N.Am.—Eu.—Fig. 120,4. *N. roscobiensis, L.Carb., Scot.; X3.3.

Peruvispira, J.Chronic, 1949 [*P. delicata]. Very small; selenizone on protruding carina; ornament growth lines (13, p. 146). L.Perm.—M.Perm., S.Am.—N.Am.—Fig. 120,6. *P. delicata, L.Perm., Peru; X10.

Pagodina Wanner, 1942 [*P. typus]. Somewhat gradate; selenizone just above angular periphery; ornament spiral (146, p. 166). Perm., SE.Asia.—Fig. 120,5. *P. typus, E. Indies; X3 (146).

Apachella Winters, 1956 [*A. translirata]. Much like Neilsonia but with selenizone above middle of last whorl and well above suture on spire; ornament absent or various combinations of spiral and collabral; some species with a parietal tooth close to outer lip (151, p. 44). L.Perm.—M.Perm., cosmop.—Fig. 120,3. *A. translirata, M.Perm., Ariz.; X4.

Pareuryalox Haas, 1953 [*P. perornata]. Littoriniform, narrowly phaneromphalous; whorls convex, not carinate; ornament minutely beaded spiral cords; selenizone wide, occupying almost all lower half of each spire whorl, with median beaded keel and another forming its upper border; inner lip reflected, almost hiding umbilicus. U.Trias, Peru.—Fig. 202A,2. *P. perornata; 2a-d, apertural, abapertural, apical, basal sides, X3 (50).

Family LOPHOSPIRIDAE Wenz, 1938
[ nom. transl. Knight, Batten & Yochelson, herein (ex Lophospirinae Wenz, 1938)]

Shell with median labral sinus that generally culminates in a median angulation, and commonly with angulations both above and below; selenizone or pseudoselenizone convex; form of shell variable, whorls may be disjunct in late growth stages or throughout. Ord.—M.Trias.

Subfamily LOPHOSPIRINAE Wenz, 1938

Labral exhalant emargination generally a sharp V-shaped sinus, with or without a short notch. Ord.—Sil.

Many early Lophospirinae have homeo-
Fig. 121. Pleurotomariacea (Lophospiridae—Lophospirinae, Ruedemanniiæ) (p. 1208-1209).

morphic counterparts in the Trochonematidae. So close is the similarity that it is difficult to decide whether or not some should be separated in different families or superfamilies.

**Loxoplocus** FISCHER, 1885 [*Murchisonia tropidophora* WHITEAVES, 1884 (≡*M. soluta* WHITEAVES, 1884)]. Sinus deep, angular; selenizone or pseudoselenizone convex. *Ord.-Sil.*, N.Am.-Eu.-NE.Asia.

L. (Lophospira) WHITFIELD, 1886 [*Murchisonia bicincta* HALL, 1847 (≡*M. milleri* S.A.MILLER, 1877, pro *M. bicincta* HALL, non M'Coy, 1844); SD OEHLERT, 1888] [=Schizolopha ULRICH in ULRICH & SCOFIELD, 1897; Ptychonema PERNER, 1903]. Turbinate; gradate; whorls mostly contiguous. *Ord.-Sil.*, N.Am.-Eu.-NE.Asia.—Fig. 121.2. *L. (L.) milleri* (MILLER), M.Ord., N.Y.; X1.3.

L. (Lophospira) At least later whorls disjunct. *M.Ord.-Sil.*, N.Am.-NE.Asia.—Fig. 121.4. *L. (L.) soluta* (WHITEAVES), M.Sil., Ore.; X0.7.

L. (Donaldiella) COSSMANN, 1903 [pro *Goniospira DONALD, 1902 (non COSSMANN, 1895)] [*Goniospira filosa* DONALD, 1902] [=Pagodispira GRAEBU, 1922]. Spire high, whorls mostly in contact. *M.Ord.-Sil.*, N.Am.-Eu.-NE.Asia.—Fig. 121.7. *L. (D.) filosa* (DONALD), U.Ord., Scot.; X2.7.

**Trochonemella** OKULITCH, 1935 [*Lophospira (?) notabilis* ULRICH & ULRICH & SCOFIELD, 1897]. Shape like *Trochonema* (s.s.), narrowly phaneromphalous; sinus relatively shallow, culminating in wide notch that gives rise to a selenizone. *M. Ord.*, N.Am.—Fig. 121.6. *T. notabilis* (ULRICH), Tenn.; X1.3.

**Longstaffia** COSSMANN, 1908 [pro *Tubulosa* COSSMANN, 1908 (non SCHWEIGER, 1820)] [*Pleurotomaria tubulosa* LINDBRÅM, 1884]. Turbiniform; convex selenizone generated by deep notch (or shallow slit) on a carina somewhat above middle of labrum; several other spiral carinae or cords with shallow labral reentrants marked by transverse lamellae. *M.Sil.*, Eu.—Fig. 121.5. *L. tubulosa* (LINDBRÅM), God.; X2.
Subfamily RUEDEMANNINAE Knight, 1956

Exhalant emargination of labrum a true slit that generates a selenizone. M.Ord.-M.Trias.

In tracing Ruedemannia into the Devonian, a succession of species is found to approach Worthenia more and more closely. The latter genus, which appears in the Mississippian, converges in various characters with Carboniferous genera of the Eotomariidae (such as Glabrocingulum); indeed, some species of G. (Ananias) are distinguishable from Worthenia only by the absence of a convex crenulated selenizone.

Ruedemannia Foerste, 1914 [*Lophospira (?)Seelya] lirata Ulrich in Ulrich & Scofield, 1897] [=Coronilla Pernier, 1907 (non Beneden, 1871)]. Turbiniform; slit short, selenizone wide, with median thread; spiral thread on slope above selenizone and 2 below. M.Ord.-Dev., N.Am.-Eu. —Fig. 121.1. *R. lirata (Ulrich), U.Ord., Ky.; ×2.7.

Worthenia Dekoninck, 1883 [*Turbo tabulatus Conrad, 1835] [=Plateworhtenia H.Chronic, 1952 (14, p. 121)]. Shape like Loxoplac tus (Lophospira) but highly ornamented with spiral and collabral threads; convex selenizone strongly crenulated; anomphalous or minutely phaneromphalous. L.Carb. (Miss.)-M.Trias., cosmop. —Fig. 121.3. *W. tabulata (Conrad), U.Penn., Pa.; ×1.3.

Family LUCIELLIDAE Knight, 1956

More or less trochiform, with marginal frill and broad shallow labral notch just below frill generating a broad selenizone; ornament on upper whorl surface generally includes oblique strongly opisthocline threads or cords normal to prosocline growth lines. Ord.-U.Carb.

Rhombella Bridge & Cloud, 1947 [*Roubidouxia umbilicata Ulrich & Bridge in Dale & Bridge, 1932]. Spire low conical, base nearly flat, with moderately wide umbilicus; labral sinus culminating at periphery in shallow notch that generates a selenizone; whorl section rhomboidal (9, p. 550). L.Ord., N.Am.—Fig. 122.2. *R. umbilicata (Ulrich & Bridge), Mo.; ×0.7.

Prosolariurn Pernier, 1903 [*P. procerum]. Oblique threads very fine; umbilicus with smooth concave callus; frill small, not fluted. U.Sil., Eu.—Fig. 123.3. *P. procerum, Czech.; ×1.3.

Epiptychia Pernier, 1907 [*Clisospira potens Pernier, 1903]. Relatively high-spired, anomphalous; frill short, scalloped; ornament of prosocline, slightly imbricating growth lamellae with fine oblique threads between and normal to them.

Family PHANEROTREMATIDAE Knight, 1956

Well-marked selenizone bordered by sharp threads high on whorl; labral slit short; anomphalous. M.Ord.-L.Dev.

Brachytomaria Koken, 1925 [*Pleurotomaria balitica de Verneuil, 1845]. Turbiniform, gradate, with tapering anomphalous base and thickened columnellar lip; ornament (in type species) comprising sharp lamellar collabral threads. M.Ord., Eu.—Fig. 124.1. *B. balitica (de Verneuil), Est.; ×1.3.

Ulrichospira Donald, 1905 [*U. similis]. Like Brachytomaria but with higher, more attenuated spire. L.Sil., Eu.—Fig. 124.3. *U. similis, Eng.; ×3 (119).

Phanerotrema Fischer, 1885 [*Pleurotomaria labrosa Hall, 1860]. Shape and position of selenizone much as in Brachytomaria but with shallower sutures and larger last whorl; collabral
lamellae or spiral cords, or both. L.Sil.-L.Dev., N.Am.-Eu.-Austral.—Fig. 124,2. *P. labrostom (HALL), L.Dev., N.Y.; X0.7.

Family GOSSELETINIDAE Wenz, 1938

[ nom. transl. KNIGHT, BATTEN & YOCHELSON, herein (ex Gosseletininae Wenz, 1938)]

Labral slit short, selenizone flat and generally without bordering threads. M.Ord.-Trias.

Subfamily GOSSELETININAE Wenz, 1938

Slit and selenizone narrow, above mid-whorl. M.Ord.-Trias.

Pseudocryptaenia Koken, 1925 [*Pleurotomaria lahueni Koken, 1897]. Rotelliform, small, phaneromphalous; outer lip with short notchlike sinus or slit, selenizone narrow and slightly raised at outer margin of upper whorl surface; ornament growth lines. M.Ord., Eu.—Fig. 125,1. *P. lahueni (Koken), Est.; X4 (80).

Stenoloron OEHLERT, 1888 [*Pleurotomaria (Stenoloron) viennayi]. Turbiniform, phaneromphalous; narrow selenizone high on whorl face. M.Sil.-L.Dev., Eu.—Fig. 125,4. *S. viennayi (OEHLERT), L.Dev., Fr.; X1 (108).

Platyloron OEHLERT, 1888 [*Pleurotomaria bishofii GOLDFUSS, 1844]. Rotelliform, small, anomphalous; broad convex selenizone on upper whorl face. M. Sil.-M.Dev., Eu.—Fig. 125,3. *P. bishofii (GOLDFUSS), M.Dev., Ger.; X4.

Umbotropis PERNER, 1903 [*U. albicans]. Umboniform, with narrow umbilicus; slit and selenizone above mid-whorl; surface smooth, glossy. L.Dev., Eu.—Fig. 125,2. *U. albicans, Czech.; X4.

Triangularia FRECH, 1894 [*T. paradoxa]. Conical triangular, with many narrow whorls and wide umbilicus; flat selenizone on upper whorl face. L.Dev., Eu.—Fig. 125,6. *T. paradoxa, Ger.; 6a,b, apical and apertural views, X2 (44).

Gosseletina FISCHER, 1885 [*Gosseletia DE KONINCK, 1883] (non BARROS, 1882) [*Pleurotomaria callosa DE KONINCK, 1843]. Turbiniform, anomphalous, with much thickened inner lip; slit short; narrow flat selenizone high on whorl face; surface of type species glossy but other species referred to genus have spiral and collabral ornament and are narrowly phaneromphalous. ?Dev., L.Carb.(Miss.)-Perm., ?Trias., Eu.-NC.Asia-N.Am.—Fig. 125,5. *G. callosa (DE KONINCK), L.Carb., Belg.; X1.3.

Rufilla Koken, 1896 [*R. deneecincta; SD COSSMANN, 1897]. Small, globular, narrowly phaneromphalous; whorls evenly convex, smooth or with spiral ornament; selenizone rather broad, high on whorl side, with median spiral cord and bordered by two others; growth lines gently prosocryt above selenizone, more strongly so below. U.Trias. (Carn.), Eu.—Fig. 125,7. *R. deneecincta, Aus.; X5 (79).

Subfamily COELOZONINAE Knight, 1956

Slit broad and short. M.Ord.-L.Dev.
Tribe COELOZONIDES Knight, 1956

Selenizone broad, depressed. M.Ord.-M. Dev.

†Latitaenia Koken, 1925 [*Pleurotomaria rotelloidea Koken, 1896]. Rotelliform; slit and selenizone moderately high on whorl face; base rounded, narrowly phaneromphalous; ornament growth lines. M.Ord.-U.Ord., Eu.—Fig. 126,l. *L. rotelloidea (Koken), M.Ord., Norway; X2.

†Euryzone Koken, 1896 [*Helicites delphinuloides Schlotheim, 1820; SD Perner, 1907]. Widely trochiform with moderately wide umbilicus and deep sutures; slit and selenizone moderately high on whorl face; ornament faint spiral and transverse threads. U.Ord.-L. Dev., Eu.—SE.Asia-N.Am.—Fig. 126,3. *E. delphinuloides (Schlotheim), M.Dev., Ger.; X0.75.

†Conotoma Perner, 1907 [*Pleurotomaria (Clathrospira [Conotoma]) extima]. Trochiform, narrowly phaneromphalous; broad selenizone on low peripheral angle; ornament collabral and spiral threads, lumulæ strong and widely spaced. U.Sil., Eu.—Fig. 126,7. *C. extima (Perner), Czech.; X1.

†Coelozone Perner, 1907 [*Pleurotomaria (Coelozone) verna]. Low trochiform, with somewhat flattened anomphalous base; selenizone just above periphery. U.Sil., Eu.—Fig. 126,6. *C. verna (Perner), Czech.; X1.3.

Tribe PLANOZONIDES Knight, 1956

Selenizone flush with surface or slightly raised; ornament fine obliquely spiral threads normal to growth lines. M.Ord.-L. Dev.

†Catashisma E.B. Branson, 1909 [*C. typa] [=Globispira Koken, 1925]. Shell rounded; short broad slit and faint selenizone low on whorl face; narrowly phaneromphalous. M.Ord.-M.Sil. N.Am.-Eu.—Fig. 126,4. *C. extima (Lindström), M. Sil., Gotl.; X1.3.

†Pleurorima Perner, 1907 [*Pleurotomaria (Pleurorima) migrans (=Pleurotomaria pragensis Koken, 1889); SD Cossmann, 1908]. Shell thin, turbiform; selenizone on crest of broad ridge; ornament as for tribe but with spiral threads on selenizone; anomphalous. U.Sil., Eu.—Fig. 126,2. *P. pragensis (Koken), Czech.; X0.7.

†Planozone Perner, 1907 [*P. ramificans]. Turbiform, anomphalous; selenizone wide, nearly flat, slightly elevated above surface and located above mid-whorl. L. Dev., Eu.—Fig. 126,5. *P. ramificans, Czech.; X10.

Family EUOMPHALOPTERIDAE

Koken, 1896

Lenticular to trochiform, phaneromphalous, with exhalant channel developed
within anterior edge of a more or less extensive frill or carina. M.Sil.-U.Sil.

Euomphalopterus C.F.Roemer, 1876 [*Turbinites alatus WAHNELBERG, 1821]. With channel-bearing frill; homologue of usual pleurotomarian lunulae appearing as series of narrow plates within frill and concave anterior face of last one forming exhalant channel; ornament numerous lamellar transverse threads. M.Sil.-U.Sil., Eu.-N.Am.

E. (Euomphalopterus) [= Euomphalopterus FISCHER, 1885 (obj.); Bathmopterus KIRK, 1928]. Frill wide, pendent. M.Sil., Eu.-N.Am.—Fig. 127.2. *E. alatus (WAHNELBERG), Gotl.; X 0.7.

E. (Pleuromphalus) PERNER, 1903 [*P. seductor; SD PERNER, 1907]. Frill a relatively narrow horizontal carina, undulating in some species. U.Sil., Eu.—Fig. 127.3. *E. (P.) seductor (PERNER), Czech.; X 1.3.

Crenilunula KNIGHT, 1945 [*Pleurotomaria limata LINDBRÖM, 1884]. Frill short, with exhalant channel replaced by median notch on distal end of lamellar lunulae (72, p. 582). M.Sil.-U.Sil., Eu.—Fig. 127.1. *C. limata (LINDBRÖM), M. Sil., Gotl.; X 1 (90).

Family PORTLOCKIELLIDAE Batten, 1956

Turbiniform to trochiform, with notch or short labral slit giving rise to depressed selenizone low on whorl; spiral cords dominant, collabral threads also present. Dev.-M.Perm.

Agniesella COSSMANN, 1909 [pro Pleuroderma PERNER, 1907 (non Tschudi, 1837)] [*Pleurotomaria (Pleuroderma) aratula PERNER, 1907]. Turbiniform with rounded whorls and gently arched selenizone; umbilicus moderately wide; growth lines gently prosocline above and below selenizone; ornament flat revolving cords. L.Dev., Eu.—Fig. 124.4. *A. aratula (PERNER), Czech.; X 1.3.

Portlockiella KNIGHT, 1945 [*P. kentuckiensis] [=Portlockia DEKONINCK, 1881 (subj.) (non M'Coy, 1846)]. Selenizone below line of suture; ornament spiral cords with wide concave inter- and collabral threads (72, p. 579). Miss. (L.Carb.), N.Am.-Eu.—Fig. 124.5. *P. kentuckiensis, M.Miss., Ky.; X 2.7.

Shansiella YIN, 1932 [*S. altispiralis] [=Latisculis THOMAS, 1940 (140, p. 59)]. Turbiniform, anomphalous, whorls rounded; slit short, selenizone above line of suture but below mid-whorl; ornament dominantly spiral cords or threads. L.Carb.(Miss.)-L.Perm., E. Asia-N. Am.-Eu.-N. Afr.—Fig. 124.7. S. carbonaria (NORWOOD & PRATTEN), M. Penn., Mo.; X 0.7.

Tapinotomaria BATTEN, 1956 [*T. rugosa]. Turbiniform; slit a mere notch, selenizone low on whorl, concave, depressed; ornament dominantly spiral, finer collabral threads commonly forming nodes and even spines where crossing spiral elements, the latter commonly large and fasciculate (5). L.Perm.-M.Perm., N.Am.—Fig. 124.6. *T. rugosa, M.Perm., Tex.; X 5.3.

Fig. 125. Pleurotomariacea (Gosseletinae—Gosseletininae) (p. 1210).
Family CATANTOSTOMATIDAE
Wenz, 1938

[nom. transl. Knight, Batten & Yochelson, herein (ex Catantostomatinae Wenz, 1938)]

Last whorl distorted and with highly specialized inhalant and exhalant openings. M.Dev.

Catantostoma Sandberger, 1842 [*C. clathratum*]. Ornament spiral and transverse cords; selenizone bordered by cords, concave, terminating at trema (?exhalant) that suggests a short slit; last 0.3 of whorl between trema and aperture without slit or selenizone, growing obliquely downward and backward around a circular inhalant opening with marked constriction of the aperture proper. [Unusual characters of last whorl may denote adaptation to stationary mode of life.] M.Dev., Eu.—Fig. 128, 1. *C. clathratum*, Ger.; 1a, side, showing both trema and inhalant orifice below; 1b, side, showing ?exhalant trema; ×4.

Family PORCELLIIDAE Broili
(ex Koken MS.), 1924

Coiling pseudo-isostrophic or euomphaloid but protoconch invariably dextral orthostrophic; with deep slit and narrow selenizone at or near mid-whorl; umbilici above and below about equal in some species; shell thin, ornamented with nodes and spiral and collabral threads. Dev.-M.Jur. (Baj.).

Porcellia Léveillé, 1835 [*P. puso*; SD deKoninck, 1883] (=Tomoceras White & St. John, 1867; Léveillia Newton, 1891 (obj.); Brittioceras Miller, Downs, & Youngquist, 1949 (101, p. 603)). With characters of family. [Pseudo-isostrophic species superficially resemble ammonites but are distinguished readily by their lack of septa, deep slit, and orthostrophic protoconch. The genus may represent an adaptation for free swimming.] Dev.-U.Carb. (Penn., ?Perm., Eu.-SE.)

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Mollusca—Gastropoda

Rhaphischisma Knight, 1936 [pro Rotellina de Koninck, 1881 (non Agassiz, 1846)] [*Rotellina planorbiformis de Koninck, 1881]. Spire depressed, with lower lip reaching far inward and forming heavy callus that fills umbilicus. L.Carb., Eu.—Fig. 129,4. *R. planorbiformis (de Koninck), Belg.; 4a,b, oblique from above and below, X 2.

**Family PHYMATOPLEURIDAE**
Batten, 1956

Shell highly ornamented; moderately deep slit and selenizone somewhat below mid-whorl, selenizone slightly depressed below surface; parietal ornament partly or wholly resorbed within aperture in many species. L.Carb. (Miss.)-Trias.

*Glyptotomaria* Knight, 1945 [*G. apiarium*]. Shape highly variable, turbiniform or high trochiform beehive-shaped to discoidal, base commonly flattened; sutures deep to linear; umbilicus wanting, or narrow to widely conical; constant ornament of sharp collabral and spiral lirae, former prosccline just above selenizone but orthocline below it and with broad sinus on base; selenizone depressed, bordered by cords, and bearing sharp regularly spaced lunulae; shallow sinus at upper

Family RHAPHISCHISMATIDAE
Knight, 1956

Shell rotelliform, with deep narrow slit close to upper suture. L.Carb.
end of columellar lip (72, p. 577). Miss.-M.Perm., N.Am.

G. (Glyptotomaria). Trochiform to beehive-shaped or discoidal with flat base surrounded by rope-like fasciculation of spiral threads. Penn.-M.Perm., N.Am.—Fig. 130,10. *G. (G.) apiarium, U. Penn., Tex.; X3.

G. (Dictyotomaria) Knight, 1945 [*Pleurotomaria scitlua Meek & Worthen, 1861]. Turbiniform, with moderately deep sutures and somewhat flat base (72, p. 576). Miss.-Penn., N.Am.—Fig. 130,8. *G. (D.) scitlua (Meek & Worthen), M. Penn., Mo.; X4.

Borestus Thomas, 1940 [*B. wrighti] [=Platypleurotomaria Wanner, 1942 (146, p. 157)]. Gradate turbiniform, superficially resembling Worthenia but with depressed selenizone near mid-whorl and with shoulder on basal angulation sharp; ornament sharp spiral and transverse threads (140, p. 53). L.Carb.(Miss.)-M.Perm., Eu.-SE. Asia-N.Am.-S.Am.—Fig. 130,1. *B. wrightii, L.Carb., Scot.; X2.7.

Paragoniozona Nelson, 1947 [*P. nodolirata]. Trochiform; selenizone depressed, low on whorl; sutures shallow; ornament of pustules that cover much of shell, including selenizone (105, p. 460). Penn.(U.Carb.), N.Am.-SE.Asia.—Fig. 130,2. *P. nodolirata. M.Penn., Tex.; X4.

Phymatopleura Girty, 1939 [pro Orestes Girty, 1912 (non Blackinstone & Fryer, 1880, rec Redtenbacher, 1906)] [*Orestes nodosus Girty, 1912]. Turbiniform or trochiform, with depressed selenizone above basal angulation; ornament sharp spiral and collabral threads with one or more spiral rows of nodes high on whorl face. Penn., N.Am.—Fig. 130,6. *P. nodosus (Girty), M. Penn., Okla.; X5.

Callitomaria Batten, 1956 [*C. stanislavi]. Turbiniform, gradate, minutely phaneromphalos, relatively wide vertical whorl face below wide ramp; flat selenizone occupying middle of whorl face and about half its width; ornament 2 spiral cords on ramp (at its lower edge and close to suture respectively) and about 6 sharp spiral cords on

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Fig. 129. Pleurotomariacea (Porcellidae, Rhaphischismatidae) (p. 1213-1214).
base; sharp collabral threads on ramp and base in some species (5, p. 43). M.Perms., N.Am.—Fig. 130,7. *C. stamnalis*, Tex.; ×2.7.

**Discotomaria** BATTEN, 1956 [*D. basimulculata*]. Shell rather flat with low gradate spire; whorls rising in steps; upper surface of whorl a concave shoulder or ramp; outer face vertical with projecting flange separating it from base; base beneath flange first sloping gently inward and then flattening abruptly to narrow umbilicus; slit about 0.25 whorl deep, selenizone occupying upper half of smooth band at middle of outer whorl-face; base with shallow sinus below flange; highly ornamented with spiral and collabral elements (5, p. 43). U.Penn.-M.Perms., N.Am.—Fig. 130,6. *D. basimulculata*, M.Perms., Tex.: 5a,b, apertural and umbilical views, ×4.

**Eymarella** Cosmann, 1897 [pro Echites Koken, 1896 (non Krøyer, 1864)] [*Pleurotomaria subscalariformis Hörnes*]. Small, trochiform, with blunt apex due to discoidal coiling of early whorls, broadly phaneromphalous; ornament cancelling

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**Fig. 130. Pleurotomariacea (Phymatopleuridae) (p. I215-I217).**
collabral and spiral threads; selenizone impressed, at slightly flattened periphery, not overlapped on spire whorls. M.Trias.(Ladin.)—U.Trias.(Nor.), Eu.—Fig. 130.3. *E. subcircularis,formis, U.Trias. (Nor.), AUS.; 3a,b, ×2.5; ×6 (79).

Euryalox Cossmann, 1897 [pro Sagana Koken, 1896 (non Walker, 1855)] [*Pleurotomaria juavisca Koken, 1896]. Turbiniform, phaneromphalous, whorls evenly convex; ornament narrow cancellating spiral cords and collabral threads; selenizone peripheral, impressed, rather wide, bordered by spiral cords, and not overlapped on spire whorls; umbilical margin an angulation. M.Trias.(Amis.); U.Trias.(Nor.), Eu.—Fig. 130, 7. E. geometrica (Koken), U.Trias.(Carn.), AUS.; ×1.3 (79).

Codinella Kittl, 1899 [*Trocchus generelli Stopfani, 1858]. Small, elevated, cyrtocoonid, anomphalous; base short; whorls flat or feebly convex, with weak spiral ornament; selenizone at mid-whorl, growth lines prosocly below it, prosocline above; aperture small, much broader than high. M.Trias.(Ladin.), Eu.—Fig. 130.4. *C. generelli (Kittl), S.Tyroli; ×4; ×4, ×6 (66).

Family POLYTREMARIIDAE Wenz, 1938

[nom. transl. Knight, Batten & Yochelson, herein (ex Polytremariae Wenz, 1938)]

Exhalant emargination a labral slit or row of tremata; heavily thickened extension of columellar lip separated by a deep fissure from parietal lip, ornament spiral cords or threads. L.Carb.—M.Perm.

Polytremaria d'Orbigny, 1850 [*Pleurotomaria catenata deKoninck, 1843]. With series of exhalant tremata; grooved extension of columellar lip curving around umbilicus. L.Carb., Eu.—Fig. 131.2. *P. catenata (deKoninck), Belg.; showing tremata and curved pulley-like inner lip; ×2.7.

Plocostoma Gemmellaro, 1889 [*Pleurotomaria (Plocostoma) neumayri; SD Knight, 1937]. With narrow, probably short exhalant slit; selenizone narrow, borne by step high on outer whorl face; extension of parietal lip seemingly toothlike. M.Perm., Eu.—Fig. 131.6. *P. neumayri (Gemmellaro), Sicily; protrusion on columellar lip broken; ×2.7.

Family LAUBELLIDAE Cox, n. fam.

Small, ovate-conical, elevated, narrowly phaneromphalous; with angular sinus high on labrum culminating in short slit that generates raised selenizone close to adicalp suture; helicocone contracted and commonly bent upward near aperture. M.Trias.

Laubella Kittl, 1891 [*Pleurotomaria delicata Lauei, 1868; SD Dieder, 1926]. With characters of family; ornament spiral threads sometimes cancellated by collabrais. M.Trias.(Ladin.), Eu.—Fig. 133.1. *L. delicata, S.Tyroli; 1a,b, ×6 (64).

Family SCHIZOGONIIDAE Cox, n. fam.

Small, turbiniform to almost discoidal; last whorl with flattened outer face bordered by carinae or angulations, one or both nodose; spire gradate; labral emargination shallow, at upper angulation. M.Trias.—U.Trias.

Schizogonium Koken, 1889 [*Pleurotomaria scalaris Münster, 1841; SD Dieder, 1926]. Anomphalous to broadly phaneromphalous; both carinae well defined. M.Trias.(Ladin.), Eu.—Fig. 132.1. *S. scalar, S.Tyroli; ×4 (89).

Pseudoschizogonium Kutassy, 1937 [*P. turriculatum]. Depressed-turbiniform, phaneromphalous; selenizone nodose, with nodes continued by prosocline collabral ridges on horizontal upper whorl face. U.Trias.(Carn.), Eu.—Fig. 133.3. *P. turriculatum, Hung.; 3a-c, ×1.5, ×1.5, ×5 (84).

Family ZYGITIDAE Cox, n. fam.

Small, depressed - turbiniform, broadly phaneromphalous, with domelike spire; selenizone broad, depressed, at periphery on last whorl and not overlapped on spire; nodose angulation at margin of umbilicus; aperture subquadrate, with straight columellar lip leaning toward axis; labral slit rather deep (about 0.12 of last whorl). M.Trias.

Zygites Kittl, 1891 [*Pleurotomaria delphinula Laube, 1868 (pro Delphinula cancellata Klipstein, 1845, non Kiener, 1838-9)]. General surface and selenizone with ornament of cancellating spiral and collabral threads; also strong collabral folds on upper whorl face. M.Trias.(Ladin.), Eu.—Fig. 133.4. *Z. delphinula (Laube), S.Tyroli; 4a,b, ×2 (64).

Family KITTLIDISCIDAE Cox, n. fam.

Small, depressed-turbiniform to lenticular, broadly phaneromphalous; relatively broad selenizone occupying whole of outer face, which is bordered by 2 prominent carinae. M.Trias.

Kittliscus Haas, 1953 [pro Schizodiscus Kittl, 1891 (non Hall & Clarke, 1888)] [*Pleurotomaria bronni Klipstein, 1845 (=P. plana Klipstein, 1845, non Müntzer, 1844)]. Whorls with narrow shoulder; ornament collabral threads and spiral grooves on spire, spiral cords on base and umbilicus. M.Trias.(Ladin.), Eu.—Fig. 133.2. *K. bronni (Klipstein), S.Tyroli; 2a,b, ×3 (64).
Fig. 131. Pleurotomariacea (Polytremariidae, Pleurotomariidae) (p. 1217-1220).
Family TEMNOTROPIDAE Cox, n. fam.
Small, depressed turbiniform, some shells approaching auriform or neritiform, of few whorls increasing rapidly in diameter; labrum with slit generating selenizone occupying carina rather high on whorls, at angle of broad, gently sloping ramp; aperture very broad and oblique. M.Trias.-U.Trias.

Pleurotomaria DEFRANCE, 1826 [*Pleuronoma amoena* J.A.Eudes-Deslongchamps, 1849]. Conical or cyrtoconoid, anomphalous to broadly phaneromphalous; whorls weakly to strongly convex, not angular, last one rounded at periphery of convex base; selenizone at mid-whorl; ornament spiral threads that may be cancelled by collabral threads. M.Jur.-U.Cret.(Senon.), cosmop.—Fig. 131.5. *P. amoena* (J.A.Eudes-Deslongchamps), M.Jur.(Baj.), Fr.; X1.3 (111).

Stuorella KITTL, 1891 [*Trochus subconcaucus MüNSTER, 1841]. Rather small, conical, anomphalous or narrowly phaneromphalous; whorls flat, last one with angular periphery and flattened base; selenizone narrow, just above periphery, between 2 spiral cords; ornament axial costellae ending in nodes above selenizone and crossed obliquely by proscione growth threads. M.Trias.(Ladin.).-U.Trias.(Carn.), Eu.—Fig. 131.7. *S. subconcaucus* (MÜNSTER), M.Trias.(Ladin.), S.Tyrol; X3 (89).

Family PLEUROTOMARIIDAE Swainson, 1840
[nom. correct. KING, 1859 (ex Pleurotomariæ Swainson, 1840)]

Mostly medium-sized to large, trochiform; exhalant emargination a slit that generates selenizone on whorl face, in most genera at or near mid-whorl. Trias.-Rec.

Pleurotomaria DeFRANCE, 1826 [validation, ICZN pend.]. [*Pleuronoma anglicus* J.SOWERBY, 1818; SD S.P.WOODWARD, 1851] [=Pleurotomarium de BLAINVILLE, 1825 (suppression, ICZN pend.)]. Trochiform, moderately high to depressed, anomphalous to broadly phaneromphalous, gradeate, with outer whorl face flattened, at least in earlier growth stages; selenizone moderately broad, near mid-whorl; ornament sinuous spiral cords with tubercles at shoulder and in some species at margin of base. L.Jur.-L.Cret.(Apt.), cosmop.—Fig. 131.4. *P. anglica* (SOWERBY), L.Lias.; Fr.; X0.7 (111).

Bathrotomaria COX, 1956 [*Trochus reticulatus* J.SOWERBY, 1821]. Trochiform, elevated to depressed, anomphalous to broadly phaneromphalous; whors (at least in earlier growth stages) angulate, with usually broad ramp; second carina or angulation, just overlapped on spire, delimiting base; selenizone at ramp angle; ornament spiral threads commonly cancelled by collabral threads. L.Jur.-U.Cret.(Senon.), cosmop.—Fig. 131.3. *B. reticulata* (J.SOWERBY), U.Jur.(Kim.), Eng.; ×0.8 (222).

Leptomaria E. Eudes-Deslongchamps, 1864 [*Pleurotomaria amoena* J.A. Eudes-Deslongchamps, 1849]. Conical or cyrtoconoid, anomphalous to broadly phaneromphalous; whors weakly to strongly convex, not angular, last one rounded at periphery of convex base; selenizone at mid-whorl; ornament spiral threads that may be cancelled by collabral threads. M.Jur.(Baj.).-U.Cret.(Dan.), cosmop.—Fig. 131.5. *L. amoena* (J.A.Eudes-Deslongchamps), M.Jur.(Baj.), Fr.; X1.3 (111).

Stuorella KITTL, 1891 [*Trochus subconcaucus MüNSTER, 1841]. Rather small, conical, anomphalous or narrowly phaneromphalous; whorls flat, last one with angular periphery and flattened base; selenizone narrow, just above periphery, between 2 spiral cords; ornament axial costellae ending in nodes above selenizone and crossed obliquely by proscione growth threads. M.Trias.(Ladin.).-U.Trias.(Carn.), Eu.—Fig. 131.7. *S. subconcaucus* (MÜNSTER), M.Trias.(Ladin.), S.Tyrol; X3 (89).

Pyrgotrochus P.FISCHER, 1885 [*Pleurotomaria bitorquata* J.A.Eudes-Deslongchamps, 1849]. Conical or coeloconoid, anomphalous or narrowly phaneromphalous; whors flat or concave, last one with swollen band, commonly turbiniform or puckered, at periphery of flattened base; band visible on spire whorls, which also bear spiral threads; selenizone broad, below mid-whorl. L.Jur.-M.Cret.(Cenom.), cosmop.—Fig. 134.2. *P. bitorquata* (J.A.Eudes-Deslongchamps, M. Lias, Fr.; X1 (111).

Conotomaria COX, 1959 [*Pleurotomaria maileana d'Orbigny, 1843]. Conical, anomphalous to broadly phaneromphalous; whors flat or slightly sigmoideal in outline, periphery angular, may be bulging; selenizone at or above mid-whorl, quite close to suture in some species, not coinciding with an angulation; predominant ornament spiral cords. M.Jur.(Baj.).-U.Cret.(Senon.), cosmop.—Fig. 131.9. *C. maileana* (d'Orbigny), M.Cret.(Cenom.), Fr.; X1 (110).

Obornella COX, 1959 [*Pleurotomaria plicopunctata* J.A.Eudes-Deslongchamps, 1849]. Low-turbiform to sublenticular, phaneromphalous; base strongly convex; ornament close-spaced collabral costellae and spiral threads, former usually dominant; periphery commonly crenate; selenizone narrow, smooth, projecting, on upper whorl face near periphery; labral slit short. L.Jur.(U.Lias.).-U.Jur.(Oxford.), Eu.—Fig. 131.1. *O. plicopunctata* (J.A.Eudes-Deslongchamps), M.Jur.(Baj.), Fr.; X1 (111).

Chelotia BAYLE in P. FISCHER, 1885 [*Pleurotomaria concava* DESHAYES, 1832]. Cyrtococonoid, rather
broadly phaneromphalous; whorls feebly convex, last one rounded at periphery of base; selenizone narrow, between 2 narrow spiral cords rather high on whorl, not easily seen between coarse, nodose spiral cords that constitute the ornament; labral slit narrow and very long, said to extend back for more than a whorl from aperture. Eoc., Eu.

**Perotrochus** P. Fischer, 1885 [*Pleurotomaria quoyana* Fischer & Bernardi, 1856]. Turbiniform, anomalophalous, broader than high; whorls moderately convex, last one subangular at periphery of base; selenizone at or just below mid-whorl, moderately broad, flush, bearing obscure spiral threads; ornament fine cancelling spiral and labral threads; labral slit extending around 0.1 of last whorl.

**Mikadotrochus** Lindholm, 1927 [*Pleurotomaria beyrichi* Hilger, 1877]. Tectiform, narrowly phaneromphalous, whorls feebly convex, last one rounded or subangular at periphery of base; selenizone broad, flush, spirally grooved, below mid-whorl; ornament obscurely nodose spiral cords; labral slit broad, extending around 0.12 of last whorl or less, its upper margin produced beyond lower margin and merging into strongly prosocline, convex labrum. Plio.-Rec., Japan.-W.Pac.--Fig. 131, 1. *M. beyrichi* (Hilger), Rec.; ×1 (147).

**Entemnotrochus** P. Fischer, 1885 [*Pleurotomaria adansoniana* Crosse & Fischer, 1861]. Tectiform, rather broadly phaneromphalous; whorls feebly convex or obtusely angular, last one angular at periphery of rather flattened base; selenizone moderately broad, above mid-whorl, with well-marked lunulate; ornament obscure spiral cords with collateral threads near suture; labral slit long, extending around 0.5 of last whorl or more. Eoc.-Mio., Eu.-N.Am.; Rec., Carib.-W.Pac.--Fig. 131, 10. *E. adansoniana* (Crosse & Fischer), Rec., Carib.; ×0.8 (147).

Family TROCHOTOMIDAE Cox, n. fam. [==Ditremariinae Wenk, 1938]

Turbiniform; exhalant outlet an elongate elliptical trema, some shells with median constriction, generating selenizone on upper face of whorls; base with funnel-like depression affecting last whorl only; peristome discontinuous. U.Trias.(Rhaet.)-U.Jur.

**Trochotoma** J. A. Eudes-Deslongchamps, 1843 [*T. conloides*; SD S.P. Woodward, 1851] [==Ditrema d'Orbigny, 1843; Rimplus d'Orbigny, 1842 (nom. nud.)]. Columellar lip emerging from basal depression, strongly inclined, without denticulations; outer lip strongly prosocline. U.Trias.(Rhaet.)-U.Jur.(Portland.), Eu.

**T. (Trochotoma)**. Spire moderately elevated, conical or gradate; selenizone above mid-whorl, at ramp angle when this is present; peripheral carina frequent, delimiting base; ornament spiral cords. U.Trias.(Rhaet.)-U.Jur.(Portland.), Eu.--Fig. 135, 1. *T. bicarinata* (d'Orbigny), M.Lias., Fr.; la, b, ×1 (111).

**T. (Discotoma)** Haber, 1934 [*Ditrema amata* d'Orbigny, 1850]. Very depressed, whorls in-
Fig. 134. Pleurotomariacea (Pleurotomariidae) (p. 221-222).

creasing rapidly in diameter; ornament of upper face transverse folds crossed by spiral cords. M./llr. (Bathon.-U./ur.)-U./ur. (Portland.)-E./ur. (Bathon.)-U./ur. (Callov.), Eu.-Fig. 135, 2. T. (Discotoma) amata (D'ORBIGNY), M./llr. (Callov.), Fr.; 2a.b, X 15 (111).

Valvina Cox, 1958 [pro Didymodon P. FISCHER, 1885 (non Blake, 1863)] [*Trochus quinquecinctus ZIETEN, 1832]. Like Trochotoma (i.e.), but with 1 or 2 blunt denticles on columellar lip; spiral cords beaded. Jurf., Eu.—Fig. 135, 3. *V. thurmanni (DELOREIL), U./ur. (Kimm.), Fr.; 3a.b, X 1.3 (111).

Family SCISSURELLIDAE Gray, 1847
[nom. transl. et correct. FLEMING, 1822 (ex Haliotidea RAFINESQUE, 1815, subfamily name) [=Schismatobranchia GRAY, 1821]]

Shell auriform, depressed, with spire more or less strongly excentric and protruding only slightly or not at all; aperture broad, occupying most of underside; to left of aperture a broad, smooth labial area, beyond which narrow base of shell is just exposed in some species; shell wall with spiral row of small tremata, commonly on tubular projections, which become infilled progressively during growth, the last few (5 to 9) remaining open and serving as exhalant outlets; interior nacreous; no operculum. ?Cret., Mio.-Rec.

Records of Haliotis from the Cretaceous need confirmation. H. antiqua BINKHORST, 1861, from Maastricht, was thought by KAUNHOWEN (1898) to be a trochid. The type of H. cretacea LUNDGREN, 1894, from Sweden, needs re-investigation. H. lomaen-
sis Anderson, 1902, Chico Group of California, was rejected as a haliotid by Woodward (1931) but accepted by Vokes (1935).

The researches of Crofts (1929, 1937, 1955) on the anatomy and larval ontogeny of this family, and of Yonge (1947) on respiratory processes, are of great importance for the understanding of the Pleurotomariina. Only one genus, divided into several more or less intergrading subgenera, is here recognized, although generic rank has recently been claimed for Exohaliotis, on anatomical as well as conchological grounds.

Haliotis Linné, 1758 [*H. asinina; SD Montfort, 1810] [≡Teinotis Adams & Adams, 1854 (obj.); Haliotis Binkhorst, 1861 (obj.); Tinotis Fischer, 1885 (obj.); ?Cret., Mio.-Rec., cosmop.]

H. (Haliotis). Shell elongate and narrow, with apex very eccentric, almost marginal; ornament of spiral cords, almost obsolete on latter half of last whorl except on abapical side of tremata. Rec., IndoPac.—Fig. 137,4. *H. (H.) asinina, Philippines; ×0.7 (213).


H. (Exohaliotis) Cotton & Godfrey, 1933 [*H. cyclobates Péron & Lesueur, 1816]. Almost circular; spire more elevated than in other subgenera; ornament numerous nodose spiral cords and collabral rugae. Rec., Austral.

H. (Marinauris) Iredale, 1927 [*M. melinus; SD Wenz, 1938]. Rather small for genus, apex not strongly eccentric; no angulation at row of tremata; tremata large; ornament spiral cords on abapical side of tremata or on entire surface. Rec., Austral.

H. (Notohalioitis) Cotton & Godfrey, 1933 [*H. naevosa Martyn, 1784 (not binominal) =H. rubra Leach, 1814]. Tremata on tubular projections situated on angulation separating upper whorl surface from flat or concave outer face; ornament spiral cords and threads crossed by irregular transverse ribs oblique to collabral lines. Mio.-Rec., Austral.—Fig. 137,3. *H. (N.) rubra Leach, Rec.; ×0.7 (213).

H. (Ovinotis) Cotton, 1943 [*H. ovina Gmelin, 1791]. Tremata on tubular projections situated on angulation less pronounced than in N. (Notohalioitis); ornament knobby, transverse ribs oblique to collabral lines, and obscure spiral threads. Mio.-Rec., IndoPac.-Austral.

H. (Padillus) Montfort, 1810 [*P. rubicundus Montfort (non Haliotis rubicunda Röding, 1798) ?=H. scalaris Leach, 1814, or perhaps H. parva Linné, 1758] [≡Neohaliotis Cotton & Godfrey, 1933]. With broad spiral rib on adapical side of tremata, corresponding groove on interior of shell, and prominent thin collabral lamellae on adapical side of rib; tremata on tubular projections on second rib, and commonly a row of frilly projections near periphery. Rec.,
Archaeogastropoda—Pleurotomariina—Trochonemataceae

![Diagram of Pleurotomariacea (Scissurellidae)](p.I221)

**Fig. 136. Pleurotomariacea (Scissurellidae)**

Austral.-IndoPac.-S.Afr.—Fig. 137.2. *H. (P.) scalaris* Leach, Austral.; ×0.5 (168).

**H. (Paua) Fleming, 1952** [*H. iris* Martyn, 1784 (specific name validated ICZN)]. Of few whorls, cap-shaped, last whorl rising above level of submarginal apex; even convexity of surface modified by only slight angulation at row of tremata; labral area broad, its margin forming shell periphery; ornament collabral and oblique undulations, and spiral cords. Mio.-Rec., N.Z.—Japan.


**H. (Schismotis) Gray, 1856** [*S. excisa=Haliotis albicans* Quoy & Gaimard, 1834, ?=*H. laevigata* Donovan, 1808]. Large; whorls evenly convex, smooth except for almost obsolete spiral striae; tremata small, flush. Rec., Austral.

**H. (Sulculus) Adams & Adams, 1854** [*H. incisa* Reeve, 1846; SD Cossmann, 1918]. Small to medium-sized; tremata on angulation separating upper whorl surface from concave outer face; ornament spiral striae or cords and (in some specimens) irregular transverse ridges or nodes. Mio.-Rec., Medit.E.Atl.-Japan-N.Z.—Fig. 137.1. *H. (S.) tuberculata* Linné, Rec., Guernsey; la,b, abapertural and apertural sides, ×1 (213).

**Pleurotomariacea**

**Family UNCERTAIN**

*Ceratopea* Ulrich, 1911 [*C. keithi*]. Genus known from its relatively large heavy horn-shaped operculum with inner end pitted for muscle attachment, in some showing evidence of a pair of retractor muscles; outer side with blunt angulation that probably corresponds to a peripheral angulation of shell, upper surface set off from parietal surface by a rounded ridge and sharp change of direction of growth lines; inner surface sharply rounded and lower surface gently arched, with growth lines broadly concave toward shell. [Small wedge-shaped calcareous opercula that differ in form from the type species of *Ceratopea* have been referred to this genus but they seem more likely to belong to *Oropsira* or undescribed relatives of it.] L.Ord., N.Am.-Eu.—Fig. 138.1.

*C. keithi*, Va.; 1c,d, views of operculum from below and above; 1b, view showing peripheral carina; 1a, oblique view into attachment pit; all ×1.

**Spirotonaria** Koken, 1925 [*Pleurotomaria rudissima* Koken, 1897]. Turbiniform; narrowly phaneromphalous; labrum gently prosocline and convex above selenizone and also below except close to selenizone; numerous spiral threads. M. Ord., Eu.—Fig. 138.6. *S. rudissima* (Koken), Est.; ×1 (80).

**Psychozone** Perner, 1907 [*Worthenia aberrans* Perner, 1903]. Turbiniform, with inconspicuous broad selenizone high on rounded outer whorl face; sharp spiral threads and growth lines. U.Sil., Eu.—Fig. 138.4. *P. aberrans* (Perner), Czech; ×2.7.

**Platyconus** Perner, 1907 [*Pleurotomaria (Platyconus) incumbens*]. Trochiform, with relatively low spire and rounded anomphalous base; selenizone rounded convex; fairly strong transverse and spiral cords, former prosocline above and below selenizone. U.Sil., Eu.—Fig. 138.5. *P. incumbens* (Perner), Czech; ×1.

**Gyroema** Oehlerl., 1888 [*Pleurotomaria baconeriensis*]. Turbiniform, narrowly phaneromphalous; with broad selenizone and seemingly short slit; spiral and collabral threads. [When better known this genus may prove to be the same as Psychozone Perner.] L.Dev., Eu.—Fig. 138.3.

*P. baconeriensis* (Oehlerl), Fr.; ×3.7 (108).

**Trachyembex** J.Böhm, 1895 [*Pleurotomaria junonis* Kittle, 1894; SD Diener, 1926] [=Trachyembex Diener, 1926 (obj.)]. Rather small, turbiniform, variably phaneromphalous; base strongly convex; last whorl with 3 carinae, one juxtasutural, one median, 3rd at margin of base and in some shells overlapped on spire; collabral lines or ridges present in some; narrow selenizone between 2 ridges said to be carried by median carina. [The presence of this selenizone is not obvious in published figures and needs verification; if there is no selenizone, the genus should be removed from the Pleurotomariacea.) M. Trias. (Ladin.), Eu.—Fig. 138.2. *T. junonis* (Kittle), S.Tyrol.; ×1.5 (65).

**Transylvanella** Kutassy, 1937 [*T. acmaeiformis*]. Low trochiform, broadly phaneromphalous, sharply carinate at periphery; spire coeloconoid, its whorls flat, with spiral cords; selenizone just above periphery; aperture low, oblique. U. Trias. (Carn.), Eu.—Fig. 123.5. *T. acmaeiformis*, Hung.; ×1.5 (84).
Turbiniform, with channel at labrum within a spiral angulation about midway between sutures or higher on whorl, or with shallow sinus at about the same position; ornament spiral angulations, threads or cords, or rows of nodes, with collabral threads or growth lines; shell with nacreous lining. M.Ord.-M.Perm.

The Trochonematacea and Trochonematidae have usually been made a catchall for several heterogeneous groups of fossil gastropods of the Paleozoic and Mesozoic, but are here greatly reduced. According to either conception, they include only extinct forms. Inferences as to their anatomy and phylogeny can, therefore, be made only from shell features and from apparently related forms that appear more readily understandable.

In Middle and Late Ordovician time, species of trochonematacean genera (some as yet undescribed) resembled in remarkable detail those of the contemporary pleurotomariacean family Lophospiridae. It is, therefore, thought that the Trochonematacea were derived from the latter family. They differ chiefly in that the deep labral sinus or slit of the Lophospiridae is replaced by
an internal channel in a homologous position. It seems very possible that the more primitive trochonemataceans retained paired ctenidia, as was almost certainly true of the Lophospiridae, but that the right-hand ctenidium was lost in later genera, the anal tube moving to the right and the channel or sinus in the lip becoming vestigial.

**Family TROCHONEMATIDAE Zittel, 1895**

With characters of superfamily. *M.Ord.-M.Perm.*

**Proturritella Koken, 1889 [*P. gracilis*] [Goniocoma Koken, 1896; Pseudurnema Cossmann, 1899 (pro Goniocoma Koken, 1896); Nematotrechus Koken, 1925].** With subangular labral sinus culminating on median of 3 spiral carinae; narrowly phaneromphalous; ornament cancellate. *M.Ord., Eu.—Fig. 139.6. *P. gracilis, Swed.; X2.7.*

**Trochonema Salter, 1859 [*Pleurotomaria umbilicata Hall, 1847].** Turbiniform to aciculate, with a major spiral angulation having channel within; later whorls disjunct in some forms. *M.Ord.-L. Dev., N.Am.-Eu.-NE.Asia.*


---Fig. 139.7. *T. (T.) umbilicatum (Hall), M.Ord., Can.(Que.); X2.*

**T. (Eunema) Salter, 1859 [*Eunema strigitatum*].** Much like *Trochonema (s.s.)* but with high spire. *M.Ord.-U.Sil., N.Am.-Eu.—Fig. 139.1. *T. (E.) strigitatum (Salter), M.Ord., Can.(Que.); X1.3.*

**T. (Trochonemopsis) Meek, 1872 [*Trochonema tricarinata*].** Much like *Trochonema (s.s.)* but with 3 spiral angulations; suture not channeled. *L.Dev., N.Am.—Fig. 139.2. *T. (T.) tricarinatum (Meek), L.Dev., Ohio; X1.3.*

**Amaurotoma Knight, 1945 [*Pleurotomaria subsinuata Meek & Worthen, 1861].** Turbiniform, with shallow sinus high on labrum; ornament of spiral cords and collabral threads (72, p. 583). *Miss.-Penn., N.Am.—Fig. 139.4. *A. subsinuata (Meek & Worthen), M. Penn., Ill.; X5.*

**Cyclobathmus Knight, 1940 [*Trepospira haworthi Beede, 1907].** Turbiniform, gradate; broad shallow sinus in lip above shoulder angulation; ornament of spiral cords. (68, p. 314). *M. Perm., N.Am.-Eu.-NC.Asia—Fig. 139.3. *C. haworthi (Beede), M. Perm., Tex.; X8.*

**Cyclites Knight, 1940 [*Pleurotomaria multivenata Girty, 1908, =Wortmannia depressa Beede, 1907].** Low, turbiniform, slightly gradate; channel within shoulder angle; ornament of spiral cords or threads. (68, p. 310). *M. Perm., N.Am.-NC.Asia-SC.Asia-SE.Asia.—Fig. 139.5. C. depressus (Beede), Tex.; X6.*
Superfamily FISSURELLACEA Fleming, 1822
[nom. transl. Cox, 1959 (ex Fissurellidae Fleming, 1822)]
[Help in preliminary organization of data, given by Miss
Grace-Johnson, is here acknowledged]

Shell conical, porcelaneous; protoconch spiral; with perforation, slit, notch, or emar­
gination for passage of exhalant current; muscle scar horseshoe-shaped, open an­
teriorly (138, 147).

Trias.-Rec.

Family FISSURELLIDAE Fleming, 1822
[nom. correct. d’Orbigny, 1839 (pro Fissurellidae Fleming,
1822)]

With characters of superfamily. Trias.-Rec.

Subfamily EMARGINULINAE Gray, 1834
[nom. transl. Cossmann, 1888 (ex Emarginulidae Gray,
1834)]

Apex present in most forms; when wholly removed by perforation, apex replaced by projecting shelf within; slit anterior to apex. ?Trias., Jur.-Rec.

Emarginula Lamarck, 1801 [*E. conica] [=Emar­
ginulus Montfort, 1810 (obj.); Imarginula Gray,
1821 (obj.)]. Slit of varying extent; apex varying in position; no septum within. ?M.Trias., L.Jur.-
Rec., cosmop.

E. (Emarginula). Slit long and narrow, seleni­zone depressed between two ribs; shell short­
ovate, elevated; ornament radial riblets can­
cellated by collabral threads. ?M.Trias., Rec.,
Eu.-N.Am.-S.Am.-Australasia.—Fig. 140,1. *E.
(E.) conica, Rec., Eng.; la-c, ×3 (184).

E. (Altomarginula) Haber, 1932 [*E. desnoyersi
J.A. Eudes-Deslongchamps, 1842]. Very elevated,
with apex pointing to rear and located above margin; slit deep, selenizone in well-impres­
sed groove; ornament radial threads. M.Jur. (Bathon.),
Eu.—Fig. 140,7. *E. (A.) desnoyersi, Fr.; ×3
(147).

E. (Arginula) Palmer, 1937 [*E. arata Conrad,
1933]. Larger than E. (Emarginula), slit broader and shorter, selenizone not depressed between two ribs. M.Eoc., SE.USA.

E. (Entomella) Cossmann, 1888 [*E. clypeata
Lamarck, 1803]. Apex near posterior margin, slit short and broad, selenizone not on a rib. Eoc., Eu.—Fig. 140,3. *E. (E.) clypeata, Eoc.,
Fr.; 3a-c, ×3 (215).

E. (Semperia) Crosse, 1867 [*S. piaiana; SD
Cossmann, 1888]. Juvenile shells as in E. (Emar­
FIG. 140. Fissurellacea (Fissurellidae—Emarginulae (p. 1226-1228).

ginula) but adults with slit closed at margin, forming a perforation on anterior slope. Eoc.-Rec., Eu.

E. (Subzeidora) Iredale, 1924 [*E. connectens Thiele, 1924]. Apex posterior, incurved; slit very long. Rec., S.Pac.

E. (Tauschia) Haber, 1932 [*E. orthogonia Tausch, 1890]. Like Emarginula (s.s.) but with raised riblike selenizone. L.Jur., Eu.-Afr.—Fig. 140,11. *E. (T.) orthogonia Tausch, L.Jas., S.Tyrol; 11a,b, ×1.5 (147).

Austriacopsis Haber, 1932 [*Rimula australis Hörnes, 1853]. Patelliform, apex not far from median; exhalant outlet an elongate trema between apex and middle of anterior margin. Jur.

A. (Austriacopsis). Not greatly elevated; trema pyriform, midway between apex and anterior margin, tapering anteriorly to narrow slit; ornament moderately strong radial ribs. Jur. (Lias.-Portland.), Eu.—Fig. 140,9. *A. (A.) australis (Hörnes), L.Jas., Aus.; 9a,b, ×1.5 (147).

A. (Puncturellopsis) Haber, 1932 [*Fissurella acuta J.A.Eudes-Deslongchamps, 1842]. Elevated; trema elliptical, near apex; ornament radial threads. M.Jur.(Baj.-Bathon.), Eu.—Fig. 140,10. *A. (P.) acuta (J.A.Eudes-Deslongchamps), M.Jur.(Bathon.), Fr.; 10a,b, ×1.5 (147).

A. (Balinula) DACQUÉ (ex Haber, MS.), 1933 [*Emarginula? triontina GRECO, 1899]. Elevated; trema pyriform, elongate, near anterior margin; ornament cancellate. M.Jur.(Aden.-Baj.), Eu.—Fig. 140,6. *A. (B.) triontina (GRECO), M. Jur.(Aalen.), Italy; 6a,b, ×4.5 (189).

Cladpidina Gray, 1847 [*Patella notata LINNÉ, 1767]. Conical, surface with fine radiating ribs; apex not recurved; anterior notch short. C. (Cladpidina). Internal groove on anterior slope weak or wanting. Rec., S.Pac.

C. (Montfortula) Iredale, 1915 [*Emarginula rugosa QUY & GAIMARD, 1834] (=Plagiorhysis FISCHER, 1885 (non CHAUDORI, 1848)]. Internal groove distinct. Plio.-Rec., Australasia.—Fig. 140,8. *C. (M.) rugosa (QUY & GAIMARD), Rec., Austral., ×1 (147).

Emarginella PILSBRY, 1891 [*Emarginula cuvieri AUDOUIN, 1826]. Shell coarsely latticed; mantle partially enveloping shell. Rec., E.Afr.-E.Indies.—Fig. 140,5. *E. cuvieri (AUDOUIN), Rec., Red Sea; ×1 (147).

Emersonia Haber, 1932 [*Cemoria costata EMERSON, 1870]. Small, cap-shaped, with posteriorly

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pointing, hooklike, almost terminal apex; narrow exhalant slit extending halfway to apex from anterior margin and funnel-shaped internal plate towards apex from extremity of slit; ornament radial riblets of 2 orders, collateral threads in intervals. *L. jur., Eu.—Fig. 141, 1. *E. costata (Emerson), M.Lias., Ger.; exterior, interior showing septum. 1a,b, X4 (181).

Hemitoma Swainson, 1840 [*Patella tricostata Sowerby, 1823, ex Humphrey MS (non Gmelin, 1791) = P. octoradiata Gmelin, 1791] [=Subemarginula Gray, 1847 (obj.; Siphonella Isel, 1869 (non Hagenow, 1851)). Shell low to moderately elevated, but not conical; internal groove distinct, with a short slit or notch anteriorly. Eoc.-Rec., Eu.-N.Am.-S.Am.-S.Pac.-Fig. 140, 4. *H. (H.) octoradiata (Gmelin), Rec., W.Indies; 4a,b, X1 (147).

H. (Montfortia) Recluz, 1843 [*Emarginula australis Quoy & Gaimard, 1834; SD Iredale, 1915]. Selenizone forming stout ridge; anterior slope convex, posterior concave behind apex. Eoc.-Rec., Eu.-N.Am.-S.Am.-S.Pac.—Fig. 140, 2. H. (M.) australis (Quoy & Gaimard), Rec., Austral., X1 (147).


Loxotoma Fischer, 1885 [*Emarginula neocomiensis d'Orbigny, 1843]. Like Emarginula (s.s.) but asymmetrical, selenizone and marginal exhalant slit forming an acute angle with mid-line of shell. *U. jur.(Portland.)-Eoc., Eu.—Fig. 141, 7. *L. neocomiensis (d'Orbigny), L.Cret.(Neocom.), Fr.; 7a,b, X2 (110).

Notomella Cotton, 1957 [*Emarginula candida A. Adams, 1852] [=Entomella Cotton, 1945 (non Cossmann, 1888)]. Resembling Emarginula, ovate, depressed-conical, apex recurved; anal slit long and narrow. Terr.-Rec., Australasia-IndoPac.—Fig. 141, 5. *N. candida (A. Adams), Rec., E.Indies; 5a,b, X2 (216).

Puncturella Lowe, 1827 [*Patella noachina Linne, 1758] [=Cemoria Leach, 1852 (non Risso, 1815)].

Fig. 141. Fissurellacea (Fissurellidae—Emarginulinae) (p. 1228-1230).
Fig. 142. Fissurellacea (Fissurellidae—Diodorinae, Fissurellinae) (p. 1230-1231).

1826); Sipho Brown, 1827 (non Fabricius, 1823); Vacerra Iredale, 1924 (non Godman, 1900). Conical, with perforation on anterior slope or near apex entering conduit or curved shelly plate within; internal groove and selenizone weak or wanting. Eoc.-Ree.

P. (Puncturella). Perforation near summit, apex recurved, persistent in adult. Oligo.-Ree., Eu.-N.Pac.—Fig. 141, 3. *P. noachina (Linne), Rec., Norway; 3a,b, X2 (147).


P. (Fissurisepta) Seguenza, 1863 [*F. papillosa; SD Woodring, 1928]. Perforation at apex; internal septum strong; no internal groove; surface sculpture weak. Mio.-Rec., Eu.-W. Atl.-IndoPac.-Australasia.


Rimula Defrance, 1827 [*R. blainvilli; SD Gray, 1847] (= Rimularia Waldheim, 1834 (obj.)). Apical whorls present, inclined to right; perforation on anterior slope, long and narrow; no internal septum. Cret.-Rec., Eu.-N.Am.-S.Am.-IndoPac.—Fig. 141, 2. *R. blainvilli, Eoc., Fr.; 2a-c, X5 (147).

Rimulopsis Haber, 1932 [*Emarginula goldfusii Roemer, 1836]. Small, cap-shaped, apical region narrow, extending well beyond posterior margin, apex slightly recurved; ornament symmetrical radial ribs and collabral threads. Elliptical trema on anterior slope. Jur., Eu.

R. (Rimulopsis). Anterior slope with broad median rib bearing selenizone and small trema placed some distance from anterior margin. Jur.(Lias.-Portland.), Eu.—Fig. 141, 6. A. deslongchampsi (Cossmann), M.Jur.(Bathon.), Eng.; 6a,b, X6 (104).

R. (Konikaua) Daqué, 1933 (ex Haber MS) [*Rimula multisirriata Zittel, 1873]. Trema midway between apex and margin; selenizone in deep groove. U.Jur.(Tithon.), Eu.—Fig. 141, 8.
Mollusca—Gastropoda

*R. (K.) multistriata* (Zittel), Czech.; 8a,b, ×5 (157).

**Scutus Montfort**, 1810 [*Sc. antipodes* (=*Parmophorus deBlainville*, 1817 (obj.); *Parmophora Desmarest*, 1859 (obj.); *Parmaphora Bowdich*, 1822 (obj.); *Scutum Sowerby*, 1842 (obj.); *Aviceutum Iredale*, 1940). Depressed, oblong, apex not absorbed; selenizone wanting; muscle scar near margin. Eoc.—Rec., Eu.—Austral.—IndoPac.

S. (Scutus). Shell large, truncate anteriorly, smooth. Mio.—Rec., Eu.—IndoPac.—Australia.——Fig. 141.9. *S. (S.) antipodes*, Rec., SE.—Austral.; ×0.5 (147).

S. (Nannoscutum) Iredale, 1937 [*N. forsythi*]. Shell small, stout, with strong concentric linear sculpture. Rec., Australia.


**Tugali Gray** in Dieffenbach, 1843 [*T. elegans*, =*Emarginula parmophoidea Quoy & Gaimard, 1834* (=*Tugalia Gray*, 1847 (obj.)). Surface radiate-cancellate; apex entire, posterior, recurved; margin crenulate within, sinuate anteriorly. Mio.—Rec., Australia.—IndoPac.—Antarctica.

T. (Tugali). Apex at posterior third. Mio.—Rec., IndoPac.—Australia.——Fig. 141.4. *T. (T.) parmophoidea* (Quoy & Gaimard), Rec., N.Z.; 4a,b, ×0.7 (147).


**Zeidora A. Adams**, 1860 [*Z. calceolina* (=*Crepidemarginula Seguenza*, 1880; *Legrandia Beddome*, 1883 (non Hanley, 1872)).] Apex posterior, recurved; selenizone on anterior slope, with elevated edges and anterior slit; septum within on posterior margin. Plio.—Rec., Eu.—W Atl.—Pac.—RedSea.

Z. (Zeidora). Internal septum broad. Plio.—Rec., Eu.—W Atl.—Pac.———Fig. 141.10. *Z. calceolina*, Rec., Japan; 10a,b, ×4 (191).


**Subfamily DIODORINAE** Wenz, 1938

Shell conical, apex perforate; perforation bounded by callus within that is truncate posteriorly; muscle scar open anteriorly, with hook-shaped terminations (3). Jur.—Rec.


**Megathura Pilsbry**, 1890 [*M. californica = Fissurella crenulata G.B. Sowerby, 1825* (=*Macrochasma Dall, 1915 (obj.)).] Large, perforation large, oval; muscle scar faint; surface radiately striate; inner margin finely crenulate. Plio.—Rec., Japan.—W.N.Am.———Fig. 142, 8. *M. crenulata* (Sowerby), Rec., Calif.; 8a,b, ×3 (147).

**Pseudosissurella Haber**, 1932 [*Fissurella corallensis Buvignier, 1852*. Small, rather high, apex just posterior to median, perforation small, with slight posterior slant; ornament fine rounded radial ribs. Jur., Eu.———Fig. 142.6. *P. corallensis* (Buvignier), U.Jur. (Raurac.), Fr.; 6a,b, ×7.5 (147).

**Stromboli Berry**, 1954 [*Fissurella beebei Hertlein & Strong, 1951*.] Perforation slanting, slightly in front of apex. Rec., C.Am.———Fig. 142.4. *S. beebei* (Hertlein & Strong), Rec., W.Mex., ×0.5 (192).

**Subfamily FISSURELLINAE** Fleming, 1822

Exhalant perforation at or near apex, bordered within by a rounded callus (2). Eoc.—Rec.

**Fissurella Bruguiere**, 1789 [*Patella nimboasa Linne*, 1758; SD Lamarck, 1799] (=*Fissurellus deMontfort, 1810* (obj.)). Apex nearly central, inner margin of shell smooth or weakly crenulate. Oligo.—Rec., Eu.—N.Am.—C.Am.—S.Am.

F. (Fissurella). Shell with border dark internally. Eoc.—Rec., Eu.—Atl.—Pac.———Fig. 142.12. *F. nimboasa* (Linne), Rec., W.Indies; ×0.7 (147).

F. (Balboaina) PEREZ-FARFANTE, 1943 [*Patella picta Gmelin, 1791* (=*Balvoina Carcelles, 1951 (error)); Balvoina Perez-Farfanate, 1952 (error)]. Like *F. fissurella* but larger, internal callus broader. Rec., southern S.Am.


F. (Clypadilla) Swainson, 1840 [*Patella pustula Gmelin, 1791* (=*F. punctata Fischer, 1857*).] Depressed, saddle-shaped, ends elevated; perforation in front of middle; margin somewhat crenulate. Rec., Atul.—W.Indies.

F. (Cremides) Adams & Adams, 1854 [*F. albatrites Reeve, 1849; SD Cossmann & Peyrot, 1917*.] Perforation central, shell with well-developed radial ribs; inner margin crenulate. Oligo.—Rec., N.Am.—C.Am.

**Amblychileps Pilsbry**, 1890 [*Fissurella trapezina G.B. Sowerby, 1835 = *F. juvanicensis Lamarck, 1822* (=*Sophismalepas Iredale, 1924*. Saddle-
Suborder PATELLINA von Ihering, 1876

[nom. transl. Cox & Knight, herein (ex Patelloidea von Ihering, 1876)] [=Cyclobanchia (Goldfuss, 1820, partim) Gray, 1821; Docoglossa Trochel, 1866; Onychoglossa Sars, 1878; Phylliobanchia Lamber, 1833; hiaturoidea Perrier, 1889; Heterocardia Bernard, 1890]

Shell conical or cap-shaped, bilaterally symmetrical, without perforation or marginal notch, without internal septum; muscle attachment scar semicircular or horse-shoe-shaped, open on anterior side; outer shell layer calcitic, inner layers aragonitic, iridescent in some but not nacreous; no operculum; living forms with single bi-pectinate ctenidium or with circle of small branchiae beneath mantle margin or with neither; pallial genital organs wanting; heart with single auricle, ventricle not traversed by rectum; radula long, docoglossate, teeth clawlike, number in each row small, exercising effective rasping stroke during outward protrusion of odontophore. [Habitat littoral zone, clinging to rocks.] ?M.Sil.-L.Trias., M.Trias.-Rec.

Superfamily PATELLACEA Rafinesque, 1815

[nom. transl. Thielle, 1925 (ex Patellidae, nom correct. Gray, 1834, pro Patellaria Rafinesque, 1815)]


?Family METOPTOMATIDAE Wenz, 1938

Shell patelliform or helcioniform; muscle scar horseshoe-shaped with anterior opening not closed by pallial line, scar broadest at anterior end; nature of inner shell layers and of possible coiled protoconch imperfectly known. M.Sil.-M.Perm.

The Metoptomatidae are seemingly represented by undescribed species and genera occurring as far back as early Middle Ordovician time. Their derivation is uncertain, but it seems probable that they arose from the early pleurotomarian stem or even from the still more primitive bellerophonts. No direct evidence can be cited to indicate that this family was docoglossate but, on the other hand, there is not yet enough evidence to establish it as a superfamily unrelated to but convergent with the Patellacea.

Palaeoscurria Perner, 1903 [*P. calyptrata; SD Cossmann, 1904]. Externally resembling Leptopitaxis but musculature entirely unknown. [Existence of supposed muscle scars described and figured...
3a, from above; 3b, interior showing scar (upper part anterior); 3c, left side; all X 1.3.

**Family SYMMETROCAPULIDAE**
Wenz, 1938
[nom. transl. et correct. Cox, herein (ex Symetrocapulinae Wenz, 1938)]

Cap-shaped, longitudinal profile downcurved from submedian summit to more or less anteriorly placed and directed beak; protoconch coiled, of 1.5 to 2 whorls, retained (unless eroded) by adult shell; muscle scar unknown. Trias.-Jur., ?Cret.

For lack of definite evidence to the contrary, this group is provisionally retained in the Patellina, following Wenz, although it may eventually prove to be related to the caenogastropod family Capulidae.

**Symmetrocapulus** DACQUE, 1933 [*Patella rugosa J.SOWERBY, 1816 (non RÖDING, 1798) = *P. tesoni J.A.EUDES-DESLONGCHAMPS, 1843 (ex Symetrocapulus HABER, 1932 (nom. nud.))]. Rather large; beak at anterior third to quarter of length; ornament radial riblets and concentric folds. ?Jur., ?Cret., Eu.—Fig. 144.1. *S. rugosus (J.Sowerby), M.Jur. (Bath.), Fr.; 1a, b, from above and left side, X2 (147).

**Phryx** BLASCHKE, 1905 [*Capulus (Phryx) bilateralis*]. Rather small, domelike, with submedian summit and terminal beak; no ornament except growth striae; protoconch unknown. M.Trias.-U. Trias., Eu.-Asia.—Fig. 144.2. *P. bilateralis, M.Trias. (Ladin.), S.Tyrol; right side, X1 (147).
Family ACMAEIDAE Carpenter, 1857

Shell conical, porceleanous; respiratory organ a single ctenidium, no branchial cor­don. M. Trias.-Rec.


S. (Scurriopsis). Well-elevated, broadly elliptical, apex only slightly anterior to median; cancelling collabral and radial threads on entire surface; muscle scar (observed in type species) horseshoe-shaped with broad anterior gap. M. Trias.-U. Jur., Eu., N. Afr.—Fig. 145,2. *S. (S.) neumayri, L. Lias., Sicily; 8a, b, from above and left side, X 1 (130).

S. (Hennocquia) Wenz, 1938 (ex Haber, 1932, nom. nud.) [*Patella hennocquii TerqueM, 1855]. Only moderately elevated, ovate, with anterior end the narrower; apex well anterior; radial riblets almost confined to posterior end. L. Jur. (L. Lias.), Eu.—Fig. 145,6. *S. (H.) hennocquii (TerqueM), Fr.; 6a, b, from above and right side, X 1 (224).


Marbodeia Cheilot, 1887 [pro Guerangeria Coss­mann, 1885 (non Oehlert, 1881)] [*Patella clypeola J. A. Eu­des-D­elongs­champs, 1842]. Small, narrowly elliptical, depressed, convex in profile except for apex, which forms projecting stud limited by a depression; ornament depressed, rounded radial riblets. M. Jur. (Bathon.), Eu.—Fig. 145,1. *M. clypeola (J. A. Eu­des-D­elongs­champs), Fr.; 1a, b, from above and right side, X 1.5 (17).

Conorhytis Cossmann, 1907 [*Patella squamula J. A. Eu­des-D­elongs­champs, 1863]. Moderately large, well-elevated, broadly elliptical, apex just anterior to median; ornament fine squamae or wrinkles with irregular quincuncial arrangement, and obscure radial threads. M. Jur. (Baj.-Bathon.), Eu.—Fig. 145,7. *C. raduloides (Cossmann), M. Jur. (Bathon.); 7a, b, from above and right side, X 1 (170).

Deslongchampsia Morris & Lycett (ex McCoy, MS), 1851 [*Patella appendiculata J. A. Eu­des-D­elongs­champs, 1842; SD Laube, 1868 (Tate, 1868, Appendix to S. P. Woodward, Manual of Mol­lusca, p. 39, designated D. eugenei Morris & Lycett as type species in the same year, but Laube’s designation is here accepted)]. Of small-medium size, cap-shaped, rather depressed, sub-orbicular, with apex anterior to median and point­ing anteriorly; broad, smooth sulcus runs from apex to rounded lobelike projection of anterior margin; remainder of surface radially costate. M. Jur. (Bathon.)-U. Jur. (Oxford.), Eu.—Fig. 145,2. *D. appendiculata (J. A. Eu­des-D­elongs­champs), M. Jur. (Bathon.), Fr.; 2a-c, from above, anterior, and left side, X 1 (170).

Fig. 145. Patellacea (Acmaeidae—Acmaeinae) (p. 1233-1234).

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Hamptoniella Wenz, 1938 [pro Hamptonia Haber, 1932 (nom. nud.) non Walcott, 1920] [*Umbrella? hamptonensis Morris & Lyckett, 1851]. Small, circular, flat or almost so; aperture submedian; surface with straight or undulating low, rounded, subradial ribs, increasing outward by intercalation and forking. M.Jur.(Bathon.), Eu.—Fig. 145,5. *H. hamptonensis (Morris & Lyckett), Eng.; 5a,b, specimens from above, X1.8 (Cox, n).


A. (Chiazacmea) OLIVER, 1926 [*Patelloidea flammea QUOY & GAIMARD, 1834]. Rec., S.Pac.


A. (Collisellina) Dall, 1871 [*Patella saccharina LINNÉ, 1758]. Rec., IndoPac.

A. (Conacmea) OLIVER, 1926 [*A. parviconoidae SUTER, 1907]. Rec., IndoPac.


A. (Kikukozora) Habe, 1944 [*Collisella (K.) langordi], Rec., Japan.


A. (Parvacmea) IREDALE, 1915 [*A. daedala SUTER, 1907]. Small, thin, beaks well forward, hooked. Oligo.-Rec., N.Z.

A. (Patelloidea QUOY & GAIMARD, 1834 [*P. rugosa; SD GRAY, 1847]. Radially ribbed; with strong color markings as in *A. (Collisella). Rec., IndoPac.—Fig. 145,4. *A. (P.) rugosa (QUOY & GAIMARD), Rec., E.Indies; 4a,b, exterior and interior, anterior toward top, X1 (147).


A. (Subacmea) OLIVER, 1926 [*Notoacmea scopulina]. Rec., Australasia.


A. (Thalassacmea) OLIVER, 1926 [*Notoacmea badia]. Rec., N.Z.

Lottia Gray, 1833 [*L. gigantea G.B.Sowerby, 1834; SD Dall, 1871] [=Tecturella CARPENTER, 1860 (non STIMPSON, 1854); Tecturia CARPENTER, 1861, Lecania CARPENTER, 1866 (non MACQUART, 1839), pro Tecturella]. Large, low, apex nearly marginal; muscle impressions joined by a curved line. Rec., W.N.Am.

Pectinodonta DALL, 1882 [*P. arcuata]. Low, somewhat arched, apex blunt, subcentral; animal blind; in deep water. Rec., Atl.-Japan.—Fig. 146,1. *P. arcuata, Rec., W.Indies; X2 (147).

Potamacmaea FEHÉR, 1922 [*Tecturella fluviatilis BLANDFORD, 1868]. Rounded, finely radially ribbed; in brackish to fresh water. Rec., India.

Scurria Gray, 1847 [*Patella scurra LESSON, 1841]. High, apex subcentral; sculpture more concentric than radial. Rec., W.S.Am.—Fig. 146,2. *S. scurra (LESSON), Rec., W.S.Am.; X1 (147).

**Family PATELLIDAE Rafinesque, 1815** [nom. correct. Gray, 1834 (pro Patellaria Rafinesque, 1815)]

Iridescent to porcelaneous within; with a branchial cordon (palial gill lamellae) but no true ctenidium. ?Jur., Eoc.-Rec.

**Subfamily PATELLINAE Rafinesque, 1815** [nom. transl. THIELE, 1929 (ex Patellidae, nom. correct. Gray, 1834, pro Patellaria Rafinesque, 1815)]

Shell strong and solid, interior iridescent; embryonal shell not evident. ?Jur., Rec.


**P. (Patella).** Oval, with strong radial ribs, apex nearly central. ?U.Cret., Eoc.-Rec., Eu.-Afr.—Fig. 147,2. *P. (P.) vulgata, Rec., Fr.; from above, anterior toward top, X1 (147).


H. (Helcion). Radially ribbed. ?Jur., Rec., Eu.-Afr.-Pac.—Fig. 147,1. *H. (H.) pectinatus (Born), Rec., S.Afr.; 1a,b, from above and left side, X1 (147).


Subfamily NACELLINAE Thiele, 1929
Shell solid in some species, in others thin-shelled to transparent; interior with metallic glaze. Eoc.-Rec.


N. (Nacella). Apex submarginal; shell nearly transparent. Eoc.-Rec., Eu.-S.Am.-Antarct.——Fig. 148,2. *N. (N.) mytilina (Helbling), Rec., Strait of Magellan; right side, X1 (147).


Cellana H. Adams, 1869 [*Nacella cernica] (=Helcionicus Dall, 1871). Shell fairly solid, apex subcentral; radial ribs strong; interior brilliantly glazed. Mio.-Rec., S.Pac.-IndoPac.—Fig. 148,1. *C. cernica (Adams), Rec., Mauritius; from above, anterior toward right, X1 (147).

Family LEPETIDAE Dall, 1869
Small, colorless shells, conical or cap-shaped, apex in front of center; smooth or with inconspicuous sculpture; muscle scar as in Acmaeidae. Animal without ctenidia or branchial cordon. Mio.-Rec.


L. (Lepea). Rather small, exterior beaded; tip of muscle scar in front of apex. Plio.-Rec., Eu.-N. Atl.—Fig. 149,1. *L. (L.) caeca (Müller), Rec., North Sea; 1a,b, from above and right side, X1 (147).

L. (Cryptobanchia) Middendorff, 1851 [*Patella caeca concentrica; SD Dall, 1869] (=Cryptocenula Dall, 1918 (obj.)). Larger, nearly smooth, tip of muscle scars not in front of apex. Plio.-Rec., N.Pac.-Arct.
Mollusca—Gastropoda

**Family LEPETELLIDAE Dall, 1881**

Small, low to steeply conical, smooth; apex central or behind middle, not spiral; aperture rounded to oval. *Rec.*

Lepetella *Verrill, 1880* [*L. tubicola*]. Apex elevated, nearly central. Rec., N.Atl.-Carib.-N.Z.

L. (Lepetella). Apex slightly hooked behind; shell margin nearly circular. Rec., N.Atl.-Carib.-

**Fig. 150, 2.** "L. (L.) tubicola" Rec., Mass.; right side, X5 (147).

L. (?Tecticrater) *Dell, 1956* [*Cocculina compressa Suter, 1908*]. Saddle-shaped, anterior and posterior margins arched upward. Rec., N.Z.

Addisonia *Dall, 1882* [*A. paradoxa*]. Apex back of middle, blunt. Rec., Atl.-Medit.—

**Fig. 150, 4.** "A. paradoxa, Rec., NW.Atl.; right side, X2 (147).

Bathysciadium *Dautzenberg & Fischer, 1900* [*B. conicum (=Lepeta costellata Locaro, 1898)*]. Steeply conical, with radial striae. Rec., Atl.-Pac.—

**Fig. 150, 3.** "B. costellatum (Locaro), Rec., Azores; right side, X10 (147).

Cocculinella *Thiele, 1909* [*Acmaea minuissima Smith, 1904*]. Low, narrow-oval. Mio.-Rec., Indian O.-Austral.—

**Fig. 150, 5.** *C. minuissima (Smith), Rec., Andaman L; 5a,b, from above and left side, X7.5 (147).

**?PATELLINA, Superfamily and Family UNCERTAIN**

The following genera of Mesozoic patelliform gastropods seem closely related. *Brunonia* has been referred to the Siphonariidae and *Rhytidopilus* to the Acroridae.
Cossmann, assumed also to belong to the Pulmonata. In no specimen, however, has the muscle scar been observed, and affinities with the pulmonates have yet to be proved. In the following descriptions it is assumed, without proof, that the apex, if not median, is anterior to median.

Berlicia Deloriol, 1903 [*B. ledonica]. Founded on broadly elliptical, patelliform internal molds of medium size; surface with concentric undulations and curved oblique furrow running from apex to anterior margin. U.Jur.(Argoe.), Jura.Mts.(Fr.-Switz.).

Rhytidopilus Cossmann, 1895 [*Patella humbertina Buvignier, 1852]. Thin, patelliform, broadly elliptical, with subcentral apex; surface with concentric undulations; two furrows bordering a slightly elevated sector run from apex to anterior margin. M.Jur.(Bathon.)-L.Cret.(Alb.), Eu.—Fig. 151.2. *R. humbertinus (Buvignier), U.Jur. (Kimm.), Fr.; 2a,b, from above and anterior side, ×2.5 (18).

Pseudorh tidopilus Cox, n.gen., herein (pro Haber, 1932, nom. nud.) [*P. lenneri Cox, n.sp., herein (pro Haber, 1932, nom. nud.) (=Helcion castellana Lennier, 1868), non Patella castellana Thurmann & Étallon, 1861]. Like Rhytidopilus, but lacking anterior elevated sector. L.Jur.-U.Jur., Eu.

Brunonia Müller, 1898 [*B. grandis]. Large, patelliform, variably elevated, commonly asymmetrical; apex at or anterior to mid-length; surface with irregular concentric folds and (in some specimens) a narrow anterior elevated sector, as in Rhytidopilus. U.Cret.(L.Senon.), Ger.—Fig. 151.1. *B. grandis; 1a,b, from above and right side, ×1 (206).—Fig. 151.3. B. irregularis Müller; 3a,b, from above and right side, ×1 (206).

Suborder TROCHINA Cox & Knight, 1960

[=Eugastropodes chiestonéures Bouvier, 1887; Trochomorphpha Naef, 1911]

Shell mostly conispiral, with spire not greatly elevated, more rarely discoidal; outer lip simple; inner shell layers and in some forms complete shell aragonitic and nacreous; operculum calcareous or corneous and spiral in Trochacea, calcareous and multispiral in Oriostomatacea, otherwise unknown; with single bipectinate ctenidium (left); pallial genital organs wanting; heart with 2 auricles, ventricle traversed by rectum; radula rhipidoglossate. L.Ord.-Rec.

1 Études géol. et pal. sur l'embouchure de la Seine, p. 80, pl. 88, figs. 8,8a. Diagnosis: Large Pseudorh tidopilus orbicular in outline. The species and genus (as subgenus of Scoria) were proposed by Haber with bibliographic references but without diagnoses, thus requiring validation before they can be recognized under the Rules.
Superfamily **PLATYCERATAcea**

**Hall, 1859**

[nom. transl. **knight, batten & yochelson**, herein (ex **Platyceridae Hall, 1859**)]

Primitively turbiniform with prosocline labrum and nacreous inner shell lining except in more advanced platyceratids; one group adapted to stationary habit on calyx of crinoids and to coprophagous feeding. *L*. **ord.-M.Perm.**

There is no evidence of any exhalant sinus or channel other than the channel at the juncture of the parietal and outer lips, and it is assumed that the right ctenidium was lost. It is thought that the Platyceratacea were derived independently from the Pleurotomariaceae, but the earliest genera recognized seem to have lost all vestiges of features suggesting a dibranchiate condition.

**Fig. 152.** Platyceratacea (Holopeidae—Holopeinae, Gyronematinae) (p. 1239).
Family HOLOPEIDAE Wenz, 1938
Turbiriform, with or without spiral ornament; usually with narrow umbilicus. L. Ord.-M. Perm.

Subfamily HOLOPEINAE Wenz, 1938
[nom. transl. Knight, Batten & Yochelson, herein (ex Holopeidae Wenz, 1938)]
Without or almost without spiral ornament. L.Ord.-U.Dev.

Straparollina Billings, 1865 [*S. pelagica; SD de Konincck, 1881]. Columell lar lip with thickened triangular area below, generating a circumumbilical ridge. L.Ord., N.Am.-Eu.—Fig. 152.2. *S. pelagica, L.Ord., Can.(Newf.); ×1.3.

Holopea Hall, 1847 [*H. symmetrca; SD Bassler, 1915] [=Litopis Salter, 1866 (obj.); Haplospira Koken, 1897; Cirripipsis, Tortilla Perner, 1903; Staurospira Perner, 1907 (non Haeckel, 1887); Anastrophina Knight, 1937 (pro Stauros pira Perner, 1907)]. Whorls rounded, in some species disjunct; sutures deep; final whorl may bear coarse rounded ribs. M.Ord.-Dev., N.Am.-Eu.—Fig. 152.11. *H. symmetrca, M.Ord., N.Y.; ×2.7.

Globonema Wenz, 1938 [*Nematotrochus bicarina tus (Wahlenberg) Koken, 1925 (non Wahlenberg, 1821) = Trochonema (Globonema) kokeni Wenz, 1938]. Sutures moderately deep; with low carina at periphery above suture and another encircling the umbilicus; numerous collateral threads (147, p. 228). U.Ord., Eu.—Fig. 152.6. G. kokeni (Wenz), Norway; ×3.3 (80).

Threavia Lamont, 1946 [*T. gula]. With carina low on whorl (85, p. 642). U.Ord., Eu.—Fig. 152.1. *T. gula, Scot.; ×2.7 (85).

Raphispira Perner, 1903 [*R. plena]. Resembling Holopea but with a circumumbilical cord. U.Sil., N.Am.-Eu.—Fig. 152.10. *R. plena, Czech.; ×1.3.

Protospiralis Clarke, 1904 [*Playostoma (?) minutissima Clarke, 1885]. Minute, naticiform, seemingly anomphalous. [Although very small, probably mature.] U.Dev., N.Am.

Subfamily GYRONEMATINAE Knight, 1956
Spiral ornament dominant. M.Ord.-M. Perm.

Gyronema Ulrich in Ulrich & Scofield, 1897 [*Trochonema (Gyronema) pulchellum Ulrich & Scofield, 1897]. Narrowly phaneromalous with relatively few, strong spiral cords; outer lip prosocline; reflected col umellar lip. M.Ord.-Sil., N.Am.-Eu.-N.Afr.—Fig. 152.4. *G. pulchellum (Ulrich & Scofield), M.Ord., Minn.; ×4.

Antitrochus Whidborne, 1891 [*A. arietinus; SD Knight, 1937]. Sinistral, with numerous spiral and prosocline collabral threads. M.Dev., Eu.—Fig. 152.7. *A. arietinus, Eng.; ×2.

Yunnania Mansuy, 1912 [*Y. termieri; SD Cossman, 1918]. Shell thick, anomphalous; ornament of spiral cords; growth lines prosocline. Dev.-M.Perm., S.E.Asia.-N.Am.-Eu.—Fig. 152.9. *Y. termieri, L.Perm., China; ×3.3.

Araconema Knight, 1933 [*A. virgatum] [=Tur bina deKonincck, 1881 (non Brown in Herrmannsen, 1847); Palaeoturbinia Wenz, 1938 (147, p. 234) (pro Turbina deKonincck, 1881)]. Very small; narrowly phaneromalous; ornament of faint spiral threads or wanting. Miss.(L.Carb.)-Penn.(U.Carb.), N.Am.-Eu.—Fig. 152.8. *A. virgatum, M. Penn., Mo.; ×13.3.

Rhabdotocochlis Knight, 1933 [*R. rugata]. Very small, thick-shelled; narrowly phaneromalous; with strong spiral cords. Penn.-M. Perm., N.Am.—Fig. 152.12. *R. rugata, M. Penn., Mo.; ×40.

Cinclidonema Knight, 1945 [*C. texanum]. With shoulder below suture; anomphalous; col umellar lip slightly reflexed; ornament of numerous spiral cords and collateral threads (72, p. 584). Penn. (U. Carb.-) M. Perm., N. Am.-S. Am.-Eu.-SE. Asia.—Fig. 152.5. *C. texanum, U. Penn., Tex.; ×1.7.

?Omphalona GRAU, 1936 [*O. multispiralis]. Seemingly without shoulder but with ornament much like Cinclidonema; apertural characters unknown. L. Perm., NE.Asia.—Fig. 152.3. *O. multispiralis, China; ×1 (48).

Family PLATYCYRATIDAE Hall, 1859
[nom. correc. Knight, 1934 (==Platyceratidae Hall, 1859)]
(==Platystomidae, Cyclonemidae, S.A. MILLER, 1889)
Coprophagous on crinoids and cystoids (BOWSHER, 1955), the shells showing through their range from mid-Ordovician to late Paleozoic progressively more complete adaptation to a stationary life, principally on crinoid calices; earlier members turbiriform or naticiform, with flat col umellar lip but with irregular prosocline growth lines; lip becoming more uneven, conforming to irregularities of the crinoid or cystoid calyx, and the primitively coiled shell uncoiling or developing other peculiarities of growth as crinoids became more elaborate in the course of time; ornament present in more primitive stocks but gradually lost. M.Ord.-M. Perm.

So great is the variability induced by the stationary habit that systematics of the group are unusually difficult. One has trouble in deciding if two markedly unlike variations represent different genera or subgenera, or are actually conspecific. In the Platyceratidae the outer shell layers are relatively thick and calcitic, so that specimens
resist solution noticeably better than many gastropods that are more largely aragonitic. The inner shell layers of the primitive genus *Cyclonema* are seemingly nacreous and aragonitic, but this layer appears to be lost in the more advanced *Platyceeras*.

**Naticonema** Pernier, 1903 [^N. similare|Otospira Pernier, 1903; Naticellina Pernier, 1911]. Naticiform to globular, with flat excavated columellar lip; ornament wanting or consisting of spiral growth lines and collabral irregularly sinuous threads. Specimens known on crinoid calices. *M.Ord.-U.Sil.*, *E. N.Am.*—Fig. 153,1. *^N. similare*, U.Sil., Czech.; ×2.7.

**Cyclonema** Hall, 1852 [*Pleurotomaria bilix Conrad, 1842*.] Basically turbiform or trochiform but variously modified by stationary coprophagous habit; always with characteristically sharp spiral and finer collabral threads. *M.Ord.-L.Dev.*, *N.Am.-Eu.*

**C.** (Cyclonema) Hall, 1852 [*Cyclonemina Pernier, 1907*.] Turbiniform to trochiform, with wavy surfaces and slightly irregular growth lines; columellar lip slightly excavated or irregular. Specimens known on crinoid calices. [The supposed genus *Cyclonemina* is composed of dwarfed, monstrous, or irregular individuals of several species, normal individuals of which are referred to *Cyclonema*. The irregular growth may have been due to inability to find a suitable station on a crinoid calyx.] *M.Ord.-U.Sil.*, *N.Am.-Eu.*—Fig. 153,11. *^C. (C.) bilix (Conrad)*, U. Ord., Ind.; ×2.

**C. (Dyeria)** Ulrich in Ulrich & Scofield, 1897 [*Cylotites costatus James, 1872*.] Earlier 3 or 4 whorls rotelliform; final whorl irregularly disjunct; with or without ornament. *M.Ord.-U.Ord.*, *N.Am.*—Fig. 153,3. *^C. (D.) costatum (James)*, U.Ord., Ohio; ×1.

**C. (Pleocoma)** Pernier, 1903 [*P. protendens* SD Pernier, 1907]. Very like *Cyclonema* but with final whorl disjunct. *L.Dev.*, *Eu.*—Fig. 153,5. *^C. (P.) protendens (Pernier)*, L.Dev., Czech.; ×1.3.

**Platyceeras** Conrad, 1840 [*Pileopsis vetusta J.D.C. Sowerby, 1829; SD Tate, 1869*.] Subgenera varying from naticiform to completely disjunct, some earlier species with spiral and collabral threads or with collabral lines, some with hollow spines arising as marginal tubes, apertural margin of many shells deeply sinuate, conforming to irregularities of crinoid calyx to which it was attached during life. [Apertural irregularities primarily record characters of the host crinoid, not of the gastropod, the reentrants of some shells resembling pleurotomarian sinuses or slits, but having no homologous function.] *Sil.-M. Perm.*, cosmop.—Fig. 153,10. *^P. (O.) subrectum Hall, M.Dev.*, N.Y.; steinkern, ×0.7.

**P. (Orthynychus)** Hall, 1843 [*Platyceeras (Orthynychus) subrectum Hall, 1859* [=Igo­ceras Hall, 1880; Palaeoacoumus Grabeau & Shimer, 1909; Geronticeras Grabeau, 1936]. Very similar to *Platyceeras* (s.s.) but without coiling except that the vermiciform protoconch in some specimens becomes fused to shell; ornament like that of *Platyceeras* (s.s.), or, more commonly, of strong longitudinal folds produced by sinus over strong salient on crinoid calyx. [Specimens are common on crinoid calices.] *Sil.-L.Dev.*, *N.Am.-Eu.-N. Afr.*—Fig. 153,6. *P. (V.) tennesseense (Dun­bar)*, L.Dev., Tenn.; ×0.7.

**P. (Practaeatia)** Pernier, 1903 [*Strophostylus gregarius proeva* SD Knight, 1941 (69, p. 270)]. Naticiform to auriform; ornament of fine lamellar growth lines and crowded, oblique, irregular cords; columellar lip slightly thickened, strongly arcuate. *U. Sil.-L.Dev.*, *Eu.-N.Am.*—Fig. 153,8. *^P. (P.)...
Fig. 153. Platyceratacea (Platyceratidae) (p. 1240-1242).
Superfamily MICRODOMMATACEA
Wenz, 1938
[nom. transl. Knight, Batten & Yochelson, herein (ex Microdominae Wenz, 1938)]

Subulate to turbiniform, with simple rounded aperture, reflexed columellar lip and nacreous inner shell layer. [Probably derived from the Pleurotomariacea.] M. Ord.-M. Perm.

Family MICRODOMATIDAE Wenz, 1938
[nom. transl. et correct. Knight, Batten & Yochelson, herein (ex Microdominae Wenz, 1938)]

Umbilicus minute; usually ornamented; spire relatively high. M. Ord.-M. Perm.

Daidia Wilson, 1951 [*Eunema cerithioides Salter, 1859]. Turriculate, with slight shoulder at suture and very slight angulation about midway between sutures; collateral threads orthodine above and slightly prosocline below (150, p. 73). M. Ord., N. Am.—Fig. 154,/. *E. cerithioides (Salter), Can. (Que.); X1 (150).

Episfaxis Knight, 1937 [*pro Cosmina Perner, 1903 (non Robineau-Desvoidy, 1830)] [*Cosmina complacens Perner, 1903]. Turbiniform, with rounded whors, shallow sutures, and moderately high spire; ornament a network of fine spiral and orthocline collateral threads. L. Dev., Eu.—Fig. 154,2. *E. complacens (Perner), Czech.; X2.7.

Pagodea Perner, 1903 [*P. concomitans]. Turbiniform, with rounded whors, shallow sutures, and moderately high spire; labrum orthodine, close to upper suture, but turning shortly to strongly prosocline; ornament of 3 low spiral cords and sharp lamellar collateral threads. L. Dev., N. Am.-Eu.—Fig. 154,4. *P. concomitans, Czech.; X2.7.

Microdoma Meek & Worthen, 1867 [*M. conicum] [=Tuberculopleura Jarowlew, 1899; Pleurotrocbus Sherzer & Grabau, 1909; Microdomus Cossmann, 1915 (1916) (obj.)]. Much like Pagodea but with higher spire and shallower sutures; ornament of protoconch much like that of Pagodea, broad collateral ribs with fine threads developing gradually on later whors, breaking the ribs into 3 rows of pustules. L. Dev.-L. Perm., N. Am.-Eu.-N. Asia.—Fig. 154,3. *M. conicum, M. Penn., Ill.; X6.7.

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Glyptospira H. CHRONIC, 1952 [*G. cristulata]. Much like Microdoma but with ornament of 2 or 3 strong revolving cords on sides of whorls and 3 to 5 or more weaker cords on base, all crossed by strong lamellar rasp-like, prosocline collabral threads (14, p. 127). L.Perm.-M.Perm., N.Am.-Eu.-SE.Asia.—Fig. 154,5. *G. cristulata, M. Perm., Ariz.; X5.3.

Family ELASMONEMATIDAE Knight, 1956

Umbilicus commonly narrow, rarely minute; ornament wanting or consisting of collabral threads. U.Sil.-U.Carb. (Penn.).

Streptotrochus PERNER, 1907 [*S. rugulosus]. Trochiform, with angular periphery; labrum with shallow sinus, growth lines orthocline above, then slightly prosocline, next curving gently forward to an opisthocline direction; umbilicus seemingly narrow but not minute. U.Sil., Eu.—Fig. 155,4. *S. rugulosus, Czech.; X1.3.

Discordichilus COSSMANN, 1918 [*Trochus mollis LINNÉSTRÖM, 1884]. Depressed turbiniform, with strongly rounded periphery; labrum strongly prosocline; columellar lip thickened; umbilicus narrow. M.Sil., Eu.—Fig. 155,1. *D. mollis (LINNÉSTRÖM), Gotl.; X1.3.

Elasmonema FISCHER, 1885 [pro Callonema HALL, 1879 (non CONRAD, 1875)] [*Loxonema bellatum HALL, 1861; SD S.A. MILLER, 1889]. Conoidal, with shallow sutures; narrow funnel-like umbilicus; ornament slightly prosocline cords. L.Dev., N.Am.—Fig. 155,3. *E. bellatum (HALL), Ohio; X2.2.

Anematina KNIGHT, 1933 [*Holopea prostrana HALL, 1858]. Somewhat like Elasmonema but with higher spire; umbilicus minute; ornament lacking. Miss.-L.Carb.-Penn. (U.Carb.), N.Am.-Eu.—Fig. 155,2. *A. prostrana (HALL), M. Miss., Ind.; X4.

?Eucochlis KNIGHT, 1933 [*E. perminuta]. Very small, cyrtoconoid, with narrow umbilicus; ornament of rather widely spaced, prosocline collabral cords. Penn., N.Am.—Fig. 155,5. *E. perminuta, M.Penn., Mo.; X30.

Superfamily ANOMPHALACEA WENZ, 1938

[nom. transl. KNIGHT, BATTEN & YOCELSON, herein (ex Anomphalidae WENZ, 1938)]

Rotelliform to naticiform, with prosocline nonsinuate outer lip; narrowly phaneromphalous, cryptomphalous, or hemiomphalous; columellar lip commonly thickened or callosed in various ways; inner shell layers seemingly nacreous. Sil.-M.Perm.
Family ANOMPHALIDAE Wenz, 1938

With characters of superfamily. Sil.-M. Perm.

*Turbocheilus* Perner, 1907 [*Turbo immaturus* Perner, 1903]. Globular, naticiform; outer lip prosocline above, turning to opisthoclone at mid-whorl and gently prosocline below; callus-filled umbilicus gently concave externally. M.Sil., Eu.—Fig. 156,1. *T. immaturus* (Perner), Czech.; X2.

*Pycnomphalus* Lindström, 1884 [*P. obesus*; SD Perner, 1907]. Rotelliform, with numerous whorls and very thick shell; bearing within the umbilicus shelf-like funicle generated by massive thickening at base of columella. Sil., N.Am.-Eu.—Fig. 156,8. *P. obesus*, M.Sil., Gotl.; X2.

*Isonema* Meek & Worthen, 1866 [*I. depressum* Meek & Worthen, =Naticopsis linearis Keyes, 1889, pro *N. depressa* (Meek & Worthen) Keyes, 1889 (non Winchell, 1864), =I. humile Meek, 1872. Naticiform, labrum strongly prosocline; columellar lip thickened with heavy callus extending over umbilical region; ornament of collaral threads or cords. L.Dev., N.Am.—Fig. 156,6. *I. humile* Meek, Ohio; X1.3.

*Anomphalus* Meek & Worthen, 1867 [*A. rotulus* [=Antirotella Cossmann, 1918]. Rotelliform, whors deeply embracing above; outer lip prosocline; adult columellar lip thickened, highly variable from species to species, producing a variety of umbilical characters, so that shell ranges from heavily cryptomphalous to phaneromphalous; exterior polished. M.Dev.-Penn.(U.Carb.), N.Am.-Eu.-NE.Asia-SE.Asia.—Fig. 156,4. *A. rotulus*, M.Penn., Ill.; X10.

*Tychonia* Dekoninck, 1881 [*Natica omaliana* Dekoninck, 1843]. Depressed naticiform, with outer lip curving forward from upper suture to about mid-whorl, strongly prosocline below; columellar lip thickened and developing a funicle; surface without ornament. L.Carb., Eu.—Fig. 156,2. *T. omaliana* (Dekoninck), Belg.; X1.3.

*Straparella* Fischer, 1885 [*Straparollus fallax* De

Fig. 156. Anomphalacea (Anomphalidae) (p. 1244-1245).
KONINCK, 1843]. Rotelliform, with broad, gentle labral sinus in outer lip; columellar lip thickened at its base, generating a funicle; ornament of collabral threads. *S. fallax* (deKONINCK), Belg.; X2.

**Turbinilopsis** DEKONINCK, 1881 [ *T. inconspicua*; SD COSSMANN, 1915 [1916]]. Naticiform, with prosocline outer lip and thickened inner lip with longitudinal groove; narrow umbilicus with callus wash; without ornament. *L.Carb.*, Eu.—Fig. 156,5. *T. inconspicua*, Belg.; X4.

**Sosioyltes** GEMMELLARO, 1889 [ *S. schlotheimi*]. Small, naticiform; labrum opisthocline close to suture, turning to roundly and strongly prosocline a short distance below; narrowly phaneromphalous; ornament growth lines alone. *M.Perms.*, Eu.—Fig. 156,3. *S. schlotheimi*, Sicily; X2.

**Eiselia** DIETZ, 1911 [ *E. dyadica*]. Small, rotelliform, phaneromphalous, with wide, low collabral cords; labrum seemingly arched forward at about mid-whorl; not well known. *M.Perms.*, Eu.

**Superfamily ORIOSTOMATACEA** Wenz, 1938

[nom. transl. KNIGHT, BATTEN & YOCHELSON, herein (ex Oriostomatidae Wenz, 1938)]

Trochiform to discoidal, closely coiled or disjunct; strongly ornamented with spiral cords or spines. *U.Sil.*—*L.Dev.*, ?Trias.

**Family ORIOSTOMATIDAE** Wenz, 1938

[=HorioStomidae KOKEN, 1897 (ICZN pend.)]

Closely coiled; with heavy multispiral calcareous operculum; shell with nacreous inner layer. *U.Sil.—L.Dev.*

**Morphotropis** PERNER, 1903 [ *M. aliena*; SD PERNER, 1907]. Depressed turbiniform with moderately wide umbilicus; whorls round, sutures deep; ornament of collabral orthocline, fine threads with more widely spaced undulating lamellae. *U.Sil.*, Eu.—Fig. 157,1. *M. aliena*, Czech.; X1.3.

**Beraunia** KNIGHT, 1937 [ pro Eucyclotropis Cossmann, 1909 (non JORDAN, 1904), Eucyclotropis Cossmann, 1909, pro Cycloptropis PERNER, 1903 (non TAPPARONE-CANEPI, 1883)] [ *Cyclotropis docens* PERNER, 1903; SD PERNER, 1907] [=Rhabdospira PERNER, 1903 (non DONALD, 1898)]. Discoidal to depressed turbiniform; whorls rounded, with deep sutures; rarely disjunct; ornament dominantly spiral. *U.Sil.—L.Dev.*, Eu.—Fig. 157,3. *B. docens* (PERNER), U.Sil., Czech.; oblique apertural view with operculum, X1.3.

**Oriostoma** MNIEJ-CHALMAS, 1876 [ *O. barrandei*] [=HorioStoma FISCHER, 1885 (obj.)]. Turbiniform; umbilicus moderately wide to narrow; ornament of dominantly spiral carinae, cords or threads with finer collabral elements, in some species producing elaborate crenulations. *U.Sil.—L.Dev.*, N.Am.—Eu.—Fig. 157,2. *O. coronatum*
ornament of spiral cords, a few with long hollow spines opening adaperturally, and finer collabral threads. L.Dev., Eu.—Fig. 158,5. *T. armata*, Czech.; oblique, ×1.5.

**Meandrella** Perner, 1903 [*M. sculpta*]. Coiling nearly discoidal; aperture slightly expanded; spiral ornament numerous cords, a few of which at early growth stages carried hollow pustules; collabral ornament of fine, sharp, zigzag threads pointing adaperturally on cords and adaperturally between. L.Dev., Eu.—Fig. 158,6. *M. sculpta*, Czech.; oblique, from above, ×1.3.

?**Pseudotubina** Koken, 1896 [*P. biserialis*; SD Diener, 1926]. Hornlike, not quite planispiral, consisting of rather more than a single disjunct whorl; outer face limited above and below, or below only, by carina bearing tubercles or short prickles that disappear near aperture; growth lines parasigmoid on upper face, prosocryt on lower. U.Trias.(Carn.), Eu.—Fig. 158,7. *P. biserialis*, Aus.; 1a-c, ×2 (79).

?**Colubrella** Koken, 1896 [*C. squamata*]. Mostly hornlike, almost planispiral, consisting of up to two whorls circular or quadrate in cross section and partly or wholly disjunct in most forms; growth lines accentuated at intervals to form collabral rings or lamellae, except on inner face of whorls. M.Trias.(Ladin.)-U.Trias.(Nor.), Eu.

C. (Colubrella). Whorls partly or wholly disjunct, last expanded at aperture. M.Trias. (Ladin.)-U.Trias.(Nor.), Eu.—Fig. 158,3. C. (C.) kokeni Broili, U.Trias.(Nor.), S.Tyrol; 3a,b, ×1.5 (10).

C. (Keration) Broili, 1907 [*K. nautiliforme*]. Small, nautiliform, whorls in contact, the last only slightly expanded at aperture. U.Trias. (Carn.), Eu.—Fig. 158,4. *C. (K.) nautiliformis*, S.Tyrol; 4a-c, ×1.5 (10).

**Superfamily TROCHACEA**

Rafinesque, 1815

[nom. transl. Thiell, 1925 (ex Trochidae Gray, 1834, nom. correct., pro Trochinia Rafinesque, 1815)]

[Some help in preliminary organization of data for Tertiary genera was given by Miss Grace Johnson and is here acknowledged.]

Conical, turbiniform or subglobose shells with entire aperture; inner shell layer, and outermost layer in some genera, nacreous; operculum conocephalic or calcareous, spiral (18, 139, 147). *Trias.-Rec.*
Family TROCHIDAE Rafinesque, 1815
[nom. correct. Gray, 1834 (pro Trochinia Rafinesque, 1815)]

Peristome discontinuous in most genera, with columellar and outer lips not in same plane. Operculum circular, multispiral, thin, corneous, with central nucleus. Trias.-Rec.

Subfamily PROCONULINAE Cox, n. subfam.

Conical, mostly elevated shells with acute apex; nearly all of small or small-medium size; anomphalous or phaneromphalous; base more or less flattened; aperture quadrangular; columellar lip simple or with single plication. Trias.-U.Cret.

Fig. 159. Trochacea (Trochidae—Proconulinae (p. 1248-1249)).
FIG. 160. Trochacea (Trochidae—Chilodontinae) (p. 1249).

Diplochilus WÖHRMANN, 1894 [·D. gracilis; SD COSSMANN, 1916] [=Wöhrmannia COSSMANN, 1916 (erroneously cited as 1895) (non J.BÖHM, 1895); Raiblia COSSMANN, 1916 (both pro Diplochilus WÖHRMANN, non Diplochila BRULLE, 1835)]. Well-elevated, narrowly phaneromphalous; whorls bicarinate near lower suture; sutures deep; apertural characters imperfectly known. Trias., Eu.-Asia.—Fig. 159,7. *C. triadicus* (HöRNEs), Hung.; X1 (200).

Eocalliostoma HAAS, 1953 [·Calliostoma interruptum Cox, 1947]. Small, moderately elevated, anomphalous; whorls flat, last subangular at periphery; ornament depressed, irregular transverse ribs that tend to break up on last whorl; base flattened; columellar lip short, with strong fold at lower end. U.Trias.(Nor.), S.Am.—Fig. 180A,3. *E. interruptum* (Cox), Peru; X6 (21).

?Tylotrochus KOKEN, 1896 [·Trochus konincki HöRNEs, 1856]. Moderately elevated, anomphalous, with fewer whorls and more extended base than most genera of subfamily; whorls feebly convex, with delicate ornament of spiral and collabral threads; aperture subquadrate, columellar lip simple. Trias., Eu.-Asia.—Fig. 159,6. *T. konincki* (HöRNEs), U.Trias.(Carn.), Aus.; X1.7 (79).

Anticonulus COSSMANN, 1918 [·Trochus mariae d'ORBIGNY, 1853]. Well elevated, phaneromphalous; whorls flat to feebly convex, subimbricate in some species, smooth or spirally grooved, last angular or rounded at periphery; base low, convex; columellar lip simple, of variable inclination. Trias.-L./Jur., Eu.—Fig. 159,5. *A. nius* (d'ORBIGNY), M.Lias., Fr.; X3 (111).

Proconulus COSSMANN, 1918 [·Trochus guillieri COSSMANN, 1885]. Well elevated, anomphalous; whorls fairly numerous, flat or almost so, spirally striated or smooth, last with angular or sharply rounded periphery; base feebly convex; columellar lip simple, with moderately broad, callous outer surface having distinct outer margin, commonly an angulation. L./Jur.-U.Cret.(Senon.), cosmop.—Fig. 159,2. *P. raulineus* (BUVIGNIER), Lias., Fr.; 2a,b, X1.5 (165).

Epulotrochus COSSMANN, 1918 [·Trochus epulus d'ORBIGNY, 1850]. Well elevated, anomphalous, of very numerous low, smooth, flat whorls, last subangular at periphery; base flattened, slightly excavated mesially; aperture broad, with very oblique, simple, unthickened columellar lip. L./Jur., Eu.—Fig. 159,9. *E. epulus* (d'ORBIGNY), Fr.; 2a,b, X2.5 (111).

Lithotrochus CONRAD, 1855 [·Turritella andis d'ORBIGNY, 1842 (=Fleurotomaria humboldtii vonBuch, 1839)]. Very large and elevated, slightly cyrtoconoid, anomphalous, with peripherally carinate, imbricate whorls that overlap less in later growth stages; ornament spiral cords, strongest on outer part of base, a very prominent one adjoining peripheral carina; aperture imperfectly

Fig. 160. Trochacea (Trochidae—Chilodontinae) (p. 1249).
known. L.Jur., S.Am.—Fig. 159.11. *L. humboldtii* (von Büch), Chile; ×0.7 (162).

Trypanotrochus Cossmann, 1918 [*Trochus normanianus* d'Orbigny, 1850]. Well elevated, phaneromphalous; whorls fairly numerous, flat, last carinate at periphery; ornament nodose spiral cords; base flattened, umbilical margin carinate; columellar lip simple, straight or almost so, of variable inclination. L.Jur., Eu.—Fig. 159.9. *T. normanianus* (d'Orbigny), Fr.; ×2 (111).

Muricotrechus Cossmann, 1918 [*M. hudlestoni*]. Well elevated, anomphalous, of numerous low whors bearing 2 or more tuberculate spiral cords, lowest forming periphery; base smooth, flattened; columellar lip short, simple. M.Jur.(Baj.); L.Cret. (Kimm.), Eu.—Fig. 159.10. *D. sublucinsis* (Hudleston), M.Jur.(Baj.), Eng.; ×2.5 (59).

Discotectus Favre, 1913 [*Trochus massalongoi* Gemmellaro; SD Cossmann, 1918]. Cylroconoid, moderately elevated, anomphalous; whors numerous, last subangular at periphery; base flattened; ornament spiral cords; columellar lip short, with prominent, median fold produced beyond outer lips lying almost in same plane; tooth thickened and may be weakly dentate internally. M.Jur.(Bathon.); L.Cret.(Senon.), Eu.—Fig. 159.10. *D. crasiiplicatus* (Etallon), U.Jur.(Kimm.), Fr.Jura; 1a,b, ×3.3 (95).

Subfamily CHILODONTINAE Wenz, 1938

[=Polydontininae Cossmann, 1918]

Turbiniform, conical or pupiform shells of small or small-medium size; most forms with margined parietal callus producing continuous peristome and columellar and outer lips lying almost in same plane; tooth or fold present high on columellar lip; other teeth on one or more lips in some genera. M.Trias.-U.Cret.

Pseudoclanculus Cossmann, 1918 [*Monodonta casiana* Wissmann in Müntser, 1841]. Small, broadly conical, anomphalous; whors feebly convex, with ornament of granose spiral cords; base rather flattened, bearing in middle arched coating of calculus spreading from columellar lip; strong fold high on columellar lip extending short distance into aperture; labrum thickened and may be weakly dentate internally. M.Trias.(Ladin.); U.Trias. (Carn.), Eu.—Fig. 160.1. *P. cassianus* (Wissmann), M.Trias.(Ladin.), S.Tyroli; 1a,b, ×4; 1c, ×3 (64).

Chilodontoidea Hudleston, 1896 [*C. oolitica*]. Cylroconoid, anomphalous, with high spine of mesially carinate whors bearing spiral cords rendered granose by collabral threads; base strongly convex; small tooth high on columellar lip; parietal callus in some shells with obesu swelling or pair of small denticles; outer lip slightly thickened internally, almost orthocline. M.Jur.(Baj.), Eu.—Fig. 160.4. *C. oolitica*, Eng.; ×2.5 (59).

Wilsoniconcha Wenz, 1939 [pro Wilsonia Hudlestoni, 1896 (non Bonaparte, 1838)] [*Wilsonia liassica*]. Pupoidal but with acute apex, anomphalous; ornament spiral cords rendered granose by collabral threads; aperture obliquely ovate, extending to left of axis; inner lip with 2 strong denticles near middle; outer lip slightly thickened, almost orthocline. L.Jur.-U.Jur.(Raurac.), Eu.—Fig. 160.5. *W. liassica*, Lias., Eng.; ×2.75 (59).

Chilodonta Étallon, 1862 [*C. clathrata* SD de Loris, 1887]. With low conical spire and globose last whorl; anomphalous; aperture orbicular, with thickened outer lip and five strong teeth distributed around peristome. U.Jur.(Oxford.); U.Cret.(Maastricht.), Eu.

C. (Chilodonta) Spire with cancellating spiral and collabral threads, base with spiral threads only; parietal callus thick. U.Jur.(Oxford.); U.Cret.(Maastricht.). Eu.—Fig. 160.3. *C. (C.) clathrata*, U.Jur.(Kimm.). Fr.Jura; ×3 (95).

C. (Odontoturbo) de Loris, 1887 [*O. delicatula*]. Small, globose, smooth; no parietal callus. U.Jur.(Kimm.), Eu.—Fig. 160.6. *C. (O.) delicatula*, Fr.Jura; ×6 (95).

Agathodonta Cossmann, 1918 [*Trochus dentigerus* (sic) d'Orbigny, 1843] [=Agathodonta Wenz, 1938 (obj.)]. High turbiniform, anomphalous, with strongly convex whors and base; ornament granose spiral cords; columellar lip with two strong, obtuse teeth. L.Cret., Eu.—Fig. 160.1. *A. dentigera* (d'Orbigny), L.Cret.(Neocom.), Fr.; ×2 (110).

Subfamily MARGARITINAE Stoliczka, 1868

Small, thin shells, iridescent within; conical, turbiniform, or sublenticular; mostly phaneromphalous, a few anomphalous; peristome interrupted and columellar and outer lips unthickened in most but not all genera; columellar lip only rarely toothed; outer lip not strongly prosocline. Trias.-Rec.

Eostolicella Haas, 1953 [*Margaria turbinata von Ammon, 1893*]. Depressed turbiniform, rather broadly phaneromphalous, with whors and base strongly convex and smooth; aperture suborbicular; peristome thin, continuous; columellar lip strongly concave, not reflected, without teeth. U.Trias., Eu.-S.Am.—Fig. 161.15. *E. turbinata* (von Ammon), Rhetic, N.Italy; 15a, ×1.5; 15b, ×1.75 (160).

Solariconulus Cossmann, 1918 [*Trochus nudus* Müntser, 1841] [=Solariconulus Wenz, 1938 (obj.)]. Turbiniform, with slightly coeloconoid spire and sharp apex; narrowly phaneromphalous; whors and base convex, smooth or with faint spiral striiae; aperture quadrangular; columellar lip reflected, without teeth. M.Trias.(Ladin.); U.Trias. (Nor.), Eu.-S.Am.—Fig. 161.16. *S. nudus* (Müntser), S.Tyroli; ×4 (89).

Atira Stewart, 1926 [*Angaria ornaulissima Gabb,
Mollusca—Gastropoda

1864]. Turbiniform, rather broadly planaromorphic, with last whorl convex or somewhat flattened laterally and angulation forming umbilical margin; ornament faint spiral striae; peristome thin, continuous; columellar lip strongly concave, not reflected, without teeth. U.Cret., N.Am.—Fig. 161,18. *A. ornatusima* (GABB), Chico Gr., Calif.; X3 (221).

**Garamites** STEPHENSON, 1941 [*G. nitidus*]. Turbiniform, rather broadly planaromorphic, with strongly convex whors and base; smooth except for about 4 faint spiral grooves; umbilical margin a crenulated angulation; aperture not known intact. U.Cret., N.Am.—Fig. 161,13. *G. nitidus*, Navarro Gr., Tex.; X5 (220).

**Margarites** GRAY, 1847 (ex LEACH MS.). [*Trochus helicinus* FABRICIUS, 1780 (≡Turbo helicinus PHILIPS, 1774)] (≡*Margarita LEACH, 1819 (non LEACH, 1814); *Eumargarita* FISCHER, 1885 (obj.); *Valvatella* "GRAY" MELVILL, 1897 (non GRAY, 1857)]. Smooth or spirally ribbed, nacre conspicuous. U.Cret.-Rec.

M. (Margarites). Spire low, whors nearly smooth, last whorl large. U.Cret.(Dan.)-Rec., Eu.-N.Am.-Arct.—Fig. 161,4. *M. (M.) helicinus* (FABRICIUS), Rec., N.Atl.; X2 (147).

M. (Bathyphylina) DALL, 1881 [*Margaritaria euhiara*]. Rec., Carib.

M. (Canthariscodiscus) GALKIN, 1955 [*M. frigidus* DALL, 1919]. Small, higher than wide, periphery rounded; umbilicus obsolete. Rec., Arct.—Fig. 161,3. *M. (C.) frigidus* DALL, Okhotsk Sea; X3 (185).


M. (Papillaria) DALL, 1909 [*Trochus papillus* GOULD, 1849]. Larger than M. (Margarites), with higher spire; with spiral ribs and some axial riblets. Mio.-Rec., N.Atl.-N.Pac.-Arct.

**Antimargarita** POWELL, 1951 [*Valvatella dulcis* SMITH, 1907]. Thin, elaborately sculptured, low-spired; umbilicus wide, deep. Rec., Antarct.

**Basilissa** WATSON, 1879 [*B. superba*; SD COSSMANN, 1888]. Thin, carinate, low to high-spired. U.Cret.-Rec.


**Euchelus** PHILIPPI, 1847 [*Trochus quadricarinatus* HOLTHY, 1802 (≡*Trochus asper* GMELIN, 1791); SD HERRMANNSEN, 1847] (≡*Aradasia* GRAY, 1850; *Tulobris* G. & H. NEVILL, 1869; *Huttonia* KIRK, 1882 (non PICKARD-CAMBRIDGE, 1880)]. Oval, conical apertured rounded, outer lip thickened, lirate within; inner lip usually with tooth below. Plio.-Rec.

E. (Euchelus). Rather small, sturdy; whors convex; juvenile shells with umbilicus, adult without; operculum few-whorled. Plio.-Rec., Indo.Pac.—Fig. 161,14. *E. (E.) quadricarinatus* (HOLTHY), Rec., India; X1 (147).

E. (Antilachelus) WOODRING, 1928 [*Calliotoma asperrimum var. dentiferum* DALL, 1889]. Small, whors flat-sided, nodosely sculptured; umbilicus wide. Mio.-Rec., W.Indies.—Fig. 161,6. *E. (A.) denitiferum* (DALL), Rec., W.Indies; X3 (147).


E. (*Nevillia*) H.ADMAS, 1868 [*N. picta*; SD TOMLIN, 1938]. Small, without umbilicus, otherwise like *E. (Herpetopoma)*. Rec., IndianO.—Fig. 161,8. *E. (N.) picta*; X5 (159).

E. (Vaceuchelus) IREDALE, 1929 [*E. angulosus* PEASE, 1867]. Without basal tooth, otherwise like *E. (Euchelus)*. Rec., S.Pac.

**Granata** COTTON, 1957. [*Stomatella imbricata* LAMARCK, 1816] (≡*Stomatella auctt., non LAMARCK*]. Ear-shaped, with few whors; sculpture of numerous spiral ridges. Rec., Austral.

**Guttula** SCHEPMAN, 1908 [*G. sibogae*]. Like *Margarites* but with angular aperture. Rec., Pac.

**Hybochelus** PILSBRY, 1889 [*Stomatella cancellata KRAUS, 1848] (≡*Stomatella auctt., non LAMARCK*]. Depressed, short-spired, last whorl large; sculpture spiral or cancellate; with or without an umbilicus; no tooth on inner lip. Rec., S.Afr.-Austral.—Fig. 161,11. *H. cancellatus* (KRAUS), S.Afr.; 1Na, b, X1 (147).

**Lischkeia** FISCHER in KIENER, 1879 [*Trochus montiliferus* LAMARCK, 1816]. Relatively large, thick-shelled; spire conical, base flattened; sculpture of nodose spiral ribs. Cret.-Rec.

**L. (Lischkeia)**. Umbilicus partially concealed; columella with weak fold. U.Cret.(Maastricht.)-Rec., Eu.-S.Afr.-Japan.—Fig. 161,17. *L. (L.) montilifera* (LAMARCK), Rec., Japan; X1 (147).

L. (Calliotropis) SEQUENZA, 1903 [*Trochus ottoii PHILIPPI, 1844] (≡*Solariliopollis* SCHEPMAN, 1908 (non DEGREOIRO, 1886)]. Umbilicus wide. Plio.-Rec., W.Afr.-Eu.-S.Pac.—Fig. 161,9. *L. (C.) ottoii* (PHILIPPI), Plio.-Pleist., Italy; X2 (211).
Margarella Thiele in Troeschel, 1893 [*Trochus expansus Sowerby, 1838; SD Thiele, 1924] [pro Margaritella Thiele in Troeschel, 1891 (non Meek & Hayden, 1860)]. Small, thin-shelled, globose, nearly smooth. Mio.-Rec.

M. (Margarella). With rounded periphery, surface smooth. Mio.-Rec., N.Z.-Antarct.—Fig. 161, 10. *M. (M.) expansa (Sowerby), Rec., S.Georgia; 10a,b, X1.5 (147).


M. (Submargarita) Strebel, 1908 [*Margarites impervia]. Minute, with fine spiral riblets; nucleus, nearly whors large. Rec., Antarct.

Olivia Cantraine, 1835 [*O. otaviana] [=Craspedotus Philippi, 1847 (non Schoenherr, 1844); Heliciella Costa, 1861; Danilia Brusina, 1865]. Small, with cancellate sculpture; columella with strong fold, ending in a notch, like Euchelus. U. Cret.(Dan.)-Rec., Eu.-IndoPac.-N.Z.—Fig. 161, 2. *O. otaviana, Pleist., Italy; X1 (166).

Seguenzia Jeffreys, 1876 [*S. formosa; SD Harris, 1897]. With several carinae; aperture with an anal notch above and columellar notch below. Eoc.-Rec., Eu.-W.Atl.-S.Pac.—Fig. 161, 7. *S. formosa, Rec., off New England; X5 (147).


Timisia Jekelius, 1944 [*T. pseudopicta]. Mio., SE.Eu.—Fig. 161, 12. *T. pseudopicta, Rumania; 12a,b, X2 (194).

Tropidomarga Powell, 1951 [*T. biangulata]. Shape of Margarella (Promargarita) but more strongly sculptured. Rec., Antarct.

Fig. 161. Trochacea (Trochidae—Margaritinae) (p. 1249-1251).
Subfamily ANGARIINAE Thiele, 1924
 [=Delphinulinae Stoliczka, 1868]

Small to moderately large, low-spired or conical; surface with rows of nodes or branching spines; umbilicus wide; aperture nacreous within; operculum horny, thin. Trias.-Rec.

Asperilla Koken, 1896 [*Delphinula conosera Quenstedt, 1884; SD Koken, 1897 (=*D. longispina Rolle, 1860)]. Discoidal or with slightly protruding spire, broadly phaneromphalous, with smooth upper surface spinose at periphery; outer whorl face and base with or without spiral ornament; aperture orbicular or quadranular, with continuous peristome. U.Trias.(Nor.) - U.Jur. (Kimm.), Eu.—Fig. 162,1. *A. longispina (Rolle), U.Jur., Ger.; la,b, X1 (11).

Angaria Röding, 1798 [*Trocho delphinus Linné, 1758; SD Fischer, 1875] (=Delphinula Lamarche, 1804 (obj.); Delphinus Montfort, 1810 (obj.); Praxidice Rafinesque, 1815 (nom. nud.); Scalator Gistel, 1848 (obj.); Angarus Gray, 1857 (nom. van.).] Spire depressed or flattened.

A. (Angaria). Moderately large, sculpture of strong nodes and recurved to branching spines. M.Jur.-Rec., Eu.-Afr.-IndoPac.-Australasia. — Fig. 162,6. *A. (A.) delphinus (Linné), Rec., E. Indies; X0.7 (147).

A. (Nudangarita) Beets, 1942 [*A. (N.) ardjunoi]. Small, whorls nearly smooth, not noded but with irregular flange or keel below suture. Neog., Borneo.—Fig. 162,2. *A. (N.) ardjunoi, E.Borneo; 2a-c, apertural, umbilical, and apical views, X5 (163).

Calliomphalus Cossmann, 1888 [*Turbo squamulosus Lamarck, 1804] [=Calliomphalus Cossmann, 1918 (spelling error); Callomphalifer Cossmann, 1918 (nom. van.).] Spire conical, sculpture of spiral rows of hollow spines; base with fine cords; an ear-shaped process on inner lip. U.Cret.(Senon.)-Mio., Eu.-N.Am.—Fig. 162,7. *C. squamulosus (Lamarck), Eoc., Fr.; X1 (147).

Pseudoninella Sacco, 1896 [*Delphinula miosolarioidea]. Spire low, rounded; sculpture of irregular spiral rows of nodes; inner lip not recurved. U.Cret.(Dan.)-Mio., Eu.—Fig. 162,5. *P. miosolarioidea (Sacco), M.Mio., Italy; X1 (147).

Puruninella Beets, 1943 [*Delphinula permodesta Martin, 1914]. Smooth, spire rounded; last whorl with shouldered periphery crenulated by a row of nodes. Eoc., E.Indies.—Fig. 162,4. *P. permodesta (Martin), U.Eoc., Java; 4a-c, apertural, apical, and umbilical views, X3 (163).

Subfamily MONODONTINAE Cossmann, 1916

Littoriniform, turbiniform or conical shells of small or medium size, anomphalous with few exceptions; ornament predominantly spiral or smooth; outer lip strongly prosocline in most genera and columellar lip with one or more teeth in many genera. ?Trias., M.Jur.-Rec.

?Practittorina Kutassy, 1937 [*P. triadica; SD Kutassy, 1940]. Littoriniform, anomphalous, with subglobose last whorl and low acute spire; ornament spiral threads; aperture imperfectly known. U.Trias.(Carn.), Eu.—Fig. 163,9. *P. triadica, Hung.; X1.5 (84).

Ozodochilus Cossmann, 1918 [*Trochos subfilosus Buignier, 1852]. Small, subglobose to littoriniform, with cytoconoid spire, anomphalous; whorls flat or feebly convex, base strongly convex; ornament spiral threads, obscurely nodose in some species; peristome lying almost in a single plane and in some shells uninterrupted; columellar lip concave, joining basal lip in even curve and bearing obtuse denticle, scarcely perceptible in some species. M.Jur.(Baj.)-U.Jur.(Kimm.), Eu.—Fig. 163,17. *O. subfilosus (Buignier), U.Jur. (Raurac.), Fr.; X4 (165).
Archaeogastropoda—Trochina—Trochacea

Cochleochilus Cossmann, 1918 [*Trochuscottalidinus d'Orbigny, 1853]. Biconical, anomphalous, with flat or feebly concave whorls, last one subcarinate at periphery; ornament spiral grooves; base flattened-convex in outline; columellar lip narrowly reflected above, where its outer margin continues that of parietal callus, abruptly expanded and hollowed out below, where it is bordered on left by a carina that continues the apertureal basal margin, describing sharp curve to meet margin of reflected part of lip; tubercle at upper end of hollowed-out part. M.Jur.(Bathon.)-U.Jur.(Portland.), Eu.—Fig. 163,16. *C. cotta"

lindus (d'Orbigny), U.Jur.(Raurac.), Fr.; X8 (Cox, n).

Islipa Cox & Arkell, 1950 [*Monodonta lycetti Lycett, 1863]. Depressed turbiniform, anomphalous whose and base convex; ornament prominent spiral cords; columellar lip straight, unthickened; to its left, and originating at its lower end, spiral bulge occupies middle of base, limited on outer side by deep groove indenting basal lip. M.Jur.(Bathon.), Eu.—Fig. 163,20. 1. lycetit (Lycett), Eng.; X2.7 (Cox, n).

Michaleta Cossmann, 1904 [*M. semigranulata]. Turbiniform, anomphalous but with base excavated mesially; last whorl evenly convex at periphery; ornament granose spiral cords; aperture orbicular, with interrupted peristome; outer lip strongly prosocline; last whorl evenly convex at periphery. Cret.(Barrem.-Maastricht.), Eu.—Fig. 163,15. *M. semigranulata, U.Cret.(L.Coniac.)., Fr.; X2.7 (Cox, n).

Monodonta Lamarck, 1799 [*Trochus labio Linné, 1758] [=Monodontes Montfort, 1810 (obj.); Labio Oxen, 1815 (obj.); Odontes Sowerby, 1825 (obj.); Trochidon Swainson, 1840; Pimpellies Gistel, 1847 (obj.).] Thick-shelled, spirally sculptured. U.Cret.(Dan.).-Rec.

M. (Monodonta). Medium-sized, somewhat globose, columellar teeth wide. Oligo.-Rec., Eu.-IndoPac.-Australasia.—Fig. 163,14. *M. (M.) labio (Linné), Rec., E.Indies; X1 (147).


M. (Osilinus) Philippi, 1847 [*M. punctulata Lamarck, 1822; SD Becouvy, Dautzenberg & Dollfus, 1885] [=Gibbibus Gray, 1847 (non Scopoli, 1777); Trochius Gray, 1847; Neptetha Gray, 1852 (=Neptetusa Montersosato, 1888); Trochochochlea Mörch, 1852; Caragulus Montersosato, 1884]. Smooth or with weak spiral ribs; columellar tooth weak, broad. U.Cret.(Dan.).-Rec., Eu.-Afr.Atl.

Bankivia Krauss, 1848 [*B. varians (=Phasinella fasciata Menke, 1830); SD Fischer, 1875]. Slen- der, high-spired, nearly smooth; columella with a weak fold. Mio.-Rec., Austral.-S.Pac.

B. (Bankivia). Brilliantly nacreous. Pleist.-Rec., Australasia.—Fig. 163,4. *B. fasciata (Menke), Rec., Austral.; X1 (147).


Bathybembix Crosse, 1893 [*Bembix aea Watson, 1879] [pro Bembix watsoni, 1879 (non Fabricius, 1775)]. Thin-shelled, somewhat inflated, spirally nodose to smooth, suture adpressed to channeled; in deep water. Oligo.-Rec.

B. (Bathybembix). Smooth or with subdued sculpture on periphery. Oligo.-Rec., Japan.-N.W.Am.-E.Atl.—Fig. 163,7. *B. (B.) aea (Watson), Rec., Japan; X0.5 (227).

B. (Ginebis) Otuka, 1942 [*Trochus argenteontens Lischke, 1872]. With one row of nodes per whorl. Oligo.-Rec., Japan.

Cantharidus Montfort, 1810 [*Trochus iris Gmelin, 1791 = Limax opalis Martyn, 1784 (ICZN op. 479)] [=Cantharis Férussac, 1821 (obj.); Elenchus Swainson, 1840 (non Curtis, 1831) (obj.); Canthuridium Schauffuss, 1869 (pro Canthusiris)]. Spire tapering, surface nearly smooth; columellar fold and tooth weak or wanting. Mio.-Rec.

C. (Cantharius). Medium-sized; columella with fold but tooth obscure. Mio.-Rec., Austral.—Fig. 163,19. *C. (C.) iris (Gmelin), Rec., N.Z.; X1 (147).


C. (Levella) Marwick, 1943 [*L. tersa]. Minute, smooth, columella without fold. L.Mio., N.Z.—Fig. 163,22. *L. (L.) tersa (Marwick); X5 (204).

C. (Micrelenchus) Finlay, 1927 [*Trochus sanguineus Gray, 1843]. Small, spire relatively low, columellar fold not apparent. Mio.-Rec., N.Z.


Chrysostoma Swainson, 1840 [*Turbo nicocharius "Chemnitz, 1781" (not binominal) = Helix para-
dora Born, 1780]. Low-spired, globose, smooth; inner lip with a callus partially concealing false umbilicus. Cret.-Rec., IndoPac.-N.Z.—Fig. 163,
8. *C. paradoxum* (Born), Rec., E.Indies; X1 (147).

**Diloma** Philippi, 1845 [*Turbo nigerrimus* Gmelin, 1791; SD Herrmannsen, 1847] Spire of moderate height to low; aperture oblique; columella weakly dentate. Mio.-Rec.

**D.** (Diloma). Nearly smooth; columella with a central area of nacre. Rec., W.S.Am.-Pac.—Fig. 163,11.  *D. (D.) nigerrima* (Gmelin), Rec., Chile; X1 (147).

**D. (Anisodiloma)** Finlay, 1927 [*Trocchochlea excava* A. Adams & Angas, 1864]. Small, smooth, with blunt peripheral keel. Rec., N.Z.


**D. (Fractarmilla)** Finlay, 1927 [*Labio corrosa* A. Adams, 1853]. Peristome interrupted by last whorl. Rec., N.Z.

**D. (Melagaphria)** Gray, 1847 [*Turbo aethiops* Gmelin, 1791] (=*Neodiloma* Fischer, 1885 (obj.); *Zediloma* Finlay, 1927). Spirally sculptured, with a strong columellar tooth. Mio.-Rec., Eu.-Afr.-Japan.—Fig. 163,10.  *D. (M.) aethiops* (Gmelin), Rec., N.Z.; X1 (147).

**D. (Miofractarmilla)** Laws, 1948 [*M. bartrum*]. Like *D. (Fractarmilla)* but with one small elevated tooth in front of columella. L.Plio., Rec., N.Z.

**D. (Oxystele)** Philippi, 1847 [*T. merula "Chemnitz" (not binomial) =* Trochus sinensis* Gmelin, 1791; SD Herrmannsen, 1847] (=*Oxytele auctt.* (obj.)). Relatively large; inner lip broad, with a central furrow. Mio.-Rec., Eu.-Afr.-Japan.—Fig. 163,18.  *D. (O.) sinensis* (Gmelin), Rec., S.Afr.; X1 (147).


**Juubinus** Monterosato, 1884 [*T. matoni Payraudeau, 1827 =* T. exasperatus Pennant, 1777; SD Pilss, 1889] (=*Manotrochus* Fischer, 1885; *Miradilinus* Monterosato, 1917; *Clelandella* Winckworth, 1932). Like *Calliostoma* in form but more slender and with radula more like that of *Monodonta*. U.Cret.(Turon.)-Rec.

**J.** (Juubinus). With small columellar tooth; peripheral spiral cord nodose. U.Cret.(Turon.)-Rec., Eu.-Atl.-IndoPac.—Fig. 163,2.  *J. exasperatus* (Pennant), Rec., Mch.; X2 (147).

**J. (Strigosella)** Sacco, 1896 [*T. strigosus* Gmelin, 1791]. No columellar tooth; narrow umbilicus present. Paleoc.-Rec., Eu.

**Lesperonia** Tournoer, 1874 [*L. princeps*]. Like *Juubinus*, but smaller and with a strong carina. Oligo., Eu.—Fig. 163,3.  *L. princeps*, Oligo., Fr.; X2 (147).

**Pachydonella** Marwick, 1948 [*P. etiampicta*]. Small, turbinate, stout, spirally ribbed; columella with large tooth. Plio., N.Z.—Fig. 163,J.  *P. etiampicta*; X2 (204).

**Pictiformes** Kolesnikov, 1939 [*Monodonta mamilla* Andrzewski, 1830]. With deep suture and faint keel. Mio.(Sarmat.), SW.Asia.

**Tegula** Lessen, 1835 [*T. elegans (=Trochus pelisierpentis* Wood, 1828)]. Of moderate size to large, solid, whorls flat-sided; with or without umbilicus. Mio.-Rec.

**T.** (Tegula). With nodose spiral ribs; base flattened. Mio.-Rec., N.Am.-S.Am.-Pac.—Fig. 163,21.  *T. (T.) pelisserpentis* (Wood), Rec., W.S. Am.; 2la, b, X1 (147).


**T. (Omphalus)** Philippi, 1847 [*T. rusticus* Gmelin, 1791; SD Herrmannsen, 1847] (=*Neomphalus* Fischer, 1885 (obj.)). Like *T. (Chlorostoma)* but smooth; most species with umbilicus. Mio.-Rec., Japan-W.N.Am.-?W.Indies.


**T. (Thalotia).** Periphery rounded, aperture small. U.Tert.-Rec., E.Indies.—Fig. 163,5.  *T. conica* (Gray), Rec., Austral.; X1 (147).


**Turricula** A. Adams, 1854 [*T. monilifera* (=*Pychoystis* Gabb, 1866). Spire high, sides flattened; sutures impressed; sculpture nodose. Mio.-Rec.

**T. (Turricula).** Columella with 1 or 2 large teeth on strong fold. Mio.-Rec., N.Am.-Japan-Austr.
Fig. 163. Trochacea (Trochidae—Monodontinae) (p. 1252-1256).
Subfamily GI_BULINAEC Stoliczka, 1868

Turbiniform shells with considerable size range, mostly phaneromphalous; with predominantly spiral ornament or smooth; peristome interrupted in most genera; outer lip strongly prosocline; columellar lip smooth or (less commonly) with a weak tooth. U.Jur.-Rec.

Buckmanina Cossman, 1920 [pro Brasilia Cossman, 1918 (non Buckman, 1908)] [*TUrbo erinus d’Orbigny, 1853]. Turbiniform, thick-shelled, narrowly phaneromphalous, with strongly convex whorls and base, smooth; aperture orbicular, with thin parietal callus linking columellar and outer lips; columellar lip thickened, not reflected. U.Jur.(Raurac.)-L.Cret.(Neocom.), Eu.-S. Afr.—Fig. 164,5. *B. erinus (d’Orbigny), U.Jur. (Raurac.), Fr.; X2 (111).

Gibbula Risso, 1826 [*Trochus magus Linne, 1758; SD Herrmannsen, 1847] [=Magulus, Putulius Montenogato, 1888; Phorcus Montenogato, 1888 (non Cossman, 1888); Conotrachus Filsry, 1889 (non Seguenza, 1864); Phorculellus Sacco, 1896 (pro Phorcus); Phorculellus Cossman, 1918; Forskalipus Cen, 1931 (non Haeckel, 1888)]. Sutures impressed; umbilicus bounded by a ridge. U.Cret.-Rec.

G. (G. amat). Medium-sized, wider than high; last whorl with base set off by an angle. U.Cret.-Rec., Eu.-S.Am.—Fig. 164,8. *G. (G.) magus (Linne), Rec., Medit.; X1 (147).


G. (Amonilea) Cossman, 1920 [*Gibbula parnensis Bayan, 1870] [pro Moniliopsis Cossman, 1918 (non Conrad, 1865); Moniliopsisidae Tomlin, 1930]. Whorls inflated, sculpture fine, spiral. Eoc., Eu.—Fig. 164,4. *G. (A.) parnensis, Eoc., Fr.; X2 (147).

G. (Calliotrochus) Fischer in Kiener, 1879 [*Turbo phasiocollis Deshayes, 1863 (not homonym of T. phaiocollis Adams, 1850)]. Small, turbiniform, with narrow umbilicus. Rec., Indo-Pac.

G. (Cantharidella) Filsry, 1889 [*G. picturata Adams & Angas, 1864; SD Suter, 1913]. Small, polished, umbilicus narrow or wanting. Rec., Australasia.


G. (Enida) A.Adam, 1860 [*E. japonica; SD Kobelt, 1879]. Small, depressed, with wide umbilicus. Pleist.-Rec., Japan-IndoPac.

Fig. 164. Trochacea (Trochidae—Gibbulinae) (p. 1256-1257).

—Fig. 163,13. *T. monilisera, Rec., Austral.; X1 (147).


Turricula Dall, 1881 [*Margarita imperialis]. Resembling Lischkeia, but with reflected lip and vermiculate sculpture. Rec., Carib.—Fig. 163, 12. *T. imperialis (Dall), Cuba; 12a,b, X1 (217).
G. (Eurytrochus) Fischer in Kiener, 1879
[*Clanculus danieli Crosse, 1862; SD Pilsbry, 1889]. Low-spired, spirally ribbed; periphery bluntly angulate. Rec., S.Pac.


G. (Tumulus) Montesratoso, 1888 [*Trochus umbilicus Linne, 1758; SD Buquoy, Dautzenberg & Dollfus, 1898]. Like G. (Steromphala) but with higher spire. Mio.-Rec., Eu.

Calliovarica Vokes, 1939 [*C. ecensis]. Outer lip strongly reflected; with numerous varices crossed by spiral ribs. Eoc., W.N.Am.—Fig. 164.6. *C. ecensis, Eoc., Calif.; ×1 (225).

Cittarium Philippi, 1847 [*Turbo pica Linne, 1758] (=Meleagris Montfort, 1810 (non Linne, 1758) (obj.); Livona Gray, 1847 (obj.).] Large, turbinate, inner lip with a small callus. Pleist.-Rec., Carib.—Fig. 164.7. *C. pica (Linne), Rec., W. Indies; ×0.5 (147).

Fossarina Adams & Angas, 1864 [*F. patula] (=Minos Hutton, 1884). Small to minute, spiral sculpture very fine. Rec.

F. (Fossarina). Aperture entire. Rec., Austral.—Fig. 164.11. *F. (F.) patula, S.Austral.; ×3 (147).


Gaza Watson, 1879 [*G. daedalu]. Turbinate, finely spirally striate; umbilicus partly or entirely concealed by callus. Rec.


Houdasia Cossmann, 1902 [*H. splendid]. Small, depressed, few-whorled. Eoc., Eu.—Fig. 164.2. *H. splendid, Eoc., Fr.; ×5 (147).

Manula Thiele, 1924 [*Gibbula tasmanica Petterd, 1879]. Small, globose, nearly smooth. Rec., Austral.—Fig. 164.1. *N. tasmanica (Petterd); ×3 (147).

Norrisia Bayle, 1880 [*Trochus norrisi Sowerby, 1838] [*pro Trochus Sowerby, 1838 (non Heyden, 1826)]. Large, solid, rounded-conical. Pleist.-Rec., W.N.Am.—Fig. 164.10. *N. norrisi (Sowerby), Rec., Calif.; ×0.7 (147).

Phorculus Cossmann, 1888 [*Turbo fraterculus Deshayes, 1863]. Small, depressed, with strong spiral ribs. Eoc.-Mio., Eu.-N.Am.-S.Am.—Fig. 164.2. *P. fraterculus (Deshayes), Eoc., Fr.; 3a,b, ×1.5 (147).


Subfamily CALLOSTOMATINAE Thiele, 1924

 [=Conulinae Cossmann, 1916 (parsim)]

Conical or turbiniform shells mostly of medium to large-medium size, anomalous or narrowly phaneromphalous, many with flattened base; aperture quadrangular; peristome discontinuous, parietal region without callus in most genera; outer lip strongly proscinic; columellar lip straight, vertical or inclined, meeting parietal lip in abrupt angle, and smooth or with denticle at lower end. L.Cret.-Rec.

Calliostoma Swainson, 1840 [*Trochus conulus Linne, 1758; SD Herrmsannen, 1846] (=Conulus Nardo, 1840 (non Leske, 1778); Ziziphus Gray, 1847 (non Gray, 1843); Montagia Gray, 1852 (non Fleming, 1828); Stylochus Schuenz, 1876 (non Haeckel, 1862); Jactinithus Montesratoso, 1889 (obj.); Calliostoma, Calliostomus, Calliomus, Calliomus auctt. (obj.).] Without umbilicus. L.Cret. (Calliostoma s.l.)—Rec. (61).

C. (Calliostoma). Shell thick, with granular spirals on early whorls, later whorls nearly smooth; columellar tubercle distinct. Mio.-Rec., Medit.—Fig. 165.5. *C. (C.) conulus (Linne), Rec., Medit.; 5a,b, ×1 (147).


C. (Anape) Kolesnikov, 1939 [*Trochus anceps

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**Mollusca—Gastropoda**

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<td>1862</td>
<td><em>L. distans</em>. Spire rather low; spiral ribs smooth. Mio., E.N. Am.—Fig. 165,4. *A. (L.) distans (Conrad), Mio., USA. (Md.); X1 (203).</td>
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<td><em>Trochus elatior d’Orbigny, 1845</em>. Turriculate, many-whorled, with a peripheral keel. Mio. (Sarmat.), SW. Asia.—Fig. 165,1. *S. elatior (d’Orbigny), Mio., USSR; X3.3 (197).</td>
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<td><em>Venustatrochus Powell, 1951</em></td>
<td>1951</td>
<td><em>V. georgianus</em>. Shell like other deep-water members of subfamily but radula with numerous lateral teeth. Rec., S.Atl.</td>
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Subfamily TROCHINAE Rafinesque, 1815  
[nom. correct. SWAINSON, 1840 (pro Trochidia Rafinesque, 1815)]

Conical or, less commonly, turbiniform, nodosely ornamented shells with considerable range of size, narrowly phaneromphalous, or anomphalous with base excavated in middle; aperture quadrangular with strongly discordant lips; outer lip sharp, strongly prosocline; columellar lip straight, emerging from umbilicus or basal excavation, smooth, undulating or toothed, commonly forming marked angle with basal margin. U.Cret.-Rec.

Trochus LINNÉ, 1758 [*T. maculatus; SD IREDALE, 1912] [=Polydonta SCHUMACHER, 1817 (obj.); Lamprostoma SWAINSON, 1840 (obj.)]. Conical, base more or less flattened. Mio.-Rec.

T. (Trochus). Medium-sized to large; whorls flat-sided, periphery angular; ornament granose spiral cords; umbilicus or pseudumbilicus with callus coating; columellar lip separated by gap from parietal lip, multidentate to almost smooth, meeting basal lip in well-marked angle. Mio.-Rec., Afr.-IndoPac.-Austral.—Fig. 165,10. *T. (T.) maculatus, Rec., Philippines; X1.0 (147).

T. (Belangeria) FISCHER, 1879 [*T. scabrosus PHILIPPI, 1850]. With a spirally grooved false umbilicus. Rec., IndoPac.

T. (Coelotrochus) FISCHER, 1879 [*T. tiaratus QUOY & GAIMARD, 1834] [=Neoselandia Coss-MANN, 1918]. Relatively small, with slightly convex whorls and a deep false umbilicus. Plio.-Rec., N.Z.


T. (Infundibulum) MONTFORT, 1810 [*T. concavus GMELIN, 1791] [=Carinidea SWAINSON, 1840 (obj.)]. Surface with axial folds, base spirally ribbed; columella with single fold. Rec., IndoPac.

T. (Præcia) GRAY, 1857 [*T. elegantulus WOOD, 1828]. Relatively small, with wavy axial folds; columella ending in a tooth. Rec., India.

T. (Thorista) IREDALE, 1915 [*Polydonta tuberculata GRAY, 1843 = Trochus viridis GMELIN, 1791] [=Anthora GRAY, 1857 (non DOUBLEDAY, 1844) (obj.)]. Relatively small; upper surface with spirally arranged nodes; base with smooth spiral ribs. Pleist.-Rec., N.Z.


Clanculus MONTFORT, 1810 [*Trochus pharaonis LINNÉ, 1758] [=Otavia RISSO, 1826; Fragella SWAINSON, 1840 (obj.)]. Rather small, rounded-

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conical, surface most commonly beaded; columella with tooth; umbilical pit bordered with crenulate ridge. U.Cret.-Rec., Afr.-IndoPac.-W.C.Am.

C. (Clanculus). With single strong tooth at base of columella. U.Cret.(Maastricht.).-Rec., Eu.-IndoPac.-Australia.——Fig. 165,3. *C. (C.) pharaonius (LINK), Rec., Red Sea; X1 (147).


C. (Clanculus) Monterosato, 1879 [*Trochus cruciatus LINNÉ, 1758; SD SACCO, 1896] [=Clanculella SACCO, 1896]. With more than one denticle at end of columella. Mio.-Rec., Eu.-IndoPac.


C. (Panocochlea) Dall, 1908 [*C. (P.) rubidus]. Depressed, nearly smooth, a single strong tooth at end of columella. Rec., W.C.Am.


Tectus Montfort, 1810 [*Trochus mauritianus Gmelin, 1791] [=Pyramidis Schumacher, 1817 (non RÖDING, 1798); Pyramididea Swainson, 1840]. Conical, higher than wide, base nearly smooth; no umbilicus; columella with a strong spiral fold. U.Cret.-Rec., IndoPac.-E.Indies.

T. (Tectus). Medium-sized to large, with axial folds on spire. U.Cret.-Rec., Eu.-Afr.-IndoPac.-Japan.——Fig. 165,9. *T. (T.) mauritianus (Gmelin), Rec., E.Indies; X0.7 (147).


Subfamily UMBONINAE Pilsbry, 1886

Medium-sized shells, mostly of lenticular form; umbilicus partly or entirely filled by a callus pad. U.Cret.-Rec.

Umbonium Link, 1807 [*Trochus vestiarius LINNÉ, 1758; SD PILSBRY, 1889] [=Globulus Schumacher, 1817 (obj.); Rotella LAMARCK, 1822 (obj.)]. Solid, glossy, smooth or spirally striated. Mio.-Rec., Pac.-E.Indies.

U. (Umbonium). Suture indistinct, callus plug circular, complete. Plio.-Rec., Japan-IndoPac.—Fig. 166,7. *U. (U.) vestiarius (Linné), Rec., E.Indies; X0.7 (147).


U. (Protoretella) Makiyama, 1925 [*P. yuanta nieni s]. Suture abutting, callus broad, filling umbilicus. Mio., Japan.—Fig. 166,10. *U. (P.) yuanta nienis, Mio., Japan; X2 (147).

U. (Suchium) Makiyama, 1925 [*U. suchiense YOKOYAMA, 1923; SD Makiyama, 1927]. Whorls with spiral ribs; callus divided into 2 lobes. L. Plio.-Rec., Japan.—Fig. 166,9. *U. (S.) suchiense, Plio., Japan; X0.7 (147).

U. (Zethalia) Finlay, 1927 [*U. zelandicum A. ADAMS, 1854] [=Ethaliopsis Cossmann, 1918 (non Schepman, 1908)]. Almost without umbilicus; callus bordered by beaded ridge. Plio.-Rec., N.Z.—Fig. 166,4. *U. (Z.) zelandicum, Rec., N.Z.; X1 (147).

Antisolariun FISCHER, 1883 [*Solarium egenum Gould, 1849]. Spire conical, with beaded ribs; columellar lip only slightly reflected over umbilicus. Oligo.-Rec., N.Z.-Pac.—Fig. 166,2. *A. egenum (Gould), Rec., N.Z.; X2a,b, X2 (147).

Callumnobella THIELE, 1924 [*Gibbula gorganarum FISCHER, 1883] [=Umbro trochus THIELE, 1924 (non PERNER, 1908) (obj.)]. Spire conical, peripher y angulate, base convex; umbilical callus narrow. Rec., E.Atl.—Fig. 166,11. *C. gorganarum (FISCHER), Cape Verde; X2 (147).


E. (Sericominolia) KUBODA & HABE, 1954 [*Minolia stearnsi PILSBRY, 1895]. Whorls rounded. Rec., Japan.—Fig. 166,8. *E. (S.) stearnsi (PILSBRY); X4 (199).

Isanda ADAMS & ADAMS, 1854 [*Isanda coronata A.ADAMS, 1854]. Solid, small, polished. U.Cret.-Rec., IndoPac.-Austral.-N.Z.

I. (Isanda). Globose, umbilicus bordered by a beaded rib. Rec., IndoPac.—Fig. 166,3. *I. (I.) coronata, Austral.; X1 (147).

I. (Vanitrochus) IREDALE, 1929 [*Solariella tragema MELVILL & STANDEN, 1869] [=Conotrochus PILSBRY, 1889 (non SCHÜTTER, 1863)]. Small, spire relatively high, with spiral ribs. Oligo.-Rec., E.Indies-Austral.—Fig. 166.1. *I. (V.) tragema (MELVILL & STANDEN), Rec., Loyalty Is.; ×5 (147).

I. (Waisioli) BEETS, 1942 [*I. (W.) jucanda]. With 2 peripheral angulations; deeply umbilicate. U.Oligo., E.Indies.—Fig. 166.5. *I. (W.) jucanda; ×10 (163).

Monilia SWAINSON, 1840 [*Trochus califerus LAMARCK, 1822] [=Talopia Gray, 1842 (nom. nud.)]. Elevated, spirally ribbed. Plio.-Rec., E.Indies-Pac.-India.

M. (Monilia). Medium-sized, inner lip thickened and recurved but not concealing umbilicus. Plio.-Rec., W.Pac.-S.Pac.—Fig. 166.12. *M. (M.) califera (LAMARCK), Rec., E.Indies; 12a,b, ×1 (147).

M. (Priotrochus) FISCHER in KIENER, 1879 [*Trochus obscurus Wood, 1828; SD PILSBRY, 1889] [=Aphanotrochus MARTENS, 1880 (obj.)]. Umbilicus closed; inner lip with denticles. Pleist.-Rec., E.Afr.-India.

M. (Rossiteria) BRAZIER, 1895 [*Trochus nucleus PHILIPPI, 1849] [pro Solanderia Fischer in KIENER, 1879 (non DUCHASSAING & MICHELIN, 1846)]. Small, umbilicus wide, not set off by angle, spirally ribbed within; inner lip widened. Plio.-Rec., E.Indies.

M. (Talopena) IREDALE, 1918 [*M. incerta]. Small, spirally ribbed above, smoother below; umbilicus wide, bounded by smooth rib. Rec., S.Pac.

Subfamily SOLARIELLINAE Powell, 1951
Conical with open umbilicus; aperture more or less circular; radula with an exceptionally small number of marginal teeth (121). U.Cret.-Rec.


S. (Solariella). Umbilicus bounded by a beaded spiral rib. U.Cret.-Rec., cosmo.—Fig. 167.8. *S. (S.) maculata, Plio., Eng.; 8a,b, ×2 (231).

S. (Bowdenagaza) WOODRING, 1928 [*Micrgazza cossmanni]. Small; aperture relatively large, ovate. Mio., W.Indies.


S. (Machaeoropax) FRIELE, 1877 [*Margaria affinis FRIELE, 1877, ex JEFFREYS MS]. Relatively high-spired, with well-developed spiral ribs and collabral striae. Mio.-Rec., N.Am.-Atl.-Arct.-N.Pac.—Fig. 167.5. *S. (M.) affinis (FRIELE), Rec., N.Atl.; ×5 (213).
S. (Microgaza) DALL, 1881 [*M. rotella*]. Spire low, aperture subquadrate. Rec., Carib.

S. (Micropilicus) DALL, 1927 [*S. (M.) constricta*]. Initial whorls colored, not glassy. Rec., SE.USA.

S. (Salaricida) DALL, 1919 [*S. (S.) hondoensis*]. Resembling *Cidarina* but with wider umbilicus. Rec., Japan.—Fig. 167.6. *S. (S.) hondoensis; X1 (191).

S. (Specimen) IREDALE, 1924 [*Trochus philippensis Watson, 1880*]. Spire moderately high, turriculate. Pleist.-Rec., Austral.

S. (Suavatrochus) DALL, 1924 [*S. lubrica DALL, 1881*]. Almost or entirely smooth; in deep water. Rec., W.Indies.

S. (Zetela) FINLAY, 1927 [*Minolia textile MURDOCH & SUTER, 1906*]. Small, sculpture sharply cancellate, spiral ribs beaded on last whorl. ?Minoa.-Rec., S.Pac.—Fig. 167.1. *S. (Z.) textile (MURDOCH & SUTER), Rec., N.Z.; X5.

*Cidarina* DALL, 1909 [*Margarita cidaris CARPENTER, 1864*]. Large, resembling *Bathybembix*, with channeled suture and nodose sculpture; umbilicus nearly closed by reflected inner lip. Pleist.-Rec., W.N.Am.—Fig. 167.4. *C. cidaris (CARPENTER), Rec., Calif.; X1 (230).

*Zetela* DALL, 1909 [*Margarites lirulata CARPENTER, 1864*]. Small, with strong spiral and delicately axial sculpture; peristome interrupted by last whorl; umbilicus narrower than in *Solarilla*. Pleist.-Rec., W.N.Am.—Fig. 167.7. *L. lirulata (CARPENTER), Rec., Washington; X3 (172).

Minolia A. ADAMS, 1860 [*M. punctata*] [=Minolia DUNKER, 1882 (obj.); Minolops IREDALE, 1929]. Resembling *Solarilla* but in general larger; periostracum marked with spots and stripes of color. U.Cret.-Rec., W.Pac.-N.Z.—Fig. 167.3. *M. punctata, Rec., Korea; X1 (147).

?Minolia FINLAY, 1927 [*Minolia plicatula MURDOCH & SUTER, 1906*]. Small, initial whorls relatively large; umbilicus wide. Mio.-Rec., N.Z.—Fig. 167.2. *Z. plicatula (MURDOCH & SUTER), Rec., N.Z.; X5 (147).

**Subfamily HALISTYLINAE Keen, 1958**

Small, cylindrical shells, smooth or spirally striate. Radula suggesting some affinity with Umboninae. Pleist.-Rec.

Halistythus DALL, 1890 [*Cantaridus (H.) columna*]. Pleist.-Rec., N.Am.-S.Am.—Fig. 162.3. *H. columna (DALL), Rec., Brazil; X5 (147).

**TROCHIDAE Subfamily UNCERTAIN**

Kittlitrochus COSSMANN, 1909 [*pro Paratrochus KITTL, 1899 (non PILSBRY, 1893)] [*Tectus? margino-nodosus J. BOHM, 1895*] [=Paratrochidae TOMLIN, 1929 (obj.)]. Small, high cyrtoconoid, with high flat-sided whorls and deep sutures; faint collabral ribs on early whorls; characters of aperture unknown. M.Trias.(Ladin.), S.Tyrol.

Trochodon SULEY, 1861 [*Trochus (Trochodon) cancellatus*]. Founded on broken internal molds, showing traces of spiral ribbing, of conical gastropods with internally denticulate outer lip. U.Cret.(Cenom.). Eng.

**Family ATAPHRIDAE** COSSMANN, 1918

Small or small-medium, turbiniform or trochiform, with flat to moderately convex, smooth whors forming usually cyrtoconoid spire with even outline; shell wall thick; base convex; amnomphalous, or possibly cryptomphalous in some forms; aperture orbicular or almost so; columellar lip concave in most forms, meeting parietal lip in uninterrupted curve; callus commonly forming tubercle on columellar lip or semicircular pad partly covering base; operculum and shell structure unknown. Trias.-U.Cret.

Ataphrus GABB, 1869 [*A. crassus*]. Convexity of spire whors feeble; columellar lip with broad outer face; base without median callus pad. LJur.-U.Cret.(Maastricht), cosmop.
A. (Ataphrus). Outer face of columellar lip smooth or with basal denticle, and not limited by a strong carina. M. Jur. (Baj.) - U. Cret. (Maastricht.), cosmop.—Fig. 168,7. *A. (A.) acmon (d'Orbigny), M.Jur.(Baj.), Eng.; X 1.75 (59).


A. (Plocostylus) Gemmellaro, 1878 [*P. typus*]. Columellar lip with conspicuous tubercle facing towards aperture. L.Jur. (L.Lias.), Sicily.—Fig. 168,4. *A. (P.) typus; X 2.25 (187).

Cirsostylus Cossmann, 1918 [*Trochus glandulus Laube, 1869*]. Columellar lip vertical, with distinct outer margin, and with strong fold at its lower end. Trias.-L.Jur. (L.Lias.), Eu.—Fig. 168,6. *C. glandulus (Laube), M.Trias.(Ladin.), S. Tyrol; X 1.5 (64).

Trochopsidea Wenz, 1938 [pro Trochopsidea Gemmellaro, 1879 (non Ehrenberg, 1832)] [*Trochopsidea moroi; SD Cossmann, 1918*]. Whorls more convex than in Ataphrus; outer face of columellar lip relatively narrow, with narrow furrow parallel to its margin but without tubercle; type species described as having 4 spiral grooves, not reaching margin, in outer wall of aperture. L.Jur.-M.Jur. (Baj.), Eu.—Fig. 168,1. *T. paludinoides (Hudleston), M.Jur.(Baj.), Eng.; X 2.4 (59).

Lewisilla Stoliczka, 1868 [*Pitonellus conicus d'Orbigny, 1853*.] [=Aulacochrota Cossmann, 1916]. Moderately elevated, whorls more convex than in Ataphrus; inner lip without denticle, but extended above as semicircular callous pad covering middle of base and circumscribed by groove. L.Jur., Eu.—Fig. 168,3. *L. conica (d'Orbigny), U.Lias., Fr.; X 4.5 (111).

?Parataphrus Chavan, 1954 [*Trochus viadrinus M. Schmidt, 1905*]. Ataphrus-like, but with spirally striated whorls and very narrow umbilicus; outer lip with outer face widening toward junction with basal lip and with furrow parallel with its margin. U.Jur., Eu.—Fig. 168,2. *P. viadrinus (Schmidt), Ger.; X 4 (167).

Family STOMATELLIDAE Gray, 1840
[=Stomatellidae Stoliczka, 1868]

Few-whorled, mostly low-spired shells, not umbilicate; operculum wanting in most groups; aperture large, interior of last whorl entirely visible through it from below. Trias.-Rec.

Mesogena (Kutassy, 1940, nom. nud.), Cox, n.gen.1

1 Proposed by Kutassy with citation of type species but without diagnosis and therefore a nomen nudum, needing validation.

[=Inoceramus arctus Hoernes, 1855]. Rather small, auriform, with very rapidly expanding whorls and evenly convex surface, without carinae; ornament fine spiral and collabral threads, with collabral undulations in type species. U.Trias. (Nor.), Eu.—Fig. 169,7. *M. arctica (Hörnes), Aus.; X 3 (79).

Præstomatia (Kutassy, 1940, nom. nud.), Cox, n. gen.1 [*Stomatia acutangula Koken, 1897*]. Small, with rapidly expanding whorls having flattened upper surface separated by carina from almost vertical, moderately high outer face which may carry 2 spiral angulations; ornament collabral ridges. U.Trias. (Nor.)-U.Jur., Eu.—Fig. 169,1. *P. acutangula (Koken), U.Trias.(Nor.), Aus.; 1a,b, X 10 (79).

Stomatella Lamarck, 1816 [*S. auricula; SD Anton, 1839*] [=Pleuromya Raffinesque, 1815 (nom. nud.); Plocamotis Fischer, 1885]. Ear-shaped, without operculum. Rec., E.Indies-IndoPac.

S. (Stomatella). Surface smooth. Plio.-Rec., IndoPac.—Fig. 169,3. *S. (S.) auricula, E.Indies. 3a,b, X 2 (213).

S. (Gena) Gray, 1850 [*Stomatella nigra Quoy & Gaimard, 1834; SD Thiele, 1924*]. Last whorl finely spirally striate. Rec., IndoPac.

Broderipia Gray, 1847 [*Scutella rosea Broderip, 1834*]. Oval, limpet-shaped. Rec. Pac.—Fig. 169,6. *B. rosea (Broderip), S.Pac.; 6a-c, X 3 (147).
Roya Iredale, 1912 [*R. kermadecensis*. Resembling Broderipia but apex not terminal but at about 0.8 of length; muscle impression horseshoe-shaped, in 2 parts. Oligo-Rec., N.Z.-IndoPac.]

Stomatia Helbling, 1779 [*S. phymotis* (=Stomas Montfort, 1810 (obj.))] Whorls plicate below sutures; with several spiral ribs; aperture ovate-triangular; no operculum. Rec., RedSea-Pac.-E.Indies.

S. (Stomatia). Ear-shaped, oblique, spire small. Rec., IndoPac.—Fig. 169,2. *S. (S.) phymotis*, Red Sea; 2a,b, X0.7 (147).

S. (Microtis) Adams & Adams, 1850 [*M. tuberculata A.Adam, 1850*] [Microtina A.Adam in Sowerby, 1854 (obj.)]. Low, rather flat, with 2 tuberculate ridges; columellar margin visible within to apex of spire. Rec., Pac.


Synaptocochlea Pilsbry, 1890 [*Stomatella montrouzieri (?==S. stellata Souverbie, 1863)]. Spire very short, submarginal; surface spirally striate or decussate; aperture longer than wide; shell somewhat porcelaneous; operculum present. Rec., S. Pac.-Carib.—Fig. 169,4. *S. stellata* (Souverbie), N.Caledonia; 4a,b, X2 (147).

**Family TURBINIDAE Rafinesque, 1815**

([nom. corr. et transl. Gray, 1824 (ex Turbinacea Rafinesque, 1815)])

Strong, solid shells, small to large, few-whorled, globose; rarely smooth but mostly with well-developed sculpture; aperture nacreous within; peristome entire in most genera, rounded, lying in one plane; columella smooth, arched; operculum calcareous, spiral, with central or eccentric nucleus (42). Mainly in warm seas. M. Trias.-Rec.

**Subfamily ASTRAEINAE Davies, 1933**

([=Astralienae Adams & Adams, 1851])

Conical with more or less carinate periphery; base flattened; operculum most commonly oval. M. Trias.-Rec.

Rothpletzella J.Bohm, 1895 [*R. richthofernii (?==Coelocentrus infracarinatus Kittl., 1894)]. Depressed biconical, anomphalous, with carinate periphery; ornament opisthocline ridges crossing orthocline growth lines and ending in hollow thorns at periphery, spiral cords on base. M. Trias., ?L.Cret., Eu. [Most post-Triassic species included by Cossmann in this genus seem unrelated to the type species.]—Fig. 170,1. *R. richthofernii*, M. Trias.(Ladin.), S.Tyrol; X1 (147).
**Coelobolma** COSMANN, 1918 [*C. corbarica*]. Large, depressed conical, anomphalous but with median funnel-like excavation of base; ornament granose spiral cords; aperture very oblique; callosity of inner lip extending rather broadly over base. U.Cret. (Cenom.-Senon.), Eu.-Asia.

**Astraea** RÖDING, 1798 [*Trochus imperialis* GME LIN, 1791; SD SUTER, 1913 = *T. heliotropium* MARTY, 1784 (ICZN op. 479) [=Imperator MONTFORT, 1810 (obj.); Canthorbis SWAINSON, 1840 (obj.); Macropelmus GISTEL, 1848 (obj.)]. Periphery variously ornamented with spines. Eoc.-Rec., cosmop. A. (Astraea). Widely umbilicate. Mio.-Rec., Australasia.—Fig. 170,7. *A. heliotropium* (MARTY), Rec., N.Z.; ×0.7 (147).

**A. (Astralium)** LINK, 1807 [*Turbo calcar* LINNÉ, 1758; SD FISCHER, 1873] [=Calcar MONTFORT, 1810 (obj.); Cyclocantha SWAINSON, 1840; Stella HERRMANNSEN, 1849]. Moderately large, resembling *A. (Astraea)*, but not umbilicate. Eoc. Rec., Eu.-E.Ind.-W.Ind.-?S.Am.—Fig. 170, 2. *A. (A.) calcar* (LINNÉ), Rec., IndianO.; ×1 (213).


**A. (Bolma)** RISSO, 1826 [*Turbo rugosus* LINNÉ, 1767] [=Oobolma SACCO, 1896]. More turbinate than *A. (Astraea)*, not umbilicate, with noded sutures; operculum with spiral ribs. Mio.-Rec., Eu.-W.Afr.-IndoPac.—Fig. 170,3. *A. (B.) rugosa* (LINNÉ), Rec., Medit.; 3a,b, ×0.7 (147).

**A. (Cookia)** LESSON, 1832 [*Trochus sulcatus* GME LIN, 1791 (ICZN op. 479)] [=Tubicanthus SWAINSON, 1840 (obj.)]. Whorls somewhat inflated, with axial folds above periphery; operculum with 2 ribs. Rec., Australasia.

**A. (Distellifer)** IREDALE, 1937 [*D. wallisi*]. High-conical, with double row of spinose tubercles at periphery; no umbilicus. Rec., Austral.


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**Fig. 170. Trochacea (Turbinidae—Astraeinae) (p. 1264-1266).**
A. (Lithopoma) Gray, 1850 [*Trochus tuber Linne, 1767] [=Pachypoma Gray, 1850]. Periphery more rounded than in A. (Astraeida), sculpture subduced; no umbilicus; operculum with submarginal nucleus, with or without spiral rib, surface coarsely granulose. Mio.-Rec., Carib.


A. (Opella) Finlay, 1927 [*A. subfimbriata Suter, 1917]. Like A. (Belastraia) but with higher spire. Oligo.-Mio., N.Z.

A. (Ormastralium) Sacco, 1896 [*Trochus fimbriatus Borson, 1821] [=Tylastralium Sacco, 1896]. With 2 keels armed with blunt spines; operculum convex, smooth. Mio.-Plio., Eu.—Fig. 170,5. *A. (O.) fimbriata (Borson), Pio., Italy; ×1 (147).


A. (Pomaulax), Gray, 1850 [*Trochus japonicus Dunker, 1845; SD Fischer, 1873] [=Pachypoma aucht.; non Pomaulax aucht.]. Moderately large, solid, with coarsely granular axial sculpture; operculum ovate, convex, with terminal nucleus. Mio.-Rec., W.N.Am.-Japan.—Fig. 170,6. *A. (P.) japonicus (Dunker), Rec., Japan; ×0.7 (179).


A. (Uvanilla) Gray, 1850 [*Trochus unguis Wood, 1828; SD Fischer, 1873] [=Pomaulax aucht., non Gray]. Moderate-sized to large, sculptured with granular axial folds; operculum ovate, nucleus nearly terminal, outer face with 2 to 3 strong curved ribs. Mio.-Rec., Eu.-E.Indies W.N.Am.-C.Am.


G. (Guildfordia). Peripheral spines long, recurved, widely spaced; operculum smooth. Plio.-Rec., E.Indies-Japan.—Fig. 170,4. *G. triumphans (Philipp), Rec., Japan; ×0.7 (147).

G. (Pseudastralium) Scheiman, 1908 [*Astraeum (P.) abyssorum]. Like G. (Guildfordia) but peripheral spines short and more numerous; operculum granular. Rec., IndoPac.

Subfamily LIOTIINAE Adams & Adams, 1854

Relatively small, with both axial and spiral sculpture; spire low to flattened; operculum chitinous within but with outer surface calcareous or at least with calcareous granules; aperture nacreous. Trias.-Rec.

Eucycloscala Cossmann, 1895 [*Trochus binodosus Müntster, 1841; SD Cox, herein] [=Trochoscala Koken, 1897; Urecaalabrum Waide, 1917]. Small, ovate-conical, anomphalous or phaneromalpous, with moderately high spire of convex whorls bearing collabral ribs crossed by few spiral threads; aperture suborbiculate, peristome continuous; outer lip varicose. M.Trias.(Ladin.)-U.Cret.(Dan.), Eu.-N.Am.—Fig. 171,10. *E. binodosa (Münster), M.Trias.(Ladin.), S.Tyrol; ×2.5 (89).

Microcheilus Kittl, 1894 [*Cocheletia brauni Klipstein, 1845] [=Microchelis Cossmann, 1895 (obj.); Pseudocochlearia Cossmann, 1895 (pro Microcheilus Kittl, non Microchilus Blanchard, 1851); Pseudocochlearia Wenz, 1944]. Small, turriculate, with high cyrtoconoid spire of subangular, peripherally costate whorls; coiling of last whorl irregular; aperture orbicular, with much-thickened, continuous peristome. M.Trias. (Ladin.), Eu.—Fig. 171,1. *M. brauni (Klip­stein), S.Tyrol; ×a,b, ×3.75 (64).

Scaveola Gemmellaro, 1879 [*S. intermedia; SD Cossmann, 1918]. Sinistral, turbiniform, phaneromalpous; whorls strongly convex, last one somewhat expanded; ornament well separated collabral ribs and spiral threads; aperture orbicular, with continuous thickened peristome. L.Jur., Sicily.—Fig. 171,8. *S. intermedia; ×1 (147).

Pseudoliotina Cossmann, 1925 [*Li­tia sensu­yi Vidal, 1921]. Discoidal, upper face flat; outer face limited by 2 nodose carinae, 3rd carina forming umbilical margin; aperture orbicular, not oblique, with much thickened peristome. U.Cret. (Maastricht.), Eu.—Fig. 171,6. *P. sensu­yi; 6a,b, ×2 (18).

Li­tia Gray, 1847 [*Delphinula cancellata Gray, 1828]. Axial and spiral ribs well developed, forming latticed surface; umbilicus funnel-shaped, bounded by beaded cord; operculum concave, of many narrow whorls. Mio.-Rec., E.Indies-W.Indies N.Am.-S.Am.—Fig. 171,3. *L. cancellata (Gray), Rec., Chile; ×3 (213).

Arene Adams & Adams, 1854 [*Turbo cruentatus Mühfeld, 1824; SD Woodring, 1928]. With several spiral cords or carinae, smooth or with vaulted scales; remainder of surface finely beaded. Mio.-Rec., N.Am.

A. (Arene). With spiral funicular cord in umbilicus and low varix at outer lip; spire moderately elevated. Mio.-Rec., W.Indies-W.N.Am.—Fig. 171,5. *A. cruentata (Mühfeld), Rec., W. Indies; ×2 (147).


Liotina Fischer, 1885 [*Delphinula gervillei* DeFrance, 1818; SD Cossmann, 1888]. Relatively large, with well-developed lip varix; umbilicus bordered by rib, pitted outside, spiral ridge within; operculum with calcareous layer, tesselated, edges bristly. Eoc.-Rec., Eu.-Afr.-IndoPac.-Austral.


L. (Dentarene) Iredale, 1929 [*D. sarcina; pro Delphinula crenata* Kiener, 1839 (non Sowerby, 1833)]. Axial sculpture partly obsolete or interrupted; umbilical ridge running into a twisted appendage of inner lip. Rec., E. Indies-Austral.


Macarene Hertlein & Strong, 1951 [*Liotia californica* Dall, 1908]. Large for family, depressed-turbinate, periphery rounded-stellate. Rec., W. N. Am.—Fig. 171,2. *M. californica* (Dall), Rec., W. Mex.; ×1 (223).

*Nemrac Clark & Durham, 1946 [*N. carmenensis*]. Smooth except for beaded sutural band and axial grooves on base; with wide umbilical ridge crossed by grooves. Eoc., S. Am.—Fig. 171,9. *N. carmenensis*, Eoc., Colombia; ×5 (169).

Pareuchelus Boettger, 1907 [*Euchelus (P.) excellens*]. With several spiral ribs latticed by axial sculpture; basal margin of aperture forming angle above last spiral keel. Eoc.-Plio., Eu.-E. Indies.—Fig. 171,4. *P. excellens* (Boettger), M. Mio., Hung.; ×10 (147).

Subfamily HELICOCRYPTINAE Cox, n. subfam.

Small, smooth, lenticular, involute shells with narrow apical and very narrow basal umbilici; corner of aperture filled with callos, rendering peristome continuous and almost orbicular. Operculum unknown. M. Jur. (Bathon.)-L. Cret. (Alb.).

Eccliseogyra Dall, 1892 [*Delphinula nitida* Verrill, 1885]. Small, iridescent, whorls disjunct, with both axial and spiral riblets. Rec., E. N. Am.—Fig. 171,7. *E. nitida* (Verrill), Rec., off Md.; ×5 (172).
Subfamily PETROPOMINAE Cox, n. subfam.

Low turbiniform, anomphalous; peristome discontinuous, parietal lip passing under strongly prosocline outer lip; operculum with low, conical, visibly spiral outer face and narrowly umbilicate inner face. L.Cret. (Alb.).

The calcareous operculum shows that this subfamily should be included in the Turbinidae, although the interrupted peristome is more suggestive of the Trochidae. The operculum itself is of a unique type.

Petropoma GABB, 1877 [*P. peruanum*]. With low coeloconoid spire of flattened whorls bearing gran-ose spiral cords, present also on base; callosity of inner lip extending for moderate distance over base and with distinct margin. Eu., S.Am. — Fig. 172,2. *P. peruanum*, Peru; 2a-d, aperture and 3 views of operculum, all ×4 (188).

Subfamily TURBININAE Rafinesque, 1815
[nom. correct. Adams & Adams, 1851 (pro Turbininae Rafinesque, 1815)]

Generally large shells, whorls rounded, base convex; aperture round; operculum thick and heavy, nearly circular, convex outward. U.Cret.-Rec.

Turbo LINNÉ, 1758 [*T. petholatus*; SD Montfort, 1810] [=Laeviturbo COSSMANN, 1918 (obj.); Bothropoma THEILE, 1924; Amphiboliturbo MAGNE, 1940; Neocollonia KURDA & HABE, 1954]. Smooth to strongly sculptured; inner lip mostly widened or callused. U.Cret.-Rec., Eu.-E. Asia-IndoPac.-N.Am.-C.Am.-Austral.-Afr.

T. (Turbo). Smooth, rounded, last whorl large; inner face of operculum flat. Oligo.-Rec., Eu.-IndoPac.—Fig. 172,3. *T. petholatus*, Rec., Philippines; ×0.7 (147).

T. (Barbotella) COSSMANN, 1918 [*T. hoernesi BARBOT, 1869]. With irregular radial ribs. Mio., Eu.—Fig. 172,5. *T. (B.) hoernesii*, Sarmatian, Caucasus; X1 (147).

T. (Batillus) SCHUMACHER, 1817 [*T. cornutus Gmelin, 1791] [=Angarina Bayle, 1878 (obj.) (pro Delphinulopsis WRIGHT, 1878, non LAUBE, 1870)]. Last whorl most commonly with 2 series of hollow spines; spiral marginal rib on operculum. Rec. Japan.

T. (Callopoma) GRAY, 1850 [*T. fluctuosus Wood, 1828]. Moderately large, with strong often noded spiral ribs; operculum with heavy spiral rib at center bordered by 2 or more weaker ribs. Mio.-Rec., E.Indies-N.Am.-C.Am.

T. (Carswellena) IREDALE, 1931 [*T. exquisitus ANGAS, 1877]. Small, with a few noded spiral ribs, operculum spirally bordered. Rec., Austral.


T. (Dinassovica) IREDALE, 1937 [*D. verconis*]. Shell smooth, very large, globose; operculum oval, inner side elevated. Rec., S.Austral.


Fig. 172. Trochacea (Turbinidae—Helicocrypti-
nae, Petropominae, Turbininae) (p. 1167-1269).
Subfamily COLLONIINAE Cossmann, 1916

Small, not nacreous; turbinate to lenticular; operculum normally paucispiral. *U. Cret.-Plio.*

Collonia Gray, 1850 [*Delphinula marginata Lamarck, 1804; SD Cossmann, 1888.*] Sturdy, nearly smooth, inflated, umbilicate; outer lip thickened, peristome mostly entire; operculum with a central pit. *U.Cret.-Plio.*, Eu.-N.Am.

C. (Collonia). Umbilicus bounded by granular spiral cord. *Paleoc.-Plio.*, Eu.-N.Am.-Austral.—Fig. 173,5. *C. (C.) marginata* (Lamarck), Eoc., Fr.; 5a,b, x2 (147).


C. (Parvirotia) Cossmann, 1902 [*Turbo rotatorius Deshayes, 1863.*] Spire flattened; umbilicus set off by a ridge; sculpture axial. *Paleoc.-Plio.*, Eu.-N.Am.—Fig. 173,7. *C. (P.) rotatoria* (Deshayes), U.Eoc., Fr.; 7a,b, x5 (147).

Coanollonia Woodring, 1928 [*C. ambla*]. Depressed, sculpture both axial and radial; peristome incomplete. *Mio.*, W.Indies.—Fig. 173,8. *C. ambla*, Mio., Jamaica; x5 (147).

Cyniscella Cossmann, 1888 [*Clystostoma cornus-pastorius Lamarck, 1804.*] Minute; with spiral grooves; umbilicus bounded by nodose ridge. *Paleo.-Oligo.*, Eu.—Fig. 173,3. *C. (P.) cornus-pastorius* (Lamarck), Eoc., Fr.; 3a,b, x10 (147).

Gelasinostoma Gardner, 1947 [*Collonia elegantula Dall, 1892.*] Depressed, few-whorled; umbilical pit minute, bordered by a rib. ?Eoc., Mio.-Plio., E.N.Am.—Fig. 173,1. *G. elegantulum* (Dall), Mio., Fla.; x (186).

Otolonlia Woodring, 1928 [*Liostia siderea Guppy, 1896.*] Sculpture of fine, beaded spiral ribs. *Mio.*, W.Indies.—Fig. 173,6. *O. siderea* (Guppy), Mio., Jamaica; 6a,b, x5 (147).

Otomphalus Cossmann, 1902 [*O. dumasi*]. With 2 spiral carinae above and at periphery; umbilicus bordered by another carina. *Eoc.*, Eu.—Fig. 173,4. *O. dumasi*, Eoc., Fr.; 4a,b, x3 (147).

Pseudonina Sacco, 1896 [*Delphinula bellardi Michelotti, 1847.*] Resembling *Otomphalus* but more conical, with carinae at and below periphery.

H. (Cantrainea) Jeffreys, 1883 [*Turbo peloritanus Cantraine, 1835] [=Cantrainea, Fischer, 1885 (obj.)]. Relatively high-spired; umbilicus covered by columellar callus. Mio.-Rec., Eu.

H. (Collonista) Iredale, 1918 [*Collonia picta Pease, 1868]. Slightly umbilicate, outer lip thin, inner with small callus. Rec., Pac.

H. (Eutinochilus) Cossmann, 1918 [*Collonia miliaris Cossmann, 1892] [pro Homaloehilus Cossmann, 1892 (non Fischer, 1856)]. Minute, without umbilicus; suture channeled. Eoc., Eu.-N.Am.


Charisma Hedley, 1915 [*C. compacta]. Minute, broadly conical, base rounded; umbilicus deep and wide; sculpture finely striate. Rec., Austral.


Cirsochilus Cossmann, 1888 [*Delphinula striata Lamarck, 1804]. Spirally carinate, base with fine spiral cords; umbilicus deep, set off by ridge. M. Jur.-Plio., ?Rec., Eu.-N.Am.-S.Am.—Fig. 174, 5. "C. striatum (Lamarck), Eoc., Fr.; 5a,b, X3 (147).


Leptocollonia Powell, 1951 [*L. thielii] [==Cynisca Adams & Adams, 1854 (non Gray, 1849)]. Like Homalopoma but umbilicate, thin, colorless, operculum concave and spirally channeled. Rec., S.Atl.-S.Afr.—Fig. 174, 8. *L. thielii, Rec., S. Georgia I.; ×5 (121).

Leptothyra Pease, 1869 [*L. costata]. Whorls angulate, axially ribbed, spirally striate; with a narrow umbilicus. Rec., Hawaii.
Moelleria JEFFREYS, 1865 [*Margaria costulata MÖLLER, 1842]. Depressed, widely umbilicate; spiral cords fine, stronger below. Plio.-Rec., Eu.-N.Am. — Fig. 174.4. *M. costulata (MÖLLER), Rec., Norway; 4a,b, X 10 (147).

?Rangimata MARWICK, 1928 [*R. pervia]. Minute, depressed; umbilicus semilunar, notching inner lip. Mio., S.Pac.—Fig. 174.7. *R. pervia, Mio., Chatham I.; X 10 (147).

?Tipua MARWICK, 1943 [*Submargarita tricincta MARSHALL, 1919]. Low-spined, with 3 weak carinae on body whorl. M.Eoc. (Bortonian), N.Z.—Fig. 174.6. *T. tricincta (MARSHALL), Eoc., N.Z.; X 3 (204).

Vexinia COSSMANN, 1918 [*Delphinula crassa BAUDON, 1853]. Globose, with small umbilicus; inner lip expanded anteriorly. Eoc., Eu.—Fig. 174.1. *V. crassa (BAUDON), Eoc., Fr.; X 3 (147).

Subfamily UNCERTAIN

Pleuratella MOORE, 1867 [*P. prima]. Rather small, rotelliform, phaneromphalous, smooth; spire depressed; columellar lip with outer face expanded to left and concave below, where it appears to extend to margin of a false umbilicus. [Aperture unknown intact in type species, but preserved in P. brachyura GEMMELLARO from Sicily. Not referable to Ataphridae.] L.Jur. (L.Lias.), Eng.—Sicily.

Pterocochilos MOORE, 1867 [*P. primus] [=Tinocochilus FISCHER, 1885 (obj.)]; Mooria COSSMANN, 1899 (obj.)). Small, biconical, anomphalous, smooth, with almost flattened spire whorls and carinate periphery; base extended, with obscure angulation around median part; aperture circular, reduced by expanded inner lip, which is also extended below as prominent angular projection. L.Jur. (L.Lias.), Eng.—Fig. 175.1. *P. primus; 1a,b, X 5 (205).

Turboidea SEELEY, 1861 [*T. nodosa]. Based on ill-preserved specimen of medium size, turbiniform in shape and phaneromphalous, with large tubercles on last whorl. U.Cret. (Cenom.), Eng.

Family CYCLOSTREMATIDAE Fischer, 1885

Small to minute, turbinate to lenticular, mostly widely umbilicate, smooth to strongly sculptured, porcelaneous. U.Jur.-Rec.

Subfamily SKENEINAE Thiele, 1929

[=Delphinioidea Thiele, 1924]

Small, sculpture weak or wanting; radula with 4-5 marginal teeth. U.Jur.-Rec.

Teinostomopsis CHAVAN, 1954 [*T. saharae]. Rotelliform, smooth, anomphalous; inner lip strongly concave, with obtuse denticle at lower end and broad outer face limited by a carina. U.Jur. (Saarac.), Eu.—Fig. 176.15. *T. saharae, Fr.; X 4 (167).

Fig. 174. Trochacea (Turbinidae—Homalopomatinae) (p. 1270-1271).

Cenomanella COSSMANN, 1918 [*Rotella archiaciana D'ORBIGNY, 1843]. Low turbiniform, anomphalous, of evenly convex, spirally striated whorls with deeply canalicate suture; base callus-coated in middle. U.Cret. (Cenom.-L.Santon.), Eu.—Fig. 176.11. *C. archiaciana (D'ORBIGNY), U.Cret. (Cenom.), Fr.; X 4 (110).

Skenea FLEMING, 1825 [*Helix serpuloides MONTAGU, 1808; SD GRAY, 1847] [=Delphinioidea BROWN, 1827 (obj.); Delphinoidea BROWN, 1844 (obj.)]. Depressed, whorls rounded, smooth to spirally striate. Pleist.-Rec., Eu.-N.Am.-Japan.—Fig. 176.7. *S. serpuloides (MONTAGU), Rec., Eng.; X 10 (147).

Cirsonella ANGAS, 1877 [*C. australis]. Spire somewhat elevated. Mio.-Rec., S.Pac.—Fig. 176.17. *C. australis, Rec., Austral.; 17a,b, X 10 (147).
**Conjectura Finlay**, 1927 [*Crossea glabella* Murdoch, 1905]. Smooth, depressed-turbinate, with basal keel or fold, like *Crossea*. Rec., N.Z.

*Crossea* A Adams, 1865 [*C. miranda; SD Suter, 1913*] [*Crossea* Fischer, 1885 (obj.)]. Spire elevated; anterior margin of aperture with or without a projection. *Plio*-Rec., S.Pac.-E.Asia.

C. (Crossea). With several strong varices. *Plio*-Rec., S.Pac.-IndoPac.—*Fig. 176, 9. *C. miranda*, Rec., Japan; X5 (147).


**Daronia** A Adams, 1861 [*Cyclostrema spirula A. Adams, 1850*]. Planorboid, spire sunken. Rec., SW. Pac.

D. (Daronia). Peristome continuous. Rec., Indo-Pac.—*Fig. 176, 2. *D. spirula* (Adams), Philippines; 2a,b, X1 (147).


$\text{Dillwynella}$ Dall, 1889 [*D. modesta*]. Turbinate, not umbilicate. Rec., W.Indies.—*Fig. 176, 3. *D. modesta*, St. Lucia; X5 (147).

$\text{Ganesa}$ Jeffreys, 1883 [*G. pruinosa; SD Cossmann, 1918*]. Turbinate; smooth or striate. *Plio*-Rec., E.-N.Am.-SW.Pac.


G. (Granigyra) Dall, 1889 [*Cyclostrema limatum*]. Surface finely granulate. Rec., W.Indies-Eu.


Haplococlias Carpenter, 1864 [*H. cyclophoreus*]. Somewhat conical, spirally striate, outer lip thickened. Rec., W.C.Am.

**Kaawatina** Bartrum & Powell, 1928 [*K. turneri*]. Pyriform, 3-whorled, with axial ribs and an umbilical chink. *Plio*, N.Z.—*Fig. 176, 16. *K. turneri*, 16a,b, X10 (147).

**Leptogrya** Bush, 1897 [*L. verrilli*]. Lenticular, deeply umbilicate, with spiral striae. Rec., E.N.Am.-W.N.Am.—*Fig. 176, 5. *L. verrilli*, Delaware Bay; 5a,b, X10 (147).

Leucorhynchia Crosse, 1886 [*L. caledonica*]. Smooth, glossy, sublenticular, umbilicus deep but partly concealed by a columellar basal fold. *Cret.-Rec., Eu.-IndoPac.—Fig. 176, 8. *L. caledonica*, Rec., New Caledonia; 8a,b, X5 (147).


Lissostetella Powell, 1946 [*Lissosteta tenuilirata* Powell, 1931]. Like *Lissosteta* in shape but more solid; peristome continuous, varicose. Rec., N.Z.

Lodderena Iredale, 1924 [*Lotia minima Tenison-Woods, 1878*]. Nearly discoidal, with heavily variced aperture, peripheral keels and crenulate suture present but no axial sculpture. Rec., Australasia.

**Lodderia** Tate, 1899 [*Lotia lodderae Petterd, 1884*] [*Cyclostrema telle*, 1898 (non Bush, 1897)]. Lenticular, with several spiral keels and fine axial sculpture. Rec., Australasia.—*Fig. 176, 14. *L. lodderae* (Petterd), Austral.; X10 (147).

Lophococchi Pilsbry, 1921 [*Lophococheles minuissimus*]. Minute, with 6 spiral keels and 2 spirals in umbilicus. Rec., Hawaii.

**Munditiella** Kuroda & Habe, 1954 [*Cyclostrema ammonoceras* A. Adams, 1863]. Minute, with regular annular varices on periphery. Rec., Japan.—*Fig. 176, 12. *M. ammonoceras* (Adams); X20 (198).


Pakistania Eames, 1952 [*P. antirotata*. Sinistral, flattened above, convex below, smooth, periphery carinate; aperture kite-shaped. *Eoc., Asia.—Fig. 176, 18. *P. antirotata*, Pakistan; X20 (180).

Philoere Oliver, 1915 [*P. texturata*]. With fine spiral striae and nodes, umbilicus spirally lirate within. Rec., Pac.


**Teinostoma**, classified here by some workers, is to be included in Vitrellinidae, in *Treatise Part 1*.

Tharsiella Bush, 1897 [pro *Tharsiis* Jeffreys, 1883 (non Giebel, 1847)] [*Oxytele roremensis Granata, 1877 (ex Sequenza, MS*)] [*Porcupina cosmann, 1900 (non Haeckel, 1887) (pro Thrasiis); Porcupina cosmann, 1925 (spelling error)].
Archaeogastropoda—Trochina—Trochacea

Turbinate, smooth, umbilicus partly concealed by columnellar lip. Plio.-Rec., Eu.-W.Atl.—Fig. 176, 1. *T. romettensis* (Granata), Rec., E.Atl.; X5 (147).


Tubiola A. Adams, 1863 [*Turbo niveus* Gmelin, 1791; SD Stolzcker, 1868 (as of Chemnitz, 1784, nonbinomial)]. Like *Skenea*, but with a funnel-shaped umbilicus. Plio.-Rec., Atl.-Pac.-Austral.

**T.** (Tubiola). Low-conical, whors with growth striae only. Rec., Atl.-Pac.

**T.** (Partubiola) Iredale, 1936 [*P. blancha*]. Disc-shaped; whors with fine spiral striae, growth striae in interspaces. Plio.-Rec., Austral.

Subfamily CYCLOSTREMATINAE Fischer, 1885

[nom. transl. Cossmann, 1917 (ex Cyclostrematidae Fischer, 1885)]

Radula with single strong marginal tooth in each row and several delicate laterals; shell mostly strongly sculptured. *U.Cret.-Rec.*

Cyclostrema Marryat, 1818 [*C. cancellatum*; SD Gray, 1847] [=Pseudoliotina Cossmann, 1925]. Lenticular, with axial varices. *U.Cret.-Rec., circumtropic.—Fig. 177,9. *C. cancellatum*, Rec., W.Indies; X4 (158).


B. (Brookula). Spire blunt, interspaces between ribs with spiral sculpture. *Mio.-Rec., S.Pac.—Fig. 177,3. *B. (B.) stibarochila*, Rec., Kermadec I.; X10 (147).


Chunula Thiele, 1925 [*C. typica*] [=Chunula Thiele, 1924 (nom. nud.)]. Minute, inflated, few-whorled. *Rec., E.Indies.—Fig. 177,5. *C. typica*, Sumatra; X10 (147).

CircoLus Jeffreys, 1865 [*Delphinula daminyi* Requien, 1842 = Solarium philippii Cantraine, 1842]. Minute; smooth or with spiral riblets. *Mio.-Rec., Medit.-W.Indies-W.C.Am.—Fig. 177,2. *C. philippii* (Cantraine), Rec., Medit.; 2a-c, X5 (147).

Coronadoa Bartsch, 1946 [*C. simonsae*]. Minute, depressed, with scalariform ridges. *Rec., W.N.Am.—Fig. 177,8. *C. simonsae*, Rec., Calif.; X40 (161).

Munditia Finlay, 1927 [*Liotina tryphenensis Powell, 1926]. Depressed, outer lip varicate; spiral beaded cord in umbilicus. *Plio.-Rec., Australasia.—Fig. 177,4. *M. tryphenensis* (Powell), Rec., N.Z.; 4a,b, X5 (147).

Parviturbo Pillsby & McINTYRE, 1945 [*P. rehderi*]. Minute, turbinate, spiral ribs few, heavy. *Rec., SE.
Family PHASIANELLIDAE Swainson, 1840

[nom. transl. COSSMANN, 1918 (ex Phasianellinae Swainson, 1840)] [=Eutropiinae Adams & Adams, 1854] [Preparation of descriptions and selection of illustrations for this family are the work of MYRA KEEN and ROBERT ROBERTSON.—Ed.]

Ovate to rounded, few-whorled, without periostracum; smooth or finely spirally sculptured, rarely spirally ribbed; shell entirely porcelaneous; small species may be umbilicate; peristome not continuous; operculum externally convex. Periostracum; smooth or finely spirally sculptured, rarely spirally ribbed; shell entirely porcelaneous; small species may be umbilicate; peristome not continuous; operculum externally convex.

**Phasianella** Lamarck, 1804 [*Buccinum australe* Gmelin, 1791 (ICZN pend.)] [=Phasianus de Montfort, 1810 (obj.) (non Linné, 1758); Bolina Rafinesque, 1815 (obj.); Eutropia Swainson, 1840 (obj.); Orthopnoea Gistel, 1847 (obj.); Orthomesus PILSBRY, 1888; Mimelenchus Iredale, 1924]. Medium-sized to large, smooth, long-ovate; non-umbilicate. Mio.-Rec., Java-Austral.-IndoPac.—

**Tasmoscrossea** DELL, 1952 [*T. benthicola*]. Like Brookula but with a basal fold. Rec., Australasia.

**Zalipais** Iredale, 1915 [*Cyclostrema lissa Suter, 1908*]. Minute, with fine axial striae. Rec., Australasia.

**Coronada** and **Cyclostrema**

**Family ORBITESTELLIDAE Iredale, 1917**

Medium-sized to large, smooth, long-ovate; non-umbilicate. Mio.-Rec., Java-Austral.-IndoPac.—

**Tricola** RISSO, 1826 [*Turbo pullus LINNÉ, 1758*; SD Gray, 1847] [=Eudora Gray, 1852 (non Pérorn & LESSER, 1810) (obj.); Chromotis Adams & Adams, 1863; Eucorina CARPENTER, 1864 (non Stephens, 1831); Tricoliella Montekosato, 1884 (obj.); Steganomphalus Harris & Burrows, 1891 (obj.); Eulithidium PILSBRY, 1898; Usaticolica HABE, 1956]. Small, globose or ovate, smooth or spirally ribbed; smaller species perforate, columellar margin arched; operculum externally convex. Paleoc.-Rec., world-wide, tropics and warm temperate regions.

**T.** (Tricola). Shell fairly thick; suture slightly impressed. Paleoc.-Rec., Euc.-Carib.-N.Am.—

**T.** (T.) pullus (LINNÉ, Rec., Eng., X 2(147).—Fig. 178,1. *T. (T.) pulle* (LINNÉ), Rec., Eng., X 2(147).—Fig. 178,2. *T. (T.) variagata* (CARPENTER), Rec., W.Mex.; type species of *Eulithidium*, X 8(223).


**T.** (Hiloa) PILSBRY, 1917 [*Phasianella thanumii*]. Shell thin, suture impressed; outer lip commonly reflexed. Rec., Hawaii.


**T.** (Phasianochilus) COSSMANN, 1918 [*"Phasianella turbinoides Lamarck, 1804*]. Long-ovate, spire pointed, aperture ovate; umbilical chink present. Eoc.-Oligo., Eu.—Fig. 178,3. *T. (P.) tur­binoides*, Eoc., Fr.; X 1(171).

**Pseudophasianus** COSSMANN, 1918 [*"Turbo elatus* FUCHS, 1870*]. Cylindrical, last whorl relatively small; with small umbilicus. Eoc., Eu.—Fig. 178,4. *P. elatus* (FUCHS), Eoc., Italy; X 1(147).

**Family VELAINELLIDAE Vasseur, 1880**

Last whorl twisted into a slender spiral, simulating a multispiral shell but without the normal spiral septum. Eoc.

**Velainella** Vasseur, 1880 [*"V. columnaris*] [=Velai­nella COSSMANN, 1918 (spelling error)]. Slender, aciculate, moderately large, smooth. Eoc., Eu.—

**Family ORBITESTELLIDAE Iredale, 1917**

Shell thin, pellucid, minute, discoidal, few-whorled; widely umbilicate, columella...
Fig. 178. Trochacea (Turbinidae—Turbininae, Phasianellidae) (p. 1269, 1274).

vertical; aperture irregular in shape, edges thin. Rec.

Orbitestella Iredale, 1917 [*Cyclostrema bastowi Gatliff, 1906]. Sculpture of one or more keels crossed by axial ribs. Rec., Austral.—Fig. 179,2. *O. bastowi (Gatliff); 2a-c, X25 (147).


Suborder NERITOPSINA Cox & Knight, 1960

[=azygobranches orthoneuroides Bouvier, 1887; mononéphridés Pfeffer, 1889]

Shell commonly coiled and ovoid or globular, more rarely capuliform or patelliform; whorls few; spire, if protruding at all, relatively low; outer shell layers calcitic, unusually stable in fossils, commonly preserving color pattern; inner layers thick, aragonitic, lamellar but not nacreous; operculum (not developed in a few genera) commonly calcareous, in many post-Paleozoic genera with processes projecting from inner face and gripping inner lip; living forms with left kidney only; single, bipectinate ctenidium present on left except in terrestrial forms, attached at its base only; single hypobranchial gland, thought to be homologue of right one of other Archaeogastropoda, also present; heart with 2 auricles, right one in some reduced or with single auricle; pallial genital organs developed and complex, fertilization internal; retractor muscles paired; radula rhipidoglossate, with outermost admedian large, capituliform. M.Dev.-Rec.

Superfamily NERITACEA Rafinesque, 1815

[nom. transl. Thiele, 1929 (ex Neritacea Rafinesque, 1815)]

[Proposed as subfamily name]

Characters as defined for suborder. The superfamily includes marine, fresh-water and terrestrial forms. M.Dev.-Rec.

?Family PLAGIOTHYRIDAE Knight, 1956

Turbiniform, with thick shell, dominantly spiral ornament and one or more columnellar teeth. M.Dev.—L.Carb.(Miss.)

Dirachis Whidborne, 1891 [*D. atavus]. With moderately high spire; two teeth on inner lip; outer lip convex, prosocline; ornament of spiral cords. M.Dev., Eu.—Fig. 180, D. atavus, Eng.; X4.

Plagiothyra Whidborne, 1892 [*Monodonta purpurea d’Archac & deVerneuil, 1842; SD Cossmann, 1916]. With single tooth on inner lip;

Fig. 179. Trochacea (Velainellidae, Orbitellidae) (p. 1274-1275).
labrum convex, prosocline; ornament of fine papillae in spiral rows. M.Dev., Eu.—Fig. 180, 1. *P. purpurea (D'ARCHIAC & DEVERNEUL), Ger.; X2.

Littorinides KNIGHT, 1937 [pro Rhabdopleura de KONINCK, 1881 (non ALLMAN, 1869)] [*Littorina solida deKONINCK, 1843]. Low; elongate plate on inner lip culminating below in low tooth; ornament of numerous spiral threads. L.Carb., Eu.—Fig. 180,3. *L. solida (deKONINCK), Belg.; X2.

Family NERITOPSIDAE Gray, 1847
Shell globular, spire protruding but slightly or not at all, last whorl large; inner lip broad and smooth, formed by continuous inductura, or by inductura on parietal region merging into excavation of columellar lip on its outer face; inner walls of whorls not resorbed; operculum not spiral. M.Dev.-Rec.

Subfamily NATICOPSISINAE S.A.Miller, 1889 [nom. transl. KNIGHT, BATTEN & YOCHelson, herein (ex Naticopsideae S.A.MILLER, 1889)] [=Hologyridae KITTL, 1899]

Without ornament except for submutal collabral threads or cords in some species; outer lip strongly prosocline; parietal lip commonly thickened by inductura, extended in some species in plane of aperture over part of side of last whorl, and simple or rarely bearing single protuberation; columellar lip strongly arcuate, excavated on its outer face; operculum concentric, asymmetrical; color pattern collabral stripes, spiral bands, spots, and especially zigzag lines. M.Dev.-U.Cret.

Naticopsis M'Coy, 1844 [*N. philippisi; SD MEEK & WORTHEN, 1866]. With moderately high-spired to low, very broad shell; divisible into intergrading subgenera. M.Dev.-Trias., cosmop.

N. (Naticopsis) [=Naticodon RYCKHOLT, 1847; Fedaiella KITTL, 1894]. Commonly large; globular, but with slightly protruding spire; aperture expanded in direction oblique to axis; parietal and columellar lips moderately thickened or each with toothlike protuberance. M.Dev.-Trias., cosmop.—Fig. 181,7. *N. (N.) philippisi, L.Carb., Ire.; with operculum, X0.7.—Fig. 181,8. *N. (N.) cuneensis, M.Trias.(Ladin.), S.Tyrol; 8a,b, X1 (65).

N. (Jedria) YOCHelson, 1952 [*Naticopsis meeki KNIGHT, 1933]. More or less ovoid; heavy submutal swelling generally bearing collabral cords; parietal lip in adults markedly thickened (155, p. 65). M.Dev.-Perm., ?Trias., N.Am.-Eu.—Fig. 181,1. *N. (J.) meeki (KNIGHT), M.Penn.(U.Carb.), Mo.; X2.

N. (Marmolatella) KITTL, 1894 [*N. (M.) applanata KITTL, 1894; SD B.B.WOODWARD, 1895]. Spire more or less flattened; aperture expanded in direction perpendicular to axis; parietal and columellar lips thickened, each commonly with toothlike protuberance. L.Carb.(Miss.)-U.Trias., N.Am.-Eu.—Fig. 180A,1. *N. (Marmolatella) applanata, M.Trias.(Ladin.), S.Tyrol; 1a,b, X1 (65).

Dicosmos CANAVARI, 1890 [*D. pulcher] [=Hologyra KOKEN, 1892]. Naticiform; whole of inner lip with thick, bulging inductura; columellar lip less extended than in Naticopsis. M.Trias.(Ladin.)-U.Trias.(Carn.), Eu.-Indonesia.—Fig. 181,4. *D. alpinus (KOKEN) (=type species of Hologyra), U. Trias.(Carn.), S.Tyrol; 4a,b, X1 (10).

Planospirina KITTL, 1889 [*Nerita esinensis STOPPANI, 1858]. Spire low in early stages, but suture descending penultimate whorl before aperture; aperture ovate, broader than high; columellar lip concave, not at all extended as in Naticopsis; parietal lip much thickened, columellar lip rather less so. U.Carb.(M.Penn.)-Trias., Eu.-N.Am.—Fig. 181,10. *P. esinensis, M.Trias.(Ladin.), S. Tyrol; 10a-c, apertural, abapertural, and apical views, X1.

?Vernelia J.BÖHM, 1895 [Natica fastigiata STOPPANI, 1858 (=N. excelsa HAUER, 1851); SD B. B. WOODWARD, 1896]. Medium-sized, littoriniform, with well-elevated spire of convex whorls; aperture
ovate, higher than broad, angular and with slight adapical channel; labrum thick, but bevelled off to margin; parietal lip much thickened above. *U. Carb.* (Penn.)-Trias., Eu.-N.Am.—Figs. 180A,2, 181,3. *V. excelsa* (Hauer), M.Trias.(Ladin.), S. Tyrol; 180A,2a,b, ×1 (195); 181,3a,b, ×1 (specimen in U.S. Natl. Mus.)

**Pachyomphalus** J. BöhM, 1895 [*P. concinnsus*; SD CossMann, 1925]. Small, littoriform, with well-elevated spire of convex whorls; aperture ovate, higher than broad, relatively smaller than in *Vernelia*, angular adapically, labrum thin; inductura narrow on parietal region, more widely spread over base. *M.Trias.* (Ladin.), Eu.—Fig. 181,2. *P. concinnsus*, S.Tyrol; 2a,b, ×2 (6).

**Frombachia** BLASCHKE, 1905 [*F. uhligi*]. Rather small, turbiniform, with fairly broad umbilicus; whors with 2 spiral angulations; inductura of inner lip spread over base but not obscuring umbilicus. *M.Trias.* (Carn.), Eu.—Fig. 181,5. *F. uhligi*, S.Tyrol; 5a,b, ×1.5 (10).

**Haliotimorpha** BLASCHKE, 1905 [*H. dieneri*]. Involute, auriform, of few very rapidly enlarging whors, last one developing peripheral carina, on which are large hollow spines; aperture subrectangular, much broader than high; inner lip flattened, of moderate breadth, with sharp subparallel outer and inner margins, latter concave and without teeth. *M.Trias.* (Ladin.)-U.Trias. (Carn.), Eu.—Fig. 181,9. *H. dieneri*, U.Trias. (Carn.), Eu.—Fig. 181,9. *H. dieneri*, U.Trias. (Carn.), S. Tyrol; 9a,b, ×1 (10).

**Damesia** HOLZAPPEL, 1888 [*Crepidula crenacea* MÜLLER, 1851; SD WENZ, 1938]. Globose, with rapidly enlarging whors and very eccentric, flattened spire almost level with top of aperture; ornament depressed spiral cords; aperture subrectangular, broader than high; inner lip flattened, of moderate breadth, with sharp subparallel outer and inner margins, and largely covering quite broad umbilicus; inner margin of inner lip concave and without teeth. *U.Cret.* (Senon.), Eu.—Fig. 181,6. *D. crenacea*, Ger.; 6a,b, ×2 (56).

**Subfamily NERITOPSINAE Gray, 1847**

[**nom. transl.** KNIGHT, BATTEN & YOCHULSON, herein (ex Neritopsidae Gray, 1847)]

Much like the Naticopsinae except that spire protrudes more than in most genera of that subfamily and shell is ornamented with pustules, which in many species open adaperturally; no umbilicus; operculum, where known, massive, trapeziform, symmetrical. *L.Carb.* (Miss.)-Rec.

**Turbonitella** DEKONINCK, 1881 [*Turbo bicerialis* PHILLIPS, 1836; SD CossMann, 1916]. Turbiniform, with slightly flattened base; collar-like adpressed zone between suture and uppermost pustules; 2 rows of collabrally lengthened pustules, one at upper angulation of whorl face and other at lower angulation; columellar lip strongly excavated. *L.Carb.*, Eu.—Fig. 182,1. *T. bicerialis* (PHILLIPS), Eng.; ×2.

**Trachydomia** MEek & Worthen, 1866 [*Naticopsis nodosa* MEek & Worthen, 1861] [*Trachydomus cossmann, 1918* (obj.); *Trachydoma knight, 1933* (obj.)]. Globular, with adpressed zone; surface covered with pustules that are not segregated sharply into different kinds. *Penn.* (U.Carb.)-M.Perm., N.Am.-Eu.-NE.Asia-SE.Asia.—Fig. 182,5. *T. nodosa* (MEek & Worthen), M. Penn., Ill.; ×1.3.

**Trachydoma** GEMMELARO, 1889 [*T. delphinoides*; SD CossMann, 1916] [*Platycheilus gemmelaro, 1889; Sosiospira greco, 1937*]. Much like *Trachydomia* but without sutral adpressed zone and with pustules segregated into 2 different categories: numerous small pustules arranged in oblique opisthocline or spiral rows and few large ones arranged in spiral rows. *M.Perm.*, N.Am.-Eu.-NE.Asia.—Fig. 182,6. *T. delphinoides*, Sicily; ×1.

**Hungariella** KUTASSY, 1933 [*Neritopsis pappi* KUTASSY, 1927]. Medium-sized to large, with well-protruding, acute spire; aperture ovate, higher than broad; inner lip moderately broad, smooth, with sharp protuberance on parietal region, in some shells with other blunter ones below; ornament spiral bands, some tuberculate. *U.Trias.* (Nor.), Eu.—Fig. 182,4. *H. stredae* KUTASSY, Hung.; 4a,b, ×1 (200).

**Seisia** KUTASSY, 1934 [*S. blashkhei*]. Of medium size, with slightly protruding, very eccentric spire and rapidly increasing whors; last whorl with 3 or 4 nodose carinae, one delimiting its flat or concave upper surface and lowest forming border of broad false umbilicus; aperture suborbicular; inner lip broad, smooth, with margin almost detached from base. *M.Trias.* (Ladin.)-U.M.Trias. (Nor.), Eu.
Fig. 182.2. *S. spinosa* Kutassy, U. Trias. (Carn.), Hung.; 2a,b, ×3 (84).

*Neritopsis* Grateloup, 1832 [*N. moniliformis*] [=Radula Gray, 1842; also following (based on opercula), *Peltarion Deslongchamps & Deslongchamps*, 1858; *Cyclidia, Scaphanidia Rolle, 1862; Rhynchidia Laube, 1868*]. Of medium size, with moderately protruding, obtuse spire; last whorl

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FIG. 181. Neritacea (Neritopsidae—Naticopsinae) (p. 1276-1277).

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globose, evenly convex; ornament spiral cords and in some species collabral ribs; aperture orbicular, inner lip moderately thickened, strongly concave; operculum very solid, trapeziform. *Trias.-Rec., cosmop.*

**N. (Neritopsis).** Inner lip without tubercle. *Trias.-Rec., cosmop.*—Fig. 182,7. *N. (N.) radula* (LINNÉ), Rec., IndoPac.; ×1 (147).—Fig. 182, 9. *N. (N.) sp.*, Mio., C.Eu.; operculum ("Cyclidia valida" Rolle), 9a,b, ×5 (201).—Fig. 182,8. *N. (N.) sp.*, L.Jur.(M.Lias.), Fr.; operculum ("Peltarion bilobatum" Deslongchamps), 8a,b, ×2.3 (182).

**N. (Neritoptyx) OPPENHEIM, 1892** [*Nerita goldfussii* KEFERSTEIN in GOLDFUSS, 1844]. With prominent parietal tubercle. *U.Cret., Eu.*—Fig. 182,3. *N. (Neritoptyx) goldfussii*; Aus.; ×2.5 (208).

**Family DAWSONELLIIDAE Wenz, 1938**

Small, heliciform, with a platelike extension of inner lip. *Penn.*

**Dawsonella Bradley, 1874** [*Anomphalus meeki* BRADLEY, 1872] [=Dawsoniella FISCHER, 1887 (obj.)]. Aperture slightly expanded at final stage; with platelike extension of inner lip seemingly lying over lip of larger aperture. *M.Penn. N.Am.*

[Found with *Maturipupa vermilionensis* (BRADLEY) in fresh-water limestone in a Coal Measures sequence; it may have lived in fresh water or more likely was terrestrial.]—Fig. 189,3. *D. meeki* (BRADLEY), Ill.; ×10.

**Family NERITIDAE Rafinesque, 1815**

[*nom. transl. et correct. Gray, 1834 (ex subfamily Neritacea Rafinesque, 1815; Neritidae Fleming, 1822)] [=Protoneritidae KITTL, 1899]

Shell globose, turbiniform, capuliform or patelliform; mostly thick-walled; no umbilicus; inner walls of whorls resorbed; inner lip more or less thickened by callus or protruding as septum that narrows aperture, commonly with dentate margin (3). *Trias.-Rec.*

**Subfamily NERITINAE Rafinesque, 1815**

[*nom. transl. Swainson, 1840 (ex Neritidae Rafinesque, 1815, nom. correct. Gray, 1834)]

Operculum, where known, with rib on inner side and an apophysis. *M.Trias.-Rec.*

**NERITARIA KOKEN, 1892** [*N. similis* (=*Natica plicatilis* KLIPSTEIN, 1845)] [=Protonerita KITTL, 1894]. Naticiform, smooth, with slightly protruding spire; aperture with slight adapical channel; inner lip not extended as septum or very
little so, not dentate at margin, commonly with protuberance where its columellar and parietal parts meet; callus narrowly spread over base. M. Trias.-U.Trias., cosmop.—Fig. 183.1. *N. candida (Kittel), M.Trias.(Ladin.), S.Tyrol; \( \times 1 \) (65).

**Cryptonerita** Kittl, 1894 [*C. elliptica* (=Cryptonerita COSSMANN, 1925 (obj., errore pro Cryptonerita)). Turbiniform, broader than high, smooth, of evenly convex whorls; aperture suborbicular; inner lip concave, not extended as septum or dentate at margin, callus extending very little over base. M.Trias.(Ladin.)-U.Trias.(Carn.), Eu.—Fig. 183.2. *C. elliptica*, M.Trias.(Ladin.), S.Tyrol; \( 2a,b, \times 1.5 \) (65).

**Oncoclava** Zittel, 1882 [*Natica globulosa KILP-STEIN, 1845; SD COSSMANN, 1892 (obj.)]. Globular; inner lip with smooth, bulging pad of callus bearing 2 broad, prominent folds. *U. Carib.(Penn.), Trias.-Cret.*, cosmop.—Fig. 213.5. *O. globulosa* (KILP-STEIN), M.Trias.(Ladin.), S.Tyrol; apertural, \( \times 4 \) (Knight, n.). [J.B.Knight, R.L.Batten & E.L. Yochelson would place this genus near *Cylindritis* in the Subulitacea.]

**Neritoma** Morris, 1849 [*Nerita sinuosa* J.SOWERBY, 1818; SD COSSMANN, 1892 (obj.)]. Globular, smooth, with slightly protruding spire; inner lip much thickened, diminishing aperture. *L.Jur.-U.Cret.*, cosmop.

N. (Neritoma). Outer lip with narrow median sinus; margin of inner lip oblique, slightly concave, not dentate. *U.Jur.(Oxford.-Portland.), Eu.—Fig. 183.9. *N. (Neritoma) sinuosa* (J. SOWERBY), U.Jur.(Portland.), Fr.; \( \times 1 \) (201).

N. (Neridomus) Morris &LYCETT, 1851 [*Nerita hemisphaerica Morris &LYCETT, 1851 (non ROEMER, 1836) = Neridomus angica COX & ARKELL, 1950; SD COSSMANN, 1925 (ICZN pend.)]. Outer lip without sinus; margin of inner lip bulging along parietal region, not dentate. *L.Jur.-U.Cret.(Senon.), cosmop.—Fig. 183.11. *N. (Neridomus) angica* (COX & ARKELL), M.Jur. (Bathon.), Eng.; \( 11a,b, \times 1 \) (104).

N. (Stannia) Anderson & COX, 1948 [*Neritina staphinensis FORBES, 1851]. Outer lip without sinus; inner lip only moderately thickened, but with broad, oblique protraction near its lower end. *M.Jur.(Bathon.), Scot.*

**Trachynerita** Kittl, 1894 [*T. fornoensis (=Turbo quadrata STOPPANI, 1858); SD COSSMANN, 1925]. Globose, with low, obtuse spire and obtusely rounded periphery; narrow ramp or row of nodes below suture; aperture with slight adiапical channel; inner lip well protruded, with untoothed parasigmoidal margin, and with callus widely spread over base. M.Trias.(Anis.)-M.Jur.(Bathon.), cosmop.—Fig. 183.16. *T. depressa* (HÖRNES), M.Trias.(Ladin.), S.Tyrol; \( 16a,b, \times 1 \) (66).

**Platychilina** KOKEN, 1892 [*P. wohrmanni* (=Platycline TOMLIN, 1931 (obj.)]. Globose, with low, very eccentric spire; whorls few, rapidly expanding, last one with broad sutural ramp and 2 or more angulations coinciding with rows of tubercles; aperture subquadraangular or polygonal; inner lip moderately protruded, with straight or concave, untoothed margin. M.Trias.(Ladin.)-U.Trias.(Carn.), Eu.—Fig. 183.6. *P. caninallai (STOFPANI), M.Trias.(Ladin.), S.Tyrol; \( 6a,b, \times 1.3 \) (66).

**Delphinulopsis** LAUBE, 1865 [*D. arietina (=Pleurotomaria binodosa MÜNSTER, 1841); SD LAUBE, 1870]. Of few steeply coiled, low-embracing, rapidly enlarging whorls carrying nodose or scaly spiral carinae; inner lip protruded as broad septum with untoothed, oblique margin. M.Trias. (Ladin.)-U.Trias.(Carn.), Eu.—Fig. 183.5. *D. binodosa* (MÜNSTER), U.Trias.(Carn.), S.Tyrol; \( 6a,b, \times 1 \) (64).

**Pileolus** G.B.SOWERBY, 1823 [*P. plicatus; SD S.P. Woodward, 1851]. Small, patelliform or capuliform, smooth or with radial ribbing; inner lip protruded as broad septum, much reducing aperture. *L.Jur.-Eoc.*, cosmop.

P. (Pileolus). Patelliform, smooth or with radial ribbing; inner lip much protruded as septum with smooth or dentate margin, reducing aperture to lunate slit. *L.Jur.-U.Cret.(Turon.), cosmop.—Fig. 183.3. *P. (P.) plicatus, M.Jur.(Bathon.), \( 3a,b, \times 2 \) (147).

P. (Gargania) GUISCARDI, 1857 [*G. brocchi*]. Capuliform, with raised terminal apex not appreciably coiled; radially ribbed; inner lip septum well developed, ?not dentate; labrum thick, with broad median depression. *U.Cret.(Cenom.-Turon.), Eu.—Fig. 183.7. P. (G.) brocchi (GUISCARDI), U.Cret., Italy; \( 7a,b, \times 1 \times 2 \) (190).

P. (Velatella) MEEK, 1873 [*Nerita bellatula MEEK, 1873; SD COSSMANN, 1925]. Capuliform, with depressed submarginal apex slightly coiled and curved to one side; smooth or radially ribbed; aperture semioval; inner lip somewhat thickened, smooth or faintly crenate internally; inner lip margin not dentate. *L.Jur.(Maastricht.), N.Am.—Fig. 183.3. *P. (V.) bellatula* (MEEK), Larsme beds, Utah; \( 3a,b, \times 2.5 \), \( \times 2 \) (228).

P. (Tomostoma) DESHAYES, 1824 [*P. nerioides; SD FISHER, 1885] (=Calana GRAV, 1847). Capuliform, smooth, apex not terminal; aperture trapezoidal, inner lip with sinus. *Eoc., Eu.—Fig. 183.4. *P. (T.) nerioides* (DESHAYES), Eoc., Fr; \( 4a-c, \times 2 \) (147).

**Trochonerita** COSSMANN, 1907 [*Nerita mammiformis d’Orbigny, 1850]. Large, trochoform, smooth; whorls feebly convex, last one subangular at periphery of rather flattened base; labrum strongly prosocline; inner lip not dentate at margin, continuous with thin callus widely spread over...
Lissochilus Zittel, 1882 [*Nerita sigaretina Bu- 
vignier, 1843; SD Cossmann, 1925]. Globose, 
with slightly protruding spire of shouldered whorls;

Fig. 183. Neritacea (Neritidae—Neritinae) (p. I279-I280, I284-I285).
last whorl with one or more angulations; ornament collaral ridges cancelled in same species by spirals; aperture much reduced by inner lip septum which is not dentate along its convex margin, and is continuous with callos rather widespread over base; outer lip bevelled from thick wall to thin edge; shallow adapical channel present. *M. (Bathon.)* U.Cret.(Senon.), cosmop. — Fig. 183,13. *L. sigaretinus* (Buvignier), U.Jur., Fr.; 13a,b, X 4 (111).

**Otostoma d'Archiac**, 1859 [*Natica rugosa* Römer, 1841 (non Bosc, 1801) (≡Natica subrugosa d'Orbigny, 1850); SD Cossmann, 1925] (=Desmieria Douville, 1904 (obj.); Corsania Vidal, 1917; ?Lyostoma White, 1883). Globose, with depressed spire and rapidly enlarging whorls; ornament narrow collaral ridges or tuberculate spirals; inner lip septum broad, much reducing aperture, with large teeth along margin; outer lip strongly prosocline. [Original description of *Otostoma*, alleging broad aperture without septum, was based on imperfect specimens; this also was probably the case with *Lyostoma*.] U.Jur.-Paleoc., cosmop.—Fig. 183,14. *O. divaricatum* (d'Orbigny), U.Cret.(U.Senon.), Hung.; 14a,b, X 1 (210).

**Myagrostoma** J. Böhm, 1900 [*M. plexum*]. Small, much broader than high, with low, obtuse, strongly eccentric spire; whorls with 2 prominent granose carinae, lower one forming periphery; ornament of close-spaced collarals and spirals; base strongly convex, its outline in apertural view continuous with basal margin of aperture; aperture obliquely extended, constricted by 4 teeth, 2 on inner lip, others respectively on internally thickened basal and outer lips; thin indurata continuous with septum spread rather widely over base. U.Cret. (Turon.), SW.Asia.—Fig. 184,7. *M. plexum*, Israel; 7a,b, X 3 (164).

**Tournoerella** Munier-Chalmas, 1887 [*pro Tour- noeria Munier-Chalmas, 1884 (non Brunina, 1870)] (*Tournoeria matheroni* Munier-Chalmas, 1884). Smooth, oviform, higher than broad, most of shell formed by last 1.5 whorls, to which earlier ones form small obtuse apex; last whorl descending and becoming compressed near aperture; aperture ovate, relatively narrow, appearing when viewed directly to project well above evenly rounded base; inner lip septum oblique, moderately broad, with prominent rounded teeth. *U.Cret.-U.Cret.*, Eu.—Fig. 184,10. *T. matheroni* (Munier-Chalmas), U.Cret.(Dan.), Fr.; 10a,b, X 2 (207).

**Mesoneritina** Yen, 1946 [*Neritella nebrascensis* Meek & Hayden, 1862]. Small, globose, rather thin-shelled, with slightly protruding, obtuse spire; smooth, commonly retaining zigzag color pattern; inner lip somewhat thickened, with straight or concave, untoothed margin, and not appreciably protruded as septum. *L.Cret., N.Am.—Fig. 184,3. *M. nebrascensis* (Meek & Hayden), L.Cret., Wyo.; 3a,b, X 2 (228).

**Nerita Linné, 1758** [*N. peloronta*; SD Montfort, 1810] (=Neritarius Duméril, 1806 (obj.); *Dontostoma Herrmannsen*, 1847; Tenare Gray, 1858 (obj.)). Sturdy shells, smooth to spirally ribbed; inner lip septum well developed, its surface (labial area) commonly pustulose or irregularly ribbed. [Mainly marine.] U.Cret.-Rec., cosmop.

N. (Nerita). Outer lip thickened, with 2 teeth; labial area flattened, with 2 large teeth at margin. Paleoc.-Rec., Eu.-IndoPac.—Fig. 185,1. *N. peloronta*, Rec., W.Indies; X 1 (147).


N. (Chingua) Clark & Durham, 1946 [*N. (C.) chinguensis*]. Spiral ribs beaded; labial area smooth. Eoc., S.Am.—Fig. 184,13. *N. (C.) chinguensis*, Eoc., Colombia; X 2 (169).

N. (Fluvinerita) Pilsbry, 1932 [*N. (F.) alitcola* (=N. tenebricosa C. B. Adams, 1852)]. Smooth, inner lip straight and smooth, labial area narrow; outer lip thin; no opercular stop; operculum with minute granulations. [Fresh-water.]. Rec., W. Indies.


N. (Semenieritia) Cossmann, 1925 [*N. mammaria Lamarck, 1804] (=Semenieria Wentz, 1938 (obj.)). Small, with regularly incised growth lines; outer lip thin, inner lip dentate. *U.Cret.(Turon.)-Eoc., cosmop.—Fig. 184,2. N. (S.) mammaria*, Eoc., Fr.; 2a,b, X 3 (147).


Neritina Lamarck, 1816 [*Nerita pulligera* Linné, 1766 (ICZN Op. 119, 1931)] (=Laphrostoma Rafinesque, 1815 (obj.); Lamprostoma, Lamprostoma auctt. (obj.); Neritella Gray, 1848 (obj.); Chernites Gistel, 1848 (obj.); Clypeolum Récluz, 1850 (non Récluz, 1842); Labiaulia, Onychina
Fig. 184. Neritacea (Neritidae-Neritinae) (p. 1282-1285).
Fig. 185. Neritacea (Neritidae—Neritinae, Neritilinae, Smaragdinae) (p. 1282, 1285).

Scudder, 1882 (obj.). Smaller and thinner-shelled than *Nerita*; outer lip thin, inner lip smooth or finely dentate. [Marine, brackish, or fresh-water.] Eoc.-Rec., cosmop.

**N. (Neritina).** Relatively large, low-spired; outer lip overriding last whorl in a projecting point; labial area broad, flat. Rec., Indo-Pac.—Fig. 184,17. *N. (N.) pulligera* (Linne), Rec., E. Indies; 17a,b, ×1 (147).

**N. (Clypeolum) Récluz, 1842** [*N. latissima* Broderip, 1833; SD Pilsbry & Bequaert, 1927] [=Alina Récluz, 1842 (non Risso, 1826)]. Aperture flaring, especially posteriorly; height greater than width. Eoc.-Rec., C.-Am.

**N. (Dostia) Gray, 1847** [*Nerita crepidularia Lamarck, 1822* (=N. violacea Gmelin, 1791)] (=Mitrula Récluz, 1850 (non Gray, 1821) (obj.)). Apertural margin entire, labial area shield-shaped, with arcuate and finely toothed edge. Eoc.-Rec., Eu.-IndoPac.—Fig. 183,10. *N. (D.) violacea* (Gmelin), Rec., E. Indies; ×1 (147).


**N. (Neripteron) Lessom, 1830** [*N. taenios; SD Baker, 1923] [=Neripteron Fischer, 1885 (obj.)]. Like *N. (Dostia)* but more elongate and with labial area less symmetrical. Rec., Indo-Pac.

**N. (Neritina) Martens, 1869** [*N. labiosa Sowerby, 1841*]. Larger than *N. (Dostia)*, labial area expanded above, aperture narrower; operculum ribbed. Rec., Indo-Pac.


**N. (Vergnesia) Delpy, 1940** [*V. moppelleti*]. Dilated, concentrically striate. Eoc., Fr.—Fig. 184,1. *N. (V.) moreleti* (Delpy), U.Eoc., Fr.

**N. (Vitta) Möhrch, 1852** [*Nerita virginea Linne, 1758; SD Baker, 1923] [=Scapha Möhrch, 1852 (non Récluz, 1841) (obj.)]. Spire elevated, pointed; shell smooth, inflated; inner lip toothed. Mio.-Rec., N.Am.-S.Am.-W.Afr.—Fig. 184,8. *N. (V.) virginea* (Linne), Rec., W. Indies; ×1 (147).

**N. (Vittoida) Baker, 1923** [*N. variegata Lessom, 1830*] [=Vittoida Wenz, 1938 (obj.)]. Shell as in *N. (Vittina)*, but radula differing in details. [Brackish water.] Rec., Indo-Pac.

**Neritodryas Martens, 1869** [*Nerita cornea Linne, 1758; SD Baker, 1923*]. Moderately large, spire blunt; labial area smooth, a blunt tooth below; operculum ribbed. Rec., Indo-Pac.—Fig. 184,11. *N. cornea* (Linne), Rec., E. Indies; ×1 (147).

**Neritoplicata Oppenheim, 1892** [*"Neritina globulus Fér." (errore pro Nerita globosa Ferussac, 1823) (=Neritina uniplicata Sowerby, 1823; SD Wenz, 1938)]. Small, low-spired, smooth; with fold on inner lip. M.Jur.(Bathon.)-Paleoc., Eu.—Fig. 184,4. *N. uniplicata* (Sowerby), Paleoc., Fr.; 4a,b, ×2 (147).

**Septaria Ferussac, 1807** [*Patella borbonica Bory de Saint-Vincent, 1803*] [=Cimber Montfort, 1810 (obj.); Septarius Gray, 1821 (obj.); Catillus Gray, 1847 (non Bronniiart, 1822) (obj.); Chrobo Adams & Adams, 1858 (non Herrmannsen, 1852) (obj.); Laodita, Paryia Gray, 1868]. Shell almost isostrophic; last whorl large; aperture expanded; thin labial septum present; subequal muscle scars visible in aperture. Rec., Indo-Pac.

**S. (Septaria)** Apex projecting beyond left of aperture; labial septum broad. [In swift-flowing streams.] Rec., Indo-Pac.—Fig. 184,14. *S. (S.) borbonica* (Bory deSt.Vincent), Bourbon L.; 14a-c, ×1 (147).

**S. (Navicella) Lamarck, 1816** [*N. tessellaria; SD Children, 1823*] [=Navicella Gray, 1821 (obj.); Scapha Récluz, 1841 (obj.); Stenopoma Gray, 1868]. Apex not projecting beyond left of aperture. Rec., Indo-Pac.


**S. (Sandalium) Schumacher, 1817** [*Sandalium pica; SD Baker, 1923*] (=Patella porcellana Linne, 1758)] [non Sandalium Retzius, 1788 (nom. nud.); necoken, 1815 (nom. nud.)] [=Sandalium Récluz, 1841 (obj.); Elara Adams & Adams, 1856 (obj.); Elara Gray, 1867 (obj.)]. Like *S. (Septaria)* but with narrow labial septum. [Fluviatile, in quiet water.] Rec., Indo-Pac.

**Theodorus Montfort, 1810** [*T. lutetianus* (=Nerita flaviellatis Linne, 1758; ICZN Op. 335,
Theodorus jordani (ex 'Neritina 'Neritaea Neri'ilinae BAKER, 1923) 'Nerita 'Nerita 'T. 'Neritina perversus (B.) petasatus (V.) GRAY, 1840 'V. 'Nerita conoideus (=Nerita adamiana]. 'T. 'T. 'T. 'Nerita viridis adamsiana, 'T. 'T. 'T. 'T. 'Smaragdista rubida 'V. 'V. viridis LINNE, eol (ex 'Neritina (N.) schultzi neg =letourn 'So eon 'Neritina correctly. 'P. 'Po 'P. hell 'P. 'Neritina of the corru 'M. 'M. 'M. 'Neritina AUCTT. (obi.)]. Small, ob­ smooth, with smooth or dentate margin; operculum fitzinger, 1833; 'Elea smooth, with smooth or dentate margin; operculum liquely ovate, spire low or elevated; labial area M. (Calvertia) BOURGUIGNAT, 1880 'T. (Neritaea) ROTH, 1855 'T. (Meganninia) DAVIDACHVILI, 1932 'T. (Neritina) T. (Neritodithon) BAKER, 1923 'T. (Ninnia) WESTERLUND, 1903 'T. (Ninia) ROTH, 1855 'T. (Neritina jordani SOWERBY, 1841) 'T. (Neritoconus KOBELT, 1871 (obj.).) Spire somewhat cylindrical, high; inner lip weakly arched and dentate. 'Plio.-Rec., SW.Africa. 'T. (Neritocliton) BAKER, 1923 'T. (Neritocliton) BAKER, 1923 [*Neritina neglecta PEASE, 1860]. Rec., Hawaiian Is. 'T. (Neritocliton) ANDRUSSOV, 1912 [*Neritina petasata SENINSKI, 1905] [=Brusinaella ANDRUSSOV, 1912 (obj.]). Aperture a narrow slit between widely expanded labial and labral areas. 'Plio., SW.Asia.—Fig. 184,16. 'T. (B.) petasatus (SENIKINSKI), Plio., CAUCAUSUS; 16a,b, x2 (147). 'T. (Calvertia) Bourguignat, 1880 [*C. letourneuxi =Neritina sinjana BRUSINA, 1876; SD WENZ, 1929] [=Bourguignatia, Petreidia, Saint-Simonia, Tripolia Bourguignat, 1880; Neritodonta BRUSINA, 1884]. Obliquely ovate, spire somewhat elevated; blunt tooth or ridge on lower muscle scar; operculum with apophysis. Mio.- 'Plio., Eu.-SW.Asia.—Fig. 184,6. 'T. (C.) sinjana (BRUSINA), U.Plio., Dalmatia; x2 (147). 'T. (Clypeolaria) deMONTFORT, 1810 [*Nerita corona LINNE, 1758] [=Cliton LESSON, 1830 (obj.); Corona RECLERC, 1850 (non ALBER, 1850 (obj.).) With a subsutural row of spines or nodes. [Fluviatile or brackish.]. 'Plio.-Rec., Indopac.-Japan.—Fig. 184,12. 'T. (C.) corona (LINNE), Rec., Mauritius; 12a,b, x1 (147). 'T. (Megganinia) Davidchvili, 1932 [*T. corrugata Davidchvili, 1930]. Resembling Neritina (Neripteron) in form but with less apparent spire. 'Plio., SW.Asia. 'T. (Neritae) ROTH, 1855 [*Neritina jordani SOWERBY, 1841] [=Neritococas KOBELT, 1871 (obj.).) Spire somewhat cylindrical, high; inner lip weakly arched and dentate. 'Plio.-Rec., SW.Asia.-E.Africa. 'T. (Neritocliton) BAKER, 1923 [*Neritina neg­lecta PEASE, 1860]. Rec., Hawaiian Is. 'T. (Neritina) ANDRUSSOV, 1912 [*Neritina unguiculatus SENINSKI, 1905]. Resembling Crepidula; labial area finely granulate. 'Plio., SW.Asia. 'T. (Ninia) WESTERLUND, 1903 [*Neritina schulzei GRIMM, 1877]. Small, labial area wide and deep; aperture contracted. 'Plio.-Rec., SW. Asia.—Fig. 184,9. 'T. (N.) schulzei (GRIIMM), Rec., Caspian Sea; 9a,b, x2 (147). 'T. (Ninia) Tomlin, 1930 [*Neritaea cholchica ANDRUSSOV, 1912]. Resembling T. (Ninia) but larger; labial area flatter. 'Plio., SW.Asia. 'T. (Picroneritae) Iredale, 1936 [*Neritina ou­alamensis LESSON, 1831]. Like T. (Vittocliton) but with one large and several small teeth on inner lip. U.Mio.-Rec., IndoPac. 'T. (Vittocliton) BAKER, 1923 [*Neritina mele­agris LAMARK, 1822]. Small, smooth; inner lip weakly arched, with one tooth. Paleoc.-Rec., Eu. trop.Am.-IndoPac.—Fig. 183,12. 'T. (V.) meleagris (LAMARK), Rec., Sumatra; x1.5 (147). Ve1ates deMONTFORT, 1810 [*V. conoides (=Nerita perversa GMELIN, 1791)]. Large, spire concealed; resembling Crepidula; inner lip serrate. U.Cret.(Genomm.)-Eoc., Eu.-Asia-Afr.-N.Am.—Fig. 184,15. 'V. perversus (GMELIN), Eoc., Fr.; 15a,b, x0.7 (147). Subfamily NERITILINAE BAKER, 1923 [*nom. correct. WENZ, 1938 (ex Neritaeae BAKER, 1923)]. Small, ovate, smooth, unicolored; inner lip smooth; operculum without ribs or apophyses. [Fresh-water.] Rec. Neritilua MARTENS, 1879 [*Nerita rubida PEASE, 1867]. Aperture oblique. Rec., tropics.—Fig. 185,2. 'N. rubida (PEASE), Rec., Tahiti; x3 (147). 'Seeptariellina Bequaert & CLENCH, 1936 [*S. con­golensis]. Minute; aperture large, ovate-quadrate. Rec., W.Africa. Subfamily SMARAGDIINAE BAKER, 1923 [*nom. correct. WENZ, 1938 (ex Smaragdinae BAKER, 1923)]. Small, obliquely ovate; operculum with ribs and an apophysis. [Marine.] Mio.-Rec. Smaragdia ISSELT, 1869 [*Nerita viridis LINNE, 1758; SD KOBELT, 1879] [=Gaillardotia BOURGUIGNAT, 1877 (obj.).] Spire low, aperture narrow. Mio.-Rec., Carib.-IndoPac.-Medit. S. (Smaragdia). Aperture nearly the height of the shell. Mio.-Rec., Carib.-IndoPac.—Fig. 185,4. 'S. viridis (LINNE), Rec., Medit.; x2 (147). S. (Smaragdella) BAKER, 1923 [*Neritina hell­villensis CROSSE, 1881]. Rec., IndoPac. S. (Smaragdista) Iredale, 1936 [*Smaragdista tragenana]. Aperture 0.75 height of shell. Rec., IndoPac. 'Magadis MEVLILL & STANDEN, 1899 [*M. eumerintha]. Spire low, aperture large; sculpture of irregular axial folds. Rec., Austral. Pisulina NEVILL & NEVILL, 1869 [*P. adamsiana]. Smooth, with 1 or 2 large teeth on inner lip. Rec., India.—Fig. 185,3. 'P. adamsiana, Cey­lon; x3 (147). Family HELICINIDAE Latreille, 1825 [*nom. correct. Gray, 1840 (ex Helcinae Latreille, 1825)] [=Helcinae GUIDING, 1828; Helicinae MEUNER, 1828; Oligogyrae GRAY, 1847] [Acknowledgement of information and advice generously furnished on the Helicinidae by Dr. H. BURRETT RON BAKER is here recorded with appreciation]. Land snails of small to medium size, few-wohred, conical to lenticular; inner walls of whorls resorbed; umbilicus mostly
concealed by columellar lip or filled with a callus pad; operculum semicircular to rhombic, without apophyses, horny, nearly always reinforced exteriorly by a calcareous layer. With pulmonal cavity and no ctenidium. *U.Cret.-Rec.*

**Subfamily DIMORPHOPTYCHINAE** Wenz, 1938
(nom. correct. Keen, herein (pro Dimorphoptychinae Wenz, 1938))

Aperture with three parallel parietal folds and basal fold. *U.Cret.-PaleoC.*


**Subfamily HELICININAE** Latreille, 1825
(nom. transl. Swainson, 1840 (ex Helicinae, nom. correct. Gray, 1840, pro Helicinae Latreille, 1825))

Distinguished by details of radula; lateral teeth 5, including a comb-lateral and an accessory plate. *PaleoC., Mio.-Rec.*


*H.* (Helicina). Columellae thickened below. *Neog.-Rec., C.Am.-W.Indies.—Fig. 186,1. *H. neritella* (Lamarck), Rec., Jamaica; 1a,b, ×2 (147).


*Alcadia* Gray, 1840 [*Helicina major Gray, 1824*; SD Gray, 1847] (=Isolita Guppy, 1859; Eualcadia Wagner, 1907; "FKr" Incrustata, Intuspicata, Palliata, Sericea Wagner, 1907). Basal callus large. Rec., C.Am.-W.Indies.


Ceratopoma Möllendorff, 1893 [*Helicina caroli Kobelt, 1886*] ("FKr" Diversticolor Wagner, 1905; Negopenia Iredale, 1941 (nom. nud.)). With a peripheral keel. Rec., Pac.Is.


Hemipoma Wagner, 1905 [*Helicina hakodadiensis Hartmann, 1890; SD Wenz, 1938*]. Differing only slightly from Ceratopoma. Rec., Japan.

Orobophana Wagner, 1905 [*Helicina uberta Gould, 1847; SD Baker, 1922*]. Small, with radial and spiral sculpture; basal callus thick. Pleist.-Rec., Polynesia.—Fig. 186,2. *O. uberta* (Gould),Rec., Hawaii; ×3 (147).


P. (Pleurophora). Keel obtuse, operculum with cross-lamella. Pleist.-Rec., Pac.—Fig. 186,3. *P. dichroa* (Möllendorff), Rec., Philippines; ×3 (147).


Schasichella Shuttleworth, 1852 [*Helicina alata Pfeiffer, 1848; SD Kobelt, 1880*] (=Schiasticha Fischer, 1885 (obj.); Atuyac Baker, 1928 (obj.)). Operculum semicircular, with strong cal-
careous layer and pointed extensions on edge by columella. Rec., C.Am.

S. (Schasichella). Rec., C.Am.


Sturanya Wagner, 1905 [*Helicina plicatilis Mouson, 1865; SD Kobelt, 1905] (=Sturanyella Pilsbry & Cooke, 1934; Sturanyella aut. (obj.)). Basal callus thick on columella. Rec., Polynesia.

Sulfurina Möllendorff, 1893 [*Helicina citrina Grateloup, 1840] (=Hypostrongyla Tomlin, 1930; Pestomena Iredale, 1941 (nom. nud.)). Thin-shelled, mostly yellow in color, callus thick. Rec., SW.Pac.

S. (Sulfurina). Rec., E.Indies.


Subfamily HENDERSONINAE Baker, 1926

Reproductive organs typically more primitive than in Helicininae. ?Paleoc., Pleist.-Rec.

Hendersonia Wagner, 1905 [*Helicina occulta Say, 1831]. Small, thick-shelled, operculum subspiral, nucleus eccentric. ?Paleoc., Pleist.-Rec., N.Am.——Fig. 187,1. *H. occulta (Say), Rec., Iowa; 1a,b, apertural view and operculum, X3 (147).

Miluna Wagner, 1905 [*M. josephinae]. Operculum subspiral, with submarginal nucleus; aperture without folds. Rec., China.

Waldemaria Wagner, 1905 [*Helicina japonica A. Adams, 1861; SD Baker, 1922]. Globose, with fine radial folds. Rec., Japan.

Subfamily PROSERPININAE Gray, 1847

[nom. transl. Thiele, 1929 (ex Proserpinidae Gray, 1847)] (=Despoinidae Newton, 1891)
E. (Friotrochatella) Fischer, 1893 [*Helicina constellata Morelet, 1847]. Rec., Cuba.
Geophorus Fischer, 1885 [*Helicina agglutinans Sowerby, 1842] [=Pecoviana Iredale, 1941 (nom. nud.)]. Operculum triangular to trapezoidal, nucleus eccentric. Rec., Orient.
G. (Geophorus). Rec., E.Indies.
Heudeia Crosse, 1885 [*Helicina sechuanensis Heude, 1885]. Relatively high-spiraled, small. Rec., Orient.
H. (Calybium) Morlet, 1891 [*C. massiei]. Low-biconic, with peripheral keel and apertural folds. Rec., India.
H. (Geotrochatella) Fischer, 1891 [*Helicina monhohi Pfeiffer, 1862; SD Baker, 1922]. Without folds. Rec., IndoChina.
Pyrgodorus Fischer & Crosse, 1893 [*Helicina chryseaies Tristram, 1861] [=Artecallosa Wagner, 1908 (obj.)]. Small, high-spiraled. Rec., trop. Am.
S. (Stoastomops). Rec., W.Indies.
Viana Adams & Adams, 1856 [*Helicina regina Morelet, 1849; SD Baker, 1922] [=Ampullina deBlainville, 1824 (non Bowdich, 1822); Hapatary Gray, 1856 (obj.); Rhynchochella Shuttleworth, 1878 (obj.); Fitzia Guppy, 1895]. Relatively large; outer lip with a sinus above periphery. Rec., Cuba.

Subfamily CERATODISCINAE Pilsbry, 1927
Discoid, few-whorled, mostly spirally sculptured. Rec.
F. (Fadyenia). Depressed to globose-conic. Rec., W.Indies.
Lucidella Swainson, 1840 [*Helix aureola Ferussac, 1822] [=Prosopis Weinland, 1862 (non Fabri­cius, 1804)]. Periostracum sculptured; aperture with internal lamellae; operculum with nearly central nucleus. Mio.-Rec., C.Am.-W.Indies.
L. (Lucidella). With spiral striae. Mio.-Rec., W. Indies.—Fig. 187,3. *L. aureola (Ferussac), Rec., Jamaica; X3 (147).
L. (Perenna) Guppy, 1867 [*Helicina lamellosa (=H. lirata Pfeiffer, 1849)]. Depressed, with spiral ridges and keel. Rec., W.Indies.

Subfamily PROSERPINELLINAE Baker, 1923
Size of shell reduced relative to that of soft parts. Pleist.-Rec.
Ceres Gray, 1856 [*Caracolla eolina Duclos, 1834; SD Kobelt, 1880]. Spire nearly flat, base rounded; 2 parietal, 2 palatal folds. Rec., Mex.
Linidiella Jousseaume, 1889 [*Proserpina swifti Bland, 1863] [=Chersodes poena Sykes, 1900]. With columellar fold. Pleist.-Rec., S.Am.
L. (Linidiella). Rec., N.S.Am.—Fig. 187,2. *L. swifti (Bland), Rec., Venezuela; X2 (147).
L. (Staffola) Dall, 1905 [*Proserpina derbyi] [=Cyane H.A. Adams, 1870 (non Felder, 1861)]. Rounded, columellar lamella heavy. Pleist., Brazil.

Family DEIANIRIDAE Wenz, 1938
[nom. correct Cox, herein (pro Deianiridae Wenz, 1938)]
Rather small, rotelliform, anomphalous; inner walls not resorbed; spire depressed, upper face of whorls bordered by carina; base convex; aperture semicircular; outer lip oblique, notched at carina; inner lip straight, oblique, with 2 or 3 plications extending onto labial area, which is continued by callus spread broadly over base; operculum calcareous, with marginal nucleus from which curved groove runs to notch in opposite margin; color pattern commonly preserved. U.Cret.(Campan.-Dan.), Eu.
Deianira Stoliczka, 1860 [*Rotella bicarinata Zekei, 1852; SD Cosmann, 1909] [=Dejanira Leymerie, 1881 (obj.); Leymeria Munier-Chal-
A rchaeo gastropoda—N eritopsina—Neritacea

NERITACEA Family UNCERTAIN

Neritean fossils are particularly difficult to classify if the systematic descriptions are based on fragmentary or badly preserved material. The following generic names have been proposed for material that is certainly neritacean but quite impossible to assign more closely. Probably all are synonymous with other names and most of them belong to the Neritopsidae.

Hypodema DE KONINCK, 1853 [OCalceola dumontiana DE KONINCK, 1843; SD KNIGHT, 1937]. Genus based on heavy, thick conical naticopsoid opercula; associated shell unknown.

Platyostomella ETHERIDGE, JR., 1880 [OLittorina seotoburdigalensis ETHERIDGE, 1878] [=Platystomella LINDSTROM, 1884 (obj.)]. Genus based on SE.Asia-Pac.—FIG. 189,4. *H. cattaroensis (PFEIFFER), Rec., Dalmatia; 4a, apertural view, X 5; 4b,c, operculum, exterior and side views, X 10 (147).

H. (Chondrella) PEASE, 1871 [*Cyclostoma parvum PEASE, 1864]. Operculum ribbed within. Rec., S.Pac.

H. (Georissa) BLANFORD, 1864 [*Hydrocena pyxis BENSON, 1856] [=Omphalorissa IREDALE, 1933 (nom.nud.)]. Spirally ribbed. Rec., SE.Asia-Pac.

H. (Georissopsis) PILSBRY & HIRASE, 1908 [*Georissa (Georissopsis) heudei PILSBRY & HIRASE, 1908]. Operculum large. Rec., China.

Family TITISCANIIDAE Bergh, 1890

Marine snails without shell or operculum, anatomically related to Neritidae, with paliial cavity and ctenidium. Rec.

Titiscania BERGH, 1890 [OT. limacina]. Rec., Mauritius-Pads.

Ib Deionira MAS, 1884. With characters of family.—FIG. 188,1. D. bicaudata (ZEKELi), U.Cret.(Dan.), Aus.; 1a, apertural view, X 1.8 (apparent verticality of inner lip due to foreshortening; 1b, operculum X 5 (222).

Family PHENACOLEPADIDAE Thiele, 1929

[Scutellinidae DALL, 1889]

Conical or cap-shaped shells with apex turned backward and near posterior margin; muscle scar horseshoe-shaped, opening anteriorly. No operculum. Eoc.-Rec.

Phenacolepas PILSBRY, 1891 [*Scutella crenulata BRODERIP, 1834] [pro Scutella BRODERIP, 1834 (non LAMARCK, 1816); Scutellina GRAY, 1847 (non AGASSIZ, 1841); Scutulina COSSMANN, 1912 (obj.)]. With rugose radial ribs; apertural margin arched, not in one plane. Rec., tropics.-Atl.-Pac.

P. (Phenacolepas).—FIG. 189.1. *P. (P.) crenulata (BRODERIP), Rec., S.Pac.; X 1 (147).


P. (Cinnaeleta) IREDALE, 1929 [*Patella cinnamomea GOUFL, 1848]. Rec., Pac.


Family HYDROCENIDAE Troschel, 1856

[Scutellinidae DALL, 1889; ex Hydrocena TROSCHEL, 1856]

Small or minute shells, ovate, slender-spired, inner whors resorbed; no umbilicus; operculum calcareous, semicircular, with eccentric, terminal nucleus, strong apophysis within. [Air-breathing land forms with pulmonary cavity; mostly living near coast.] Pleist.-Rec.


juvenile specimens probably referable to one or more subgenera of *Naticopsis*. L.Carb., Eu.

*Catinella* Stache, 1877 [non Pease, 1871] [*C. depressa*]. Name invalid; genus based on unrecognizable steinkerns. MPerm., Eu.

*Neiromopsis* Waagen, 1880 [*N. minuta*]. Based on a single badly preserved and unrecognizable specimen. MPerm., SC.Asia.

*Caturina* Caneva, 1906 [*Neritomopsis (Caturina) solitaria*]. Name invalid; applied to a species represented by steinkerns supposedly with resorbed inner whorls. MPerm., Eu.

*Proboscidia* Merla, 1931 [non Proboskidia Bory de St.Vincent, 1827] [*Neritomopsis (Proboscdia) elongata*]. Name invalid; applied to a species represented by steinkerns supposedly with resorbed inner whorls. Species and genus unrecognizable. MPerm., Eu.

**?ARCHAEOGASTROPODA**

Suborder **MURCHISONIINA**

Cox & Knight, 1960

Shell commonly high-spired, with numerous whorls; outer lip with submedian sinus which may culminate in slit or notch and which was presumably exhalant in function; inner shell layers seemingly not nacreous; some genera with incipient abapical apertural canal; paired ctenidia are inferred to have been present by analogy with the Pleurotomariina, but if the abapical canal was inhalant in function, the respiratory system may have undergone evolutionary advances beyond the condition characteristic of that suborder. ?U.Cam., L.Ord.-U.Trias.

This suborder has been erected for reception of the superfamily Murchisoniacea. It is thought that this was a stock derived from the Archaeogastropoda and still retaining certain features of that order, but showing advances in some characters along lines of evolution that led to Caenogastropoda (= Pectinibranchia). The question of transferring this group from the Archaeogastropoda (in which it has been included previously) to the Caenogastropoda has been considered, but owing to the difficulty of deciding from the available evidence if archaeogastropod or caenogastropod characters predominated, it has been decided to retain the assemblage in the more primitive order, querying such reference in order to emphasize the borderline position that it occupied.

The Murchisoniacea have a labral slit or notch thought to have been exhalant in function. This indentation lies slightly above or below the middle of the labrum in a position which strongly supports the view that a pair of ctenidia inside the mantle cavity were located on opposite sides of the slit, with the anal opening between them, as in the Pleurotomariacea, from which they were probably derived. If, in accordance with past general practice, we consider the presence of the labral emargination to indicate that the Murchisoniacea were essentially pleurotomarian in nature, it would be presumed that they possessed aspidobranch ctenidia and a rhipidoglossate radula; that is, that they agreed with the Archaeogastropoda in a combination of important anatomical characters. This conclusion, however, is not inevitable. Conchologically, the Murchisoniacea show so many points of resemblance to the Cerithiacea that it may be suggested that they were ancestral to that superfamily. As in the Cerithiacea, for instance, murchisoniacean shells seem to lack a nacreous lining; moreover, they are markedly high-spired, many-whorled forms that commonly exhibit a tendency to develop an inhalant canal. Hence there is at least a possibility that in soft anatomy, as well as in shell characters, they were measurably advanced towards a cerithiacean organization; that is, they may well have had ctenidia of pectinibranch type and a taenioglossate radula, or structures transitional thereto.

The Murchisoniacea appear to have been closely related and probably ancestral to the Loxonematacea, and it may well be that the Cerithiacea were more immediately derived from the Loxonematacea, wherein a deep U-shaped labral sinus, present in earlier genera, gradually disappears, suggesting progressive loss of the right-hand ctenidium and consequent adjustments in the pallial complex. If this was the case, transition from a partly archaeogastropod to a caenogastropod organization may have taken place during the evolutionary history of the Loxonematacea. This superfamily here is assigned to the Caenogastropoda.

It must, however, be remembered that the high-spired forms included in the Cerithiacea form only one group of the Caenogastropoda. We do not suggest that
all caenogastropods were descended from Murchisoniacea, whether directly or through the Loxonematea. The turbiform and other low-spired caenogastropods were probably derived from such archaeogastropod groups as the Trochonematea, in which the right-hand ctenidium had, apparently, already disappeared.

Superfamily MURCHISONIACEA
Koken, 1896

[nom. transl. Knight, Batten & Yardley, herein (ex Murchisoniidae Koken, 1896)]

Labral sinus culminating in a sharp notch or short slit; incipient inhalant canal present in some genera. ?U.Cam., L.Ord.-U.Trias.

Family MURCHISONIIIDAE Koken, 1896

[=Hormotominae Weinz, 1938]

With labral sinus, commonly culminating in short slit or notch that generates a selenizone. ?U.Cam., L.Ord.-U.Trias.

Protospira Rueedemann, 1916 [*P. minuta]. Small, moderately high-spired, with relatively high whorls; apertural lips unknown. [Genus based on species now represented by a single poorly preserved specimen. It is the only high-spired gastropod known from Cambrian rocks, and this is all that can be said about it. Tentatively placed in the Murchisoniidae, the form could as well be loxonematean.] U.Cam., N.Am.

Gasonadia Ulrich in Weller & St. Clair, 1928 [*Murchisonia putilla Sardeson, 1896]. Small, with spire not quite so high as usual in family; labrum with angular sinus that culminates at bluntly angular periphery without slit or selenizone, gerontic aperture with widely flaring lips; with radially elongate internal tooth on floor of whorl about half-whorl back from aperture (possibly marking attachment for left-hand member of a pair of retractor muscles). L.Ord., N.Am.—Fig. 190.1. *G. putilla (Sardeson), Mo.; 1a, apertural view, X2.7; 1b, base of steinkern with impressed internal tooth, X4.

Murchisonia d'Archiac & de Verneuil, 1841 [*Turritella bilineata Dechen, 1832, pro Murex turbidatus (Schlotheim) Dechen, 1832 (non Murex turbidatus Brocchi, 1814) = Muricites turbidatus Schlotheim, 1820; SD Woodward, 1856]. With labral sinus culminating at about middle of labrum in shallow slit or notch; commonly without ornament other than margins of selenizone and growth lines. [In Middle Devonian close relatives of type species display a burst of forms with elaborate, in part bizarre, shapes and ornament quite incongruous with usual conservatism shown by genus. Recognized subgenera are more or less intergrad-
Large, very high-spired, narrowly phaneromphalous; whorls wide, flat-sided with flat selenizone bordered by striae; base flat; with flange spiralling up columella within whors.

[Structural details of the columellar flange are not well understood; it may have been partly membranous and not simply shelly. Nothing is known of its function.] L.Dev., Eu.—Fig. 190,12. *P. verneuili (Koken), Czech.; posterior view with window showing columellar ridge, X1.3.

*Miclia F.A. Roemer, 1852 [*M. cylindrica; SD Knight, 1937] [=Coelocaulus Oehlert, 1888;
\textit{Vetotuba} Etheridge, Jr., 1890; \textit{Coelidium} Clarke & Ruefmann, 1903; \textit{?Melissosoma} Clarke, 1909.

Narrowly phaneromphalous; with angular sinus culminating in short small notch without parallel sides, resulting pseudoselenizone not sharply limited; sutures shallow. 
\textit{Ord.-Dev.}, N.Am.-Eu.-Austral.——Fig. 191, J. \textit{M. davidsoni} (Oehlerl), L.Dev., Fr.; \times 1.3.

\textit{?Briolabella} Kayser, 1873 \textit{[Sciolostoma} serpens \textit{Kayser}, 1872]. Spire relatively low and whorls few, final one turning upward and backward so that aperture faces backward; slit seemingly shallow, bordered by sharp threads; with collabral ornament of sharp threads. \textit{M.Dev.}, Eu.——Fig. 190, 7. \textit{B. serpens} (Kayser), Ger.; posterior view showing twisted final whorl, \times 2.7.

\textit{Aclisina} deKoninck, 1881 \textit{[Murchisonia} striatula \textit{de Koninck}, 1843; SD S.A. Miller, 1889 \textit{[=Aclitoides} Donald, 1898 (obj.); \textit{Rhabdospira} Donald, 1898]. Whole whorl, including selenizone, covered by numerous spiral threads; slit short. \textit{L.Carb.}(Miss.), N.Am.-Eu.-NG.Asia.——Fig. 191, 4. \textit{A. striatula} (deKoninck), Belg.; \times 2.7.

\textit{Micrentoma} Donald, 1898 \textit{[Aclisina} nana \textit{de Koninck}, 1881]. Small, with attenuated apex, anomphalous; sinus shallow, apparently culminating in notch that generates a pseudoselenizone; ornament 5 or 6 spiral cords cut into nodes by collabral threads; shallow slit somewhat below middle of labrum gives rise to flat selenizone not bordered by threads or suture. \textit{L.Carb.}, Eu.——Fig. 191, 2. \textit{M. nana} (deKoninck), Belg.; \times 4.

\textit{Cerithioides} Haughton, 1859 \textit{[C.} telescopium \textit{[=Glyptobasis} deKoninck, 1881 (non McLachlan, 1871)]. Large, with tapering apex, moderately high whorls and shallow sutures; base nearly flat, anomphalous; ornamented with spiral grooves; shallow slit somewhat below middle of labrum gives rise to flat selenizone not bordered by threads or suture. \textit{L.Carb.}, Eu.——Fig. 191, 10. \textit{C. telescopium}, Irc.; \times 0.7.

\textit{Glyphodeta} Donald, 1895 \textit{[Murchisonia} zonata \textit{Donald}, 1887]. Selenizone arched gently and bordered by striae; with several broad spiral low cords separated by striae below selenizone but without ornament above it. \textit{L.Carb.}(Miss.)-\textit{M. Perm.}, Eu.-N.Am.——Fig. 191, 7. \textit{G. terebriformis} (Hall), M.Miss., Ind.; \times 4.7.

\textit{Stegoceolia} Donald, 1889 \textit{[Murchisonia} (Stegoceolia) compacta]. With spiral threads or carinae; short slit and selenizone above periphery; shape variable, basis of differentiation of intergrading subgenera. \textit{L.Carb.}(Miss.)-\textit{M. Perm.}, Eu.-N.Am.-SE.Asia.

S. \textit{(Stegoceolia)}. Spire relatively low, whorls commonly rounded. \textit{L.Carb.}(Miss.)-\textit{U.Carb.}(Penn.), Eu.-N.Am.-SE.Asia.——Fig. 191, S. \textit{(S)} compacta (Donald), L.Carb. Scot.; \times 12.

S. \textit{(Hypergonia)} Donald, 1892 \textit{[Murchisonia} quadricarinata M'Coy, 1844]. Spire high, relatively slender. \textit{L.Carb.}(Miss.)-\textit{U.Carb.}(Penn.), Eu.-N.Am.-SE.Asia.——Fig. 191, 12. \textit{S. (H)} quadricarinata (M'Coy), L.Carb., Irc.; \times 4.

S. \textit{(Taosia)} Girty, 1939 \textit{[Murchisonia} copei White, 1881]. Spire relatively high, with projecting angulation around base and selenizone in flat area above; in some species basal angulation bears row of nodes (47, p. 21). \textit{Penn.}(U.Carb.).-\textit{M. Perm.}, N.Am.-EU.-SE.Asia.——Fig. 191, 14. \textit{S. (T)} copei (White), M.Penn., N.Mex.; \times 1.3.

\textit{Goniassoma} Tomlin, 1930 \textit{[pro Goniopora} Girty, 1915 (non Cossmann, 1895; nec Donald, 1902)]. \textit{[Murchisonia} lasallensis \textit{Wortthen}, 1890]. Whorls with smooth slope above angular periphery; labrum with angular sinus that culminates just below periphery in short slit which generates slightly convex, inwardly sloping selenizone; with pair of spiral threads below selenizone, upper one located at or above lower suture; some species with faint indication of siphonal canal. \textit{Penn.}(U.Carb.).-\textit{M. Perm.}, N.Am.-S.Am.-EU.——Fig. 191, 11. \textit{G. lasallense} (Wortthen), U.Penn., Ill.; \times 4.

\textit{Cibecuia} Winters, 1956 \textit{[C. cedarensis]}. Side of whorls flat, conformable to sides of spire; sutures linear; shallow labral sinus culminating in short slit; base anomphalous; convex columellar lip reflected; ornament faint subussual nodes and spiral threads on base (151, p. 44). \textit{M. Perm.}, N.Am.——Fig. 191, 3. \textit{C. cedarensis}, Atiz.; \times 2.7.

\textit{Helicospira} Girty, 1915 \textit{[Murchisonia} buttersi Girty, 1912]. Whorls with angular periphery bearing a wavy double-crested selenizone; ornament very fine spiral and widely spaced collateral threads. \textit{[Somewhat resembles Triassic Trypanocochea Tomlin, 1931.] Perim. or Trias., N.Am.}——Fig. 191, 13. \textit{H. buttersi} (Girty), Colo.; \times 2.7.

\textit{Cheirotoma} Strand, 1928 \textit{[pro Cheirotoma} Koken, 1889 (non Dejean, 1835)]. \textit{[Pleurotoma} blumi Müntser, 1841; SD Diener, 1926]. Small; periphery at mid-whorl and carinate in most forms, carrying or forming lower border of well-marked slit and selenizone, which are also bordered above by spiral cord; ornament spiral cords and collateral threads; aperture with distinct spout as incipient inhalant canal. \textit{M.Trias.}(Anis.)-\textit{U.Trias.}(Carn.), Eu.——Fig. 191, 6. \textit{C. blumi} (Münster), M. Trias.(Ladin.). S. Tyrol; 6a,6, apertural views, \times 2 (64,89).

\textit{Trypanocochea} Tomlin, 1931 \textit{[pro Verania} Koken, 1896 (non Krohn, 1846)]. \textit{[Verania} cerithioides Koken, 1896]. Small, anomphalous; whorls angular with periphery at mid-height carrying raised selenizone bearing pointed nodes at intervals and bordered by pair of cords; sutures with spiral cord each side; slit unknown; columnella with about 6 weak folds. \textit{U.Trias.}(Carn.), Aus.——Fig. 191, 9. \textit{T. cerithioides}; \times 5 (79).

\textit{Vistilia} Koken, 1896 \textit{[V. klipsteini]}; SD Woodward, 1897]. Narrowly phaneromphalous or cryptomphalous; whorls angular, with sharp periphery at mid-height carrying or forming lower border of

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Fig. 191. Murchisoniacea (Murchisoniidae) (p. 1292-1293).
selenizone with conspicuous lunulae; slit unknown; ornament spiral cords. *M. Trias. (Anis.)-U. Trias. (Nor. ), Eu.—Fig. 191, 8. *V. klipsteini (Koken), U. Trias. (Nor. ), Aus.; ×2 (79).

Family PLETHOSPIRIDAE Wenz, 1938
[nom. transl. Knight, Batten & Yochelson, herein (ex Plethospirinae Wenz, 1938)]

Spire height variable, mostly not high; with ill-defined siphonal canal. *L. Ord.-U. Trias.

Subfamily PLETHOSPIRINAE Wenz, 1938

Broadly fusiform, with ill-defined siphonal canal; shallow slit occurring rather high on labrum but with selenizone approximately at mid-whorl between sutures. *L. Ord.-L. Dev.

Plethospira Ulrich in Ulrich & Scofield, 1897 [*Holopea cassina Whitfield, 1886]. Base narrow, canal relatively broad; ornament wanting except for growth lines. *L. Ord.-M. Sil., N. Am.-Eu.—Fig. 192, 1. *P. cassina (Whitfield), L. Ord., USA (Vt.); apertural view showing siphonal canal, ×0.7.

Seelya Ulrich in Ulrich & Scofield, 1897 [*S. ventricosa]. Rounder than Plethospira and with raised selenizone; ornament low spiral cords. *L. Ord.-M. Sil., N. Am.-Eu.—Fig. 192, 8. *S. ventricosa, L. Ord., USA (Vt.); ×1.3.

Diplozone Perner, 1907 [*D. innocens]. Base relatively broad, canal narrow; ornament sharp col­labral threads. *U. Sil.-L. Dev., Eu.—Fig. 192, 4. *D. innocens, L. Dev., Czech.; apertural view of juvenile shell showing siphonal canal, ×5.3.

Fig. 192. Murchisoniacea (Plethospiridae—Plethospirinae, Pithodeina) (p. 1295-1296).
Subfamily PITHODEINAE Wenz, 1938

Base with little or no development of a canal; slit shallow and relatively wide, selenizone wide and flat. Dev.-U.Trias.

Gyrodoma Etheridge, Jr., 1898 [*Eunema eth­eridgei CRESSWELL, 1993]. Relatively high-spired, with rounded whorls and deep sutures; selenizone broad, flat; ornament numerous spiral threads, ex­cept on selenizone. [Little is known of apertural margins.] Dev., Austral.—Fig. 192,2. *G. eth­eridgei (CRESSWELL); ×0.7 (69).

Platyzone Knight, 1945 [*Pleurotomaria trilineata Hall, 1858]. Moderately high-spired to turbini­form, minutely planeromphalous; ornament dom­inantly spiral cords which commonly are separat­ed by faint grooves into groups of 3 on base, but also including sparse faint collabral growth lines; suggestion of a canal in some species (72, p.579). Dev.-M.Perm., N.Am.-Eu.—Fig. 192,7. *P. trilineata (Hall), M.Miss., Ind.; ×3.3.

Pithodea DeKonincck, 1881 [*P. amplissima]. Rob­ust, somewhat fusiform, anomphalous; ornament numerous spiral cords. L.Carb., Eu.—Fig. 192,6. *P. amplissima, Belg.; ×0.5.

Caliendrum Brown, 1838 [*Buccinum vittatum Phillips, 1836 [=Foordella Longstaff, 1912]. Much like Pithodea but with somewhat deeper sutures and lacking spiral ornament. L.Carb. (Miss.)-U.Carb.(Penn.), Eu.-N.Am.—Fig. 192,3. *C. vittatum (Phillips), L.Carb., Eng.; ×1.

Wortheniopsis J.Böhm, 1895 [*Pleurotomaria margarethae KITTL, 1894]. Ovate-conical, acute-spired, anomphalous; whorls evenly convex or with nar­row sutural ramp; selenizone narrow, high on whorl side, bordered above by ramp angle when present; ornament spiral threads and growth lines symme­trically recurved to selenizone. M.Trias. (Ladin.)-U.Trias.(Nor.), Eu.—Fig. 192,5. *W. margarethae (KITTL), M.Trias.(Ladin.), S. Tyrol; Sa,b, abapertural views, ×1.5 (65).

?ARCHAEOGASTROPODA

Superfamilies of Doubtful Subordinal Position

Superfamily CLISOSPIRACEA

S. A. Miller, 1889

[nom. transl. Knight, Batten & Yochelson, herein (ex Clisospiridae MILLER, 1889)]

Trochiform or patelliform, with base seemingly represented by a narrow but gradually widening lamella that spirals up­ward inside shell; Shell structure unknown. L.Ord.-M.Dev.

These curious gastropods are not well known or understood, and there is not much evidence as to their systematic posi­tion. Certain resemblances to some of the Calyptraeacea are thought to indicate con­vergence rather than relationship.

Family CLISOSPIRIDAE S. A. Miller, 1889

With characters of superfamily. L.Ord.-M.Dev.

Subfamily CLISOSPIRINAE S. A. Miller, 1889

[nom. transl. Knight, Batten & Yochelson, herein (ex Clisospiridae S.A.MILLER, 1889)]

Shell sinistral. L.Ord.-Sil.

Mimospira Koken, 1925 [*Onychochilus helm­hackersi Perner, 1900; SD Knight, 1937]. Without (?or with only a very narrow) frill; sutures mod­

![Fig. 193. Clisospiracea (Clisospiridae—Clisospiri­nae, Progalerinae) (p. 1296-1297).](image-url)
Archaeogastropoda—Suborder Doubtful—Pseudophoracea

FIG. 194. Pseudophoracea (Planitrochidae) (p.1297-1298).

Figurately deep; outer lip and collabral ornament strongly prosocline; base and aperture unknown.

L.Ord., Eu.—Fig. 193,2. *M. helmhackeri (Perner), Czech.; X2 (80).

Clisospira Billings, 1865 [*C. curiosa]. With wide frill; sutures shallow; outer lip prosocline; ornament obliquely cancellate; base and aperture unknown.

L.Ord.-Sil., N.Am.-Eu.-NE.Asia.—Fig. 193,4. *C. curiosa, Can.(Que.); X2.7.

Subfamily PROGALERINAE Knight, 1956

B. dextral. L.Dev.-M.Dev.

?Procrucibulum Perner, 1911 [*Calyptraea simplex Perner, 1903; SD Cossmann, 1911]. Patelliform, with slightly twisted apex and low sharp ridge within running in a broad clockwise curve from apex to margin.

L.Dev., Eu.—Fig. 193,3. *P. simplex (Perner), Czech.; apical view, X2.

?Paragalerus Perner, 1903 [*P. holzapfeli]. Sutures rather deep, outer lip strongly prosocline; ornament fine collabral threads. [Too poorly known to warrant a restoration.]

L.Dev., Eu.

Progalerus Holzapfel, 1895 [*P. conoideus]. High conical, with base represented by a lamella spiralling up inside shell; ornament fine growth lines encircling test.

M.Dev., Eu.—Fig. 193,1. *P. conoideus (Holzapfel), Ger.; 1a, side view; 1b,c, steinkern, inside and apical view showing spiral suture, X1.3.

Superfamily PSEUDOPHORACEA

S. A. Miller, 1889

[nom. transl. Knight, Batten & Yochelson, herein (ex Pseudophoracea S.A.Miller, 1889)]

Trochiform, with either gently rounded phaneromphalous base and subangular periphery or concave base within a more or less extended frill; evidence of nacreous inner shell layers found in some genera referred to each subfamily, but information wholly lacking for others. L.Ord.-Miss.

Family PLANITROCHIDAE Knight, 1956

With gently rounded phaneromphalous base and subangular periphery. L.Ord.-U.Sil.

Raphistomina Ulrich & Scofield, 1897 [*Raphistoma lapicida Salter, 1859] [=Rotellomphalus Perner, 1903]. Lenticular, with sharp carina at periphery, suture falling beneath carina; with channel inside angular periphery and upper surface of peripheral carina flattened.

L.Ord.-Sil., N.Am.-Eu.—Fig. 194,4. *R. lapicida (Salter), M.Ord. Can.(Que.); X2.7.

Trochomphalus Koken, 1925 [*Eumphalus dimidiatus Koken, 1896]. Somewhat lenticular, with suture falling above sharp periphery; upper whorl surface with low rounded spiral ridge; umbilicus moderately wide, bordered by sharp angles.

U.Ord., Eu.—Fig. 194,3. *T. dimidiatus (Koken), Est.; X1.3 (80).

?Nematrochus Perner, 1903 [*N. concurrens]. High trochiform, with strongly prosocline outer lip and umbilicus plugged with a concave callosus. [Too poorly known to warrant reconstruction.]

U.Sil., Eu.

Planitrochus Perner, 1903 [*P. amicus; SD Perner, 1907]. Depressed trochiform, with sharp carinate periphery and moderately wide umbilicus; outer lip prosocline above and below periphery; ornament above periphery consisting of collabral

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threads, below of growth lines only. U.Sil., Eu.
—Fig. 194,2. *P. amicus*, Czech.; X 1.3.

**Horologium** **PERNER, 1907** [*H. kokeni*]. Somewhat like **Plantitrochus** but larger and less depressed; ornament above periphery wide radiating undulations or narrow subcolateral ramp and below periphery numerous fine spiral threads. U.Sil., Eu.—Fig. 194,5. *H. kokeni*, Czech.; X 1.

**Pernerritrochus** **COSMANN, 1909** [pro **Conotrochus** **PERNER, 1907** (non **PILESBBY, 1889**)]. [*Trochus? venalis* **PERNER, 1903**]. Similar to **Plantitrochus** but higher and with more rounded noncarinate periphery and narrower umbilicus; ornament above sutural collabral threads, below suture unknown. U.Sil., Eu.—Fig. 194,1. *P. venalis* (**PERNER**), Czech.; X 2.

**Family PSEUDOPHORIDAE** **S. A. MILLER, 1889**

(*=Palaeonustidae** **WENZ, 1938**)

Conical, base flat or concave within surrounding frill. Sil.-M.Perm.

**Siluriphorus** **COSMANN, 1918** [*Trochus gotlandicus* **LINDSTRÖM, 1884**]. Trochiform, with flat or concave cryptomphalous base; periphery commonly bluntly angular but in some specimens with a blunt, frill-like border; ornament strong, irregular growth lamellae, weaker on base and strongly prosocline. M.Sil., Eu.—Fig. 195,9. *S. gotlandicus* (**LINDSTRÖM**), Gotl.; X 2.

**Hystricoceras** **JAHN, 1894** [*H. spinosum*]. With concave, anomphalous base surrounded by about 12 semitubular projections on frill-like edge of upper whorl surface. U.Sil., Eu.—Fig. 195,4. *H. spinosum*, U.Sil., Czech.; X 1.

**Pseudophorus** **MEEK, 1873** [*Trochita antiqua* **MEEK, 1872**] (=**Flemingia** **DEKoNINCK, 1881** [non **JOHNSTON, 1845**]; **Flemingella** **KNIGHT, 1936** [pro **Flemingia** **DEKoNINCK, 1881**]). With narrowly phaneromphalous base surrounded by wide frill formed by extension of upper whorl surface; collabral ornament strongly prosocline growth lines above periphery. Sil.-Mass.(L.Carb.), N.Am.-Eu.—Fig. 195,2. *P. profundus* (**LINDSTRÖM**), M.Sil., Gotl.; X 2 (90).

**Pseudotectus** **PERNER, 1903** [*P. carinatus*] (=**Palaeonustus** **PERNER, 1903**). High, with gently convex anomphalous base surrounded by moderately wide frill. L.Dev., Eu.—Fig. 195,7. *P. carinatus*, Czech.; X 1.3.

**Scalaetochus** **ETHERIDGE, JR., 1890** [*Trochus (Scalaetochus) lindstroemi*]. Trochiform, with rather low whorls and nearly flat cryptomphalous base surrounded by narrow frill; callus deposit beginning in aperture and filling peripheral angle; collabral lines moderately prosocline on upper surfaces. Dev., Austral.—Fig. 195,1. *S. lindstroemi* (**ETHERIDGE, JR.**), X 0.7.

**Astralites** **WHITEAVES, 1892** [*A. fimbriatus*]. With nearly flat cryptomphalous base surrounded by digitate and fluted frill; columellar lip with 2 internal grooves passing back about 0.5 whorl and separated by ridge; ornament of upper whorl surface consisting of broadly convex prosocline collabral undulations crossed by discontinuous spiral cords; base with growth lines alone. [The 2 grooves passing inward around the columella strongly suggest by their position and abrupt inward termination that they were loci of a pair of retractor muscles.] M.Dev., N.Am.-Eu.—Fig. 195,3. *A. fimbriatus*, Can.(Man.); X 1.3.

**Protocalyptra** **CLARKE, 1894** [*P. marshalli*]. Fragile; with very strongly prosocline outer lip; base rather deep within frill but without narrow lamella spiralling up conical shell. [Present interpretation differs somewhat from that of **KNIGHT** (69) and even more markedly from that of **CLARKE**, who interpreted it as having the characters here attributed to **Procalyptra**.] U. Dev., N.Am.—Fig. 195,5. *P. marshalli*, USA(N.Y.); X 10.

**Eotreochus** **WHITFIELD, 1882** [pro **Pleurotomaria concava** **HALL, 1858** (=**Pleurotomaria tenuimarginata** **S.A.MILLER, 1877**, pro **P. concava** **HALL, 1858** [non **DESHEAYES, 1836**]). With flat base within short frill; narrowly phaneromphalous with lamella spiralling up within umbilicus from base of inner lip; ornament spiral threads on base and growth lines above. M.Miss., N.Am.—Fig. 195,6. *E. tenuimarginatus* (**S.A.MILLER**), Ind.; apertural view, with window showing spiral umbilical lamella, X 5.5.

**Sallya** **YOCHELSON, 1956** [*S. linsa*]. With very gently convex narrowly phaneromphalous base within narrow frill; no spiral lamella within umbilicus; labrum strongly prosocline to margin of frill; labium entirely within frill; ornament growth lines alone or spiral lines on base and ripple-like structures or radiating buttress-like ribs on sides (154, p.205). *M. Perm., N.Am.—Fig. 195,8. *S. linsa*, Tex., X 4.

**Superfamily CRASPEDOSTOMATACEA**

**WENZ, 1938**

[nom. transl. **COX & KNIGHT**, herein (ex **Craspedostomatidae** **WENZ, 1938**) ICZN pend.]

Little-known, problematic gastropods mostly with expanded apertures in gerontic stages; shell structure unknown. **U.Ord.-Jur.**

This probably polyphyletic and artificial group is imperfectly known and the taxonomic positions of the various genera are insecure.

**Family CRASPEDOSTOMATIDAE**

**WENZ, 1938**

(=**Brochidiinae**, **Dichostasiinae** **YOCHELSON, 1956**)

Mostly naticiform, with deep sutures and strong collabral ornament. **U.Ord.-Jur.**
?Umbonellina Koken, 1925 [*U. infrasilurica]. Naticiform, umbilicus plugged with callus; otherwise little known. U.Ord., Eu.—Fig. 196.3. *U. infrasilurica, Est.; ?×1 (80).

?Bucanospira Ulrich in Ulrich & Scofield, 1897 [*B. expansa]. Naticiform, with final quarter of last whorl in some specimens disjunct; apertural margins explanate at irregular intervals; ornament of spiral cords and collabral threads. M.Sil., N.Am. —Fig. 196.1. *B. expansa, Tchn.; ×2.

Craspedostoma Lindström, 1884 [*C. elegantulum; SD Perner, 1907]. Naticiform; outer lip explanate
at late growth stages, with expansion later thickened by numerous lamellae; umbilicus narrow, with sharp funicle; ornament dominantly collabral but with spiral elements in some species. *M. Sil.-U. Sil.*, Eu.—Fig. 196.7. *C. elegantulum*, *M. Sil.*, Eu.; X 2.7.

**Temnospira** Perner, 1903 [*Brochidium (Temnospira) monile*; SD Knight, 1937]. Depressed, with rounded whorls; umbilicus narrow; ornament of collabral lamellar ribs separated by wider interspaces, ribs coalescing to form thickened expansion of aperture at gerontic stages. *M. Sil.*, Eu.—Fig. 196,6. *T. monilis* (Perner), Czech.; 6a,b, apical and umbilical views, X 2.7.

**Spirina** Kayser, 1889 (*S. brilonensis*). Helicocone disjunct, expanding rapidly to explanate aperture; coiling of only slightly more than single whorl, slightly asymmetrical, with umbilicus pierced; ornament of collabral cords. *M. Sil.-M. Dev.*, Eu.—Fig. 196,8. *S. brilonensis*, *M. Dev.*, Ger.; 8a,b, abapertural and apical views, X 1.

**Natiria** deKoninck, 1881 [*Natica lirata* Phillips, 1836] (=*Fritschiella* Picard, 1904). Naticiform, whorls barely in contact; collabral ornament widely spaced thin lamellae with numerous finer threads between, spiral ornament poorly developed or wanting. *L. Carb.-Trias.*, Eu.—Fig. 196,2. *N. lirata* (Phillips), *L. Carb.*, Eng.; X 1.3.

**Dichostasia** Yokelson, 1956 [*D. complex*]. Small, umboniform; narrowly phaneromphalous; with greatly thickened gerontic apertural margins; ornament differing above and below periphery, of various transverse (not strictly collabral) elements above and spiral and collabral below; labrum prosocline, without sinus (154, p. 208). *L. Perm.-M. Perm.*, N.Am.—Fig. 196,4. *D. complex*, *M. Perm.*, Tex.; 4a-c, abapertural, umbilical, and apical views, X 6.

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![Fig. 196. Craspedostomatacea (Craspedostomatidae) (p. 1298-1301).](image)
Brochidium Koken, 1889 [*Cerata? cingulatus Münster, 1834; SD Cossmann, 1916]. Resembling Temnozoma but more nearly discoidal and with more lamellar collabral ornament and more sharply differentiated aperture thickening. M.Perm.-Jur., Eu.-N.Am.—Fig. 196.5. *B. cingulatum (Münster), M.Trias.(Ladin), S.Tyrol; 5a,b, apertural and apical views, X2 (64).

Family CODONOCEILIDAE S. A. Miller, 1889
[nom. correct. Knight, Batten & Yochelson, herein (pro Codonocheilidae S.A.Miller, 1889)]

Turriticate, with shallow sutures. U.Sil.-M.Jur.

Codonocheilus Whiteaves, 1884 [*C. striatum] (=Codonocheilus Lindström, 1884 (obj.)]. Spire cyrtoconoid; whorls very low, with very shallow sutures; last whorl disjunct; aperture circular and slightly explanate. U.Sil., N.Am.-Eu.—Fig. 197, 3. *C. striatum, Can.(Ont.); X6.

?Dihele W.E.Schmidt, 1905 [*D. dathei]. Pupiform, with notably flat protoconch and cancellate ornament; whorls low; aperture unknown. M.Dev., Eu.—Fig. 197,5. *D. dathei, Ger.; X2.7.

Scoliostoma Braun, 1838 [*S. dannenbergi] (=Mitchellia deKoninck, 1877). Last whorl twisted upward and on its own axis so that explanate aperture is well above mid-height on spire and facing opposite to usual direction. M.Dev.-U.Dev., Eu.-Austral.—Fig. 197.2. *S. dannenbergi, M. Dev., Ger.; 2a, rear view, showing aperture; 2b, front view, aperture turned away; X2.

Bathyclides Strand, 1928 [pro Bathycycles Koken, 1896 (non Distant, 1893)] [*Bathycycles acuminatus Koken, 1896; SD Diener, 1926] (=Bathycyla Strand, 1928 (obj.)]. Small, ovate-conical, broad, phaneromphalous, with sharply pointed apex and smooth, convex whorls; outer lip prosocline, thickened externally and internally when full-grown and at intervals during growth. U.Trias.(Carn.-Nor.), Eu.—Fig. 197.1. *B. acuminatus, U.Trias.(Carn.), Aus.; X1 (79).

Ventricaria Koken, 1896 [*Phasianella acuminata Hörnes, 1856; SD Diener, 1926] Broadly turriticate or phasianelliform, cryptomphalous, with sharply pointed apex and feebly convex, spirally striated whorls; outer lip prosocline, thickened externally. U.Trias.(Carn.-Nor.), Eu.—Fig. 197.4. *V. tumida (Hörnes), Nor., Aus.; 4a,b, X3, X1 (79).


Family CROSSOSTOMATIDAE Cox, n.fam.

Rotelliform or low-turbiniform, thick-shelled, of smooth, strongly convex whorls; aperture circular, with uninterrupted peristome and outer lip strongly thickened externally. M.Trias.(Ladin.)-M.Jur.(Baj.), Eu.

Crossostoma Morris & Lyckett, 1851 [*C. pratti]. Anomphalous: aperture contracted, particularly from inner lip; reflected part of outer lip continued above, where it adheres to penultimate whorl. L.Jur.-M.Jur.(Baj.), Eu.—Fig. 198.2. *C. reflexilabrum (d'Oribigny), M. Lias, Fr.; 2a,b, ap-
Mollusca-Gastropoda

**Superfamily PALAEOTROCHACEA**
Knight, 1956

Turbiniform, trochiform, or moderately high-spired; commonly thick-shelled, especially in parts generated by parietal and col umbellar lips; shell structure and operculum unknown. L.Dev.-U.Cret. (Senon.).

**Family PARATURBINIDAE** Cossmann, 1916

Turbiniform, including large and small forms; anomphalous or narrowly phaneromphalous; aperture suborbicular. Trias.-U. Cret.

**Floydya** Webster, 1905 [*F. concentrica*] [=Floydia C.L.Fenton, 1918 (obj.)]; *Scaliconus* Wenz, 1938 (pro *Pileolus* Spietersbach, 1919, non Cookson in J.Sowerby, 1823; nec Less, 1831; nec Ehrenberg, 1843) (147, p.260)]. Trochiform or turbiniform; ornament of broad, low undulations below upper suture. M.Dev.-U. Dev., N.Am.-Eu.—Fig. 199,2. *F. concentrica*, U.Dev., USA (Iowa); X0.5.

**Westernia** Webster, 1905 [*Loxonema gigantea* Webster, 1888; SD Knight, 1941 (69, p.385)] [=Westernia C.L.Fenton, 1918 (obj.)]. Much like Floydya but with higher spire. U.Dev., N.Am.—Fig. 199,1. *W. gigantea* (Webster), USA (Iowa); X0.5.

**Chartronella** Cossmann, 1916 [*Chartronella* (Paraturbo) heptagoniatus] [?Turboidea Seeley, 1861]. Large, thick, anomphalous; whorls with transversely elongated nodes or transverse costae and subordinate spiral cords; base coated with callus, obscuring ornament in some species. LJur.-U. Cret. (Senon.), cosmop.—Fig. 200,1. *P. stephanophorus* (Zittel), U.Jur. (Tithon.), Czech.; 1a,b, X1 (157).

**Creniturbo** Cossmann, 1918 [*Trochus direc* d’Orbigny, 1850]. Small, anomphalous; ornament spiral cords cut up by collabral grooves; broad band with two rows of depressed nodes forming flattened periphery; basal ornament not obscured by callus. U.Jur. (Raurac.), Fr.—Fig. 200,3. *C. direc* d’Orbigny); X5 (111).

**Superfamily AMBERLEYACEA** Wenz, 1938

[nom. transl. Cox, herein (ex Amberleyidae Wenz, 1938)]

Shell dextral or sinistral; commonly lititoriform or turbiniform, more rarely with expanded, discoidal last whorl but protruding apex; aperture orbicular or with margin subangular at foot of columella;
spiral element of ornament dominant in most forms, spirals commonly being noded or cancellated by transverse elements; shell structure, where known (in some Amberleyidae), nacreous; operculum unknown. M.Trias.-Olig.

While the characters of the genus Cirrus, with its usually acute, protruding apex and progressively broadening and more fully embracing whorls, are unique, the similarity to the Amberleyidae of other genera that have been included in the Cirridae is unmistakable. COSSMANN included the Cirridae in the Euomphalacea on account of the subdiscoidal last whorl of Cirrus, maintaining that this was an instance in which ontogeny was no guide to affinity. Union of the Cirridae with the Amberleyidae in a single new superfamily serves to bring together a number of genera with obvious similarities, although Cirrus itself stands apart from the other included forms. The Platycrideridae also seem better included in this superfamily than in the Euomphalacea, where they were placed by WENZ. A tendency for the initial whorls to be planispiral, so well displayed in this family, is also seen in the South American cirrid genera, Hesperocirrus and Sororcula. Most Amberleyacea resemble the caenogastropod group Littorinacea in many features of the shell, but the nacreous structure (observable in the Amberleyidae) suggests that they are best included in the Archaeogastropoda.

Family PLATYACRIDAE Wenz, 1938
Shell turbinate, phaneromphalous, with apical truncation due to planispiral coiling of early whorls; either dextral or sinistral; aperture orbicular. M.Trias.-U.Jur.

Platyacra ZITTEL, 1882 [*Trochus impressus Schafhautl, 1863]. Sinistral; high-turbinate with early whorls planispiral; later whorls with inframedian carina, forming periphery of base; umbilicus moderately broad, with carinate margin. U.Trias. (Rhaetic)-L.Jur., Eu.—Fig. 201.1. *P. impressa (Schafhautl), U.Trias.(Nor.), Bavaria; ×1.3 (233).

Lepidotrochus KOKEN, 1894 [*L. bittneri; SD Cossmann, 1916]. Shell form as in Platyacra, but dextral and with narrower umbilicus; ornament of cancelling spiral and collabral threads; M.Trias.-U.Trias., Eul., N.Z.—Fig. 201.4. *Lepidotrochus bittneri, M.Trias., Aus.; ×1.3 (79).
Drepanoconcha Zilch, 1949 [*Drepania deGREGORIO, 1930 (non Huebner, 1816, nec Lafont, 1874) [*Drepania pulchra deGREGORIO]. Rather small, sinistral, elevated, but broadly truncated at apex, with early whorls planispiral; later whorls convex, steeply coiled, with narrow collabral ribs. L.Jur., Eu.—Fig. 201.2. *D. pulchra (deGREGORIO), Sicily; 2a,b, ×2 (174).

Hyperacanthus Koren, 1894 [*Cirrus superbus HöRNES, 1855]. High-turbinate with earliest whorls planispiral; later whorls strongly convex, obscurely biangulate, last 2 with nodes or spines at angulations; base convex, with nodose spiral cords; whole surface with dense collabral threads; umbilicus moderately broad; aperture very oblique. U.Trias.(Nor.)-L.Jur., Eu.—Fig. 201.5. *H. superbus (HÖRNES), U.Trias.(Nor.), Aus.; 5a,b, ×1 (79).

Acrosolarium Koren, 1896 [*A. superbum]. Turbinate with earliest whorls planispiral; later whorls with carina at edge of broad, horizontal sutural shelf; last whorls with 2 further angulations, lower crenate and forming margin of rather narrow umbilicus; aperture unknown. U.Trias.(Nor.), Eu.—Fig. 201.3. *A. superbum, Aus.; ×1.3 (79).

Family CIRRIDAE Cossmann, 1916
Littoriniform or with expanded, discoidal last whorl, sinistral; aperture suborbicular. U.Trias.-M.Jur.(Bathon.).

Cirrus J.Sowerby, 1815 [*C. nodosus; SD S.P. Woodward, 1851] [*Cirrhus FéRUSAC, 1821 (obj.)]. Moderately large, broadly phaneromphalous, ranging from high-spired with only slightly expanded last whorl to subdiscoidal; aperture with uninterrupted margin. U.Trias.-M.Jur. (Bathon.), Eu.-S.Am.

C. (Cirrus). Apex very acute, but relative whorl diameter and overlap increasing progressively during growth to an extent varying in different species; coiling slightly irregular in some forms; ornament nodose spiral cords or coarse cancelling spiral and collabral ridges. L.Jur.-M.Jur. (Bathon.), Eu.—Fig. 202.4. *C. (C.) nodosus, M.Jur.(Baj.), Eng.; 4a,b, ×0.8 (59)—Fig. 202, 1. *C (C.) leachi J.Sowerby, M.Jur.(Baj.), Eng.; ×1 (59).


Hamusina Gemellaro, 1878 [*Turbo bertheloti d'ORBIGNY, 1850; SD Cossmann, 1916]. High conical, anomphalous, shell wall thin; whorls, apart from ornament, almost flat, last with sharp peripheral carina continuing line of suture; base

Fig. 200. Palaeotrochacea (Paraturbinidae) (p. 1302).

Fig. 201. Amberleyacea (Platyacridae) (p.1303-1304).
Archaeogastropoda—Suborder Doubtful—Amberleyacea

Fig. 202. Amberleyacea (Cirridae) (p. 1304-1305).

feebly convex; ornament nodes or spiral threads, some nodose. L.Jur.-M.Jur.(Baj.), Eu., S.Am.—Fig. 202,6. *H. bertheloti (d’ORBIGNY), U.Lias., Fr.; X1 (111).

Spirocirrus COSSMANN, 1916 [*Turbo calisto d’ORBIGNY, 1850]. Turbiniform or conical, with moderately broad umbilicus, later whorls not expanded as in Cirrus; ornament strong axial ribs crossed by spiral threads, base with spiral threads only; columellar lip slightly reflected. L.Jur.-M.Jur. (Bathon.), Eu.—Fig. 202,5. *S. calisto (d’ORBIGNY), M.Jur. (Bathon.), Fr.; X1 (111).

Auseria FUCINI, 1895 [*Trochus (Auseria) pseudonustus; SD WENZ, 1938]. High conical, anomphalous; whorls smooth, flat-sided, with sharply carinate, crenulated periphery situated just above suture, producing an imbricate spire; base depressed. L.Jur. (L.Lias.), Eu.—Fig. 202,2. *A. pseudonustus, L.Lias., Italy; 2a,b, X1 (147).

Sororcula HAAS, 1953 [*S. gracilis]. Small, high conical, narrowly phaneromphalous, carinate at periphery of flattened base; protoconch planispiral; whorls flat or slightly concave, not overlapping; sutures incised; ornament spiral row of tubercles adjoining each suture, tubercles joined in one species by transverse ribs; aperture broader than high, with inner lip reflected over umbilicus. U.Trias., Peru.—Fig. 202A,1. *H. robusteornatus; 1a,b, apertural, abapertural views, X5; 1c, abapertural view of another specimen, X3 (50).

Aristerella DUBAR, 1948 [*Amphitrochilia (Aristerella) undata]. Medium size, slightly coeloconoid, narrowly phaneromphalous, sharply carinate at periphery of feebly convex base; whorls flat, not overlapping; sutures incised; ornament nodose or undulating spiral cord adjoining each suture and spiral threads on remainder of surface; aperture quadrangular. L.Jur. (M.Lias.), N.Afr.—Fig. 202A,3. *S. gracilis; 3a-c, apertural, abapertural, basal views, X6 (50).

Family AMBERLEYIDAE WENZ, 1938

[Dextral, turbiniform, littoriniform or low turriculate, with convex or imbricat-
ing whorls; apertural margin not continuous across parietal region in most forms; shell structure nacreous. *M.Trias.-Oligo.*

**Hesperocirrus***

Mollusca—Gastropoda

**Amberleya Morris & Lycett, 1851** [*A. bathonica Cox & Arkell, 1950 (=*A. nodosa Morris & Lycett, non Terebra nodosa Buckman, ICZN pend.*)]. Littoriniform to subturriculate, anomphalous. Trias.-Oligo.


A. **(Eucycus) J.A.Eudes-Deslongchamps, 1860** [*E. obeliscus*]. Ornament spiral carinae; columellar lip more or less straight and vertical, its margin commonly meeting that of basal lip in angle or spoutlike protrusion. *Trias.-Oligo., Eu.-S.Am.—Fig. 203.6. *A. (E.) obeliscus (J.A. Eudes-Deslongchamps), M. Lias., Fr.; X1 (182).*

**Eunomopsis Kittl, 1891** [*Turon epaphus Laube, 1869; SD Cossmann, 1916*]. Small, with moderately acute, conical spire and convex base with small pseudumbilicus; ornament narrow axial costellae ending in nodule near each suture; small denticle at upper end of columellar lip. *M.Trias. (Ladin.)-U.Trias.(Carn.), Eu.—Fig. 203.7. *E. epaphus (Laube), M.Trias.(Ladin.), S.Tyrol; X5 (89).*

**Paleunema Kittl, 1891** [*Pleurotomaria nodosa Münster, 1841*]. High turbiniform, almost turriculate, anomphalous; whorls imbricate, with prominent peripheral carina just above suture bearing growth lines that form series of back-pointing scales generated by notch in outer lip; base strongly convex, with spiral cords; columellar lip slightly concave. *M.Trias.(Ladin.), Eu.—Fig. 203.3. *P. nodosa (Münster), S. Tyrol; X1.5 (64).*

**Tectospira Picard, 1904** [*T. chopi*]. Rather small, turbiniform, anomphalous; whorls imbricate, with

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**Fig. 202A.** Amberleyacea (*Carinacea*) (p. 120, 1505).
prominent peripheral carina just above suture and, above it, about 2 weak spiral angulations crossed by collabral threads; base depressed, convex, with spiral cords; aperture oval, broader than high; outer lip notched at peripheral carina; columellar lip strongly concave. M.Trias., Eu.—Fig. 203,10. *T. chopi, Muschelkalk, Ger.; X3 (212).

Riselloidea COSSMANN, 1909 [*Risellopsis COSSMANN, 1908 (non KESTEVEN, 1902)] [*Risellopsis subdisjuncta COSSMANN, 1908] [=Riselloidea COSSMANN, 1909 (? misprint)]. Small, trochiform, anomphalous, with conical spire and flattened base with carinate periphery; whorls with nodose carina adjoining each suture, sutures thus occupying deep channel; ornament axial ridges on whorl side between carinae and spiral cords on base, Trias.-L.Cret.(Neocom.), Eu.—Fig. 203,8. *R. biaarmata (MÜNSTER), M.Jur., Ger.; X3 (111).

Eucyclomphalus VONAMMON, 1892 [*Trochus cupido d’ORBIGNY, 1850; SD COSSMANN, 1916]. Medium-sized, rather broadly phaneromphalous, with high conical spire of whorls with sharp nodose peripheral carina, and convex base bearing spiral cords; columellar lip straight, vertical, not reflected. L.Jur., Eu.—Fig. 203,4. *E. cupido (d’ORBIGNY), M.Lias., Fr.; X3 (111).

Ooliticia COSSMANN, 1893 [*Turbo philippi MORRIS & LYCETT, 1851]. Medium-sized, stoutly littoriniform, anomphalous, with conical spire slightly exceeding height of aperture, evenly convex periphery, and convex base; ornament broad nodose spiral cords; columellar lip thickened, with blunt fold at its upper end. L./ur.-U.Cret.(Maastricht.), cosmop.—Fig. 203,2. *O. philippi (MORRIS & LYCETT), M.Jur.(Baj.), Eng., 2a,b, X2 (59).

Onkospira ZITTEL, 1873 [*Turbo ranellatus QUENSTEDT, 1858 (=Turbo ancurus MÜNSTER in GOLDFUSS, 1844)] [=Oncoepis COSSMANN, 1916 (ob.)]; Tritonilla KOKEN, 1896]. High turbiniform, anomphalous; whorls strongly convex, with spiral cords, collabral riblets, and either 1 or 2 series of varices almost in alignment on successive whorls, last varix situated behind outer lip; inner lip rather broadly reflected. U./ur.-L.Cret., Eu.—Fig. 203,1. *O. gracilis ZITTEL, U.Jur. (Tithon.), Czech.; 1a,b, X1.2, X1.5 (157).

Tanaliopsis COSSMANN, 1916 [*Trochus spiniger J.deC.SOWERBY, 1833 (cited as Turbo spiniger ZEKELI)]. With stoutly conical spire and depressed, feeibly convex base; spire with 8 to 10 axial costae aligned on successive whorls and forming nodes at periphery of last; aperture orbicular,
**Family NODODELPHINULIDAE** Cox, n. fam.

Small to medium-sized, turbiniform, with height and breadth almost equal, phaneromphalous; spiral ornament dominant; aperture orbicular (except in *Amphitrochus*), not very oblique, with continuous peristome; operculum and shell structure unknown. *U.Trias.–U.Cret.*

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**Nododelphinula** Cossmann, 1916 [*Delphinula buckmani* Morris & Lycett, 1851]. Turbiniform, broadly phaneromphalous; last whorl with concave, vertical outer face bordered by 2 nodose spiral carinae, upper of which is exposed on spire whorls; ornament spiral threads or cords crossed in some species by collabral threads or ribs; circumumbilical carina with nodes continued by ribs passing short distance into umbilicus. *M.Jur.(Baj.)–L.Cret., Eu.*—Fig. 204,1. *N. hudlestoni* Cossmann, *M.Jur.(Baj.), Eng.; X2.5 (59).

**Amphitrochus** Cossmann, 1907 [*Trochus duplicatus* J.Sowerby, 1817] (=*Amphitrochilia Cossmann, 1909* [pro *Amphitrochus Cossmann, 1907, non Amphitrocha Agassiz, 1862*]). Trochiform, with conical spire and depressed, concave base; narrowly phaneromphalous; last whorl with prominent periphery formed by 2 conspicuous nodose cords, one or both exposed on spire whorls just above suture which is bordered by further nodose cord; crenulated or nodose carina at umbilical margin; aperture quadrate. *U.Trias.(Nor.)–L.Cret.* (Neocom.), *Eu.*—Fig. 204,4. *A. duplicatus* (J.Sowerby), *M.Jur.(Baj.), Eng.; X2.5 (59).

**Helicacanthus** Dacqué in Wenz, 1938 [pro *Meta­canthus* Dacqué, 1936 (non *Costa, 1847*)] [*Turbo thurmanni* Pictet & Campiche, 1863]. Turbiniform, narrowly phaneromphalous; last whorl with broad, concave outer face bordered by two prominent spiral carinae both of which are exposed on later spire whorls; ornament strong spiral cords present also on base and within umbilicus. *U.Jur.–L.Cret.* (Neocom.), *Eu.*—Fig. 204,2. *H. thurmanni* (Pictet & Campiche), *L.Cret.(Apt.), Switz.; X2 (147).

**Metriomphalus** Cossmann, 1916 [*Turbo davoustii* d’Orbigny, 1850]. Small, turbiniform, narrowly to broadly phaneromphalous, with convex whorls and base bearing a small number of spiral cords, one forming margin of umbilicus, carrying nodes or short prickles, terminal one of each cord forming projection of outer lip. *U.Trias.–U.Cret.* (Senon.), *Ger.; X1 (147).*

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**ARCHAEOGASTROPODA**

** Genera Inquirenda**

**Atlantobellerophon** Trechmann, 1930 [*A. sealandicus*]. Large, apparently depressed-conispiral, with last whorl disjunct (*fide* Marwick); anal slit deep, peripheral. [Founded on a single imperfect last whorl; apparently pleurotomarian
rather than bellerophon.] U.Trias. (Rhaetic, Ota­pirian), N.Z.

Burdikinia KNIGHT, 1937 [pro Polyamma Ether­idge, Jr., 1917 (non Kriechbaumer, 1894)] [*Polyamma burdikiensis Etheridge, Jr., 1917]. Large, discoidal, with broad ramp above and narrow base; seemingly with row of hollow spines of unknown length opening adapertually on outer edge of ramp; base turning inward rapidly below ramp, ornamented with about 4 rows of spirally elongated pustules. [There should be no trouble in recognizing this striking genus, but placing it systematically is impossible without more information.] Dev., Austral.—Fig. 205, 4. *B. burdiki­ensis (Etheridge, Jr.); 4a,b, apical and side views, X 0.7 (69).

Cinctaspira POWELL, 1933 [*C. conica]. Trochi­form, with wide umbilicus and sharp spiral flange at about mid-whorl height. L.Ord., N.Am.

Conchula STEININGER, 1849 [non Herrmannsen, 1847] [*C. cylindracea]. Type not figured; un­recognizable; name invalid. M.Dev., Eu.

Cyclora HALL, 1845 [*C. minuta]. Very minute, naticiform. [Probably based on steinkerns of protoconchs of some other genus, possibly Cyclonema; locally very abundant.] U.Ord., N.Am.

Geinitzia DIETZ, 1911 [non Gemmellaro, 1892; nec Handlirsch, 1906] [*G. carinata]. Inade­quately described and figured; name invalid. Perm., Eu.

Kebina Vologdin, 1955 [*K. pulchra]. High-spired, narrowly phaneromphalous, with spiral carinae; very minute. [Known only from section of one specimen (143, p. 355)], L.Cam., Russia.

Lepitorina PERNER, 1907 [*Murchisonia oehlerti Perner, 1903]. Rather high turbiniform; with sharp sinus in outer lip culminating only slightly below suture in deep slit that generates narrow selenizone which is gently convex outside and more strongly convex within; sutures shallow, covered by adpressed zone; columellar and parietal lips little known; ornament other than growth lines seemingly a slight stria below selenizone. [This remarkable species is so very different from any other known that it defies classification; foundation of a new major category is thought to be un­wise in the present state of knowledge.] U.Sil., Eu.—Fig. 205, 3. *L. oehlerti (PERNER), Czech.; X2.

Ozarkina ULRICH & BRIDGE, 1931 [pro Ozarkispira Ulrich & Bridge, 1931 (non Walcott, 1924)] [*Ozarkispira typica Ulrich & Bridge, 1931]. Known from discoidal steinkerns which show nu­merous narrow, rounded whorls but no surface or apertural features that would permit classification. L.Ord., N.Am.—Fig. 205, 1. *O. typica (ULRICH & BRIDGE), Mo.; 1ab, oblique view from above and below, latter showing cross section, X2.

Ozarkocanus HELLER, 1956 [*O. prearcuatus]. With high conical, slightly curved, cap-shaped shell; aperture oval; ornament longitudinal costae or threads. [Possibly not a gastropod.] L.Ord., USA.

Pichynella RUSCONI, 1954 [*P. annulata]. Very minute (1 mm.), possibly a protoconch. [Too little known for systematic assignment.] L.Ord., S.Am.

Pondia ODER, 1932 [*P. powelli]. Based on 2 frag­ments, seemingly of a calcareous operculum, pos­sibly of Maclurites. L.Ord., N.Am.

Procancellaria WILCKENS, 1922 [*P. parkiana]. Ovate, with low spire, anomphalous; whorls con­vex; ornament cancellating collabral and spiral grooves, the former feebly prosoclinc; aperture ovate, with uninterrupted peristome, subangular adapically; columellar lip vertical, moderately ex-
panded, without folds. U.Cret., N.Z.—Fig. 205, 2. *P. parkiana; X1 (229).

*Pythmenerna* Lamont & Gilbert, 1945 [*Euomphalus praenantis* Phillips, 1848]. Turbiniform, with strong spiral carinae above periphery and finer ones below. [The original diagnosis of this genus and the description and figures of the type species are quite inadequate for systematic placement more closely than in the Archaeogastropoda.] (86, p. 643.) U.Sil., Eu.

**SUPPLEMENT**

**PALEOZOIC AND SOME MESOZOIC CAENOGASTROPODA AND OPISTHOBRANCHIA**

By J. Brookes Knight¹, R. L. Batten², E. L. Yochelson³, and L. R. Cox⁴

**INTRODUCTION**

When the *Treatise* was first conceived, the senior author, whose field of special study is the gastropods of the Paleozoic, undertook to cover all orders represented in that era, including supposed patelloid gastropods now classified as Monoplacophora. Almost from the beginning R. L. Batten and E. L. Yochelson were associated with him.

As work on the *Treatise* progressed it became apparent that Part I, covering Scaphopoda, Amphineura, Monoplacophora, and the gastropod order Archaeogastropoda would be ready for publication in a reasonable time. However, manuscript for Part J, planned to include the prosobranch taxa Mesogastropoda and Neogastropoda (here combined as an order named Caenogastropoda), large divisions that are very abundant and varied in post-Paleozoic time, and the subclasses Opisthobranchia and Pulmonata, has been so delayed that it might not appear during the senior author’s lifetime.

The authors recognize that no final treatment of the predominantly post-Paleozoic orders can be successful without including consideration of the vast amount of information that will be presented by specialists in these overwhelmingly post-Paleozoic groups. Nevertheless, the authors concerned with Paleozoic groups which include the more primitive members, perhaps ancestral to the better-known ones of later times, feel that they can contribute important matter too frequently overlooked by students of the younger fossil genera and especially by neontologists.

For this reason and because the student of Paleozoic Gastropoda will profit from having current data on all the orders in his field even though not in final form, consent was obtained to include them in Part I as a Supplement.

With the exceptions to be noted, the three authors already mentioned are responsible for the material here presented, especially the systematics. Dr. L. R. Cox, British Museum (Natural History), who has supervision over sections of the *Treatise* dealing with all gastropods, has examined the manuscript of the Supplement and has been kind enough to add data on authorship and to suggest diagnoses for several taxa that are best known to workers on post-Paleozoic mollusks. Cox has prepared the diagnosis and synonymy for the order Caenogastropoda (replacing Mesogastropoda and Neogastropoda of previously written text) and he is author of the division of the Loxonematacea included in the family Zygopleuridae; this family, although entirely Mesozoic, has been included here to make the account of the superfamily

¹ Honorary Research Associate, Smithsonian Institution, Washington, D.C.; Longboat Key, Florida.
² Department of Geology, University of Wisconsin, Madison.
⁴ Department of Palaeontology, British Museum (Natural History), London.

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complete. The diagnosis of the subclass Opisthobranchia was drafted after a discussion with Prof. Alastair Graham and Dr. Vera Fretter, leading authorities on this group. For these kindnesses the authors are grateful.

It is planned that when Part J appears the groups covered in this Supplement will be reviewed and integrated systematically with the post-Paleozoic forms by the authors engaged in the task; accordingly, it is not intended that the arrangements here presented will be binding upon them. In the meantime, the arrangement of the suprafamilial taxa is not materially altered from those current in recent years. Wenz (1938) in particular has been followed. However, several large familial categories assigned by that author to the Archaeogastropoda have been placed in the Caenogastropoda and even in the Opisthobranchia. The authors are unable at this time to recognize any compelling reasons for classifying any Paleozoic taxa in the Pulmonata.

Order CAENOGASTROPODA
 Cox, 1959

[=pectinibranches deBlainville, 1814 (partim); Siphonobranchia−Pectinibranchia (partim) Gay, 1820; Ctenobranchiata Schleicherr, 1820 (partim); Hemipomatostoma+Apomatostoma Menke, 1830; Pectinibranchiata Gray, 1850 (partim); Monotocardia Exophallia Mörch, 1865; Streptoleurosa Asymmetrbranchia Spengler, 1881 (partim); monotocardes Bouvier, 1887; Ctenobranchia Pelseneer, 1893; Pectinibranchia Pelseneer, 1906; Mesogastropoda + Stenoglossa Theile, 1925; Mesogastropoda−Neogastropoda Wege, 1938]

Shell asymmetrical, of many shapes, porcelaneous; right ctenidium absent, the left monopunctate (but absent in certain families); inhalant siphon present or absent; heart with one auricle; one kidney only; pallial genital organs present in most forms, forming a penis in the male; nervous system moderately to highly concentrated; proboscis present in many forms; radula of several types, mostly with relatively few teeth in a row. Marine, fresh-water and terrestrial. Ord.—Rec.

Superfamily LOXONEMATACEA
Koken, 1889

[nom. transl. Cossmann, 1909 (ex Loxonematidae Koken, 1889)]

Commonly high-spired, with numerous whorls, mostly anomphalous; deep to obsolescent labral sinus without slit or notch; inner shell layers not nacreous. M.Ord.—U. jur.

Although the sinus in the Loxonematacea does not culminate in a slit or notch, as in the Murchisoniacea, it is thought to have served as an excurrent channel, at least in those genera in which it is deepest. Perhaps the anal tube lay between a pair of ctenidia, as has been postulated for the Murchisoniacea. With passage of time, however, the sinus tends to become shallower and its culmination is found to move toward the suture. This supports the inference that, if the right ctenidium was retained in more primitive forms, it had been lost by Devonian time, and the anus and other pallial organs had been displaced to the positions which they occupy in the Cerithiacea.

The Loxonematacea seem to have been closely related to the Murchisoniacea and probably were derived from them.

Family LOXONEMATIDAE Koken, 1889

[=Holopellidae Koken, 1897]

Mostly relatively large; labrum with median sinus, lower segment opisthochline; ornament dominantly collabral; protoconch seemingly of several whorls, unornamented. M.Ord.—Miss.

Loxonema Phillips, 1841 [*Terebra? sinuosa* J. dec.Sowerby, 1839; SD King, 1850] [==Holopella M'Coy, 1851; Rhabdostropha Donald, 1905]. Sinus deep; sutures moderately deep. M.Ord.—Miss., cosmop.—Fig. 206,4. *L. sinuosum* (J. dec. Sowerby), MSl., Eng.; X2.

Girvania Longstaff, 1924 [*G. excavata*]. Small, extremely slender, high-spired and many-whorled; with shallow labral sinus; spiral threads and collabral undulations. U.Ord., Eu.—Fig. 206,2. *G. excavata*, Scot.; X4.

Spiroceps Longstaff, 1924 [*S. girvanensis*]. Whorls rounded except for sloping ramp above low spiral cord occurring somewhat above mid-whorl. U.Ord., Eu.—Fig. 206,6. *S. girvanensis*, Scot.; X4.

Stylonema Perner, 1907 [*Loxonoma (Stylonema) potens*; SD Longstaff, 1909]. Very slender, high-spired, many-whorled; with shallow sinus, upper limb extending a little farther beyond aperture than lower; ornament numerous very fine collabral threads. LSil.—L.Dev., Eu.—Fig. 206,1. *S. potens* (Perner), USl., Czech.; X0.7.

Aulacostrepsis Perner, 1907 [*A. simplex*]. Much like Stylonema but wider, with lower and wider whorls; minutely phaneromphalous, with umbilical opening surrounded by rounded ridge. L.Dev., Eu.—Fig. 206,3. *A. simplex*, Czech.; X1.3.

Katopychia Perner, 1907 [*K. alba*; SD Cossmann, 1909] [==Catopychia Cossmann, 1909 (obj.)]. Whorls flat, with shallow sutures; outer lip...
strongly opisthocline until close to base, without sinus (unless the subangular juncture of outer and parietal lips may be interpreted as a sinus). L.Dev., Eu.—Fig. 206,5. *K. alba*, Czech.; apertural view, X2.7.

Polygyrina Koken, 1892 [*Turritella lommelii* Münster, 1841; SD Cossmann, 1909]. Whorls many, strongly convex; protoconch obtuse, dome-like; growth lines forming broad, symmetrical sinus on spire whorls, their complete curve parasyigmoid. L.Trias.-U.Trias., Eu.-Asia.—Fig. 206, 7. *P. lommelii* (Münster), M.Trias-(Ladin.), S.Tyrol; 7a, early whorls, X3; b-d, later whorls, X1 (64).

Family PALAEOZYGOPLEURIDAE Homy, 1955

Relatively small, labral sinus shallow or wanting; protoconch composed of one or (rarely) more smooth whorls; ornament collateral or wanting. Dev.-L.Carb.

Palaeozygoplectura Homy, 1955 [*Zygopleura alinae* Perner, 1907] (=Bajozyga, Palaeozyga Homy, 1955 (58, p.27)). Small, high-spired, with labral sinus; whorls not shouldered, with shallow sutures or adpressed (58, p.27). Dev.-L.Carb., Eu.—Fig. 207,1. *P. alinae* (Perner), L.Dev., Czech.; 1a, apertural view, X6; 1b, early whorls X14.


Family PSEUDOZYGOPLEURIDAE Knight, 1930

[nom. transl. Knight, Batten & Yochelson, herein (ex Pseudozygopleurinae Knight, 1930)] (=Palaeoxyginae Wenz, 1938)

Gross characters variable but distinguished by nature of ornament and shape of protoconch; first 1 to 1.5 whorls of protoconch smooth, strong collateral ornament appearing on 2nd whorl and continuing to 4th where it gives way very abruptly to adult type of ornament (commonly present but lacking in some species); 1st ornamented whorl commonly slightly swollen, giving protoconch shape suggestive of corneet. L.Carb.(Miss.)-M.Perm.

The presence or absence of the pseudozygopleurid type of protoconch can be determined only on specimens in which this part of the shell is exceptionally well preserved, although the shape of the protoconch may be suggestive even if fine details are not discernible. If the protoconch of any genus is unknown its placement here is queried. The distinctive juvenile characters of the Pseudozygopleuridae are shown clearly by many Pennsylvanian and Permian shells but are not yet known in Mississippian genera that it seems impossible to exclude. Homy’s stimulating monograph on the Palaeozygopleuridae appeared after
the section on the Pseudozygopleuridae was completed. There proved to be considerable overlap in respect to genera for which protoconchs are unknown. With these it is impossible to decide definitely between two assignments or possibly others. The authors have concluded to leave their arrangement as it was but are conscious that some at least of the queried genera may prove to belong where Horný placed them. Triassic genera very similar to the Pseudozygopleuridae are referred to the family Zygoopleuridae because the protoconchs of well-preserved specimens are smooth.

?Tmetonema Longstaff, 1912 [*T. subsulcatum*]. Small, with collateral threads crossing whorls which bear broad, slightly depressed band approximately at mid-height, slight sinus (shown by pattern of threads) occurring above band; threads prosocline close to upper suture but opisthocline crossing band and then gradually prosocline on base; protoconch unknown. [Description derived from Longstaff's photographic illustration; this fails to accord with her diagnosis and line drawings, which do not agree among themselves.] L.Carb., Eu.

?Knightella Longstaff, 1933 [pro Knightia Longstaff, 1933 (non Jordan, 1907)] [*Knightia irregularis* Longstaff, 1933]. Whorls rounded, sutures moderately deep; outer lip with very shallow sinus; ornament growth lines only. [Shape of protoconch suggests Pseudozygopleuridae but characteristic larval ornament not demonstrated.] L.Carb.-U.Carb., Eu.—Fig. 208.6. *K. irregularis* (Longstaff), L.Carb., Scot.; X8.

?Microptychia Longstaff, 1912 [*M. wrighti*]. Earlier adult whorls with moderately strong collateral threads outlining shallow sinus; beyond 1st 0.25 of spire threads become obsolete over middle of whorls but are accentuated at shallow sutures; protoconch unknown. Miss.(L.Carb.)-Penn.(U.Carb.), N.Am.—Fig. 208.13. *E. sulcata* (DeKoninck), L.Carb., Belg.; X1.

P. (Pseudozygopleura) Knight, 1930 [*Loxonema semicostatum* Meek, Knight, 1930 (=L. attenuata semicostata Meek, 1872)]. Collaral threads or cords on all whorls, or confined to earlier whorls, or absent entirely. Miss.-Penn.-M.Perm., N.Am.—Fig. 208.12. *P. (P') pupoides* (Meek), LPerm., Camb.; X10.

P. (Pyrgozyga) Knight, 1930 [*Pseudozygopleura (Leptozyga) minuta*]. Very small, cyrtoconoid, with high spire but relatively few whors. Penn., N.Am.—Fig. 208.4. *P. (L.) minutus*, Penn., Mo.; X20.

P. (Palaecostylus) [=Pyrgozyga Knight, 1930]. Very high-spired, with many low broad whorls; collaral ornament orthochine or nearly so. Penn.-M.Perm., N.Am.-SE.Asia.—Fig. 208.7. *P. (P') pupoides*, LPerm., Cambodia; X4.

?Hemizyga Girty, 1915 [*H. elegans*; SD Knight, 1930]. With both collateral and spiral ornament; labral sinus very shallow or absent. Miss.-M.Perm., N.Am.

?H. (Hemizyga) [=Strianematina H.Chronic, 1952 (14, p.130)]. Collaral ornament of fine to coarse somewhat prosocline threads, spiral ornament mostly on base; protoconch unknown.
Fig. 208. Loxonematacea (Pseudozygopleuridae) (p. 1313-1315).
Miss.—M.Penn., N.Am.—Fig. 208,5. *H. (H.) elegans., M.Penn., Mo.; × 5.3.

H. (Hyphantozoga) KNIGHT, 1930 [*H. (Hyphantozoga) gracilis]. Spiral and collabral ornament of subequal sharp threads. Penn., N.Am.—Fig. 208,9. *H. (P.) corona, M.Penn., Mo.; × 10.

H. (Ploczygza) KNIGHT, 1930. [*H. (Ploczygza) corona]. Collabral ornament of strong cords or ribs, spiral ornament of fine threads or striae. U.Carb.—(Penn.), N.Am.—Fig. 208,8. *H. (P.) corona, N.Penn., Mo.; × 10.

Cyclogyza KNIGHT, 1930 [*C. mirabilis; SD KNIGHT, 1936]. Minute, with protoconch of subfamily, spiral threads on adult shell; shallow sinus low on whorl. Penn., N.Am.—Fig. 208,3. *C. mirabilis, M.Penn., Mo.; × 20.

?Spiromphalus HAYASAKA, 1939 [*S. yabei]. Much like Palaeostylos with deep and (for such a high-spired shell) wide umbilicus, within which is a spiral projecting flange; protoconch unknown (54, p.20). Perm., NE.Asia.—Fig. 208,10. *S. yabei, Japan; apertural view, with window showing spiral flange, × 4.5.

Family ZYGOPLEURIDAE Wenz, 1938
[nom. transl. Cox, herein (ex Zygopleurinae Wenz, 1938)]

Shell slender; protoconch smooth, of up to about 3 regularly increasing whorls; ornament narrow collabral riblets which have parasigmoid curve in most genera; subordinate spiral ornament in some genera. Trias.—U.Jur.

Zygopleura KOKEN, 1892 [*Cerithium meyeri KLEIPSTEIN, 1843 (=Turritella hybrida MÜNSTER, 1841, non DESHAYES, 1832); SD Cossmann, 1899]. Whorls strongly convex; riblets well defined and with pronounced parasigmoid curve; no spiral ornament. Trias.—U.Jur. (L.Kimm.), cosmop.—Fig. 209,9. *Z. meyeri (KLEIPSTEIN), M.Trias. (Ladin.), Italy; × 2.5 (178).

Katosira KOKEN, 1892 [*K. fragilis]. Whorls flattened-convex; collabral riblets not extending on to base and with parasigmoid curve less pronounced than in Zygopleura; weak spiral threads on whorl side, stronger ones on base; apertural margin slightly reflected anteriorly to form ill-defined spout, possibly a rudimentary siphonal outlet. U.Trias.—M.Jur. (Baj.), cosmop.—Fig. 209,1. *K. feriniana (D'ORBIGNY), M.Lias., Fr.; × 1 (111).

Kitliconcha BONARELLI, 1927 [*Zygopleura (Kitliconcha) cassiana, pro Loxonema walmstedtii KITTL (parim.), 1894, non Turritella walmstedti KLIPSTEIN, 1843]. Broad and less acute than in most genera of family; whorls strongly convex; collabral riblets strong on spire whors, where only their opisthocyrt upper part is exposed, obsolete on last whor except for a varix; no spiral ornament. M. Trias.—Ladin., Eu.—Fig. 209,4. *K. cassiana, S.Tyrol; 4a-c, × 1 (64).

Anoptychia KOKEN, 1892 [*Melania supraplecta MÜNSTER, 1841; SD Cossmann, 1909]. Whorls flat to feebly convex; in some species a carina occupies periphery of last whorl and is just exposed on those of spire; collabral riblets on early whors only; spiral threads weakly developed on sides, stronger on base. M.Trias.—(Ladin.)—M.Jur. (Baj.), cosmop.—Fig. 209,7. *A. supraplecta (MÜNSTER), M.Trias. (Ladin.), S.Tyrol; × 3 (64).

Allocosia Cossmann, 1897 [pro Heterocosmia KOKEN, 1896, non EiHENBERG, 1872] [*Holopella grandis HÖRNES, 1855]. Large, slightly coeloco­noid, very acute at apex; whors strongly convex, collabral riblets confined to very early ones, spiral threads more persistent; aperture (if appearance is not due to fracture) with spoutlike siphonal outlet. M.Trias.—U.Jur., cosmop.—Fig. 209,11. *A. grandis (HÖRNES), U.Trias. (Nor.), Aus.; 11a, b, × 1, 0.5 (79).

Hypressileura KOKEN, 1892 [*H. cathedralis]. Slender, with high, almost flat whors; early whors with feebly sigmoid riblets, which later fade away progressively, partly or wholly, from their abapical end upward; spiral threads present in some. M.Trias.—(Ladin.)—U.Jur. (M.Lias.), Eu.—Fig. 209,5. *H. subnodosa (KLEIPSTEIN), M.Trias. (Ladin.), S.Tyrol; 5a-c, × 1 (64).

Tyrossicus KITTL, 1892 [*Tyrossicus cassianii COX (nom. nov.) =*Turritella compressa MÜNSTER, 1841 (non MÜNSTER, 1840); SD Cossmann, 1909] [=Stephanocosmia Cossmann, 1895 (pro Coronaria KOKEN, 1892, non LOWE, 1854)]. Whors low, convex or with median angulation, bearing at mid-height row of blunt tubercles located in some species on axial riblets crossing the strongly parasigmoid growth lines; spiral threads present in some. M.Trias.—U.Jur. (Raurac.), cosmop.—Fig. 209,12. *T. subcompressus KITTL, M.Trias. (Ladin.), S.Tyrol; 12a, b, later whors, × 1 (64).

Goniospira Cossmann, 1895 [pro Goniogrya KITTL, 1894 (non AGASSIZ, 1857)] [*Turritella armata MÜNSTER, 1841]. Small; whors high, steeply coiled, with sharply angular nodose periphery at mid-height; 2nd angulation, continuing suture, defining spirally striated part of base of last; growth lines strongly parasigmoid. M.Trias., Eu.—Fig. 209,3. *G. armata (MÜNSTER), S.Tyrol; 3a-b, × 1, × 2 (64).

1 MüNSTER in 1841 described 2 different species (now included in Anoptychia) under the names Melania supraplecta and Turritella supraplecta. Koken, when founding Anoptychia, cited Chemnitzia supraplecta MÜNSTER as one of its species, and, as at that time only Melania supraplecta had been transferred to Chemnitzia (by D'ORBIGNY, 1850) it could be argued that this was the species intended. Cossmann, however, cited Turritella supraplecta as type species of Anoptychia, although in illustration of it he reproduced Kitl's figure of Melania supraplecta. KITTL had sunk Turritella supraplecta in the synonymy of T. carinata MÜNSTER (unfortunately a homonym of T. carinata LEA). Melania supraplecta is here cited as type species of Anoptychia (see also HAM, 1953, p. 122 [no. 50 in following reference list]).
**Raha Marwick**, 1953 [*Coronaria spectabilis* TRECHMANN, 1918]. Large, coeloconoid; lower part of whorls with strong rounded ribs ending by suture in tubercles; spiral threads present, strongest on unribbed region; collabral lines almost straight. *U.Trias.*-[*Carn.*], N.Z.—Fig. 209,10. *R. spectabilis* (TRECHMANN); X0.7 (204).

**Allostrophia Kittl, 1894** [*Melania perversa* MÜNSTER, 1841]. Sinistral; whorls moderately convex; collabral riblets with strong sigmoid curve, and becoming obsolete on later whorls; no spiral ornament. *M.Trias.*-[*Ladin.*]-*U.Trias.*-[*Nor.*], Eu.-S.Am.—Fig. 209,2. *A. perversa* (MÜNSTER), *M.Trias.*-[*Ladin.*], S.Tyrol; 2a,b, X1 (10).

**Virgella DEGREGORIO, 1930** [*V. jucunda*]. Small, sinistral; early whorls unknown, later ones high, feebly convex, bearing close-spaced narrow collabral riblets parallel with axis, not sigmoid. *L.Jur.*, Sicily.—Fig. 209,13. *V. jucunda*; 13a,b, X3 (174).

**Rigauxia COSSMANN, 1885** [*Chemnitizia canaliculata* RIGAUX & SAUVAGE, 1868; SD COSSMANN, 1909]. Very acute; whorls high, feebly concave to feebly convex, with narrow sutural ramp in some species; presence of narrow parasigmoid collabral riblets, low varices, and spiral threads variable. *L.Jur.*-[*M.Jur.*](Callov.), Fr.-Sinai.—Fig. 209,6. *R. canaliculata* (RIGAUX & SAUVAGE), *M.Jur.* (Bathon.), Fr.; 6a,b, X1, X1.5 (17).

**LOXONEMATEA** Genus inquirendum

**Protostylus Mansuy, 1914** [*P. lantenoisi*; SD BATTEN, 1952 (4, p.355)]. Smooth, unornamented, with flat whorls and shallow sutures; labrum and protoconch unknown. *Perm.*, SE.Asia.—Fig. 209,8. *P. lantenoisi*, Yunnan; X1.3.

**Superfamily CERITHIACEA**

**Fleming, 1822**

[nom. transl. et correct. COSSMANN, 1906 (ex Cerithiidae Fleming, 1822)]

Shell mostly high-spired, with many whorls, less commonly of other shapes; operculum spiral; penis absent. *L.Dev.-Rec.*
Family TURRITELLIDAE Woodward, 1851

Family Turritellidae also erected in the same year independently by W. Clark; =Acanthonematidae Wenz, 1938.

High-spired, with 8 to 20 or more whorls, spiral ornament commonly conspicuous; shallow labral sinus usually culminating at or above mid-whorl with upper limb extending farther adaperturally than lower; siphonal notch or canal wanting. L.Dev.-Rec.

Turritella Lamarck, 1799 [*Turbo terebra Linné, 1758]. Moderate to large, slender; whorls convex, neanic primary spirals starting in the order abapical-medial-adiapical; outer lip arcuate, lateral sinus shallow, oblique; no basal sinus. Oligo.-Rec., SE.Asia-E.Indies-Japan; Mio., S.Eu.-N.Afr.-trop. & subtrop. Am.

Acanthonema Sherzer & Grabau, 1908 [*A. holopiforme (=Orthonema newberryi Meek, 1873); SD Grabau & Shimer, 1909]. With spiral row of spirally elongate pustules just below upper suture and in some shells 1 or 2 similar rows just above lower suture; minutely phaneromphalous. L.Dev., N.Am.—Fig. 210,1. *A. newberryi (Meek), Ohio; ×2.

Orthonema Meek & Worthen, 1862 [*Eunema? saltieri Meek & Worthen, 1861]. Commonly with very slight subsutural shoulder, principal spiral thread or carina just below it coinciding roughly with culmination of labral sinus, then below this a pair of threads, angulations or carinae; anomphalous. L.Carb.(Miss.)-M.Perm., N.Am.-Eu.—Fig. 210,5. *O. saltieri (Meek & Worthen), M.Penn., Ill.; ×4.

Callispira Nelson, 1947 [*C. quinquecostata]. Much like Orthonema but with 5 or 6 closely spaced spiral cords and labral sinus culminating on 2nd cord (105, p. 464). Penn., N.Am.-NE.Asia.—Fig. 210,4. *C. quinquecostata, M.Penn., Tex.; ×2.

Family PROCERITHIIDAE Cossmann, 1905

[nom. correct. Wenz, 1938 (pro Procerithiidae Cossmann, 1905)]

Commonly high-spired; ornament of collateral and spiral elements, former commonly dominant but wanting in some genera; varices rarely present; apertural margin entire or with rudimentary siphonal outlet, at most a small sinus or break.


Spanionema Whidborne, 1891 [*Loxonema scalaroides Whidborne, 1889]. Outer lip prosocline, with a few heavy irregularly spaced varices; no labral sinus; seemingly anomphalous. M.Dev., Eu.—Fig. 210,2. *S. scalaroides (Whidborne), Eng.; ×1.3.

Kinishbia Winters, 1956 [*K. nodosa]. High-spired, with many whorls; sides slightly coeloconoidal, base rounded, narrowly phaneromphalous, with short inhalant canal; whorls somewhat inflated but with spiral groove above low peripheral carina; sutures shallow; ornament a row of nodes on shoulder, each composed of 2 or 3 smaller nodes arranged vertically; labrum seemingly orthocline (151, p.44). M.Perm., N.Am.—Fig. 210,3. *K. nodosa, Ariz.; ×3.3 (151).

Superfamily CYCLOPHORACEA

Gray, 1847

[nom. transl. Knight, Batten & Yochelson, herein (ex Cyclophoridae Gray, 1847)]

Prevailing conispiral but varying in shape; pedal ganglia ladder-like; pallial cavity commonly transformed into a lung, without ctenidium; operculum coneous, typically multispiral. Habitat fresh-water and terrestrial. L.Carb.(Miss.)-Rec.
Family CYCLOPHORIDAE Gray, 1847
Apertural margins commonly somewhat thickened or reflexed, with or without apertural teeth or notches. L.Carb.(Miss.)-Rec.

Subfamily DENDROPUPINAE Wenz, 1938
Small, pupiform, with one or more lamellar teeth in aperture; whorls smooth or with numerous collateral threads; operculum unknown. L.Carb.(Miss.)-L.Perm.

Owing to certain errors in assignment of geologic age and in understanding of morphological features, genera included in this subfamily have been placed previously with pulmonate families, principally the Pupillidae. No compelling reason is seen to recognize the occurrence of Pulmonata in the Paleozoic—indeed, it seems improbable that representatives of this group appeared so early. The Dendropupinae may be classed in the Cyclophoridae close to the Diplomatinae or actually incorporated in this subfamily, which contains several pupiform genera with toothed apertures and ornament consisting of numerous collabral threads. The occurrence of genera here included in the Dendropupinae indicates that they are not marine forms but evidence for assignment of a terrestrial or fresh-water habitat, or both, is inconclusive.

?Carbonispira YEN, 1949 [*C. scotica]. Little known, based on poorly preserved specimen, described characters probably due to crushing and corrosion (152, p. 238). L.Carb., Eu.

Dendropupa OWEN, 1861 [*Pupa vetusta DAWSON, 1859] (=Strophites DAWSON, 1880 (non DESHAYES, 1832); ?Strophella DAWSON, 1895). Relatively large, cylindrical pupiform, with numerous fine collateral threads. [Aperture of type species poorly known; a specimen with broken whorls discloses what seem to be lamellar columellar teeth but their number and position are not clear. There is little to support DAWSON's drawing of the aperture.] Miss.-Penn., N.Am.—Fig. 211,1. *D. vetusta (DAWSON), Penn., Can.(N.Scot.); final whorl showing broken internal folds, X6.7.

Maturipupa PILSBRY, 1926 [*Pupa vermilionensis BRADLEY, 1872]. Without ornament; aperture with strong lamellar parietal tooth; colunellar lip arcuate and truncate at notched base; labrum not thickened. [Eventually may be shown to represent juvenile stages of Anthracopupa.] L.Carb.(Miss.); U.Carb.(Penn.), N.Am.-Eu.—Fig. 211,2. *M. vermilionensis (BRADLEY), M.Penn., Ill.; X13.3.

Anthracopupa WHITFIELD, 1881 [*A. ohioensis]. Ornament of faint collateral threads; spire and base both somewhat tapering; aperture with strong lamellar parietal tooth and columellar tooth, notch on inner side of upper end of labrum, which, like columellar lip, is considerably thickened at final growth stage. L.Perm., N.Am.—Fig. 211,2. *A. ohioensis, Ohio; X13.3.

[The remaining subfamilies of the Cyclophoridae are post-Paleozoic, the majority being confined to Cenozoic deposits.]

Family VIVIPARIDAE Gray, 1847
Broadly turbiniform; anomphalous or minutely phaneromphalous; mostly unornamented but spiral cords or rows of pustules present on some shells. Living species inhabit fresh water and are viviparous. ?L.Carb.,Jur.-Rec.

Viviparus MONFORT, 1810 [*V. fluviorum (= Helix vivipara LINNÉ, 1758)] [=Paludina FURSAC, 1812]. Medium-sized, mostly with smooth, convex whors, but some species with carinate or nodosely carinate whors. Jur.-Rec., cosmop. [A record from the Lower Carboniferous of England was based on an internal mold, perhaps of a marine shell, and needs confirmation before acceptance.]
Superfamily RISSOACEA
Adams & Adams, 1854

Shell mostly small, commonly turriculate or ovate, more rarely turbiniform to subdiscoidal, smooth or ornamented; mostly holostomatous, aperture circular or ovate. Perm.-Rec.

Family HYDROBIIDAE Stimpson, 1865

Shell small or minute, smooth or with collabral threads or riblets, rarely spirally carinate. Operculum horny, spiral. [Mostly in fresh or brackish water.] Perm.-Rec.

Superfamily SUBULITACEA
Lindström, 1884

Subulate, acicular to subglobular; commonly with anterior notch and columellar fold, although these are but weakly developed in some, also basically with parietal fold; inner shell layers not sharply differentiated, not nacreous. M.Ord.-M.Perm.

Inasmuch as the superfamily is extinct, anatomical features can be inferred only from characters of the shell. The total lack of a sinus or slit in the outer lip argues for advanced anatomical asymmetry. Surely only a single ctenidium, probably of cteno-branch type, was present. Likewise, all other primitively paired pallial organs must have been represented only by the topographically left-hand member. The anterior notch and columellar fold probably were associated with an inhalant siphon and the pallial currents presumably made their exit at the angle where the outer lip joins the preceding whorl. The derivation of the group is uncertain but it probably was close to the Loxonemataceae.

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elongatus "HALL." =EMMONS, non M. elongatus PHILLIPS, 1841). Subulate to fusiform, spire high and straight or short and curved; whorls flat or gently arched, with shallow sutures; aperture narrowly elongate, with small but sharp anterior notch; labral inductura present; ornament lacking.


S. (Subulites) [=Polyphemopsis PORTLOCK, 1843]. Spire straight, whorls high, last one occupying about half of total height; aperture acuminated above, widest below. M.Ord.-U.Sil., N.Am.-Eu.-NC.Asia.—Fig. 212,7. *S. (S.) subelongatus (d'ORBIGNY), M.Ord., N.Y.; ×1.3.

S. (Cyrtospira) ULRICH in ULRICH & SCOFIELD, 1897 [*C. tortilis; SD COSSMANN, 1909]. Axis of shell curved, last whorl occupying much more than half of total shell height. M.Ord.-U.Sil., N.Am.-Eu.--Fig. 212,4. *S. (C.) tortilis (ULRICH), M.Ord., Tenn.; ×2.

S. (Fusispira) HALL, 1872 [*F. ventricosa; SD S.A.MILLER, 1889]. Fusiform; aperture narrow, acuminate above and narrower below than in S. (Subulites). M.Ord.-L.Dev., N.Am.-Eu.-NE.Asia.--Fig. 212,3. *S. (F.) ventricosus (HALL), M.Ord., Wis.; ×0.7.

Bulimorpha WHITFIELD, 1882 [pro Bulimella HALL, 1858 (non PFEIFFER, 1854)] [*Bulimella bulimiformis HALL, 1858]. Fusiform, with gently arched whorls, final whorl more than half of total height; well-developed siphonal fold seen in broken specimens. Miss., N.Am.—Fig. 212,2. *B. bulimiformis (HALL), M.Miss., Ind.; apertural view with window showing columellar features, ×4.

Leptoptygma KNIGHT, 1936 [*Auriptygma virgatum KNIGHT, 1931]. Fusiform but with rounded base, sutures deep; labral inductura with low fold not covering parietal lip; siphonal channel below fold very wide and diffuse; ornament lacking or consisting of fine collabral threads. Miss., N.Am.—Fig. 212,1. *L. virgatum (KNIGHT), M.Penn., Mo.; apertural view with window showing columellar features, ×4.

?Sinospira YIN, 1932 [*S. ornata]. Naticiform, with protruding spire and moderately deep sutures; ornament of fine collabral threads; apertural features unknown. [May prove to be senior synonym of Leptoptygma.] U.Carb., E.Asia.—Fig. 212,5. *S. ornata, China; ×1.3 (153).

Ceraunocochlis KNIGHT, 1931 [*C. fulminula]. Very small, subulate, whorls of spire, low, first whorl button-like; sutures very shallow; entire labrum covered by inductura, with small anterior notch; without ornament. Miss.-Penn., N.Am.—Fig. 212,6. *C. fulminula, M.Penn., Mo.; ×10.

Subfamily SOLENISCINAE Wenz, 1938 [nom. transl. KNIGHT, BATTEN & YOCHelson, herein (ex Soleniscidae Wenz, 1938)]

Parietal fold present, in some genera appearing as diffuse thickening on parietal inductura. M.Dev.-M.Perm.

Ianthinopsis MEER & WORTHEN, 1866 [*Platyostoma? tumida MEER & WORTHEN, 1861] [=Plectostylus CONRAD, 1842 (non BECK, 1837);...
Strobas deKoninck, 1881; Sphaerodoma Keyes, 1889; Strobaeus Cossmann, 1909 (pro Strobas deKoninck, 1881, obj.). Form variable, globular with pointed apex to high-spired fusiform; without ornament but exceptionally with faint spiral ridges; strong columellar siphonal fold barely visible in unbroken apertures but well developed just within it, resorbed in all but last 1 or 2 whorls; an obscure parietal fold may appear as broadly arched thickening of parietal inductura; labrum thin but thickening as growth proceeds until outer shell wall is very massive and earlier whorls completely filled, with whorl partitions and columella much reduced by resorption. M.Dev.-M.Perm., N.Am.-S.Am.-Eu.-NE.Asia-SE.Asia-NC.Asia. — Fig. 213,4. *S. tumida (Meek & Worthen), U. Penn., Tex.; apertural view with window showing development and resorption of columellar fold and filling of earlier whorls, X1.3.

Soleniscus Meek & Worthen, 1861 [pro Macrochelus Phillips, 1841 (non Kirby, 1838)] [*S. typicus] [Duncania Bayle, 1879; Macrochilina Bayle, 1880 (pro Duncania Bayle, 1879, non deKoninck, 1872); Macrochilus Lindström, 1884]. Fusiform; with small siphonal notch visible externally; small siphonal canal present internally with more or less elevated parietal fold somewhat above it; ornament lacking. Miss.(L. Carb.)-M.Perm., N.Am.-Eu.-NE.Asia-SE.Asia.—Fig. 213,3. *S. typicus, M.Penn., Ill.; 3a, apertural view with window showing columella, X1.3; 3b, apertural view with broken lip exposing columella, X2.7.

?Procerithiopsis Mansuy, 1914 [*P. ambigua; SD Cossmann, 1918]. Small, minutely phaneromphalous, with rather strong collabral ribs; seemingly with small siphonal notch and columellar folds much as in Soleniscus. L.Perm., SE.Asia.—Fig. 213,6. *P. ambigua, Cambodia; apertural view with window showing columellar folds, X6.

Cylindritopsis Gemmellaro, 1889 [*C. ovalis; SD Cossmann, 1909] (=Ankorella Delfey, 1941 (29, p. 272)). Ovoid, with shallow sutures and small spire; base produced anteriorly with deep siphonal notch and heavy siphonal fold, higher parietal fold in middle of parietal lip being set off by deep groove; parietal inductura well developed. M.Perm., Eu.-Asia.—Fig. 213,2. *C. ovalis, Sicily; X2 (46).

Labridens Yochelson, 1956 [*L. shupeii]. Form much as in Cylindritopsis but with relatively higher spire; base produced anteriorly with small siphonal fold, a stronger fold above it low on parietal lip and still higher a very low obscure fold bordered by shallow groove; labium thin, with prominent sharp lira or internal fold approximately opposite 3rd low fold on parietal lip; surface without ornament (156, p. 45). This is a unique Paleozoic genus in having a well-developed labral lira, which, with the parietal folds, suggests that the Jurassic and Cretaceous Nerineacea may have had their origin here.] M.Perm., N.Am.—Fig. 213,1. *L. shupeii, Tex.; X3.

Family MEEKOSPIRIDAE Knight, 1956
Without columellar fold and anterior notch; ?U.Sil., L.Carb.(Miss.)-M.Perm.

?Auriptygmo Pernier, 1903 [*A. fortior; SD Cossmann, 1909]. Very similar to Leptopygyma but columella thin and gently spiral about pseudumbilicus, without columellar fold. U.Sil., Eu.—Fig. 214,3. *A. fortior, Czech.; X1.3.

Meekospira Ulrich, in Ulrich & Scofield, 1897 [*Eulima? peracuta Meek & Worthen, 1861] (= Cossmann, 1920 (20, p. 83); Cambodiagrama Strand, 1928). Slender, sharply acuminate; columellar lip somewhat arcuate, reflexed, inductura not covering upper part of parietal lip. L.Carb.(Miss.)-L.Perm., N.Am.-S.Am.-Eu.-SE.Asia.—Fig. 214,2. *M. peracuta (Meek & Worthen), M.Penn., Ill.; X1.3.

Girtyspira Knight, 1936 [*Bolimella canaliculata Hall, 1858]. Small, fusiform, with relatively high final whorl which has narrow ramp or is adpressed, columellar lip arcuate. L.Carb.(Miss.­)­M.Perm., N.Am.-Eu.—Fig. 214,1. *G. canaliculata (Hall), M.Miss., Ind.—X6.7.

Subclass OPISTHOBRANCHIA
Milne Edwards, 1848
[nom. emend. Bronn, 1862 (pro Opisthobranchiata, nom. correct. Woodward, 1851, also Morris & Lyceyt, 1851 (pro 'opisthobranches' Milne Edwards, 1848, invalid vernacular name)), nom. auct. conscr. proposed Cox, 1958 (ICZN pend.)]

Shell tending to be reduced or absent; if present, either aciculate (Pyramidellidae) or more commonly low-spired, involute or convolute, and commonly covered largely by expansions of the mantle or foot which cannot always be entirely withdrawn into it; columellar folds frequent; protoconch commonly heterostrophic, ornament absent

Fig. 214. Subuliticea (Meekospiridae) (p. 1321).
or if present commonly confined to spiral elements, operculum commonly absent in adult, tentacles ear-shaped or flattened; eyes sunken, mantle cavity becoming shallow, commonly rotated to face more or less to the right and finally lost with shell; gills in mantle cavity foliobranch, not filamentous, absent in some genera, replaced in others by pallial outgrowths; ciliated strips present on right side of mantle cavity to help exhalant current, tendency to concentrate all ganglia on dorsal side of esophagus with consequent elongation of pedal and parapedal commissures and shortening of visceral loop, leading to euthyneury (except Acteonidae and Toledonidae); ventricles anterior to auricle (except Acteonidae, Pyramidellidae, Ringiculidae); hermaphrodite; penis invaginable (except Acteonidae), commonly armed; reproductive ducts tending to be sunk in haemocoele and to split into separate vas deferens, oviduct, and vagina; esophagus without glands, its opening into stomach adjoining that of intestine, with stomach tending to be reduced to a caecum; histology of digestive gland comparatively elaborate. Marine only, eggs hatch to freeswimming veligers showing torsion and operculum. *Dev., Miss.-Rec.*

**Family STREPTACIDIDAE Knight, 1931**

High-spired, with moderately deep labral sinus that culminates roundly high on whorl; protoconch with initial discoidal whorl that caps spire flatly or is deviated either simply or at top of a variably long segment of disjunct whorls. *Dev., L.Carb. (Miss.)-M.Perm.*

The shell form in this family and particularly the labral sinus remind one strongly of the Loxonematacea, from which they probably were descended. The protoconch is very similar to that found in the Mathildidae to which they may be closely related.

**Donaldina Knight, 1933 ["Acisina grantonensis Donald, 1898].** Ornament of spiral threads confined generally to lower part of whorl. *Dev., L.Carb. (Miss.)-L.Perm., N.Am.-Eu.*--Fig. 215,3. *D. grantonensis (Donald),* L.Carb., Scot.; 3a, apertural view, X10; 3b, heterostrophic apex, X25.

**Platyconcha Longstaff, 1933 [*P. dunlopiana].** Ornament of strong collateral costae. *L.Carb.-U.Carb., Eu.*--Fig. 215,2. *P. dunlopiana, L.Carb., Scot.*; apertural view showing flat apex, X9.

**Streptacus Meech, 1872 [*S. whitfieldi].** Very slender, ornamented only with growth lines. *U.Carb. (Penn.)-M.Perm., N.Am.-Eu.*--Fig. 215,1. *S. whitfieldi, M.Penn., Ill.*; apertural view showing heterostrophic apex, X10.

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**Order UNCERTAIN**

**Superfamily PYRAMIDELLACEA**

d'Orbigny, 1840

[nom. transl. Wenz, 1938 (ex Pyramidellidae d'Orbigny, 1840)]

Small, aciculate; with or without columnellar fold, protoconch orthostrophic, heterostrophic, or deviated. *Dev., Miss.-Rec.*

The work of Thorson (1946) and Fretter & Graham (1949) has demonstrated that the Pyramidellidae are opisthobranchs and that some (if not all) living species are highly specialized ectoparasites. The presence and size of the heterostrophic or deviated protoconch found in most species may be a measure of time spent as freeswimming larvae. Living species lack radulae. There is no evidence of parasitism or lack of a radula in the other families (Streptacididae, Mathildidae) that may be included because of form and protoconch. The reported radula of a living species assigned to the Mathildidae, as well as the assignment itself, should be reinvestigated.
Pyramidellacea, Acteonacea, Pelagiellacea

Order PLEUROCOELA Thiele, 1925
Commonly with dextral shell and mantle cavity but both tending to become obsolete; shell commonly involute, nearly so, or convolute. Miss.-Rec.

Superfamily ACTEONACEA d'Orbigny, 1842
[nom. transl. Wenzy, 1938 (ex Acteonidae d'Orbigny, 1842)]
[=Cephalaspidea Fischer, 1883]
Shell commonly external but in many forms enclosed by mantle. Miss.-Rec.

Family ACTEONIDAE d'Orbigny, 1842
Shell spiral, external, commonly with spiral ornament, columnella commonly with 1 or 2 folds; with corneous operculum and cephalic shield, soft parts completely retractable into shell; streptoneurous; auricle in front of ventricle. L.Carb.-Rec.

Acteonina d'Orbigny, 1850 [*Chemnitzia carbonaria deKoninck, 1843; SD Meek, 1863] [=Acteonina Fischer, 1883 (obj.)]. Small, cylindrical, with high narrow aperture and very short gradate spire; protoconch seemingly a single deviated whorl, partly immersed; with collar-like structure above suture; probably a fold low on columnella; fine spiral striae. L.Carb., Eu.—Fig. 216,1.
*A. carbonaria (deKoninck), Belg.; X4.

?GASTROPODA INCERTAE SEDIS
The genus Pelagiella is classed tentatively as belonging to the Gastropoda because shell form suggests this assignment, but it is not possible to reach conclusions about its relationships within the class. If Pelagiella is a gastropod, its remoteness from others is indicated by such features as the presence of fine spiral striae inside the shell, gerontic thickening inside the aperture, filling of apex by solid shell matter, variable position of apertural sinuses, and common occurrence of dextral and sinistral individuals in a single species. Each of these characters is found in some very much later gastropods but few of them appear in Paleozoic forms. Comprehensive studies based on large collections have never been made.

Superfamily PELAGIELLACEA Knight, 1956
Shell comprising 0.5 to 3 whorls, rather flattened on top and arched below or rotelliform above and umbilicate below, with sharply rounded periphery; initial whorl (protoconch) wider than thick, with faintly bulbous beginning; shell relatively thick and may be filled completely near apex so as to produce short blunt curved steinkerns; with one or more labral sinuses (indicated by growth lines) that vary in shape, depth and position in different species; with numerous very fine spiral grooves inside of shell in some species; external ornament wanting or consisting of fine spiral and collabral markings. Cam.

This little-known assemblage is difficult to study and to place systematically. Some authors (Wenzy, 1938; Knight, 1952) have doubted that they are gastropods.

Family PELAGIELLIDAE Knight, 1956
With characters of superfamily. Cam.

Pelagiella Matthew, 1895 [*Cytolithes atlantoides Matthew, 1894] [=Parapelagiella, Proceceoecius, Protocæcoecia Kobayashi, 1939 (77, pp. 286-287); Semicircularia Lochman, in Lochman & Duncan, 1944 (91, p. 44)]. Dextral or sinistral, with broad blunt apex and rapidly expanding helicocone; shallow sinus culminating at periphery or with one or more sinuses above or below periphery; interior marginal thickening of gerontic shell indicated by steinkerns. [Parapelagiella was proposed for forms without the supposed constricted apertural margin of Pelagiella, but this is a gerontic feature of Pelagiella itself, though seen rarely; Proceceoecius was proposed for forms with a ridge on the upper shell surface and Protocæcoecia...
gyra for sinistral forms. In so-called Proecyliop-
terus sinuses above and below the periphery gen-
erate ridges, and there are both dextral and sinistral
individuals in the type species. Semicircularia is
based on steinkerns of a sinistral form, the sup-
posed short blunt uncoiled spire denoting apical
filling of the shell. All these forms are considered
to be congeneric with Pelagiella.] Cam., N.Am.
NE.Asia. — Fig. 216,2. *P. aitantoides
(Matthew), L.Cam., N.B.; X4.

GENERIC NAMES ASSIGNED TO
PALEOZOIC FOSSILS IMPROPERLY
REGARDED AS GASTROPODA AND
MONOPLACOPHORA

Anticalytreac Quinsteed, 1867 [=Autodetus
Lindström, 1884] (worm).
Archaeonassa Fenton & Fenton, 1937 (tail).
Barella Hedstrom, 1930 (hyolithid operculum).
Charrua Rusconi, 1955 (problematical organism).
Chubooia Walcott, 1879 (carbon scale).
Colecitus Hall, 1879 [pro Coleoptrion Hall, 1876
(non Sandberger, 1847)] (hyolithid).
Conchoptiss Walcott, 1879 (scyphozoan).
Conularia Miller (1818) in Sowerby, 1821 (Scy-
phozoan).
Halophiala Koken, 1925 (?pelecypod).
Harttites Howell & Knight, 1936 [pro Hartti
Walcott, 1884 (non Steindachner, 1877)] (not a mollusk).
Hercynella Kayser, 1878 [pro Pilidium Kayser,
1878 (non Müller, 1846; nec Forbes, 1849; nec
Middendorff, 1851); Pilidion Perner, 1911 (non
Wagler, 1830)] (pelecypod).
Hyolithellus Billings, 1871 (hyolithid) and Dis-
cinella Hall, 1871 (its operculum).
Hyolithes Eichwald, 1840 (hyolithid).
Matthievia Walcott, 1885 (possibly extinct class of
unknown affinities).
Mohergella Hedström, 1923 (hyolithid operculum).
Paoshanella Yin, 1937 (problematical organism).
Polyopera Clark, 1925 (hyolithid).
Rectogloia Van Tul & Berckheimer, 1914
coprolite).
Salterella Billings, 1865 (hyolithid).
Scenellopsis Resser, 1938 (probably not a mollusk).
Stenotheca Salter, 1872 (crustacean).
Stenothecoides Resser, 1938 (?crustacean).
Tentaculites Schlotheim, 1820 (?worm).
Watsonella Grabau, 1900 (conchostracan).

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**SOURCES OF ILLUSTRATIONS**

( Supplementary to works cited in the preceding list of references)

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Since the manuscript was prepared the following generic names proposed for Paleozoic gastropods have come to the attention of Knight, Batten and Yochelson. The suggested systematic placement of these genera is given below, but in order not to delay publication of the Treatise volume, no illustrations or diagnoses are given.

**Acevina Rusconi, 1952** [*?Helcionella (Acevina) cucunchnensis*] Archaeogastropoda, incertae sedis. M.Cam., S.Am.(Arg.).

**Cycloscena Fletcher, 1958** [*C. anomphala*] Anomphalacea, possibly Anomphalidae. Perm., Austral.

**Elkoceras Lintz & Lohr, 1958** [*E. volborthi*] Euomphalacea, Euomphalidae, a junior synonym of *Straparollus (Phanerotinus)*. L.Miss., USA (Nev.).

**Hampilina Kobayashi, 1958** [*H. goniospira*] Helcionellacea, Helcionellidae. Cam., NE.Asia (Korea).

**Lacunospira Batten, 1958** [*L. alta*] Pleurotomariacea, Eotomariidae. Perm., USA(Tex.).

**Lamellospira Batten, 1958** [*L. conica*] Pleurotomariacea, doubtfully Phymatopleuridae. Perm., USA(Tex.).


**Planikenia Fletcher, 1958** [*P. minor*] Pleurotomariacea, Sinuopeidae, a junior synonym of *Keenia*. Perm., Austral.

**Pleurocinctosa Fletcher, 1958** [*Pleurotomaria trifilata Dana, 1947*] Pleurotomariacea, Eotomariidae, a junior synonym of *Peruvispira*. Perm., Austral.

**Rhabdocantha Fletcher, 1958** [*Pileopsis alta Dana, 1849*] Platycearatacea, Platycearatidae, a junior synonym of *Platyceras (Orthomychia)*. Perm., Austral.

**Randomia Matthew, 1899** [*R. aurorae*] Possibly Monoplacophora or Helcionellacea. M.Cam., Newfoundland.

**Strotostoma Fletcher, 1958** [*S. ryltonensis*] Possibly Platycearatacea, possibly Platycearatidae. Perm., Austral.

**Walnichollsia Fletcher, 1958** [*Pleurotomaria subcancellata Morris, 1845*] Pleurotomariacea, not assigned to family. Perm., Austral.

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