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SUPRASPECIFIC GROUPS OF THE
PELECYPOD FAMILY
CORBULIDAE

HAROLD E. VOKES

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SUPRASPECIFIC GROUPS OF THE PELECYPOD FAMILY CORBULIDAE

SUPRASPECIFIC GROUPS OF THE PELECYPOD FAMILY CORBULIDAE

HAROLD E. VOKES

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INTRODUCTION

DURING THE COURSE OF A STUDY, under the auspices of the American Museum of Natural History and the John Simon Guggenheim Memorial Foundation, on the stratigraphy and paleontology of the Lebanon Mountains, Republic of Lebanon, in western Asia, the writer obtained a large fauna from the locality near Abeih, which has been referred to by Whitfield (1891) and subsequent authors as the "Olive Locality." The study of this fauna revealed seven species of corbulid pelecypods differing among themselves to a degree that was, in most cases, considered to be of more than specific importance. This fact led to a review of the supraspecific groups of the family Corbulidae and to certain rather unexpected conclusions which it seems desirable to record.

While it has been customary to refer all relatively small, globose, inequivalved, concentrically ornamented, and posteriorly rostrate pelecypods to the genus *Corbula*, *sensu lato*, a considerable number of names have been proposed for groups which were, when distinguished, considered to be of subgeneric or sectional rank. In the preparation of this report, more than 50 names were considered, which have been referred at one time or another to the genus *Corbula* or to the family Corbulidae. Within this group, however, there are a number of names that were placed there by but one or two authors, which clearly do not belong there and have been referred to other families by subsequent students. Omitting these, there were found in the literature 42 names of groups that had more or less validly been referred to the genus

Corbula or are obviously related to that genus. Of these, 20 have been rejected, and 21 are considered valid as supraspecific names. One homonym is here renamed, and one new genus is described.

The study has been based solely upon the type species of each of the proposed groups. Wherever possible, actual specimens have been examined; where this could not be done, the study was based upon the original illustrations, together with such subsequent figures as were considered authentic. In two cases it has been possible to supplement these illustrations with specimens of species considered by the original author as being closely related to, or synonymous with, the type species. The summary of characters given in the following discussion is based wholly upon this material. Congeneric species have not been considered, since the amount of latitude permitted in the definition of the limits of each group is a matter that is subject to considerable personal interpretation. As a result, however, each group has here been treated as of equal rank, and no distinction as to generic or subgeneric level has been made. The examination of a large number of species will undoubtedly show intergradation between some of the groups, and some will certainly prove to be of subordinate rank. Limitations, both of time and of the original purpose of the study, have precluded any such examinations at this time.

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TENTATIVE CLASSIFICATION

As a result of this study, the following tentative assignment is proposed for the valid supraspecific groups examined.

FAMILY CORBULIDAE

SUBFAMILY CORBULINAE

No chondrophore in the left valve, the resilium being received in a pit on the hinge plate. Cretaceous and Recent.

Corbula Lamarck, 1799; *Corbulomima*, new genus.

SUBFAMILY CARYOCORBULINAE

Left valve with a projecting chondrophore, valves usually subequal, and normally more or less rostrate. Cretaceous (probably Jurassic)–Recent.

Bothrocorbula Gabb, 1873; *Hexacorbula*

Olsson, 1932; *Notocorbula* Iredale, 1930; *Variocorbula* Grant and Gale, 1931; *Caryocorbula* Gardner, 1926; *Panamicorbula* Pilsbry, 1932; *Anisocorbula* Iredale, 1930; *Bicorbula* Fischer, 1887; *Tenuicorbula* Olsson, 1932; *Ursirivus*, new name; *Cuneocorbula* Cossmann, 1886; *Cuspicorbula* Olsson, 1928; *Anapteris* Van Winkle, 1919; *Physoida* Pallary, 1900.

SUBFAMILY CAESTOCORBULINAE

Valves discrepant in shape, the left being more equilateral and less rostrate than the right; with an accessory siphonal plate posterior to the left valve, which fits into the rostrum of the right. Interior of the left valve with a projecting chondrophore. Cretaceous and Eocene.

Caestocorbula Vincent, 1910; *Parmicorbula* Vokes, 1944.

SUBFAMILY CORBULAMELLINAE

Shell very small, valves subtrigonal, lacking both posterior rostrum and umbonal ridge. Posterior adductor seated on raised,

spoon-shaped lamella. Cretaceous.

Corbulamella Meek and Hayden, 1857.

SUBFAMILY PACHYDONTINAE

Valves tending to be twisted and distorted, with the ligamental area so twisted that the resilium was attached to the lateral, rather than to the dorsal, face of the "chondrophore." Oligocene and Pliocene.

Pachydon Gabb, 1868; *Tiza* De Gregorio, 1890.

SUBFAMILY LENTIDIINAE

Shell small, essentially tellinid in external shape. The right valve lacking a hinge plate, with the cardinal tooth seated on a subumbonal thickening projecting from the interior of the valve. ?Miocene–Recent.

Lentidium Cristofori and Jan, 1832.

INCERTAE SEDIS

Semicorbula Cossmann, 1909. Known only from a single right valve which has a well-developed nymph plate.

SYSTEMATIC DESCRIPTION

FAMILY CORBULIDAE FLEMING

SUBFAMILY CORBULINAE

CORBULA LAMARCK, 1799

Plate 1, figures 1-5

Corbula BRUGUIÈRE, 1797, Tableau encyclopédique et méthodique des trois règnes de la nature, vol. 1, pl. 230. *Nomen nudum*.

Not *Corbula* "Bolten" Roeding, 1798, Museum Boltenianum, p. 184 (not validly proposed; see Opinion 1, International Rules of Zoological Nomenclature) (= *Asaphis* Modeer, 1793).

Corbula LAMARCK, 1799, Mém. Soc. Hist. Nat., Paris, p. 81.

Aloidis MEGERLE VON MÜHLFELDT, 1811, Gesellsch. Naturf. Fr. Mag., 5 Jahrb., p. 67 (monotype *Aloidis guineënsis* Megerle von Mühlfeldt = *Corbula sulcata* Lamarck).

TYPE (BY SUBSEQUENT DESIGNATION, SCHMIDT, 1818): *Corbula sulcata* Lamarck. Recent, coast of Senegal.

The generic name *Corbula* was first used by Bruguière as the heading of a plate on which were 18 figures representing six different species. No specific names were employed, but the figures are clear and well illustrate the species concerned. These have subsequently been identified as follows (see Gardner, 1928, p. 226):

1a-c. *Corbula sulcata* Lamarck

2a-c. An undetermined bivalve, probably a *Chama*

3a-c. *Corbula porcina* Lamarck. "Not identified with assurance. Possibly a varietal form of *C. gibba* (Oliv) from the Mediterranean; more probably an exotic; cf. *C. acutangula* Rissel, from the Red Sea" (Gardner, *loc. cit.*)

4a-d. *Corbula nucleus* Lamarck [= *C. gibba* (Oliv)]

5a-c. *Corbula gallica* Lamarck

6a-b. *Corbula margaritacea* Lamarck [= *Anatina trapezoides* Lamarck]

These excellent figures have led to the widespread acceptance of the generic name *Corbula* and to its being credited to Bruguière. As shown by Winckworth (1930, p. 15), however, *Corbula* Bruguière is a *nomen nudum*. Under Article 25 of the International Rules of Zoological Nomenclature, a name to be available has to be "accompanied by an indication, or a definition, or a description," and under Opinion 1, an "indication" is

defined (with regard to genera) as "(1) a bibliographic reference, or (2) a definite citation of an earlier name for which the new name is proposed, or (3) the citation or designation of a type species." All these involve a text, and there is no text accompanying plate 230 in Bruguière's work; hence the generic name *Corbula* is not available as here proposed.

The next use of the name *Corbula* came in 1798, in the Museum Boltenianum (p. 184). Here the name is used for 14 species, none of which is referable to the *Corbula* of Bruguière. In this work, however, while there are bibliographic references given for some of the species included, there is no reference, description, or type designation¹ that would serve to validate the generic name as proposed, and it, too, must be considered as not available.

Lamarck in 1799 (p. 89) used the generic name *Corbula* and referred to Bruguière's plate, adding, however, a short description of the genus, thus validating it. He did not, however, refer any species to the genus and gave no names for the forms figured by Bruguière. Thus *Corbula* Lamarck, 1797, is one of the genera covered in Opinion 46 of the International Rules, being a genus "for which no species was distinctly named in the Original Publication."

In 1801 he referred five species to the genus, three of them, *C. sulcata*, *C. margaritacea*, and *C. gallica*, having been figured by Bruguière. However, he did not select or in any way indicate a type for the genus, and all five species were thus available as genosyntypes for subsequent selection as the genotype.

It has been pointed out by Stewart (1930, p. 286) that the first such type designation was that of Schmidt in 1818 (pp. 77, 177) who designated *Corbula sulcata* as type of

¹ Winckworth (March 13, 1930) designated *Corbula anomala* "Bolten" as the type, a designation which makes *Corbula* "Bolten" Roeding a synonym of *Asaphis* Modeer, 1793. In the same year (June 27, 1930) Iredale (p. 404) designated *Corbula rosea* as type of *Corbula* "Bolten," an action which would also serve to reduce the name, if it were valid, to the synonymy of *Asaphis*.

Corbula Lamarck. Unfortunately, however, Schmidt designated three species as types on an earlier page (p. 57). Grant and Gale (1931, p. 420, footnote 1) suggest that, because of this, Schmidt's designations "may be disregarded" and the designation by Children (1823, p. 301) of *C. nucleus* Lamarck [= *C. gibba* (Olivi)], may be accepted. This species was not, however, available for designation, not being one of the original genosyntypes. (The name *C. nucleus* was not proposed by Lamarck until 1818, p. 496.) Despite the earlier *lapsus* by Schmidt, there are no valid grounds upon which his later designations

of *C. sulcata* may be disregarded, and this is here accepted as the type species.

DIAGNOSIS OF THE TYPE SPECIES: The shell is large and heavy, the valves unequal, the right being larger than the left. Both valves are sharply rostrate with a prominent keel extending from the umbo to the posterior ventral margin, and another of lesser strength extending to the dorsal side of the posterior end, the area between the two keels being conspicuously concave on both valves but bearing an additional median groove on the left. The sculpture is concentric, that on the right valve consisting of coarse, rounded

PLATE 1

Corbula sulcata Lamarck. Recent. Senegal.

1. Exterior of right valve, topotype, A.M.N.H. No. 33847: 1. $\times 1.5$.

2. Dorsal view of same specimen. $\times 1.5$.

3. Left side of same specimen. $\times 1.5$.

5. Interior of right valve of this specimen. $\times 1.55$.

5. Interior of left valve, topotype, A.M.N.H. No. 33847: 2. $\times 1.6$.

Notocorbula vicaria Iredale. Recent. Sydney Harbor, Australia.

6. Exterior of right valve. Reproduction of Iredale's original figure, plate 65, figure 3. $\times 1.6$.

7. Dorsal view of conjoined valves. Reproduction of Iredale's original figure, plate 65, figure 9. $\times 1.5$.

8. Exterior of left valve. Reproduction of Iredale's original figure, plate 65, figure 4. $\times 1.5$.

9. Interior of right valve. Reproduction of Iredale's original figure, plate 64, figure 9. $\times 1.5$.

10. Dorsal view of left valve to show chondrophore. Reproduction of Iredale's original figure, plate 64, figure 8. $\times 1.2$ (?).

Varicorbula gibba (Olivi). Recent. Zetland, British Isles.

11. Exterior of right valve, hypotype, U.S.N.M. No. 172150. $\times 2$.

12. Interior of right valve of same specimen. $\times 2$.

13. Dorsal view of same specimen. $\times 2$.

14. Interior of left valve of same specimen. $\times 2$.

15. Left side of same specimen. $\times 2$.

Caryocorbula alabamiensis (Lea). Eocene. Claiborne, Alabama.

16. Dorsal view of left valve, topotype, U.S.N.M. No. 154904. $\times 2$.

17. Exterior of right valve, topotype, U.S.N.M.

No. 154904. $\times 1.9$.

18. Interior of right valve, same specimen as figure 17. $\times 2$.

19. Interior of left valve, same specimen as figure 16. $\times 2$.

20. Exterior of left valve, same specimen as figure 16. $\times 2$.

Hexacorbula hexacyma (Brown and Pilsbry). Miocene.

21. Interior of left valve, hypotype, U.S.N.M. No. 559499. $\times 2.8$.

22. Exterior of left valve, same specimen as figure 21. $\times 2.8$.

23. Dorsal view of left valve, same specimen as figure 21. $\times 2.8$.

Bothrocorbula viminea (Guppy). Miocene. Bowden, Jamaica.

24. Exterior of left valve. Reproduction of Woodring's figure, (1925), plate 26, figure 7. U.S.N.M. No. 115648. $\times 2.3$.

25. Exterior of right valve. Reproduction of Woodring's figure, (1925), plate 26, figure 5. U.S.N.M. No. 115648. $\times 2.3$.

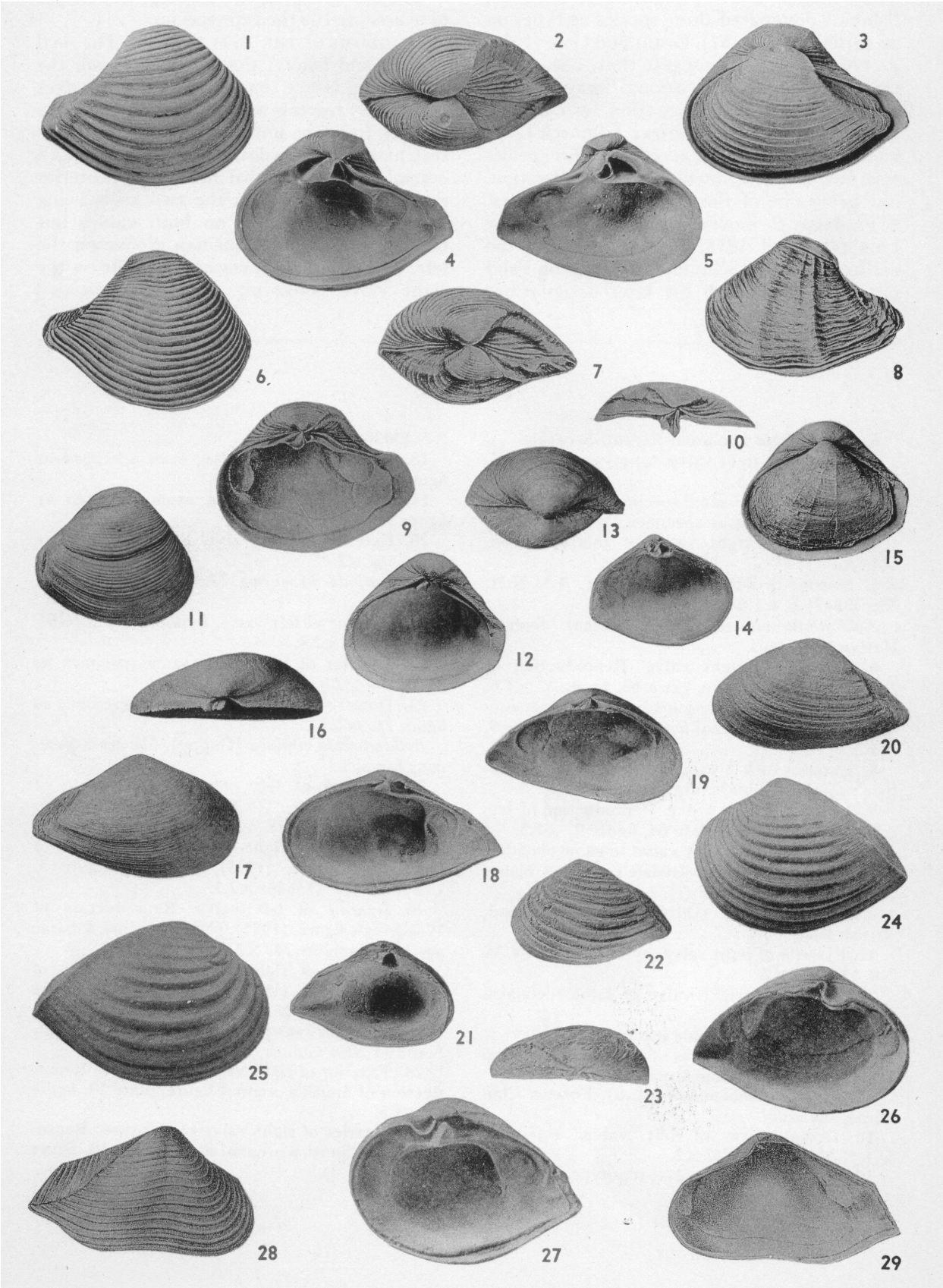
26. Interior of left valve. Reproduction of Woodring's figure, (1925), plate 26, figure 8. Same specimen as figure 24. $\times 2.3$.

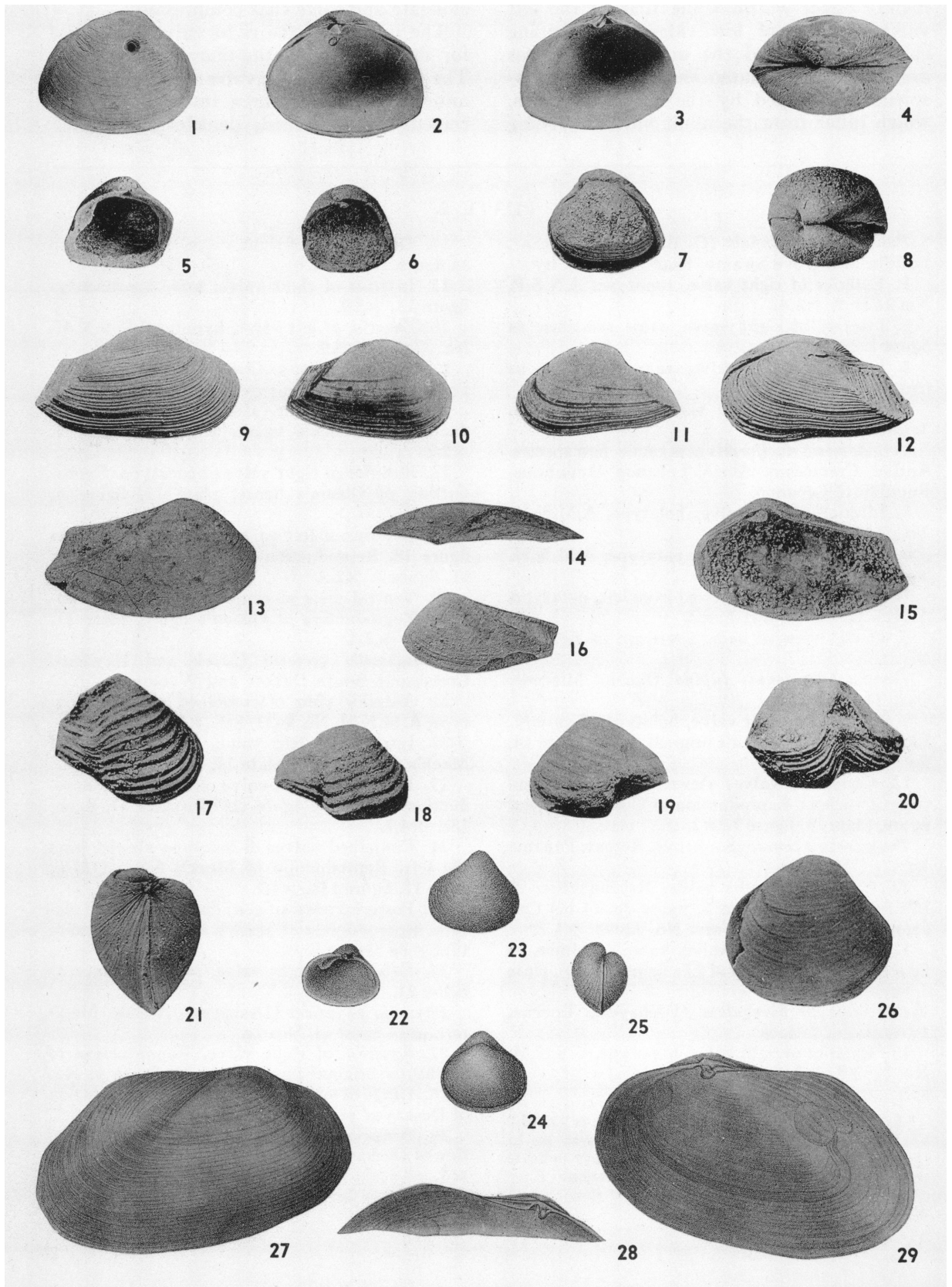
27. Interior of right valve. Reproduction of Woodring's figure, (1925), plate 26, figure 6. Same specimen as figure 25. $\times 2.3$.

Anisocorbula macgillivrayi (Smith). Recent. South of New Guinea.

28. Exterior of right valve of holotype. Reproduction of Smith's original figure, plate 10, figure 8. $\times 1.5$.

29. Interior of right valve of holotype. Reproduction of Smith's original figure, plate 10, figure 8a. $\times 1.5$.





ridges separated by interspaces of approximately equal width, while that of the left valve consists of low ridges, overlapping shingle-like toward the umbo. The umbos are moderately inflated and prominent, conspicuously capped by the nepionic valves, which differ from the adult valves in being

almost equivalved, proportionately more elongate and somewhat compressed.

The interior of the right valve is grooved for the reception of the margins of the left. The hinge of the right valve is marked by an anterior socket-like area into which is received the thickened, dentiform, anterior

PLATE 2

Panamicorbula inflata (C. B. Adams). Recent. Paitilla Mangrove Swamp, near Panama City.

1. Exterior of right valve, topotype, A.N.S.P. No. 155409. $\times 1.6$.

2. Interior of right valve, same specimen as figure 1. $\times 1.6$.

3. Interior of left valve, same specimen as figure 1. $\times 1.6$.

4. Dorsal view, same specimen as figure 1. $\times 1.6$.

Corbulomima nuciformis new genus, new species. Aptian, Cretaceous. Abeih, Lebanon Mountains, Republic of Lebanon.

5. Interior of left valve, holotype, A.M.N.H. No. 25932: 1. $\times 2$.

6. Interior of right valve, paratype, A.M.N.H. No. 25932: 2. $\times 2$.

7. Conjoined valves viewed from left, paratype, A.M.N.H. No. 25932: 3. $\times 2$.

8. Dorsal view of same specimen as figure 7. $\times 2$.

Tenuicorbula tenuis lupina Olsson. Miocene. Que. Tucillal, Peru.

9. Exterior of right valve, holotype of variety. Reproduction of Olsson's original figure, plate 14, figure 10. $\times 2$.

12. Conjoined valves viewed from left, paratype of variety. Reproduction of Olsson's original figure, plate 14, figure 7. $\times 2$.

Tenuicorbula tenuis (Sowerby). Recent. Panama Bay.

10. Exterior of right valve. Reproduction of Li's figure, (1930), plate 5, figure 38, of his *Corbula glypta*. Columbia Univ. No. 22098. $\times 1.2$.¹

11. Exterior of left valve, same specimen as figure 10. Reproduction of Li's figure, (1930), plate 5, figure 38A. $\times 1.2$.¹

Cuneocorbula biangulata (Deshayes). Eocene. Paris Basin, France.

13. Exterior of right valve, hypotype, U.S.N.M. No. 326895. $\times 3.9$.

14. Dorsal view of right valve, same specimen as figure 13. $\times 3.9$.

15. Interior of right valve, same specimen as figure 13. $\times 3.9$.

16. Exterior of left valve, hypotype, U.S.N.M. No. 326895. $\times 3.9$.

Cuspicorbula busera Olsson. Eocene. Restin, Peru.

17. Exterior of right valve of paratype. Reproduction of Olsson's figure, plate 11, figure 5. $\times 2.2$.

18. Exterior of right valve of paratype. Reproduction of Olsson's figure, plate 11, figure 6. $\times 2.3$.

19. Exterior of left valve of same specimen as figure 18. Reproduction of Olsson's figure, plate 11, figure 7. $\times 2.3$.

20. Ventral view of conjoined valves of holotype. Reproduction of Olsson's figure, plate 11, figure 8. $\times 2.5$.

Corbulamella gregaria (Meek and Hayden). Cretaceous. South Dakota and Wyoming.

21. Anterior view of conjoined valves, hypotype, A.M.N.H. No. 9433/1:1. $\times 10$.

22. Interior of left valve, Reproduction of Meek's figure (1876), plate 17, figure 13d. $\times 4.7$.

23. Exterior of right valve of holotype. Reproduction of Meek's figure (1876), plate 17, figure 13c. $\times 4.7$.

24. Conjoined valves of holotype viewed from the left. Reproduction of Meek's figure (1876), plate 17, figure 13a. $\times 4.7$.

25. Posterior view of conjoined valves of holotype. Reproduction of Meek's figure (1876), plate 17, figure 13b. $\times 4$.

26. Exterior of right valve, same specimen as figure 21. $\times 10.8$.

Physoida physoides (Deshayes). Recent. Mediterranean coast of Algeria.

27. Exterior of right valve. Reproduction of Deshayes' original figure, plate 22, figure 4. $\times 5$.

28. Hinge of left valve. Reproduction of portion of Deshayes' original figure, plate 22, figure 5.

29. Hinge of right valve. Reproduction of portion of Deshayes' original figure, plate 22, figure 5. $\times 5$.

¹ Li (1930, pl. 5) indicates that this figure is " $\times 75$," but the dimensions of the specimen as given by Li (p. 264) and by Pilsbry (1931, p. 431) clearly indicate that the illustration is of greater magnification.

dorsal margin of the left; the right cardinal is moderately heavy, slightly recurved dorsally, the resilial pit is deep, extending dorsad under the tip of the umbo, and a small but well-developed posterior lateral tooth is found immediately behind this pit. The hinge of the left valve consists of the thickened anterior dorsal margin, mentioned above; immediately posterior to it there is a deep socket for the reception of the right socket. The ligament is received in a deep resilial pit located posterior to the socket and separated from it by a thin septum; posterior to this pit there is a prominent left posterior cardinal which is adjacent and fused to the posterior dorsal margin of the valve; the posterior lateral of the right valve is received in a narrow pit on the posterior dorsal margin of the left. The adductor scars are moderately prominent, slightly impressed, the posterior more so than the anterior; the pallial line is obscure, more prominent posteriorly at the broad, shallow, pallial sinus.

DIMENSIONS: Topotype, A.M.N.H. No. 33847:1; length, 24.6 mm.; height, 18.4 mm.; diameter, right valve, 8.4 mm.; left valve, 7.5 mm.; both valves, 14 mm. Recent, Senegal.

Topotype, A.M.N.H. No. 33847:2; left valve, length, 22.6 mm.; height, 16.8 mm.; diameter, 7.2 mm. Recent, Senegal.

The presence of a posterior lateral tooth on the right valve and of a posterior cardinal tooth on the left, together with the absence of a chondrophore in the left valve, sharply separates this form from the great majority of species which have in the past been referred to this genus.

CORBULOMIMA, NEW GENUS

Plate 2, figures 5-8

GENOTYPE: *Corbulomima nuciformis*, new species. Cretaceous, Aptian of Abeih, Lebanon Mountains, Republic of Lebanon.

DIAGNOSIS OF THE TYPE SPECIES: The shell is moderately small and inequivalved, with the right valve larger than the left. Both valves are marked with a posterior umbonal ridge extending to the posterior ventral margin, and ornamented with moderately strong concentric ribs.

The inner margins of the right valve are grooved for the reception of the left. The

hinge of the right valve consists of a large, triangular cardinal tooth, with a corresponding socket present in the left. The posterior adductor muscle is received on a small platform-like projection extending from the posterior-dorsal surface of the valve, the "platform" having a spoon-shaped concave surface. Pallial line and pallial sinus were not seen.

This peculiar form is corbuloid in all its characteristics, except for the fact that there are no special structures in either valve for the reception of the resilifer. In this character it somewhat resembled the fresh-water genus *Pachydon* Gabb. (See below.) In the present group the area on the right valve, which is grooved for the reception of the posterior margin of the left valve, seems to be somewhat broader immediately behind the cardinal tooth than would be required solely for the valve margin, and the groove extends to a point immediately above the cardinal tooth. This is the position which is normally occupied by the resilial pit; and apparently the resilifer was received at this point, below the area occupied by the margin of the left valve, with no special structures being developed for its reception; this is essentially the condition to be observed in *Pachydon* and to some extent in *Tiza* De Gregorio. The cardinal socket in the left valve is relatively more elongated posteriorly than would be required for the reception of the right cardinal tooth, and it seems most probable that the resilifer fitted into the posterior area of this socket. This differs from *Pachydon* and *Tiza* in which the left valve bears a pseudo-chondrophore-like swelling of the valve margin, but it is somewhat similar to the condition noted in *Corbula*, *sensu stricto*, except that there is no evidence in the present species suggesting the presence of the thin septum which separated the resilial pit from the cardinal socket in *C. sulcata*.

Corbulomima nuciformis, new species

Plate 2, figures 5-8

HOLOTYPE: A.M.N.H. No. 25932:1; left valve, length, 9.5 mm.; height, 7.8 mm.; diameter, 4.6 mm.

PARATYPE: A.M.N.H. No. 25932:2; right valve, length (slightly incomplete), 8.2 mm.; height, 7.7 mm.; diameter, 5 mm.

PARATYPE: A.M.N.H. No. 25932:3; both

valves, length, 10.5 mm.¹; height, 9 mm.; diameter, 9 mm.

The important characters of this species have been given above in the generic diagnosis. The valves are strongly inflated and give the shell a rounded, ball-like appearance suggestive of a small nut. The concentric sculpturing consists of moderately heavy ribs separated by interspaces of approximately equal width; the umbos are prosogyrate, not strongly inflated in comparison with the rest of the valve, and are closely approximate. Due to the fact that the margins of the left valve fit into the right, the dorsal edges of the valve tend to project slightly in front of the umbo, while, correspondingly, the umbo of the right valve tends to project slightly over the margins of that valve.

Internally, the peculiar features of the hinge will serve to separate this species from any of the corbuloid forms whose hinge characters have been described. An examination, however, of the hinge characters of "*Corbula*" *aligera* Hamlin (1884, p. 38, pl. 4, fig. 6a, b, c, d), which occurs in association with the present species, shows that it, too, is to be referred to *Corbulomima*. However, it differs greatly in its external appearance, being relatively quite compressed and possessing extremely prominent, almost alately-projecting, posterior umbonal ridges.

LOCALITY AND HORIZON: This species is known only from the collections made at the "Olive Locality" on the hill slope northwest of the village of Abeih, and approximately 500 yards west of the Aleih-Abeih road, in the Lebanon Mountains, Republic of Lebanon. The fossils are found on the terraces of the olive groves in the Aptian sandstones a short distance above the contact with the Neocomian continental deposits. (Vokes, 1941, p. 1722.)

CARYOCORBULINAE, NEW SUBFAMILY

CARYOCORBULA GARDNER, 1926

Plate 1, figures 16-20

Caryocorbula GARDNER, 1926, Nautilus, vol. 40, p. 46; GARDNER, 1928, U. S. Geol. Surv. Prof. Paper 142E, p. 230.

¹ The right valve being larger than the left, the length and height measurements indicated above are those of the right valve; the left has a length of 9.2 mm. and a height of 8.3 mm.

Cuneocorbula of Dall and authors. (Not of Cossman, 1886.)

TYPE (BY ORIGINAL DESIGNATION): *Corbula alabamiensis* Lea. Claiborne, Eocene, Atlantic and Gulf coastal plains from South Carolina to the Rio Grande River.

DIAGNOSIS OF THE TYPE SPECIES: The shell is of moderate size, slightly inequivalved. Both valves are acutely keeled posteriorly, and both are concentrically rugose.

The internal margins of the right valve are grooved for the reception of the edge of the left. The right cardinal tooth is moderately heavy, upcurved at the tip; the adjoining resilial socket is deep and very broad, with an inconspicuous ridge margining it dorsolaterally. The left valve has a relatively broad chondrophore which is, posteriorly, continuous with the dorsal margin of the valve, being separated from it by a low ridge. The dorsal side of the chondrophore bears a well-developed median ridge. The anterior cardinal socket is long, somewhat open above. Muscle scars are prominent, thickened, somewhat rugose; the pallial line is simple, and the pallial sinus short, scarcely defined.

DIMENSIONS: Topotype, U.S.N.M. No. 154904; right valve, length, 19.1 mm.; height, 11.2 mm.; diameter, 5.3 mm. Eocene, Claiborne, Alabama. Burns collection.

Topotype, U.S.N.M. No. 154904; left valve, length, 17.3 mm.; height, 8.7 mm.; diameter, 5.3 mm. Eocene, Claiborne, Alabama. Burns collection.

PANAMICORBULA PILSBRY, 1932

Plate 2, figures 1-4

Panamicorbula PILSBRY, 1932, Nautilus, vol. 45, p. 105.

TYPE (BY ORIGINAL DESIGNATION): *Corbula* (*Panamicorbula*) *inflata* (C. B. Adams). Recent, Mazatlan to Peru, in brackish water.

Through the kindness of Dr. Pilsbry I have been permitted to examine and figure a pair of valves of this species from the Zetek collection of the Academy of Natural Sciences of Philadelphia. This specimen is, presumably, a part of the lot studied by Pilsbry when he proposed the name *Panamicorbula*.

DIAGNOSIS OF THE TYPE SPECIES: The shell is moderately large, thin, highly inflated and gibbous, and not rostrate, being subequilat-

eral with the umbos situated approximately halfway between the anterior third and the middle length of the shell. The valves are almost equal in size, the right being slightly larger than the left with its dorsal, anterior, and ventral margins grooved for the reception of those of the left valve. The thinness of the shell has resulted in the formation of a slightly thickened ridge along the dorsal margin into which the groove is impressed. The side of this dorsal ridge ventral to the groove is slightly projecting, especially at a point about halfway along the anterior side, and less so, near the posterior end of the posterior side. These projections were interpreted by Pilsbry as representing lateral teeth, a conclusion with which the writer is in disagreement, believing them to represent only slightly thickened buttresses designed to aid in holding the unusually inflated left valve in position.

Both valves bear a moderately prominent posterior angulation extending from the umbone to the posterior ventral margin, and their surfaces are sculptured by low, inconspicuous, rounded concentric ribs which are set closely together and are somewhat irregular and unequal in development. Under the microscope a few radial striae are to be seen just anterior to the posterior umbonal angulation.

The hinge of the right valve consists of a relatively small cardinal tooth situated just anterior to a deep but relatively small resilial pit. The hinge of the left valve is quite reminiscent of that of *Caryocorbula* Gardner, bearing a small, but relatively broad chondrophore which is, posteriorly, continuous with the dorsal margin of the valve, from which it is separated by a shallow groove. The dorsal side of the chondrophore is bipartite, the anterior portion being convexly rounded upward, the posterior portion concave. The two areas are separated by a pronounced ridge.

The muscle scars are of moderate size, rounded, and inconspicuous; the pallial line is simple and the pallial sinus scarcely defined.

DIMENSIONS: Topotype, A.N.S.P. No. 155409; length, 17.6 mm.; height, 13.6 mm.; diameter, both valves, 10.9 mm.; right valve, 5.8 mm.; left valve, 5.8 mm. Paitilla Mangrove Swamp, near Panama City. James Zetek collection.

Panamicorbula seems probably to have

been derived from some caryocorbulid form, differing principally in the loss of the rostrate posterior prolongation, the greatly increased inflation of the shell, the thinness of the shell itself, and, correlated with this latter feature, the development of the tooth-like lateral buttresses to the dorsal grooves of the right valve.

VARICORBULA GRANT AND GALE, 1931

Plate 1, figures 11-15

Varicorbula GRANT AND GALE, 1931, San Diego Soc. Nat. Hist., mem. 1, p. 420, footnote 1.

Corbula, *sensu stricto*, of authors, including Gardner 1926, 1928; Grant and Gale, 1931. (Not of Lamarck, 1799.)

Aloidis of authors. (Not of Megerle von Mühlfeldt, 1811.)

Agina of authors. (Gray, 1847.) (Not *Agina* Turton, 1822 = *Saxicava*.)

TYPE (BY ORIGINAL DESIGNATION): *Corbula gibba* (Olivi). Recent, west coast of Europe and the Mediterranean Sea.

This group has represented *Corbula*, *sensu stricto*, to those authors who have followed Children's (1823, p. 301) designation of *Corbula nucleus* Lamarck [= *Corbula gibba* (Olivi)] as type of the genus *Corbula*. The acceptance of Schmidt's earlier designation of *C. sulcata* left this group without a name until Grant and Gale, in a footnote, tentatively¹ proposed the name *Varicorbula*.

DIAGNOSTIC CHARACTERS: The shell is relatively small. The valves are unequal, the right being larger, relatively higher, more inflated, and obtusely rostrate posteriorly; the left smaller, transversely elongate, and not rostrate posteriorly. The sculpture is discrepant, that of the right valve consisting of concentric ribbing, that of the left composed of faint, widely spaced radials and of concentric growth striae, which occasionally, toward the ventral margin, become sufficiently coarse to simulate a concentric sculpturing.

The margins of interior of the right valve are grooved for the reception of the sharp edge of the left. The right cardinal tooth is moderately strong, subtriangular in section, being ridged above; the resilial pit is narrow,

¹ "In case a new name is needed for the *gibba* group, we propose *Varicorbula* with *Corbula gibba* (Olivi) as figured by Bucquoy, Dautzenberg, and Dollfus for the type" (Grant and Gale, 1931, p. 420, footnote 1).

deep, extending up under the umbone. The left valve has a moderately projecting chondrophore which bears on its posterior side a dentiform swelling that appears to fit into the posterior edge of the resilial pit of the right valve. The muscle scars are of moderate size, but slightly impressed. The pallial line is obscure, with the pallial sinus scarcely defined.

DIMENSIONS: Hypotype, U.S.N.M. No. 172150; length, 14.3 mm.; height, 12 mm.; diameter, right valve, 5.3 mm.; left valve, 4.2 mm.; both valves, 9.1 mm. Recent, Zetland, British Isles. Jeffrys collection.

BOTHROCORBULA GABB, 1873

Plate 1, figures 24–27

Bothrocorbula GABB, 1873, Proc. Acad. Nat. Sci. Philadelphia, for 1872, p. 274.

TYPE (BY MONOTYPY): *Corbula viminea* Guppy. Miocene, Bowden, Jamaica.

DIAGNOSIS OF THE TYPE SPECIES: The shell is moderately large, thick, and heavy, transversely elongate-ovate and strongly rostrate posteriorly with prominent posterior umbonal ridges extending to the posterior ventral margin of both valves. The right valve is slightly larger than the left. The sculpture of both valves consists of coarse, concentric waves which are suppressed before attaining the umbonal ridge. Both the waves and the interspaces between them are marked by fine, concentric striae which are continuous across the umbonal ridge and on the posterior slope. A few fine, distant radial threads are present in the interspaces between the concentric waves but are absent on the posterior slope. A deeply excavated lunular pit is present immediately in front of the umbones, being wider and much more prominent in the left valve than in the right.

The ventral margins of the right valve are grooved for the reception of the left. The right cardinal is large and triangular, its tip being strongly curved dorsally. The right ligamental pit is broad, extending somewhat above the cardinal and is bounded below by a low ridge, which, posteriorly, serves to form the anterior margin of an inconspicuous pit into which fits a small dentiform projection from the margin of the left valve. This is the only tooth-like structure on the left hinge, the deep

lunule occupying the anterior half of the hinge area. Immediately posterior to the lunule is a deep cardinal socket that curves up under a long, narrow, chondrophore-like projection of the posterior-dorsal valve margin present immediately anterior to the dentiform process. Adductor scars are relatively large and prominent, situated on the thickened valve margins. The pallial line is not sharply defined; the pallial sinus is obsolete.

DIMENSIONS (FIDE WOODRING, 1925, p. 190): Topotype; length, 17.5 mm.; height, 12 mm.; diameter, right valve, 4.8 mm. Miocene, Bowden, Jamaica.

If the right valve measured is the same specimen as shown in Woodring's illustrations, plate 26, figures 5, 6, these are $\times 2.35$ rather than $\times 2$, as indicated.

HEXACORBULA OLSSON, 1932

Plate 1, figures 21–23

Hexacorbula OLSSON, 1932, Bull. Amer. Paleont., vol. 19, no. 68, p. 140.

TYPE (BY ORIGINAL DESIGNATION): *Corbula hexacyma* Brown and Pilsbry. Gatun formation, Miocene of Panama.

The only important character distinguishing *Corbula hexacyma* Brown and Pilsbry (1913, p. 518, pl. 26, fig. 4) from *Bothrocorbula viminea* (Guppy) (1866, p. 293, pl. 18, fig. 11; see Woodring, 1925, pl. 25, figs. 5–8) is the complete absence of the deep lunule so characteristic of the latter species. As has been pointed out by Woodring (1925, p. 189) and by Olsson (1932, p. 140), there is considerable variation in the strength of the lunule in *Bothrocorbula*, and in *B. synarmostes* Dall it is "very small and easily overlooked" (Olsson, p. 140). The writer has, therefore, considerable doubt as to the necessity for this name.

DIMENSIONS: Hypotype, U.S.N.M. No. 559499; left valve, length, 7.2 mm.; height, 4.6 mm.; diameter, 2.4 mm. Gatun formation, Miocene, Panama Canal Zone.

NOTOCORBULA IREDALE, 1930

Plate 1, figures 6–10

Notocorbula IREDALE, 1930, Rec. Australian Mus., vol. 17, no. 9, p. 404, pl. 64, figs. 8, 9, pl. 65, figs. 3, 4, 9.

TYPE (BY ORIGINAL DESIGNATION): *Notocorbula vicaria* Iredale. Recent, New South Wales. Type from Sydney Harbor.

Iredale, in proposing this name, stated: "If *Corbula* Bruguière be disregarded the name will disappear, and I, therefore, introduce *Notocorbula*, with *N. vicaria* Iredale as type, for the southern Australian species with the cardinal tooth keeled, a feature I have not seen remarked upon elsewhere." Although the present writer's conclusions do not indicate that the name *Corbula* will disappear, the generic name *Notocorbula* is accepted since the genotype, as figured by Iredale (no specimens have been available for examination), differs in a number of characters from, and is clearly not congeneric with, the type of *Corbula*.

DIAGNOSIS OF THE TYPE SPECIES: The shell is large, the right valve inflated, with the internal margins grooved for the reception of the flatter left valve. The umbones are approximate, inflated, relatively low and conspicuously capped by the nepionic valves which are normally more elongate than the adult. Both valves are rostrate posteriorly, produced into a short "snout"; with a strong umbonal keel extending to the posterior ventral margin, and a relatively weaker keel extending to the dorsal side of the posterior margin, the area between the keels being markedly concave. Sculpture is discrepant, with concentric ribbing strong on the right valve and relatively weak on the left, which is marked by a few, unequally spaced radial elevations.

The right valve has a strong "keeled" anterior cardinal, and a resilial pit which appears to be relatively small; the left valve, a large, peculiarly bipartite chondrophore. The adductor scars are unusually large and well defined, the pallial line is sinuous, and the pallial sinus small, almost vertical.

DIMENSIONS (FIDE IREDALE): Type; length, 23 mm.; height, 17 mm.; diameter, both valves, 14 mm. Recent, Sydney Harbor, New South Wales.

ANISOCORBULA IREDALE, 1930

Plate 1, figures 28, 29

Anisocorbula IREDALE, 1930, Rec. Australian Mus., vol. 17, no. 9, p. 404.

TYPE (BY ORIGINAL DESIGNATION): *Corbula macgillivrayi* Smith. Recent, south of New Guinea in 28 fathoms. Challenger Station 188.

The following diagnosis is based upon

Smith's original description and figures (1885, p. 30, pl. 10, fig. 8-8b):

DIAGNOSIS OF THE TYPE SPECIES: The shell is large, very long, compressed, only slightly inequivalved but very inequilateral and deeply truncate posteriorly, "terminating in an acute point." A sharp keel extends from the umbo to the posterior ventral margin. The median area of both valves is marked by a well-defined, broad depression resulting in a definite sinus in the ventral margin. Sculpture consisting of concentric ridges, weaker behind the posterior keel, and of "numerous, excessively fine radiating lines, which are minutely granular, especially conspicuous in the grooves between the costae."

The margins of the right valve are grooved for the reception of the edges of the left, and in old specimens the margins of the left valves are minutely denticulated all around, with the grooves of the right valves correspondingly pitted. The pallial line is sinuous with the sinus in the valve margins, and the pallial sinus is obsolete. The muscle scars are moderately large, not thickened. The hinge has not been described, but judging from the illustrations, the right cardinal is small and narrow, trending diagonally so that the ventral extremity is distinctly posterior to the anterior one.

DIMENSIONS (FIDE SMITH): Type; length, 26 mm.; height, 13 mm.; diameter, both valves, 9 mm. Recent, south of New Guinea in 28 fathoms.

TENUICORBULA OLSSON, 1932

Plate 2, figures 9-12

Tenuicorbula OLSSON, 1932, Bull. Amer. Paleont., vol. 19, no. 68, p. 141.

TYPE SPECIES (BY ORIGINAL DESIGNATION): *Corbula tenuis* Sowerby. Recent, Mazatlan to Peru, *vide* Olsson.

Corbula tenuis Sowerby is a very rare species, and I have been unable to examine any specimens. The following diagnosis is given by Olsson:

DIAGNOSIS OF THE TYPE SPECIES: "Shell unusually thin, inequilateral, subequivalve; posterior side contracted with a strong, cord-like posterior keel, defining the posterior area which is more coarsely sculptured than the rest of the valve surface; a smaller secondary

keel in the middle, defines an escutcheon-like area; no lunule; posterior side obliquely truncate and bicarinate at the end; hinge normal with a strong cardinal tooth in right valve, the ligament pit notch-like, small and seemingly passing internally beneath the beaks; in the left valve, a grooved posterior cardinal; external sculpture of fine, concentric threads coarser on the posterior area."

It is most probable that the so-called "grooved posterior cardinal" of this diagnosis represents the chondrophore. Olsson gives no dimensions for the species, but a specimen dredged from Panama Bay, which was described by Li (1930, p. 264, pl. 5, fig. 38, 38A) as *Corbula glypta*¹ and has been referred by Pilsbry (1931, p. 431) and by Olsson (1932, p. 142) to *Corbula tenuis*, has the following dimensions, according to Pilsbry: length, 24 mm.; height, 13.3 mm.; diameter, 10.5 mm.

BICORBULA FISCHER, 1887

Plate 3, figures 1-5

Bicorbula FISCHER, 1887, Manuel de conchyliologie et de paléontologie conchyliologique, p. 1123.

Corbula, *sensu stricto*, of Dall and authors. (Not of Lamarck, 1799.)

TYPE (BY MONOTYPY): *Corbula gallica* Lamarck. Eocene, Lutetian-Bartonian, Paris Basin, France.

DIAGNOSIS OF THE TYPE SPECIES: The shell is large, inequivalved, with the right valve larger and higher than the left. The posterior keel is obsolete, more prominent on the left than on the right valve. Concentric sculpture is suppressed and feeble with an obscure radial striation on the left valve.

The right hinge is reduced, with a prominent anterior cardinal. The resilial pit extends far behind the base of the cardinal to a thickened area immediately under the strongly curved opisthogyrous umbone, the tip of which is protected by a thin callus projecting forward from above the cardinal. The left valve has a long, slender, projecting, up-curved chondrophore. The anterior cardinal socket is deep, open posteriodorsad, but closed anteriodorsad by a rugose projection

¹ In his description, Li has obviously wrongly oriented his specimen, so that the anterior and posterior ends are reversed.

of the valve margin. The dorsal interior of the right valve is obscurely grooved for the reception of the left. Muscle scars are relatively small and not sharply delimited; a broad, very shallow pallial sinus is present.

DIMENSIONS: Hypotype, A.M.N.H. No. 16717/1:1; right valve, length, 40 mm.; height, 32.7 mm.; diameter, 12.8 mm. Eocene, Anvers, France.

Hypotype, A.M.N.H. No. 16717/1:2; left valve, length, 32.3 mm.; height, 24.4 mm.; diameter, 8.4 mm. Eocene, Anvers, France.

URSIRIVUS, NEW NAME

Plate 3, figures 6-10

Anisorhynchus Conrad MS, MEEK, 1871,² in Hayden, F. V., Preliminary report of the United States geological survey of Wyoming and portions of contiguous territories, p. 293.

Anisorhynchus CONRAD, 1874, Proc. Acad. Nat. Sci. Philadelphia, for 1874, p. 27 (error for *Anisorhynchus*).

Not *Anisorhynchus* Schoenherr, 1842, Gen. et Spec. Curc., vol. 6, pt. 2, p. 308 (Coleoptera).

TYPE (MONOTYPE OF *Anisorhynchus*): *Corbula* (*Potamomya*?) *pyriformis* Meek. Cretaceous, Bear River group, Wyoming.

Meek was in considerable doubt as to the "propriety of retaining Mr. Conrad's section *Anisorhynchus*, as subgenerically distinct from *Corbula*" (1876, p. 243; see also 1871, p. 293, and 1877, pp. 172, 173). It is evident that he was not able to compare his specimens with *Corbula sulcata*, which he correctly considered to represent the type of the genus *Corbula*, otherwise he would not have stated (1871, p. 293) that "it agrees almost exactly, in its hinge, muscular, and pallial impressions, with *Corbula* . . . and we have almost nothing left but its *Neaera*-like form, and brackish water habits, to separate it from *Corbula*; while some marine species, such as *C. alaeformis*³ of Gabb, present almost exactly the same form."

² In later publications (1876, pp. 240-244), Meek notes this date as 1872. However, his personal copy of this paper bears the notation, in his handwriting, "Ap. 1871." Furthermore, a footnote on page 292 states that a portion of the paper, including that in which this name is proposed, was "printed in pamphlet form . . . on the 18th February, 1871." I have not seen a copy of this pamphlet.

³ Stanton (1896, p. 1040, pl. 64, figs. 6, 7) has noted that "*Corbula*" *alaeformis* Gabb (1869, p. 177, pl. 29,

A close examination of a large number of topotypes of "*Corbula*" *pyriformis* and their comparison with the types of other corbulid groups indicate that there are several characters which serve to distinguish this form. Because the name *Anisorhynchus* is preoccupied in Coleoptera, the new name *Ursirivus* is proposed, in allusion to the fact that "*C.*" *pyriformis* is, with the exception of two occurrences in the Dunvegan Cretaceous of Alberta (MacLearn, 1926, p. 118), known only from the Bear River group of the Upper Cretaceous of Wyoming and Idaho, where it is exceedingly abundant.

A second species clearly referable to this genus has recently been described (in MS) by Dr. L. W. Stephenson from the fauna of the Lewisville formation of Texas. This is of particular interest, since it is associated with a typically marine fauna, whereas the Bear River fauna represents fresh- to brackish-water types.

The form described by Greeve (1938, pp. 24-27, pl. 8, figs. 6, 7, 9-17, 20; text figs. 2, 3) from the Neocene of Iquitos, Peru, as *Anisorhynchus* (?) *jeanneti* Greeve is in no way related to this genus. It is somewhat reminiscent of *Tiza* De Gregorio, although clearly not referable to that genus. Unfortunately, the original illustrations are very poor, and it is not possible to diagnose the group at the present time.

DIAGNOSIS OF THE TYPE SPECIES: The shell is large for the family, moderately thick, elongate, subpyriform, and nearly equivalved, the right valve being but slightly larger than the left. The umbos are anterior, situated approximately at the anterior third of the length of the valve, but are somewhat variable in position and are strongly inflated. The anterior and central portions of the valve are strongly inflated and gibbous; posteriorly the valves become compressed, narrowed, and produced to form a long rostral "snout." Anterior to the umbos is a large, prominent, and deep, though not sharply defined, lunular depression; posteriorly there is an equally prominent and deep escutcheon which is delimited by a strong umbonal ridge extending to the posterior end of the dorsal border. A second

and weaker umbonal ridge is normally, but not always, present and extends to the posterior ventral margin. Both lunule and escutcheon are larger and more prominently developed in the right valve than in the left. The surface of both valves is ornamented by coarse concentric ridges which tend to be most regularly spaced near the umbo and to become coarser and more unequally spaced toward the median part of the valve, sometimes becoming obsolete toward the ventral margin.

The interior margins of the right valve have an inconspicuous posterior dorsal groove, a broad, shallow, ventral groove, and a rather heavy internal ridge immediately posterior to the resilial pit for the reception of the margins of the left valve. The hinge of the right valve consists of a large, triangular cardinal tooth, obscurely striated and curved slightly upward. Immediately posterior to this tooth there is a deep resilial pit, which is broad and extends somewhat dorsad of the posterior side of the cardinal. The left hinge has a broad cardinal socket, which is widely open dorsad, and a relatively narrow, moderately elongate chondrophore, which, because of the width of the shell area adapted for fitting under the margins of the right valve, does not project very greatly beyond the actual margin of the shell. The anterior and posterior edges of the chondrophore are delimited by a strong ridge, and a third, weaker ridge marks the center of the structure. Muscle impressions are not prominent, the anterior being generally somewhat more strongly defined than the posterior. The pallial line is not sharply impressed, but exhibits a shallow, rounded sinus.

DIMENSIONS: Topotype, U.S.N.M. No. 103717; right valve, length (incomplete), 37 mm.; height, 25.6 mm.; diameter, 14 mm. (When complete, the valve was probably about 42 mm. long.) Bear River, near the mouth of Sulphur Creek, Wyoming.

Topotype, U.S.N.M. No. 103717; left valve, length (incomplete), 34.5 mm.; height, 32 mm.; diameter, 16 mm. Bear River, near the mouth of Sulphur Creek, Wyoming.

Hypotype, U.S.N.M. No. 103716; both valves, length, 32.4 mm.; height, 22.2 mm.; diameter, 21.6 mm. Seven miles above Evanston, Wyoming.

fig. 63) actually has a taxodont hinge. He refers it to "*Leda*."

The large size (an incomplete topotype is 48 mm. long and probably exceeded 50 mm. when complete), the deep lunule and escutcheon, the pronounced pyriform shape of both valves, and the presence of a small but definite pallial sinus are all distinctive characters of this group.

CUNEOCORBULA COSSMANN, 1886

Plate 2, figures 13–16

Cuneocorbula COSSMANN, 1886, Ann. Roy. Soc. Malac. de Belgique, vol. 21, p. 49 (p. 37 of separate).

Not *Cuneocorbula* Dall and authors (= *Caryocorbula* Gardner).

TYPE (BY SUBSEQUENT DESIGNATION, DALL, 1898): *Corbula biangulata* Deshayes. Eocene, Paris Basin, France.

DIAGNOSIS OF THE TYPE SPECIES: The shell is small, thin, elongate, and markedly birostrate. The umbos are moderately prominent, anterior, not strongly inflated, and sharply defined posteriorly by a strong, sharp, umbonal ridge which extends to the posterior ventral margin. A second such ridge extends to the posterior dorsal margin, the area between the two ridges being strongly concave. The surface is ornamented by feeble, irregular, concentric ribs which generally do not cross the umbonal ridge onto the posterior slope.

Anterior and posterior dorsal margins of the right valve are feebly grooved for the reception of the margins of the left. The right hinge consists of a prominent, triangular cardinal tooth, which is elongate anteriorly, the posterior edge being almost vertical. The resilial pit is deep, elongate posteriorly, and tends to curve dorsad under the umbo to a point almost above the cardinal. The left hinge consists of an anterior cardinal socket followed by a projecting chondrophore which is relatively thin and peculiarly "roof-shaped," being angulate above. The anterior slope of this chondrophore is parallel to the anterior-dorsal slope of the valve and is deeply grooved for the reception of the resilifer; the posterior slope is parallel and adjacent to the posterior-dorsal margin of the valve and is smooth. Muscle scars and pallial line are inconspicuous. A small pallial sinus seems to be present.

DIMENSIONS: Hypotype, U.S.N.M. No.

326895; right valve, length, 9.5 mm.; height, 5 mm.; diameter, 1.6 mm. Eocene, Chenay, Paris Basin, France.

Hypotype, U.S.N.M. No. 326895; left valve, length, 6.8 mm.; height, 3.4 mm.; diameter, 1.3 mm. Eocene, Chenay, Paris Basin, France.

The collections available for study contained no specimens with right and left valves in association, and it was not possible to make any observations relative to the proportionate size of the two. It is believed, however, that they are approximately equal-valved.

CUSPICORBULA OLSSON, 1928

Plate 2, figures 17–20

Cuspicorbula OLSSON, 1928, Bull. Amer. Paleont., vol. 14, no. 52, p. 99 (p. 53 of separate), pl. 11, figs. 5–8.

TYPE (BY ORIGINAL DESIGNATION): *Corbula (Cuspicorbula) busera* Olsson. Restin formation, Eocene, Restin, Peru.

DIAGNOSIS OF THE TYPE SPECIES: "Shell small or medium-sized, solid, inflated, coarsely sculptured and with the posterior extremity strongly contracted and rostrate; the anterior and central portion of the valves is strongly convex or inflated, oblique, with a deep, wide, chordate lunular area in front and below the beaks; the posterior end is strongly contracted into a short, rostrate portion by a deep sinus, directed towards the left from the central and anterior part of the shell, and the general form of the shell is strongly suggestive of a *Cuspidaria*; the right valve is slightly larger than the left and less [more] strongly sculptured; sculpture of the right valve consists of about 10 or 12 coarse, concentric ribs separated by wide interspaces, and these ribs are continued across the posterior sinus to the posterior extremity; on the umbos, this sculpture is generally much finer; the sculpture of the left valve is similar to the right but finer; interior concealed" (Olsson, 1928, pp. 99, 100).

DIMENSIONS (FIDE OLSSON¹): Length, 13 mm.; height, 9.5 mm.; diameter, 9.25 mm.

¹ These are dimensions given by Olsson in his text. However, they are not the dimensions of the types, as indicated in his plate descriptions; here the holotype is said to have a length of 10.5 mm., and the two "co-types" are indicated as being 11.5 and 10 mm. long. It

I have not been able to examine representatives of this species. In the absence of any knowledge as to the nature of the hinge, it is not possible to indicate the relationships of this peculiar form. The deep constriction in the posterior region and the deep, wide, chordate lunular area, which unfortunately is not shown in the illustrations, seem to be entirely distinctive.

PHYSOIDA PALLARY, 1900

Plate 2, figures 27-29

Physoida PALLARY, 1900, Jour. de Conch., vol. 48, p. 409.

TYPE (BY ORIGINAL DESIGNATION): *Corbula physoides* Deshayes. Recent, Mediterranean Sea off the coast of Algeria.

I have seen no specimens of the type species of this genus, and the following diagnosis is based upon the excellent description and illustrations given by Deshayes (1844-1848, p. 234, pl. 22, figs. 4-6).

DIAGNOSIS OF THE TYPE SPECIES: Shell small, fragile, and transparent, resembling a minute *Anodonta* in external appearance. The surface appears to be smooth and polished, but under magnification shows a number of transverse striae and irregular growth lines. A low, posterior, umbonal ridge extends to the posterior ventral angle of the valves. The right valve is slightly larger and a little more convex than the left.

The hinge of the right valve consists of a moderately prominent, strongly curved cardinal tooth, with a large, shallowly excavated resilial pit immediately posterior to it. The hinge of the left valve consists of a dentiform projection on the cardinal margin, which forms the anterior side of a deep, triangular socket for the reception of the cardinal tooth of the right valve. The chondrophore is situated immediately behind this socket. It is described as being flattened and triangular in shape.

The muscle scars are relatively small; the pallial line is simple, with very little indication of a sinus.

DIMENSIONS (FIDE DESHAYES): Length,

may be that these dimensions are those of the largest specimen in the collections. The diameter is apparently that of conjoined valves.

11 mm.; height, 7 mm. Recent, Mediterranean Sea off the coast of Algeria.

ANAPTERIS VAN WINKLE, 1919

Plate 3, figures 11-14

Anapteris VAN WINKLE, 1919, Bull. Amer. Paleont., vol. 8, no. 33, p. 7; VAN WINKLE, 1921, *ibid.*, vol. 8, no. 36, p. 9.

TYPE (BY MONOTYPY): *Anapteris regalis* Van Winkle. St. Maurice beds (upper Nanjemoy), Eocene, Newcastle, Virginia.

The type and only known species of this group is a most peculiar form. I have not been able to examine actual specimens, but on the basis of the original descriptions and illustrations, supplemented by enlarged photographs of the original specimens kindly furnished by Mrs. Palmer, I am able to give the following diagnosis:

DIAGNOSIS OF THE TYPE SPECIES: The shell is relatively large, thick, and apparently somewhat inequivalved; the umbos low, approximate, and not strongly inflated. The right valve is slightly convex, the left flat with the posterior end reflexed outwardly.¹ Both valves have a sharp posterior umbonal carina extending to the sharply angulate posterior ventral margin. "Surface [of the left valve] ornamented with prominent concentric lines which extend from the umbonal ridge to the anterior end, where they terminate in a peculiar manner as though the anterior end had been broken; on the posterior portion of the shell anterior to the umbonal ridge where the lines merge into the ridge, a separation of the lines occurs giving place to very short, equally prominent surface markings. Just anterior and parallel to the umbonal carina is a fine channel; the prominent lines posterior to the umbonal ridge extend almost vertically to the dorsal margin" (Van Winkle [Palmer], 1919, p. 7). The sculpture of the right valve is similar to that of the left except that the concentric lines do not show the peculiar anterior terminations and extend to the dorsal margin without interruption.

¹ It is probable that there is a corresponding inward flexure of the right valve, as in the case of many of the corbulid groups, and that the "intimation of a gape" (Van Winkle [Palmer], 1919, p. 7) is a suggestive rather than an actual condition. The material available to me does not permit any definite statement regarding this feature.

Internally, the anterior limit of the body chamber is marked, in the left valve, by a well-defined, raised ridge. A considerable portion of the valve extends dorsally and, in smaller amount, anteriorly from this ridge to form a peculiar wing-like flare; this is the portion of the exterior of the valve, which is marked by the unusual termination of the concentric sculpture. No such termination is apparent on the anterior end of the right valve; instead there is a coarsening and thickening of the posterior dorsal margin of the valve, a structure not apparent on the left valve.

The anterior dorsal margin of the right valve is grooved and slightly thickened internally for the reception of the sharpened margins of the left; the posterior dorsal margin is similarly thickened, and the ventral margin appears to have been grooved.

The hinge of the right valve consists of a moderately strong, triangular cardinal tooth, with, posteriorly, a broad, sunken, resilial pit which undercuts the umbo and extends in a narrowing curve to a position immediately dorsad to the cardinal. In the left valve there is a deep cardinal socket followed posteriorly by a projecting chondrophore whose surface is marked by "a narrow, short posterior groove: the anterior groove is slightly marked, in some cases practically obsolete" (Van Winkle [Palmer], 1919, p. 7). The pallial line is moderately prominent; the pallial sinus short and only very slightly sinuous.

DIMENSIONS: Syntype, P.R.I.¹ No. 1391; left valve, length, 17 mm.; height, 9.5 mm.; diameter, 2.7 mm. St. Maurice (upper Nanjemoy), Eocene, Newcastle, Virginia, first Ianthina expedition collection.

Syntype, P.R.I. No. 1392; left valve, length, 14 mm.; height, 7.7 mm.; diameter, 2 mm. Same locality and collection.

Topotype, P.R.I. No. 296; right valve (broken), length, 15 mm.; height, 8 mm.; diameter, $2.2 \pm$ mm. Newcastle, Virginia, first Ianthina expedition collection.

It is to be noted that the characteristic wing-like flare is present on the anterior end of the left valves only, unless the somewhat similar, but, in the writer's opinion, not neces-

sarily analogous, structure on the posterior dorsal margin of the right valve does represent the same type of flare. In a personal communication dated January 17, 1944, Mrs. Palmer writes:

"Whether the 'wings' are pathologic or not is not clearly apparent. Some pathologic cases as *Venus tridacnoides* (Miocene) and *Athleta tuomeyi* (Eocene) are obviously so. These (*Anapteris*) shells do not have that definite pathologic appearance. They rather look to me as though it was a feature of instability. It obviously varies in the amount of development and certainly is not confined to either valve."²

CORBULAMELLINAE, NEW SUBFAMILY

CORBULAMELLA MEEK AND HAYDEN, 1857

Plate 2, figures 21-26

Corbulamella MEEK AND HAYDEN, 1857, Proc. Acad. Nat. Sci. Philadelphia, for 1857, p. 143.

TYPE (BY ORIGINAL DESIGNATION): *Corbula ? gregaria* Meek and Hayden. Montana group, Upper Cretaceous, "Yellowstone River, Montana Territory."

Meek's types of this interesting little species have been stored for the duration of the war and were not available for this study. It was not possible to secure an adequate preparation of the hinge structures from the material available, and in the following diagnosis the details of that critical area are taken from Meek's description (1876, pp. 246, 247).

DIAGNOSIS OF THE TYPE SPECIES: The shell is very small, subtrigonal, and rather strongly inflated. The valves are unequal in size, the right being larger and more convex than the left. The umbos are inflated, approximate, and slightly prosogyrous, with that of the right valve being higher and more prominent than the left. There is no evidence of any posterior umbonal ridge, the surface of the valves being broadly convex and ornamented with microscopic concentric lines.

The ventral margin of the right valve is grooved for the reception of the margin of the left.³ The hinge of the right valve consists

² Mrs. Palmer interprets the posterior dorsal structure on the right valve as being a wing-like flare strictly analogous with that of the left valve.

³ It is believed that the anterior and posterior dorsal margins of the right valve are also grooved, but the evi-

¹ Palaeontological Research Institution, Ithaca, New York.

of an anterior cardinal tooth followed, posteriorly, by a "comparatively large cartilage-pit under the beak" (Meek); that of the left valve appears to be more slender than that of the right and consists of an anterior cardinal socket, followed, posteriorly, by a projecting chondrophore which is "larger and more prominent" than the cardinal tooth of the right valve.

"The anterior muscular impression is narrow-ovate, faintly marked and placed near the border; the posterior impression has the same form, and appears to occupy nearly or quite the whole surface" of a "very prominent spoon-shaped process" which projects, as a small platform, into the interior of the valve along its posterior dorsal side.

The pallial line is moderately well impressed, the pallial sinus shallow "and apparently a little angular" (Meek).

DIMENSIONS: Hypotype, A.M.N.H. No. 9433/1:1; both valves, length (slightly incomplete posteriorly), 2.6 mm.; height, 2.5 mm.; diameter, 2 mm. Upper Cretaceous, Belle Fourche River, South Dakota.

CAESTOCORBULINAE, NEW SUBFAMILY

CAESTOCORBULA VINCENT, 1910

Plate 4, figures 1-4

Caestocorbula VINCENT, 1910, Ann. Soc. Roy. Zool. Malac. de Belgique, for 1909, vol. 44, p. 141.

GENOTYPE (BY ORIGINAL DESIGNATION): *Corbula henckeliusi* Nyst (error for *C. henckeliusiana* Nyst). Eocene, sables de Wemmels, Belgium.

The writer (Vokes, 1944) has recently discussed this genus in some detail, noting that the peculiar type of siphonal plate found by Vincent (1890, p. vii; 1910, p. 140) in his specimen of "*Corbula*" *henckeliusiana* Nyst (1836, p. 4, pl. 1, fig. 8a, b; 1844, pp. 63, 64, pl. 2, fig. 3a, a', b, b') also occurred in "*Corbula*" *elegans* Sowerby (1827, p. 139, pl. 572, fig. 1; see Woods, 1908, pl. 34, fig. 28a) and in "*Corbula*" *crassiplica* Gabb (1860, p. 394, pl. 68, fig. 25). In addition, five species are known in which the rectangular type of plate noted by Vincent (1910, p. 141) in "*Corbula*" *regulbiensis* Morris occurs. The generic name

Parmicorbula has been proposed for this group. Thus, siphonal plates are now known in eight species, a fact which, together with the nature of the plates themselves and the manner of their emplacement, clearly indicates that Gardner (1926, p. 44; 1928, p. 227) was in error in interpreting the structure observed by Vincent as being either foreign to the shell or due to some phenomenon of breakage.

I have not been able to study specimens of *Caestocorbula henckeliusiana* (Nyst), the following diagnosis being based upon specimens of "*Corbula*" *ficus* Brander from Wemmel, a species which Vincent considered to be synonymous with *C. henckeliusiana*.

DIAGNOSIS: The shell is relatively small and very inequivalved. The right valve is larger than the left, more inflated and produced posteriorly to form a prominent rostral "snout"; its surface is sculptured by coarse concentric ribs. The left valve is almost equilateral sub-triangular in outline, not produced posteriorly, but bearing a prominent posterior umbonal ridge. The surface is ornamented with concentric ribbing which is finer than that of the right valve; occasional traces of radial ornamentation may also be observed. The dorsal margins of the right valve are strongly grooved for the reception of the margins of the left. The posterior dorsal margin along the rostrum of the right valve is sharply bent laterally to meet the dorsal margin of a small, separate siphonal plate which served to protect the left side of the siphons in place of a rostrum from the left valve.

The siphonal plate¹ has the form of an oblique trapezium, with the more oblique angle at the anterior dorsal corner, which lies against the posterior dorsal side of the left valve. The surface bears a distinct oblique median ridge that extends diagonally across the plate from the acute dorsal angle to the broader posterior ventral one. The surface is ornamented by raised lamellar growth lines that are chevron shaped and parallel to the posterior and ventral margins of the plate.

¹ The specimens of "*Corbula*" *ficus* available lack the siphonal plate. This description is based upon Vincent's figure, together with that of Woods (*op. cit.*), and upon more than a dozen specimens of *C. crassiplica* Gabb, from the Ripley formation at Coon Creek, Tennessee, in which the plates were observed by the writer.

dence available does not permit a conclusive statement regarding this condition.

The right cardinal tooth is triangular, relatively large, and heavy, and the resilial pit is prominent and elongate, extending dorsad slightly above the posterior side of the cardinal tooth. The left hinge consists of an anterior cardinal socket followed posteriorly by a moderately broad, projecting chondrophore.

The muscle scars are slightly thickened and rugose; the pallial sinus is extremely well developed for the family Corbulidae, broad and rounded.

DIMENSIONS: Hypotype, U.S.N.M. No. 13070; right valve, length (slightly incomplete posteriorly), 13.6 mm.; height, 10.5 mm.; diameter, 5.2 mm. Eocene, Wemmels, Belgium.

Hypotype, U.S.N.M. No. 13070; both valves (juvenile), length (slightly incomplete posteriorly), 7.6 mm.; height, 5.2 mm.; diameter, 3.7 mm. Eocene, Wemmels, Belgium.

PARMICORBULA VOKES, 1944

Plate 4, figures 5-10

Parmicorbula VOKES, 1944, Amer. Jour. Sci., vol. 242, pp. 619, 621, pl. 1, figs. 7-18.

GENOTYPE (BY ORIGINAL DESIGNATION): "*Corbula*" *neaeroides* Blanckenhorn. Aptian, Cretaceous, from Abeih, Lebanon Mountains, Republic of Lebanon.

DIAGNOSIS OF THE TYPE SPECIES: The shell is of moderate size, moderately inflated, and very inequivalved. The right valve is larger than the left, more inflated, and produced posteriorly to form a prominent rostral "snout"; its surface is ornamented by coarse concentric ribs that die out before reaching the rostrum so that the latter is generally relatively smooth. The left valve is almost equilateral, not produced posteriorly, but bearing a moderately prominent posterior umbonal ridge; the surface is marked by concentric ribbing, which is generally finer than that on the right valve. Occasionally there are traces of radial ribbing present. The dorsal margins of the right valve are grooved for the reception of those of the left, and just within the ventral margin there is a linear depression. The left valve rested against the inner side of this depression.

Both the posterior dorsal and ventral margins of the right valve are constricted at the anterior end of the rostrum, and along that

structure are sharply bent laterally to receive between them the similarly bent margins of a small, rectangular siphonal plate. The exterior of this plate is marked by a shallow, inconspicuous, median groove, and by growth lines which run transversely across it. Internally, there is a low median ridge complementary to a similar ridge trending parallel to the length of the rostrum of the right valve.

The hinge, muscle impressions, and pallial sinus are similar to those of *Caestocorbula*.

DIMENSIONS: Topotype, A.M.N.H. No. 25933:1; length, 21.1 mm.; height, 14.6 mm.; diameter, both valves, 11 mm.; length, left valve, 16.5 mm.; height, left valve, 12.2 mm.

Topotype, A.M.N.H. No. 25933:2; right valve, length, 17.5 mm.; height, 12.9 mm.; diameter, 6.5 mm.

Topotype, A.M.N.H. No. 25933:3; juvenile specimen, both valves, length, 7.1 mm.; height, 4.4 mm.; diameter, 3.6 mm.

PACHYDONTINAE, NEW SUBFAMILY

PACHYDON GABB, 1868

Plate 4, figures 11-15

Pachydon GABB, 1868, Amer. Jour. Conch., vol. 4, p. 198.

Anisothyrus CONRAD, 1871, Amer. Jour. Conch., vol. 6, p. 196.

Pachyodon (Gabb, emend.) MEEK, 1876, Report of the United States geological survey of the territories (Hayden), vol. 9, p. 240.

Not *Pachyodon* von Meyer, 1838, N. Jahrb. f. Min., p. 414 (Mammalia).

Not *Pachyodon* Stutchbury, 1842, Ann. Mag. Nat. Hist., vol. 8, p. 481 (Mollusca).

Not *Pachyodon* Agassiz, 1846 (emend. for *Pachyodon* Schumacher, 1816), Nomenclatoris zoologici index universalis, p. 275 (Mollusca).

Not *Pachyodon* Costa, 1856, Atti Accad. Pontaniana, vol. 7, no. 1, p. 38 (Pisces).

Not *Pachydon* Broun, 1881, Manual of the New Zealand Coleoptera, pt. 2, p. 705 (Coleoptera) (= *Phorostichus* Broun, 1882).

TYPE (BY SUBSEQUENT DESIGNATION, MEEK, 1876): *Pachydon obliqua* Gabb. Pebas beds, Pliocene, Amazon Basin, Brazil.

Although the original orthography of this name may not meet with the full approval of etymologists, there seems to be, under Article 19 of the International Rules, no need

¹ In the original publication (Vokes, 1944) the catalogue numbers assigned to these specimens were erroneously stated to be 16403/4:1, 16403/4:2, 16403/4:3.

for its emendation, as was done by Meek (1876, p. 240). In its original form it is fully available for the group of species to which it is attached, but in its emended form it is several times preoccupied, twice within the Mollusca. The substitute name *Anisothyris* Conrad is superfluous.

DIAGNOSIS OF THE TYPE SPECIES: The shell is moderately large, inequivalved, the right larger and somewhat more inflated than the left; umbos anterior, subspiral,¹ projecting in advance of the anterior margin of the shell. The moderately well-developed umbonal ridge, more prominently developed on the left valve than on the right, tends on both valves to bifurcate a short distance behind the umbo and to continue as narrow, moderately sharp ridges separated by a raised but slightly concave surface to the posterior margin. The anterior ridge forms the posterior ventral angulation, and the posterior one reaches the valve margin at about the middle of the posterior end, which is, however, not sharply delimited from the posterior dorsal margin. The surface of the valves is marked with a low, inconspicuous, concentric ornamentation most strongly developed immediately anterior to the posterior umbonal ridge but elsewhere so submerged as to permit the valve to have a superficially polished appearance.

The inner margins of the right valve are finely grooved for the reception of those of the left. The hinge of the right valve consists of a large, broad, projecting, and dorsally curved rugose cardinal tooth, with a narrow, elongate, socket-like depression curving up from a position posterior to the tooth to a point immediately above it. This depression terminates in a minute, roofed pit which trends anteriorly. The socket serves for the reception of the nymph-like "chondrophore" of the left valve as well as for the attachment of the resilifer whose anterior end seems to have terminated in the tiny pit which may be

¹ Judging from the figures given by Conrad (1871, pl. 10), and from such specimens as are available, the extreme anterior position of the umbones and their coiled or subspiral nature are features of but specific importance among the eight or more species of this genus recognized in the Pebas fauna. In *P. ovatus* (Conrad), for example, they are situated but slightly in advance of the anterior third of the length and are not markedly coiled.

the remnant of the typical corbuloid resilial pit. The left hinge consists of a deep, rugose, cardinal socket which is strongly buttressed anteriorly by a heavy ridge, and of the "chondrophore" which is essentially but an elongate nymph-like swelling on the posterior dorsal margin of the valve from which it is separated only by a long, narrow groove. The face of this "chondrophore" is broadly grooved for the attachment of the resilifer. This groove is not on the dorsal face of the structure as in most corbuloid groups, however, but instead faces laterally directly into the "socket" of the right valve.

The interiors of the valves, within the moderately prominent pallial lines, are granulated and rugose. The pallial sinus is broad, shallow, and somewhat irregularly developed. The anterior adductor scar is deeply impressed, very rugose, moderately large and reniform; the posterior scar is moderately large, slightly impressed and is smooth.

DIMENSIONS: Topotype (?), A.M.N.H. No. 12661/1:1; both valves, length,² 12.3 mm.; height, 14.2 mm.; diameter, 10.3 mm. (The left valve, being smaller, has a length of 11.1 mm., a height of 11.9 mm., and a diameter of 4.6 mm.; diameter of right valve, 5.9 mm.) Pliocene (?) Pebas beds, upper Amazon River near Pebas, Brazil. Orton collection.

TIZA DE GREGORIO, 1890

Plate 4, figures 16-22

Tiza DE GREGORIO, 1890, Ann. de Géol. et de Paléont., livr. 8, p. 234.

TYPE (BY MONOTYPY): "*Corbula*"? (*Tiza amara* De Gregorio (= *Corbula alta* Conrad, 1850, pl. 1, fig. 3; not Conrad, 1849, pl. 12, figs. 33-35 = *C. aliformis* Conrad, 1866). Oligocene, Mint Springs formation, Vicksburg group, Vicksburg, Mississippi.³

² The shape of the valves is such as to permit considerable uncertainty as to the exact position from which to take the measurements. As a matter of convenience, these measurements were taken parallel to, and perpendicular to, the greatest width of the large cardinal tooth.

³ When De Gregorio described his "*Corbula*" (*Tiza amara*," he said (1890, p. 234, pl. 37, figs. 12-14): "J'ai beaucoup de doute en égard à leur provenance," etc. The illustrations leave no doubt that he had specimens of the Vicksburg form, an Oligocene rather than an Eocene species.

DIAGNOSIS OF THE TYPE SPECIES: The shell is relatively large and exceptionally inequivalved, the two valves differing so greatly from each other in size and shape as to have little or no resemblance. There is also great variation in the proportions of the same valve, the height:length ratio of specimens in the collection varying from 1:0.86 to 1:1.28.

The right valve is relatively heavy and is twisted laterally so that the umbo projects above the left valve. The surface of the valve is smooth, except for rather coarse concentric growth rugae. Two relatively low posterior umbonal ridges extend to the dorsal and ventral corners of the short, straight, posterior ventral margin.

The anterior and posterior dorsal margins of the right valve are grooved for the reception of those of the left. The hinge consists of a large triangular cardinal tooth with a very broadly triangular resilial socket posterior to it. The dorsal portion of this socket tends to extend up to, and often is slightly excavated under, the umbone. Anterior to the cardinal there is a relatively broad area of smooth hinge plate upon which rests a similar area of the hinge plate in the left valve. Posterior to this area in the latter there is a moderately deep cardinal socket. The "chondrophore" consists of a thickened raised area on the hinge plate. It is bordered anteriorly by a narrow raised ridge, and posteriorly by a narrow groove followed by a narrow raised area at the junction with the posterior dorsal, flange-like margin of the valve.

Externally, the left valve has a strikingly donaciform outline with a short, broadly rounded anterior and a produced posterior area. The most striking feature is the presence of a broad, flange-like projection along the posterior dorsal margin at right angles to the main area of the valve. There are two posterior umbonal ridges, as on the right valve, but the dorsal area of the valve is sharply deflected along the line of the anterior ridge. The valve is not inflated, and the umbo is small, low, and distant from the margin in compensation for the extreme overhang of that of the right valve.

The muscle scars of both valves are relatively small and slightly excavated. The pallial line is moderately well impressed and proceeds in a broad curve from the anterior

adductor scar to a point directly below the anterior ventral edge of the posterior adductor, where it turns at a sharp right angle proceeding in a short, straight line to that muscle area. Other than this there is no evidence of a pallial sinus.

DIMENSIONS: Topotype, U.S.N.M. No. 9552; right valve, length, 23 mm.; height, 18 mm.; diameter,¹ 8.3 mm. Vicksburg group, Vicksburg, Mississippi. Heilprin collection.

Topotype, U.S.N.M. No. 136859; right valve, length, 15.3 mm.; height, 17 mm.; diameter, 7.7 mm. Vicksburg group, Vicksburg, Mississippi. C. W. Johnson collection.

Topotype, U.S.N.M. No. 136859; left valve, length, 17.9 mm.; height, 12 mm.; diameter, 3 mm.² Vicksburg group, Vicksburg, Mississippi. C. W. Johnson collection.

LENTIDIINAE, NEW SUBFAMILY

LENTIDIUM CRISTOFORI AND JAN, 1832

Plate 4, figures 23-27

Lentidium CRISTOFORI AND JAN, 1832, Catalogus in IV sectiones divisus rerum naturalium . . . , sect. 2, p. 8; Mantissa Test., p. 4.

Corbulomya NYST, 1844, Mém. Cour., Acad. Roy. Sci. de Belgique, vol. 17, p. 59.

TYPE (BY SUBSEQUENT DESIGNATION, DALL, 1898): *Lentidium maculatum* Cristofori and Jan = *Corbula mediterranea* Costa. Recent, Mediterranean Sea.

DIAGNOSIS OF THE TYPE SPECIES: Shell small, thin, and translucent, elongate trapezoidal, and somewhat tellinoid in appearance, inequivalved, the right valve being larger than the left. The umbos are low, approximate, and central in position; that of the

¹ Owing to the peculiar lateral twisting of the right valves of this species it is difficult to state a true diameter of the valves. That which is given above is measured at right angles to a line extending from the umbo through the midlength of the shell; a diameter measured at a right angle to the length of the shell will be much less, though perhaps a truer expression of the true inflation of the valve. In topotype U.S.N.M. No. 136859, this latter diameter is 5.2 mm., and in U.S.N.M. No. 9552, it is 6.4 mm.

² Here, as in the right valve, it is difficult to state the true inflation of the valve, that given above bearing the same relationship to the umbo as the diameter given for the opposite valve. The peculiar posterior dorsal flange on the left valve protrudes considerably beyond this line, and a measurement through the widest extension of this area gives a diameter of 5.9 mm. for this specimen.

right valve projects very slightly in front of the inner margin of the valve, while that of the left is correspondingly behind the valve margin. Two low, rounded, and inconspicuous ridges proceed from behind the umbo, one extending to the posterior ventral margin, and the other to the posterior dorsal margin; the surface of the valve between these two ridges bears a shallow concavity. The surface of both valves is ornamented with fine, rounded concentric ridges separated by interspaces of unequal width.

The anterior dorsal and the ventral margins of the right valve are grooved for the reception of the left. The posterior dorsal margin bears a well-developed ridge just inside the valve margin against which the corresponding margin of the left valve closes. There is no true hinge plate in the right valve, the single cardinal tooth projecting from a subumbonal thickened area of the interior of the valve. This tooth is vertically elongated, triangular, and thickened ventrally, but does not project beyond the valve margin. Immediately posterior there is a broad, socket-like resilial pit which curves upward well into the tip of the umbo. The left valve has a small, narrow hinge plate. On the anterior end of this structure is a small, cardinal-like process, which appears to be a dentiform projection from the valve margin. Immediately posterior there is an elongate-triangular socket for the right cardinal, bounded posteriorly by the anterior edge of the projecting

chondrophore. This chondrophore is a bipartite structure, the anterior half being grooved for the reception of the resilium, the posterior half bearing a ridged, tooth-like process which projects but little less than the anterior, resilium-bearing portion of the structure.

The muscle scars are small and impressed, the pallial line is also impressed, and the pallial sinus is broad and shallow.

DIMENSIONS: Hypotype, U.S.N.M. No. 202031; both valves, length, 7.8 mm.; height, 4.9 mm.; diameter, 2.5 mm.; diameter, right valve, 1.8 mm.; diameter, left valve, 1.3 mm. Recent, Genoa, Italy. Jeffrys collection.

I have not seen Cristofori and Jan's work and have accepted the citation as of Dall (1898, p. 838). According to Bucquoy, Dautzenburg, and Dollfus (1896, p. 587) the description in Cristofori and Jan is too imperfect to allow any certainty as to the species which they were describing. These authors, therefore, refer "*Corbula*" *mediterranea* Costa to the genus *Corbulomya* Nyst (1844, p. 58), type, *Corbula complanata* Sowerby. I have seen only right valves of this form, which is considerably larger than *Lentidium mediterranea* but has identical hinge characters, and, therefore, I agree with most previous authors in considering *Corbulomya* a synonym of *Lentidium*. If this latter name be abandoned as a *nomen dubium*, the name *Corbulomya* is available.

PLATE 3

Bicorbula gallica (Lamarck). Eocene. Paris Basin, France.

1. Exterior of right valve, hypotype, A.M.N.H. 16717/1:1. $\times 1.5$.

2. Interior of right valve, same specimen as figure 1. $\times 1.5$.

3. Dorsal view of left valve, hypotype, A.M.N.H. No. 16717/1:2. $\times 1.4$.

4. Exterior of left valve, same specimen as figure 3. $\times 1.5$.

5. Interior of left valve, same specimen as figure 3. $\times 1.6$.

Ursirivus pyriformis (Meek). Cretaceous. Wyoming.

6. Dorsal view of conjoined valves, hypotype, U.S.N.M. No. 103716. $\times 1.5$.

7. Exterior of right valve, topotype, U.S.N.M.

No. 103717. $\times 1.5$.

8. Interior of right valve, same specimen as figure 7. $\times 1.5$.

9. Interior of left valve, topotype, U.S.N.M. No. 103717. $\times 1.5$.

10. Dorsal view of left valve, same specimen as figure 9. $\times 1.4$.

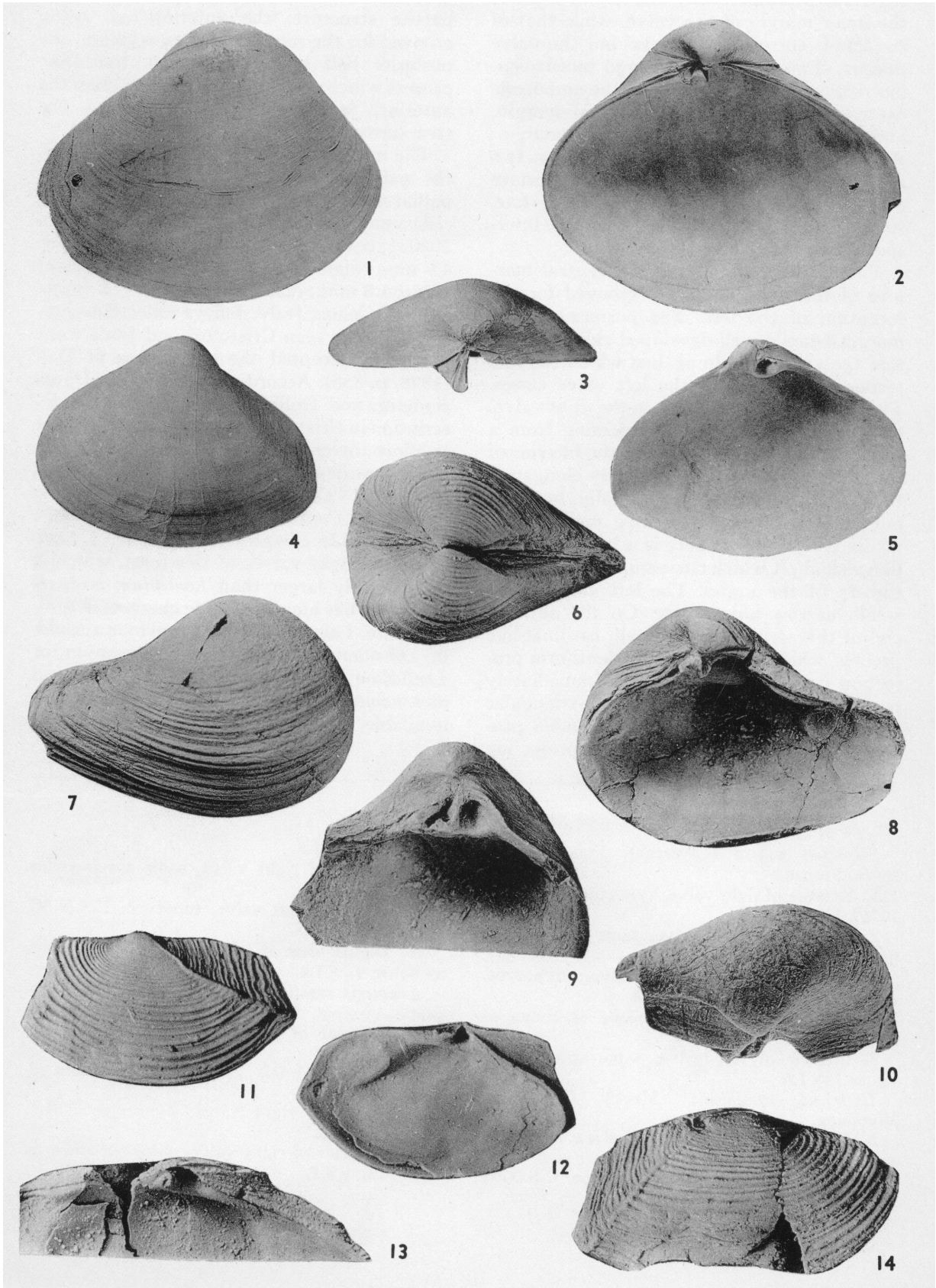
Anapteris regalis Van Winkle. Eocene. New-castle, Virginia.

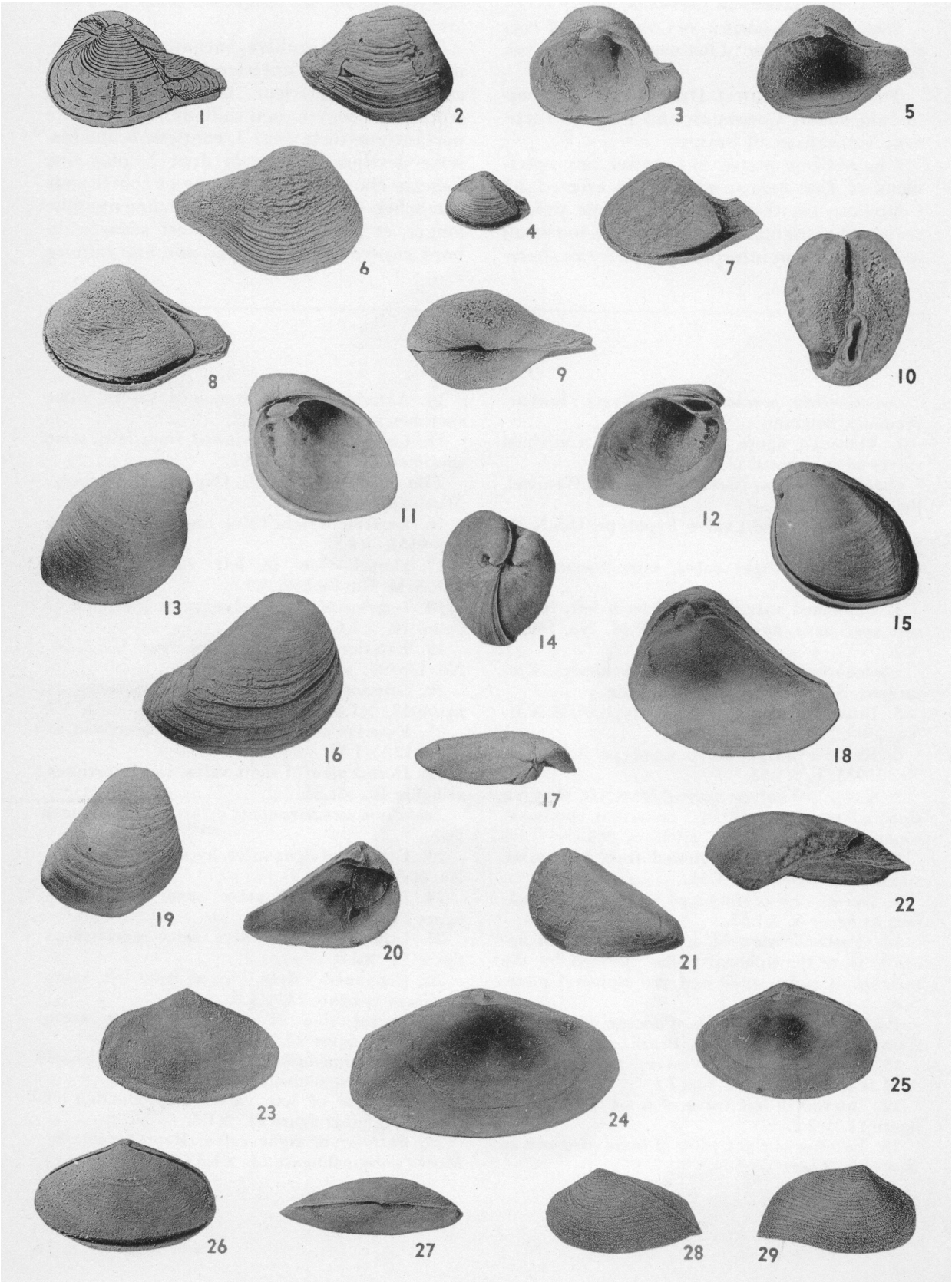
11. Exterior of left valve of syntype, P.R.I. No. 1392. $\times 4.3$.

12. Interior of left valve, same specimen as figure 11. $\times 4.3$.

13. Hinge of right valve, hypotype, P.R.I. No. 296. $\times 5.5$.

14. Exterior of right valve, same specimen as figure 13. $\times 3.7$.





INCERTAE SEDIS

SEMICORBULA COSSMANN, 1909

Semicorbula COSSMANN, in Cossmann and Peyrot, 1909, Act. Soc. Linnéenne Bordeaux, vol. 63, p. 186.

TYPE (BY ORIGINAL DESIGNATION): *Semicorbula nadali* Cossmann and Peyrot. Tertiary, Aquitanian, of France.

I have been unable to examine any specimens of this genus, which was erected by Cossmann on the basis of a single unique valve. The original illustrations are too small to be of value in interpreting the form, there-

fore it will be necessary to rely on the original description for its diagnosis. This is as follows:

"Coquille irrégulière, inéquilatérale, finement striée; côté antérieur atténué et sinueux, côté postérieur largement arrondi; crochet prosogyre, peu saillant; valve droite portant une forte dent 3, contiguë à une fossette destinée à loger la dent 2, plus une fossette chondrophore oblique et courte sous le crochet, enfin au-dessus d'elle, une nymphe longue et peu saillante qui est séparée du bord supéro-postérieur par une fine rainure

PLATE 4

Caestocorbula henckeliusiana (Nyst). Eocene. Wemmels, Belgium.

1. Vincent's figure of left side of conjoined valves with siphonal plate in position.

Caestocorbula ficus (Brander). Eocene. Wemmels, Belgium.

2. Exterior of right valve, hypotype, U.S.N.M. No. 13070. $\times 2$.

3. Interior of right valve, same specimen as figure 2. $\times 2$.

4. Conjoined valves, viewed from left, immature specimens, hypotype, U.S.N.M. No. 13070. $\times 2$.

Parmicorbula neaeroides (Blanckenhorn). Cretaceous. Abeih, Republic of Lebanon.

5. Interior of right valve, topotype, A.M.N.H. No. 25933: 2. $\times 1.5$.

6. Exterior of right valve, topotype, A.M.N.H. No. 25933: 1. $\times 1.55$.

7. Conjoined valves, viewed from left, showing siphonal plate in position, immature specimen, topotype, A.M.N.H. No. 25933: 3. $\times 4$.

8. Conjoined valves, viewed from left, same specimen as figure 6. $\times 1.55$.

9. Dorsal view of conjoined valves, same specimen as figure 6. $\times 1.55$.

10. Posterior view of specimen shown in figure 7. Note the siphonal "tube" formed by the rostrum of right valve and the siphonal plate. $\times 6$.

Pachydon obliqua Gabb. Pliocene (?). Upper Amazon River, near Pebas, Brazil.

11. Interior of right valve, topotype (?), A.M.N.H. No. 12661/1:1. $\times 2.1$.

12. Interior of left valve of same specimen as figure 11. $\times 2.2$.

13. Exterior of right valve of same specimen as figure 11. $\times 2$.

14. Anterior view of conjoined valves, same specimen as figure 11. $\times 1.9$.

15. Conjoined valves viewed from left, same specimen as figure 11. $\times 2.1$.

Tiza aliformis (Conrad). Oligocene. Vicksburg, Mississippi.

16. Exterior of right valve, topotype, U.S.N.M. No. 9552. $\times 1.5$.

17. Dorsal view of left valve, topotype, U.S.N.M. No. 136859. $\times 1.6$.

18. Interior of right valve, same specimen as figure 16. $\times 1.6$.

19. Exterior of right valve, topotype, U.S.N.M. No. 136895. $\times 1.6$.

20. Interior of left valve, same specimen as figure 17. $\times 1.45$.

21. Exterior of left valve, same specimen as figure 17. $\times 1.45$.

22. Dorsal view of right valve, same specimen as figure 16. $\times 1.55$.

Lentidium mediterranea (Costa). Recent. Genoa, Italy.

23. Exterior of right valve, hypotype, U.S.N.M. No. 202031. $\times 4.0$.

24. Interior of left valve, same specimen as figure 23. $\times 6.0$.

25. Interior of right valve, same specimen as figure 23. $\times 4.0$.

26. Conjoined valves, viewed from left, same specimen as figure 23. $\times 4.0$.

27. Dorsal view of conjoined valves, same specimen as figure 23. $\times 4.0$.

Pteromya crowcombeia Moore. Triassic (Rhaetic). Beer-Crowcombe, England.

28. Exterior of left valve. Reproduction of Moore's original figure 22. $\times 1.3$.

29. Exterior of right valve. Reproduction of Moore's original figure 23. $\times 1.3$ (?).

impressions musculaires très inégales; pas de sinus palléal.

"Quoiqu'il soit téméraire de fonder un nouveau Genre de Pélécypodes sur une seule valve très ambiguë, nous ne pouvons classer cet échantillon dans aucun des groupes connus de la famille *Myacidae*. Même la détermination du côté antérieur donne lieu à quelques hésitations, puisque la dent est encadrée de deux fossettes, dont l'une peut—aussi bien que l'autre—servir à loger une dent

opposée et qu'il n'y a pas de trace de sinus; mais la présence d'une nymphe qu'on ne peut confondre avec une lamelle latérale nous décide à considérer comme postérieur le côté le plus large et comme antérieur celui qui est plus atténué, contrairement à ce qui se passe chez les *Corbulidae* rostrées. Dans ces conditions, il y aurait une autre anomalie dans la forme des impressions musculaires, l'antérieur étant étroite et allongée, la postérieure grande et arrondie."

REJECTED NAMES

The following names, applied to groups which at one time or another have been referred to the family Corbulidae, have been rejected as members of that group during the course of this study:

"AGINA TURTON," GRAY, 1847

Agina Turton, GRAY, 1847, Proc. Zool. Soc. London, pt. 15, p. 191.

Gray cited *Agina* Turton as a member of the Corbulidae, giving *Mya inaequalis* as the type. However, *Agina*, as proposed by Turton (1822, p. 54), was monotypic, with *Mya purpurea* as the sole species. This is a *Saxicava*, and *Agina* is a synonym of that genus. Gray's erroneous inclusion of the genus in the Corbulidae was, however, accepted by a number of authors.

ALOIDIS MEGERLE VON MÜHLFELDT, 1811

Aloidis MEGERLE VON MÜHLFELDT, 1811, Gesellsch. Naturf. Fr. Mag., 5 Jahrb., p. 67.

TYPE (BY MONOTYPY): *Aloidis guineensis* Megerle von Mühlfeldt (= *Corbula sulcata* Lamarck).

This is an exact synonym of *Corbula* Lamarck. (See p. 7 above.)

ANISORHYNCHUS CONRAD, IN MEEK, 1871

Anisorhynchus Conrad MS, MEEK, 1871, in Hayden, Preliminary report of the United States geological survey of Wyoming and portions of contiguous territories, p. 293.

TYPE (BY MONOTYPY): *Corbula* (*Potamomya*?) *pyriformis* Meek.

The generic name *Anisorhynchus*, having

been earlier used by Schoenherr in Coleoptera, has been here replaced in the Corbulidae by *Ursirivus*, new name. (See p. 15 above.)

AZARA D'ORBIGNY, 1839

Azara D'ORBIGNY, 1839, Voyage dans l'Amérique Méridionale, Paléontologie, pl. 7 (text, 1842, p. 161).

TYPE (BY MONOTYPY): *Azara labiata* (= *Mya labiata* Maton).

A synonym of *Erodona* Daudin, in Bosc, 1802. (See below.)

CORBULOMYA NYST, 1844

Corbulomya NYST, 1844, Mém. Cour., Acad. Roy. Sci. de Belgique, vol. 17, p. 59.

TYPE (BY SUBSEQUENT DESIGNATION, HERRMANNSEN, 1847): *Corbula complanata* Sowerby.

This is a synonym of *Lentidium* Cristofori and Jan, 1832. (See p. 23 above.)

CORBURELLA LYCETT, 1850

Corburella LYCETT, 1850, Ann. Mag. Nat. Hist., ser. 2, vol. 6, p. 422.

TYPE (BY ORIGINAL DESIGNATION): *Corbula curtansata* Phillips. Corallian, Jurassic, of Yorkshire, England.

This is a synonym of *Tancredia* Lycett, 1850 (see Cox, 1929, pp. 571–573), and is not a member of the Corbulidae.

"ERODINA DAUDIN," GRAY, 1847

Erodina Daudin, GRAY, 1847, Proc. Zool. Soc. London, pt. 15, p. 191.

This is an evident *lapsus* for *Erodona* Daudin, in Bosc (see below).

ERODONA DAUDIN, in Bosc, 1802

Erodona DAUDIN, in Bosc, 1802, Histoire naturelle des coquilles, vol. 2, p. 329.

TYPE (BY MONOTYPY?): *Erodona macroides* Bosc (fide Dall, 1898, p. 836, who adds "but named on pl. 6, fig. 1, *Mya erodona*").

Dall (1898, p. 836) gives a reference to Daudin's work as "Mem. Moll. Vers. et Zooph. 1800," while Fischer (1887, p. 1123) gives the name as "*Erodona* Daudin in Bosc, 1802," and Neave (1939, p. 289) states "*Erodona* (Daudin MS.) Bosc, 1802." I have been unable to locate a copy of Daudin's work, so give it as above.

I am quite uncertain as to the systematic position of this group, which has long been included in the Corbulidae. The hinge of the right valve is very similar to that of *Spheniopsis* Sandberger, 1863 (type species of the family Spheniopsidae), and consists of two thin cardinals which border a prominent, triangular, resilial pit.¹ But in the latter genus the left valve lacks a hinge plate and is edentulous except for margined grooves which receive the cardinal lamellae of the right valve, the resilium being received under the beaks. In *Erodona*, there is a well-defined, projecting chondrophore which is, however, broader and heavier than that in most Corbulidae.

Although this group is somewhat intermediate in character between the Corbulidae and the Spheniopsidae, I do not believe that it is to be referred to the former family. The members of this genus are confined to the fresh and brackish waters of South American late Tertiary and Recent faunas. It may well be that careful studies will result in their being allocated to a separate family, and that their apparent relationship to both of the above families will be held to be superficial.

GRIPPINA DALL, 1912

Grippina DALL, 1912, Nautilus, vol. 25, p. 128.

TYPE (BY ORIGINAL DESIGNATION): *Grippina californica* Dall.

¹ Dall (1898, p. 839) considers that these are not cardinal teeth, even though there are sockets in the left valve for their reception. He interprets them as the turned-up edges of the hinge plate bordering the resilial pit and adds that there is "no well-defined cardinal tooth or laterals."

The hinge characters of both right and left valves, together with the well-marked, rounded, and ascending pallial sinus, clearly ally this genus with *Spheniopsis* Sandberger, 1863 (type, *Spheniopsis scalaris* Brown, Oligocene, Germany).

HARLEA GRAY, 1842

Harlea GRAY, 1842, Synopsis of the contents of the British Museum, 44th ed., p. 78.

In the forty-fourth edition of the "Synopsis of the contents of the British Museum," Gray proposes three names: *Harlea*, *Raleta*, and *Tomala*, giving a brief diagnosis of each, but not designating types or assigning any species to them. Later, in his famous "List of the genera of recent Mollusca, their synonyma and types" (1847, p. 192) he indicates, as type of each, "*Corbula*, n. sp." All three are, therefore, *nomina nuda*. (See Iredale, 1913, pp. 294-309.)

OSTOMYA CONRAD, 1874

Himella H. ADAMS, 1860, Proc. Zool. Soc. London, vol. 28, p. 203.

Not *Himella* Dallas, 1852, List of the . . . hemipterous insects in the . . . British Museum, vol. 2, pp. 379, 404 (Hemiptera).

Not *Himella* Grote, 1874, Proc. Acad. Nat. Sci. Philadelphia, for 1874, p. 200 (Lepidoptera).

Ostomya CONRAD, 1874, Proc. Acad. Nat. Sci. Philadelphia, for 1874, p. 30.

Anticorbula DALL, 1898, Trans. Wagner Free Inst. Sci., vol. 3, pt. 4, p. 839 (new name for *Himella* H. Adams, 1860, not Dallas, 1854).

Guianadesma MORRISON, 1943, Nautilus, vol. 57, no. 2, p. 49.

TYPE SPECIES (BY MONOTYPY): *Ostomya papyria* Conrad. Pebas beds, Pliocene, upper Amazon River.

It is difficult to understand Dall's reference of this group to the Corbulidae, for, aside from the possession of an internal ligament, it seems to differ entirely from this group. Morrison considered that his genus *Guianadesma* (type, by original designation, *G. sinuosum* Morrison) was probably to be interpreted as a rather aberrant member of the Lyonsiidae. It is quite possible that he is correct in this interpretation. There can be no doubt that *Guianadesma sinuosum* and *Ostomya fluviatilis* (Adams), the monotype of *Himella* and therefore of *Anticorbula*, are congeneric.

In recent correspondence, Dr. Pilsbry of the Academy of Natural Sciences of Philadelphia, to whom I am indebted for the loan of the specimens of *A. fluviatilis* studied during the preparation of this report, stated that he believed that *Anticorbula* is a synonym of *Ostomya* Conrad, 1874 (monotype, *O. papyria*, from the Pebas Pliocene of the upper Amazon River). I have seen no specimens of *O. papyria*, but judging from Conrad's original description and poor figures that interpretation seems quite justified and is accepted here. I have since noted that Pilsbry and Olsson (1935, p. 21) have referred "*Himella*" *fluviatilis* to *Ostomya*.

POTAMOMYA SOWERBY, 1835

Potamomya SOWERBY, 1835, Mineral conchology, systematic index, vols. 1-6, vol. 6, p. 241.

According to Sykes (1906, p. 193), the "Systematic index" to volumes 1 to 6 of Sowerby's "Mineral conchology" was issued August 1, 1835. This antedates the appearance of the second volume of the first edition of the "Conchological manual" (1839, p. 88) in which *Potamomya* appears as a *nomen nudum*, but which is usually given as the place where the name was originally proposed.

The species listed in the "Systematic index" as being referred to this genus include *Mya plana* Sowerby (1814, pl. 76, fig. 2), *Mya subangulata* Sowerby (1814, pl. 76, fig. 3) which is listed as *Mya plana* var. *subangulata*, and *Mya gregaria* Sowerby (1822, pl. 363). These species are from marine upper Eocene and Oligocene strata of England, but seem quite similar to *Erodona mactroides* Bosc, the type of the genus *Erodona*, of which *Potamomya* is generally considered to be a synonym. In any event, the genus does not belong in the family Corbulidae as here interpreted.

PTEROMYA MOORE, 1861

Plate 4, figures 28, 29

Pteromya MOORE, 1861, Quart. Jour. Geol. Soc. London, vol. 17, p. 505.

TYPE (BY SUBSEQUENT DESIGNATION, STOLICZKA, 1870): *Pteromya crowcombeia* Moore. Triassic, Rhaetic, Beer-Crowcombe, England.

The hinge of this form is entirely unknown, and its systematic position is, therefore, wholly conjectural. Stoliczka (1870, p. xv) considered it to be a synonym of *Corbula*, adding, "Except for its thin structure this shell does not appear to differ from *Corbula*." According to Moore's original description, however, it is widely gaping posteriorly, a condition which does not occur among the Corbulidae, and the writer is, therefore, inclined to agree with Richardson and Tutchter (1916, p. 51) in placing it among the Myidae.

RALETA GRAY, 1842

Raleta GRAY, 1842, Synopsis of the contents of the British Museum, 44th ed., pp. 78, 91.

This is a *nomen nudum*. (See remarks under *Harlea* Gray, 1842.)

TAENIODON DUNKER, 1848

Taeniodon DUNKER, 1848, Palaeontographica, vol. 1, no. 4, p. 179, pl. 25, figs. 1-3; PHILLIPI, 1897, Zeitschr. Deutschen Geol. Gesellsch., vol. 49, no. 3, p. 442, pl. 16, fig. 5, 5a-c.

TYPE (BY MONOTYPY): *Taeniodon ellipticus* Dunker. Liassic, Halberstadt, Germany.

This peculiar little genus, which has a somewhat tellinoid shell, is characterized by having an anterior cardinal in the right valve that is sharply directed anteriorly, and with a distinct "cartilage pit" behind the beak in the left valve. Dunker thought that the ligament was partly internal, partly external; Phillipi showed that it was wholly internal.

Stoliczka referred the genus to the Corbulidae, apparently as a subgenus of *Corbula*, with the statement (1871, p. 480): "The genus is evidently closely allied to *Corbula*, and still more so to *Quenstedtia*. . . ." Phillipi (1897, p. 442), after a study of additional specimens, concludes that the genus is unique and not related to any other fossil group. I have not been able to examine any specimens, and, as the published figures are inadequate to permit any conclusions being drawn from them, I follow Phillipi and reject this genus as a member of the Corbulidae.

TEMUCORBULA OLSSON, 1932

Temucorbula OLSSON, 1932, Bull. Amer. Paleont., vol. 19, no. 68, p. 244.

This is obviously a typographical error for *Tenuicorbula* Olsson, 1932.

TOMALA GRAY, 1842

Tomala GRAY, 1842, Synopsis of the contents of the British Museum, 44th ed., p. 91.

This is a *nomen nudum*. (See remarks under *Harlea* Gray, 1842.)

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