COMMONWEALTH OF VIRGINIA

VIRGINIA CONSERVATION COMMISSION

VIRGINIA GEOLOGICAL SURVEY

ARTHUR BEVAN, *State Geologist*

Bulletin 52

Geology of the Appalachian Valley in Virginia

By

CHARLES BUTTS

Part II—Fossil Plates and Explanations

PREPARED IN COOPERATION WITH THE UNITED STATES GEOLOGICAL SURVEY

UNIVERSITY, VIRGINIA

1941

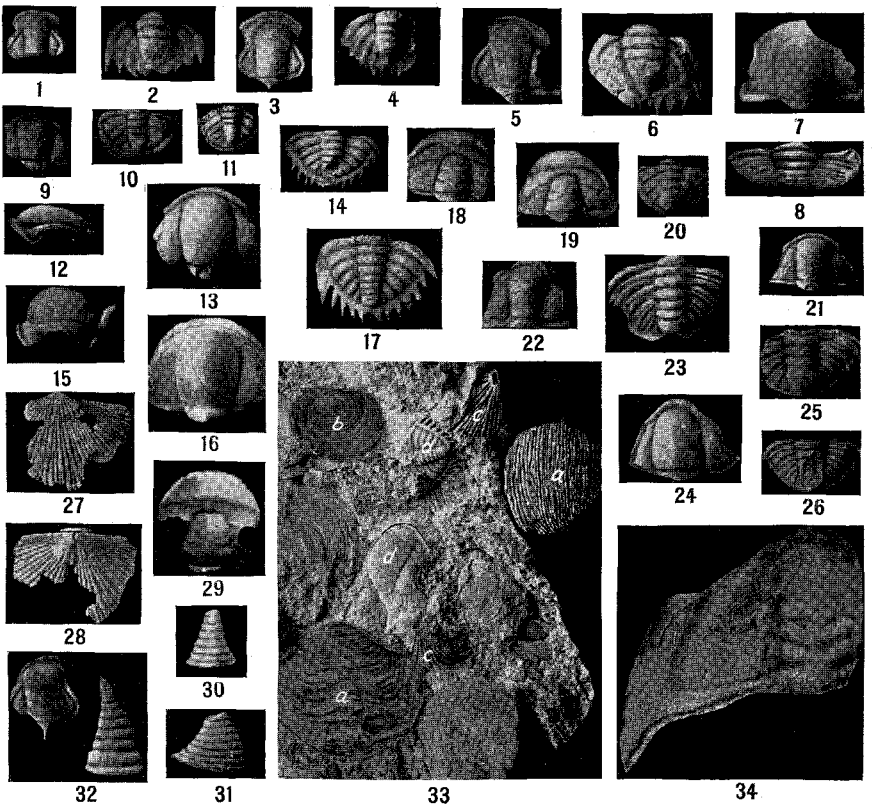
RICHMOND:

DIVISION OF PURCHASE AND PRINTING

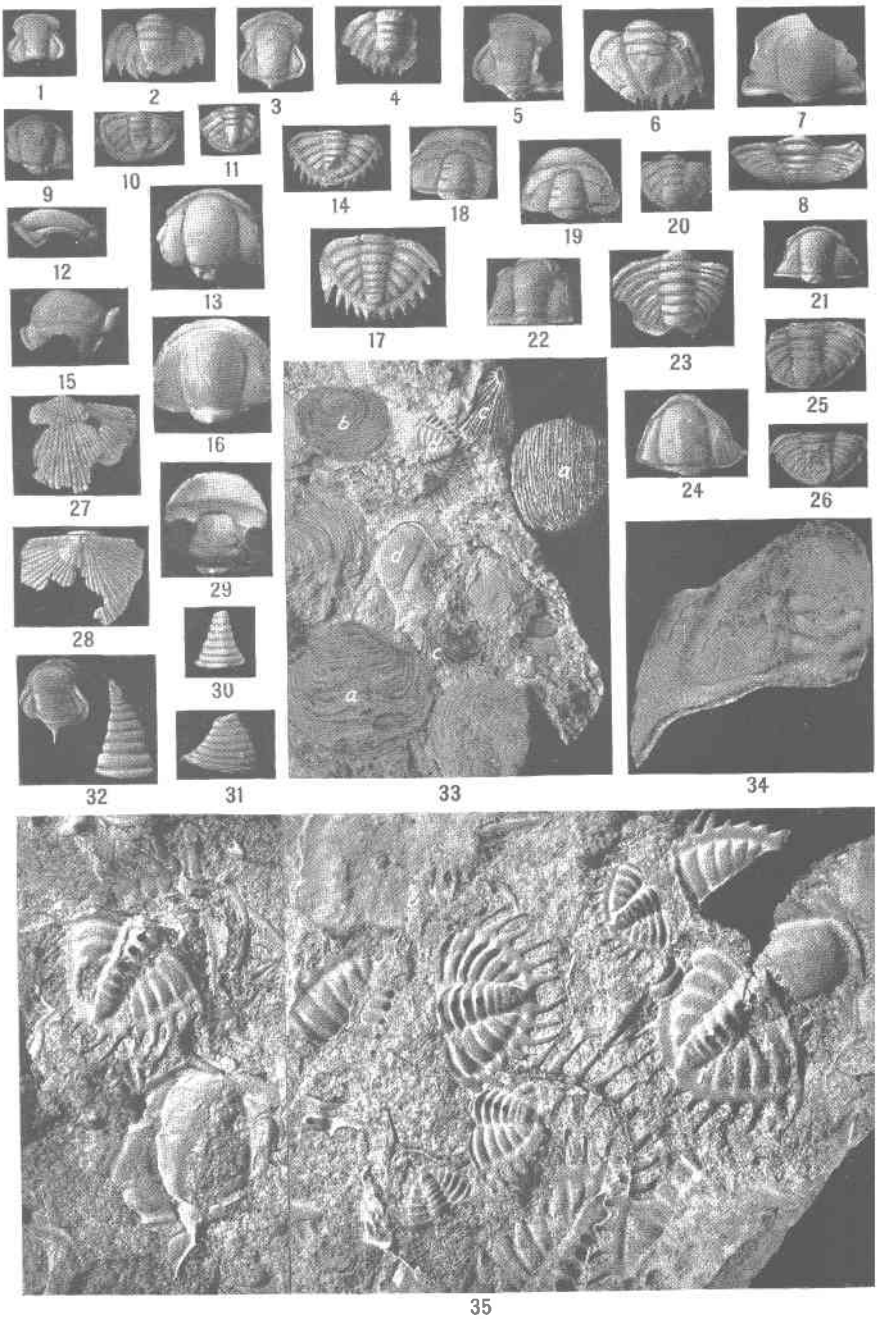
1941

CONTENTS

Fossil Plates and Explanations



SHADY FOSSILS



SHADY FOSSILS

PLATE 64.—SHADY FOSSILS[1]

FIGURE

1, 2. *Prozacanthoides virginicus* Resser.
Head and tail. Shady dolomite; Fossil Point 1 mile northeast of Austinville, Wythe County. Also occurs on old tram grade on Clear Creek about 1000 feet northwest of Fossil Point. U. S. N. M. 94749.

3, 4. *Prozacanthoides excavatus* Resser.
Head and tail. Occurrence as 1. U. S. N. M. 94752.

5, 6. *Prozacanthoides expansus* Resser.
Head and tail. Occurrence as 1. U. S. N. M. 94753.

7, 8. *Bicaspis austinvillensis* Resser.
Head and tail. Tail, × 2. Shady dolomite. Occurrence as 1. U. S. N. M. 94735.

9–11. *Bonnia crassa* Resser.
9, head; 10, 11, tails. Occurrence as 1. U. S. N. M. 94757.

12–14. *Kootenia browni* Resser.
12, head, side view; 13, head, dorsal view; 14, tail. Occurrence as 1. U. S. N. M. 94762.

15–17. *Kootenia virginiana* Resser.
15, head, side view; 16, head, dorsal view; 17, tail. Occurrence as 1. U. S. N. M. 94761.

18. *Proliostracus granulatus* Resser.
Head. Occurrence as 1. U. S. N. M. 94741.

19. *Proliostracus goodwini* Resser.
Head. Occurrence as 1. U. S. N. M. 94740.

20, 21. *Bonniella minor* Resser.
Tail and head. Occurrence as 1. U. S. N. M. 94739.

[1] All the fossil figures are of natural size, except those designated in the plate descriptions by the notations × 2, × 4, etc., which indicate that the figures are two or four or more times the natural size, respectively. Fossil localities not in Virginia are designated by states

Unless otherwise specified, all the specimens are in the United States National Museum and bear the numbers given in the accompanying plate descriptions.

FIGURE

22, 23. *Bonniella virginica* Resser.

Head and tail. Wax impression of head, × 2. Occurrence as 1. U. S. N. M. 94731.

24–26. *Olenoides hybridus* Resser.

24, head; 25, 26, tails. Occurrence as 1. U. S. N. M. 94732.

27, 28. *Nisusia* cf. *N. festinata* (Billings).

Ventral and dorsal valves. Incomplete specimens etched out with acid. Occurrence as 1. A widely distributed Lower Cambrian fossil; known as far north as Labrador. U. S. N. M. 91905.

29. *Austinvillia virginica* Resser.

Head. Occurrence as 1. U. S. N. M. 94742.

30, 31. *Helcionella buttsi* Resser, × 2.

30, edge; 31, side view. A fossil gastropod shell allied to the limpets. The shell tapered to an apex as in the specimen of Fig. 32. Occurrence as 1. U. S. N. M. 94726.

32. *Helcionella callahani* Resser and *Zacanthoides nitidus* Resser, × 2.

Side view of *Helcionella* and dorsal view of head of *Zacanthoides*. Occurrence as 7. U. S. N. M. 94727, 94728.

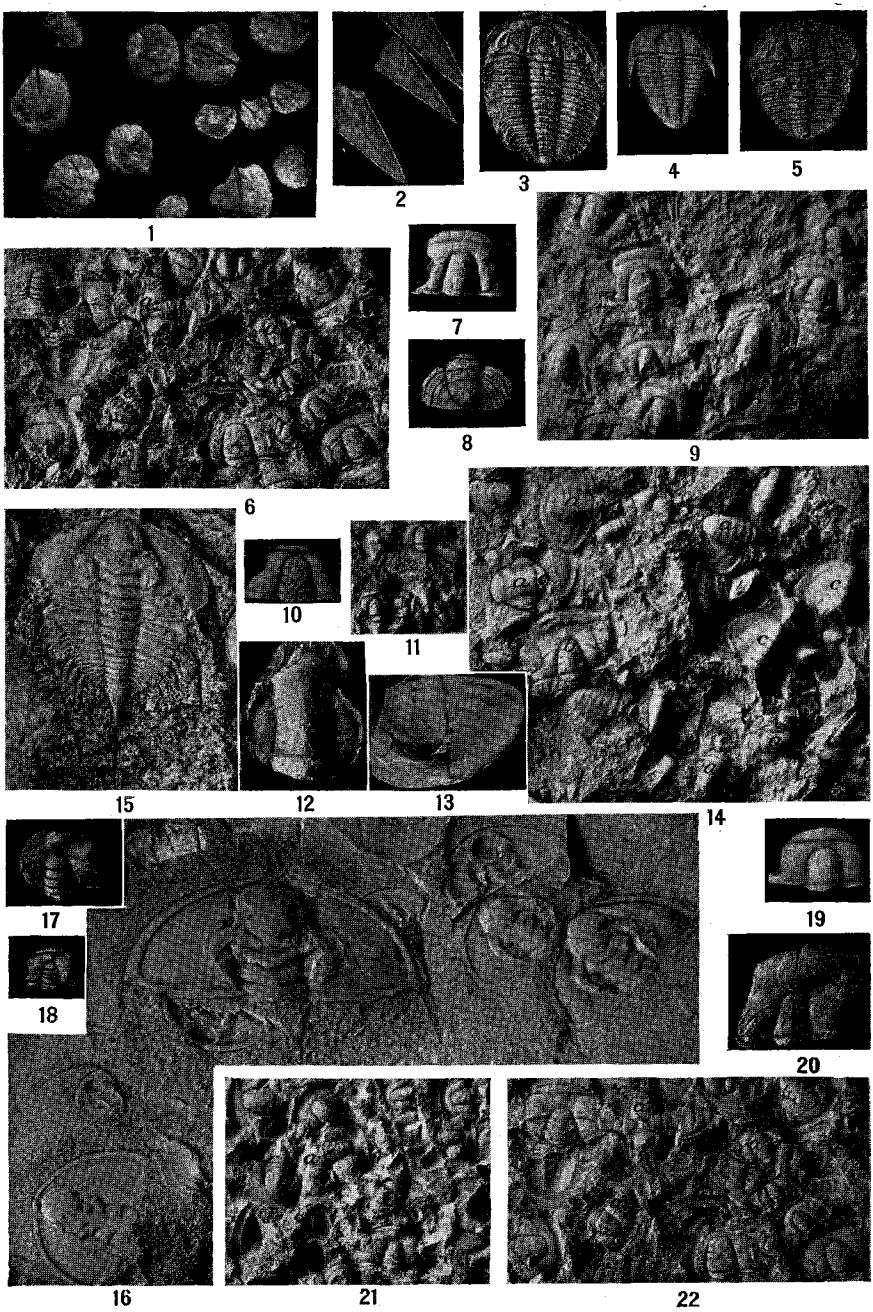
33. Small slab, with three species: a and b, *Kutorgina* cf. *K cingulata* Billings; a, ventral valve; b, dorsal valve; c, *Nisusia* cf. *N. festinata* (Billings); d, *Kootenia browni* Resser. Occurrence as 1. *Nisusia* and *Kutorgina* are among the oldest known brachiopods. U. S. N. M. 94733.

34. *Olenellus austinvillensis* Resser.

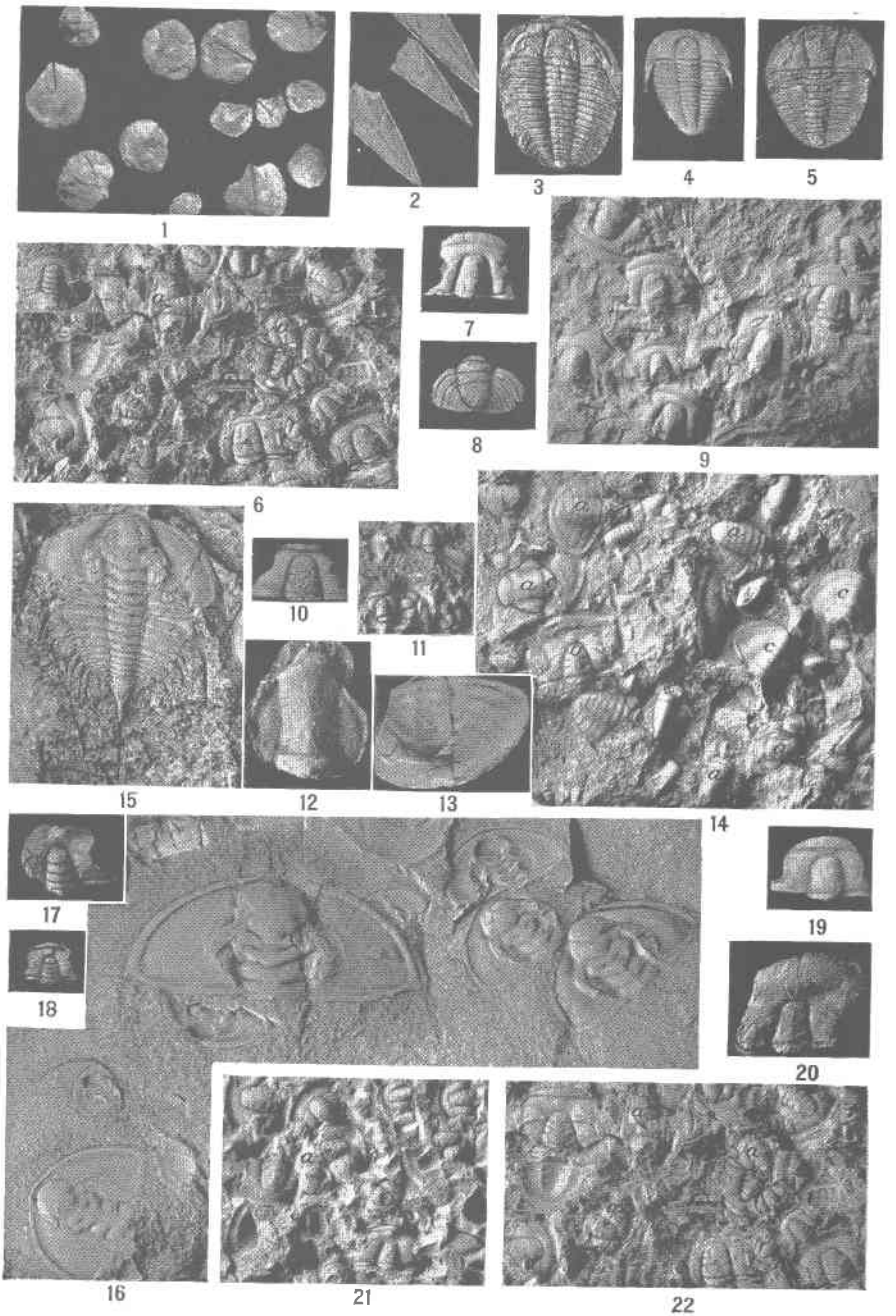
Head. Occurrence as 1. U. S. N. M. 94767.

35. *Kootenia currieri* Resser.

Part of slab with several specimens; mainly tails, with well-preserved tail spines. Two partly preserved heads, one in upper right, and another in the lower left corner. Shady dolomite; along road to Buddle Branch three-fourths of a mile southeast of Austinville, Wythe County. U. S. N. M. 94770.



SHADY AND ROME-WAYNESBORO FOSSILS



SHADY AND ROME-WAYNESBORO FOSSILS

PLATE 65.—SHADY AND ROME-WAYNESBORO FOSSILS

FIGURE

1. *Acrotreta buttsi* Resser, × 4.

   Thickly crowded on the surface of a thin layer which is blacked out in the figure. Rome (Waynesboro) formation; cut on the Chesapeake and Ohio railroad at city station, Waynesboro, Augusta County. Also half a mile southeast of Nance, Botetourt County. Rarely found in Virginia. U. S. N. M. 94778.

2. *Hyolithes wanneri* Resser and Howell, × 2.

   Rome formation; along U. S. Route 460, 1 mile southwest of Webster, Botetourt County. U. S. N. M. 92723.

3. *Ptychoparella michaeli* Resser, × 2.

   Lower Cambrian, Shady dolomite; three-fifths of a mile northwest of Bethany and about 2 miles due east of Austinville, Wythe County. U. S. N. M. 94781.

4. *Ptychoparella buttsi* Resser, × 2.

   Rome formation; Lee Highway at angle in road one-third of a mile northeast of Garst's store and 3½ miles southwest of Buchanan, Botetourt County. This point is on the abandoned road a few hundred feet east of its present location. U. S. N. M. 94771.

5. *Poliella virginica* Resser, × 2.

   Occurrence as 3. U. S. N. M. 94782.

6. *Alokistocarella typicalis* Resser (b) and *Alokistocare virginicum* Resser (a).

   Middle Cambrian, Rome formation, near top and about 100 feet below the base of the Rutledge limestone. Along road about 4 miles southwest of Purchase and 6½ miles southwest of Clinchport, Scott County. U. S. N. M. (a) 94816; (b) 94807, upper left-hand corner.

7–9. *Elrathiella buttsi* Resser.

   Middle Cambrian, Rome formation. 7, 9, top of formation along road 1 mile northeast of Bandys Chapel (Baptist Valley) about 4 miles west of Tazewell, Tazewell County. U. S. N. M. 94790. 8, tail, × 2, about 600 feet below the Rutledge limestone along State Route 71, 900 feet north of old

FIGURE

Cresswell and 2 miles north of Bolton, Russell County. U. S. N. M. 94779. (See Part I, Pl. 15D.)

10, 11. *Solenopleurella minor* Resser.

Middle Cambrian, Rome formation near the top. 10, head, × 4, occurrence as 8; 11, heads, × 2, occurrence as 7. U. S. N. M. 94779a, 94783.

12. *Glossopleura virginica* Resser.

Head. Middle Cambrian, Rome formation; about 200 feet below the Rutledge limestone along State Route 82, 1 mile southeast of Cleveland, Russell County. U. S. N. M. 94787. (See Part I, Pl. 16C.)

13. *Glossopleura buttsi* Resser.

Tail. Top of Rome formation; Aldrich, Shelby County, Alabama. U. S. N. M. 90169.

14, a. *Anoria bantius* (Walcott).

Heads and tails. The heads have long narrow glabellae and the tails have strong furrows. Occurrence as 12. U. S. N. M. 94788.

b. *Alokistocare? clevelandense* Resser.

Head. Occurrence as 12. U. S. N. M. 94789.

c. *Glossopleura virginica* Resser.

Smooth tails. Occurrence as 12. U. S. N. M. 94787.

15. *Olenellus buttsi* Resser.

Rome formation; along road about 1½ miles north of Montevallo, Alabama. Shows an entire trilobite as well as a good specimen of the genus *Olenellus*. U. S. N. M. 94777.

16. *Olenellus romensis* Resser and Howell.

Slab with several heads. Occurrence as 2. U. S. N. M. 92721.

17, 18. *Alokistocare virginicum* Resser.

Specimen of 17 somewhat distorted. Occurrence as 6. (See also Figs. 6a, 21a, and 22a.) U. S. N. M. 94811.

FIGURE

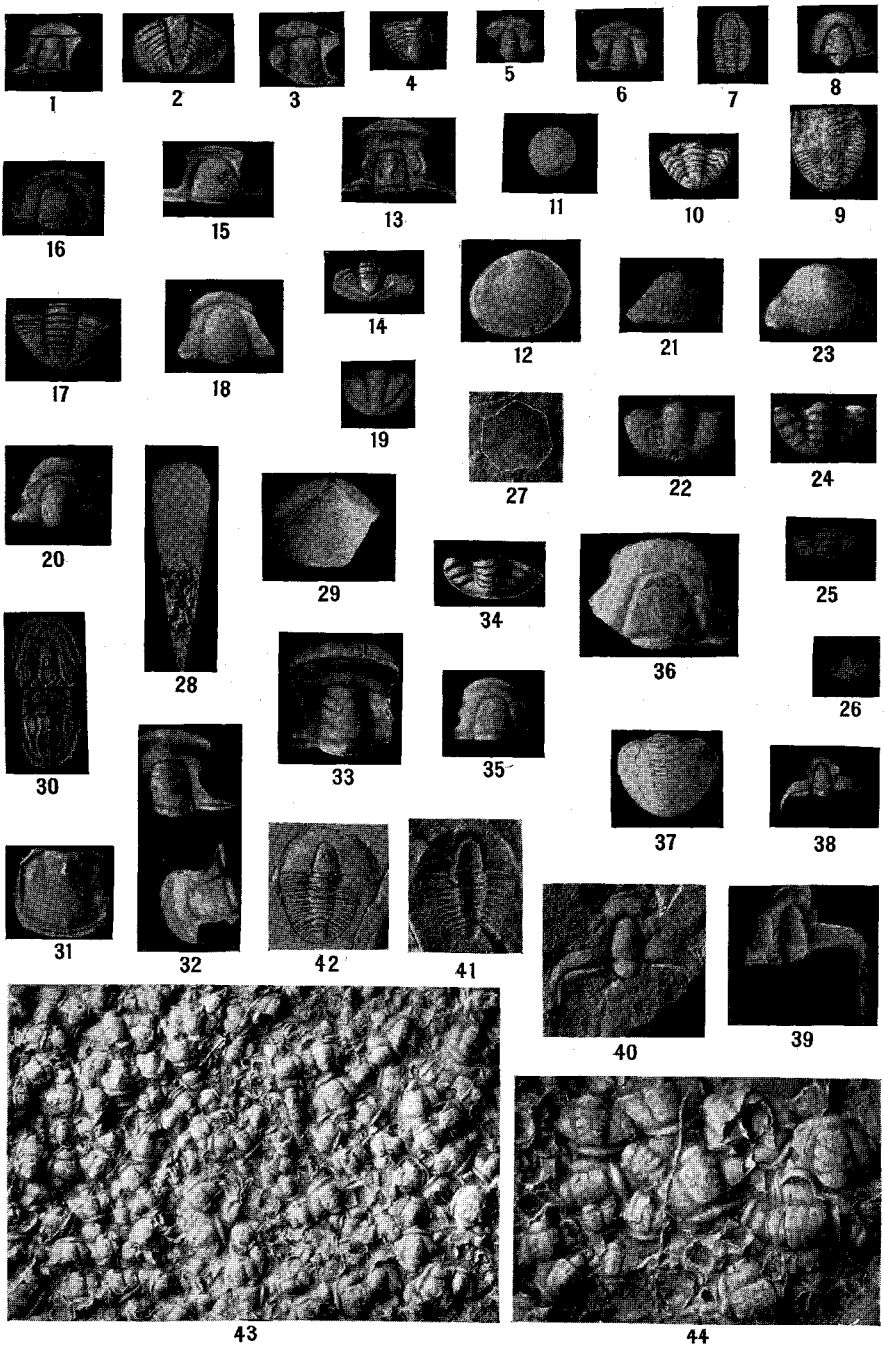
19. *Solenopleurella virginica* Resser.
Occurrence as 4. U. S. N. M. 94772.

20. *Amecephalina poulseni* Resser.
Associated with specimens of Figs. 3 and 5. Occurrence as 3. U. S. N. M. 94780.

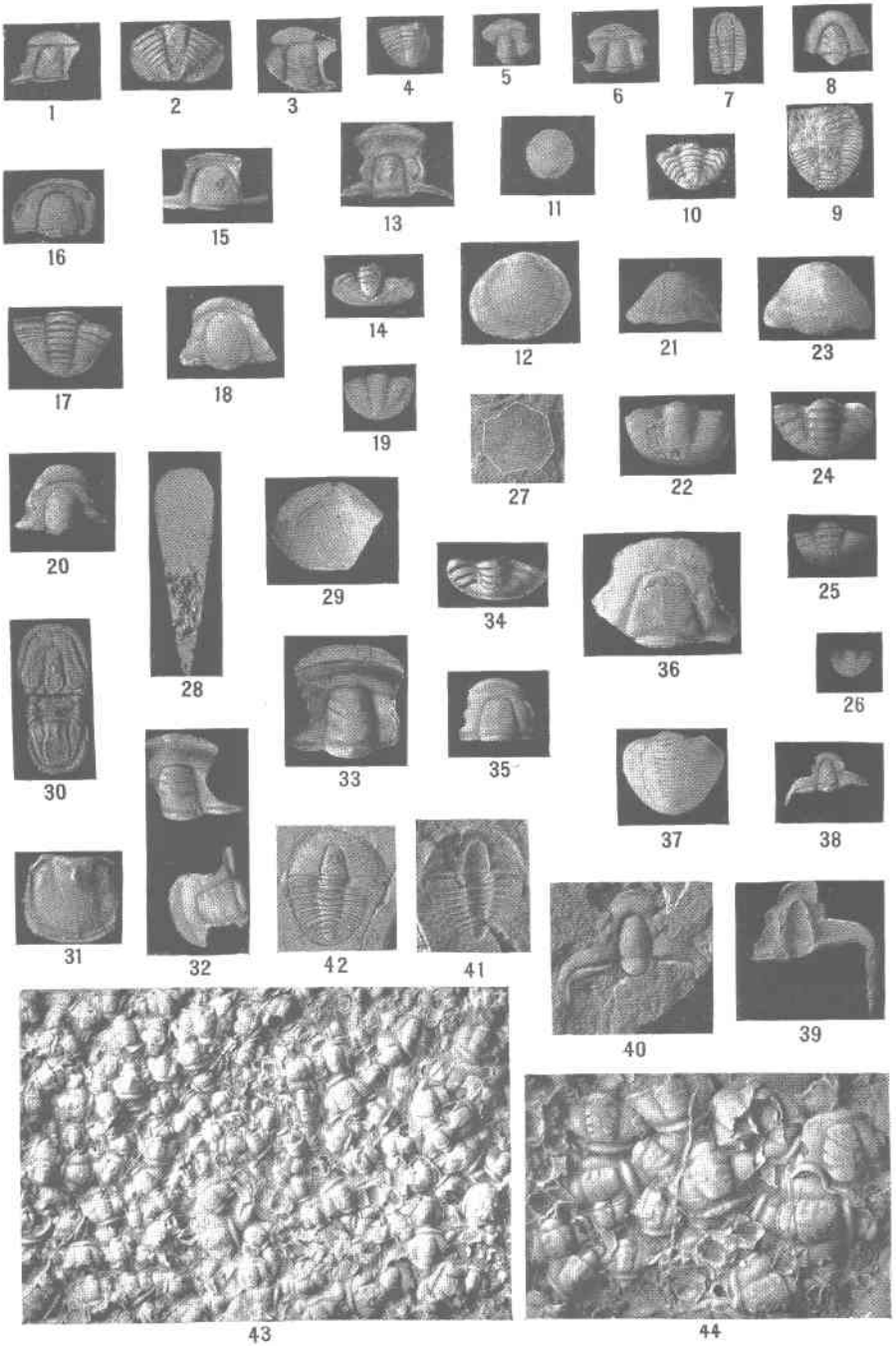
21. *Acrocephalops exigua* Resser.
Just to right of middle of lower margin. Also *Alokistocare virginicum* (a) and *Alokistocarella typicalis,* heads. Occurrence as 6. U. S. N. M. 94806.

22. *Acrocephalops teres* Resser.
Upper left corner. Also *Alokistocare* (a) and *Alokistocarella.* Occurrence as 6. U. S. N. M. 94816.

The fossils illustrated by Figs. 6-14, 17, 18, 21, and 22, listed here as occurring in the upper part of the Rome formation, have been assigned by Resser to the overlying Rutledge formation. (See Geol. Soc. America Spec. Paper No. 15, 1938.)



RUTLEDGE AND NOLICHUCKY FOSSILS



RUTLEDGE AND NOLICHUCKY FOSSILS

PLATE 66.—RUTLEDGE AND NOLICHUCKY FOSSILS

FIGURE

1, 2. *Genevievella campbelli* Resser, × 1½.

Head and tail. Nolichucky formation; vicinity of Goodwins Ferry, Giles County. U. S. N. M. 94969, 94969a.

3, 4. *Genevievella wallacensis* Resser.

3, head, × 2; 4, associated tail. Nolichucky formation; one-eighth of a mile southeast of Wallace, Washington County. U. S. N. M. 94981.

5. *Genevievella clinchensis* Resser.

Head. Nolichucky formation; Copper Ridge, 11 miles northwest of Knoxville, Tenn. U. S. N. M. 94979.

6. *Genevievella virginica* Resser.

Head. Nolichucky formation; 3 miles northeast of Abingdon, Washington County. U. S. N. M. 94982.

7. *Terranovella bristolensis* Resser, × 2.

Head and thorax. Nolichucky formation; reservoir on Mumpower Creek, 3¾ miles north of Bristol, Washington County. U. S. N. M. 94986.

8, 9. *Terranovella buttsi* Resser, × 2.

8, head; 9, thorax and tail. Nolichucky formation; half a mile northwest of Holston Mill and 5 miles southeast of Marion, Smyth County. U. S. N. M. 94984.

10. *Terranovella bristolensis* Resser, × 3⅓.

Tail. Occurrence as 7. U. S. N. M. 94986.

11, 12. *Dicellomus appalachia* Walcott, × 2.

Ventral valves of a large and of a small specimen. Nolichucky formation. 11, in railroad cut one-fourth of a mile east of Clinchport, Scott County; 12, occurrence as 1. U. S. N. M. 97282, 97283.

13, 14. *Clevelandella aruno* (Walcott).

Head and tail. Conasauga formation, Nolichucky horizon; 1½ miles southwest of Cleveland, Tenn. U. S. N. M. 61718.

15. *Blountiella buttsi* Resser.

Head. Occurrence as 6. U. S. N. M. 94962.

FIGURE

16, 17. *Blountia rogersvillensis* Resser, × 2.
Head and tail. Nolichucky formation; along Big Creek, 4 miles northeast of Rogersville, Tenn. U. S. N. M. 94959.

18. *Maryvillia bristolensis* Resser.
Head. Nolichucky formation; reservoir 3½ miles north of Bristol, Washington County. U. S. N. M. 94963.

19. *Blountia bristolensis* Resser, × 2.
Tail. Occurrence as 18. U. S. N. M. 94942.

20. *Blountia alexas* Walcott, × 2.
Head. Occurrence as 16. U. S. N. M. 62785.

21, 22. *Kingstonia apion* Walcott, × 2.
Head and tail. Conasauga formation, Nolichucky horizon; 5 miles west of Cleveland, Tenn. U. S. N. M. 70252, 70253.

23, 24. *Kingstonia walcotti* Resser, × 3⅓.
Head and tail. Occurrence as 5. U. S. N. M. 94937.

25. *Kingstonia clevelandensis* Resser, × 2.
Tail. Occurrence as 21. U. S. N. M. 94950.

26. *Kingstonia virginica* Resser, × 2.
Tail. Occurrence as 6. U. S. N. M. 94941.

27. Cystid or crinoid plate.
Nolichucky formation; Prospectdale, 4 miles south of Pearisburg, Giles County. Common in the Nolichucky of Virginia and Tennessee. U. S. N. M. 94988.

28, 29. *Hyolithes curticei* Resser.
Tube and operculum. Occurrence as 5. U. S. N. M. 94989.

30. *Proagnostus bulbus* Butts, × 4.
Conasauga formation, Nolichucky horizon; Cedar Bluff, Cherokee County, Ala. U. S. N. M. 94867.

31. *Oedorhachis greendalensis* Resser, × 4.
Tail. Nolichucky formation; half a mile southeast of Greendale, Washington County. U. S. N. M. 94861.

32. *Aphelaspis walcotti* Resser.
Heads. Nolichucky formation; cut at bridge of Norfolk and Western Railway over Buchanan Branch 2½ miles southwest of Saltville, Smyth County. U. S. N. M. 94923.

FIGURE

33. *Aphelaspis quadrata* Resser.

Head. Occurrence as 5. U. S. N. M. 94924.

34. *Aphelaspis simulans* Resser, × 2.

Tail. Nolichucky formation; 1 mile northwest of Washburn, Tenn. U. S. N. M. 94925.

35. *Maryvillia widnerensis* Resser.

Head. Elbrook dolomite, Nolichucky horizon; Widner Branch, 13 miles east of Abingdon, Washington County. U. S. N. M. 94956.

36, 37. *Maryvillia masadensis* Resser.

Head and tail. Occurrence as 35. U. S. N. M. 94964.

38–42. *Norwoodella saffordi* (Walcott).

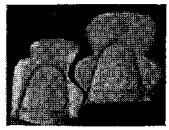
38-40, heads; 41, 42, counterparts of an entire specimen; 41, external mold; 42, internal mold; 38, 40, internal molds; 39, external mold of various heads. Nolichucky formation. 38, 39, along State Route 71 half a mile southeast of Old Cresswell and 1½ miles northwest of Bolton, Russell County; 40-42, Rogersville, Tenn. 38, 39, U. S. N. M. 97281; 40, 94890; 41, 42, 61599.

43, 44. *Solenopleurella buttsi* Resser.

43, slab with many heads; 44, × 2, part of same slab enlarged but not the part shown in 43. Rutledge limestone; 1 mile northwest of Fairview, Scott County. U. S. N. M. 94786.


1


2

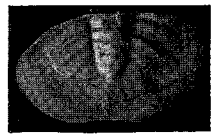

13


14

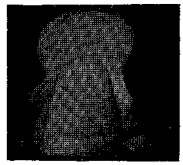

4

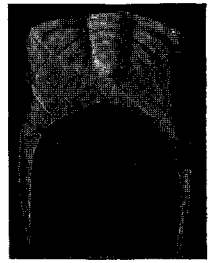

3

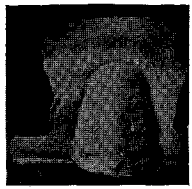

7

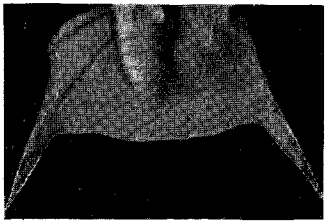

15


11

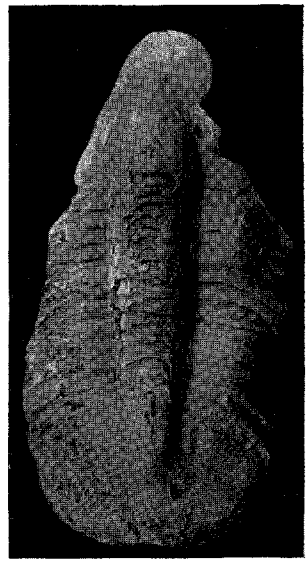

12

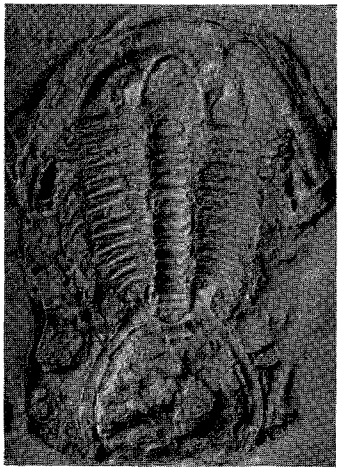

10


5


9


8


16


6

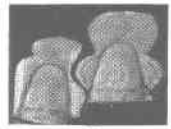

17


18

NOLICHUCKY AND CONOCOCHEAGUE FOSSILS


1


2


13

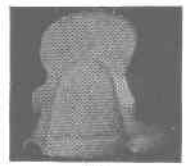

14


3


7


4

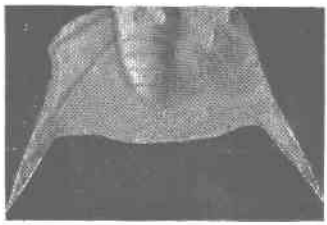

11


12

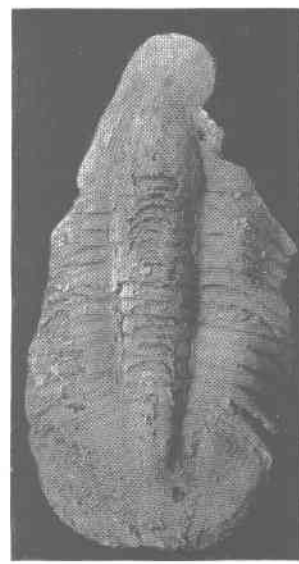

15

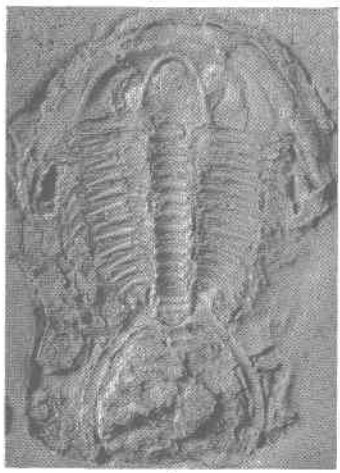

5


10


9


8


16


6


17


18

NOLICHUCKY AND CONOCOCHEAGUE FOSSILS

PLATE 67.—NOLICHUCKY AND CONOCOCHEAGUE FOSSILS

FIGURE

1–4. *Tricrepicephalus* sp.

1, 2, heads. 1, exterior, × 2; 2, partly exterior, partly internal mold; 3, tail; 4, free cheek, internal mold. Nolichucky formation; two-fifths of a mile southeast of Greendale, Washington County. U. S. N. M. 97284.

5. *Tricrepicephalus simplex* Resser.

Internal mold. Conasauga formation, Nolichucky horizon; Murphrees Valley, Ala. U. S. N. M. 94915.

6. *Tricrepicephalus cedarensis* Resser.

External mold. Conasauga formation, Nolichucky zone; Cedar Bluff, Cherokee County, Ala. U. S. N. M. 94955.

7. *Crepicephalus greendalensis* Resser.

Head, internal mold. Nolichucky formation; half a mile southeast of Greendale, Washington County. U. S. N. M. 94912.

8, 9. *Crepicephalus buttsi* Resser.

Head and tail, internal molds. Nolichucky formation; 2 miles east of Cleveland, Russell County. U. S. N. M. 94908.

10. *Crepicephalus rectus* Resser, × 5.

Tail, internal mold. Nolichucky shale; War Gap 8 miles northwest of Rogersville, Tenn. U. S. N. M. 94916.

11. *Coosia calanus* (Walcott).

Head, external mold. Nolichucky formation; Wolf Creek 6 miles northeast of Rocky Gap, Bland County. U. S. N. M. 62789.

12. *Coosia robusta* (Walcott).

Head, internal mold. Nolichucky formation; Copper Ridge 11 miles northwest of Knoxville, Tenn. U. S. N. M. 57590.

13, 14. *Coosia latilimbata* Resser.

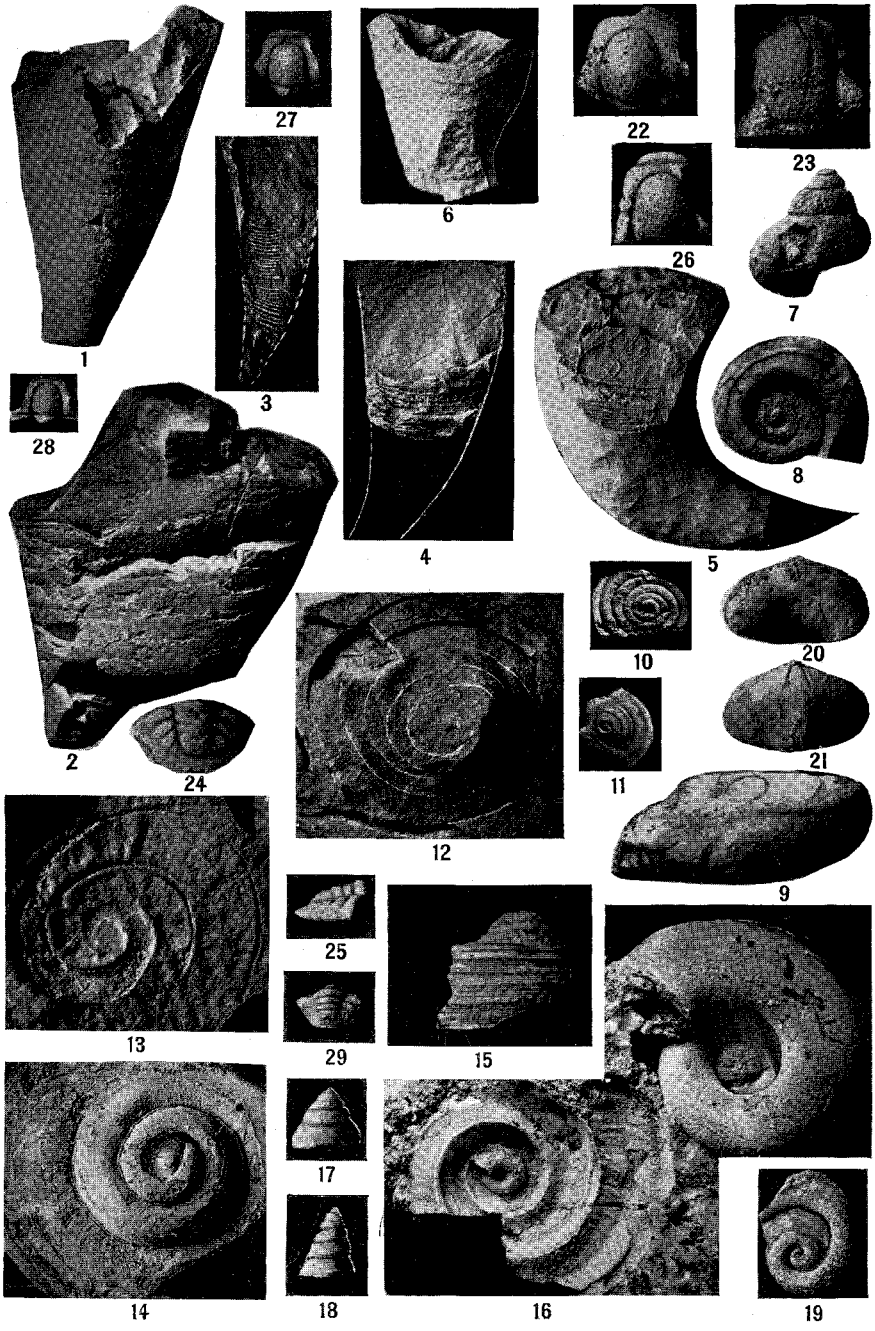
Heads, internal molds. Nolichucky formation. 13, Queens Knob 3 miles north of Wytheville, Wythe County; 14, cut at bridge of Norfolk and Western Railway over Buchanan Branch 2½ miles southwest of Saltville, Smyth County. U. S. N. M. 94918, 94903.

FIGURE

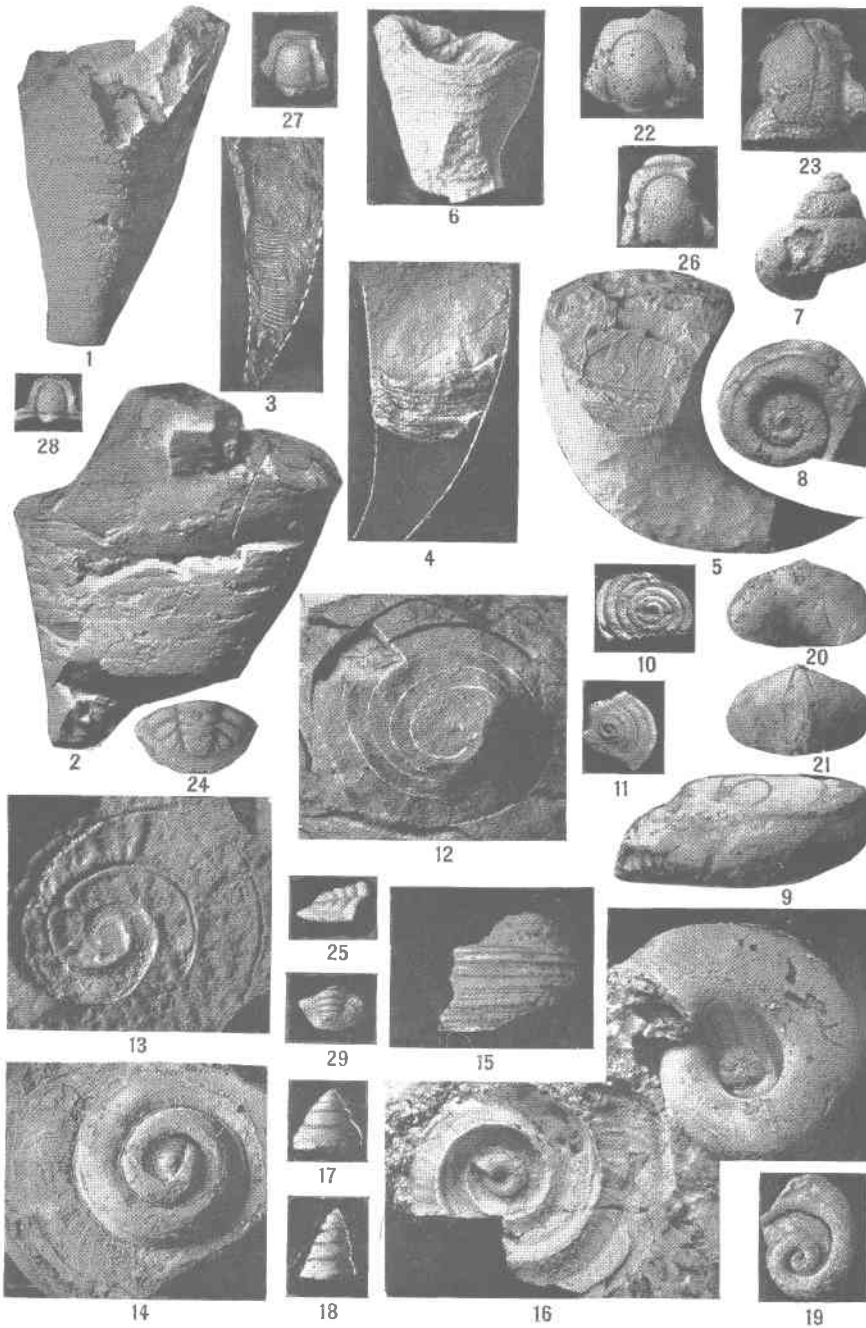
15. *Coosia calanus* (Walcott).
Tail, internal mold. Occurrence as 11. U. S. N. M. 62790.

16. *Coosia superba* Walcott.
Internal mold. Occurrence as 6. U. S. N. M. 57589.

17, 18. *Tellerina wardi* (Walcott).
Head and tail, internal molds. Conococheague limestone; along Lee Highway (old location), 1 mile north of Natural Bridge, Rockbridge County. U. S. N. M. 94998.



CHEPULTEPEC AND BEEKMANTOWN FOSSILS



CHEPULTEPEC AND BEEKMANTOWN FOSSILS

PLATE 68.—CHEPULTEPEC AND BEEKMANTOWN FOSSILS

FIGURE

1, 2. *Clarkoceras* sp.

Edge and side views of same specimen. Chepultepec residual chalky chert; along U. S. Route 25 and in shallow ravine by house below Gobblers Knob 3½ miles southeast of Cumberland Gap village, Tennessee. (See Middlesboro sheet.) U. S. N. M. 97285.

3. *Dakeoceras?* sp.

Natural longitudinal section in limestone. Such fossils are generally distributed in the Chepultepec but scarce and hard to find. Along State Route 501 at top of hill 3 miles northwest of Lexington, Rockbridge County. U. S. N. M. 97286.

4. *Dakeoceras* sp.

Outline of lower end restored. Chepultepec limestone; slope 50-100 feet above road and three-fourths of a mile northeast of Cambria, Montgomery County. U. S. N. M. 97287.

5. *Levisoceras* sp.

Chepultepec limestone; 500 feet northeast of the road 1 mile northwest of Fishers Hill, Shenandoah County. U. S. N. M. 97288.

6. *Hemithecella expansa* Ulrich and Bridge, n. gen. and sp.

Dorsal view. Chepultepec formation in an old quarry one-fourth mile southeast of the Lee Highway and about 6 miles northeast of Bristol, Washington County. Figured specimen: U. S. N. M. 97289. A thin, transversely arched, triangular plate, broadest and highest anteriorly, tapering posteriorly to a slender spine, the dorsal longitudinal profile concave upward, ventral profile flat. Anterior end with a shallow, central emargination, the extremities evenly rounded to join the lateral margins. A thin septum in the posterior third of the shell, parallel to and almost in the plane of the ventral margin. In internal molds this septum is indicated by two spines along the median line, placed one above the other, the upper one shorter than the lower. Surface of internal molds smooth; outer surface marked by growth lines which parallel the curvature of the anterior margin. The genus resembles *Hyolithes,* but is proportionately much broader, and differs in the sinuate anterior margin, the concave dorsal profile and in the lack of a continuous ventral plate. Genotype:—*Hemithecella expansa*

FIGURE

Ulrich and Bridge, n. sp. Length 25 mm., breadth 20 mm., height at anterior end 7 mm., depth of anterior emargination 4 mm. The unfigured holotype, U. S. N. M. 96211, is from the Gasconade chert of Camden County, Missouri. Sections and fragments of these forms are of occasional occurrence in the Chepultepec limestone throughout Virginia. Numbers of specimens occur in dolomite at the top of the Natural Tunnel, Scott County, at the south portal. They are very obscure on the weathered surfaces of the limestone and hard to find. They are known elsewhere in the Gasconade formation of Missouri with which the Chepultepec is correlated on the basis of a good many fossils in common, and the limestone containing these forms in Virginia is, therefore, correlated with the Chepultepec and Gasconade.

7. *Sinuopea* aff. *S. basiplanata* Ulrich and Bridge.

Chepultepec limestone; along State Route 91 at intersection with northeast road 2 miles south of Saltville, Smyth County. U. S. N. M. 97290.

8, 9. *Helicotoma uniangulata* (Hall).

Internal molds in chalky chert. 8, top; 9, side view of another specimen showing the lateral profile characteristic of *Helicotoma.* Note the ridge toward the outer margin of 8, which suggested the name *uniangulata.* Occurrence as 1. U. S. N. M. 97291a, 97291b.

10. *Ozarkispira subelevata* Ulrich and Bridge, n. sp.

Chepultepec formation; along road three-fourths of a mile northwest of Indian Rock, Botetourt County. Figured specimen: U. S. N. M. 97292. Diameter 14 to 16 mm., height 3 mm.; whorls, about 6, narrow, very slowly enlarging, about 1.5 mm. across the top, flat across the top, smoothly rounded and slightly embracing the preceding whorl on the umbilical side; apical angle 170 to 180 degrees; distinguished from *O. rotuliformis* (Meek)=*O. leo* Walcott, by its larger size and greater apical angle. The unfigured cotypes, U. S. N. M. 96210, of this species are from the Ellenburger limestone of Texas.

11. *Ophileta* sp.?

Chepultepec limestone; along Southern Railway at crossing of Linwood Street in Bristol, Tenn. U. S. N. M. 97293.

FIGURE

12. *Ophileta* cf. *O. complanata* Vanuxem.

Internal mold. Chepultepec or Stonehenge limestone; about 4 miles north-northeast of Middletown, Frederick County. U. S. N. M. 97294.

13. *Eccyliomphalus* sp.?

Internal mold and section. Occurrence as 12. This type is rather common in the Chepultepec. U. S. N. M. 97295.

14–16. *Lophonema?* sp.

14, apical view, impression of the external mold shown in 16 (lower); 15, side view of an impression of the external mold of the body whorl of another specimen and perhaps another species, to show character of ornamentation; 16, internal mold (upper right) of umbilical side of a specimen. Beekmantown, *Ceratopea* zone; along road 1¼ miles northeast of Bolar, Bath County. U. S. N. M. 97296a, 97297, 97296b.

17, 18. *Gasconadia putilla* (Sardeson).

Chepultepec limestone; in old quarry about one-fourth of a mile southeast of the Lee Highway and 6 miles northeast of Bristol, Washington County. *Gasconadia* is a widely distributed Chepultepec or Gasconade genus. U. S. N. M. 97298a, 97298b.

19. *Eccyliopterus* sp.?

Internal mold of the umbilical side. Occurrence as 11. U. S. N. M. 97299.

20, 21. *Syntrophina* aff. *S. campbelli* (Walcott), × 2.

Internal molds. Ventral and dorsal views of same specimen. Beekmantown, Nittany? horizon; from chert at the base of steep slope just southeast of State Route 71 and about half a mile east of Bolton, Russell County. Associated pieces of chert contain specimens of *Lecanospira* and *Hystricurus* which prove their Nittany age. U. S. N. M. 97300.

22. *Jeffersonia* sp.

Internal mold of head in chert, dorsal view. Beekmantown, horizon of Jefferson City limestone of Missouri lying between the *Lecanospira* and *Ceratopea* zones; along road 1½ miles southeast of Whites Mill, Washington County. U. S. N. M. 97301.

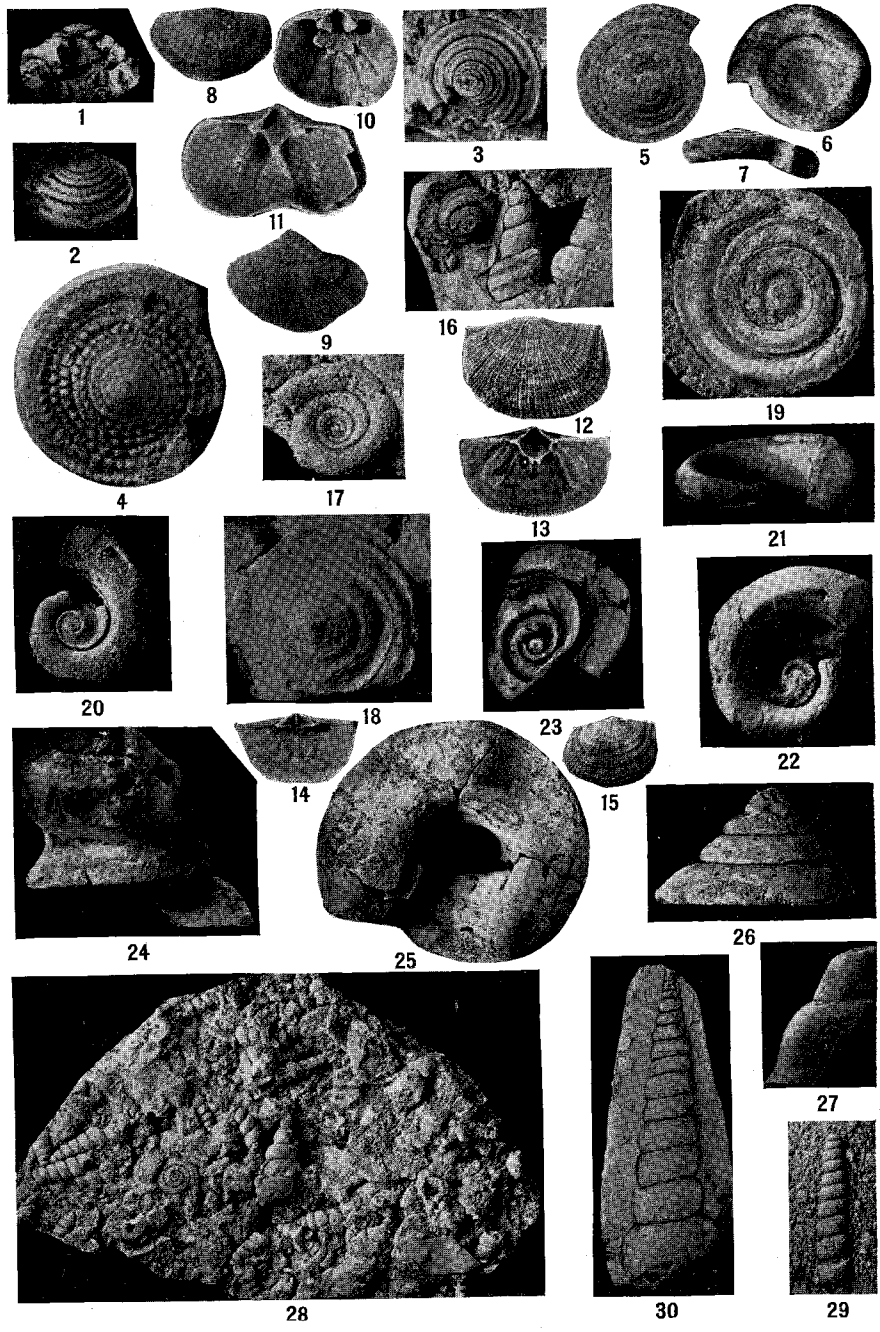
FIGURE

23–25. *Bathyurus?* sp., × 2.

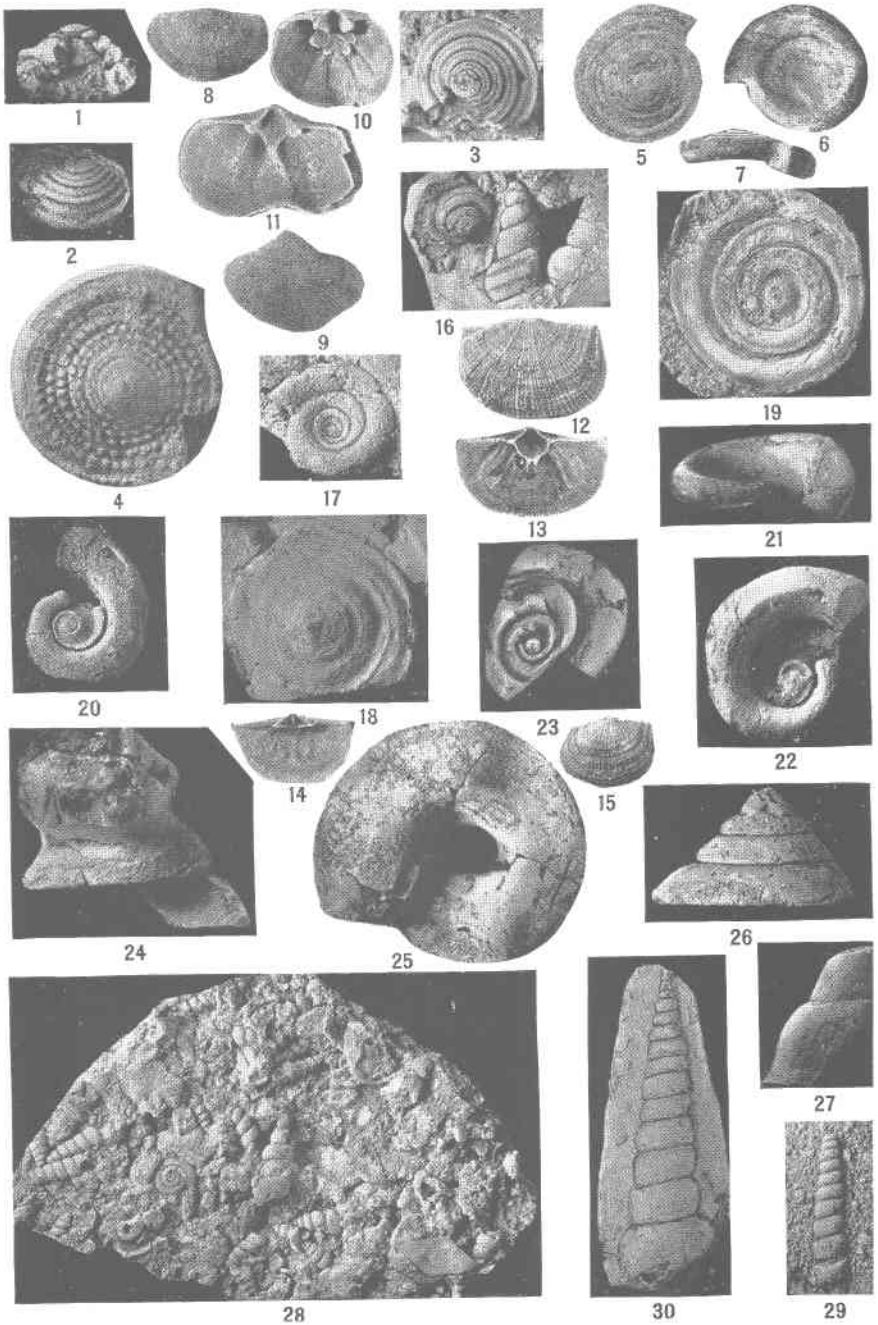
Internal molds in chert. 23, head, dorsal view; 24, dorsal, 25, side view of a tail. Beekmantown, *Ceratopea* horizon; along State Route 91 about 2½ miles south of Saltville, Smyth County. 23, U. S. N. M. 97302a; 24, 25, 97302b.

26–29. *Hystricurus conicus* (Billings).

Internal molds. 27, × 2; 26-28, heads, dorsal views; 29, tail, dorsal view. Beekmantown, *Lecanospira* zone. 26, 29, near summit of Gobblers Knob about 100 feet directly above the locality of the Chepultepec species shown in 1, associated with *Lecanospira;* 27, occurrence as 20; 28, occurrence as 22. U. S. N. M. 97304a, 97305, 97303, 97304b.



CHEPULTEPEC AND BEEKMANTOWN FOSSILS



CHEPULTEPEC AND BEEKMANTOWN FOSSILS

PLATE 69.—CHEPULTEPEC AND BEEKMANTOWN FOSSILS

FIGURE

1–3. *Orospira* sp.

1, 3, internal molds; 1, profile view showing section as exposed in broken part of 3; 3, apical view; 2, wax impression of the external mold of the original shell covering the upper side of 3, showing the character of the external surface of the shell. Beekmantown, *Ceratopea* zone; chert pile at a point 4¼ miles nearly north of Roanoke, which contains a mixture from different zones, such as *Lecanospira salteri* (Pl. 70, fig. 10). 1, 3, U. S. N. M. 97314a; 2, 97314b.

4. *Orospira* sp.

Impression from an external mold of the upper surface showing well the prominent nodes on the whorls characteristic of the genus. Beekmantown, *Ceratopea* zone; along road about 6½ miles west-southwest of Greenville, Augusta County. U. S. N. M. 97315.

5–7. *Orospira?* sp.

Bears some resemblance to *Ophileta*. Internal molds. Apical, umbilical, and side views. Spire of 7 restored in photograph. Beekmantown, *Ceratopea* zone; along U. S. Route 21 about 1¼ miles east of Sharon Springs, Bland County. U. S. N. M. 97316.

8–11. *Tetralobula delicatula* Ulrich and Cooper, × 2.

8, dorsal valve; 9, ventral valve; 10, interior of a dorsal valve; 11, interior of a ventral valve. Chepultepec limestone; along road midway between Quicksburg and Forestville, Shenandoah County. U. S. N. M. 91094g, 91094b, 91094j, 91094f.

12–15. *Finkelnburgia buttsi* Ulrich and Cooper.

12, 13, exterior and interior of a ventral valve, × 1⅓; 14, 15, interior and exterior of a dorsal valve, × 2. Occurrence as 8. U. S. N. M. 91380a, 91380k, 91380d, 91380c.

16. *Hormotoma?* sp. and *Lophonema* sp.

Lophonema in upper left corner. Impression from external molds. Occurrence as 5. U. S. N. M. 97317.

17, 18. *Ophileta* sp.

Probably 2 sp.; 17, internal mold of the umbilical side of a specimen; 18, poorly preserved internal mold of the upper

FIGURE

side of another specimen. Beekmantown, *Lecanospira* zone. 17, 2½ miles east of the railroad station, Bluefield, W. Va.; 18, along U. S. Route 33, 1½ miles southwest of Keezletown, Rockingham County. U. S. N. M. 97318, 97319.

19. *Ophileta* cf. *O. solida* Butts.

Impression of an external mold of the upper side. Beekmantown, probably *Ceratopea* horizon; from stone fence along highway about 2¼ miles northeast of Blacksburg and three-fourths of a mile west of Lusters Gate, Montgomery County.

The specimens of *Ophileta* figured are not good. Specimens representing several species are common in the Beekmantown and the underlying Chepultepec. (See Geology of Alabama, Ala. Geol. Survey, Spec. Rept. No. 14, Pl. 16, Figs. 11, 14, 15-18 for better representations of the genus.) U. S. N. M. 97320.

20–22. *Eccyliopterus* sp.?

Internal molds. 20, umbilical view of a specimen; 21, 22, side and apical views of another specimen. Beekmantown, base of the Nittany; half a mile south of Loves Mill and 16 miles east of Abingdon, Washington County. 20, U. S. N. M. 97321a; 21, 22, 97321b.

23. *Maclurites affinis* (Billings)?

A poorly preserved internal mold of the lower side of a specimen in chert, provisionally referred to this species. Beekmantown, *Ceratopea* zone; along road about 3 miles southeast of Moscow, Augusta County. A rather common fossil of the Axemann limestone between the *Lecanospira* and *Ceratopea* zones in Central Pennsylvania. U. S. N. M. 97322.

24–27. *Roubidouxia,* 2 sp.

24, 25, 27, seem to be *R. umbilicata* Ulrich and Bridge; 26, may be a different species with narrower whorls and slightly different contour of the sides of the shell with the sutures less deeply impressed; 24-26, internal molds in chert; 27, impression of an external mold of two whorls showing the external contour of the shell; 24, side view showing the shape of the whorls (transverse section of the basal whorl); 25, basal view of 24, showing the umbilicus; 26, side view of a nearly complete shell, probably another whorl or two at the apex not preserved. Beekmantown, Nittany zone. 24, 25,

FIGURE

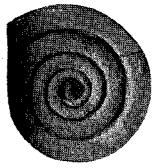
about half a mile northeast of Nickelsville, Scott County; 26, along back road to Max Meadows 1 mile northeast of Wytheville, Wythe County; 27, locality as 17. *Roubidouxia* is a unique and easily identifiable shell, fairly common and widely distributed, everywhere associated with *Lecanospira,* and equally characteristic of the Nittany horizon of the Beekmantown. 24, 25, U. S. N. M. 97323; 26, 97324; 27, 97325.

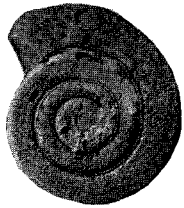
28, 29. *Coelocaulus delicatulus* Butts, n. sp.

Distinguished from *C. linearis* (Billings) by its smaller size and fewer whorls. 29, × 2. Beekmantown, *Ceratopea* zone; along road at head of Rattle Creek (Bristol quadrangle) 3 miles northwest of Abingdon and one-eighth of a mile south of road intersection. This species is common in the spongy chert of the uppermost beds of the Beekmantown in southwestern Virginia, commonly associated with *Orospira.* Cotypes: U. S. N. M. 97326a, 97326b.

30. *Coelocaulus* sp.?

Impression of an external mold in chert. Beekmantown, *Ceratopea* zone; 1 mile northwest of Old Sweet Springs, W. Va. U. S. N. M. 97327.

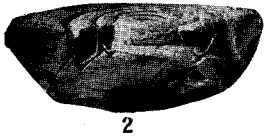

1

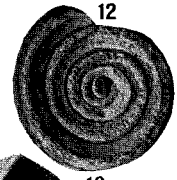

11

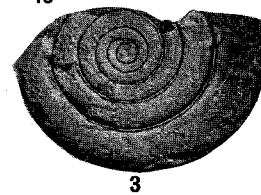

12

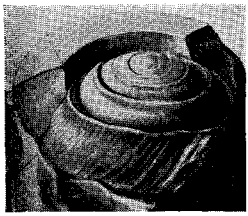

13

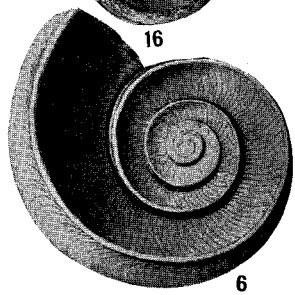

14

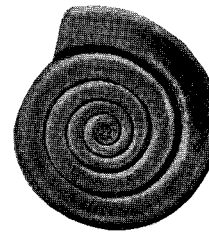

2


16


3


5


6

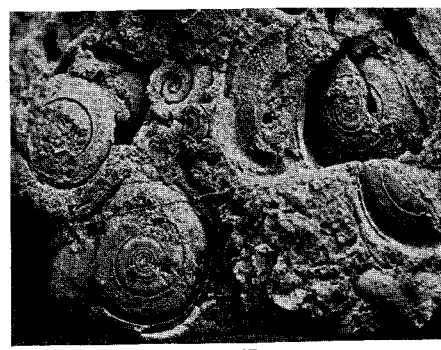

7


8


10


4


9


15

BEEKMANTOWN FOSSILS


1


11


12


13

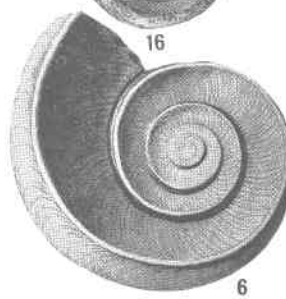

14


2


16


3


5


6

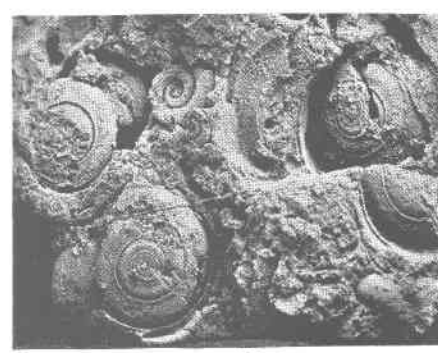

7


8


10


4


9


15

BEEKMANTOWN FOSSILS

PLATE 70.—BEEKMANTOWN FOSSILS

FIGURE

1-7, 16. *Lecanospira compacta* (Salter).

1, 3, 4, 7, internal molds, umbilical views (7, after Salter); 16, internal mold of depressed spire of 1; 2, natural section of 3, showing shape of whorls; 5, oblique view showing shape of whorls, part of umbilical surface of an outer whorl, and external mold of depressed spire; 6, restoration of exterior of spiral surface. Beekmantown, Nittany horizon. 1-3, 16, Morristown, Tenn., collected by Charles T. Cate; 4, Sinking Creek Valley, Craig County; 5-7, Beauharnois near Montreal, Canada, after Salter, Canadian Organic remains, Decade 1, p. 16, Pl. 3, 1859. 1, 16, U. S. N. M. 97306a; 2, 3, 97306b; 4, 97307.

8, 9. *Lecanospira sigmoidea* Ulrich and Bridge?

External molds of the depressed spire. 9, preserves part of the internal mold of the body whorl, on the right. The external mold of the depressed spire is the most characteristic expression of the fossils of this genus and the most certain criterion for its identification. Beekmantown, Nittany horizon. 8, occurrence as 1; 9, along State Route 80 about half a mile northwest of Blackford, Russell County. U. S. N. M. 97308, 97309.

10. *Lecanospira salteri* Ulrich and Bridge.

Beekmantown, Nittany horizon; pile of chert about 1 mile due south of Hollins College and 4½ miles nearly north of Roanoke, Roanoke County. U. S. N. M. 97310.

11. *Lecanospira* sp.?

Seems to differ from the other species figured by fewer and more rapidly expanding whorls. Beekmantown, Nittany horizon; along road, 800 feet northeast of Draper, Pulaski County. U. S. N. M. 97311.

12–14. *Lecanospira* cf. *L. biconcava* Ulrich and Bridge.

Differs from other species of *Lecanospira* in the more shallow concave spire and the slightly concave umbilical surface. 12. wax impression of the concave spiral surface shown in 14, convex toward the observer; 13, internal mold of the umbilical surface; 14, internal mold of the spiral surface. Basal beds of the Beekmantown; ridge just south of Wassum

FIGURE

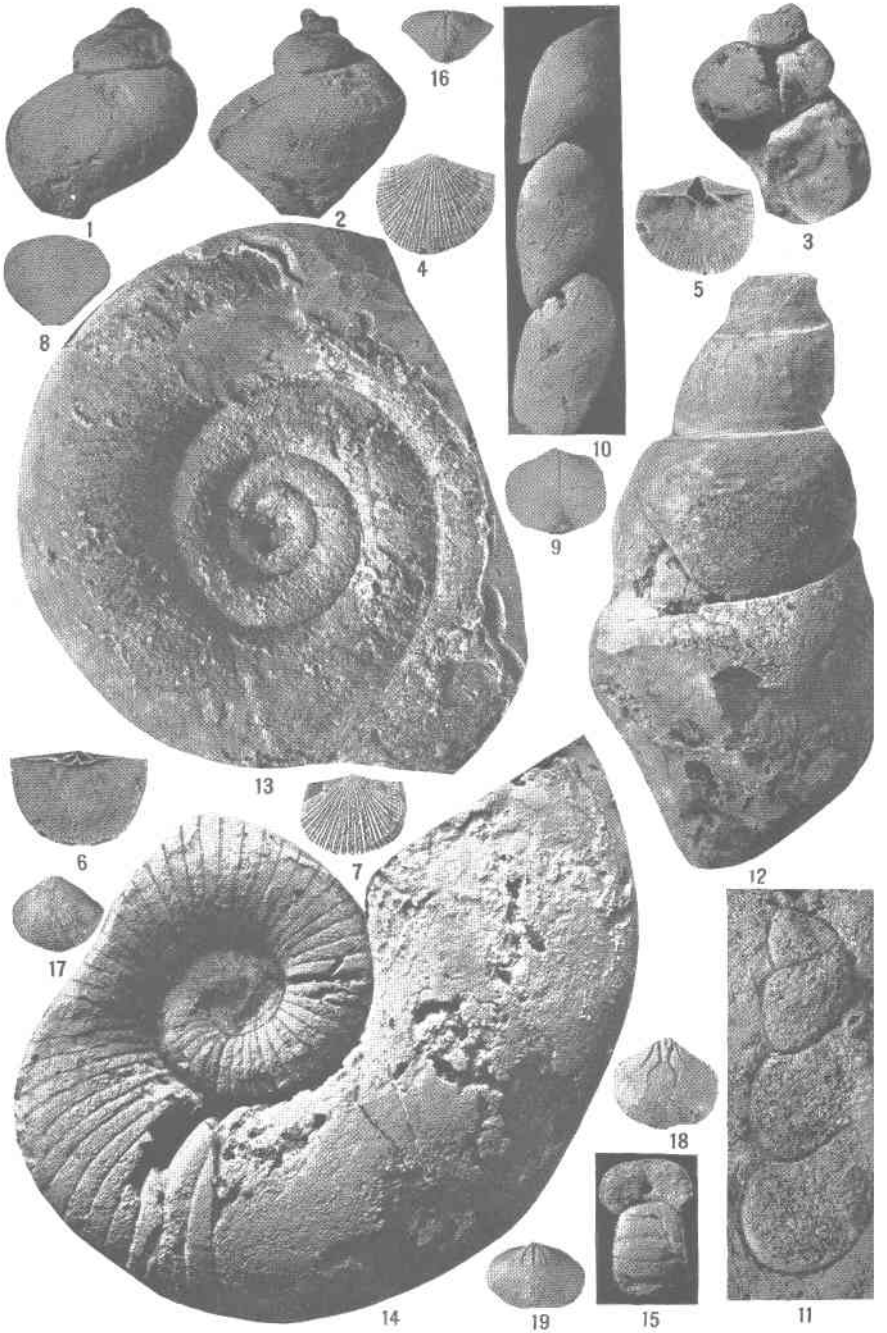
Valley and 4 miles northwest of Marion, Smyth County. This seems to be about the oldest known form of *Lecanospira*. U. S. N. M. 97312.

15. *Lecanospira* sp.

Slab with several specimens. Beekmantown, Nittany horizon; top of Cave Hill directly above the Luray Caverns, Page County. U. S. N. M. 97313.

The entire genus *Lecanospira* is confined to the lower 1000 feet or less of the Beekmantown which is, therefore, known as the *Lecanospira* zone. It occurs in that zone throughout a broad belt extending from the northwest Highlands of Scotland, throughout Newfoundland, Quebec, and the Appalachian Valley to Texas and the Arbuckle Mountains of Oklahoma. It is one of the most persistent and easily identified guide fossils known.

BEEKMANTOWN FOSSILS



BEEKMANTOWN FOSSILS

PLATE 71.—BEEKMANTOWN FOSSILS

FIGURE

1–3. *Plethospira* aff. *P. cassina* (Whitfield).

Internal molds. 3, side showing aperture of 1. Beekmantown, *Ceratopea* zone. 1, 3, northwest slope of Chestnut Ridge about 2 miles east-southeast of Harrisonburg, Rockingham County; 2, north end of spur in north meander of Clinch River, just west of 82d meridian and 4 miles southwest of Blackford, Russell County. 1, 3, U. S. N. M. 97340; 2, 97341.

4–7. *Finkelnburgia virginica* Ulrich and Cooper, × 1⅓.

Silicified specimens etched from limestone. 4, 5, exterior and interior of a ventral valve; 6, interior of dorsal valve; 7, exterior of dorsal valve. Beekmantown limestone, Nittany horizon; in old quarry just northeast of Middletown-Marlboro road about 3 miles northwest of Middletown, Frederick County. 4, 5, U. S. N. M. 91410c; 6, 91410a; 7, 91410d.

8, 9. *Syntrophina campbelli* (Walcott), × 1⅓.

8, dorsal; 9, ventral view. Chepultepec? horizon; about one-fourth of a mile northeast of Tenn. Route 32 and 2 miles northwest of Tazewell, Claiborne County, Tenn. This specimen, like specimen of Pl. 68, figs. 20 and 21, was collected from a pile of chert which also contained *Lecanospira,* making its reference to the Chepultepec doubtful. U. S. N. M. 91615.

10. *Hormotoma longispira* Butts, n. sp.

Distinguished from *Hormotoma gracilens* by the large, elongate, loosely coiled, and relatively slender whorls. Beekmantown, Nittany horizon; 1¼ miles northeast of the railroad station, Cloverdale, Roanoke County. Holotype: U. S. N. M. 97342.

11. *Hormotoma* sp.?

Internal mold in chert. Beekmantown, Nittany zone; Yellow Branch, 4½ miles east-southeast of Rose Hill, Lee County. U. S. N. M. 97343.

12. *Fusispira obesa* (Whitfield).

Internal mold in chert. Beekmantown, *Ceratopea* zone; along road on Snake Run 1½ miles northeast of Iron Hill Springs, Alleghany County. U. S. N. M. 97344.

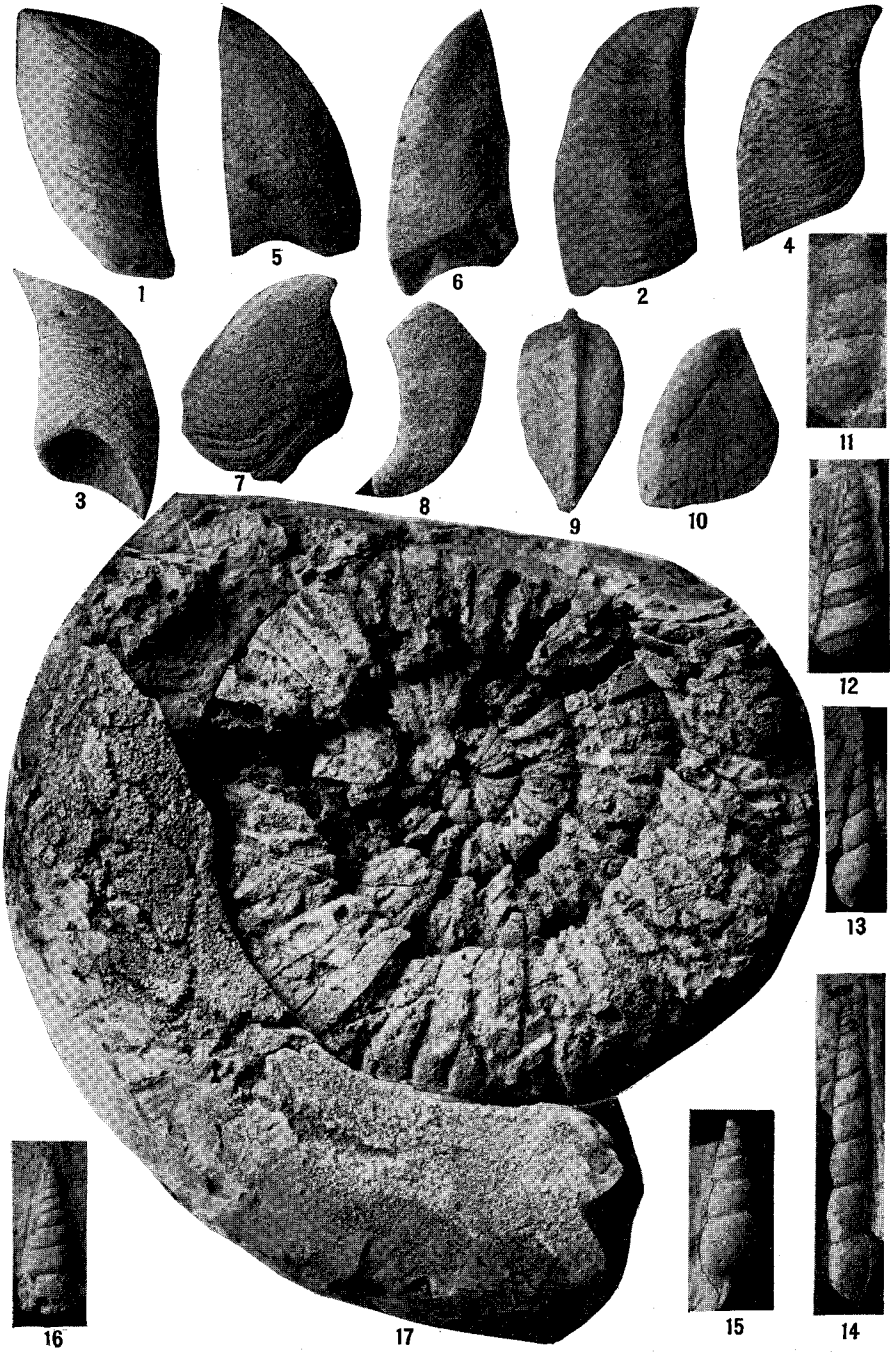
FIGURE

13. Coiled cephalopod, genus and species undescribed.
Plaster cast of an external mold. Beekmantown, *Ceratopea* zone near top; along road about 1¼ miles northeast of Bolar, Bath County. U. S. N. M. 97345.

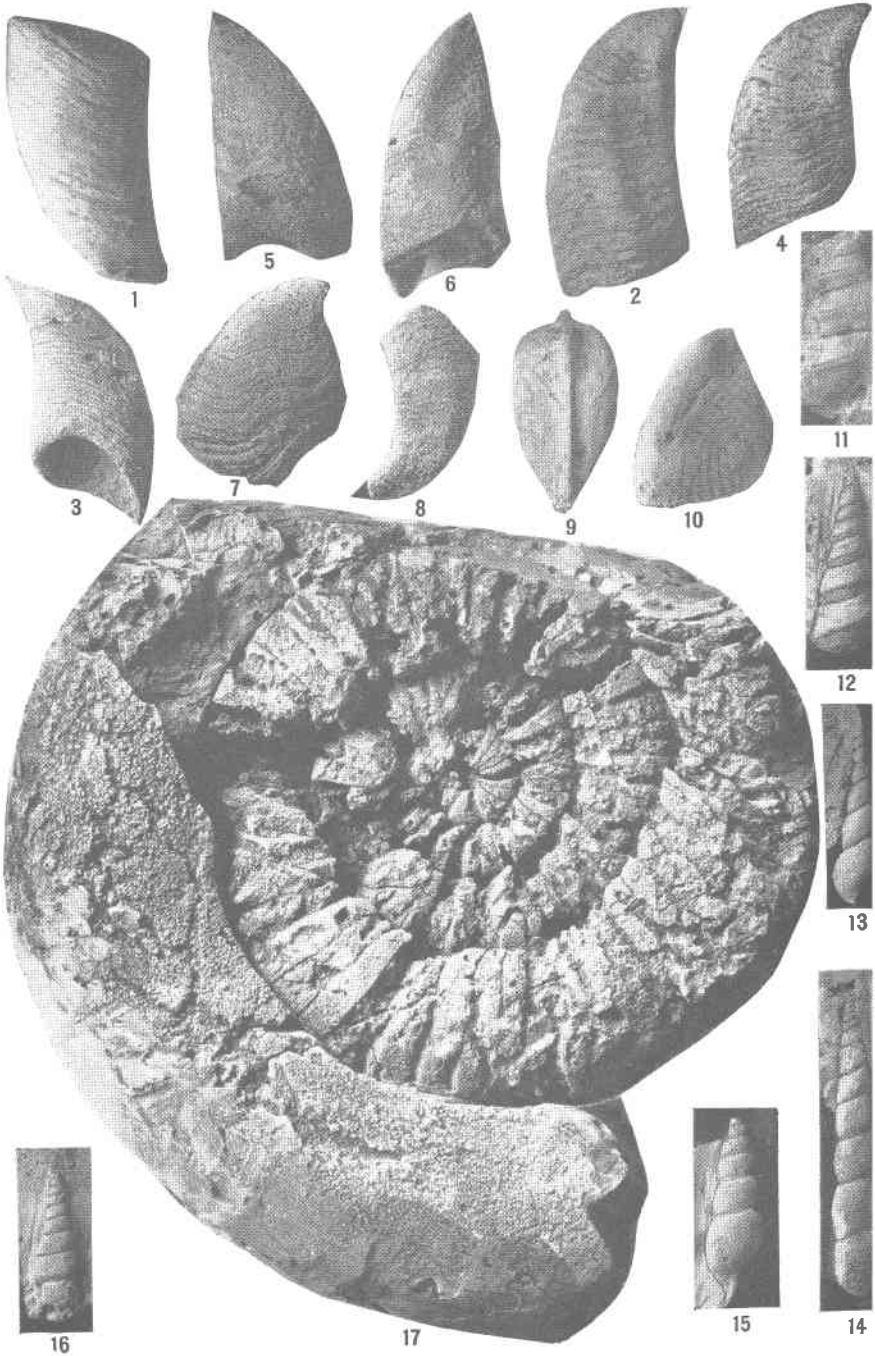
14. *Campbelloceras virginianum* (Hyatt) emend Foerste.
Internal mold in chert. Beekmantown, *Ceratopea* zone; Brushy Hills 2 miles northwest of Lexington, Rockbridge County. U. S. N. M. 9611.

15. *Tarphyceras?*
Inner whorls showing shape of whorls and position of siphuncle. Beekmantown, *Ceratopea* zone; exact locality not known.

16–19. *Xenelasma syntrophoides* Ulrich and Cooper.
16, 19, internal molds of a dorsal valve, different poses of same specimen; 17, exterior of ventral valve; 18, internal mold of ventral valve. 16, 17, 19, × 1⅓; 18, × 2. Beekmantown, *Lecanospira* zone?; chert pile in field 1¼ miles due south of Hollins College, Roanoke County. The doubt about the horizon of this species arises from the fact that pieces with *Lecanospira* (Pl. 70, fig. 10) and other pieces with *Orospira* (Pl. 69, figs. 1-3) are found in the same chert pile, thus indicating that material from both the *Lecanospira* and *Ceratopea* horizons are mixed. 16, 19, U. S. N. M. 91684b; 17, 91684j; 18, 91684l.



BEEKMANTOWN FOSSILS



BEEKMANTOWN FOSSILS

PLATE 72.—BEEKMANTOWN FOSSILS

FIGURE

1–4. *Ceratopea* sp. (Operculum of unknown gastropod.)

1, 2, opposite sides of a specimen; 3, 4, opposite sides of another specimen. Beekmantown, *Ceratopea* zone. 1, 2, Falling Spring Valley, in angle between U. S. Route 220 and Warm Springs Mountain road to Clifton Forge about one-eighth of a mile northeast of Bath County line; 3, 4, Smithville, Ark. 1, 2, U. S. N. M. 97328; 3, 4, 97330.

5, 6. *Ceratopea keithi* Ulrich.

Opposite sides of a silicified specimen etched from limestone with acid. Beekmantown, *Ceratopea* zone; along Denton Branch at road intersection about three-fourths of a mile southeast of Holston River and 7 miles slightly southeast of Abingdon, Washington County. U. S. N. M. 97329.

7. *Ceratopea tennesseensis* Oder.

Beekmantown, *Ceratopea* zone; one-fourth of a mile north of Middle River and half a mile northwest of the Lee Highway, Augusta County. U. S. N. M. 97331.

8. *Ceratopea subconica* Oder.

Occurrence as 7. U. S. N. M. 97332.

Ceratopea is as characteristic of the upper part of the Beekmantown as *Lecanospira* is of the middle part. It occurs in the Jefferson City and higher members of the Beekmantown in Arkansas and Missouri, in the Newala limestone of Alabama, and in the Bellefonte dolomite of Pennsylvania, and has not been found in any other part of the geological column.

9, 10. *Euchasma blumenbachi* (Billings)?

A bivalve crustacean; internal mold; hinge and lateral views; 10, shows faintly the radiating ribs, very similar to, if not identical with, Billings, species. Beekmantown, *Ceratopea* zone; Brushy Hills about 2 miles northwest of Lexington, Rockbridge County. It is associated with *Campbelloceras virginianum*. (See Pl. 71, fig. 14.) U. S. N. M. 97333.

11. *Ectomaria?* sp.

Internal mold in chert. Beekmantown, *Ceratopea* zone; along road 1¼ miles east-northeast of Sharon Springs, Bland County. U. S. N. M. 97334.

FIGURE

12. *Lophospira* sp.?
    Internal mold in chert. Occurrence as 11. U. S. N. M. 97335.

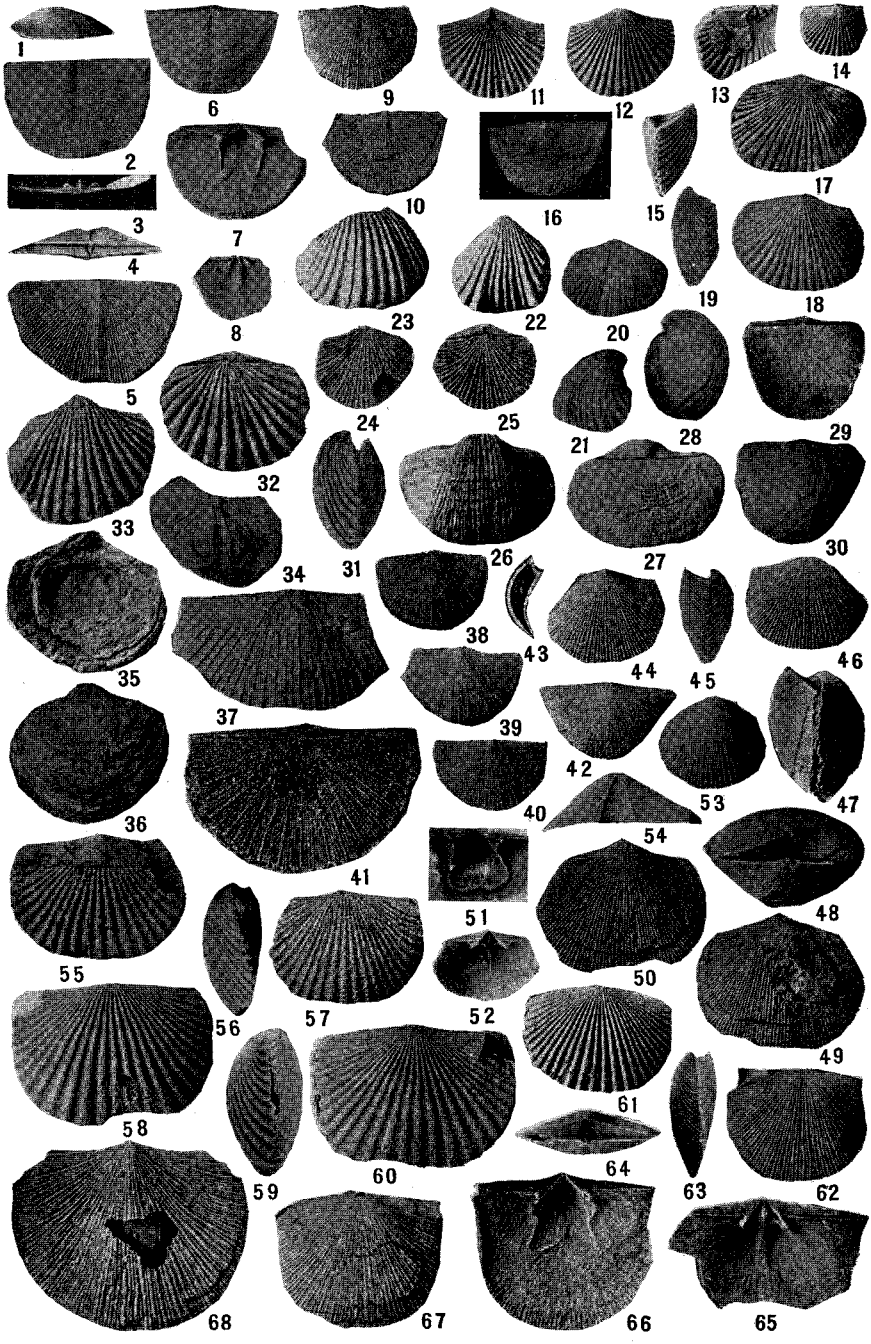
13. *Hormotoma* aff. *H. artemesia* (Billings).
    Internal mold in chert. Beekmantown, *Ceratopea* zone; Sugar Loaf knob 10 miles west of Staunton, Augusta County. U. S. N. M. 97336.

14. *Hormotoma* sp.?
    Internal mold. Occurrence as 11. U. S. N. M. 97337.

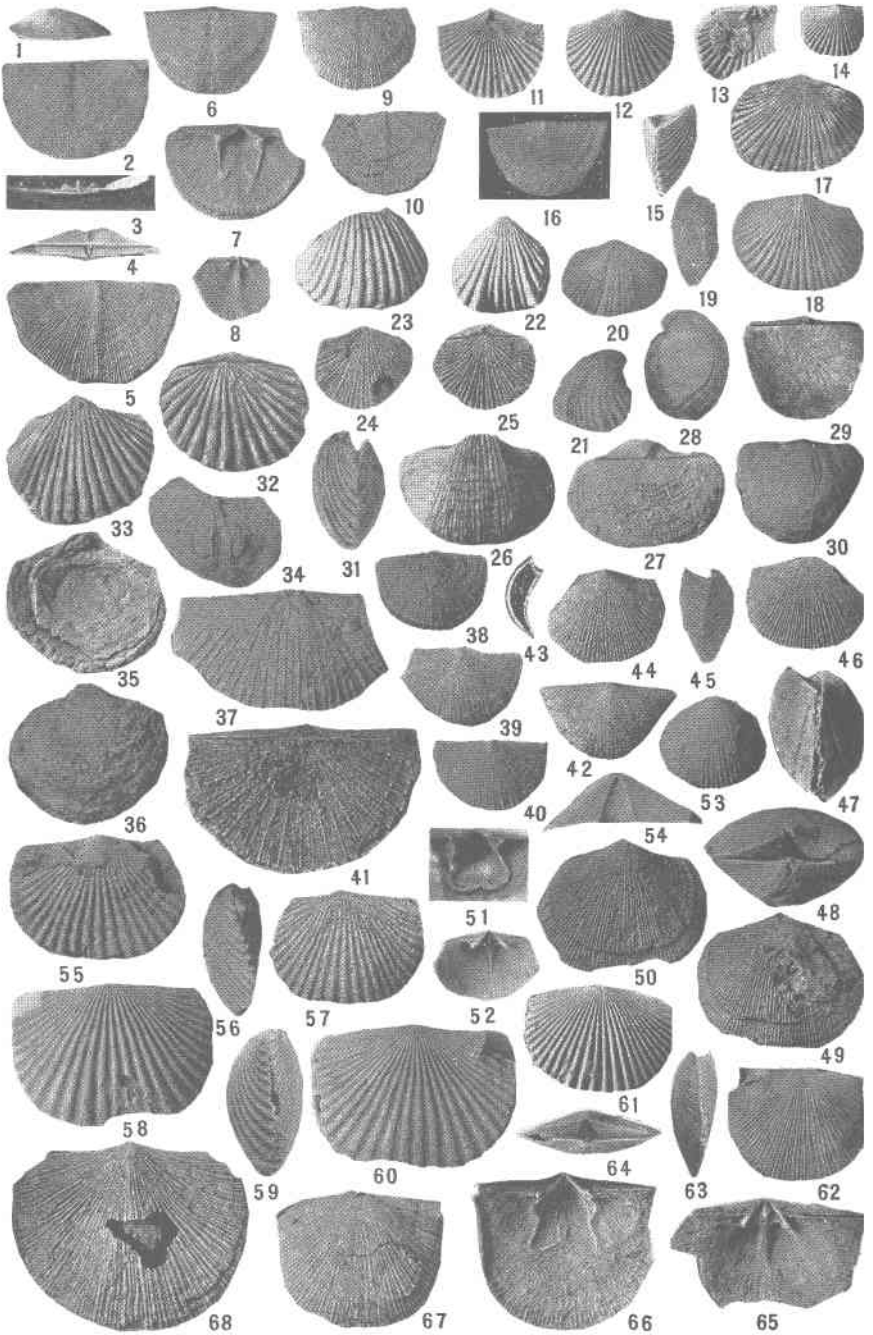
15. *Hormotoma gracilens* (Whitfield).
    Internal mold in chert. Beekmantown, *Lecanospira* zone; along U. S. Route 33 about 1½ miles south-southwest of Keezletown, Rockingham County. U. S. N. M. 97338.

16. *Turritoma acrea* (Billings).
    Internal mold in chert. Occurrence as 1. U. S. N. M. 97339.

17. *Centrotarphyceras macdonaldi* (Hyatt).
    Internal mold in chert. Beekmantown, *Ceratopea* zone; half a mile west of Strasburg Junction, Shenandoah County. U. S. N. M. 97496.



MURFREESBORO, MOSHEIM, AND LENOIR FOSSILS



MURFREESBORO, MOSHEIM, AND LENOIR FOSSILS

PLATE 73.—MURFREESBORO, MOSHEIM, AND LENOIR FOSSILS

FIGURE

1–10. *Valcourea strophomenoides* (Raymond).

1, 6, profile and dorsal views of a specimen; 2, 5, dorsal and ventral views of another individual; 3, posterior view of the dorsal valve of another specimen showing prominent hinge teeth and cardinal process; 4, posterior or hinge view of another individual retaining both valves, the dorsal valve above; 7, interior of ventral valve; 8, interior of dorsal valve; 9, 10, dorsal and ventral views of another specimen. Lenoir limestone. 1, 2, 4-8, along Whistle Creek 2 miles northwest of Lexington, Rockbridge County; 3, southeast foot of Brushy Hills 1½ miles due west of Lexington; 9, 10, quarry of Mathieson Alkali Works at Porterfield, 5 miles east of Saltville, Smyth County. 1, 6, U. S. N. M. 98177a; 2, 5, 98177b; 3, 98178; 4, 98177c; 7, 98177d; 8, 98177e; 9, 10, 98179.

11–15. *Hesperorthis* cf. *H. tricenaria* (Conrad).

11, 12, 15, dorsal, ventral, and profile views of the same individual; 14, dorsal valve of a smaller specimen; 13, interior of the dorsal valve of another specimen. Occurrence as 1. 11, 12, 15, U. S. N. M. 98180a; 13, 98180b; 14, 98180c.

16. *Rafinesquina* sp.

Ventral valve. Lenoir limestone; North Fork of Roanoke River 3 miles southeast of Blacksburg, Montgomery County. U. S. N. M. 98217.

17–19. *Plectorthis exfoliata* (Raymond)?.

Dorsal, ventral, and profile views of the same individual. Lenoir limestone; quarry at Marion, Smyth County. Rare. U. S. N. M. 98181.

20, 21. *Oxoplecia transversa* Butts, n. sp.

Distinguished by its width relative to its length. 20, dorsal; 21, profile view of a specimen. Stones River (Murfreesboro) limestone; Rye Cove, Scott County. Holotype: U. S. N. M. 98182.

22, 23. *Camarotoechia plena* (Hall)?

Dorsal and ventral valves. Lenoir limestone; Marcem quarry 2 miles west of Gate City, Scott County. U. S. N. M. 98220a, 98220b.

FIGURE

24, 25. *Dalmanella?* sp., × 4.

Ventral and dorsal views. Holston limestone; locality as 9. U. S. N. M. 98183.

26–28. *Productorthis* sp.

Ventral, dorsal, and profile views of the same individual. Occurrence as 17. Rare, only this specimen and a fragment of another found. This and a few specimens, possibly another species, in the Holston limestone at the Porterfield quarry, Smyth County, and at McNutt quarry near Sharon Springs, Bland County, (Pl. 80, figs. 4-10) are the only known occurrences of this genus in America. Its main occurrence is in the Baltic regions of Europe whence it invaded America in Lenoir and Holston times. U. S. N. M. 98184.

29, 30. *Rafinesquina* cf. *R. minnesotensis* (Winchell).

Dorsal and ventral views of the same individual. Lenoir limestone; Pearisburg, Giles County. U. S. N. M. 98185.

31–33. *Hebertella?* sp.

31, 32, profile and dorsal views of the same individual; 33, ventral view of another specimen. Occurrence as 17. 31, 32, U. S. N. M. 98221a; 33, 98221b.

34–36. *Christiania?* cf. *C. lamellosa* Bassler.

34, interior of ventral valve; 35, 36, dorsal and ventral views of the same specimen. Occurrence as 17. 34, U. S. N. M. 98214a; 35, 36, 98214b.

37. *Sowerbyites* sp., × 3.

Occurrence as 9. U. S. N. M. 98186.

38–41. *Sowerbyella* sp.

38-40, ventral views of 3 small specimens, × 2; 41, dorsal view of 40, × 4. Occurrence as 9. Abundant in same bed with *Monotrypa*. (See Pl. 74, figs. 31-35.) 38, U. S. N. M. 98213a; 39, 98213b; 40, 41, 98213c.

42, 43. *Sowerbyites* sp.

42, ventral view; 43, sectional view showing curvature of valves. Occurrence as 22. U. S. N. M. 98187a, 98187b.

FIGURE

44–52. *Mimella* sp.

44-46, ventral, profile, and dorsal views of the same specimen; 47-50, profile, posterior, ventral, and dorsal views of another individual; 51, interior of ventral valve; 52, interior of dorsal valve. Compare with interior of *Pionodema,* (Pl. 92, fig. 7). 44-46, occurrence as 22; 47-52, occurrence as 1. Common. 44-46, U. S. N. M. 98191; 47-50, 98188a; 51, 98188b; 52, 98188c.

53, 54. *Mimella* sp.

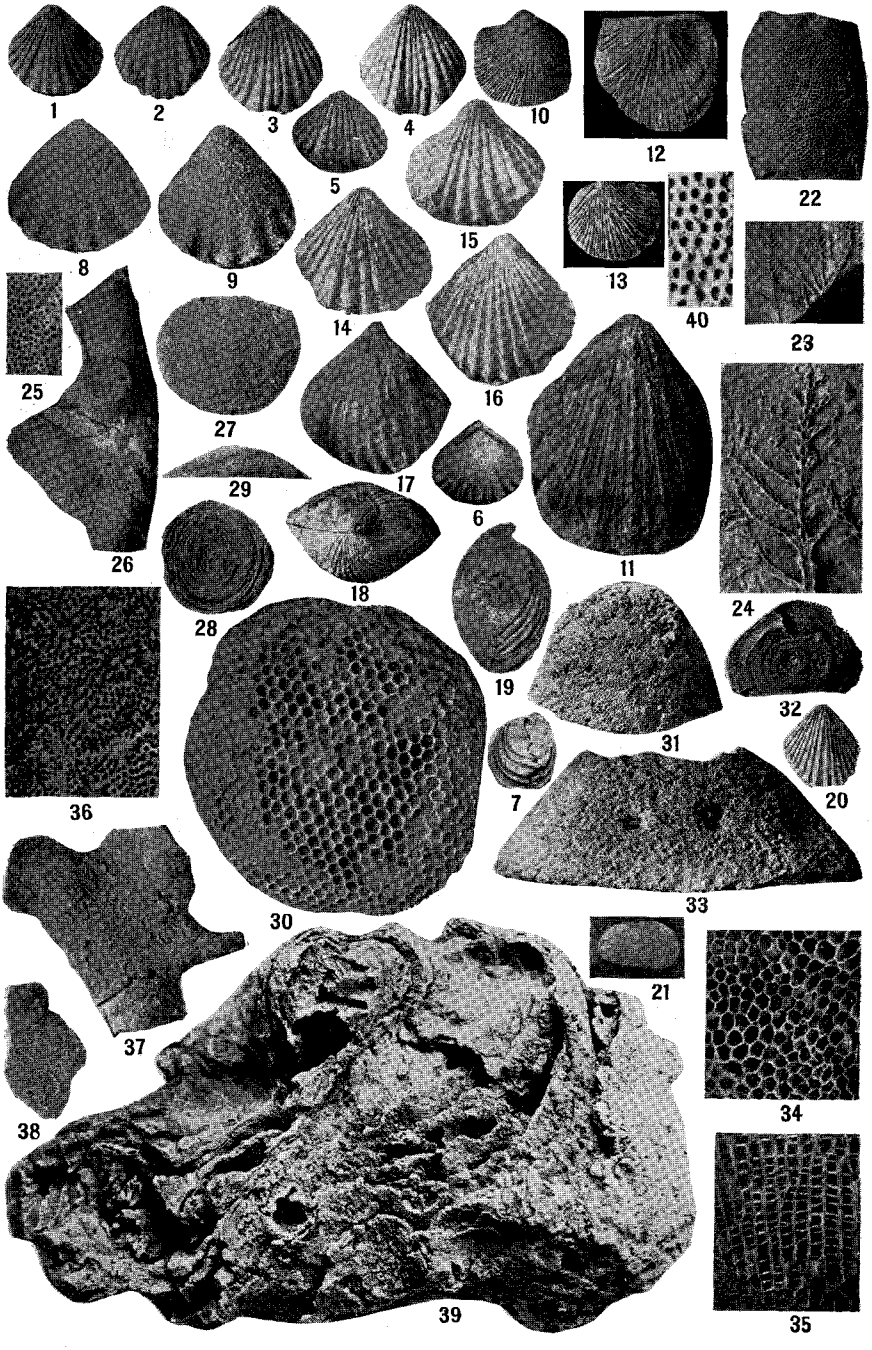
53, ventral valve; 54, posterior view of different specimen. Stones River (Murfreesboro) limestone; Willow Spring, Washington County. U. S. N. M. 98190a, 98190b.

55–61. *Dinorthis atavoides* Willard.

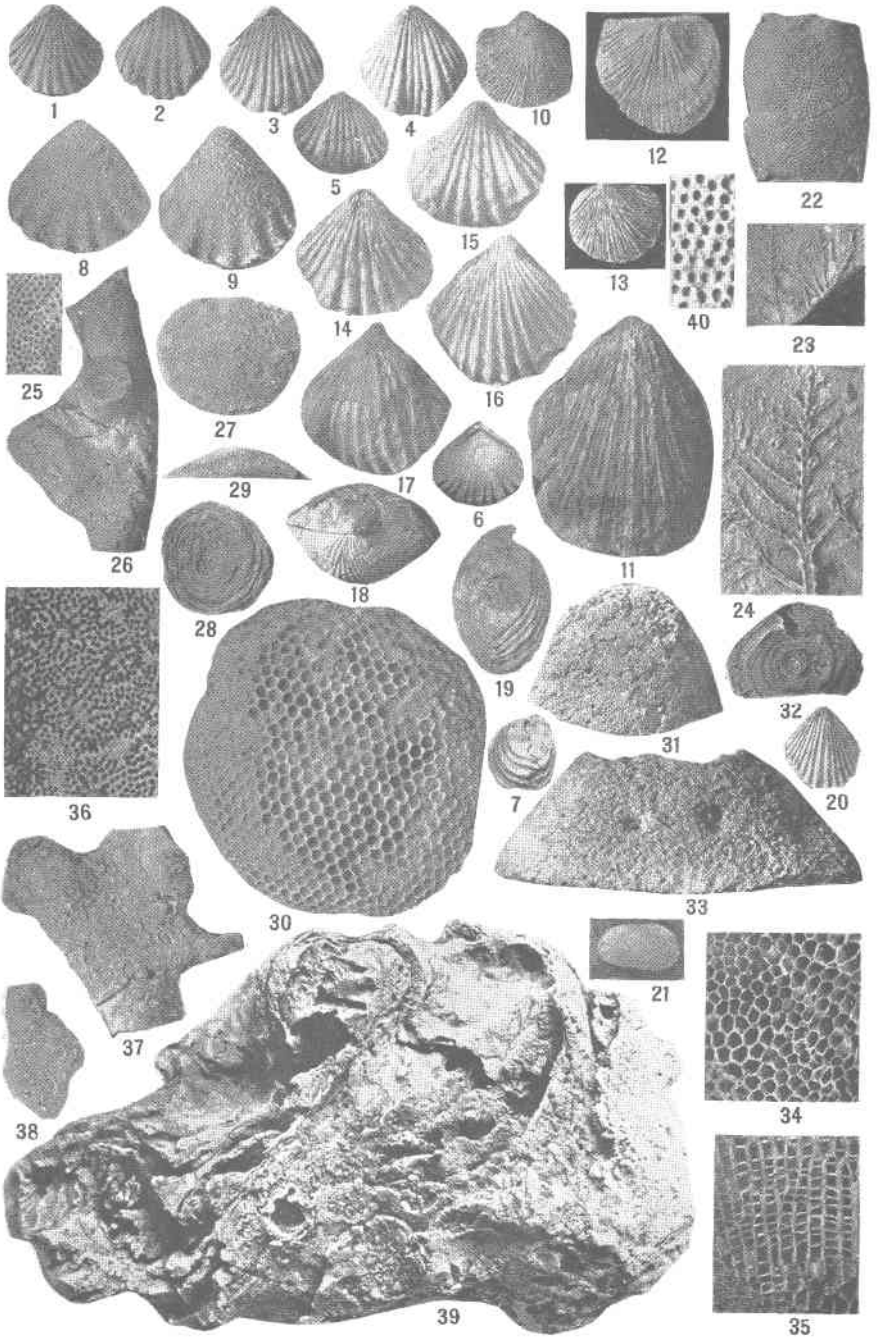
55-57, ventral, profile, and dorsal views of the same individual; 58-60, ventral, profile, and dorsal views of another specimen; 61, ventral view of another specimen. Lenoir limestone. 55-57, Templeton Branch 5 miles northwest of Gate City, Scott County; 58-61, locality as 22. 55-57, U. S. N. M. 98215; 58-60, 98216a; 61, 98216b.

62–68. *Multicostella* cf. *M. platys* (Billings).

62-64, ventral, profile, and posterior views of an individual; 65, interior of a dorsal valve; 66, interior of a ventral valve; 67, dorsal view; 68, ventral views of 2 specimens. Occurrence as 1. 62-64, U. S. N. M. 98189a; 65-68, 98189b, 98189c, 98189d, 98189e.



MURFREESBORO AND LENOIR FOSSILS



MURFREESBORO AND LENOIR FOSSILS

PLATE 74.—MURFREESBORO AND LENOIR FOSSILS

FIGURE

1–7. *Camarella* sp.

1, 2, dorsal and ventral views of an average sized specimen; 3, 4, dorsal and ventral views of a larger specimen; 5-7, ventral, dorsal, and profile views of a small specimen with 4 ribs in the sinus and 5 ribs on the fold. Lenoir limestone; Whistle Creek 2 miles northwest of Lexington, Rockbridge County. 1, 2, U. S. N. M. 98192a; 3, 4, 98192b; 5-7, 98192c.

8. 9. *Camarella varians* Billings? × 4.

Dorsal and ventral views. Lenoir limestone; Yellow Branch 5 miles southeast of Rose Hill, Lee County. Rare, only this one specimen found. U. S. N. M. 98193.

10. *Paurorthis* sp., × 2.

Ventral valve. Stones River limestone; Rye Cove, Scott County. U. S. N. M. 98194.

11–13. *Paurorthis* sp.

11, × 4; 12, 13, × 2. 11, 13, ventral valves; 12, dorsal valve, 3 individuals. Lenoir limestone; quarry at Marion, Smyth County. U. S. N. M. 98195a, 98195b, 98195c.

14–19. *Camarotoechia plena* (Hall)?

14, 15, dorsal and ventral views of an average sized specimen; 16-19, dorsal, ventral, posterior, and profile views of a large specimen. Lenoir limestone; south base of Big A Mountain 3 miles northwest of Honaker, Russell County. 14, 15, U. S. N. M. 98196a; 16-19, 98196b.

20. *Zygospira* (?) cf. *Z. acutirostris* (Hall), × 3.

Stones River (Murfreesboro) limestone; 600 feet south of St. Clair station on Norfolk and Western Railway and 6 miles southwest of Bluefield, W. Va. U. S. N. M. 98197.

21. *Modiolopsis* cf. *M.? consimilis* Ulrich.

Left valve. Residual chert of the Stones River (Murfreesboro) limestone. Associated with abundant small *Leperditia*. Along State Route 8 about 2 miles northeast of Pearisburg, Giles County. U. S. N. M. 98218.

22. *Mesotrypa?* sp.

Occurrence as 11. Rare. U. S. N. M. 98219.

FIGURE

23, 24. *Glauconome* sp.

24, part of 23, × 4. Occurrence as 11. Rare in America, occurs in the Baltic region of Europe. U. S. N. M. 97347.

25, 26. *Dekayella?* sp.

25, part of 26, × 4. Lenoir limestone; Marcem quarry 2 miles west of Gate City, Scott County. Abundant. U. S. N. M. 97348.

27–30. *Monotrypa* sp.

27, view of the celluliferous surface; 29, profile view of the same specimen; 28, epithecal view of a specimen; 30, celluliferous surface of a small specimen, × 4. Occurrence as 11. Abundant. 27, 29, U. S. N. M. 97349a; 28, 97349b; 30, 97349c.

31–35. *Monotrypa* sp.

31, profile view of a zoarium of average size; 32, epithecal view of a smaller specimen; 33, profile view of a large, broken specimen; 34, deep transverse sectional view, × 4; 35, longitudinal section, × 4. Lenoir limestone; quarry of the Mathieson Alkali Works about 5 miles east of Saltville, Smyth County. U. S. N. M. 97350a, 97350b, 97350c, 97350d, 97350e.

36–38. *Constellaria* sp.

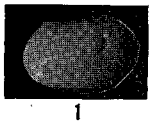
37, 38, two silicified specimens; 36, enlargement of part of 38, × 4. Occurrence as 25. 37, 38, U. S. N. M. 97351b, 97351a.

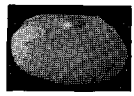
39. *Monticulipora?* sp.

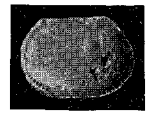
Occurrence as 1 and 25. U. S. N. M. 97352.

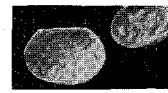
40. *Mesotrypa?* sp.

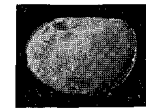
Enlargement from 22, × 4.

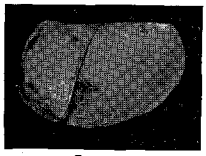

1

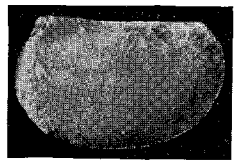

2

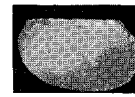

3

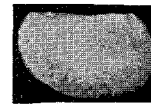

4

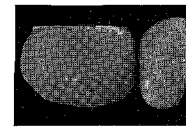

5

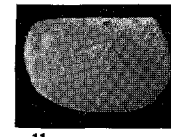

6

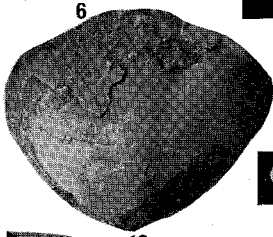

7


8


9

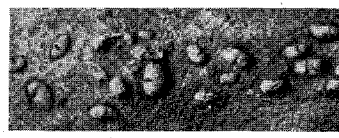

10

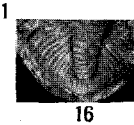

11

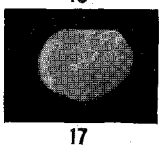

12


13

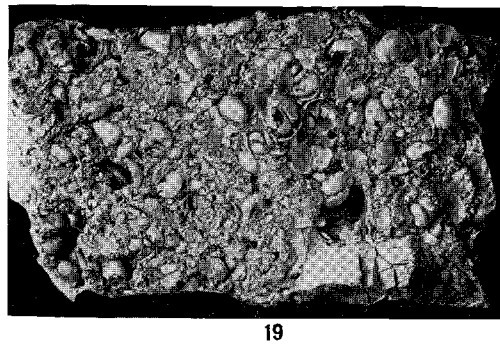

14

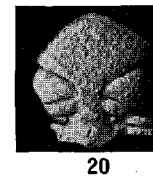

15


16


17


18


19

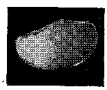

20

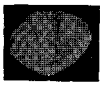

21


22


23


24

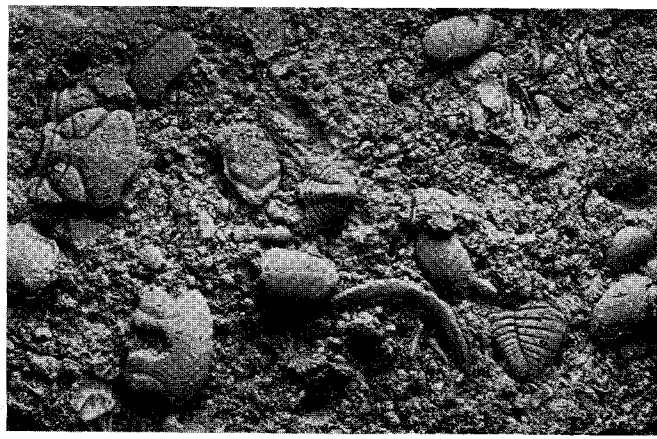

25


26

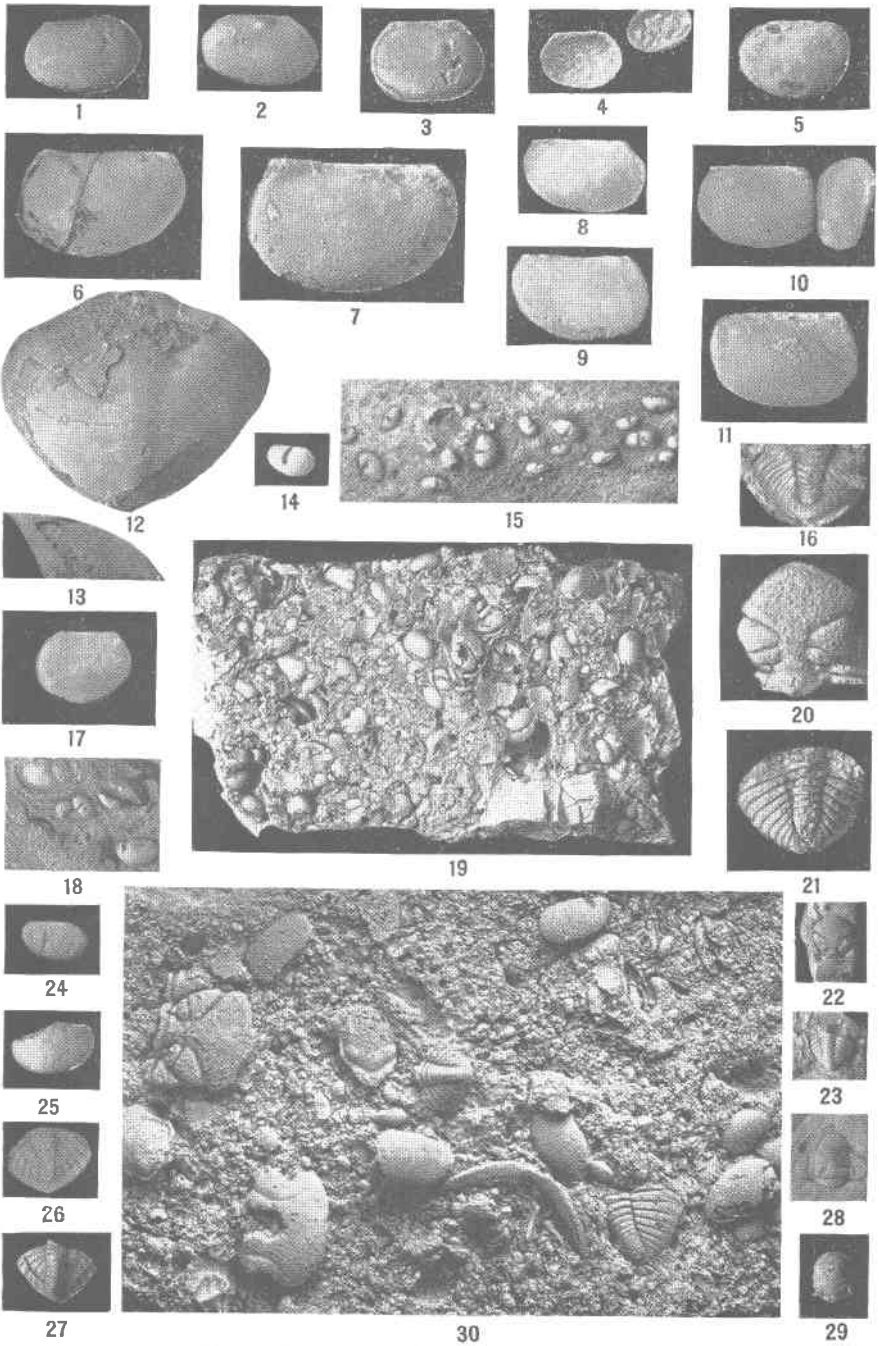

27


28


29


30

MURFREESBORO, LENOIR, AND HOLSTON FOSSILS



MURFREESBORO, LENOIR, AND HOLSTON FOSSILS

PLATE 75.—MURFREESBORO, LENOIR, AND HOLSTON FOSSILS

FIGURE

1, 2. *Isochilina* sp., × 4.

Right and left valves. Lenoir limestone; North Fork Roanoke River about 3 miles southeast of Blacksburg, Montgomery County. U. S. N. M. 97353a, 97353b.

3–5. *Leperditia* sp., × 4.

3, 5, right valves; 4, interior of right valve. Occurrence as 1. U. S. N. M. 97354a, 97354b, 97354c.

6–9. *Isochilina* sp., × 4.

6, 7, right valves; 8, 9, left valves. Stones River (Murfreesboro) limestone; Yellow Branch 5 miles southeast of Rose Hill, Lee County. U. S. N. M. 97355a, 97355b, 97355c, 97355d.

10, 11. *Isochilina* sp., × 4.

Left valves. Stones River (Murfreesboro) limestone; along State Route 58 about 1½ miles west of Jonesboro, Lee County. U. S. N. M. 97356a, 97356b.

12, 13. *Homotelus?* sp.

Dorsal and profile views of a tail. Stones River (Murfreesboro) limestone; Rye Cove, Scott County. U. S. N. M. 97357.

14, 15. *Leperditella?* sp., × 4.

14, left valve; 15, surface of chert nodule with several specimens of both valves. The actual area of 15 is 3 x 10 millimeters. Chert nodules in basal Stones River (Murfreesboro) limestone; 2¾ miles southwest of Rye Cove School, Scott County. These small ostracodes are abundantly sprinkled over the surface of chert nodules in association with *Pterygometopus* and *Bathyurus* shown in 22, 23, 28, 29. U. S. N. M. 97358a, 97358b.

16. [a]*Pterygometopus* cf. *P. annulatus* Raymond, × 2.

Tail. Horizon uncertain, Stones River (Murfreesboro) or Ottosee limestone; Rye Cove, Scott County. U. S. N. M. 97359.

[a] The name *Calliops* has recently been substituted for the American trilobites referred to the genus *Pterygometopus*. Delo, David M., Jour. of Paleontology, vol. 9, no. 5, p. 417, 1935. See also Geol. Soc. America Spec. Paper No. 29, 1940.

FIGURE

17. *Aparchites* sp., × 4.
Right valve. Lenoir limestone; quarry at Marion, Smyth County. U. S. N. M. 97360.

18. *Eurychilina?* sp., × 4.
Left valve. Occurrence as 14. U. S. N. M. 97361.

19. *Leperditia?* sp.
Slab crowded with carapaces. Stones River (Murfreesboro) limestone in residual chert in road bank midway between Pearisburg and Ripplemead, Giles County. This form is widely distributed in the Stones River. U. S. N. M. 97362.

20, 21. [a]*Pterygometopus* sp.
20, wax impression of an external mold of a head, × 2; 21, tail. Chert in Lenoir (?) limestone; along road at intersection of State Routes 64 and 71 about 1½ miles southwest of Dickensonville, Russell County. U. S. N. M. 97363a, 97363b.

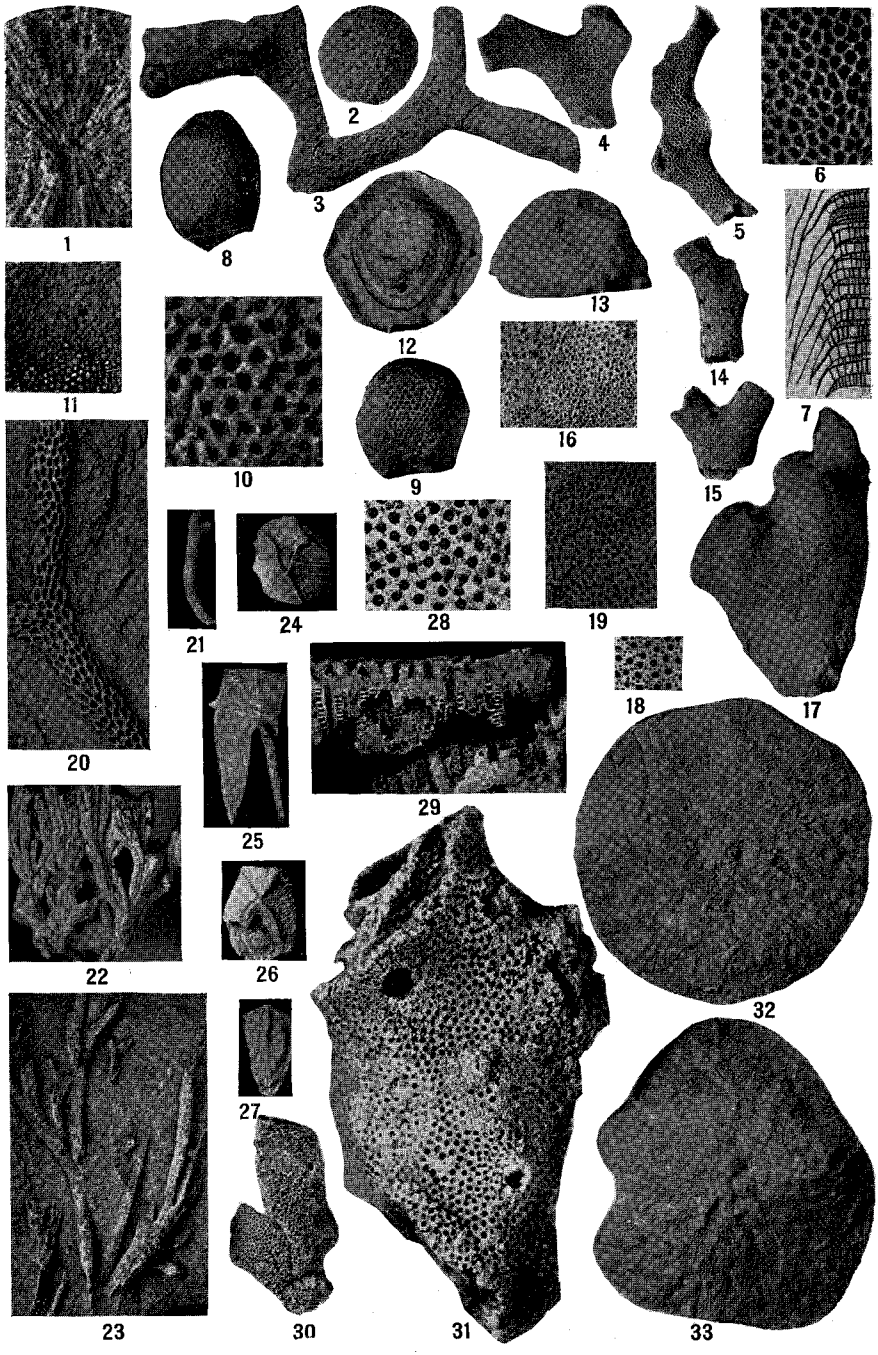
22, 23. *Pterygometopus* sp.
Occurrence as 14. U. S. N. M. 97364a, 97364b.

24, 25. *Leperditia* cf. *L. fabulites pinguis* Butts.
Occurrence as 14. U. S. N. M. 97365a, 97365b.

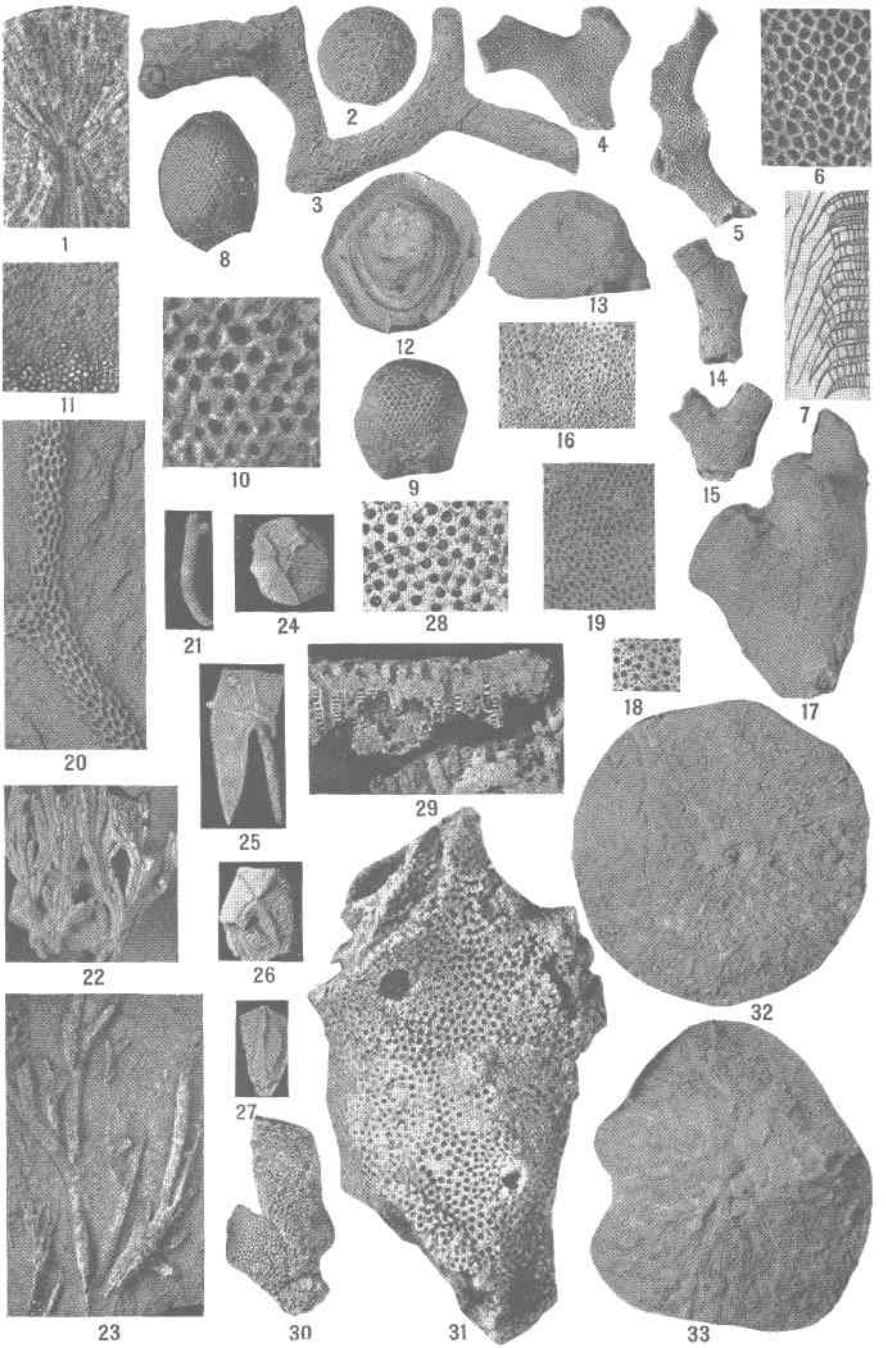
26–29. *Bathyurus* sp., × 2.
26, 27, tails; 28, 29, heads. Chert nodules in base of Stones River (Murfreesboro) limestone. 26, 1½ miles west of Jonesville, Lee County; 27-29, locality as 14. U. S. N. M. 97366, 97367a, 97367b, 97367c.

30. [a]*Pterygometopus, Illaenus?,* and *Leperditia.*
Slab of chert with characteristic assemblage. Occurrence as 20. U. S. N. M. 97368.

[a] The name *Calliops* has recently been substituted for the American trilobites referred to the genus *Pterygometopus.* Delo, David M., Jour. of Paleontology, vol. 9, no. 5, p. 417, 1935. See also Geol. Soc. America Spec. Paper No. 29, 1940.



MURFREESBORO, LENOIR, AND HOLSTON FOSSILS



MURFREESBORO, LENOIR, AND HOLSTON FOSSILS

PLATE 76.—MURFREESBORO, LENOIR, AND HOLSTON FOSSILS

FIGURE

1, 2. *Hindia* cf. *H. parva* Ulrich.

2, entire specimen; 1, radial section showing internal structure, × 4. Lenoir limestone; Marcem quarry about 2 miles west of Gate City, Scott County. U. S. N. M. 97369a, 97369b.

3. *Dekayella?* sp.

Lenoir limestone; Yellow Branch 5 miles southeast of Rose Hill, Lee County. A common form attached to weathered surfaces. U. S. N. M. 97370.

4–6. *Batostoma* sp.

4, 5, fragments of branches showing external appearance; 6, showing size and shape of zooecia, × 4. A common form revealed on weathered surfaces of the Lenoir limestone. Locality as 3. U. S. N. M. 97371a, 97371b, 97371c.

7. *Batostoma varium* Ulrich.

Longitudinal section to show general manner of growth of *Batostoma*. (Geol. of Minnesota, vol. 3, pl. 25, fig. 23, 1895.)

8–10. *Nidulites ovoides* Butts, n. sp.

8, 9, exterior view of two specimens. 10, a part of 9, × 4, showing the form and size of the openings of the radial tubes. Differs from *Nidulites pyriformis* in its ovoid shape as contrasted with the pear shaped outline of *N. pyriformis*. Lenoir limestone 3 miles southeast of Blacksburg, Montgomery County. Cotypes: U. S. N. M. 97372a, 97372b.

11–13. *Cyphotrypa* sp.

11, a small part of the surface of 13, × 4, to show shape and size of the zoecia. 12, epithecum; 13, profile view. Occurrence as 1. U. S. N. M. 97373.

14–16. *Nicholsonella* sp.

14, 15, fragments of 2 individuals; 16, small part of 15, × 4, to show size and arrangement of zoecia. Occurrence as 3. U. S. N. M. 97374a, 97374b.

17–19. *Nicholsonella pulchra* Ulrich.

17, nearly entire specimen; 19, part of 17, × 4, showing size and spacing of zoecia. 18, drawing showing interzoecial

FIGURE

papillae, × 6. (Based on Geol. of Minnesota, vol. 3, pl. 21, fig. 9, 1895.) 17, 19, occurrence as 3. 17, 19, U. S. N. M. 97375; 18, 43552.

20, 21. *Eridotrypa?* sp.

Slender ramose species. 20, enlargement of 21, × 4; 21, fragment, natural size. Lenoir limestone; quarry at Marion, Smyth County. Common at that place. U. S. N. M. 97376.

22. *Tetradium* cf. *T. halysitoides* Raymond, × 4.

Silicified coralites, longitudinal view. Stones River limestone; 1½ miles southeast of Dryden, Lee County. U. S. N. M. 97377.

23. *Tetradium syringoporoides* Ulrich, × 4.

Longitudinal view. Stones River (Murfreesboro) limestone; locality as 22. U. S. N. M. 97378.

24–27. *Cheirocrinus?* sp.

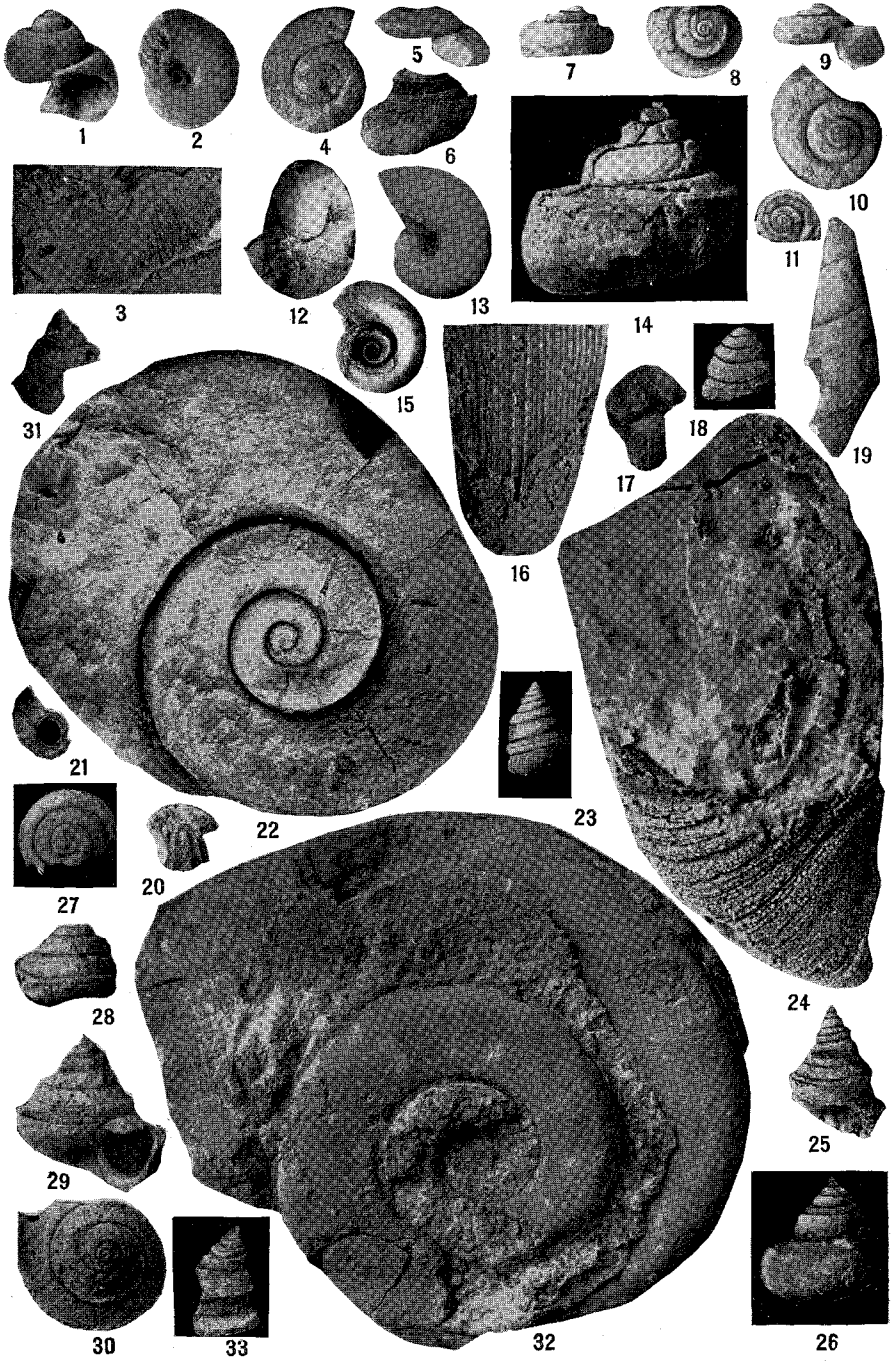
Detached plates. Occurrence as 20. U. S. N. M. 97379a, 97379b, 97379c, 97379d.

28–31. *Mesotrypa* sp.

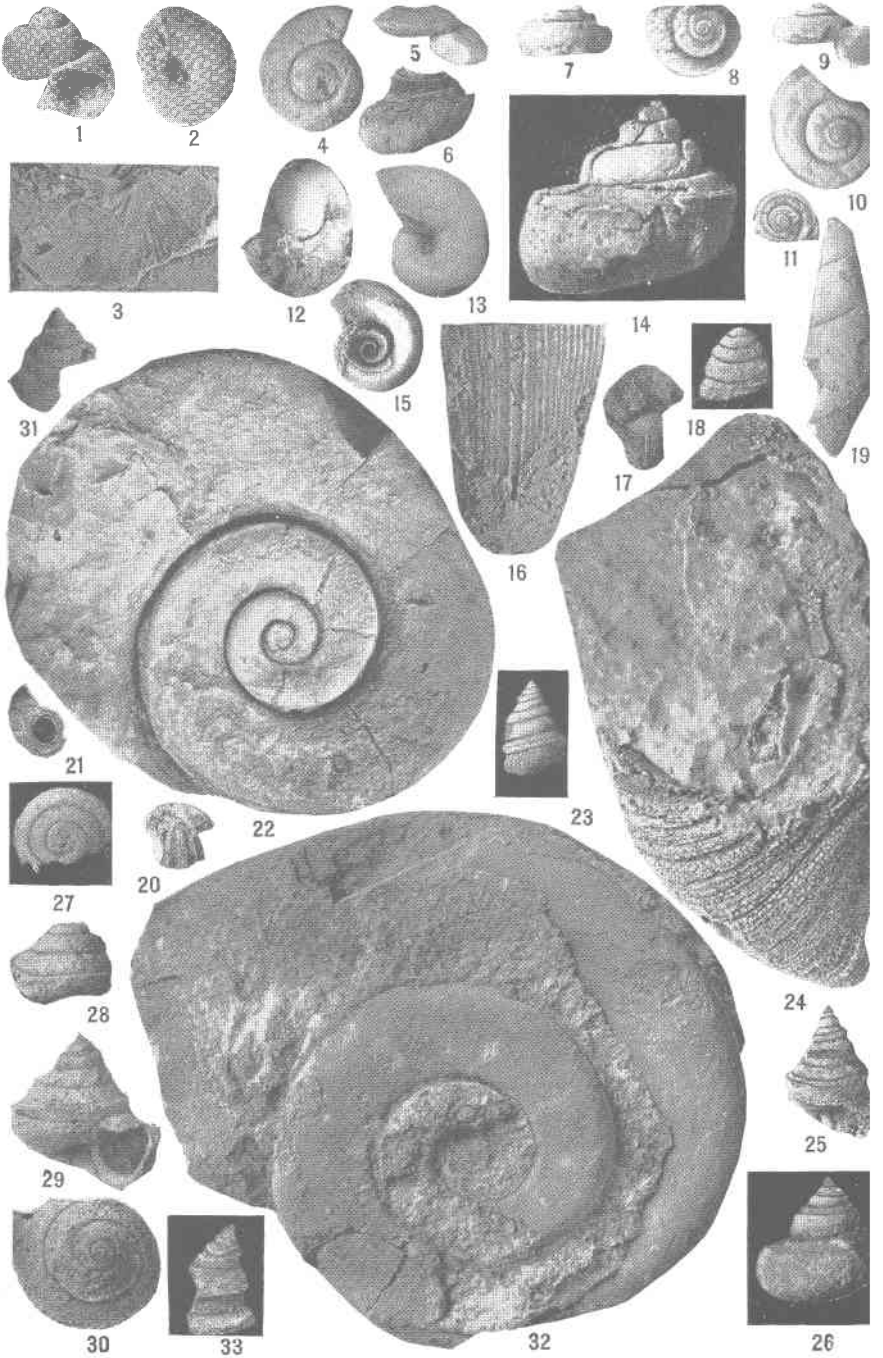
28, small part of surface of 30, × 4, to show shape and spacing of zoecia. 29, longitudinal section of 31, × 4, showing mesopores with many diaphragms. 30, 31, exteriors of two fragments; 31, × 2. Occurrence as 3. U. S. N. M. 97380a, 97380b.

32, 33. Sponge cf. *Anthaspidella* or *Zittelella.*

Common in upper part of Lenoir limestone in the Marion quarry and elsewhere. Many individuals on the surface of some layers of limestone. U. S. N. M. 97381a, 97381b.



MURFREESBORO, LENOIR, AND HOLSTON FOSSILS



MURFREESBORO, LENOIR, AND HOLSTON FOSSILS

PLATE 77.—MURFREESBORO, LENOIR, AND HOLSTON FOSSILS

FIGURE

1–3. *Holopea scrutator* Raymond?

1, 2, apertural and umbilical views of an internal mold. 3, small part of an external mold of the under side of the basal whorl of a fragment showing the revolving lines which are on the exterior of the shell, × 4. Associated with *Eotomaria?* sp. (Pl. 78, figs. 24-28.) Stones River (Murfreesboro) limestone; Willow Spring, Washington County. U. S. N. M. 97382a, 97382b.

4, 5. *Liospira* cf. *L. decipiens* Ulrich.

Apical and profile views of an internal mold. Lenoir limestone; along east slope of Angels Rest Mountain three-fourths of a mile west-southwest of Pearisburg, Giles County. U. S. N. M. 97383.

6–11. *Helicotoma tennesseensis* Ulrich and Scofield.

6, impression of an external mold in chert; 7, 8, profile and apical views of an impression of an external mold; 9, 10, profile and apical views of an exfoliated specimen; 11, apical view of an impression of an external mold of a small specimen. Stones River (Murfreesboro and Lenoir) limestones. 6, Lenoir limestone; along Whistle Creek 2 miles northwest of Lexington, Rockbridge County; 7-11, Stones River; 7, 8, top of spur half a mile northeast of the junction of Stony Creek with New River and 3¼ miles northeast of Pearisburg, Giles County; 9, 10, Yellow Branch 5 miles southeast of Rose Hill, Lee County; 11, Stones River, near base; about 2¾ miles southwest of Rye Cove School, Scott County. Associated with *Leperditella, Bathyurus,* and *Pterygometopus,* as shown on Pl. 75. 6, U. S. N. M. 97385; 7, 8, 97384; 9, 10, 97386; 11, 97387.

12, 13. *Sinuites* sp.

Edge and side views of a specimen. Lenoir limestone; Marcem quarry 2 miles west of Gate City, Scott County. U. S. N. M. 97388.

14. *Trochonemella trochonemoides* (Ulrich)?

Side view of a large specimen. Mosheim limestone; along State Route 58 just south of Hardys Creek and 5 miles northeast of Rose Hill, Lee County. U. S. N. M. 97389a.

FIGURE

15–17. *Kokenospira virginiana* Butts, n. sp.

Larger than *K. costalis* (Ulrich) and has 12 or more revolving lines on each side of central band, instead of 7 as in *K. costalis*. Largest shells three-fourths of an inch in diameter. 15, side, 17, edge view of same specimen; fine striae, as in 16, visible on the specimen. 16, edge view of outer whorl of another specimen showing band and the revolving furrows characteristic of the genus, × 4. This figure posed wrong end up. Rare; apparently only one other species known or described in America, *K. costalis* (Ulrich), of which a single specimen is known. Fourteen specimens of *K. virginiana* collected. Occurrence as 12. Holotype: 15, 17, U. S. N. M. 97390a; paratype: 16, 97390b.

18. *Eotomaria?* sp.

Profile view of a specimen. See 27 for apical view. Occurrence as 14. U. S. N. M. 97391a.

19. *Subulites* sp.

Lenoir limestone; Marcem quarry 2 miles west of Gate City, Scott County. U. S. N. M. 97392.

20, 21. *Tetranota* cf. *T. bidorsata* (Hall).

Edge and side views of a specimen. Occurrence as 12. U. S. N. M. 97393.

22. *Maclurites* sp.

Supposed umbilical view of a specimen giving the appearance of left hand coils. Lenoir limestone; in Pearisburg, Giles County. U. S. N. M. 97394.

23. *Lophospira* aff. *L. elongata* Butts?, × 2.

Occurrence as 14. U. S. N. M. 97397.

24. *Maclurites* sp.

Operculum of a large specimen. Lenoir? limestone; Rye Cove about 3 miles southwest of Rye Cove School, Scott County. U. S. N. M. 97395.

25. *Lophospira centralis* Ulrich.

Silicified specimen preserving parts of the shell. Occurrence as 12. U. S. N. M. 97398.

FIGURE

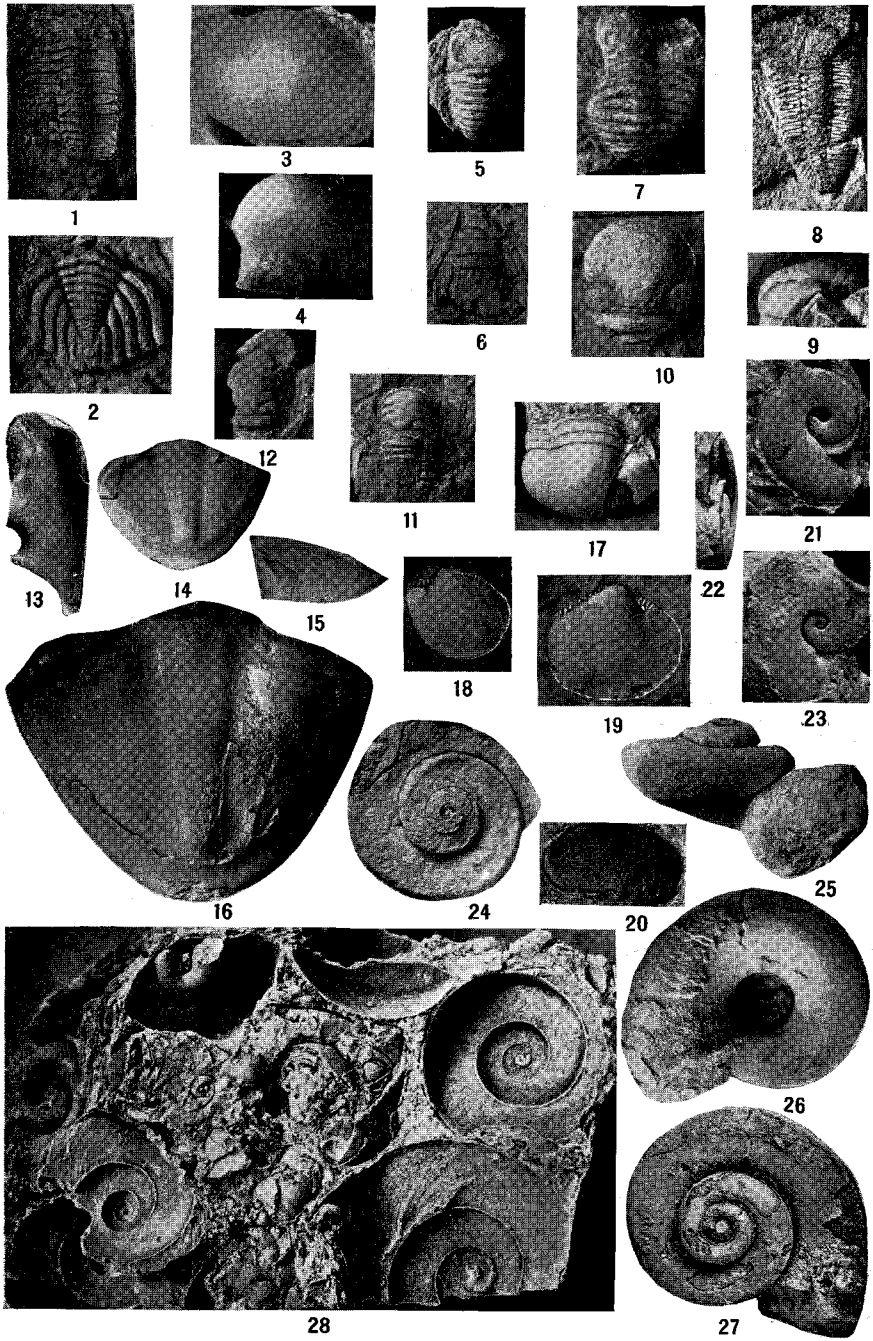
26. *Trochonemella trochonemoides* (Ulrich)?, × 2.
Small specimen. Occurrence as 14. U. S. N. M. 97389b.

27, 28. *Eotomaria?* sp.
27, apical view of 18; 28, profile view of another specimen. Occurrence as 14. U. S. N. M. 97391a, 97391b.

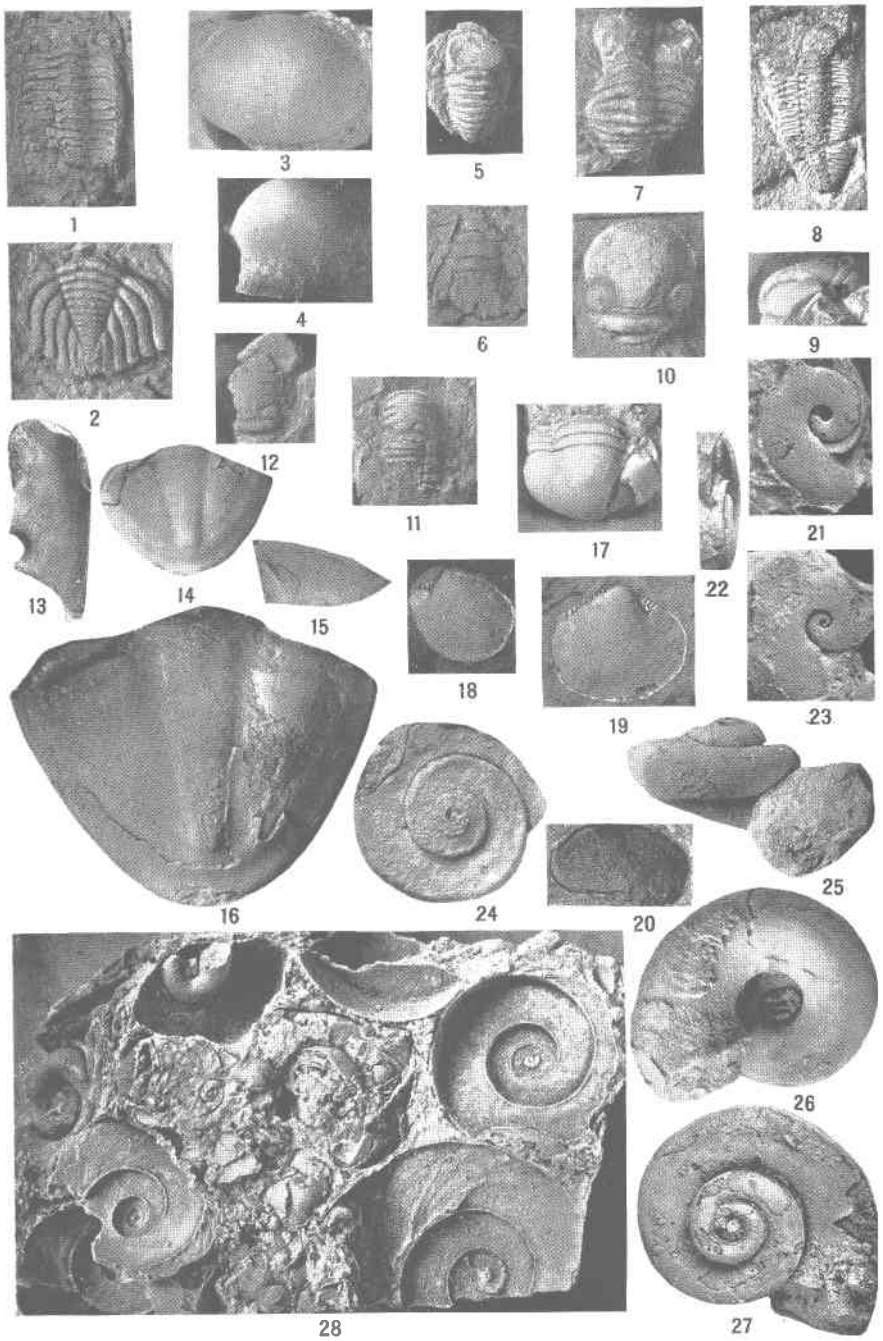
29, 30. *Trochonemella trochonemoides* (Ulrich)?
Apical and profile views of a small specimen that seems to differ in the slopes of the whorls from the forms shown in Fig. 14. Occurrence as 14. U. S. N. M. 97389c.

31, 33. *Lophospira* cf. *L. bicincta* (Hall).
Fragmental. 31, external mold in chert, concave toward the observer; 33, clay impression from 31. Murfreesboro limestone; top of spur half a mile northeast of mouth of Big Stony Creek and 3¼ miles northeast of Pearisburg, Giles County. U. S. N. M. 97399.

32. *Maclurites magnus* Lesueur.
Supposed umbilical view of a specimen giving the appearance of left-hand coil. Lenoir limestone; along Norfolk and Western Railway 2¼ miles southwest of Marion, Smyth County. U. S. N. M. 97396.



MURFREESBORO, LENOIR, AND HOLSTON FOSSILS



MURFREESBORO, LENOIR, AND HOLSTON FOSSILS

PLATE 78.—MURFREESBORO, LENOIR, AND HOLSTON FOSSILS

FIGURE

1, 2. *Pliomerops canadensis* (Billings).

1, thorax; 2, tail, × 2. Lenoir limestone; quarry at Marion, Smyth County. U. S. N. M. 97400a, 97400b.

3, 4. *Bumastus* cf. *B. lioderma* Raymond.

Head, dorsal and profile views. Lenoir limestone; Rye Cove, Scott County. U. S. N. M. 97401.

5, 6. *Remopleurides* sp.

5, thorax with imperfect head; 6, imperfect tail. Occurrence as 1. U. S. N. M. 97402a, 97402b.

7. *Encrinurus* sp.

Poorly preserved specimen. Occurrence as 1. U. S. N. M. 97403.

8. *Pterygometopus* sp.

Thorax and tail. Lenoir limestone; 1 mile northeast of Galena, Augusta County. U. S. N. M. 97404.

9. *Illaenus* cf. *I. consimilis* Billings.

Tail, profile view. Dorsal view shown in fig. 17. Stones River (Murfreesboro) limestone; 1½ miles south of Rye Cove School, Scott County. U. S. N. M. 97405.

10. *Sphaerexochus* sp., × 2.

Head. Restored on lower left. Occurrence as 1. U. S. N. M. 97406.

11, 12. *Ceraurinus?* sp.

11, head and part of thorax; 12, imperfect head. 11, Lenoir limestone; 3 miles southeast of Blacksburg, Montgomery County; 12, locality as 1. U. S. N. M. 97407, 97408.

13–16. *Homotelus* sp.

13, free cheek; 14, 16, dorsal views of two tails; 15, profile view of 14. Lenoir limestone; Dunkard Church 6 miles north of Buchanan, Botetourt County. 13, U. S. N. M. 97409a; 14, 15, 97409b; 16, 97409c.

17. *Illaenus* cf. *I. consimilis* Billings.

Tail, dorsal view of 9. Occurrence as 9. U. S. N. M. 97405.

FIGURE

18, 19. *Ctenodonta* sp.

Left and right valves. Stones River (Murfreesboro) limestone; Willow Spring, Russell County. Associated with *Eotomaria?* Abundant. U. S. N. M. 97410a, 97410b.

20. *Modiolopsis* cf. *M.? consimilis* Ulrich.

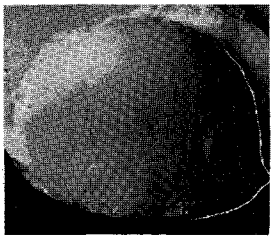
Clay impression of the external mold of an imperfect left valve. Occurrence as 18. U. S. N. M. 97411.

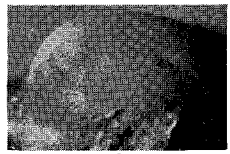
21–23. *Oxydiscus catilloides* (Raymond) ?, × 3.

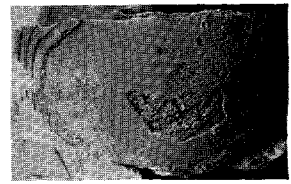
21, 23, side views of two specimens; 22, edge view of 21. Occurrence as 18. 21, 22, U. S. N. M. 97412a; 23, 97412b.

24–28. *Eotomaria?* sp.

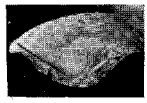
24, impression from an external mold on the upper right corner of 28; 25-27, profile, umbilical, and apical views of the internal mold of a specimen; 28, piece of a large mass crowded with shells of this species. The lines of ornamentation are visible on some specimens. Occurrence as 18. 25-27, U. S. N. M. 97413a; 24, 28, 97413b.

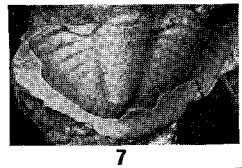

1

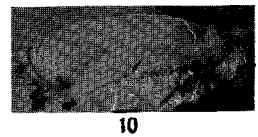

2

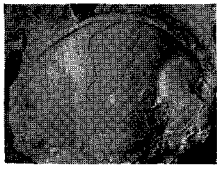

3

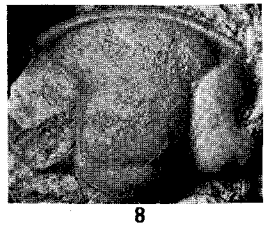

4

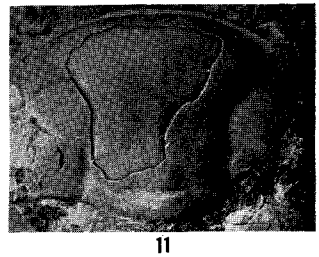

5

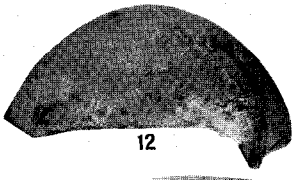

7


10


6

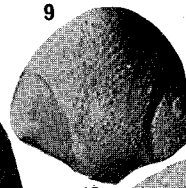

8


11

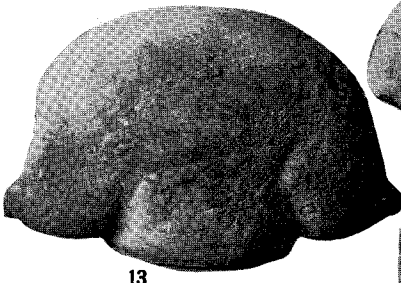

12

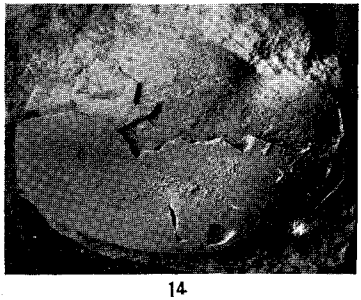

9

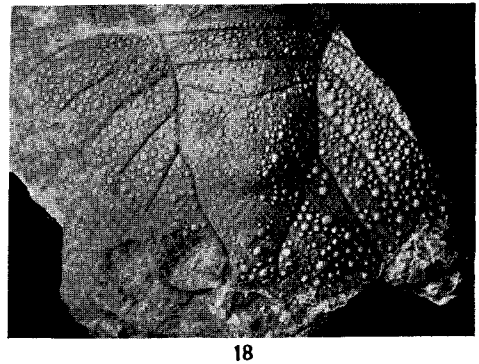

15


16

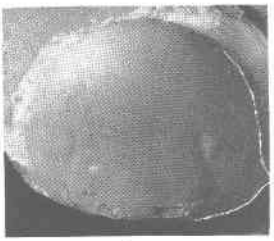

17


13


14


18

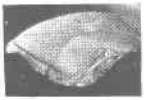
HOLSTON AND WHITESBURG FOSSILS


1


2

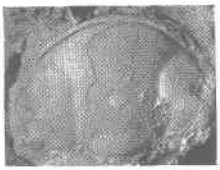

3

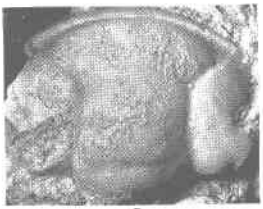

4


5

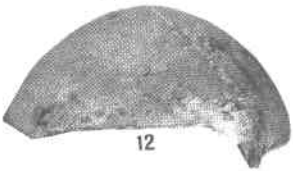

7


10


6

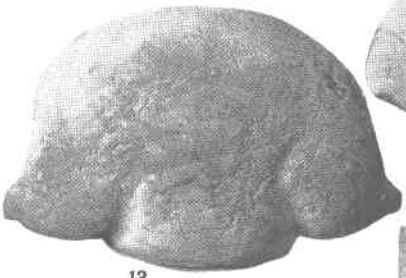

8

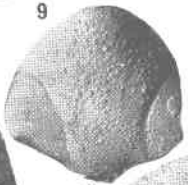

11


12


9

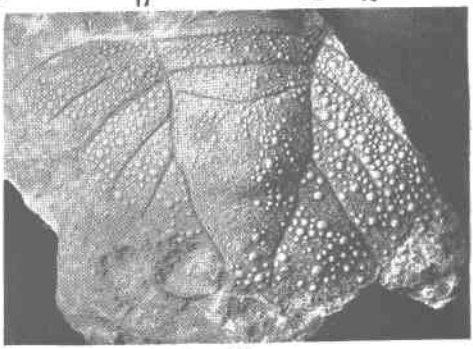

15


13


16


17


14


18

HOLSTON AND WHITESBURG FOSSILS

PLATE 79.—HOLSTON AND WHITESBURG FOSSILS

FIGURE

1–3. *Bumastus lioderma* Raymond?

1, 2, dorsal and profile views of a head; 3, dorsal view of a tail. Holston limestone; quarry of the Mathieson Alkali Works at Porterfield about 5 miles east of Saltville, Smyth County. 1, 2, U. S. N. M. 97414a; 3, 97414b.

4–9. *Basilicus* sp.

5, 6, profile and dorsal views of a head; 8, 9, dorsal and profile views of another head; 4, 7, profile and dorsal views of a tail. Holston limestone. 5, 6, Tilson Mill about 16 miles north of Marion, Smyth County; 8, 9, locality as 1; 4, 7, McNutt quarry 9 miles southwest of Bland, Bland County. 4, 7, U. S. N. M. 97415; 5, 6, 97416; 8, 9, 97417.

10, 11. *Basilicus* sp.

Dorsal and profile views of a head. Limestone, exact age uncertain, a few feet thick between the Lenoir and Chambersburg limestones; along the Southern Railway about 600 feet northeast of Strasburg intersection and about 1 mile west of Strasburg, Shenandoah County. U. S. N. M. 97418.

12–14. *Illaenus fieldi* Raymond?

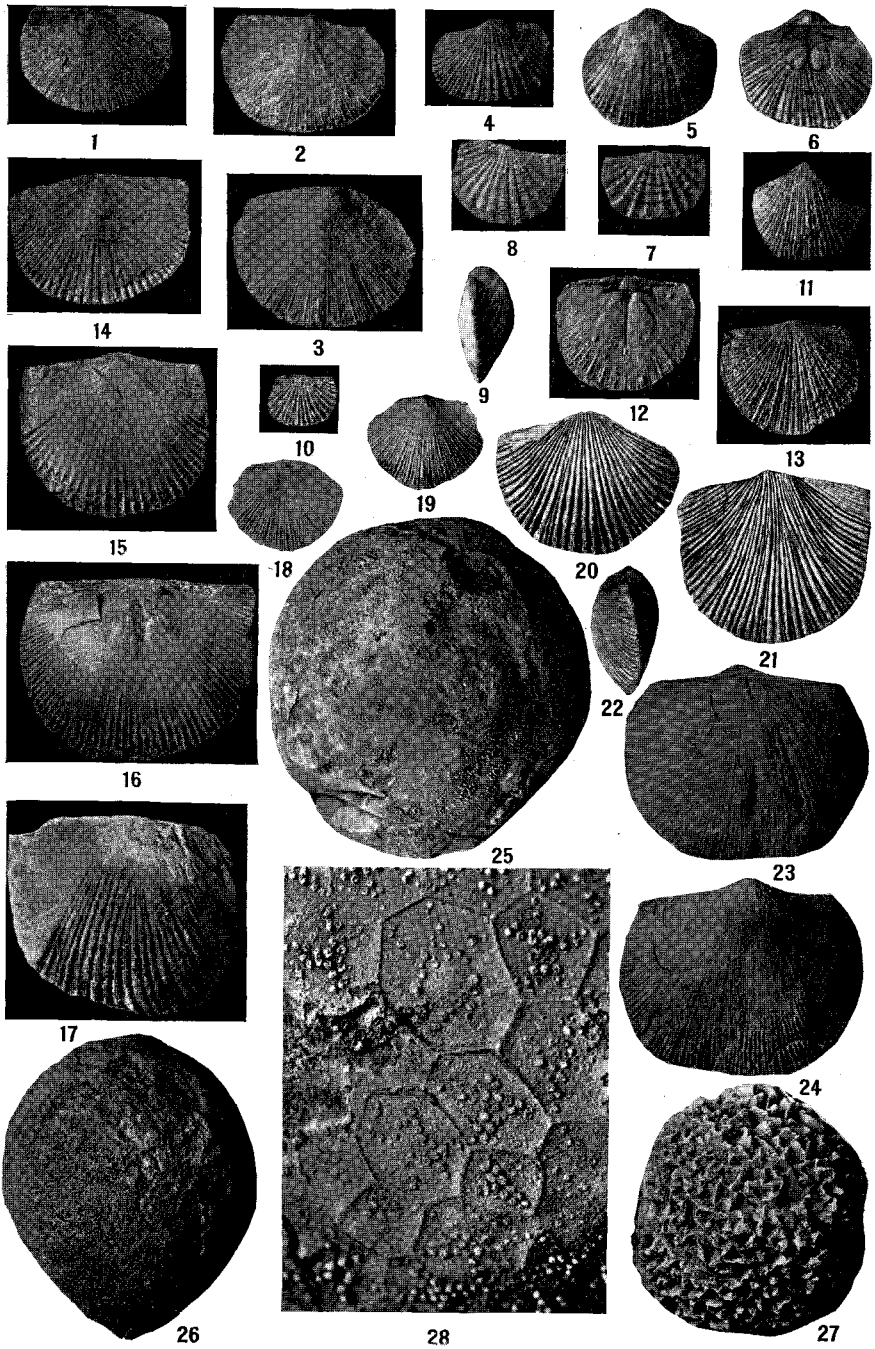
12, 13, profile and dorsal views of a head; 14, dorsal view of a tail. Whitesburg limestone; Grayson farm about 4 miles southwest of Bland, Bland County. 12, 13, U. S. N. M. 97419a; 14, 97419b.

15. *Hyboaspis shuleri* Raymond.

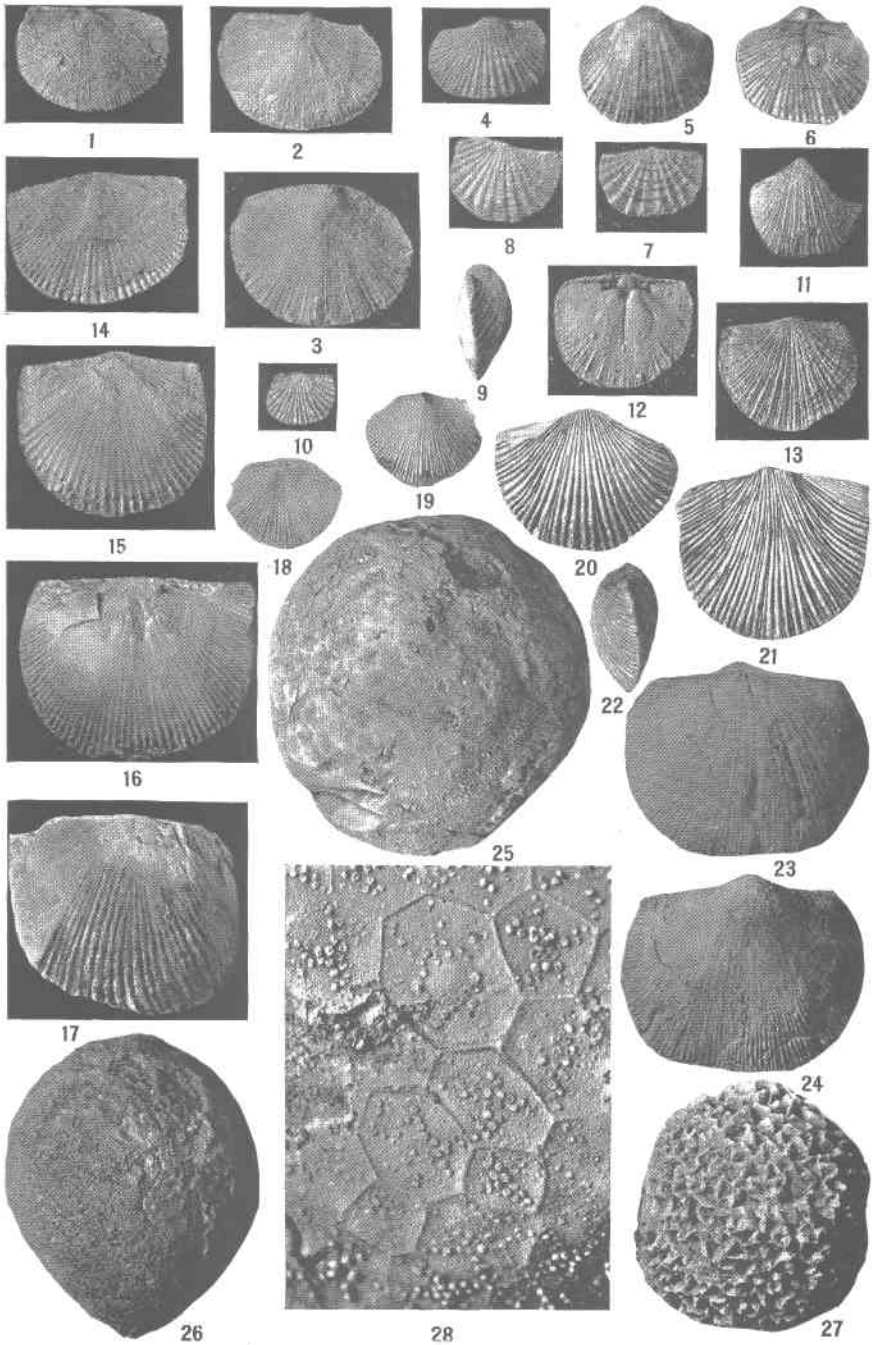
Dorsal view of a tail. Head and thorax apparently unknown. Occurrence as 1. U. S. N. M. 97420.

16–18. *Acrolichas prominulus* Raymond.

16, 17, head, dorsal and profile views of a plaster cast of the type. (See Bull. Mus. Comp. Zool., vol. 67, no. 1, pl. 8, figs. 11, 12, 1925.) 18, dorsal view of tail. Occurrence as 4. U. S. N. M. 78348.



HOLSTON AND WHITESBURG FOSSILS



HOLSTON AND WHITESBURG FOSSILS

PLATE 80.—HOLSTON AND WHITESBURG FOSSILS

FIGURE

1–3. Undetermined genus, related to *Rafinesquina?*

1, dorsal valve; 2, 3, ventral valves; 3, × 2. Holston limestone; quarry of the Mathieson Alkali Works at Porterfield 5 miles east of Saltville, Smyth County. U. S. N. M. 99256a, 99256b, 99256c.

4–10. *Productorthis agilera* (Willard).

5, 6, 9, ventral, dorsal, and profile views of the same specimen; 4, 7, 8, 10, doubtfully referred to this species, probably a *Glyptorthis*. Occurrence as 1. 5, 6, 9, U. S. N. M. 99257; 4, 99258a; 7, 99258b; 8, 99258c; 10, 99258d.

11–13. *Paurorthis catawbaensis* Butts, n. sp., × 2.

Characterized by its convex valves and the fasciculation of its striae; differs from *P. parva* (Pander) by its finer ornamentation. 11, impression of an external mold of a ventral valve; 12, internal mold of a dorsal valve; 13, impression of the external mold of the same specimen as 12, showing the actual exterior of the shell. Holston? limestone, shaly facies near bottom; along State Route 311 about 6½ miles northwest of Salem and half a mile southwest of Catawba post office, Roanoke County. Horizon doubtful; is just above Mosheim limestone and may be Lenoir or Whitesburg. Cotypes: U. S. N. M. 99259a, 99259b, 99259c.

14–17. *Multicostella whitesburgensis* Butts, n. sp.

Distinguished by its large, robust size and coarse, simple ribs, and biconvex valves. Ribs 10 to 11 in 10 millimeters. Whitesburg limestone. 14, 15, half a mile west of Lexington, Rockbridge County; 16, 17, near the south base of Big Butt Mountain 6½ miles northwest of Lexington, Rockbridge County. Cotypes: U. S. N. M. 99260a, 99260b, 99261a, 99261b.

18, 19. *Dinorthis?* sp.

Dorsal and ventral valves of same specimen. Occurrence as 1. U. S. N. M. 99262.

20, 21. *Cyrtonotella virginiensis* Butts, n. sp.

Ventral valve very convex; dorsal valve concave; main ribs extending to beak, 10 in 10 mm.; secondary ribs intercalated in anterior half. 20, ventral valve; 21, dorsal valve

FIGURE

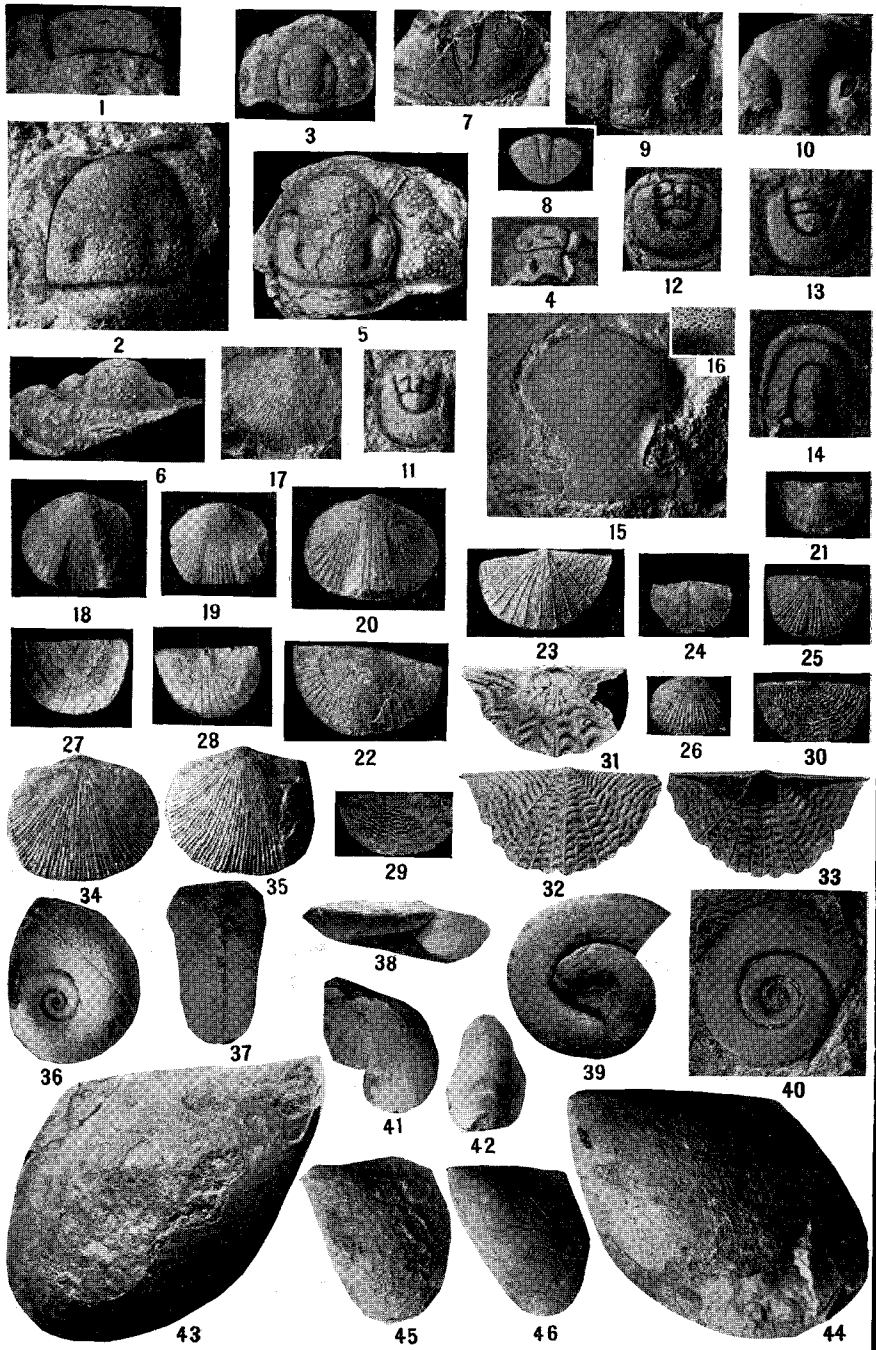
of different individuals. Holston limestone?, shaly phase; one-third of a mile southwest of Catawba, Roanoke County. Cotypes: U. S. N. M. 99263a, 99263b.

22–24. *Doleroides?* sp.

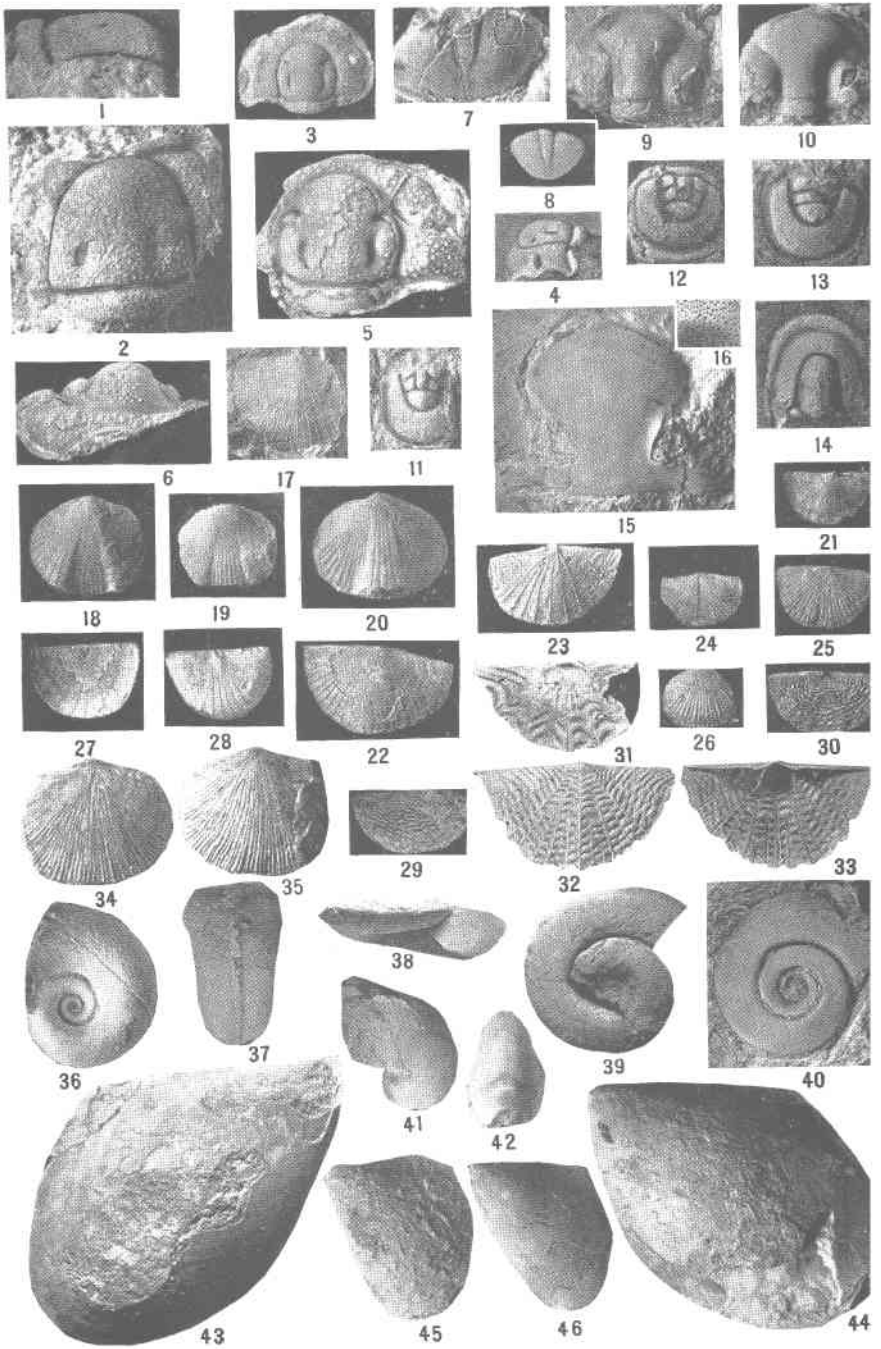
22, profile of specimen of Pl. 81, figs. 34 and 35; 23, 24, dorsal and ventral views of another and larger specimen. Occurrence as 1. 22, U. S. N. M. 98225a; 23, 24, 98225b.

25–28. *Echinosphaerites* cf. *E. aurantium* (Gyllenhal).

25, internal mold, test exfoliated, showing the fillings of the pores; 28, part of surface of 25, × 4, showing more plainly the fillings of the pores; 26, an exfoliated specimen; 27, an exfoliated specimen showing crystalline calcite common in fossil echinoderms. Whitesburg limestone. 25, 27, 28, base of the northeast slope of Green Hill about 2 miles southwest of Collierstown, Rockbridge County; 26, from field half a mile north of State Route 4 and 2½ miles east of Dale Enterprise, Rockingham County. 25, 28, U. S. N. M. 97421a; 27, 97421b; 26, 97422.



HOLSTON AND WHITESBURG FOSSILS



HOLSTON AND WHITESBURG FOSSILS

PLATE 81.—HOLSTON AND WHITESBURG FOSSILS

FIGURE

1, 2. [a]*Glaphurina brevicula* Ulrich, × 2.

Dorsal and side views of a head. Holston limestone; 2 miles northwest of Lexington, Rockbridge County. U. S. N. M. 80549.

3, 4. [a]*Glaphurus* sp.

Dorsal and side views of a head. Holston limestone; quarry of the Mathieson Alkali Works at Porterfield 5 miles east of Saltville, Smyth County. U. S. N. M. 97423.

5, 6. [a]*Glaphurus latior* Ulrich, × 2.

Dorsal and front views of a head. Whitesburg limestone; 6 miles southwest of Bland, Bland County. U. S. N. M. 80552.

7–10. *Bronteopsis gregaria* Raymond.

7, 8, tails; 9, 10, heads, dorsal views. 8, × 2. Whitesburg limestone. 7-9, Cedar Grove Church 1 mile east of Harrisonburg, Rockingham County; 10, Hoge farm 6 miles southwest of Bland, Bland County. U. S. N. M. 97424a, 97424b, 97424c, 97425.

11–14. *Arthrorhachis elspethi* Raymond, × 4.

11-13, tails; 14, head. Whitesburg limestone. 11, 12, 14, locality as 10; 13, Swoope 7 miles west of Staunton, Augusta County. U. S. N. M. 97426a, 97426b, 97427, 97426c.

15, 16. *Homotelus* sp.

16, a small part of the carapace of 15 to show punctation, × 4. Whitesburg limestone?; source uncertain. U. S. N. M. 97428.

17. *Rafinesquina* sp.?

Occurrence as 3. U. S. N. M. 98222.

18–20. *Oxoplecia* sp.

18, 19, ventral valves; 20 dorsal valve, all different individuals. Whitesburg limestone; Cedar Grove Church 1 mile east of Harrisonburg, Rockingham County. U. S. N. M. 98227a, 98227b, 98227c.

[a] After Ulrich, E. O., Proc. U. S. Nat. Mus., vol. 76, pp. 1-101, pls. 1-8, 1929.

FIGURE

21, 22. *Sowerbyella?* sp.

Ventral valves. 22, × 2. Rare. Whitesburg limestone; Lexington, Rockbridge County. U. S. N. M. 98228a, 98228b.

23. *Sowerbyella?* sp., × 2.

Whitesburg limestone; locality as 3. Associated with *Ptychoglyptus*. (See Figs. 29 and 30.) U. S. N. M. 98229.

24–26. *Hebertella?* sp.

24, 25, ventral valves; 26, dorsal valve, doubtfully referred to this form. Occurrence as 3. U. S. N. M. 98223a, 98223b, 98223c.

27, 28. *Leptellina elegantula* Butts, n. sp.

Distinguished by its small size and fine regular alternating striae, 6 large ones in 5 mm., with 10-15 finer striae between. 27, external mold; 28, internal mold of the same specimen. Occurrence as 23. Holotype: U. S. N. M. 98224.

29–33. *Ptychoglyptus virginiensis* Willard.

29, 32, exteriors of ventral valves; 30, exterior of dorsal valve; 33, interior of 32; 31, interior of a dorsal valve. 31-33, × 2. Whitesburg limestone. 29, 30, locality as 3; 31-33, etched from a slab collected on the crest of a low ridge 1½ miles west of Lairds Knob and 6 miles east of Harrisonburg, Rockingham County. U. S. N. M. 98230a, 98230b, 98231a, 98231b.

34, 35. *Doleroides?* sp.

Dorsal and ventral valves. Occurrence as 3. (See Pl. 80, fig. 22, for profile view.) U. S. N. M. 98225a.

36, 37. *Bucania* sp.

Dorsal and side views of a specimen. Ornamented by transverse scalloped lines which do not show here. Occurrence as 3. U. S. N. M. 97429.

38–40. *Liospira* sp.

Internal molds. 38, 39, side and apical views of a specimen; 40, apical view of another specimen. Occurrence as 21. U. S. N. M. 97430a, 97430b.

41, 42. *Sinuites* sp.

Side and dorsal views. Occurrence as 21. U. S. N. M. 97431.

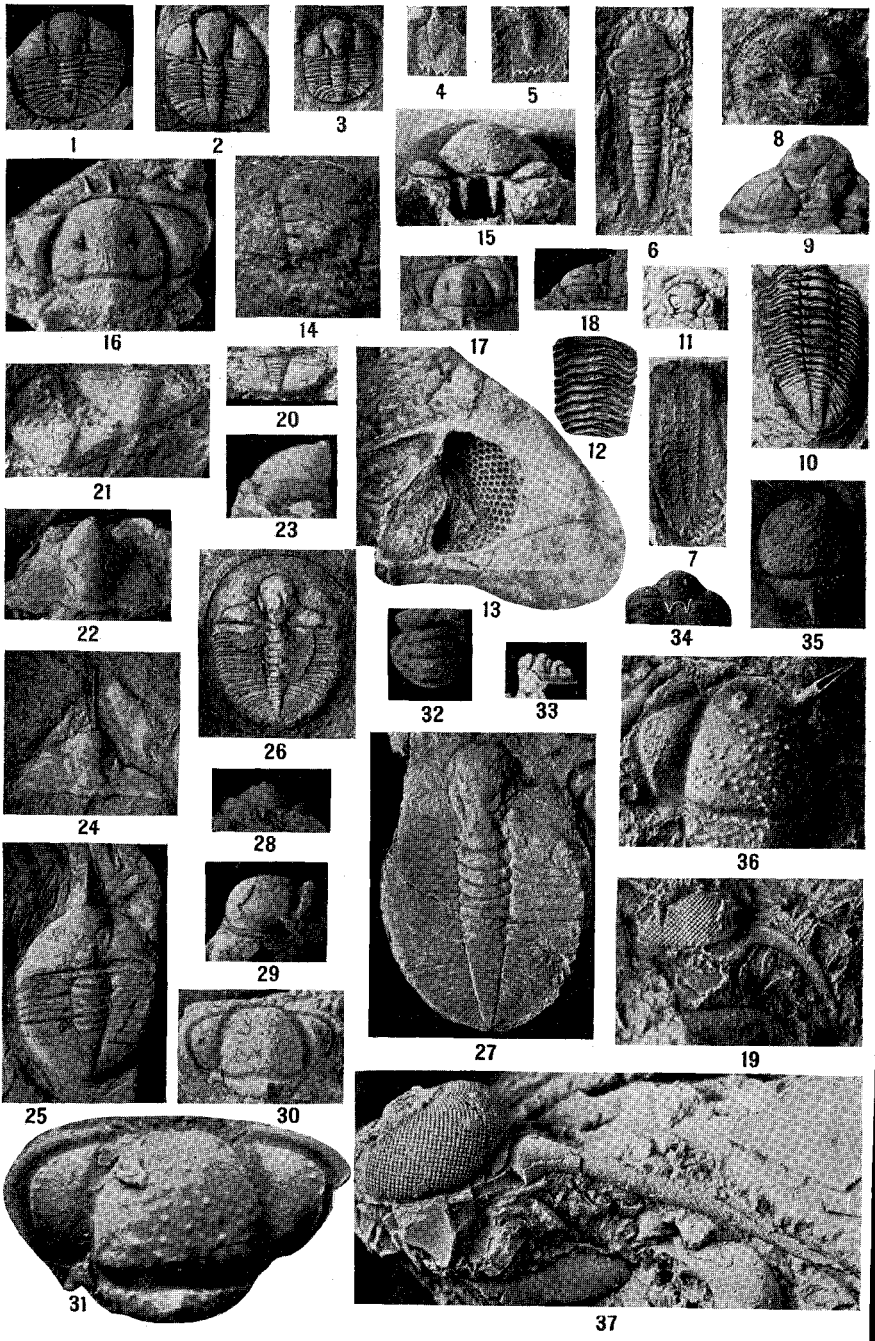
FIGURE

43, 44. *Clionychia* sp.?

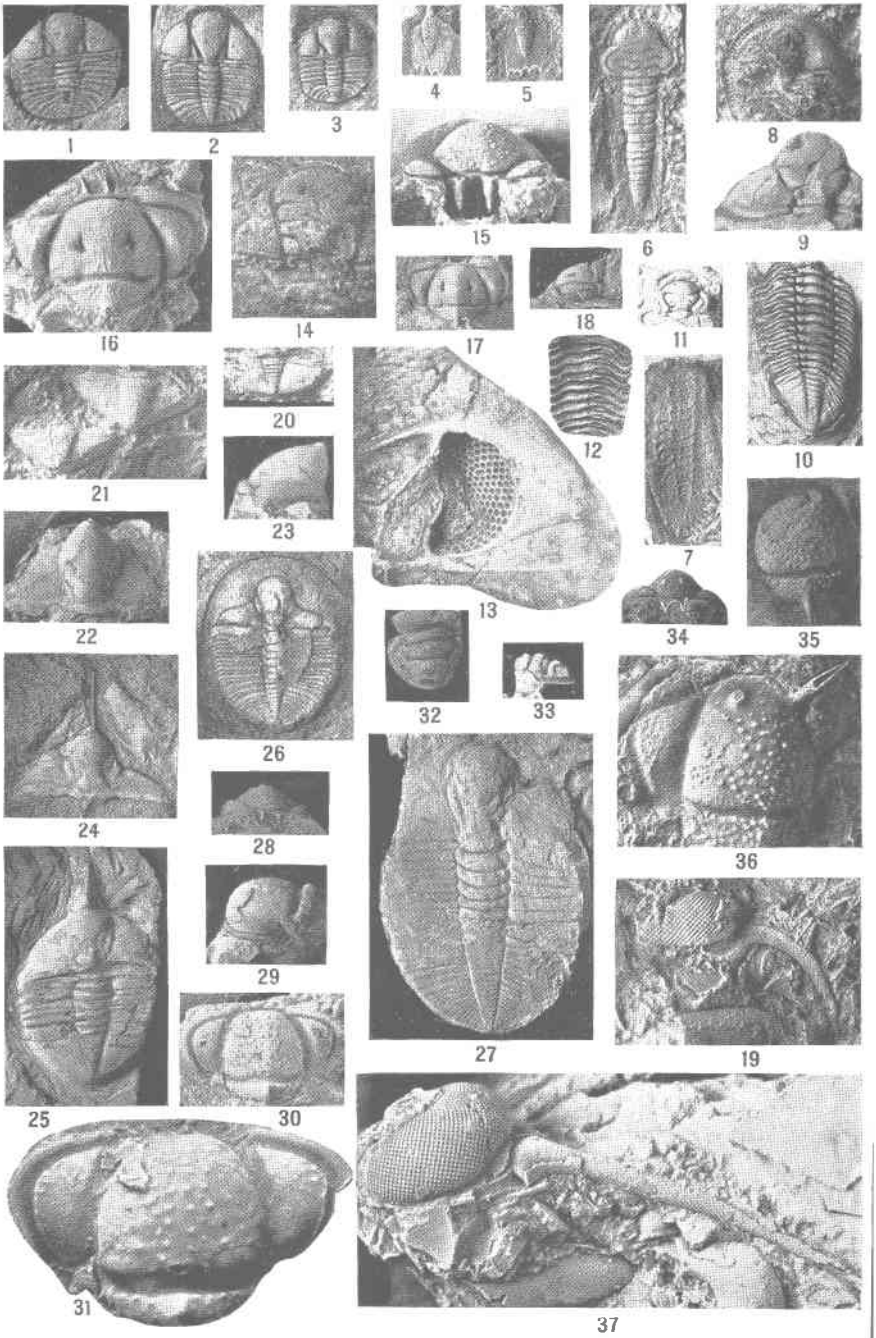
Right and left valves. Occurrence as 3. U. S. N. M. 97432a, 97432b.

45, 46. *Clionychia* cf. *C. nitida* Ulrich.

Two left valves. Occurrence as 3. The undulating growth lines on 45 are probably abnormal, for on the opposite valve they are nearly regular, and on 46, they are regular and even, but so faint that they do not show here. This species closely resembles *C. nitida* Ulrich from the Platteville (Lowville) limestone of Minnesota. U. S. N. M. 97433a, 97433b.



WHITESBURG, ATHENS, AND OTTOSEE FOSSILS



WHITESBURG, ATHENS, AND OTTOSEE FOSSILS

PLATE 82.—WHITESBURG, ATHENS, AND OTTOSEE FOSSILS

FIGURE

1–3. *Ampyxina scarabeus* Butts, n. sp., × 2.

Dorsal views of three individuals. The glabella is more narrowly obovate, the furrows on the thoracic segments are slightly narrower and more nearly parallel to the sutures, and the lateral lobes on the pygidium are more sharply flexed downward at the outer extremities than in *A. bellatula* (Savage), the only other described species. Athens shale; along State Route 114, 4 to 5 miles southwest of Catawba Sanatorium, Roanoke County. Cotypes: U. S. N. M. 97434a, 97434b, 97434c.

4–7. *Robergia major* Raymond.

4, 5, tails. (The posterior extremities have been retouched to bring out the scalloped margins.) 6, internal mold of a nearly complete specimen, dorsal view; 7, external mold of a thorax, dorsal view. (A few of the lateral lobes of the thorax have been strengthened by retouching.) Athens shale. 4, 7, west end of bridge 1 mile west of Front Royal, Warren County; 5, 6, old quarry of Mathieson Alkali Works 2 miles southeast of Saltville, Smyth County. Raymond's types were obtained here. U. S. N. M. 97435a, 72145a, 72145b, 97435b.

8. *Tretaspis reticulata* Ruedemann?

Dorsal view of an exfoliated head. The reticulation is faintly shown on the right fixed cheek in the specimen and very plainly shown on a fragment in the same collection preserving the original exterior of the carapace. Limestone in the Athens; 1½ miles east of Tenth Legion, Rockingham County. U. S. N. M. 97436.

9–13. *Pterygometopus* sp.?

9, 11, internal molds of two heads lacking the free cheeks; 10, internal mold of a thorax with tail; 12, internal mold of part of another thorax; 13, external mold of part of a head, × 4, preserving part of the glabella and free cheek with a perfect facetted compound eye common to trilobites. Athens shale; 5 miles northwest of Roanoke and three-fourths of a mile northeast of Kingstown, Roanoke County. U. S. N. M. 97437a, 97437b, 97437c, 97437d, 97437e.

FIGURE

14. *Ceraurus* or *Ceraurinus* sp.?, × 2.

Dorsal view of a partly preserved head. Ottosee limestone; Rye Cove, Scott County. U. S. N. M. 97438.

15. [a]*Telephus gelasinosus* Butts, × 4.

Anterior view to show vertical frontal spines or teeth characteristic of the genus. Whitesburg limestone; Pratts Ferry, Bibb County, Ala. U. S. N. M. 71468.

16–19. [a]*Telephus bipunctatus* Ulrich.

16, dorsal view of a head, × 4; 17, 18, dorsal and profile views of a head, × 2; 19, free cheek with eye and spine, × 4. The two pits on the glabella are the most distinctive feature of this species. Whitesburg limestone; Lexington, Rockbridge County. Occurs south to Pratts Ferry, Bibb County, Ala. Ulrich states that this is the most abundant and widely distributed of American species of *Telephus*. 16, U. S. N. M. 80543b; 17, 18, 80543a; 19, 80543d.

20. *Ampyx* sp.

Tail. Whitesburg limestone; 1½ miles north of Seven Mile Ford, Smyth County. U. S. N. M. 97439.

21–23. *Ampyx* sp.

21, tails; 22, 23, dorsal and profile views of a head. Occurrence as 16. 21, U. S. N. M. 72102a; 22, 23, 72102b.

24, 25. *Ampyx americanus* Safford and Vogdes.

24, head with frontal spine; 25, entire specimen, dorsal view. Athens shale. 24, Riverton, Warren County; 25, Southern Railway bridge east of Bulls Gap, Tenn. U. S. N. M. 72104, 97440.

26, 27. *Dionide holdeni* Raymond.

Nearly entire specimens, dorsal views. 26, × 4, occurrence as 1; 27, occurrence as 24. U. S. N. M. 97441, 97442.

28–31. [a]*Telephus pustulatus* Ulrich.

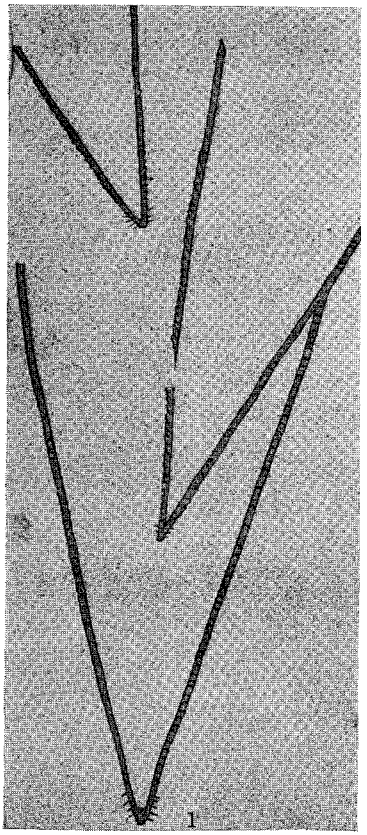
28-30, anterior, profile, and dorsal views of a head, × 2; 31, same as 30, × 4. Occurrence as 16. U. S. N. M. 80536.

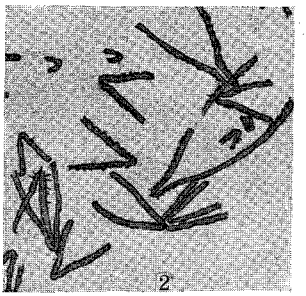
32–37. [a]*Telephus bicornis* Ulrich, × 4.

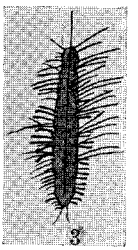
32, 33, dorsal and profile views of a tail; 34, anterior view of a head showing the bases of two occipital spines; 35, dorsal

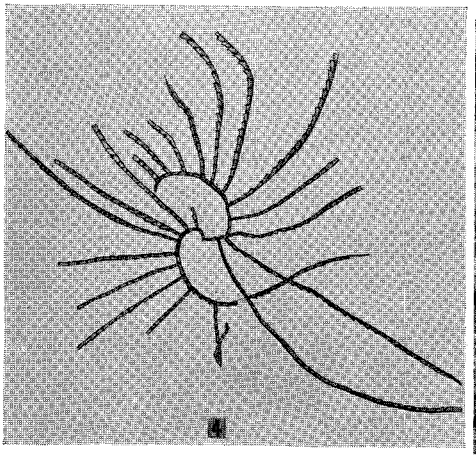
[a] After Ulrich, E. O., Proc. U. S. Nat. Mus., vol. 76, pp. 1-101, pls. 1-8, 1929.

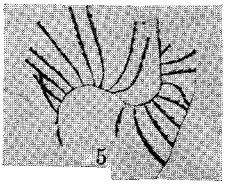
view of a head showing a complete posterior occipital spine; 36, dorsal view of a head preserving base of the left frontal spine and a larger part of the right spine which is restored; 37, eye with long spine. Whitesburg limestone; Grayson farm 4 miles southwest of Bland, Bland County. 32, 33, U. S. N. M. 80535j; 34-37, 80535f, 80535d, 80535h, 80535a.

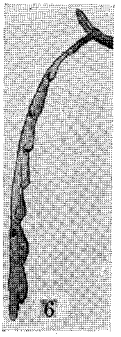


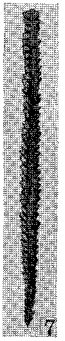


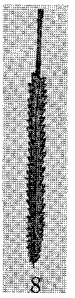


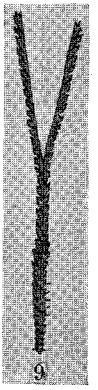


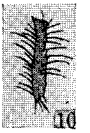


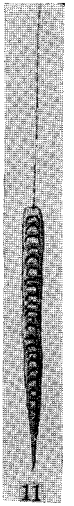




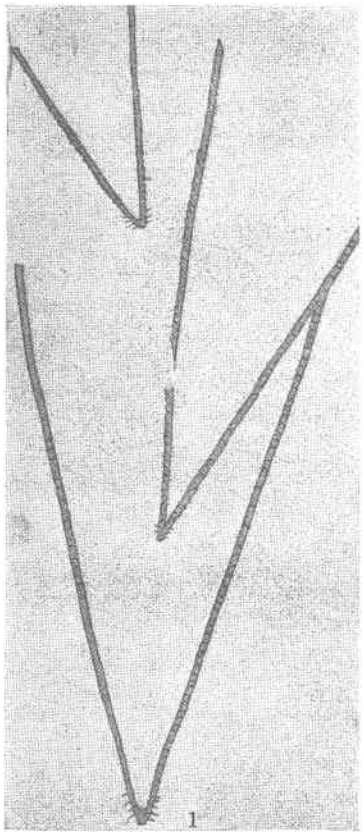


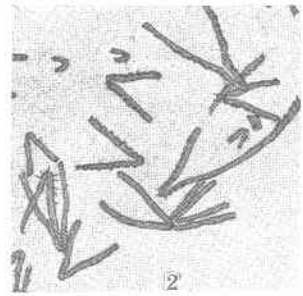


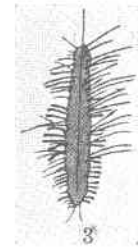


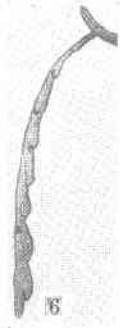


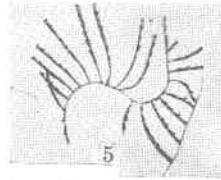
GRAPTOLITES FROM ATHENS SHALE

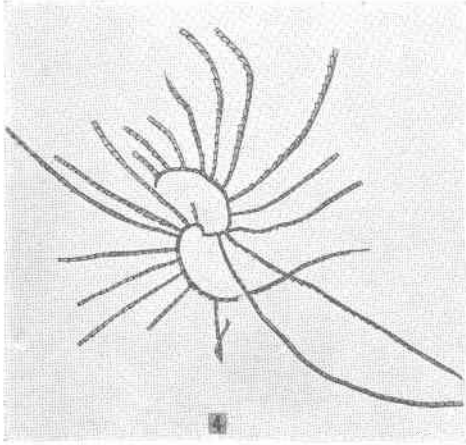












GRAPTOLITES FROM ATHENS SHALE

PLATE 83.—GRAPTOLITES FROM ATHENS SHALE

All the figures on this plate, except Figs. 4 and 13, are reproduced from Ruedemann, "The Graptolites of New York," New York State Museum, Mem. 11, 1908. The specimens figured, except that of Fig. 4, were collected outside of Virginia, but all the species occur in the Athens of Virginia.

FIGURE

1. *Dicellograptus moffatensis alabamensis* Ruedemann.
   Athens shale; Pratts Ferry, Ala.

2. *Dicellograptus smithi* Ruedemann.
   Athens shale; Pratts Ferry, Ala.

3. *Glossograptus ciliatus* Emmons.
   Normanskill shale; Glenmont, N. Y.

4–6. *Nemagraptus gracilis* (Hall).
   4, along road about half a mile south of Lusters Gate and 2½ miles east of Blacksburg, Montgomery County. Camera lucida drawing by R. Ruedemann. Athens shale. U. S. N. M. 97443. 5, 6, Normanskill shale, Kenwood, N. Y. (after Ruedemann.)

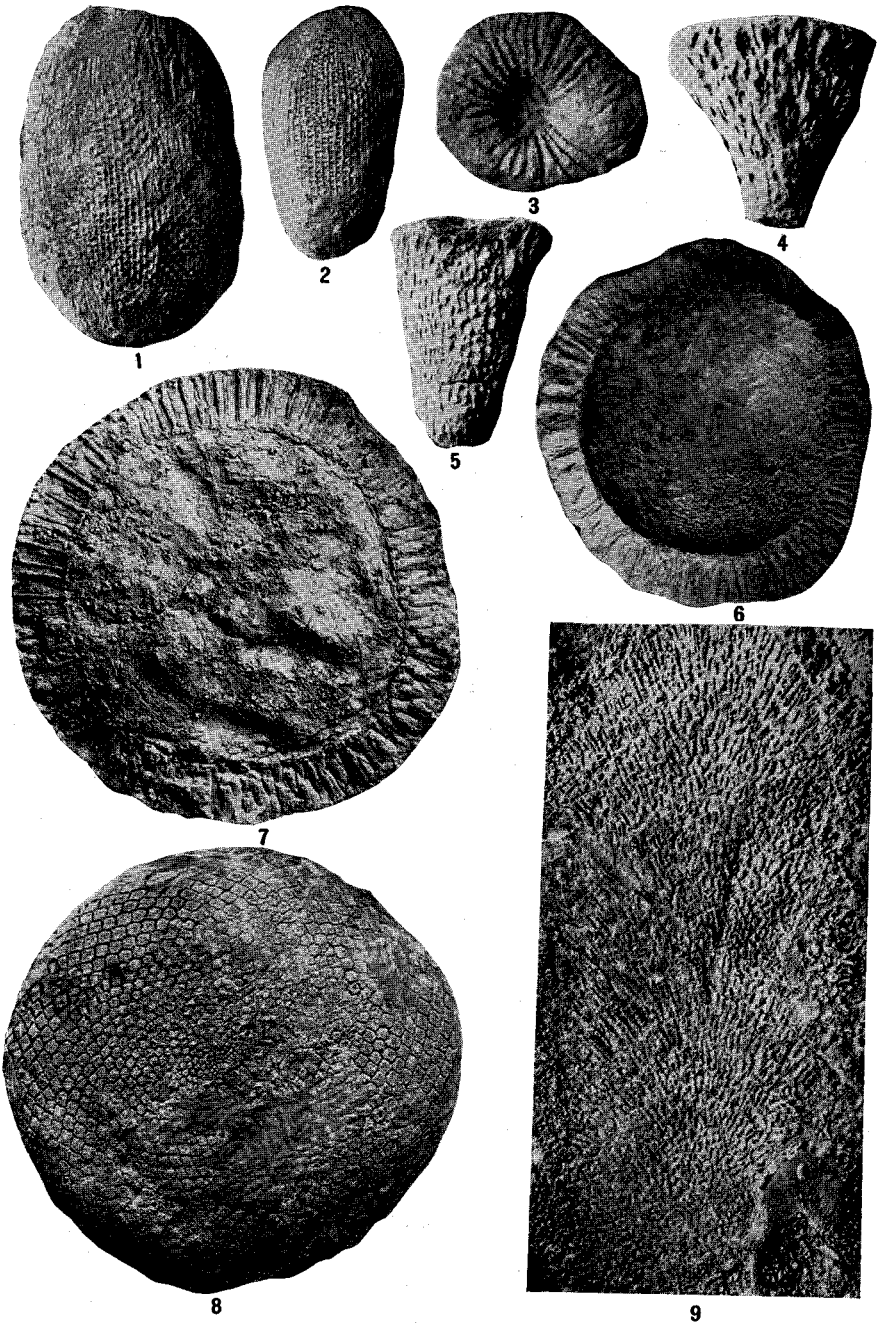
7, 8. *Diplograptus foliaceus* (Murchison).
   7, Utica shale; Cohoes, N. Y.; 8, Normanskill shale, Glenmont, N. Y.

9. *Dicranograptus spinifer* Lapworth.
   Normanskill shale; Glenmont, N. Y.

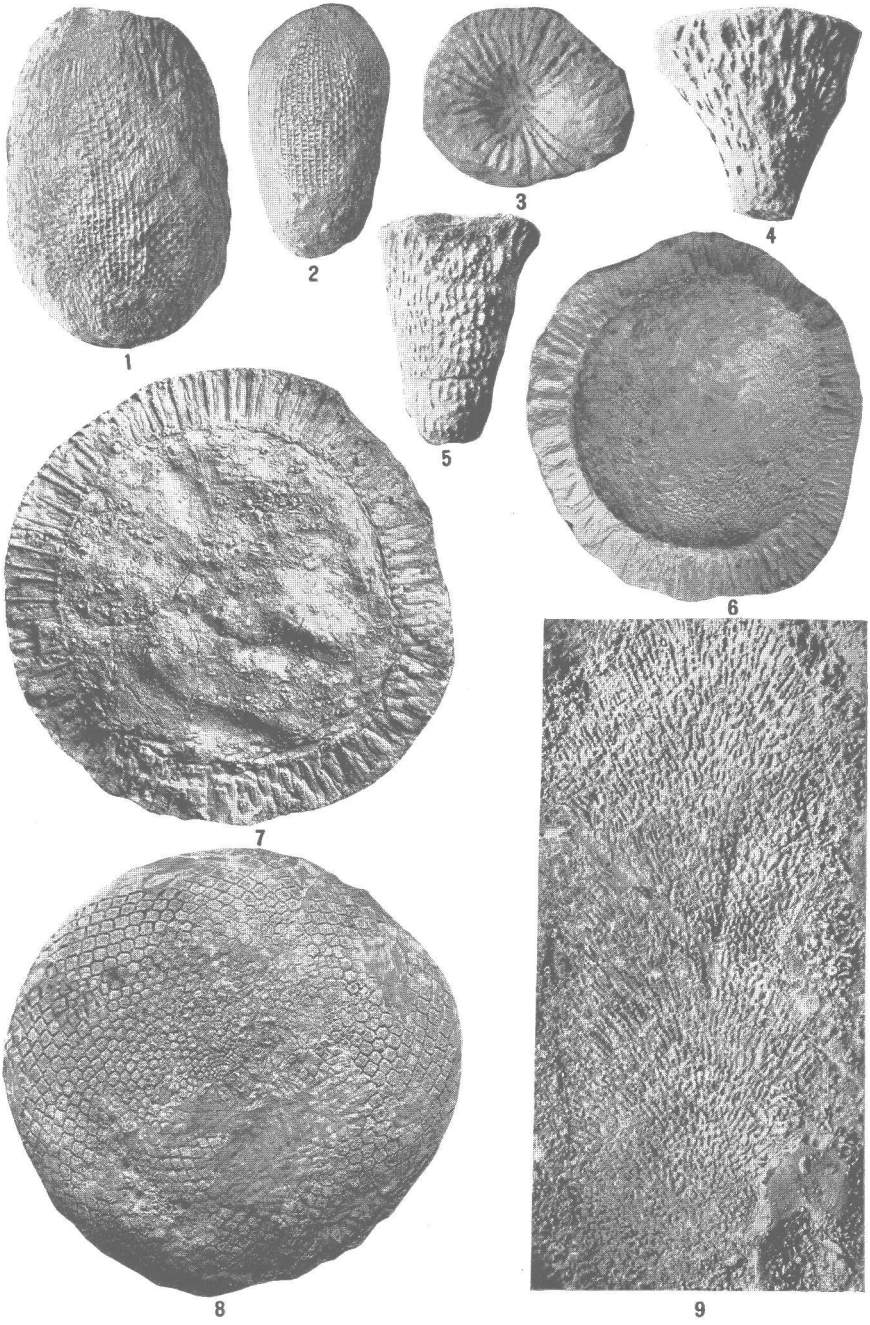
10. *Glossograptus ciliatus* mutation *horridus* Ruedemann.
   Graptolite shale; Summit, Nev.

11, 12. *Diplograptus foliaceus* (Murchison).
   Normanskill shale; Glenmont, N. Y.

13. *Climacograptus scharenbergi* Lapworth.
   Limestone in the Athens shale; Cahaba River 4 miles northeast of Centerville, Bibb County, Ala. U. S. N. M. 71489.



OTTOSEE FOSSILS



OTTOSEE FOSSILS

PLATE 84.—OTTOSEE FOSSILS

FIGURE

1, 2. Sponge; genus and species undetermined.

Ottosee limestone; Rye Cove, Scott County. U. S. N. M. 97444a, 97444b.

3–5. Sponge; genus and species undetermined.

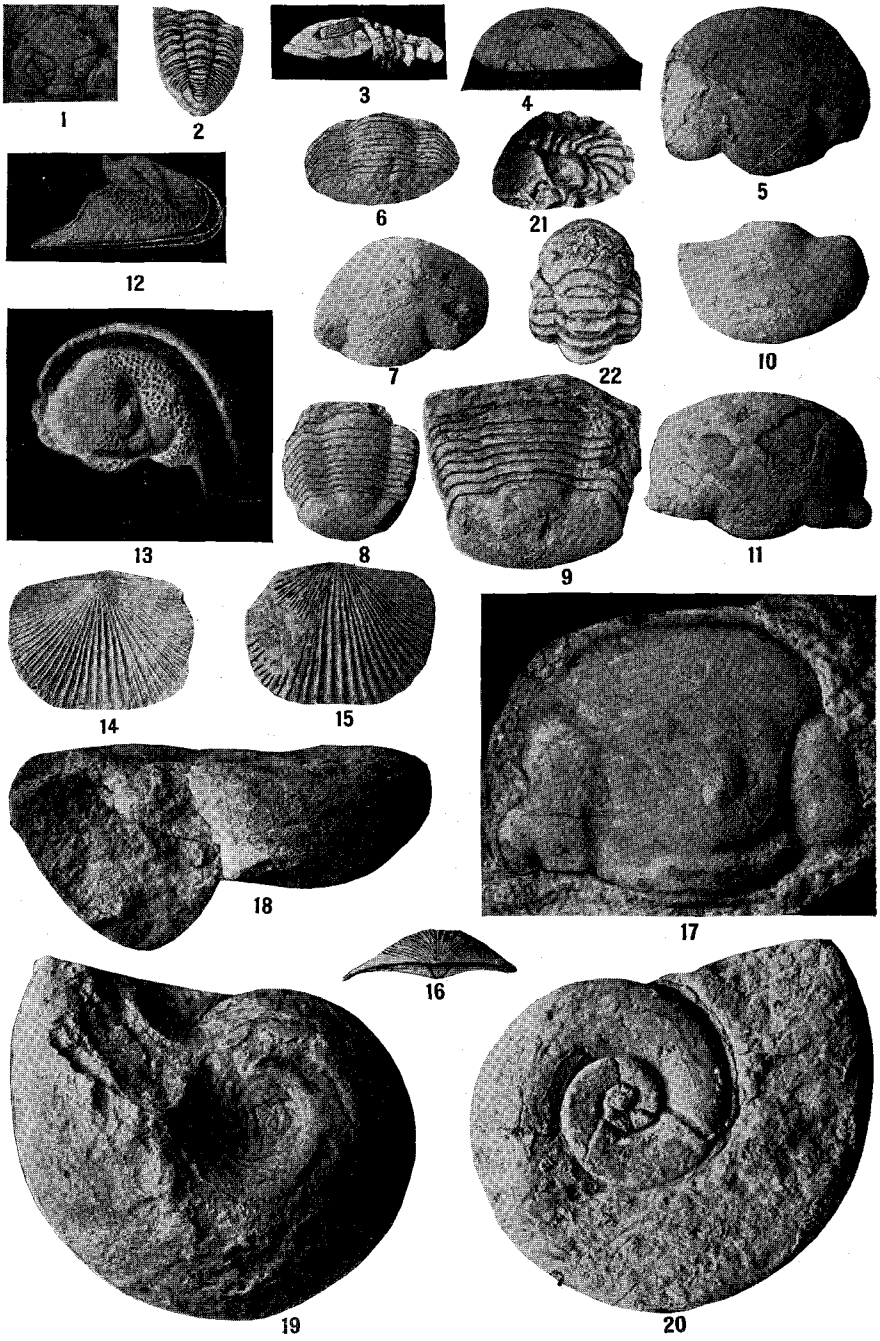
3, 4, calycinal and lateral views of a specimen; 5, lateral view of another specimen. Occurrence as 1. 3, 4, U. S. N. M. 97445a; 5, 97445b.

6–8. *Receptaculites* sp.

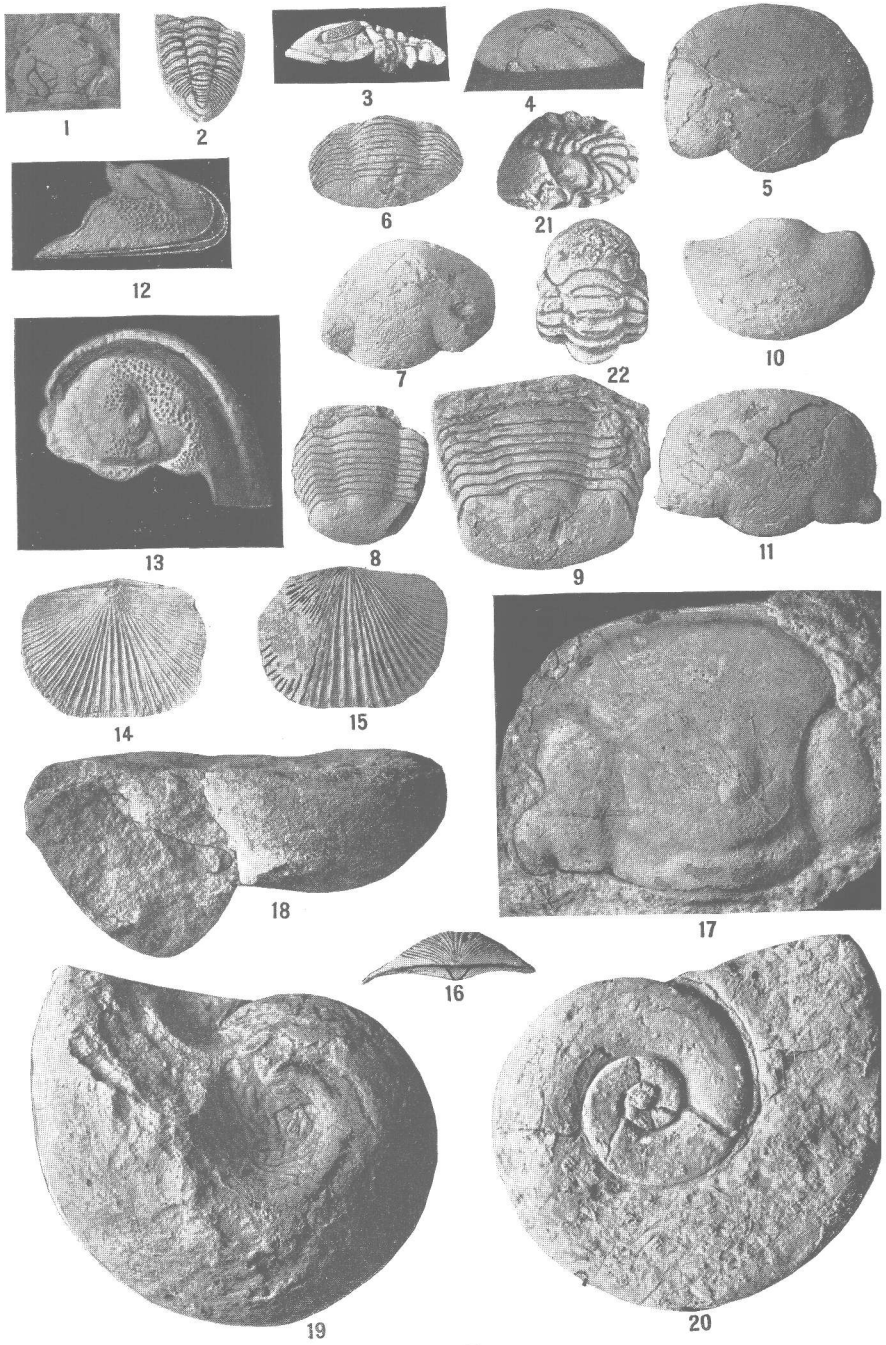
6, under side, showing concavity; 7, under side of another specimen with concavity filled and showing thickness of wall and upright pillars; 8, top view of the same specimen showing external ends and quincuncial arrangement of pillars. A common Ottosee fossil. Occurrence as 1. 6, U. S. N. M. 97446a; 7, 8, 97446b.

9. *Dystactospongia* sp. undetermined.

Ottosee limestone; along State Route 71, 500 feet southeast of Dickensonville, Russell County. U. S. N. M. 97447.



OTTOSEE FOSSILS



OTTOSEE FOSSILS

PLATE 85.—OTTOSEE FOSSILS

FIGURE

1–3. *Pterygometopus* sp.

1, head; 2, tail and thorax; 3, side view of head showing the faceted eye and part of thorax; a broken, and somewhat distorted specimen. Ottosee limestone; Rye Cove, Scott County. U. S. N. M. 97448a, 97448b, 97448c.

4–11. *Illaenus fieldi* Raymond.

4, 5, side and dorsal views of a head; 6, 8, 9, tail and thorax of different specimens; 10, dorsal view of a tail; 7, 11, dorsal view of two heads. Ottosee limestone. 4, 5, 11, about three-fourths of a mile northeast of Rye Cove, Scott County; 6-10, 1 mile west of Rye Cove, Scott County. 4, 5, U. S. N. M. 97449a; 6-11, 97450a, 97450b, 97450c, 97450d, 97450e, 97449b.

12, 13. *Eoharpes* sp., × 2.

Side and dorsal views of head. The reticulate ornamentation consists of deep pits and their dividing walls. Occurrence as 1. U. S. N. M. 97451.

14–16. *Dinorthis transversa* Willard.

Dorsal, ventral, and posterior views of a specimen. Occurrence as 1. U. S. N. M. 98038.

17. *Basilicus?* sp.

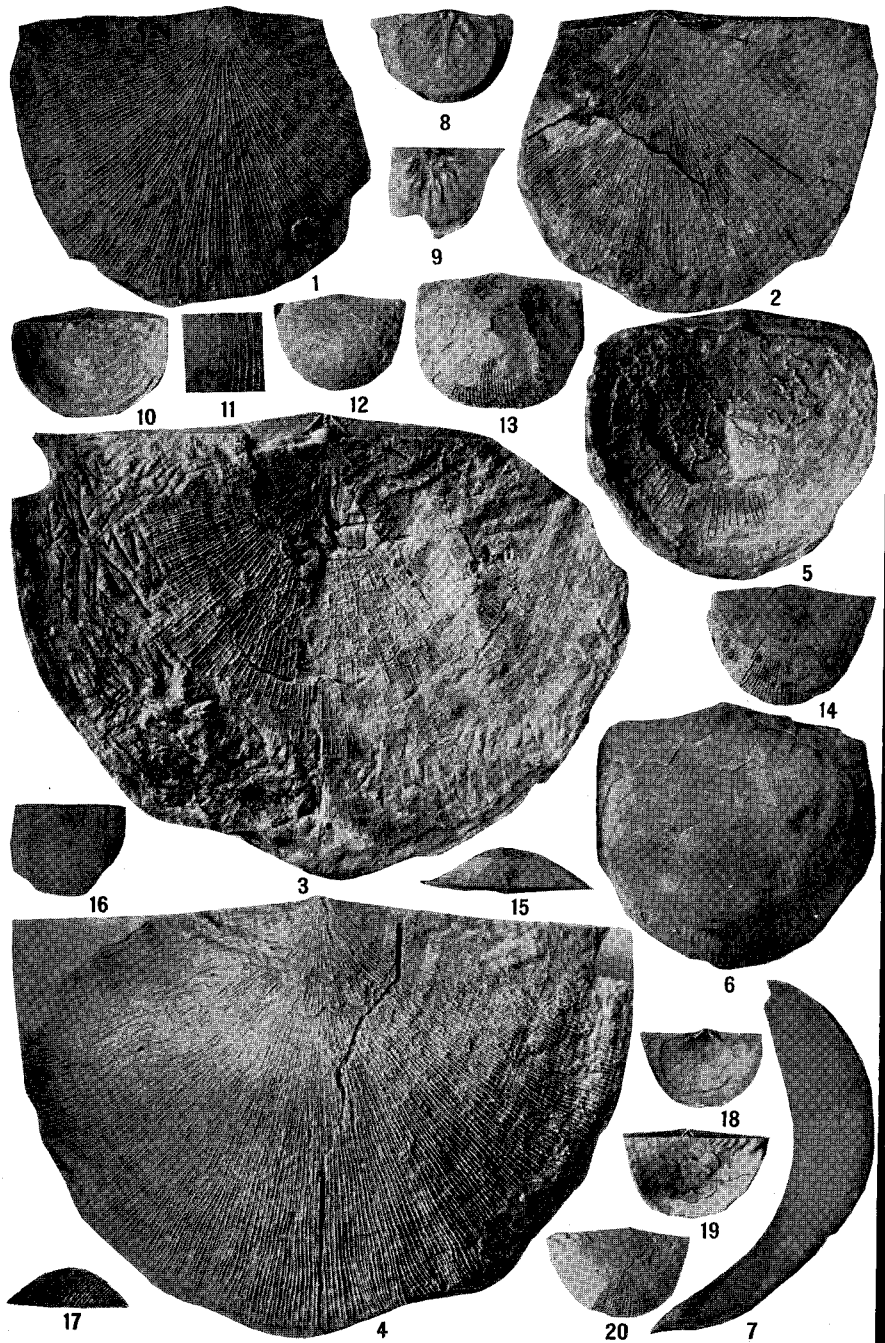
Dorsal view of a head. Occurrence as 1. U. S. N. M. 97452.

18–20. *Maclurites* aff. *M. bigsbyi* (Hall).

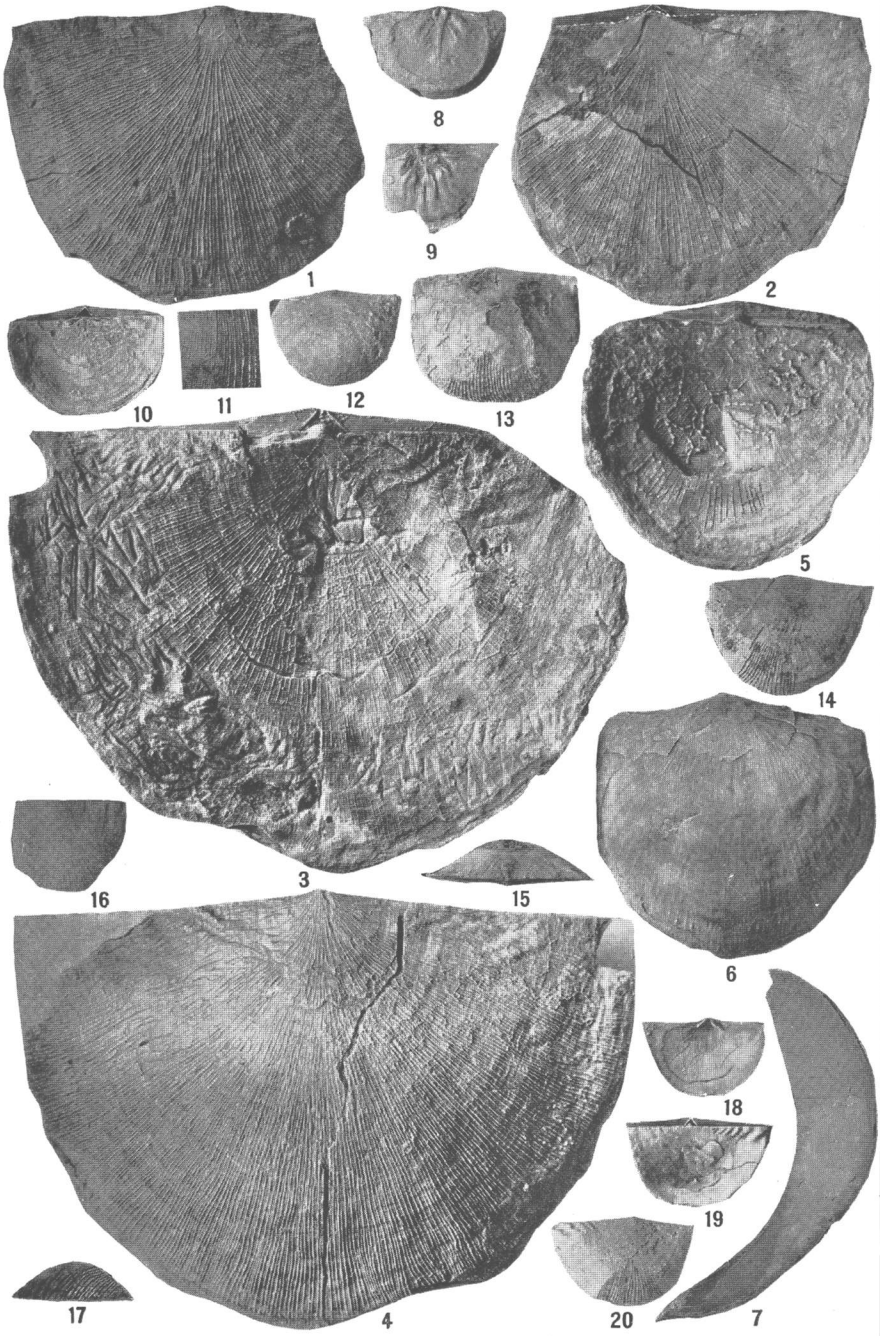
18, side view of a specimen; 19, upper view; 20, basal view of another specimen. Occurrence as 1. 18, U. S. N. M. 97453a; 19, 20, 97453b.

21, 22. *Sphaerexochus* sp., × 3.

Side and dorsal views. Occurrence as 1. U. S. N. M. 97454.



OTTOSEE FOSSILS



OTTOSEE FOSSILS

PLATE 86.—OTTOSEE FOSSILS

FIGURE

1–4. *Rafinesquina magna* Butts, n. sp.

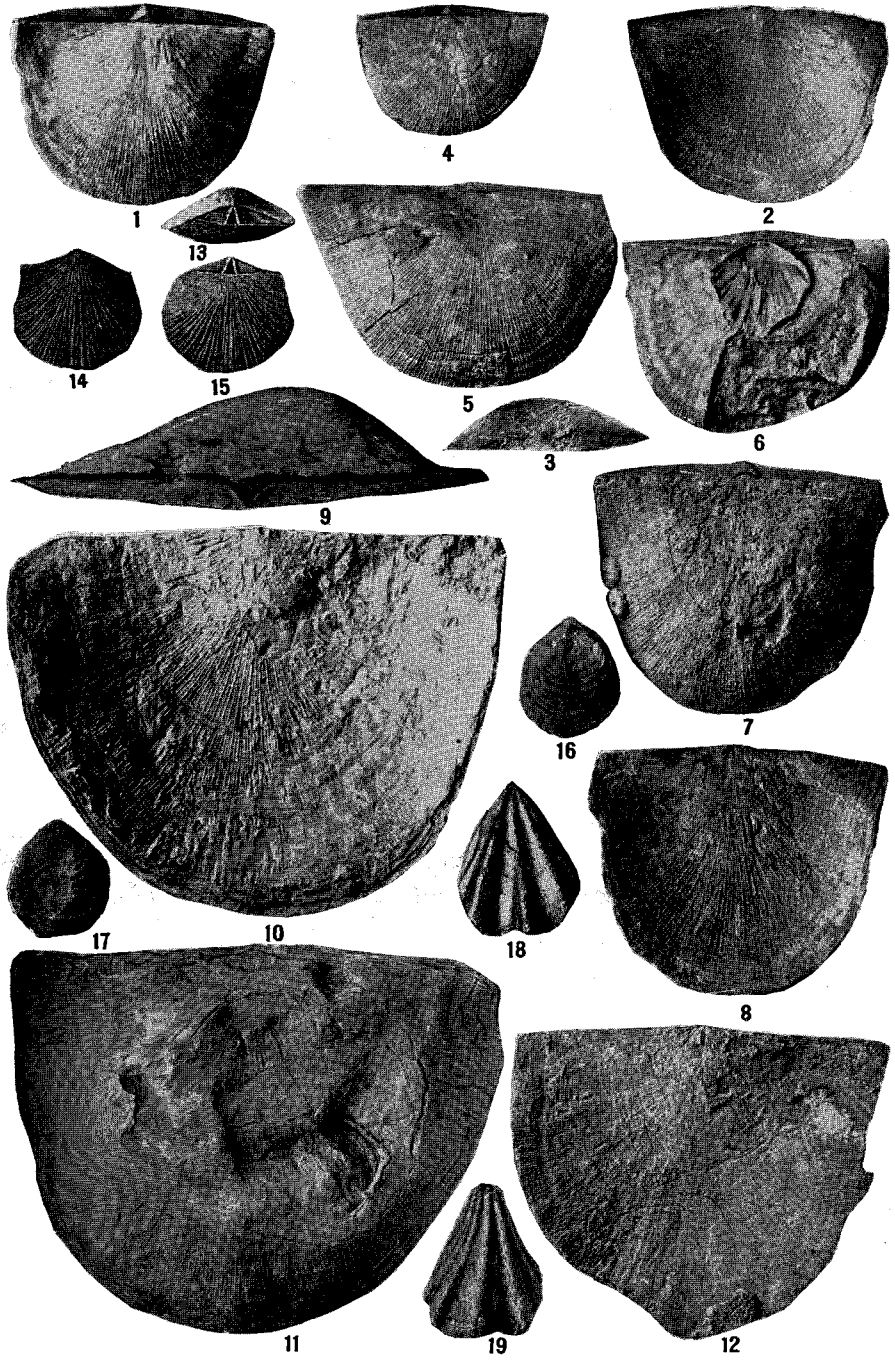
Distinguished by its large size and low convexity. Large striae, 20 in 10 mm., with one or two fine striae between. Specimen of 3, 4, width on hinge line, 3¼ inches; beak to front, 2⅓ inches. So far as known one of the largest species of the genus. 1, 2, ventral and dorsal views of a medium sized specimen; 3, 4, dorsal and ventral views of the largest specimen found. Ottosee limestone; Rye Cove, Scott County. Cotypes: 1, 2, U. S. N. M. 98198; 3, 4, 98199.

5–7. *Rafinesquina* cf. *R. champlainensis* Raymond.

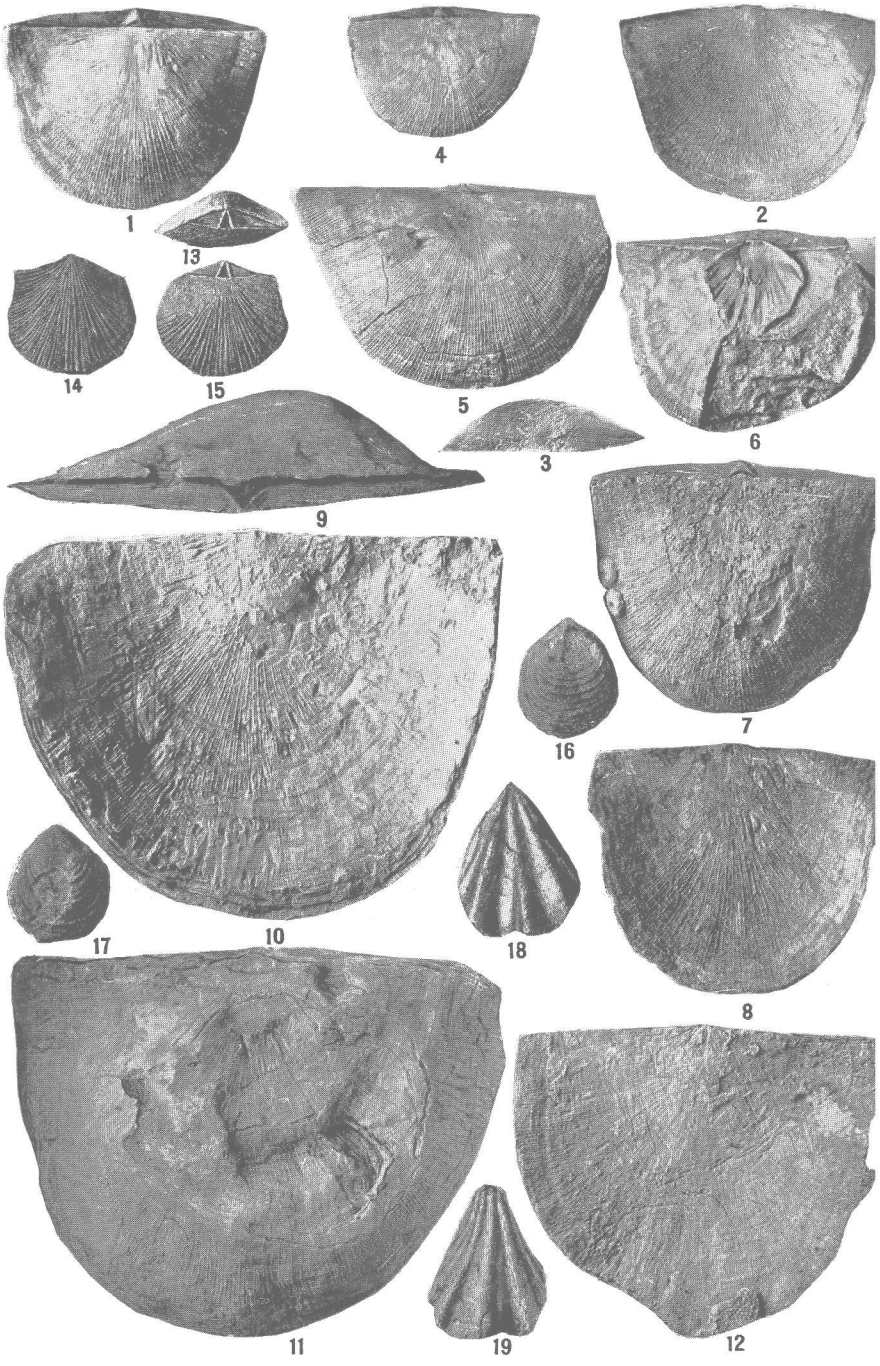
5, 6, dorsal and ventral views of a specimen; 7, sectional view of another specimen showing the convex curvature of the ventral valve (right) and concave curvature of the dorsal valve (left). In *Strophomena* (Pl. 87, figs. 1-12) the relative curvature of the valves is just the reverse. 5, has a network of the stoloniferous bryozoon, *Stomatopora,* upon it. Ottosee limestone; Green Valley 3 miles southeast of Lebanon, Russell County. 5, 6, U. S. N. M. 98200a; 7, 98200b.

8–20. *Rafinesquina* aff. *R. minnesotensis* (N. H. Winchell).

8, 9, interiors of dorsal valves; 9, shows the five digitate muscular impressions characteristic of the dorsal valve of *R. minnesotensis;* 10, 19, dorsal valves of different individuals; 12-14, 20, ventral valves of four individuals; 13, an especially convex specimen; 15, posterior view; 17, profile view of 14; 18, interior of a ventral valve; 11, 16, surfaces of specimens preserving the striae better than the average; 11, × 2. Occurrence as 1. Very abundant. 8-13, U. S. N. M. 98226a, 98226b, 98226c, 98226d, 98226e, 98226f; 14, 15, 17, 98226g; 16, 98226h; 18-20, 98226i, 98226j, 98226k.



OTTOSEE FOSSILS



OTTOSEE FOSSILS

PLATE 87.—OTTOSEE FOSSILS

FIGURE

1–6. *Strophomena medialis* Butts, n. sp.

Distinguished by its medium size, low convexity, and regular alternating coarse and fine striae, 30 in 10 mm. Intermediate fine ones inconstant. 1-3, dorsal, ventral, and profile views of a specimen; 4, dorsal view of a small specimen with more irregular striae; 5, ventral view of a specimen with typical striae; 6, interior of a ventral valve. Ottosee limestone; Rye Cove, Scott County. Cotypes: 1-3, U. S. N. M. 98201a; 4-6, 98201b, 98201c, 98201d.

7–12. *Strophomena amploides* Butts, n. sp.

Larger than *S. medialis,* dorsal valve flat in front of the umbo; striae more irregular than in *S. medialis;* about 20 coarse striae in 10 mm. with 1 to 3 finer ones between. 7, 8, dorsal and ventral valves of a specimen; 9-11, posterior, ventral, and dorsal views of the largest specimen found; 12, ventral valve of a specimen. Occurrence as 1. Cotypes: 7, 8, U. S. N. M. 98202a; 9-11, 98202b; 12, 98202c.

13–15. *Pionodema* sp., × 2.

Posterior, ventral, and dorsal views. Occurrence as 1. U. S. N. M. 98203.

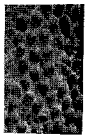
16, 17. *Schizambon cuneatus* Willard.

16, dorsal valve; 17, ventral valve. Two specimens. Ottosee limestone; three-fourths of a mile northeast of Rye Cove School, Scott County. U. S. N. M. 98204a, 98204b.

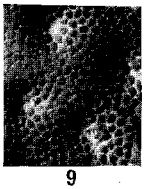
18, 19. *Oligorhynchia* sp., × 4.

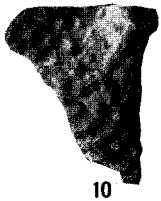
Dorsal and ventral valves. Ottosee limestone; Miller farm on northwest slope of Wallen Ridge about 2 miles southeast of Olinger, Lee County. *Oligorhynchia* is very rare in Virginia and so far found only at this place and in Rye Cove. U. S. N. M. 98205.

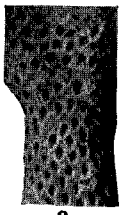

1

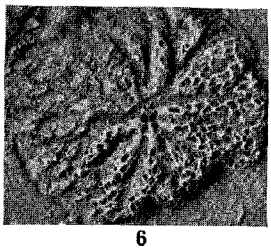

2

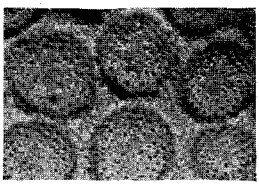

5

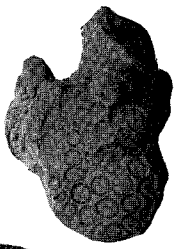

9

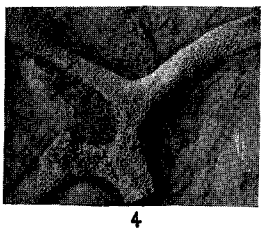

10

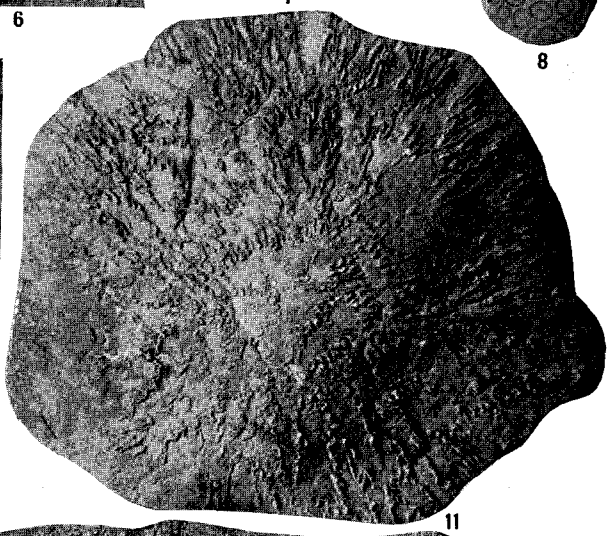

3

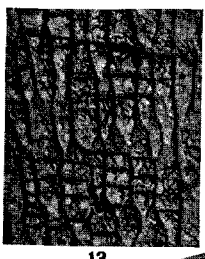

6


7


8


4

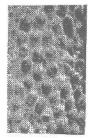

11

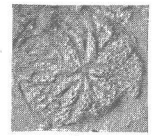

13

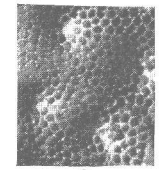

12

OTTOSEE FOSSILS

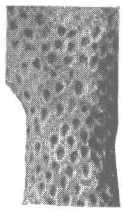

1

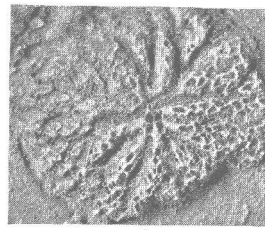

2

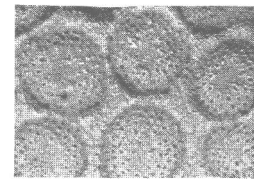

5

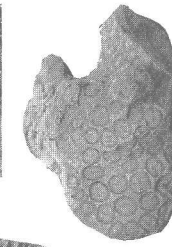

9

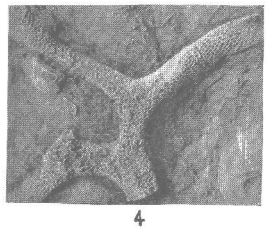

10

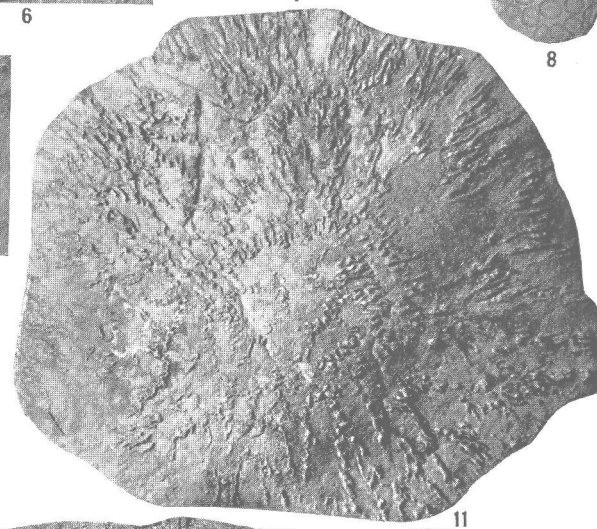

3


6


7


8


4


11


13


12

OTTOSEE FOSSILS

PLATE 88.—OTTOSEE FOSSILS

FIGURE

1–4. *Anolotichia* sp.

3, an enlargement from 1, × 4; 2, an enlargement from 4, × 4. Ottosee limestone; Rye Cove, Scott County. U. S. N. M. 97455, 97456.

5, 6. *Scenellopora radiata* Ulrich.

5, a macula, × 2; 6, the same, × 4. Occurrence as 1. U. S. N. M. 97457. The holotype, U. S. N. M. 43289, is supposed to be from the type Ottosee at Knoxville, Tenn.

7, 8. *Ceramaporella* sp.

7, part of 8, × 4. Occurrence as 1. U. S. N. M. 97461.

9, 10. Bryozoan; genus and species undetermined. Occurrence as 1.

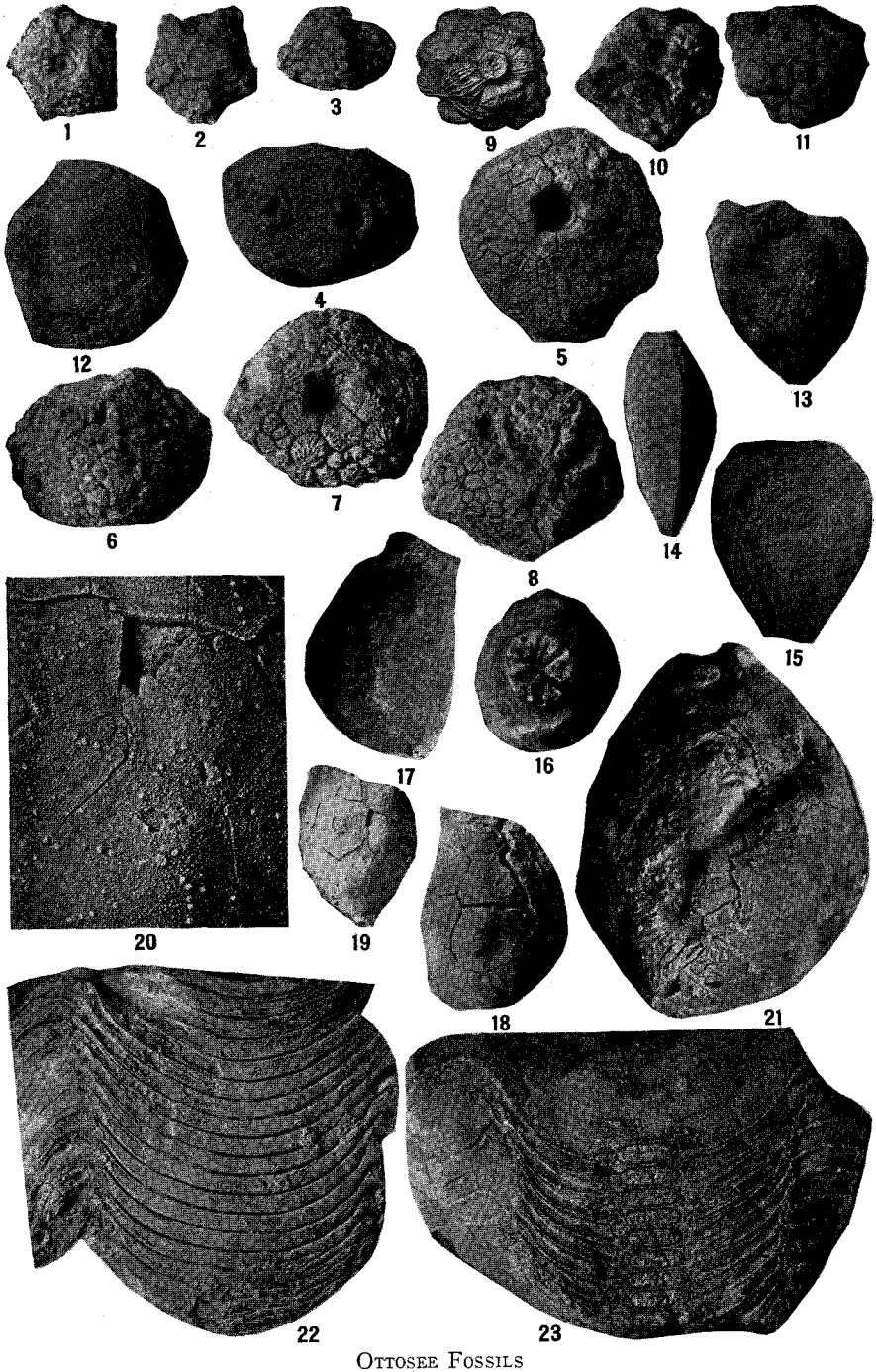
9, part of 10, × 4. U. S. N. M. 97458.

11. *Tetradium* sp.

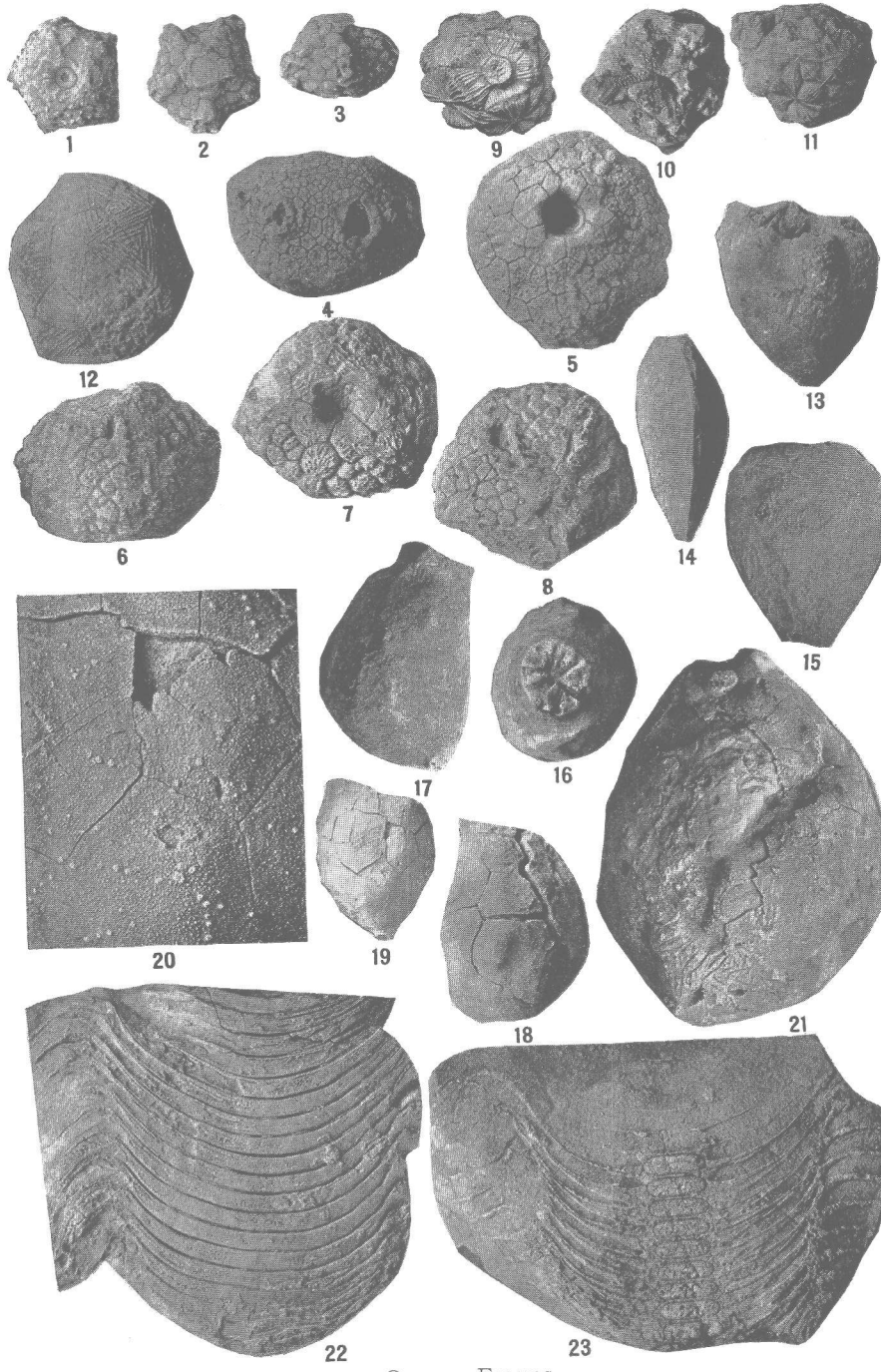
Very common and characteristic form in the Ottosee of Rye Cove, Scott County. U. S. N. M. 97459.

12, 13. *Lichenaria* cf. *L. carterensis* (Safford).

13, part of 12, × 2. Like *Favosites* but lacks radiating septa. Ottosee limestone; along Sinking Creek, 1½ miles northwest of Newport, Giles County. U. S. N. M. 97460.



OTTOSEE FOSSILS



OTTOSEE FOSSILS

PLATE 89.—OTTOSEE FOSSILS

FIGURE

1–3. *Diabolocrinus perplexus* Wachsmuth and Springer.

Dorsal, ventral, and lateral views. Ottosee limestone; half a mile west of Rye Cove School, Scott County. U. S. N. M. 97462.

4–8. *Diabolocrinus asperatus* (Miller and Gurley)?.

4, 5, lateral and basal views of a specimen; 6-8, lateral, basal, and ventral views of another specimen, possibly a different species from *D. asperatus*. Ottosee limestone; Rye Cove, Scott County. U. S. N. M. 97463, 97464.

9–11. *Palaeocrinus* aff. *P. striatus* Billings.

Basal, ventral and lateral views. Occurrence as 4. U. S. N. M. 97465.

12. *Echinosphaerites* sp.

Occurrence as 4. U. S. N. M. 97466.

13. *Holocystites?* sp.

Shape and ornamentation like *Holocystites*. Ottosee limestone; 1½ miles southwest of Rye Cove School, Scott County. U. S. N. M. 97467.

14, 15. *Platycystites faberi* Miller.

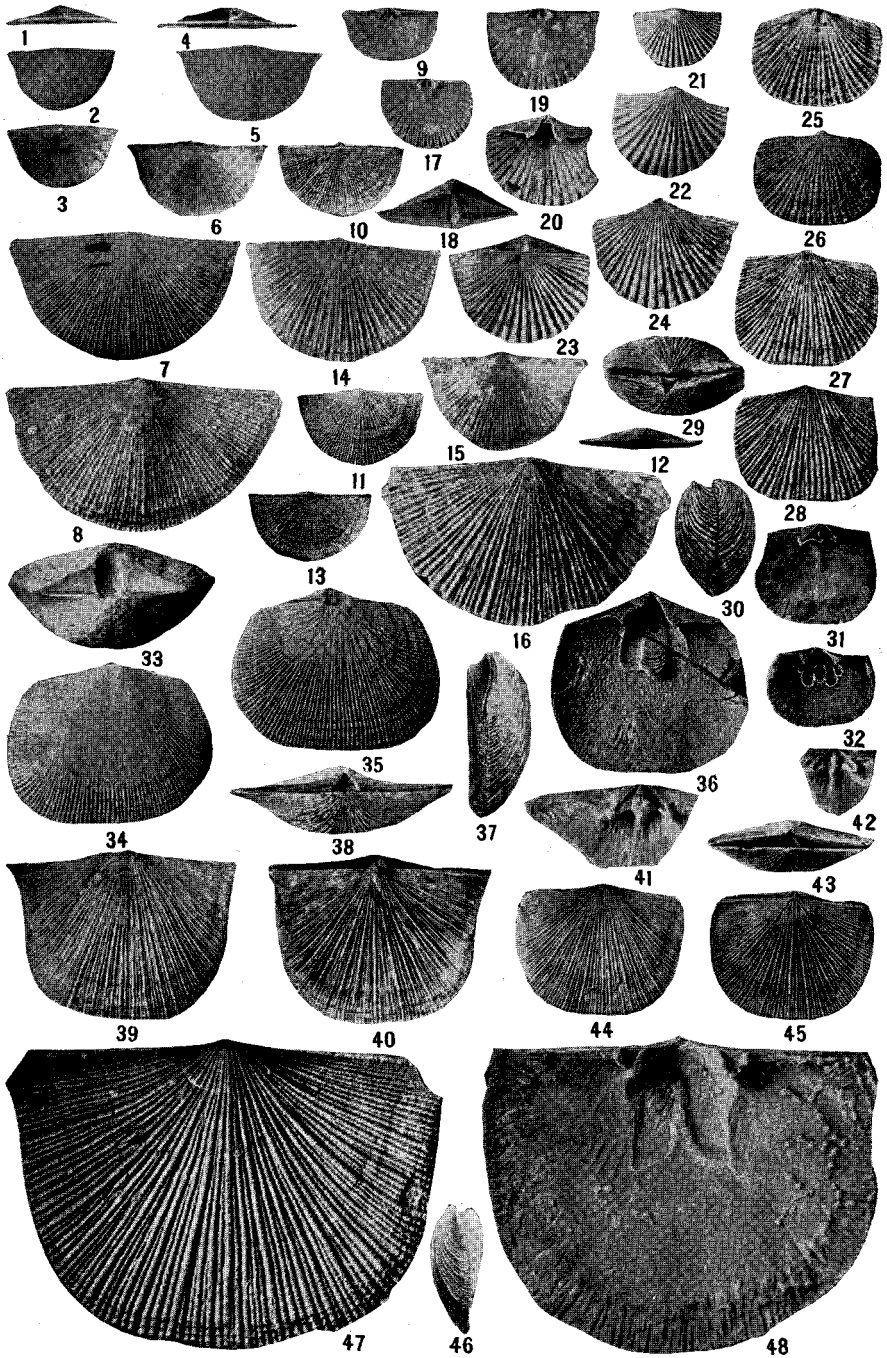
Edge and side views. Occurrence as 13. U. S. N. M. 97468.

16–21. Cystid; genus and species undetermined.

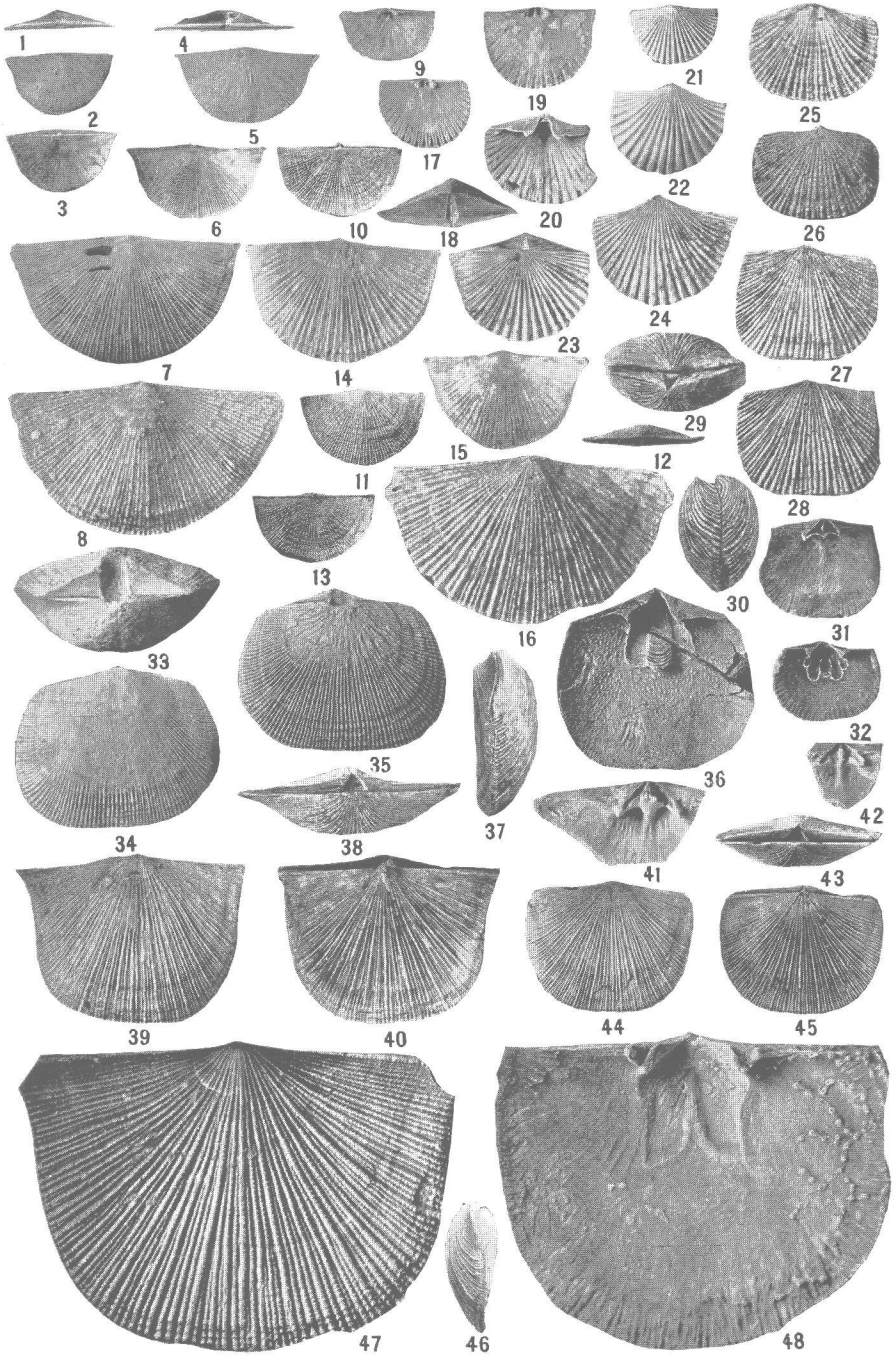
17-19, 21, lateral views; 16, summit view of 17; 20, part of 19, × 4; 21, posed with shadow on left. Occurrence as 4. 16, 17, U. S. N. M. 97469a; 18, 97469b; 19, 20, 97469c; 21, 97469d.

22, 23. *Gonioceras* sp.?

Near *G. anceps* Hall of the Lowville limestone of New York. 23, natural section showing part of siphuncle. Occurrence as 4. U. S. N. M. 97470a, 97470b.



OTTOSEE FOSSILS



OTTOSEE FOSSILS

PLATE 90.—OTTOSEE FOSSILS

(From Rye Cove, Scott County)

FIGURE

1–8. *Sowerbyella* sp.

2, 5, 7, 8, ventral valves; 7, × 2; 8, × 4; 3, 6, dorsal valves of 2, 5; 1, posterior view of 2; 4, posterior view of 5. 1-3, U. S. N. M. 98206a; 4-6, 98206b; 7, 8, 98206c, 98206d.

9–16. *Sowerbyella* sp.

9, interior of a ventral valve; 10-12, dorsal, ventral, and posterior views of a specimen; 13, darker print of 10 showing the transverse lines more plainly; 10, shows better the cardinal process of the dorsal valve; 14-16, ventral valves of 3 specimens; 14, × 2; 16, specimen of the same size as that of 8, × 4. The differences in the striae of the two species is plainly shown in 7, 14, and in 8, 16. 9, U. S. N. M. 98207a; 10-13, 98207b; 14-16, 98207c, 98207d, 98207e.

17–24. *Hesperorthis* aff. *H. tricenaria* (Conrad).

17, 19, interiors of dorsal valves; 20, interior of ventral valve; 18, 23, 24, posterior, dorsal, and ventral views of the same specimen; 21, 22, ventral views of smaller specimens. 17, 19, U. S. N. M. 98208a, 98208c; 20, 98208d; 18, 23, 24, 98208b; 21, 22, 98208e, 98208f.

25–32. *Glyptorthis* aff. *G. bellarugosa* (Conrad).

25, 26, dorsal and ventral valves of a specimen; 27-30, ventral, dorsal, posterior, and lateral views of a specimen; 31, interior of a dorsal valve; 32, interior of a ventral valve. 25, 26, U. S. N. M. 98209a; 27-30, 98209b; 31, 32, 98209c, 98209d.

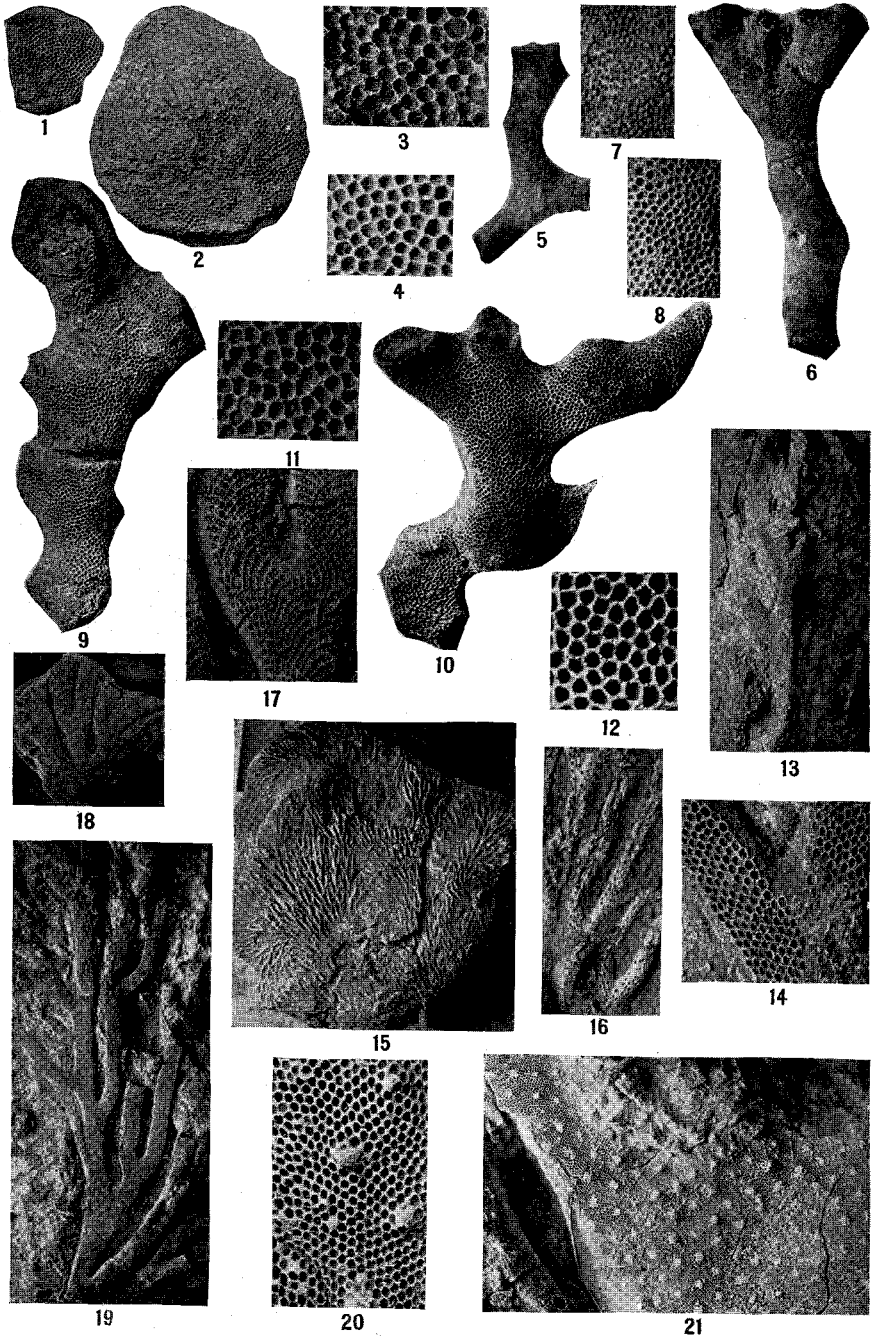
33–36. *Mimella superba* Butts, n. sp.

Distinguished from *M. melonica* Willard by its larger size and more subquadrate form. 33-35, posterior, ventral, and dorsal views of a large specimen; 36, interior of a ventral valve. Holotype: 33-35, U. S. N. M. 98210; Paratype: 36, 98211.

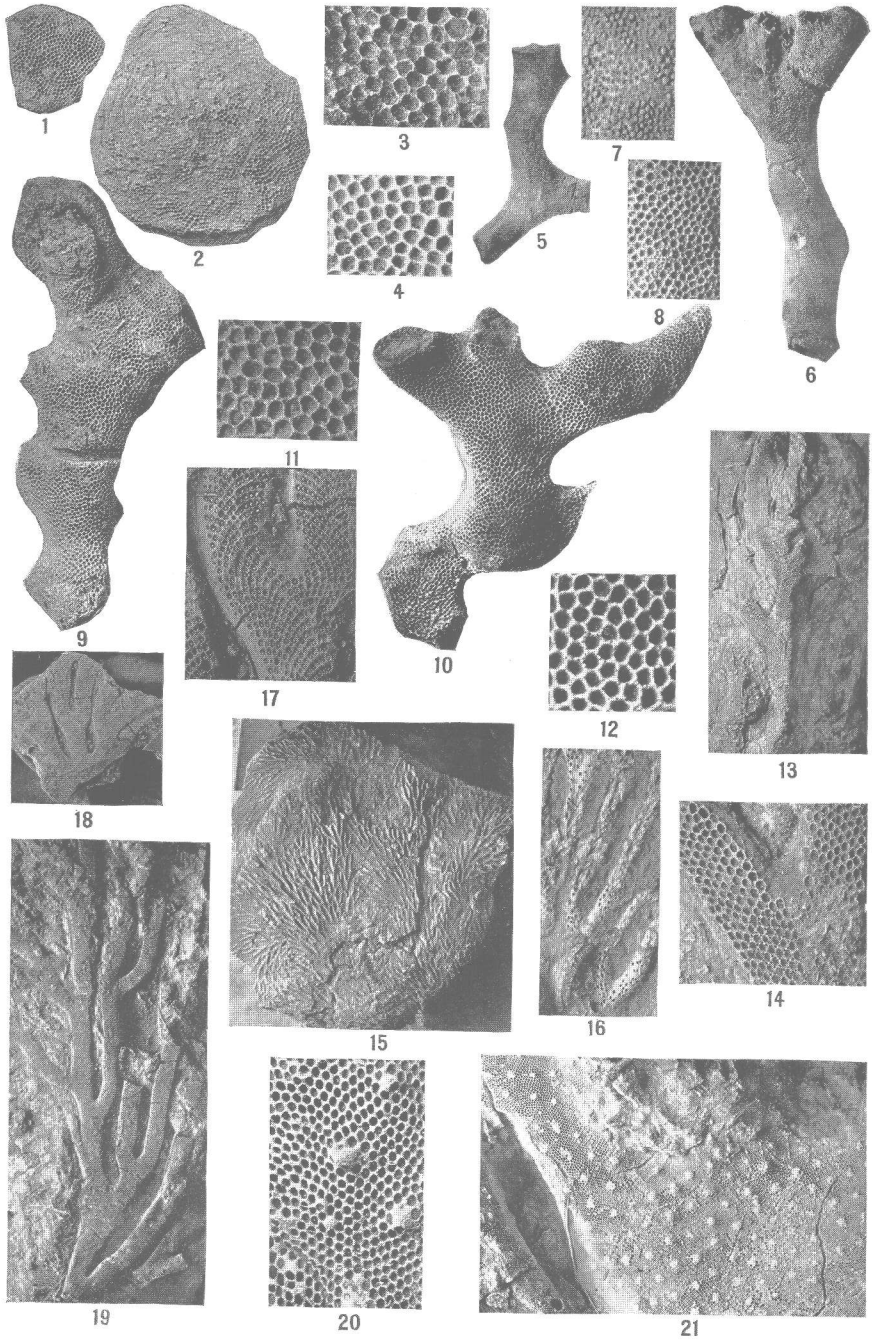
37–48. *Multicostella* aff. *M. platys* (Billings).

37-40, lateral, posterior, ventral, and dorsal views of a specimen of average size; 41, 42, interiors of two dorsal valves; 43-46, posterior, ventral, dorsal, and lateral views of a slightly

smaller specimen; 47, ventral valve of a specimen, × 2; 48, interior of ventral valve, × 2, with chain of the coral *Stomatopora* on right margin. 37-40, U. S. N. M. 98212a; 41, 42, 98212b, 98212c; 43-46, 98212d; 47, 48, 98212e, 98212f.



OTTOSEE FOSSILS



OTTOSEE FOSSILS

PLATE 91.—OTTOSEE FOSSILS
(From Rye Cove, Scott County)

FIGURE

1–4. *Mesotrypa* sp.

3, part of 2, × 4; 4, part of 1, × 4. U. S. N. M. 97471a, 97471b.

5–8. *Dekayella?* sp.

5, 6, two individuals; 7, surface of 5, × 4; 8, surface of 6, showing shape and size of cells, × 4. U. S. N. M. 97472a, 97472b.

9–12. *Batostoma sevieri* Bassler.

9, 10, two specimens; 11, surface of 9, × 4; 12, surface of 10, × 4. U. S. N. M. 97473a, 97473b.

13, 14. *Phaenopora* sp.

Distinguished by its branching arborescent manner of growth. 14, part of 13, × 4. U. S. N. M. 97474.

15, 16. *Chasmatopora* sp.

15, noncelluliferous side; 16, celluliferous face of a few branches of another individual, × 4. U. S. N. M. 97475a, 97475b.

17–19. *Graptodictya* sp.

Distinguished by its parallel branching and U-shaped bifurcation. 17, part of 18, × 4. U. S. N. M. 97476a, 97476b.

20, 21. *Pachydictya* sp.

Distinguished by its large expanded frond. 20, part of 21, × 4. U. S. N. M. 97477.


1


2


3

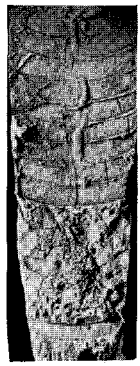

4

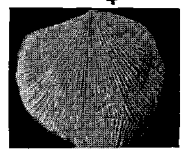

5

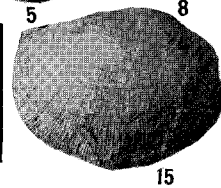

8


9

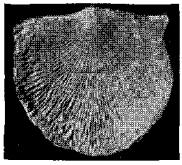

10

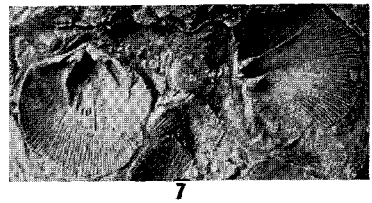

11


6

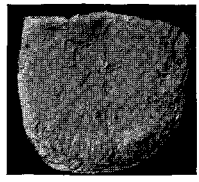

15

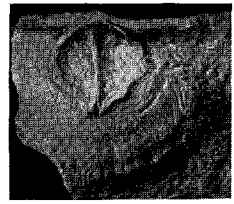

25


12

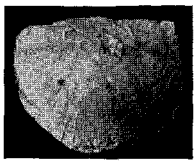

7

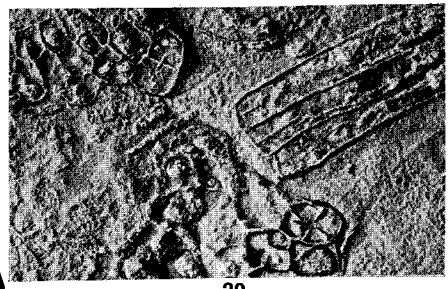

16


13


14


19


17


20


18

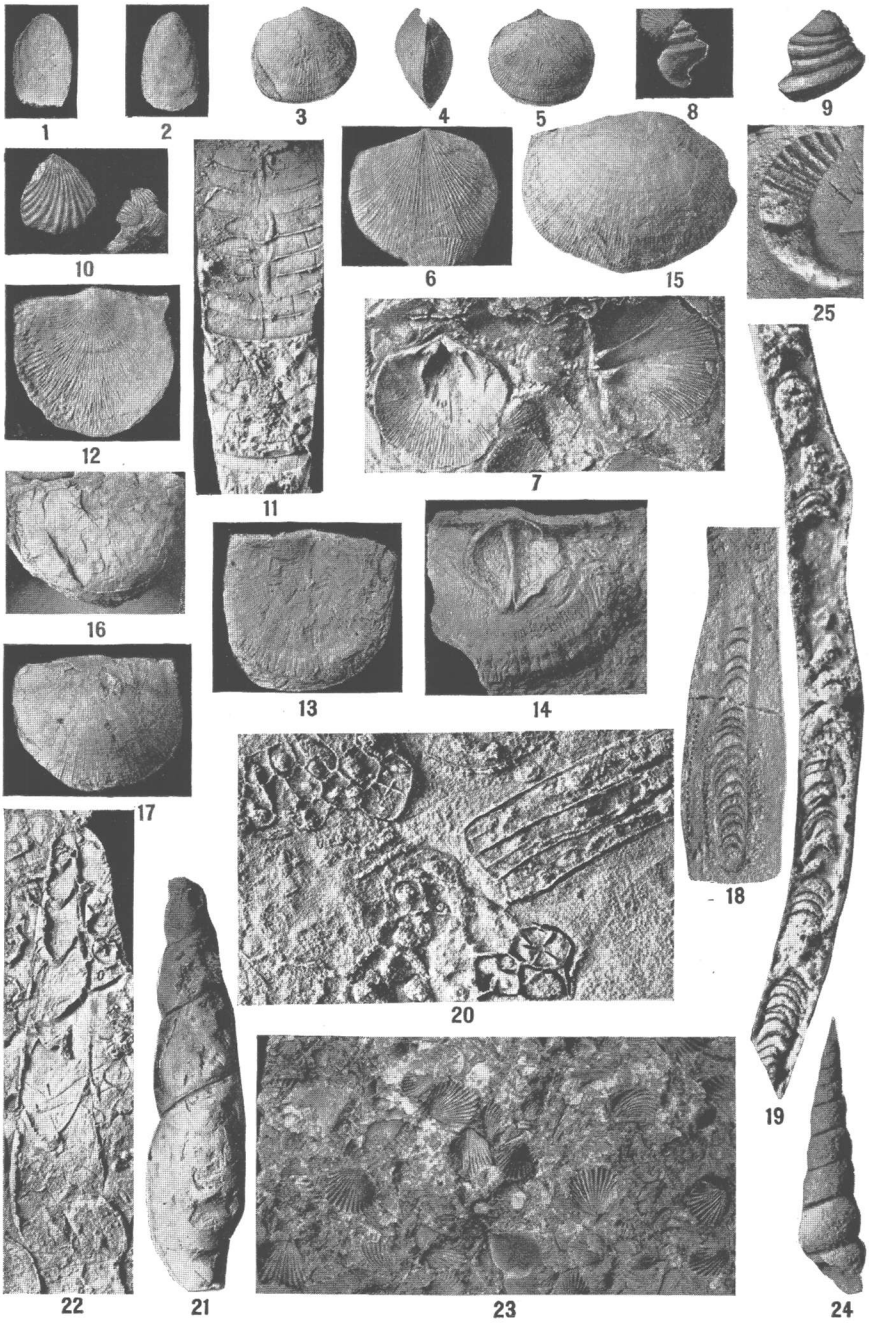

22


21


23


24

LOWVILLE-MOCCASIN FOSSILS



LOWVILLE-MOCCASIN FOSSILS

PLATE 92.—LOWVILLE-MOCCASIN FOSSILS

FIGURE

1, 2. *Lingula* sp.

External and internal molds of a ventral valve. Sandstone in the top of the Moccasin formation; northwest foot of Catawba Mountain along State Route 311 in the angle just southeast of Catawba Creek and 1 mile southeast of Catawba Sanitorium, Roanoke County. U. S. N. M. 97478a, 97478b.

3–7. *Pionodema subaequata* (Conrad).

3-5, ventral, profile, and dorsal views of a specimen; 6, ventral view of a specimen from the same slab as shown in 7; 7, interior of a ventral (left), and of a dorsal (right), valve. Lowville limestone. 3-5, along U. S. Route 58 about 3½ miles east of Cumberland Gap village, Tenn.; 6, 7, slab collected near Franks Run 2 miles northwest of Crabbottom, Highland County. 3-5, U. S. N. M. 97479; 6, 7, 97480a, 97480b.

8. *Lophospira oweni* Ulrich and Scofield.

Lowville limestone; half a mile east of Olinger, Lee County. U. S. N. M. 97481.

9. *Eotomaria dryope* (Billings).

Lowville limestone; along U. S. Route 19 half a mile south of St. Clair station and 3 miles southwest of Bluefield, Tazewell County. U. S. N. M. 97483.

10. *Camarotoechia plena* (Hall)? Also several specimens of *Zygospira recurvirostris* (Hall).

Limestone in the Moccasin formation; 3 miles northeast of Sweet Chalybeate Springs, Alleghany County. U. S. N. M. 97482.

11. *Orthoceras multicameratum* Emmons.

Dove-colored limestone in the base of the Moccasin (red) formation; about 50 feet above the Ottosee limestone in Ward Cove 3½ miles southwest of Snapp, Tazewell County. (See Tazewell sheet). U. S. N. M. 97484.

12–14. *Strophomena incurvata* (Shepard).

12, ventral valve; 13, dorsal valve; 14, interior of another ventral valve. Lowville limestone; northwest slope of Wallen Ridge southeast of Olinger, Lee County. U. S. N. M. 97485a, 97485b, 97485c.

FIGURE

15. *Strophomena?* sp.

A very convex or hemispherical dorsal valve with striae-like *Strophomena* or *Rafinesquina.* Several specimens. Lowville limestone; on slope just south of Gate City, Scott County. U. S. N. M. 97486.

16, 17. *Rafinesquina?* sp.

16, exfoliated dorsal valve; 17, ventral valve. Occurrence as 12. U. S. N. M. 97487a, 97487b.

18, 19. *Cryptophragmus antiquatus* Raymond. (*Beatricea gracilis* Foerste.)

One of the main guide fossils of the Lowville limestone. 18, shows two layers of spongy tissue outside of the septate internal chambers. 18, northwest slope of Peters Mountain 3½ miles southwest of Gap Mills on road to Waiteville, W. Va.; 19, Rye Cove, Scott County, about 50 feet above Ottosee limestone. U. S. N. M. 97489, 97488.

20. *Tetradium cellulosum* (Hall), × 4.

Shows both cross and longitudinal sections of dividing coralites. Lowville limestone; just northwest of Powell River about 6 miles southeast of Rose Hill, Lee County. Another main guide fossil of the Lowville limestone. U. S. N. M. 97490.

21, 22. *Subulites cf. S. regularis* Ulrich and Scofield.

21, exterior; 22, longitudinal section. Lowville limestone. 21, locality as 3; 22, in Ward Cove 2 miles southwest of Snapp, Tazewell County. (See Tazewell sheet.) U. S. N. M. 97491, 97492.

23. Slab crowded with *Zygospira recurvirostris* (Hall).

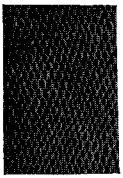
Lowville limestone; 3 miles northeast of Sweet Chalybeate Springs, Alleghany County. Occurs also in older limestone but most commonly in the Lowville. U. S. N. M. 97493.

24. *Hormotoma gracilis* (Hall).

Occurrence as 3. U. S. N. M. 97494.

25. *Centrocyrtoceras annulatus* (Hall).

Occurrence as 22. U. S. N. M. 97495.

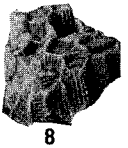

1


3

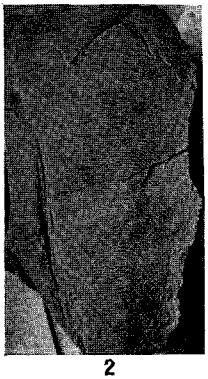

5


6


7


8


11

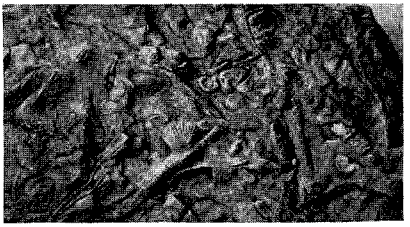

2

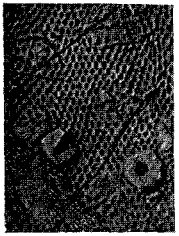

4


9


10


18

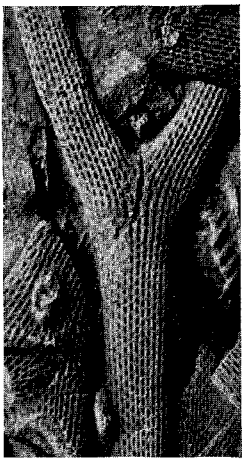

14


12


17

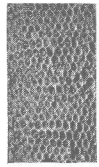

13


15


16

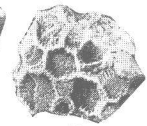
LOWVILLE FOSSILS


1


3

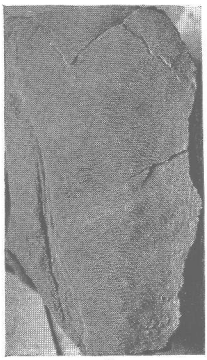

5


6


7


8

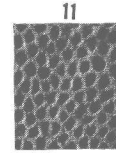

11


2

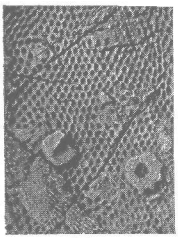

4

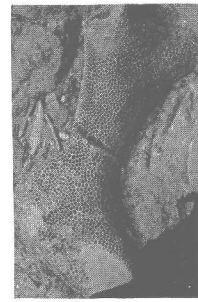

9


10


18

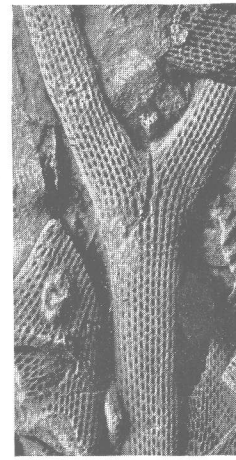

14


12


17


13


15


16

LOWVILLE FOSSILS

PLATE 93.—LOWVILLE FOSSILS

FIGURE

1, 2. *Escharopora* sp.

1, part of 2, × 4. Lowville limestone; Warm Springs, Bath County. U. S. N. M. 97497.

3, 4. *Escharopora* sp.

3, part of 4, × 4. Lowville limestone; cut on the Virginian Railway along east bluff of New River one-fourth of a mile north of Walker Mountain, Giles County. U. S. N. M. 97498.

5, 6. *Streptelasma profundum* (Conrad).

Lowville limestone; along U. S. Route 58 about 3½ miles east of Cumberland Gap village, Tenn. U. S. N. M. 97499a, 97499b.

7, 8. *Columnaria halli* Nicholson.

Occurrence as 5. U. S. N. M. 97500.

9. *Rhinidictya nicholsoni* Ulrich.

Lowville limestone; along railroad 600 feet south of Speers Ferry railroad station, Scott County. U. S. N. M. 97501.

10, 11. *Escharopora subrecta* (Ulrich).

11, upper specimen on 10, × 4. Lowville limestone; Wheeler quarry 1 mile northeast of Walnut Hill, Lee County. U. S. N. M. 97504.

12, 13. *Escharopora confluens* Ulrich.

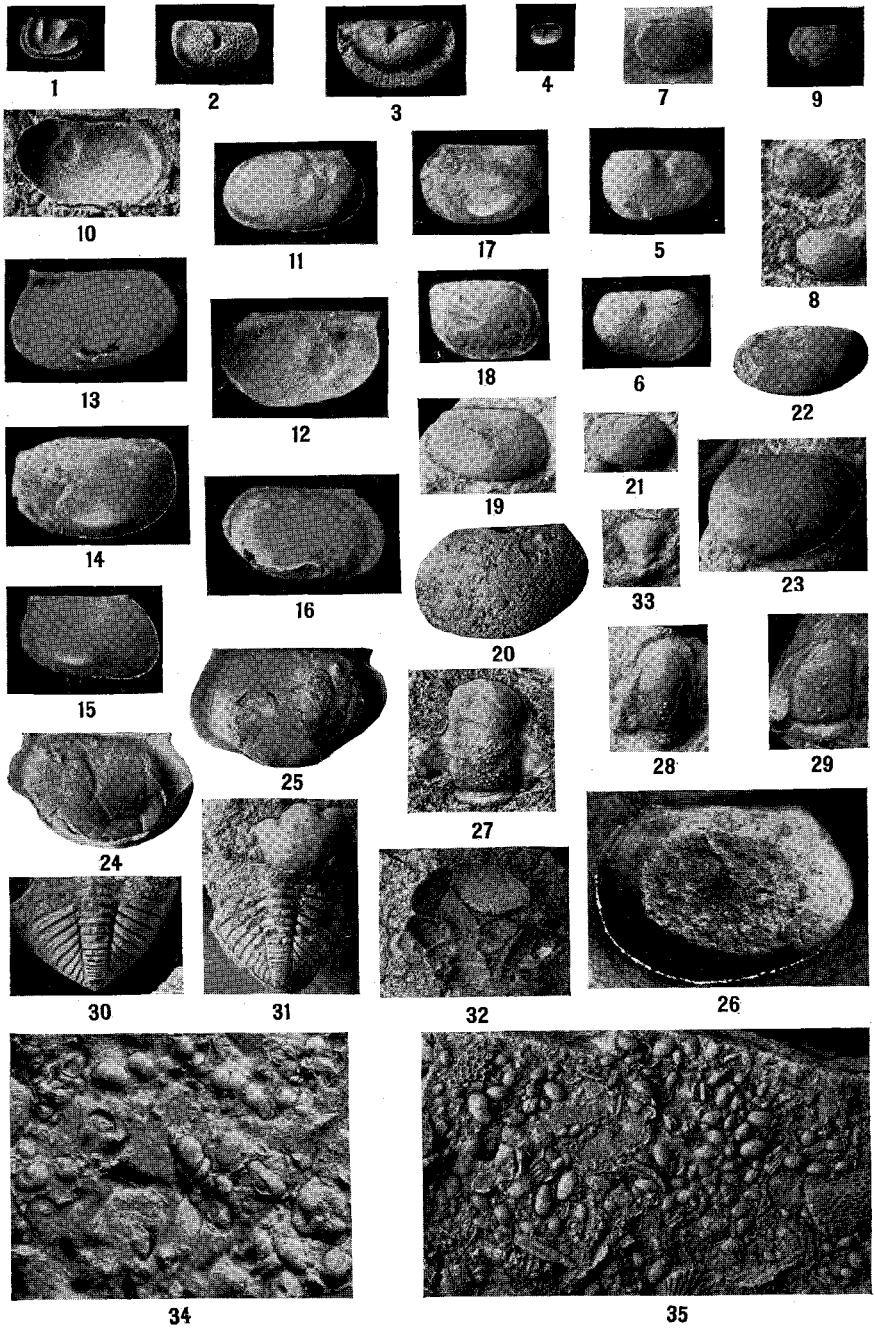
12, part of 13, × 4. Occurrence as 9. U. S. N. M. 97505.

14–16. *Rhinidictya nicholsoni* Ulrich.

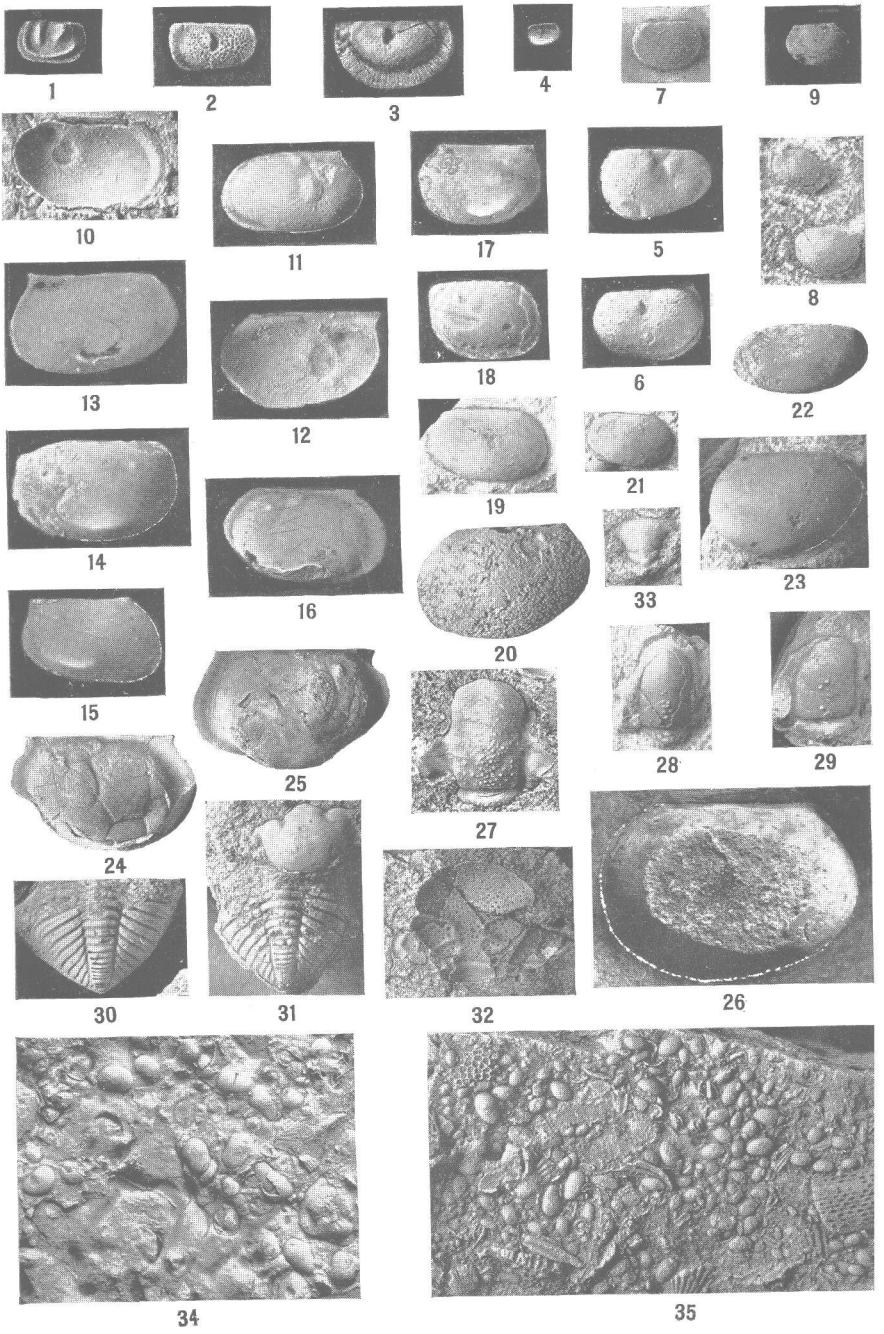
Lowville limestone. 16, central specimen of 15, × 4; 14, northwest slope of Wallen Ridge 2 to 3 miles southeast of Dryden, Lee County; 15, locality as 5. 14, U. S. N. M. 97502; 15, 16, 97503.

17, 18. *Batostoma magnopora* Ulrich.

18, part of 17, × 4. Lowville limestone; cut on Virginian Railway on New River 1 mile south of Goodwins Ferry, Giles County. U. S. N. M. 97506.



LOWVILLE AND EGGLESTON FOSSILS



LOWVILLE AND EGGLESTON FOSSILS

PLATE 94.—LOWVILLE AND EGGLESTON FOSSILS

FIGURE

1. *Drepanella* aff. *D. crassinodo* Ulrich, × 4.

Left valve. Lowville limestone; Wheeler quarry 1 mile northeast of Walnut Hill, Lee County. U. S. N. M. 97507.

2, 3. *Eurychilina reticulata* Ulrich, × 4.

Right valves. 2, with flange broken away but preserving the reticulated surface; 3, exfoliated. Eggleston limestone (upper Black River); along road on northwest slope of Peters Mountain 3½ miles southwest of Gap Mills, Monroe County, W. Va. U. S. N. M. 97508a, 97508b.

4–6. *Haploprimitia minutissima* (Ulrich)?.

5, 6, × 6. 4, left valve natural size; 5, right valve; 6, enlargement of 4. Eggleston formation (upper Black River); northwest slope of Wallen Ridge 3½ miles southeast of Dryden, Lee County. 4, 6, U. S. N. M. 97509a; 5, 97509b.

7–9. *Leperditella tumida* (Ulrich), × 4.

7, left valve; 8, 9, right valves. Lowville limestone; locality as 2. U. S. N. M. 97510a, 97510b, 97510c.

10–12. *Isochilina* sp., × 4.

10, external mold of right valve; 12, external mold of left valve; 11, internal mold of right valve. Lowville limestone; southwest base of Elk Knob, 13½ miles southwest of Big Stone Gap, Lee County. U. S. N. M. 97512a, 97512b, 97512c.

13–17. *Isochilina armata* (Walcott), × 4.

13, 14, 17, right valves; 15, 16, left valves. Lowville limestone. 13, 15, 17, northwest slope of Wallen Ridge 2 miles southeast of Olinger, Lee County; 14, slope to Powell River 1 mile southwest of mouth of Yellow Branch, Lee County; 16, Little Indian Creek 2 miles northeast of Belfast Mills, Russell County. U. S. N. M. 97513a, 97514, 97513b, 97515, 97513c.

18. *Isochilina* sp.

Left valve. Occurrence as 10. U. S. N. M. 97516.

19–23. *Leperditia fabulites* (Conrad).

20, 23, × 2. 19, 21, left valves; 20, 22, 23, right valves; 22, may be compressed vertically; 20, 23 are possibly of a different species. Lowville limestone. 19, 22, 23, along U. S.

FIGURE

Route 19 half a mile south of St. Clair railroad station and at road intersection 3 miles southwest of Bluefield, Virginia; 20, along U. S. Route 58, 3½ miles northeast of Cumberland Gap village, Tenn.; 21, along road in Thompsons Valley 2 miles southeast of Tazewell, Tazewell County. U. S. N. M. 97518a, 97517, 97519, 97518b, 97518c.

24, 25. *Isochilina* sp.

Left and right valves. Eggleston limestone (upper Black River); Ward Cove along northwest slope of ridge 2 miles due south of Snapp, Tazewell County. (See Tazewell sheet.) U. S. N. M. 97520a, 97520b.

26. *Leperditia* sp.

Eggleston limestone (upper Black River); northwest slope of Wallen Ridge 2½ miles southeast of Dryden, Lee County. U. S. N. M. 97521.

27. *Bathyurus* aff. *B. johnstoni* Raymond.

Lowville limestone about 30 feet above the Ottosee limestone; Rye Cove, Scott County. U. S. N. M. 97522.

28, 29. *Bathyurus?* sp.

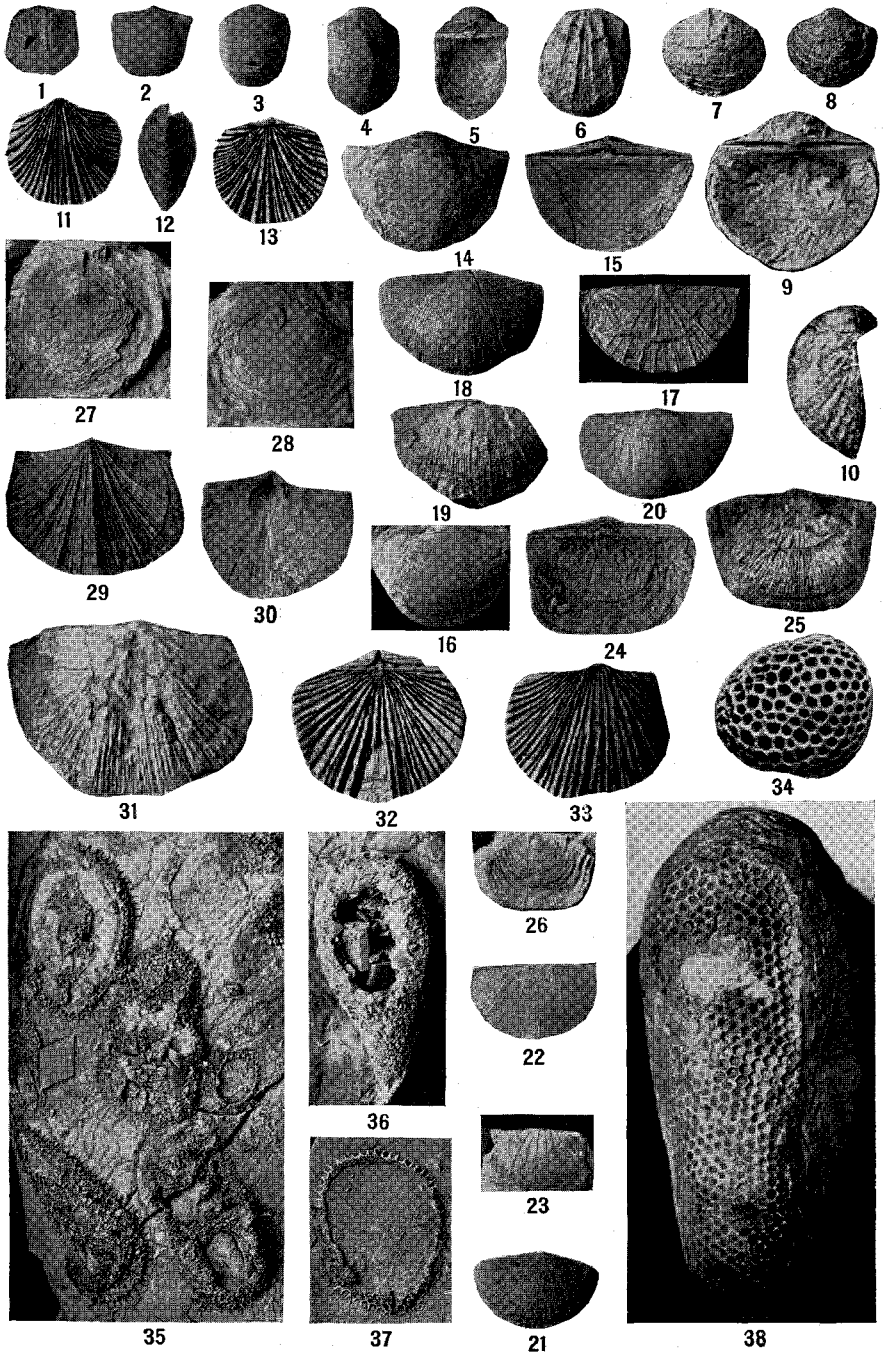
Lowville limestone; northwest base of Clinch Mountain just south of Gate City, Scott County. U. S. N. M. 97523a, 97523b.

30–33. *Calliops* cf. *C. callicephala* (Hall).

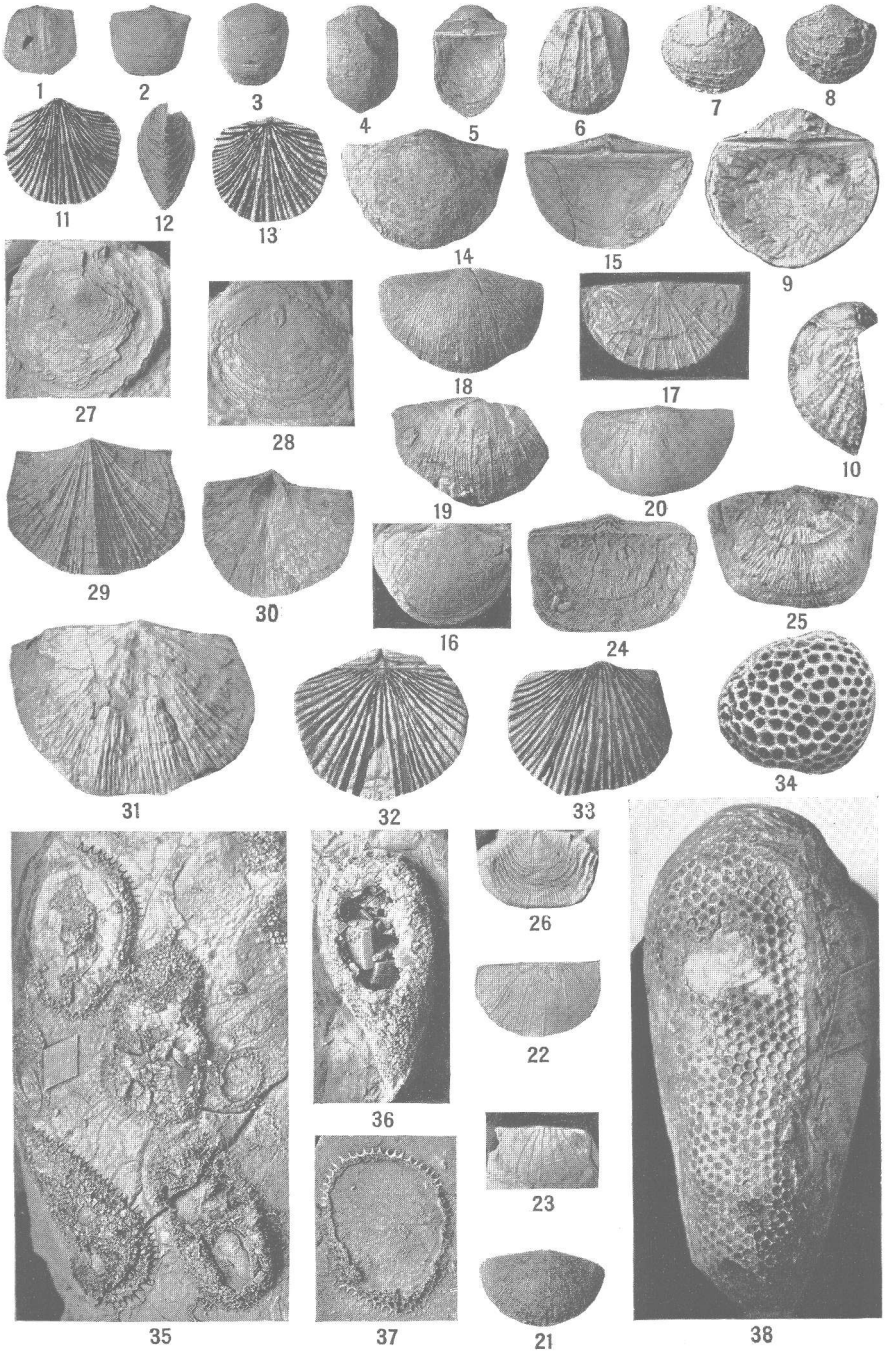
33, associated labrum. Occurrence as 27. U. S. N. M. 97524a, 97524b, 97524c, 97524d.

34, 35. *Leperditella sulcata* (Ulrich).

34, × 4; 35, × 2. A few individuals show a faint dorsal sulcus, but most of them do not, and it may be doubted whether all are *L. sulcata.* Lowville limestone; along road near State Route 64 about 2 miles northeast of Olinger, Lee County. U. S. N. M. 97511a, 97511b.



CHAMBERSBURG FOSSILS



CHAMBERSBURG FOSSILS

PLATE 95.—CHAMBERSBURG FOSSILS

FIGURE

1–3. *Christiania trentonensis brevis* Butts, n. var.

Distinguished from typical *C. trentonensis* Ruedemann by its shorter length:—young individuals or shorter forms?. Chambersburg limestone; Strasburg, Shenandoah County. Cotypes: U. S. N. M. 97536a, 97536b, 97536c.

4–6. *Christiania* cf. *C. trentonensis* Ruedemann.

4, 5, dorsal and ventral views of a specimen; 6, interior of a ventral valve. Occurrence as 1. 4, 5, U. S. N. M. 97537a; 6, 97537b.

7–10. *Christiania lamellosa* Bassler.

7, 8, ventral valves; 9, 10, dorsal and profile views of 8, × 2. Occurrence as 1. 7, U. S. N. M. 97538a; 8, 9, 10, 97538b.

11–13. *Dalmanella?* sp, × 2.

Occurrence as 1; also about one-third of a mile north of Green Mount Church and 4 miles north of Harrisonburg, Rockingham County. U. S. N. M. 97539.

14–16. *Sowerbyella* cf. *S. pisum* (Ruedemann), × 2.

14, 15, ventral and dorsal views of a specimen; 16, ventral view of another specimen. Occurrence as 1. 14, 15, U. S. N. M. 97540a; 16, 97540b.

17. *Sowerbyella platys* Butts, n. sp., × 2.

Distinguished from *S. pisum* (Ruedemann) by the nearly plane or flat surface of its ventral valve. Occurrence as 1. Holotype: U. S. N. M. 97541.

18–21. *Sowerbyella* sp.?

Ventral valves. 19-21, × 2. 19, 20, occurrence as 1; 18, 21, one-third of a mile north of Green Mount Church, Rockingham County. U. S. N. M. 97542a, 97543a, 97543b, 97542b.

22, 23. *Sowerbyella alternata* Butts, n. sp.

Ventral valves. 23, × 2. Distinguished by the strongly alternating striae. Slightly broader on the hinge line than *S. pisum* which it most resembles. Occurrence as 1. Cotypes: U. S. N. M. 97544a, 97544b.

FIGURE

24, 25. *Leptaena homostriata* Butts, n. sp., × 2.
Dorsal and ventral valves of a specimen. Distinguished from *L. unicostata* (Meek and Worthen) by its regular striae. Occurrence as 1. Holotype: U. S. N. M. 97545.

26. *Leptaena* aff. *L. rhomboidalis* (Wilckens).
Ventral valve. Occurrence as 1. U. S. N. M. 97546.

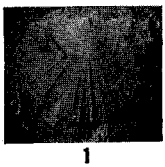
27, 28. *Orbiculoidea* sp.
Occurrence as 1. U. S. N. M. 97547a, 97547b.

29–31. *Dalmanella edsoni* Bassler.
29, ventral valve; 31, dorsal valve; 30, interior of a ventral valve. Occurrence as 1. U. S. N. M. 97548a, 97548b, 97548c.

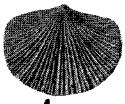
32, 33. *Nicolella strasburgensis* Butts, n. sp.
Dorsal and ventral valves. Distinguished from *N. actoniae*, the type of the genus, by its finer costae. Rare in America. Occurrence as 1. Cotypes: U. S. N. M. 97549a, 97549b.

34. *Bolboporites americanus* Billings(?), × 4.
Occurrence as 1. U. S. N. M. 97550.

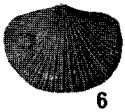
35–38. *Nidulites pyriformis* Bassler.
38, × 2. Occurrence as 1. A highly characteristic fossil of the Chambersburg limestone but occurs also in the base of the Ottosee limestone in Clinch River Valley east of Blackford and on Little Indian Creek, Russell County. U. S. N. M. 97551.


1


3


4


5


6

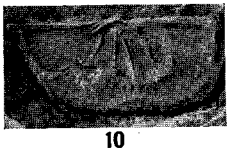

7


11


12

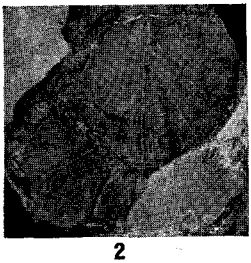

13

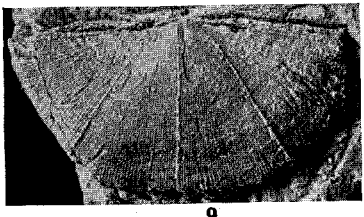

8

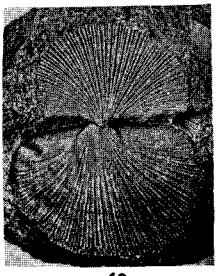

10


14


15

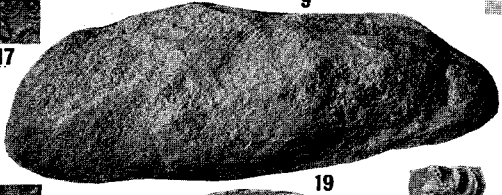

2


9


16


24

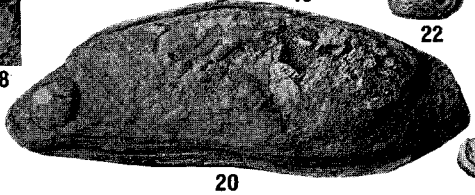

17


19


22

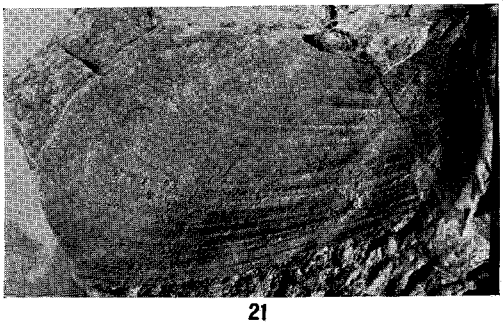

18


25


20

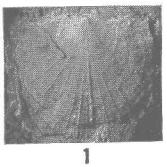

23


26


21


27

CHAMBERSBURG, MARTINSBURG, AND SEQUATCHIE FOSSILS

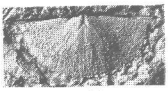

1


3


4


5


6

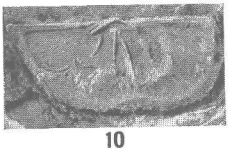

7


11

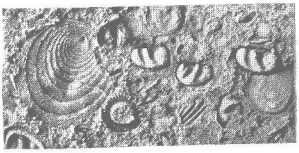

12

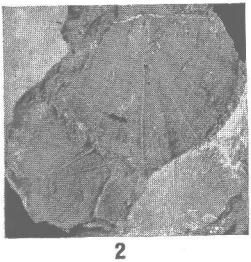

13

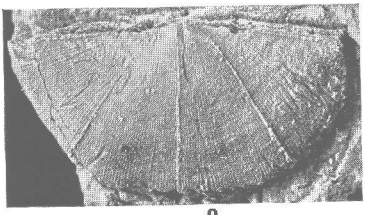

8

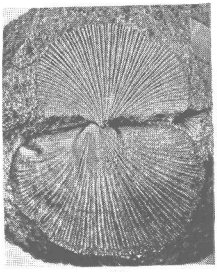

10

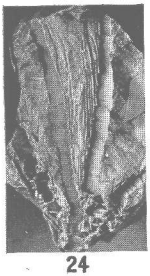

14


15

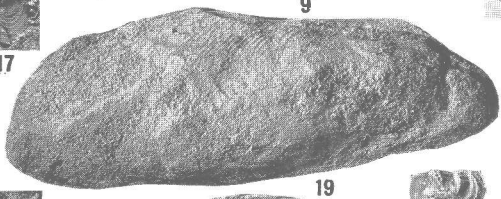

2

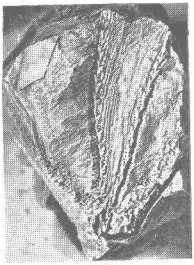

9


16


24

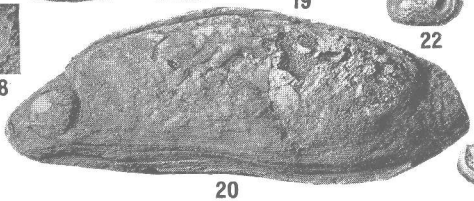

17


19


25

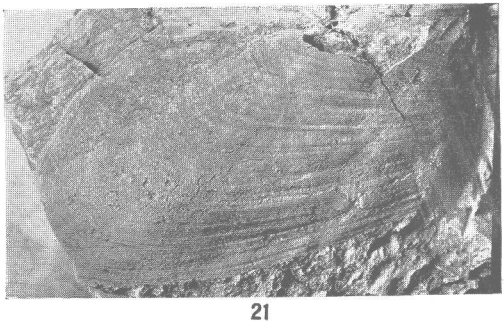

18


22


20


23


26


21


27

CHAMBERSBURG, MARTINSBURG, AND SEQUATCHIE FOSSILS

PLATE 96.—CHAMBERSBURG, MARTINSBURG, AND SEQUATCHIE FOSSILS

FIGURE

1, 2. *Rafinesquina alternata* (Emmons).

Ventral valves, exteriors. Chambersburg limestone; three-fourths of a mile northeast of Collierstown (present location), Rockbridge County. U. S. N. M. 97578a, 97578b.

3–6. *Dalmanella fertilis* Bassler.

3, external mold of a ventral valve; 4-6, dorsal, profile, and ventral views of a whole specimen. 3, Martinsburg shale, Trenton horizon; along State Route 311 at the northwest base of Catawba Mountain, about three-fourths of a mile southeast of Catawba Sanatorium, Roanoke County; 4-6, along State Route 63 about three-fourths of a mile southeast of Dickerson Ford (bridge), Lee County. 3, U. S. N. M. 97580; 4-6, 97579.

7, 8. *Sowerbyella rugosa* (Meek), × 2.

7, internal mold of a ventral valve; 8, external mold of a dorsal valve. Martinsburg shale; along the northwest slope of Catawba Mountain about 1¼ miles southeast of Catawba Sanatorium, Roanoke County. U. S. N. M. 97581a, 97581b.

9. *Sowerbyella rugosa* var. *triradiatus* Butts, n. var., × 4.

Distinguished from *S. rugosa* by 3 equally spaced strong striae with many fine striae between. Chambersburg limestone; Strasburg, Shenandoah County. Holotype: U. S. N. M. 97582.

10. *Sowerbyella* sp.

Interior of a dorsal valve of unusual form and size. Martinsburg shale, Trenton horizon; along road on Buffalo Creek half a mile northwest of Zollmans and 1½ miles northwest of Buffalo Mills, Rockbridge County. U. S. N. M. 97583.

11. *Ceratopsis chambersi* (Miller), × 6⅓.

Internal mold of a left valve. Martinsburg shale, Trenton horizon; along southeast slope of Smith Ridge about three-fourths of a mile southwest of Carvin Creek gorge at reservoir of Roanoke Waterworks, Roanoke County. U. S. N. M. 97584.

12. *Ctenobolbina ciliata* (Emmons), × 6⅓.

Internal mold of left valve showing ciliated margin. (One of specimens in fig. 15.) Occurrence as 7. U. S. N. M. 97585a.

FIGURE

13, 14. *Tetradella* aff. *T. quadrilirata* (Hall and Whitfield).

13, wax impression of an external mold of a right valve, × 6⅓; 14, slab with several specimens, × 4. Martinsburg shale, Trenton horizon. 13, along State Route 311 at northwest base of Catawba Mountain 1 mile southeast of Catawba Sanatorium, Roanoke County; 14, near locality and bed of 11. U. S. N. M. 97587, 97586.

15. *Ctenobolbina ciliata* (Emmons), × 4.

Slab with several specimens, also *Pholidops*. Occurrence as 7. U. S. N. M. 97585.

16. *Dalmanella emacerata* (Hall)?

Martinsburg shale, Maysville horizon; along Cub Run just east of Catharine Furnace at the southeast foot of Massanutten Mountain and 12 miles southwest of Luray, Page County. U. S. N. M. 97588.

17, 18. *Pholidops cincinnatiensis* Hall.

Occurrence as 7. U. S. N. M. 97589a, 97589b.

19, 20. *Orthodesma* sp.?

Martinsburg shale, Maysville horizon; along State Route 16 just northwest of crest of Walker Mountain and 5 miles north of Marion, Smyth County. U. S. N. M. 97590a, 97590b.

21. *Cuneamya?* sp.

Martinsburg shale, Maysville horizon; same locality as 7. U. S. N. M. 97591.

22, 23. *Drepanella richardsoni* (Miller), × 4.

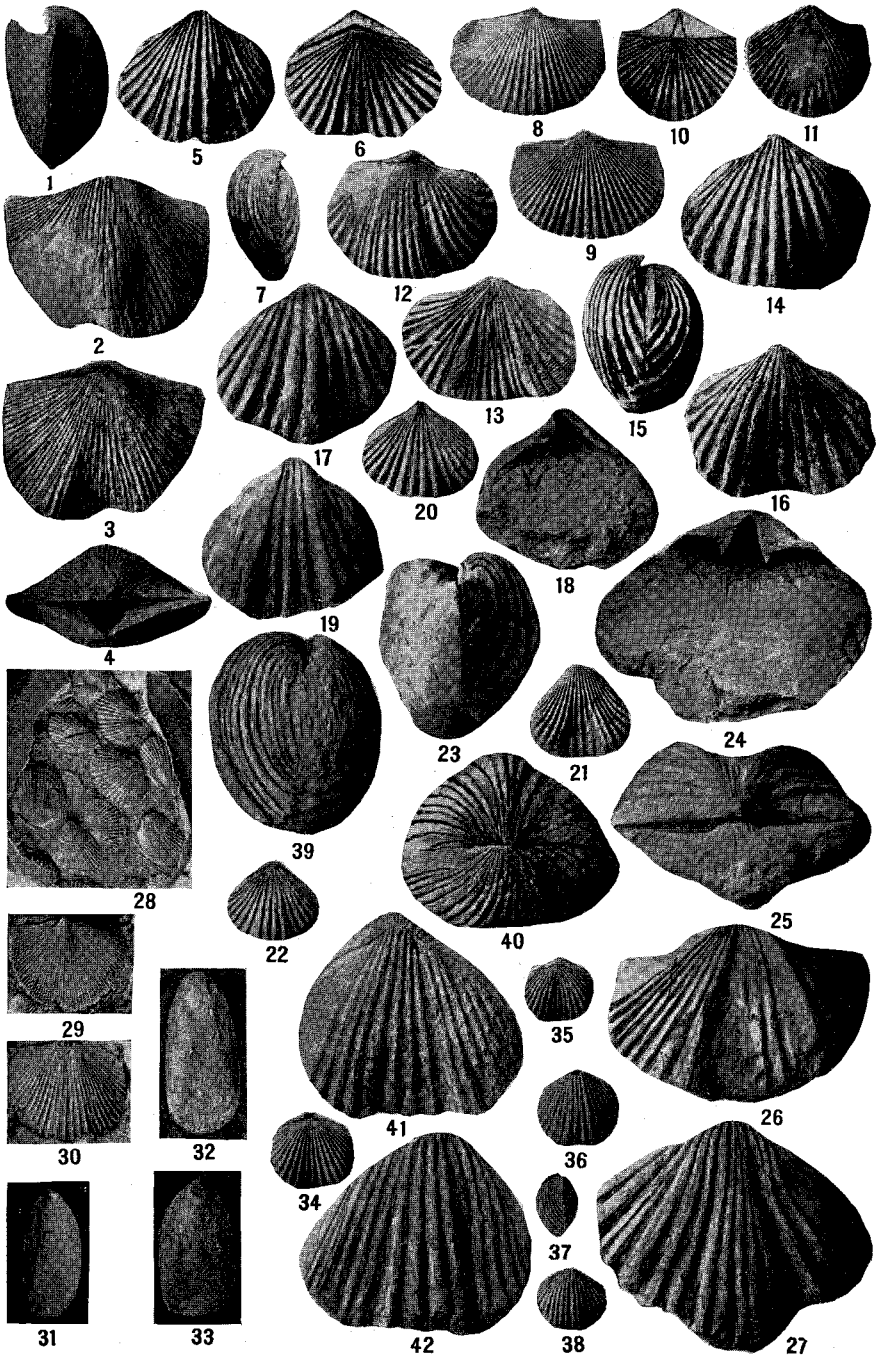
Right and left valves. Whitewater formation; Upper Cowan Creek, Clinton County, Ohio. Occurs in the Sequatchie (Juniata-Richmond) formation three-fourths of a mile southeast of Cumberland Gap village, Tenn., but no specimens suitable for illustration were obtained. U. S. N. M. 97592a, 97592b.

24, 25. *Ectenocrinus simplex* (Hall).

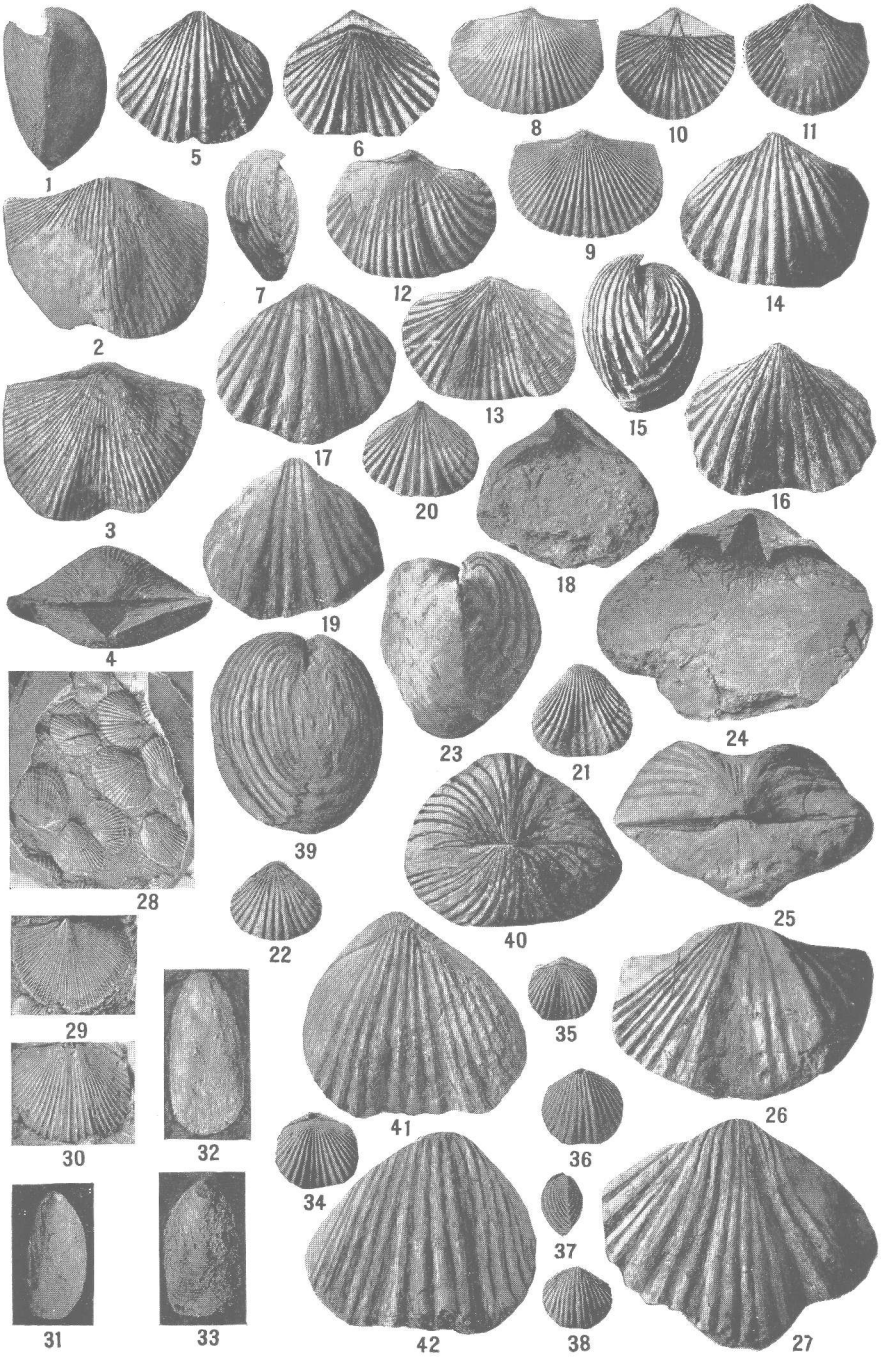
Martinsburg shale, probably Eden horizon; quarry on Lee Highway about half a mile southeast of New Market Gap, Massanutten Mountain, Page County. U. S. N. M. 97593a, 97593b.

26, 27. *Glyptocrinus pattersoni* Miller.

Occurrence as 24. U. S. N. M. 97594a, 97594b.



CHAMBERSBURG, MARTINSBURG, TRENTON, AND REEDSVILLE FOSSILS



CHAMBERSBURG, MARTINSBURG, TRENTON, AND REEDSVILLE FOSSILS

PLATE 97.—CHAMBERSBURG, MARTINSBURG, TRENTON, AND REEDSVILLE FOSSILS

FIGURE

1–4. *Hebertella sinuata* Hall and Clarke.

Profile, dorsal, ventral, and posterior views of an entire specimen. Reedsville shale, Maysville horizon; along road three-fourths of a mile southeast of Cumberland Gap village, Tenn. U. S. N. M. 97595.

5–7. *Zygospira kentuckiensis* James, × 2.

Dorsal, ventral, and profile views of a whole specimen. Reedsville shale, Maysville horizon; Fourmile fenster 3 miles south of Ewing, Lee County. U. S. N. M. 97596.

8, 9. *Hebertella frankfortensis* Foerste.

Dorsal and ventral views of a specimen. Trenton limestone; southeast slope of Big A Mountain about three-fourths of a mile southeast of the summit, Russell County. U. S. N. M. 97597.

10, 11. *Hesperorthis tricenaria* (Conrad).

Dorsal and ventral views of a whole specimen. Chambersburg limestone; one-third of a mile north of Green Mount Church and 5 miles north of Harrisonburg, Rockingham County. U. S. N. M. 97598.

12, 13. *Oxoplecia* sp.

Dorsal and ventral views of a specimen. Occurrence as 10. U. S. N. M. 97599.

14–19. *Orthorhynchula linneyi* (James).

14-16, dorsal, profile, and ventral views of a specimen; 17, dorsal view of another specimen; 18, 19, internal and ventral views of another specimen; 18, partly filled with matrix but shows the absence of an area like that of *Platystrophia* (Fig. 24); Martinsburg shale, Maysville horizon. 14-16, Cumberland Gap, Tenn.; 17-19, along U. S. Route 58 on the west slope of Wallen Ridge one-fourth of a mile northwest of the summit and 1½ miles northwest of Stickleyville, Lee County. 14-16, U. S. N. M. 97601; 17, 97602a; 18, 19, 97602b.

FIGURE

20–22. *Rhynchotrema increbescens* (Hall).

20, 22, dorsal views of two specimens; 21, ventral view of 22. Trenton limestone; along State Route 63 three-fourths of a mile southeast of Dickerson Ford (bridge) on Powell River, Lee County. U. S. N. M. 97603a, 97603b.

23–27. *Platystrophia laticosta* (Meek).

23, 25, 26, profile, posterior, and ventral views of a specimen; 27, dorsal view of another specimen; 24, interior of 27, showing hinge area. Occurrence as 17. 23, 25, 26, U. S. N. M. 97604a; 24, 27, 97604b.

28. *Zygospira modesta* Hall.

Clay impression from an external mold of several specimens in fine-grained sandstone. Martinsburg shale, Eden horizon?; along State Route 311 on the northwest slope of Catawba Mountain 1 mile southeast of Catawba Sanatorium, Roanoke County. U. S. N. M. 97605.

29. *Rafinesquina alternata* (Emmons).

Occurrence as 28. U. S. N. M. 97606.

30. *Catazyga* cf. *C. erratica* (Hall).

Internal mold of a dorsal valve. Occurrence as 28. U. S. N. M. 97607.

31–33. *Lingula nicklesi* Bassler.

Internal molds of ventral valves; 33, preserves part of the shell. Martinsburg shale, Maysville horizon; just east of Miller Creek at the northwest foot of Ramsay Mountain, Max Meadows, Wythe County. Common in association with *Orthorhynchula linneyi* in the top of the Martinsburg shale (*Orthorhynchula* zone) throughout Virginia. U. S. N. M. 97608a, 97608b, 97608c.

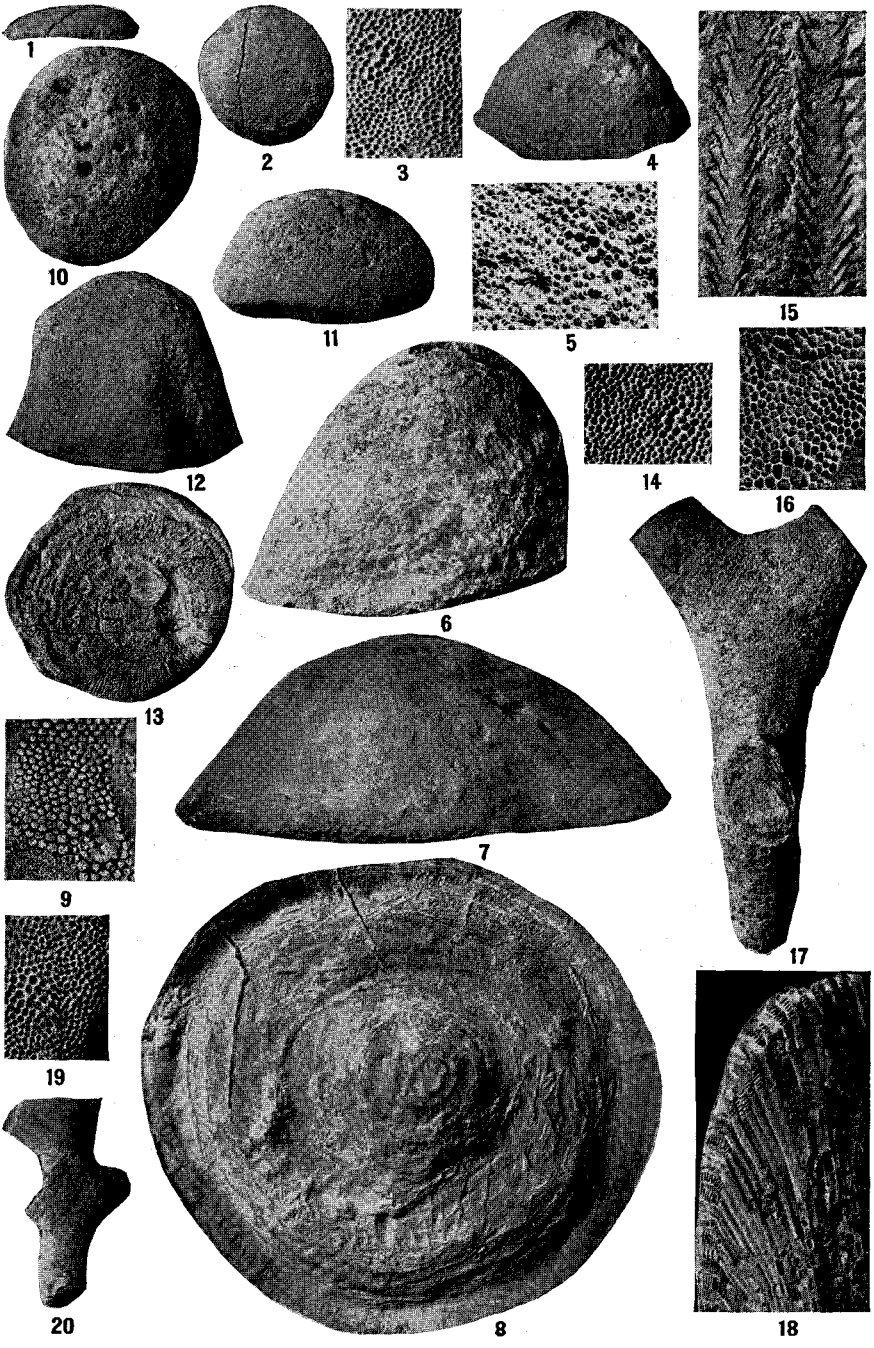
34–38. *Zygospira recurvirostris* (Hall), var. approaching *Z. kentuckiensis* James.

34, 36, dorsal and ventral views of a specimen; 35, 37, 38, dorsal, profile, and ventral views of another specimen. Martinsburg shale, about top of Trenton horizon; along State Route 80 on the northwest slope of Clinch Mountain about half a mile northwest of the summit, Russell County. 34, 36, U. S. N. M. 97609a; 35, 37, 38, 97609b.

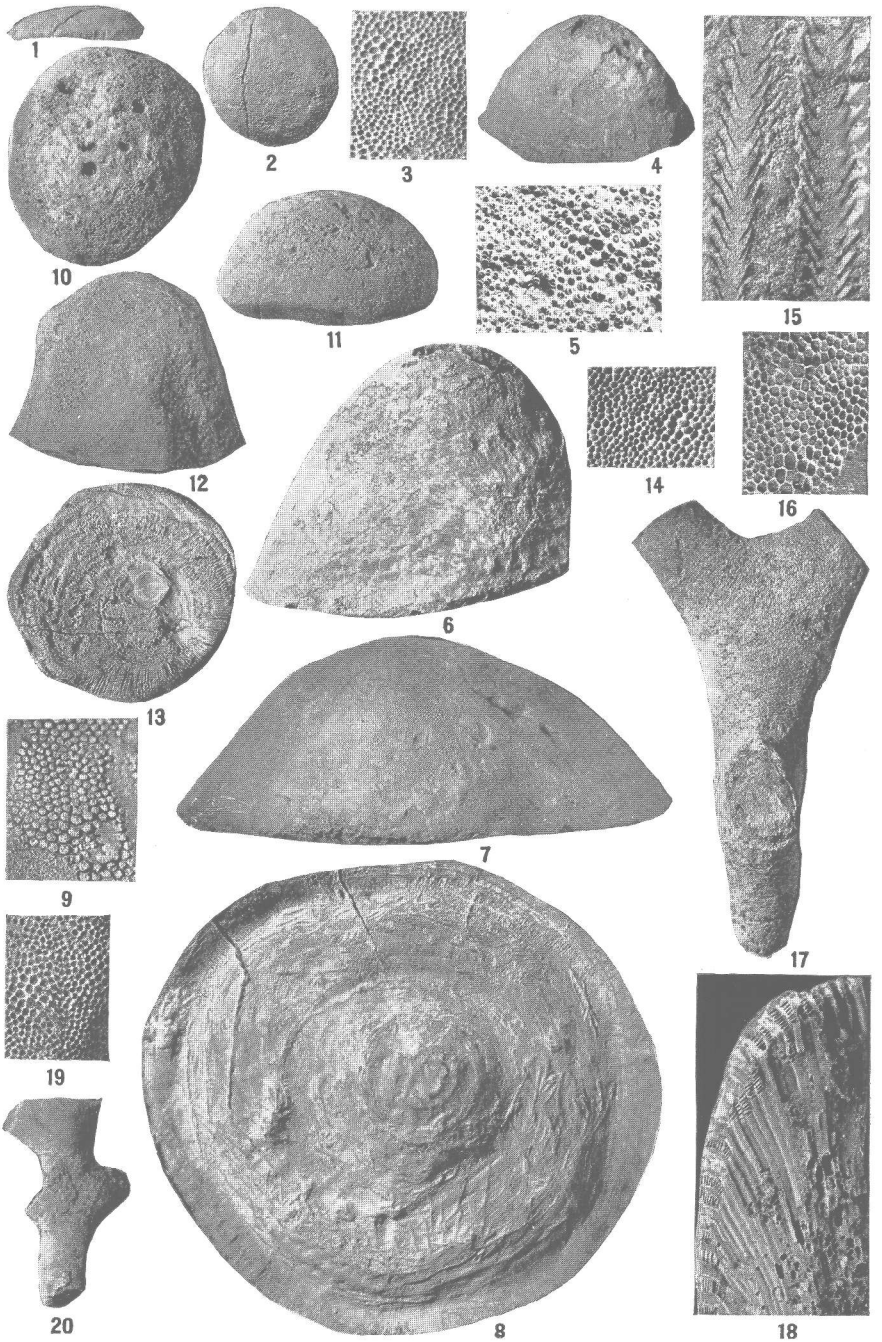
FIGURE

39–42. *Orthorhynchula linneyi* (James).

Profile, posterior, ventral, and dorsal views of a large specimen. Martinsburg shale, Maysville horizon; along State Route 91 in McCall Gap through Walker Mountain between Saltville and Glade Springs, Washington County. U. S. N. M. 97600.



TRENTON AND REEDSVILLE FOSSILS



TRENTON AND REEDSVILLE FOSSILS

PLATE 98.—TRENTON AND REEDSVILLE FOSSILS

FIGURE

1–3. *Monotrypa* sp.

Distinguished by its lenticular shape and large maculae. 1, side view; 2, zooecial surface showing maculae; 3, surface of 2, × 4. Trenton limestone; along State Route 64 about three-fourths of a mile southeast of Dickerson Ford on the Powell River, Lee County. U. S. N. M. 97552.

4–9. *Prasopora simulatrix* Ulrich.

4, 6, 7, side views of 3 specimens; 5, part of exfoliated surface of 6, × 4, showing cystiphragms; 8, view of epithecal surface of 7; 9, part of the weathered surface of 7, × 4, showing the matrix filling the zooecial tubes. Martinsburg shale, Trenton zone; along State Route 80 on northwest slope of Clinch Mountain about half a mile northwest of summit and about 1 mile south of Rockdell, Russell County. 4, 6, 7, U. S. N. M. 97553a, 97553b, 97553c.

10–14. *Mesotrypa quebecensis* (Ami).

10, 11, top and side views of a specimen; 12, 13, side and epithecal views of another specimen; 14, part of surface of another specimen, × 4, to show cells. Occurrence as 1. 10, 11, U. S. N. M. 97554a; 12, 13, 97554b; 14, 97554c.

15. *Diplograptus amplexicaulis* (Hall).

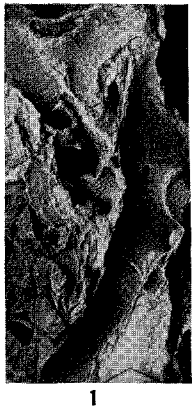
Martinsburg shale, Trenton zone; 1½ miles south of summit of Little House Mountain west of Lexington, Rockbridge County. U. S. N. M. 97555.

16–18. *Hallopora ampla* (Ulrich).

16, part of surface of a specimen to show cells, × 4; 17, nearly whole specimen; 18, part of a vertical section through the center of a specimen, × 4, showing the internal structure and manner of growth of the zooecial tubes and the closely packed diaphragms at the sharply flexed extremities. Occurrence as 4. U. S. N. M. 97556a, 97556b, 97556c.

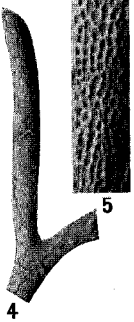
19, 20. *Amplexopora pustulosa* Ulrich?

19, part of surface of a specimen to show cells, × 4. Reedsville shale, Maysville horizon?; three-fourths of a mile southeast of Cumberland Gap village, Tenn. U. S. N. M. 97557a, 97557b.


1

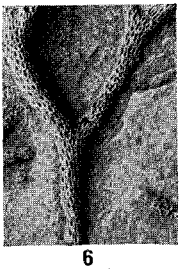

3


2


4

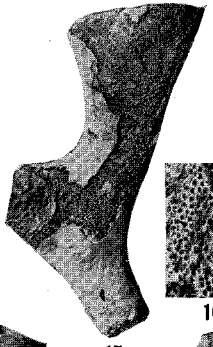

5


13


6

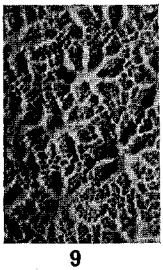

7

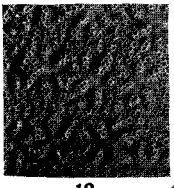

8


15


16


17


9


10


14


18


19

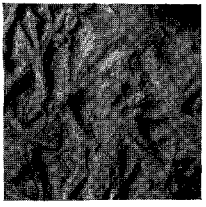

11


12

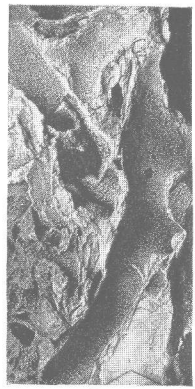

20

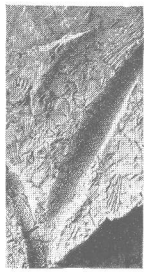

21

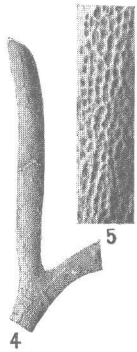

22


23

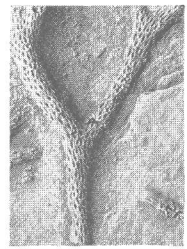
TRENTON, REEDSVILLE, AND MARTINSBURG FOSSILS

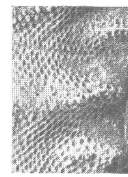

1

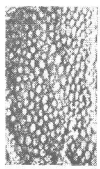

3


4

5

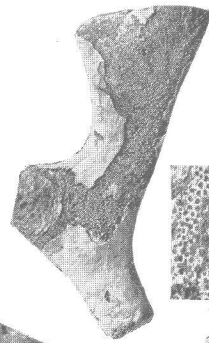

6

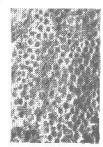

7

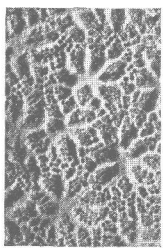

2

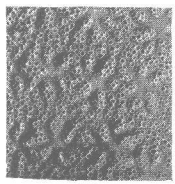

8


13


15


16

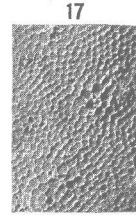

9


10


17


14

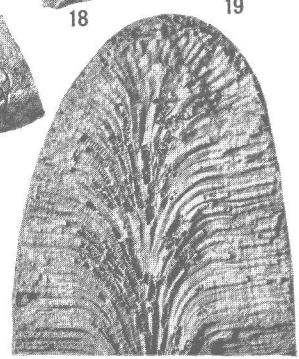

18


19

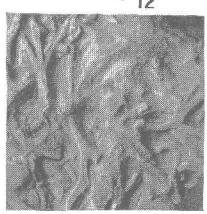

11


12


20


21


22


23

TRENTON, REEDSVILLE, AND MARTINSBURG FOSSILS

PLATE 99.—TRENTON, REEDSVILLE, AND MARTINSBURG FOSSILS

FIGURE

1, 2. *Hallopora andrewsi* (Nicholson)?

1, external mold; 2, part of 1, × 4, to show cells. The elevations are the matrix filling the cells or pits (zooecial apertures) of the original specimen. Martinsburg shale, Maysville horizon; along State Route 311 on the northwest slope of Catawba Mountain about 1 mile southeast of Catawba Sanatorium, Roanoke County. U. S. N. M. 97558.

3, 4. *Hallopora sigillarioides* (Nicholson).

3, external mold; 4, wax impression of same. Martinsburg shale, Eden horizon; same locality as 1. U. S. N. M. 97559.

5, 6. *Eridotrypa?* sp.

5, part of 6, × 4, to show cells. Martinsburg shale, probably Trenton horizon; Blue Spring Creek about 11 miles northwest of Eagle Rock, Botetourt County. A common slender bryozoon in the Trenton. U. S. N. M. 97560.

7, 8. *Escharopora hilli* (James).

7, part of 8, × 4, to show cells. Reedsville shale, Maysville zone; along road about three-fourths of a mile southeast of Cumberland Gap village, Tenn. A highly characteristic Maysville fossil. U. S. N. M. 97561.

9–12. *Constellaria teres* Ulrich and Bassler.

11, 12, two specimens natural size to show exteriors; 9, 10, parts of surfaces of two other specimens, × 4, to show arrangement of cells. Trenton limestone; along southeast slope of Big A Mountain about three-fourths of a mile southeast of summit, Russell County. U. S. N. M. 97562a, 97562b, 97562c, 97562d.

13, 14. *Constellaria florida* Ulrich.

13, part of 14, × 4. Occurrence as 7. U. S. N. M. 97563.

15–17. *Dekayia?*

16, part of surface of a specimen, × 4. Martinsburg shale; along State Route 80 on the northwest slope of Clinch Mountain and 800 feet northwest of the summit, Russell County. U. S. N. M. 97564a, 97564b, 97564c.

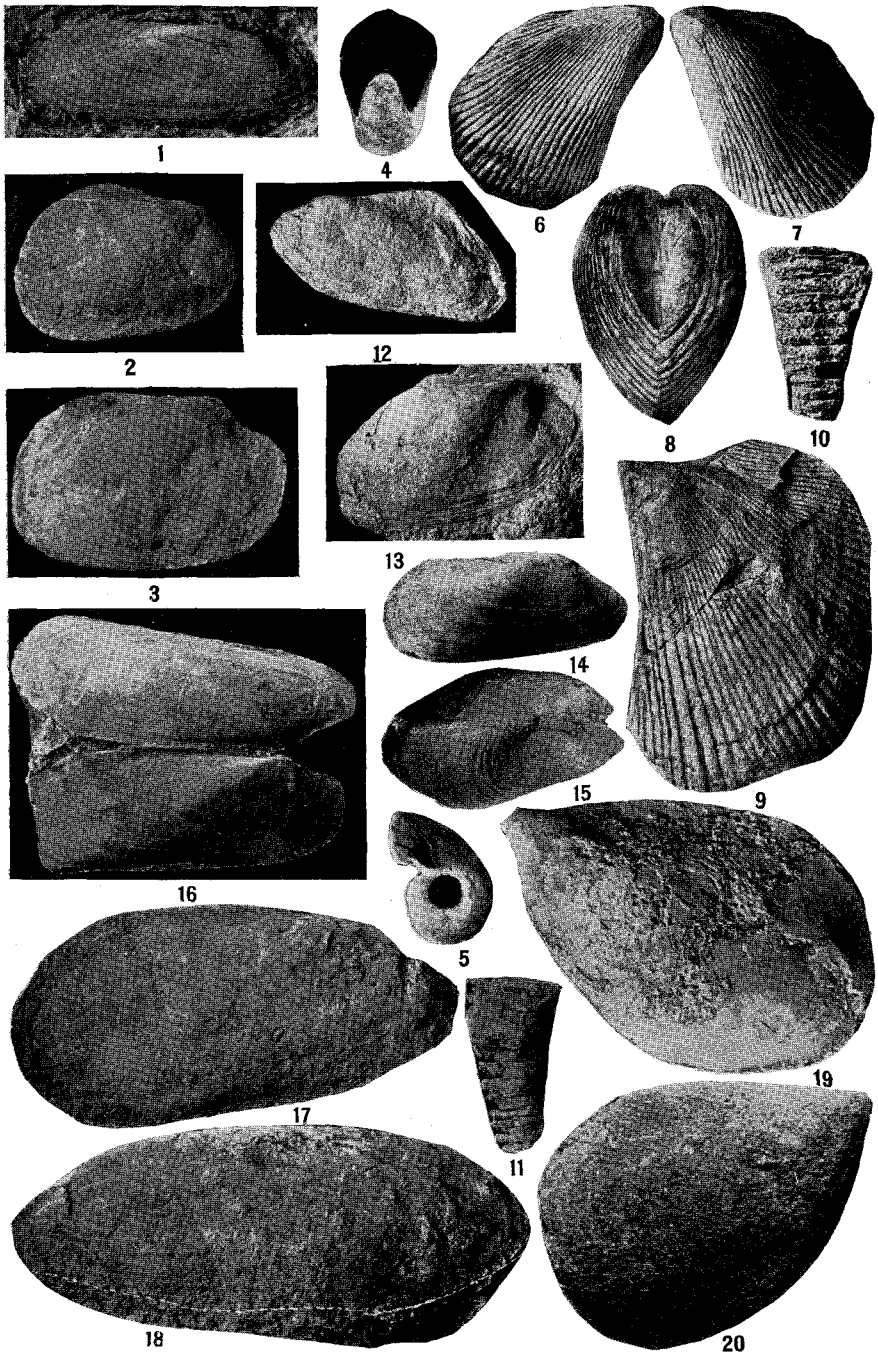
FIGURE

18–21. *Amplexopora cingulata* Ulrich.

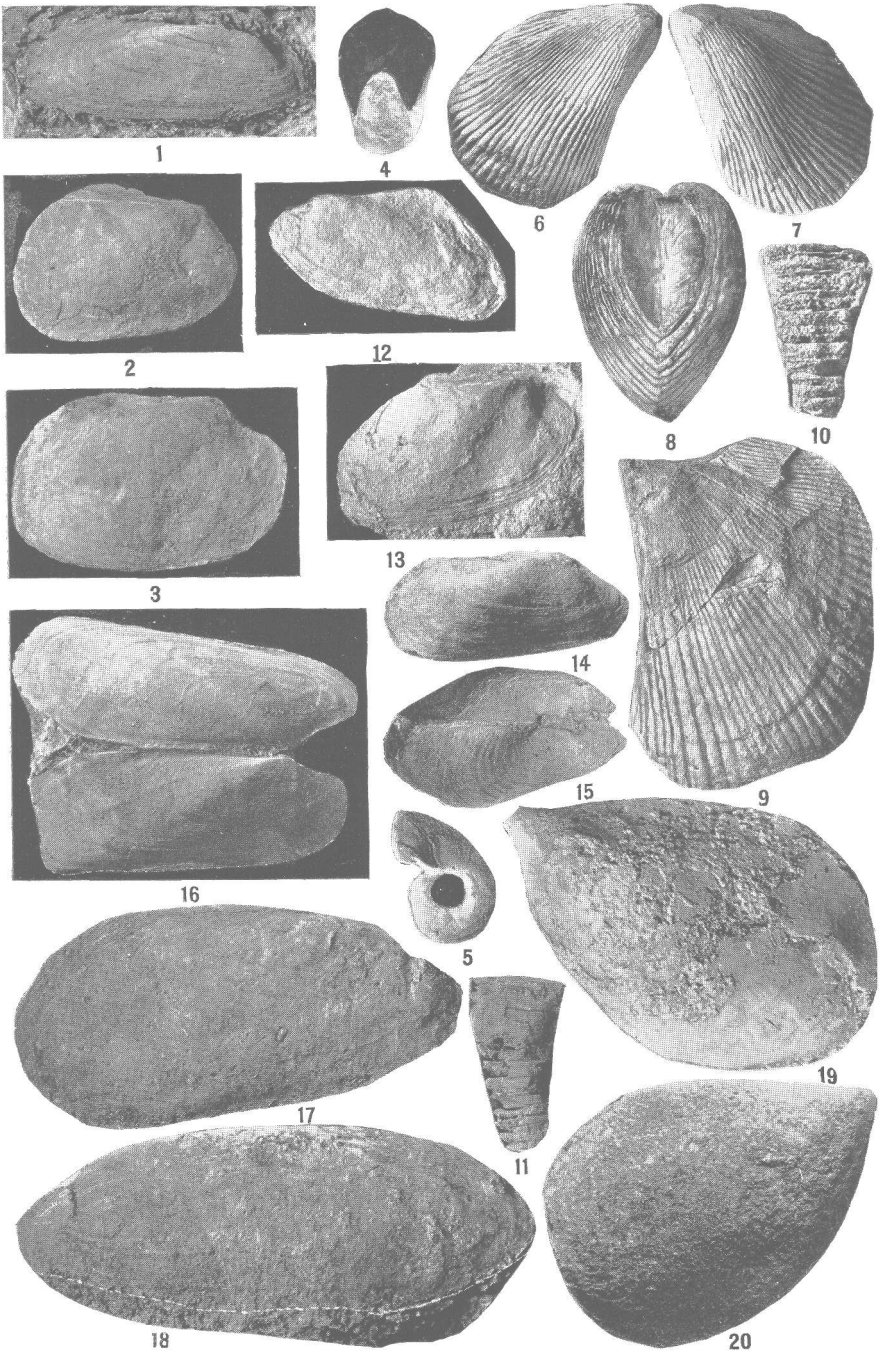
19, surface of a specimen, × 4, to show cells; 21, natural longitudinal section through a branch, × 4, to show manner of growth. The inner tubes and the outer ends of the zooecia at right angles to the surface are closely packed with diaphragms which show only faintly in the photograph of the broken surface but are plainly visible on a polished surface. Some of these are strengthened by retouching. Reedsville shale; Fourmile fenster about 3 miles southeast of Ewing, Lee County. U. S. N. M. 97565a, 97565b, 97565c, 97565d.

22, 23. *Eridotrypa?*

22, part of 23, × 4. Fragments of *Cryptolithus* on 23. Compare with 5, 6. These slender bryozoa are rather common and distinctive Trenton fossils. Martinsburg shale, Trenton zone; along road cut on Buffalo Creek half a mile northwest of Zollmans and 1½ miles northwest of Buffalo Mills, Rockbridge County. U. S. N. M. 97566.



LOWVILLE AND MAYSVILLE FOSSILS



LOWVILLE AND MAYSVILLE FOSSILS

PLATE 100.—LOWVILLE AND MAYSVILLE FOSSILS

FIGURE

1. *Rhytimya* sp.?

   Right valve. Martinsburg shale, Maysville horizon; along State Route 311 on the northwest slope of Catawba Mountain 1¼ miles southeast of Catawba Sanatorium, Roanoke County. U. S. N. M. 97567.

2, 3. *Modiolodon truncatus* (Hall).

   Right valves. Reedsville shale, Maysville horizon; along Louisville & Nashville Railroad about three-fourths of a mile southeast of Cumberland Gap village, Tenn., and about 175 feet east of east portal of tunnel. U. S. N. M. 97568a, 97568b.

4, 5. *Sinuites* cf. *S. cancellatus* (Hall).

   4, apertural view; 5, side view of a specimen. Occurrence as 2. U. S. N. M. 97569.

6–8. *Byssonychia radiata* (Hall).

   Right and left valves and byssal view of a whole specimen. Martinsburg shale, Maysville horizon; along U. S. Route 58 on the northwest slope of Wallen Ridge about one-fourth of a mile northwest of summit and 1½ miles northwest of Stickleyville, Lee County. U. S. N. M. 97570.

9. *Byssonychia vera* Ulrich.

   Left valve of a whole specimen. Martinsburg shale, Maysville horizon; along road on North Fork of Roanoke River at south end of Paris Mountain about one-fourth of a mile west of Fagg Station, Montgomery County. U. S. N. M. 97571.

10, 11. *Wetherbyoceras conoidale* (Wetherby).

   Dorsal and lateral views showing curvature. Martinsburg shale, Maysville horizon; along State Route 80 on the northwest slope of Clinch Mountain about one-fourth of a mile northwest of the summit, Russell County. U. S. N. M. 97572.

12, 13. *Modiolopsis* sp.?

   Left and right valves. Martinsburg shale, Maysville horizon; along State Route 88 a few hundred feet northwest of summit of Walker Mountain and 5 miles north of Marion, Smyth County. U. S. N. M. 97573a, 97573b.

FIGURE

14, 15. *Rhytimya* sp.?

14, right valve; 15, hinge view, showing both valves of the same specimen. Occurrence as 12. U. S. N. M. 97574.

16. *Whiteavesia* sp.?

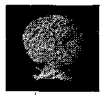
Hinge view of both valves of a whole specimen. Occurrence as 1. U. S. N. M. 97575.

17, 18. *Modiodesma modiolare* (Conrad).

Right and left valves. In 18 the white line marks about the lower margin of the shell. Occurrence as 2. U. S. N. M. 97576a, 97576b.

19, 20. *Clionychia* sp.

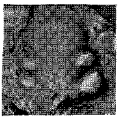
Left and right valves. Lowville limestone, 30-50 feet above Ottosee limestone; in Rye Cove about three-fourths of a mile southwest of Rye Cove School, Scott County. U. S. N. M. 97577a, 97577b.

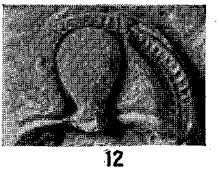

1


6


7

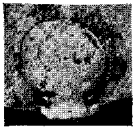

8


9

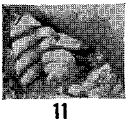

12

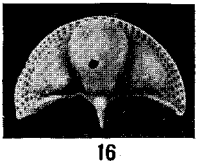

2

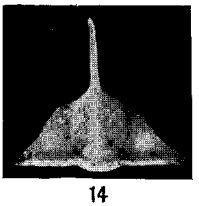

3

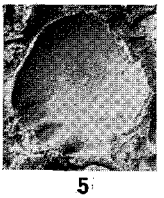

4


10

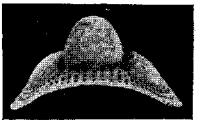

11

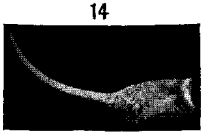

16


14


5

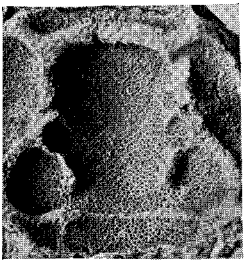

19


17


15


18


21


20


22

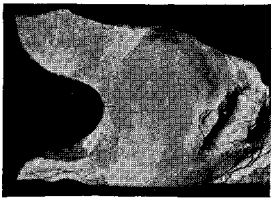

13


23


24

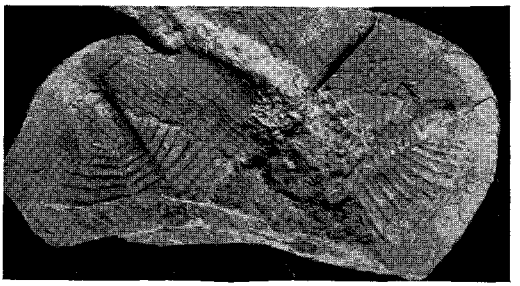

25

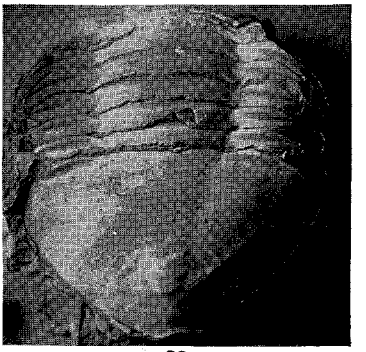

27


30


29


26


31


28

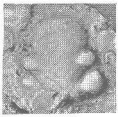
ATHENS, CHAMBERSBURG, MARTINSBURG, BRASSFIELD, AND CLINTON FOSSILS

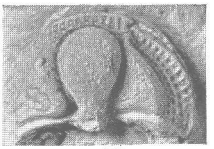

1


6


7

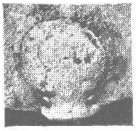

8


9

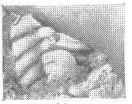

12

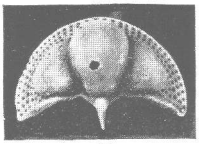

2

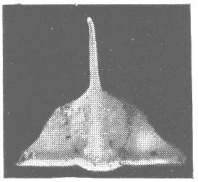

3


4

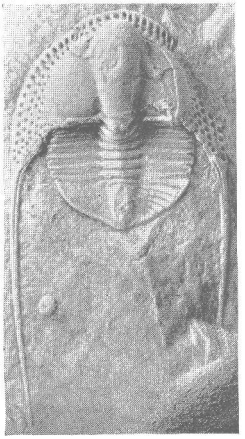

10

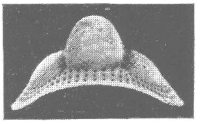

11

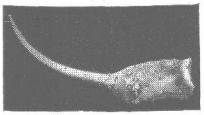

16


14

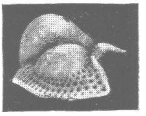

5

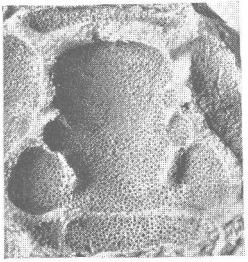

19


17

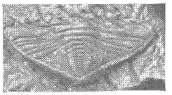

15


21


18


20

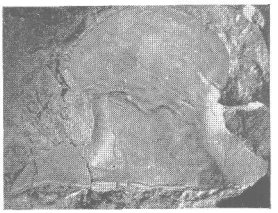

22

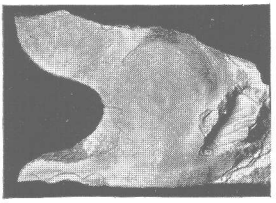

13

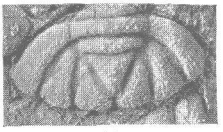

23


24

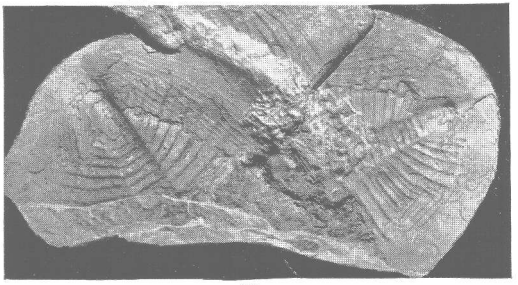

25

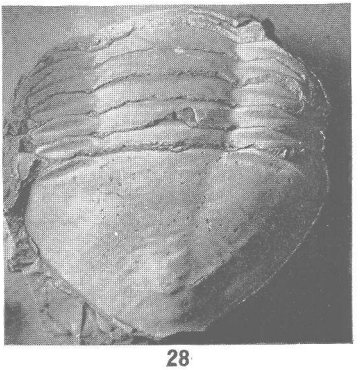

27


30


29


26


31


28

ATHENS, CHAMBERSBURG, MARTINSBURG, BRASSFIELD, AND CLINTON FOSSILS

PLATE 101.—ATHENS, CHAMBERSBURG, MARTINSBURG, BRASSFIELD, AND CLINTON FOSSILS

FIGURE

1–5. *Phacops pulchellus* Foerste.

1-4, × 2; 5, × 4; 1, 3, 4, internal molds of heads; 5, external mold of head; 2, internal mold of a tail. Brassfield formation; along Louisville & Nashville Railroad half a mile southeast of Cumberland Gap, Tenn. 1-4, from sandstone at base of formation; 5, from ferruginous limestone at top of formation. (See Part I, Pl. 60B.) U. S. N. M. 97525a, 97525b, 97525c, 97525d, 97526.

6, 9. *Calymene niagarense* of authors.

According to Foerste not typical *C. niagarense*. Internal molds of heads. Clinton formation, ore bed; Fourmile fenster about 2 miles south-southeast of Ewing, Lee County. U. S. N. M. 97527a, 97527b.

7, 8, 10, 11. *Calymene vogdesi* Foerste.

All fragmentary. 7, 8, internal molds of heads; 10, 11, internal molds of tails. Occurrence as 5. U. S. N. M. 97528a, 97528b, 97528c, 97528d.

12, 13. *Tretaspis reticulata* Ruedemann, × 2.

Head and tail. Chambersburg limestone; vicinity of Strasburg, Shenandoah County. U. S. N. M. 97529a, 97529b.

14, 15. *Ampyx hastatus* Ruedemann, × 2.

Dorsal and profile views of a head. Specimens etched out of limestone. Chambersburg limestone; Tumbling Run 1½ miles southwest of Strasburg, Shenandoah County. U. S. N. M. 97530.

16–19. *Cryptolithus tessellatus* Green, × 2.

16-18, dorsal, front, and profile views of a head, etched out of limestone; 19, wax impression from an external mold of a whole specimen including the tail. Pleural furrows on lobes of tail faintly shown. Martinsburg shale, Trenton horizon. 16-18, 3 miles northeast of Long Glade, Augusta County; 19, Swatara Gap, northwest of Lebanon, Lebanon County, Pa. 16-18, U. S. N. M. 97531; 19, 90061.

FIGURE

20–22. *Calymene granulosa* (Foerste).

20, external mold of a head, × 4; 21, internal mold of a tail; 22, internal mold of a head. Martinsburg shale, Eden horizon; along State Route 311 on the northwest slope of Catawba Mountain and about 1 mile southeast of Catawba Sanatorium, Roanoke County. U. S. N. M. 97532a, 97532b, 97532c.

23–26. *Arthrorhachis* cf. *A. elspethi* Raymond, × 2.

24, 25, heads; 23, tail; 26, entire specimen rolled up and showing only the tail with the spines. All etched from limestone. Occurrence as 14. This is the only known occurrence of *Arthrorhachis* in formations younger than the Athens shale. 23, U. S. N. M. 97533a; 24, 25, 97533b; 26, 97533c.

27, 28. *Homotelus simplex* (Raymond and Narraway).

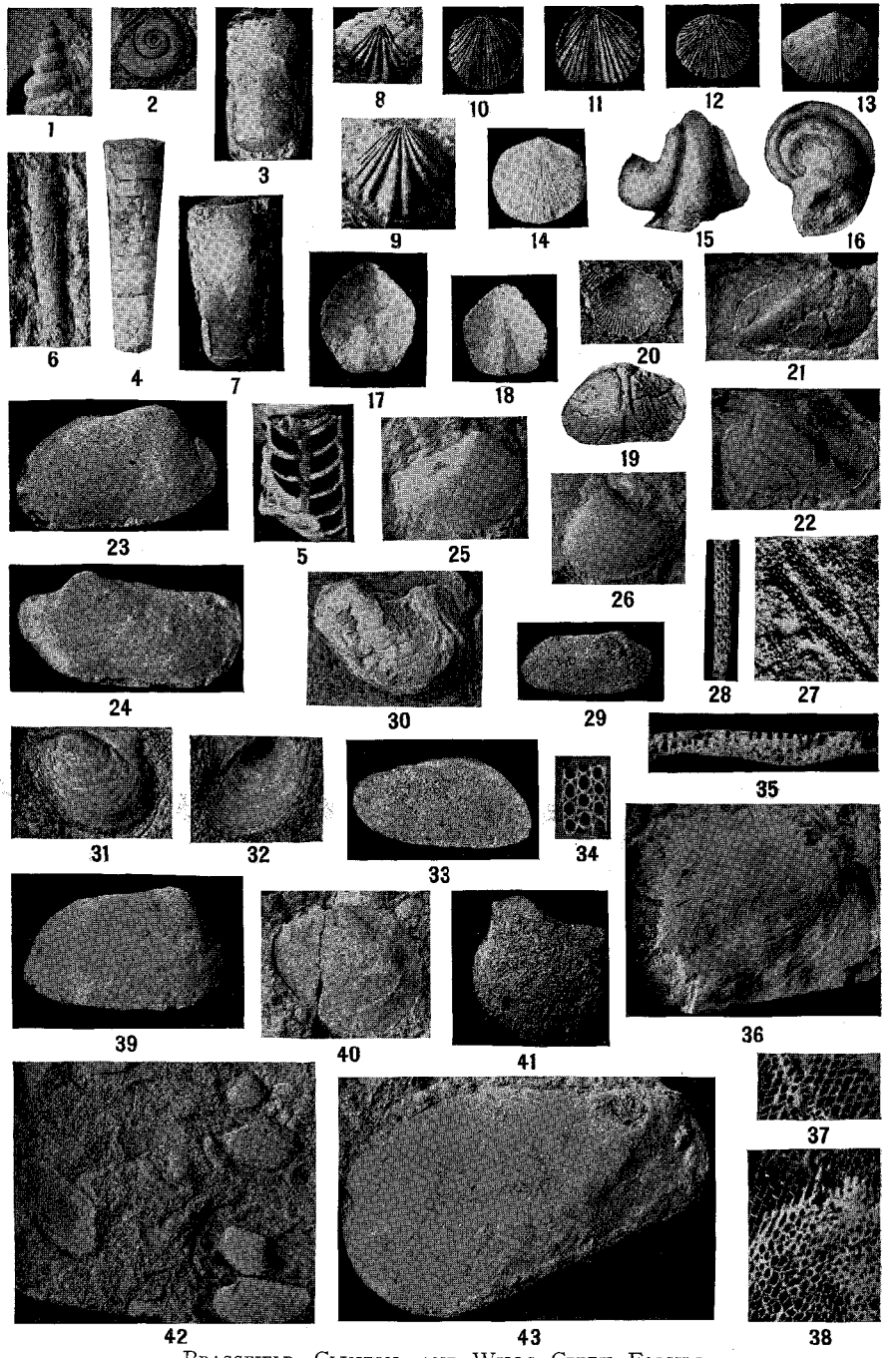
27, head; 28, thorax and tail. Occurrence as 14. U. S. N. M. 97534a, 97534b.

29. *Sphaerexochus?* sp., × 4.

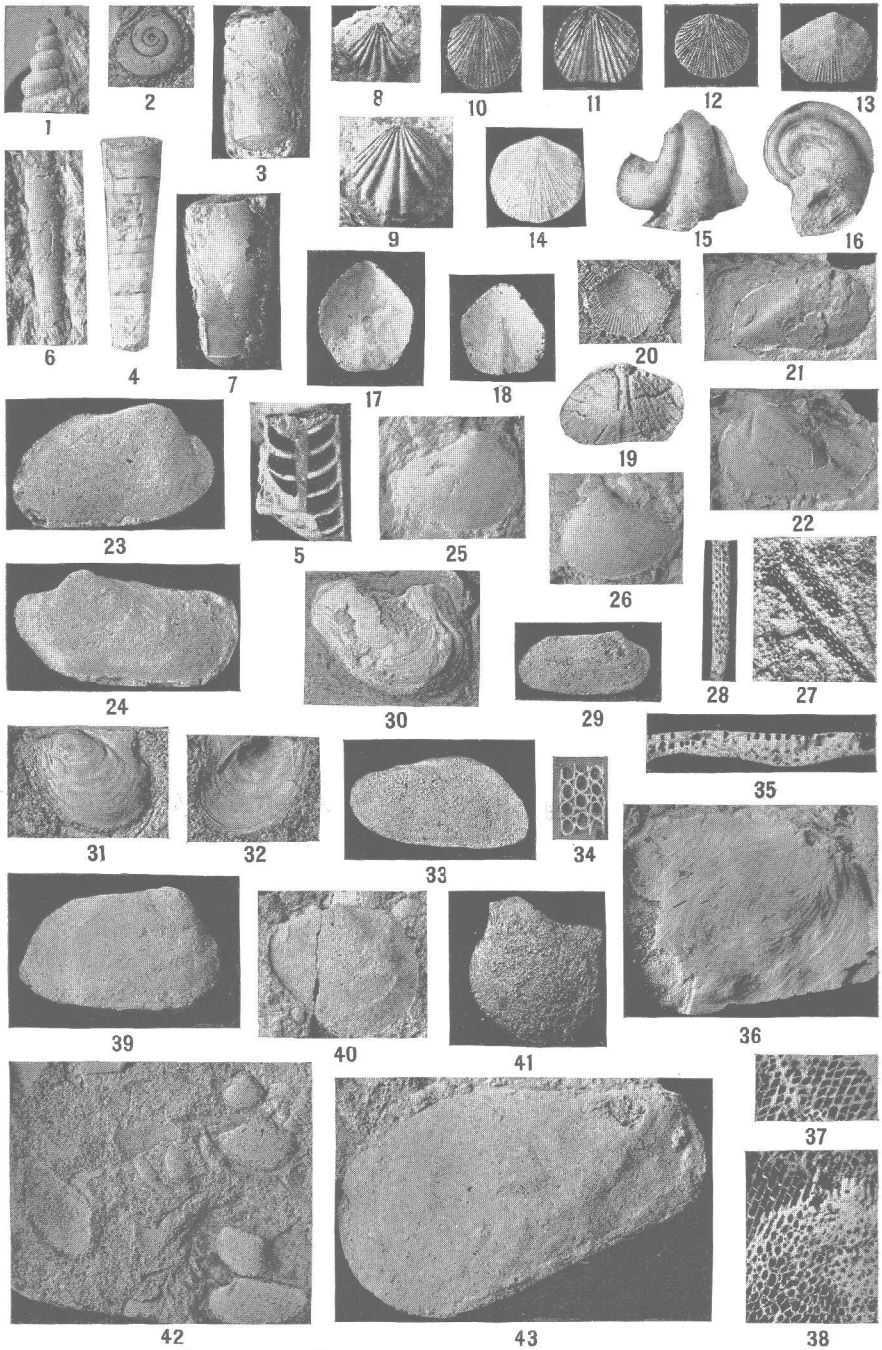
Tail. Occurrence as 12. U. S. N. M. 97535.

30, 31. *Basilicus* cf. *B. marginalis* (Hall).

Part of head and two tails. Athens limestone; 1½ miles south-southwest of Murat, Rockbridge County. U. S. N. M. 102308.



BRASSFIELD, CLINTON, AND WILLS CREEK FOSSILS



BRASSFIELD, CLINTON, AND WILLS CREEK FOSSILS

PLATE 102.—BRASSFIELD, CLINTON, AND WILLS CREEK FOSSILS

FIGURE

1. *Hormotoma subulata* (Conrad).
   Limestone at top of Brassfield horizon; near west end of tunnel on the Louisville and Nashville Railroad about half a mile east of Cumberland Gap village, Tenn. U. S. N. M. 97611.

2. *Straparollus* cf. *S. incarinatum* Foerste.
   Clinton formation near top; railroad cut on Wolf Creek 1 mile south of Rocky Gap village, Bland County; on same piece with *Bonnemaia obliqua* (Pl. 104, figs. 31 and 33). U. S. N. M. 97612.

3–5. *Cycloceras inceptum* (Foerste).
   5, vertical section showing septae and siphuncle. Occurrence as 1. U. S. N. M. 97614a, 97614b, 97614c.

6, 7. *Orthoceras?* (*Coleolus*) *clintonensis* Foerste, × 2.
   Marked with about 10 very fine revolving lines between the septae. Occurrence as 1. U. S. N. M. 97615a, 97615b.

8, 9. *Camarotoechia* cf. *C. decemplicata* (Sowerby), × 2.
   Occurrence as 1. U. S. N. M. 97616a, 97616b.

10, 11. *Hebertella?* sp., × 2.
   Dorsal and ventral valves. Occurrence as 1. U. S. N. M. 97617a, 97617b.

12–13. *Rhipidomella* sp.
   Occurrence as 1. U. S. N. M. 97618a, 97618b.

14. *Rhipidomella hybrida* (Sowerby).
   Occurrence as 1. U. S. N. M. 97610.

15, 16. *Bucanella trilobata* (Conrad), × 4.
   Occurrence as 1. U. S. N. M. 97619.

17–19. *Meristina maria* (Hall)?
   17, 18, external molds probably of dorsal valves; 19, internal mold of the rostral cavity of a dorsal valve, showing faintly the vascular scars. Clinton formation, Rochester horizon; along State Route 284 about 2 miles southeast of Crabbottom, Highland County. U. S. N. M. 97620a, 97620b, 97620c.

FIGURE

20. *Parmorthis* sp.
Occurrence as 17. U. S. N. M. 97622.

21, 22. *Clidophorus?* sp.
Right and left valves. Occurrence as 1. U. S. N. M. 97623a, 97623b.

23, 24. Cf. *Modiolopsis orthonota* (Conrad).
Right and left valves. Sandstone in base of Brassfield; about half a mile southeast of Cumberland Gap village, Tenn. (Pl. 60B) U. S. N. M. 97624a, 97624b.

25, 26. *Ctenodonta* sp.?
Occurrence as 1. U. S. N. M. 97625a, 97625b.

27, 28. *Helopora fragilis* Hall, × 4.
27, poorly preserved external mold in sandstone, in which it is abundant. The white spots are the projecting matrix filling the pores that are shown in 28, which is a specimen in limestone showing the external characters. Brassfield horizon. 27, basal sandstone, same locality as 23; 28, Cataract formation; forks of Credit River, Ontario, Canada. A very widespread fossil at this horizon. U. S. N. M. 97626, 71553.

29. *Orthonota?* sp.
Sandstone in Wills Creek formation. Associated with *Leperditia elongata willsensis* (Pl. 104, figs. 27, 28 and 32). Along Grannys Run half a mile southeast of Craig Healing Springs, Craig County. U. S. N. M. 97627.

30. *Pterinea* sp.
Wills Creek formation; 1 mile east of Monterey, Highland County. U. S. N. M. 97628.

31, 32. *Pterinea* sp.
Internal and external molds of the same specimen. Occurrence as 30; may be same species. U. S. N. M. 97629.

33. *Modiolopsis* sp.
Left valve. Occurrence as 30. U. S. N. M. 97631.

34-38. *Phaenopora expansa* Hall and Whitfield.
34, × 8, diagrammatic enlargement of the surface of another species to show external character of *Phaenopora;* 35, × 4, edge view of a fragment of a lamina; 36, one surface

FIGURE

of the bilaminar frond on which the specimen split. 37, 38, × 4, enlargement of parts of the exfoliated surface in lower left of 36. The rest of the surface of 36 is occupied by lozenge-shaped cells like those in 37. Occurrence as 1. 35, 36, U. S. N. M. 97632a, 97632b.

39, 40. *Cyrtodonta?*, 2 species.

Occurrence as 1. U. S. N. M. 97633, 97634.

41. *Pterinea* sp.?

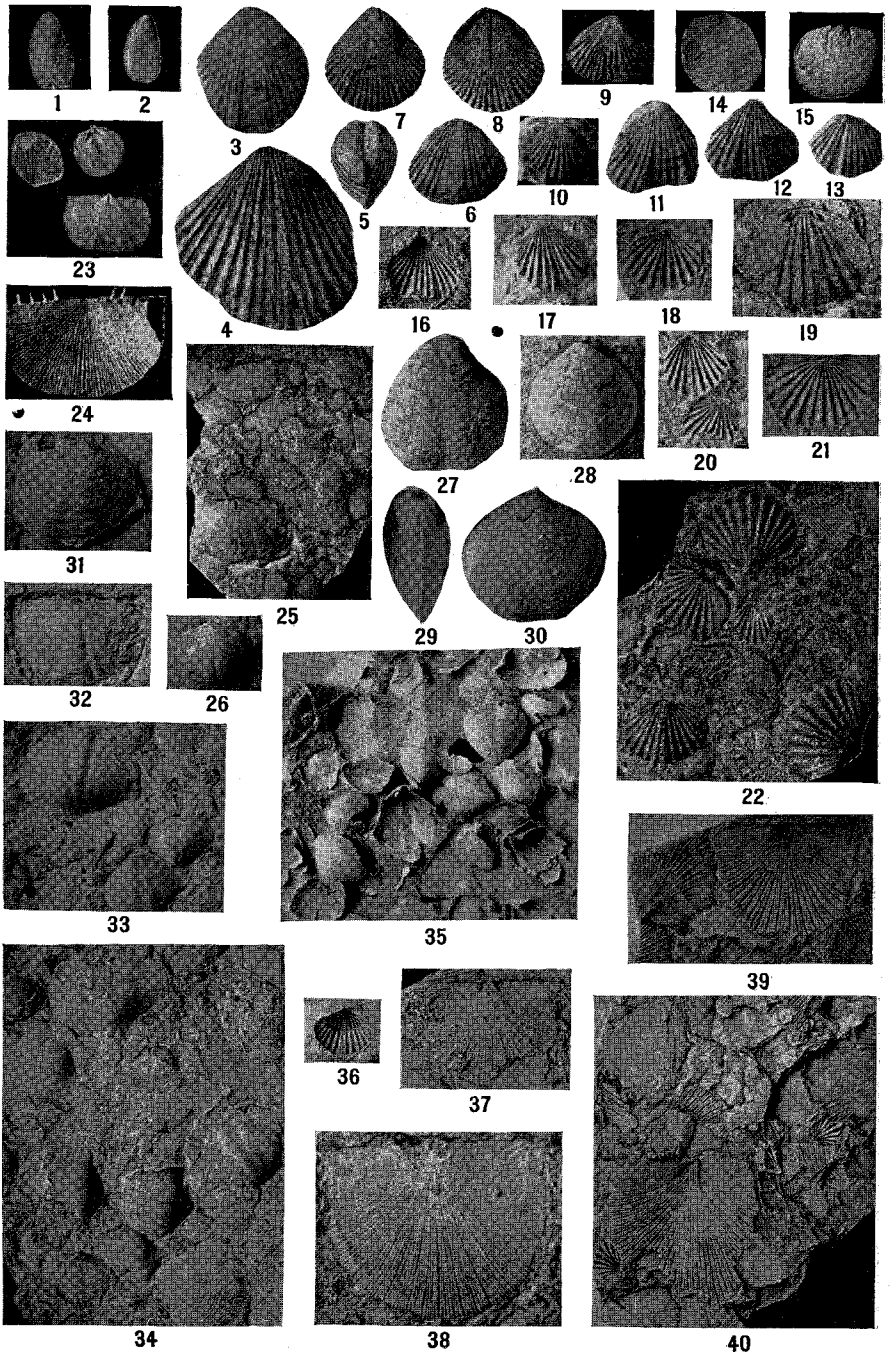
Clay impression from an external mold of a left valve. Occurrence as 29. U. S. N. M. 97635.

42. *Clidophorus* sp.

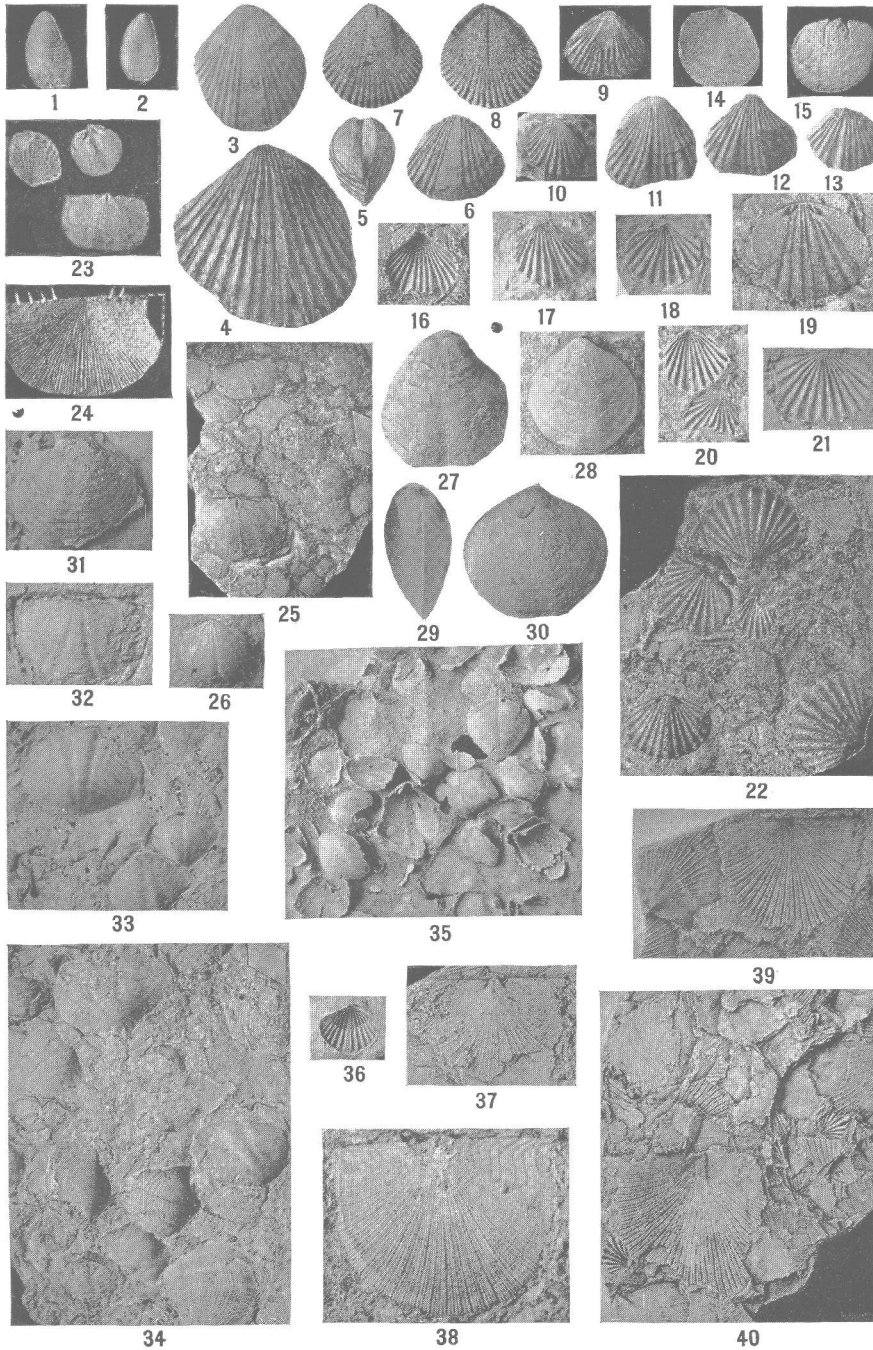
Right and left valves. Sandstone in base of Brassfield formation; half a mile southeast of Cumberland Gap, Tenn. U. S. N. M. 97636. (See part I, plate 60B.)

43. *Modiolopsis* sp.

Occurrence as 42. U. S. N. M. 97630.



BRASSFIELD, CLINTON, AND TONOLOWAY FOSSILS



BRASSFIELD, CLINTON, AND TONOLOWAY FOSSILS

PLATE 103.—BRASSFIELD, CLINTON, AND TONOLOWAY FOSSILS

FIGURE

1, 2. *Lingula cuneata* Conrad.

Brassfield formation, sandstone at base; half a mile southeast of Cumberland Gap, Tenn. U. S. N. M. 97637a, 97637b.

3–6. *Homeospira evax* (Hall).

3, ventral valve of a specimen; 4-6, ventral, profile, and dorsal views of a nearly whole specimen; 4, × 2. Clinton formation, Rochester horizon; along State Route 284 about 2 miles southeast of Crabbottom, Highland County. 3, U. S. N. M. 97638a; 4-6, 97638b.

7, 8. *Uncinulus?* sp.

Ventral and dorsal views of a specimen. Clinton formation; 2 miles north of Blackwater, Lee County. U. S. N. M. 97639.

9–13. *Camarotoechia tonolowayensis* Swartz.

9, 11, 12, ventral valves; 10, 13, dorsal valves. Tonoloway limestone? 9, 10, Tumbling Run 4 miles southwest of Saltville, Smyth County; 11-13, Flat Top Mountain about 1 mile east of Hollybrook, Bland County. U. S. N. M. 97640a, 97640b, 97641a, 97641b, 97641c.

14, 15. *Parmorthis?* sp., commonly called *Dalmanella elegantula* (Dalman).

14, impression of an external mold of a ventral valve; 15, internal mold of the same valve. Clinton formation; along road on southeast slope of Jack Mountain about 2½ miles west of Doe Hill, Highland County. U. S. N. M. 97621.

16, 17. *Camarotoechia neglecta* (Hall).

Ventral and dorsal valves. 16, Clinton formation; same locality as 3; 17, Brassfield limestone; same locality as 1. U. S. N. M. 97642, 97643.

18–22. *Anoplotheca hemispherica* (Sowerby).

18, external mold of a ventral valve; 19, internal mold of ventral valve, × 2; 20, external mold of a ventral valve (above), and of a dorsal valve (below); 21, external mold of a dorsal valve; 22, internal molds of 3 ventral valves and external mold of 1 dorsal valve. (See also Fig. 23.) Clinton formation. This fossil is apparently the only constant

FIGURE

member of the Clinton fauna from New York to Georgia and Alabama. 18, iron ore mine dump in Fourmile fenster about 2 miles south-southeast of Ewing, Lee County; 19, about 2½ miles northwest of Star Tannery post office, Frederick County; 20-22, southeast slope of Powell Mountain on U. S. Route 58 about 1 mile due north of Pattonsville, Scott County. U. S. N. M. 97644, 97645, 97646a, 97646b, 97646c.

23–25. *Chonetes novascoticus* Hall.

23, lower right, internal mold of a ventral valve; upper left, external mold of the ventral valve of *Anoplotheca hemispherica* showing ornamentation; upper right, small orthoid; 24, × 2, external mold of a ventral valve which preserves a few hinge spines; 25, slab with several internal molds of ventral valves. Clinton formation; about 1¾ miles northwest of Star Tannery post office, Frederick County. U. S. N. M. 97647a, 97647b, 97647c.

26–30. *Hindella* (*Greenfieldia*) *congregata* Swartz.

27-30, × 2. 26, 27, 30, ventral valves; 28, dorsal valve; 29, profile of the whole specimen of 30. Tonoloway limestone. 27, 28, same locality as 9; 26, 29, 30, along road near north end of Bolar Valley and 1 mile northwest of Trimble, Bath County. U. S. N. M. 97649a, 97648a, 97648b, 97649b.

31–34. *Reticularia bicostata* (Vanuxem).

31, ventral valve; 32, dorsal valve; 33, 34, parts of slabs with several specimens of ventral and dorsal valves. Occurrence as 3. U. S. N. M. 97650a, 97650b, 97650c, 97650d.

35. *Hindella* (*Greenfieldia*) *congregata* Swartz.

Etched slab with several specimens of both valves, some showing interiors. Occurrence as 26. U. S. N. M. 97649c.

36. *Trematospira camura* Hall.

External mold of a ventral valve. Occurrence as 3. U. S. N. M. 97651.

37–40. *Brachyprion corrugata* (Conrad).

37, internal mold of a ventral valve; 38-40, probably all external molds of ventral valves. 39, 40, show how thickly the shells are crowded together in the rock; 38, shows the crenulations in the upper right corner that suggest the specific name. Clinton formation; along U. S. Route 58 about half a mile northeast of Cumberland Gap village, Tenn. U. S. N. M. 97652a, 97652b, 97652c, 97652d.


1

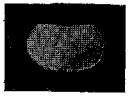

4


5


6

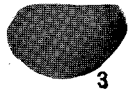

7

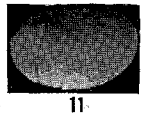

8


2


36

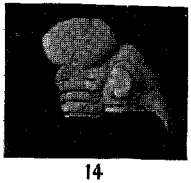

37

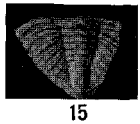

3


11


10

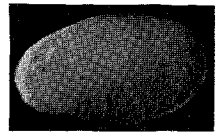

9


14


15

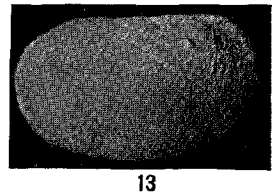

16


23


12


20


24

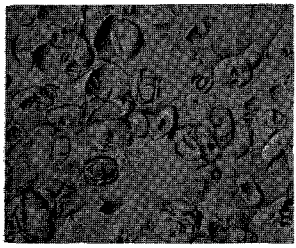

13

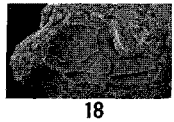

22


21


25


17

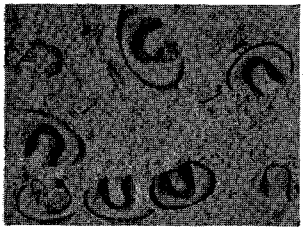

29

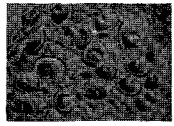

18


26

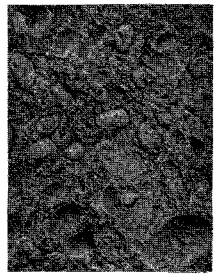

27

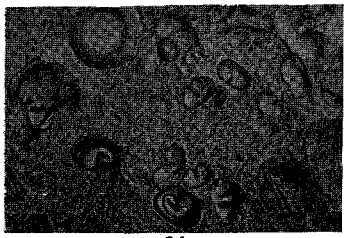

19


30

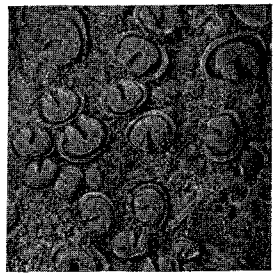

31


28

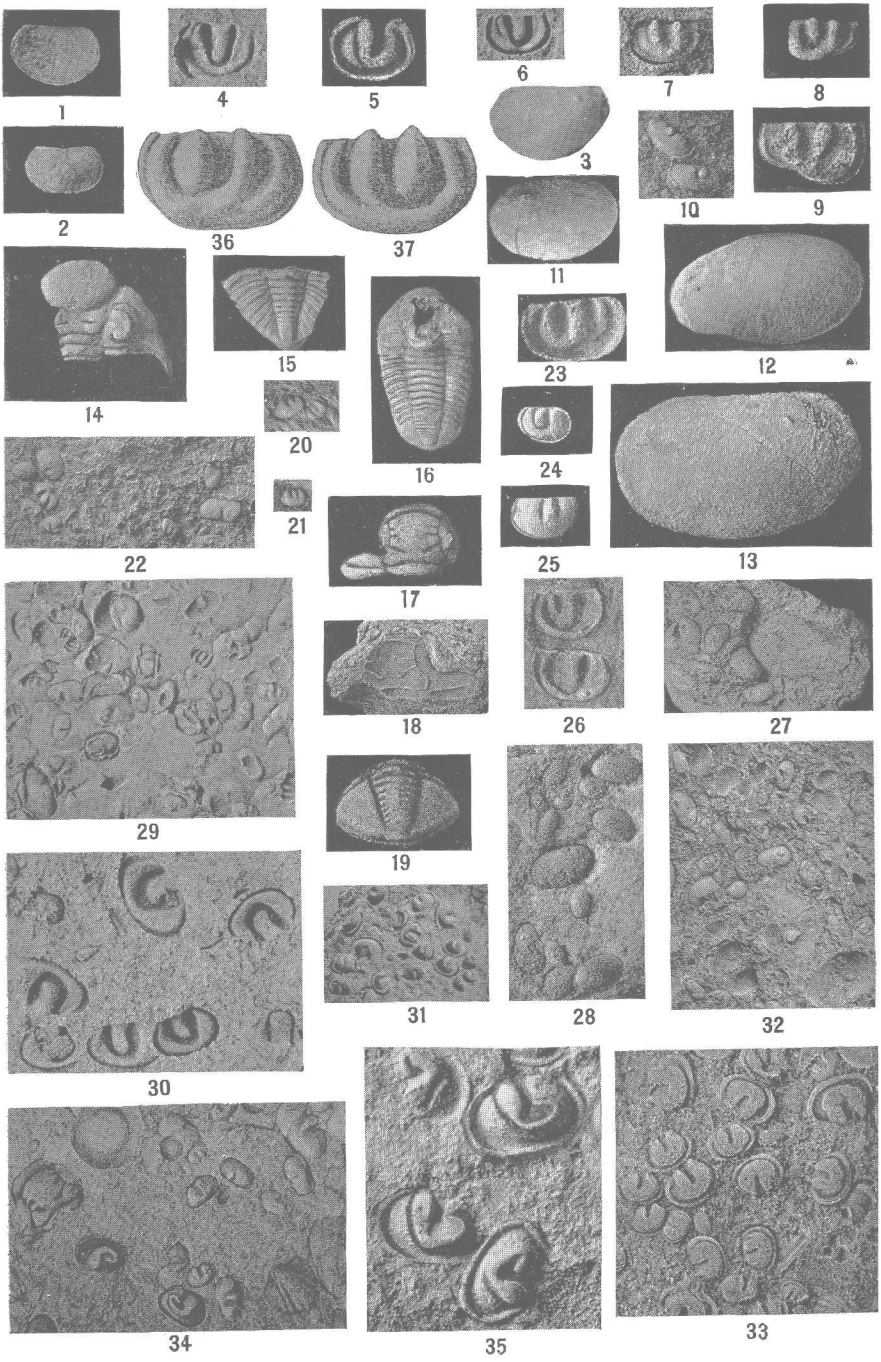

32


34


35


33

CLINTON, MCKENZIE, AND WILLS CREEK FOSSILS



CLINTON, MCKENZIE, AND WILLS CREEK FOSSILS

PLATE 104.—CLINTON, MCKENZIE, AND WILLS CREEK FOSSILS

FIGURE

1. *Leperditia alta* (Conrad), × 2.
   Interior of a left valve. Wills Creek limestone; along U. S. Route 50 just west of the north end of Great North Mountain, Frederick County. U. S. N. M. 97653.

2. *Leperditia scalaris praecedens* Ulrich and Bassler.
   Left valve. Tonoloway limestone?, along Chesapeake and Ohio Railway between Gala and Haden, Botetourt County. U. S. N. M. 97654.

3. *Leperditia altoides* Weller.
   Right valve. Occurrence as 2. U. S. N. M. 97655.

5. *Zygosella cristata* Ulrich and Bassler?
   Impression of an external mold of a right valve. Clinton formation, near top; along U. S. Route 58 on the east slope of Powell Mountain 1 mile due north of Pattonsville, Scott County. U. S. N. M. 97658.

4, 6–9. *Zygobolba decora* (Billings), × 4.
   4, 6, external molds of left valves; 7, internal mold of right valve; 8, 9, females, right and left internal molds. Horizon, low in the middle Clinton or lower Clinton near the top. 4, waste from mining of iron ore bed in Fourmile fenster 3 miles south of Ewing, Lee County; 6-9, same locality as 5. U. S. N. M. 97656a, 97657a, 97657b, 97657c, 97657d.

10. *Kloedenia longula* Ulrich and Bassler, × 4.
   Right and left valves. Wills Creek formation?, argillaceous limestone in bed of small creek not far above the top of the Bloomsburg sandstone; Harshberger Gap near south end of east ridge of Massanutten Mountain, Rockingham County. U. S. N. M. 97659.

11. *Isochilina?* sp.
   Slab with *Kloedenia longula* and *Leperditia*. Occurrence as 10. U. S. N. M. 97660.

12, 13. *Leperditia elongata willsensis* Ulrich and Bassler, × 4.
   12, left valve, crushed or abnormal?; 13, right valve. Wills Creek formation; same locality as 10. U. S. N. M. 97661a, 97661b.

FIGURE

14, 15. *Dalmanites limulurus* (Green).

Head and tail. Clinton formation, Rochester member; along State Route 284 about 2 miles southeast of Crabbottom, Highland County. U. S. N. M. 97664a, 97664b.

16–19. *Liocalymene clintoni* (Vanuxem).

16, a nearly entire individual; 17, internal mold of a head, × 2; 18, external mold of another head; 19, internal mold of a tail. Clinton formation. 16, in gap through Rich Patch Mountain about 1½ miles south of Rich Patch, Botetourt County; 17-19, along road about 2 miles northeast of Blackwater, Lee County. One of the commonest Clinton fossils in Va. U. S. N. M. 97665, 97666a, 97666b, 97666c.

20–22. *Kloedenia normalis* Ulrich and Bassler, × 4.

Also *Eukloedenella simplex,* U. S. N. M. 97692, in 22 on right. 20, 21, right valves; 22, left valve. McKenzie limestone; along State Route 284 about 2 miles southeast of Crabbottom, Highland County. U. S. N. M. 97667a, 97667b, 97667c.

23. *Drepanellina clarki* Ulrich and Bassler, × 4.

External mold of left valve. Characteristic fossil of the Rochester horizon of the Clinton formation; same locality as 20. U. S. N. M. 97670.

24, 25. *Kloedenia normalis* Ulrich and Bassler, × 4.

Left and right valves. 24, occurrence as 20; 25, Tonoloway or Wills Creek limestone; along Tumbling Run 4 miles southwest of Saltville, Washington County. U. S. N. M. 97668, 97669.

26. *Zygobolba decora* (Billings).

External mold of right valve. Occurrence as 4. U. S. N. M. 97656b.

27, 28. *Leperditia elongata willsensis* Ulrich and Bassler.

Internal molds of both valves. Wills Creek formation; along Grannys Run half a mile southeast of Craig Healing Springs, Craig County. U. S. N. M. 97662a, 97662b.

FIGURE

29. *Eukloedenella sinuata* Ulrich and Bassler.
Dizygopleura swartzi Ulrich and Bassler.

E. sinuata, the elongate forms with two low ridges; *D. swartzi,* the short forms with prominent lobes. Small piece of shale thickly covered with specimens, × 4. McKenzie formation; immediately beneath the Bloomsburg formation along U. S. Route 50 at north end of Great North Mountain, Frederick County. U. S. N. M. 97671, 97691.

30. *Zygobolbina conradi* Ulrich and Bassler, × 4.

External molds of both valves, thickly scattered on a small piece of sandstone. Clinton formation; on southeast slope of Jack Mountain 2 miles west of Doe Hill, Highland County. A good index fossil of the middle Clinton horizon. U. S. N. M. 97672.

32. *Leperditia elongata willsensis* Ulrich and Bassler.

Internal mold of both valves. Wills Creek formation; along State Route 284 about 2½ miles southeast of Crabbottom, Highland County. U. S. N. M. 97663.

31, 33. *Bonnemaia obliqua* Ulrich and Bassler.

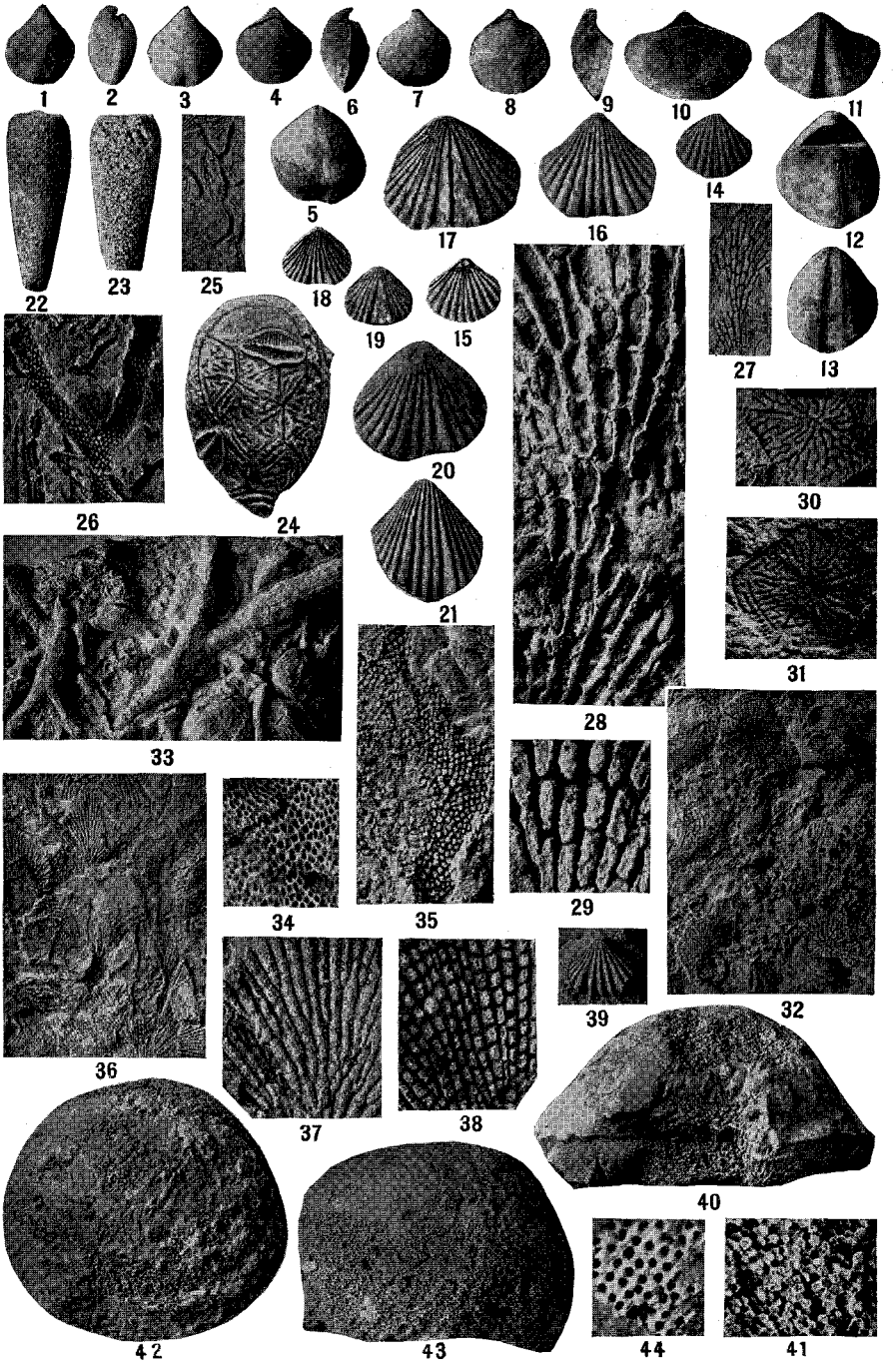
31, part of a small slab thickly strewn with internal molds; 33, wax impression of 31, × 2. Clinton formation, upper part; along railroad cut on Wolf Creek 1 mile south of Rocky Gap village, Bland County. U. S. N. M. 97613.

34, 35. *Mastigobolbina typus* Ulrich and Bassler.

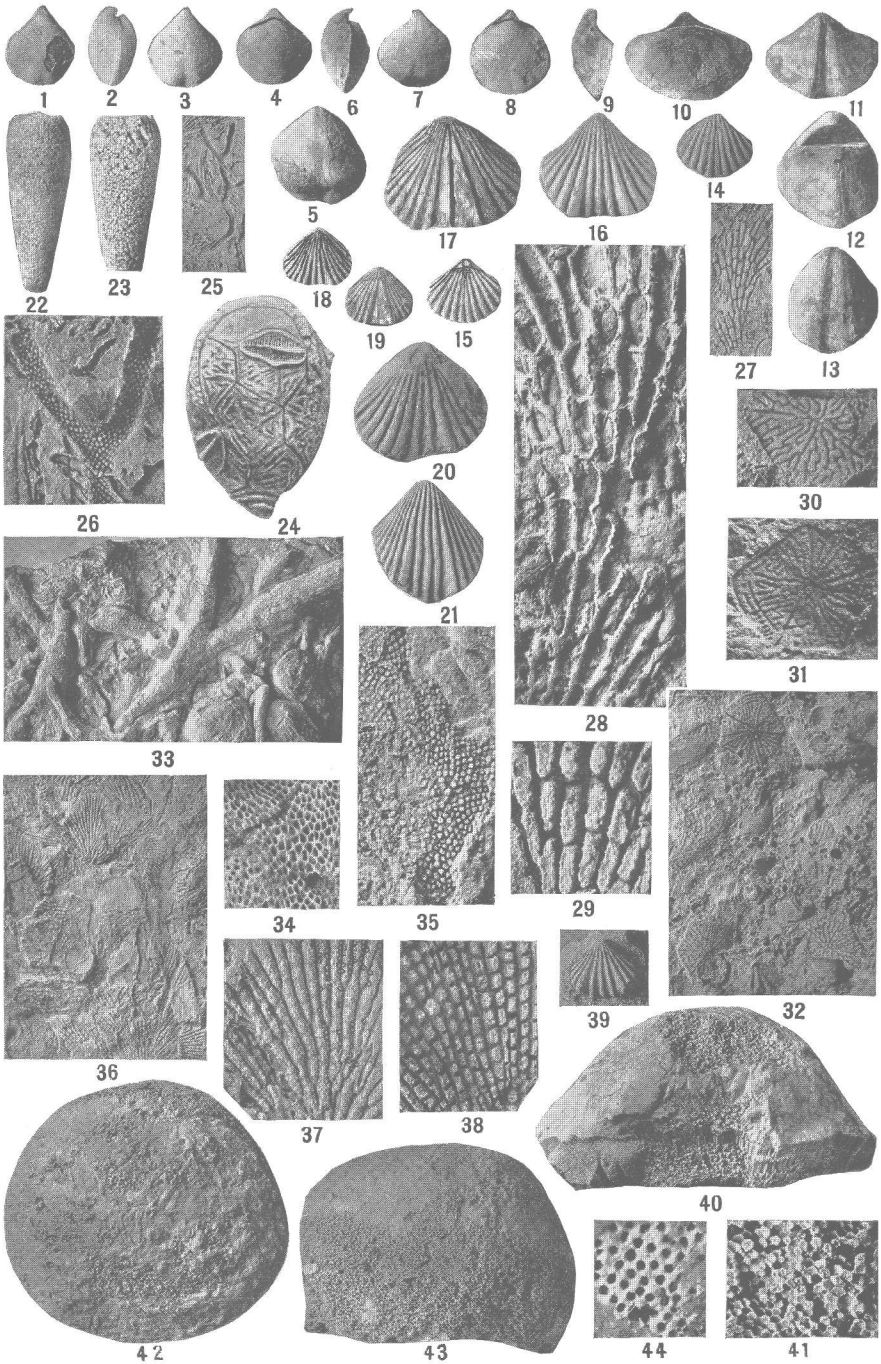
Wax impressions of external molds. 34, × 2; 35, × 4. In 35, the upper two are right valves and the lower a left valve. Clinton formation, near top; along State Route 284 about 2 miles southeast of Crabbottom, Highland County. A good index fossil of the upper Clinton. U. S. N. M. 97673a, 97673b.

36, 37. *Drepanellina clarki* Ulrich and Bassler, × 8.

Right and left valves. Enlarged drawings of perfect specimens to show actual character, Cumberland, Maryland. Characteristic fossils of the Rochester horizon of the Clinton formation. U. S. N. M. 83478.



KEYSER FOSSILS



KEYSER FOSSILS

PLATE 105.—KEYSER FOSSILS

FIGURE

1–3. *Whitfieldella nucleolata* Hall.

Dorsal, profile, and ventral views of a whole specimen. Keyser limestone; about 1½ miles northwest of Palo Alto, Highland County. U. S. N. M. 97675.

4–8. *Hindella* (*Greenfieldia*) *congregata* Swartz?

4, 6, 7, dorsal, profile, and ventral views of a whole specimen. 5, 8, ventral and dorsal views of other specimens. Keyser limestone; along U. S. Route 250 about 1 mile southeast of McDowell, Highland County. 4, 6, 7, U. S. N. M. 97676a; 5, 97676b; 8, 97676c.

9–11. *Spirifer modestus* Hall.

Profile, dorsal, and ventral views of a whole specimen. Keyser limestone; about 2 miles northwest of Palo Alto, Highland County. U. S. N. M. 97677.

12, 13. *Spirifer modestus plicatus* Maynard.

Dorsal and ventral views of a whole specimen, with obscure ribs barely visible on the ventral valve. Occurrence as 9. U. S. N. M. 97678.

14, 15. *Trematospira* cf. *T. camura* Hall.

Ventral and dorsal views of a whole specimen. Keyser limestone; southeast slope of Peters Hill about 2 miles west of Newcastle, Craig County. U. S. N. M. 97679.

16–21. *Camarotoechia litchfieldensis* (Schuchert).

16, 21, ventral valves of 2 specimens, × 2; 18, 19, ventral and dorsal views of a specimen; 19, exfoliated; 17, 20, dorsal, and ventral views of the same specimen as 18, 19, × 2; Keyser limestone. 16, 21, same locality as 1; 17-20, about 2 miles northeast of Van Buren Furnace, Shenandoah County. (See Pl. 109, figs. 8-10.) 16, 21, U. S. N. M. 97681a, 97681b; 17-20, 97680.

22–24. *Lepocrinites manlius* Schuchert.

22, 23, stems; 24, head, retaining the upper part of the stem. Keyser limestone. 22, same locality as 14; 23, along road 2½ miles west of Newcastle, Craig County; 24, Keyser, W. Va. (courtesy of Maryland Geological Survey, Lower Devonian, Pl. 32, fig. 8). 22, 23, U. S. N. M. 97674, 97725.

FIGURE

25, 26. *Orthopora rhombifera* (Hall).
26, part of 25, × 4. Occurrence as 17. U. S. N. M. 97682.

27–29. *Fenestrellina altidorsata* (Ulrich and Bassler).
27, external mold of the celluliferous side; 28, impression of 27, × 4; 29, part of 27, × 4. Occurrence as 17. U. S. N. M. 97683.

30-32. Cystid plates, probably *Pseudocrinites abnormalis* Schuchert, 30, 31, × 2.
Occurrence as 9. U. S. N. M. 97684a, 97684b, 97684.

33, 34. *Eridotrypa parvulipora* Ulrich and Bassler.
34, × 4. Occurrence as 4. U. S. N. M. 97685a, 97685b.

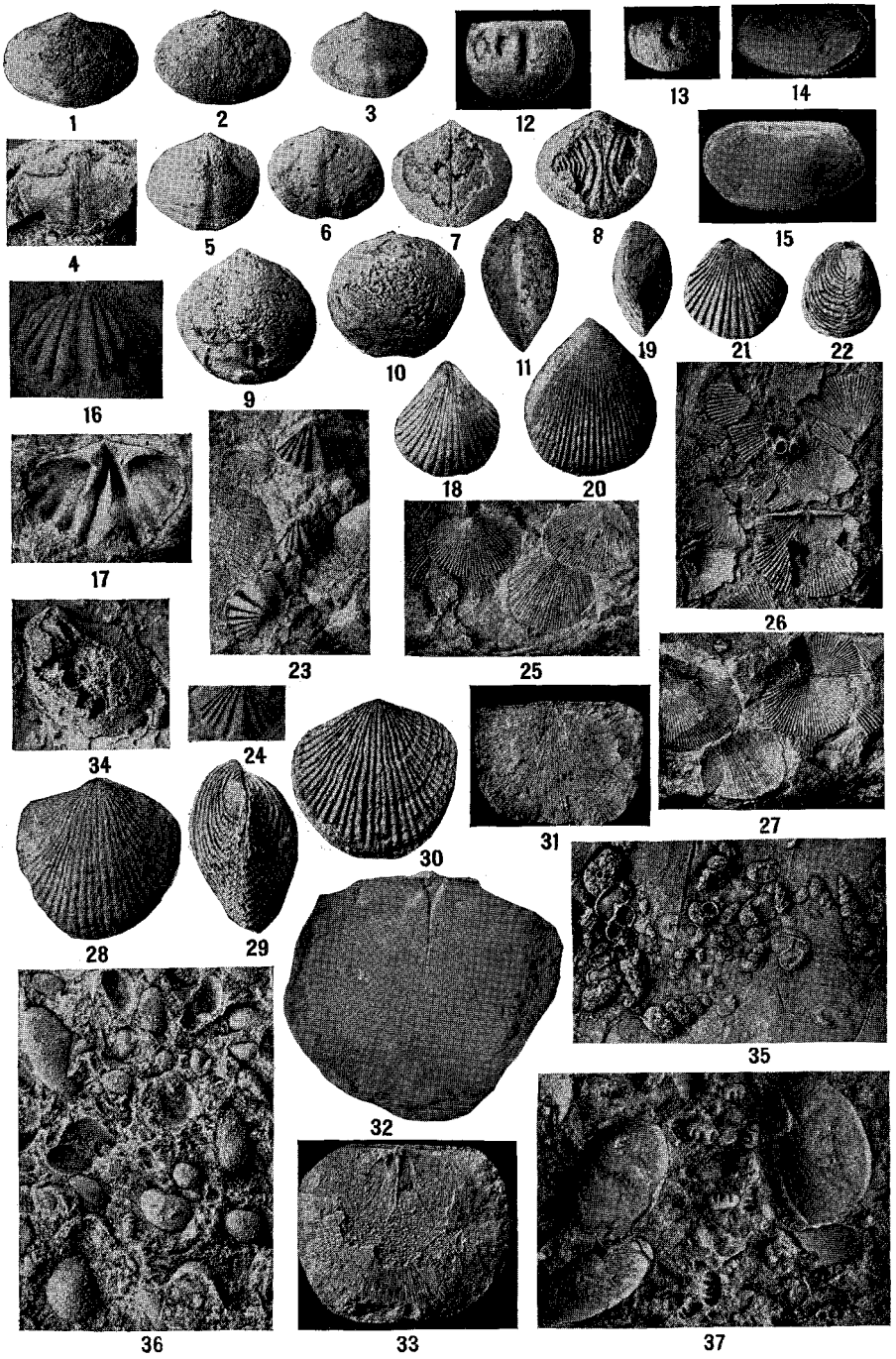
35. *Diplostenopora siluriana* (Weller), × 4.
Poorly preserved, external mold in limestone. Occurrence as 17. U. S. N. M. 97686.

36–38. *Fenestrellina cumberlandica* (Ulrich and Bassler).
36, slab with a mat of fossils; 37, 38, celluliferous and non-celluliferous surface, × 2. Occurrence as 17. U. S. N. M. 97687.

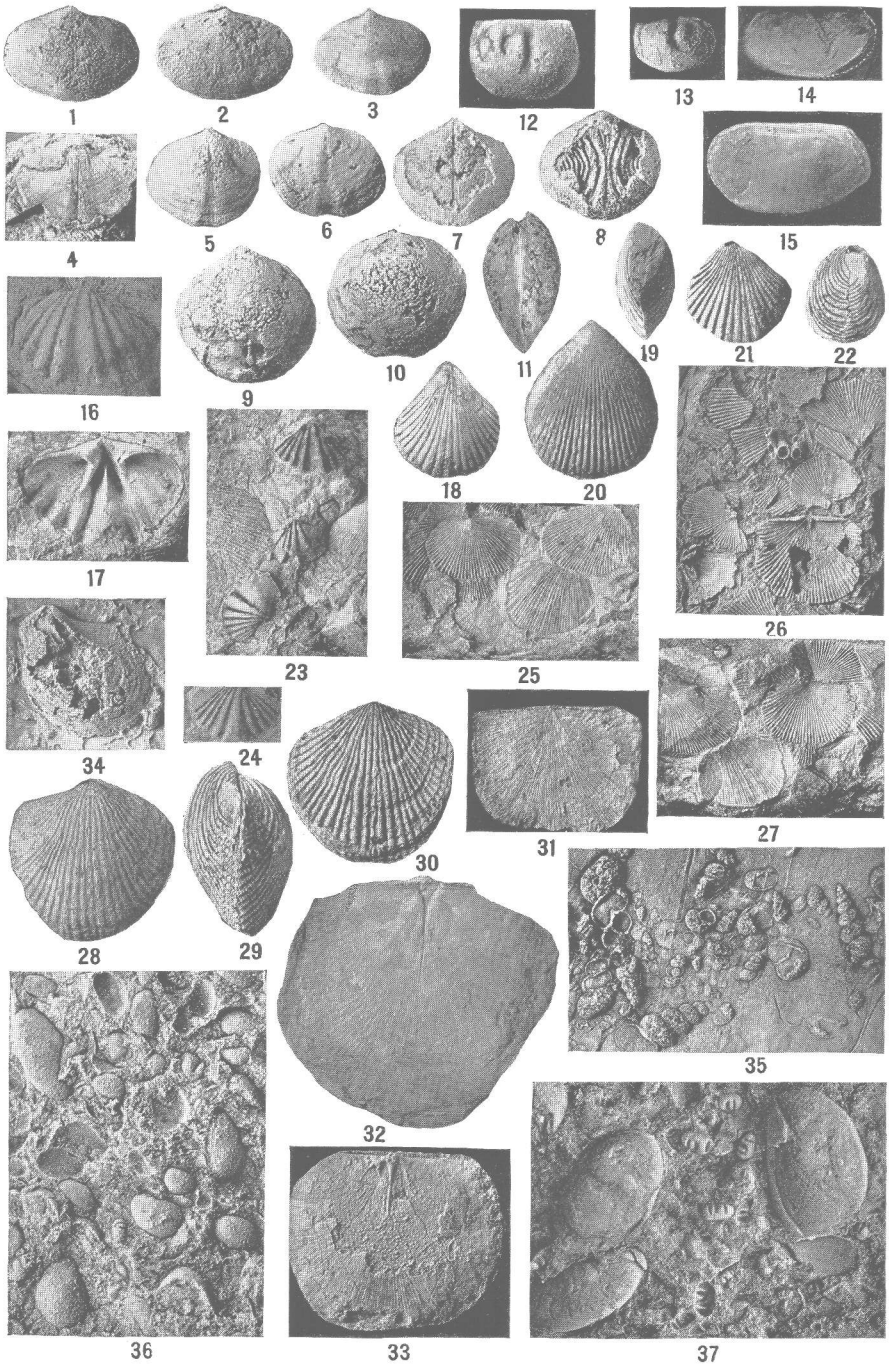
39. *Camarotoechia* cf. *C. altiplicata* (Hall).
Ventral valve, apparently representing the silicified shell. Occurrence as 9. U. S. N. M. 97688.

40, 41. *Cyphotrypa corrugata* (Weller).
41, × 4. Occurrence as 9. U. S. N. M. 97689.

42–44. *Stromatotrypa globularis* Ulrich and Bassler.
42, 43, summit and lateral views; 44, part of surface, × 4. Keyser limestone; along U. S. Route 250 in Back Creek Valley on the northwest slope of Lantz Mountain, Highland County. U. S. N. M. 97690.



KEYSER FOSSILS



KEYSER FOSSILS

PLATE 106.—KEYSER FOSSILS

FIGURE

1–6. *Nucleospira elegans* Hall.

1, 2, ventral and dorsal views of a whole specimen; 3, ventral valve of another specimen; 4, internal mold of a ventral valve showing the narrow furrow made by the low septum in that valve; 5, 6, dorsal and ventral views of a narrower specimen. Keyser limestone; Peters Hill 2 miles west of Newcastle, Craig County. U. S. N. M. 97693a, 97693b, 97693c, 97693d.

7–11. *Nucleospira swartzi* Maynard?, × 2.

7, 8, ventral and dorsal views of a partially exfoliated specimen; 8, showing the spiral arm supports; 9-11, ventral, dorsal and profile views of another specimen. Keyser limestone; 2 miles northeast of Van Buren Furnace, Shenandoah County. U. S. N. M. 97694a, 97694b.

12, 13. *Kloedenia* sp., × 4.

Left and right valves of different specimens. Keyser limestone; 1 mile southeast of McDowell, Highland County. U. S. N. M. 97695a, 97695b.

14, 15. *Leperditia elongata* Weller, × 4.

Left and right valves. Occurrence as 12. U. S. N. M. 97696, 97697.

16, 17. *Delthyris perlamellosus praenuntius* F. M. Swartz.

Exterior and interior of different ventral valves. Occurrence as 1. U. S. N. M. 97698a, 97698b.

18, 19. *Uncinulus convexorus* Maynard.

Dorsal and profile views of a whole specimen. The ventral valve is almost the same as the dorsal. Occurrence as 7. U. S. N. M. 97699.

20. *Uncinulus* cf. *U. globulus* Schuchert.

Ventral valve. Keyser limestone?; about 800 feet southeast of Bells Valley, Augusta County. U. S. N. M. 97700.

21, 22. *Uncinulus nucleolatus* (Hall)?

Dorsal and profile views of a nearly whole specimen. Keyser limestone; about 2 miles northwest of Palo Alto, Highland County. U. S. N. M. 97701.

FIGURE

23, 24. *Spirifer vanuxemi* Hall.

23, slab with two ventral valves (upper), and one dorsal valve (lower); 24, dorsal valve. Associated with *Chonetes jerseyensis* (25-27). Keyser limestone; on Sand Ridge 2½ miles southwest of Gore, Frederick County. U. S. N. M. 97702a, 97702b.

25–27. *Chonetes jerseyensis* Weller.

Small pieces of rock covered with many specimens, some in fragmentary condition; mostly ventral valves, some showing interiors. 25, 27, counterparts. This fossil is highly diagnostic of the lowermost part of the Keyser limestone. 25, 27, same locality as 23; 26, same locality as 1. 25, 27, U. S. N. M. 97703; 26, 97704.

28–30. *Atrypa reticularis* (Linné).

28, 30, dorsal and ventral views of a specimen; 29, profile view of another specimen. Keyser limestone. 28, 30, same locality as 1; 29, 1¾ miles west of Palo Alto, Highland County. 28, 30, U. S. N. M. 97705; 29, 97706.

31–33. *Stropheodonta bipartita* (Hall).

31, partly exfoliated ventral valve showing internal mold of beak; 32, internal mold of a dorsal valve; 33, partly exfoliated ventral valve showing the interior of the dorsal valve below. All show the hinge denticles. 31, occurrence as 23; 32, occurrence as 21; 33, occurrence as 1. U. S. N. M. 97707, 97708, 97709.

34. *Pterinea?* sp.

Left valve. Keyser limestone; along U. S. Route 250 on the southeast slope of Bullpasture Mountain, Highland County. U. S. N. M. 97710.

35. *Hormotoma?* sp.

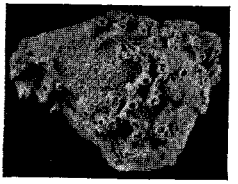
A small piece of limestone crowded with these high-spired gastropods. Keyser, or perhaps Tonoloway, limestone; same locality as 12. U. S. N. M. 97711.

36. *Leperditia* and other small ostracodes.

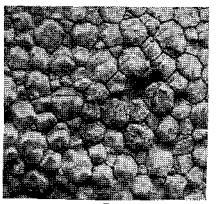
Of common occurrence in the Keyser limestone; Buffalo Gap, Augusta County. U. S. N. M. 97712.

FIGURE

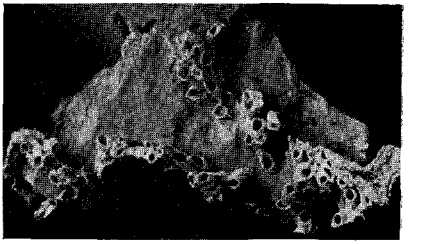
37. Small piece of argillaceous limestone crowded with ostracodes; *Leperditia* (large) and probably species of *Dizygopleura* (small). Occurrence as 12. 36, 37 are good examples of the prolific occurrence of these small ostracodes peculiarly characteristic of the Tonoloway and Keyser limestones. U. S. N. M. 97713.



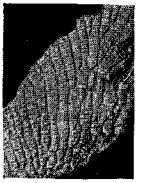
1



2

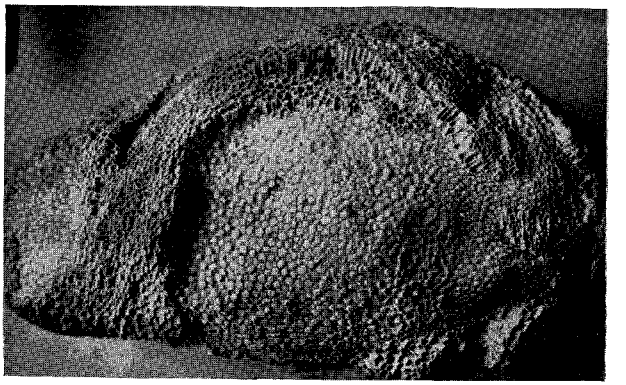


6



3

7



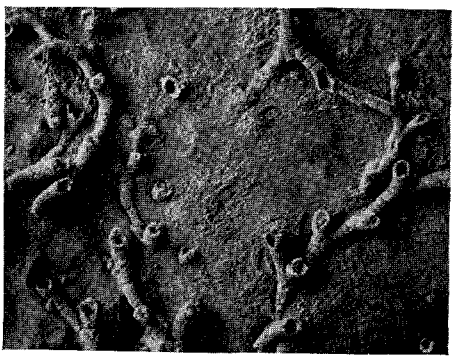
5

4

9

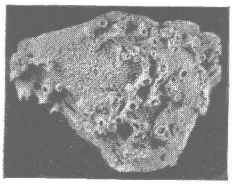
8

10

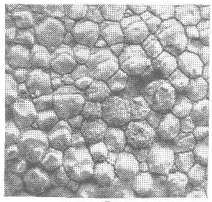


11

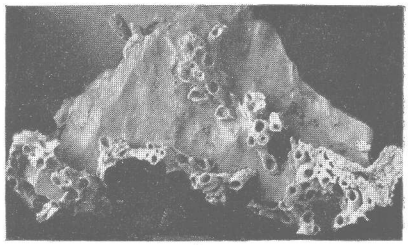
KEYSER FOSSILS



1

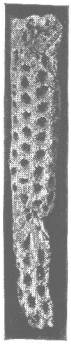


2

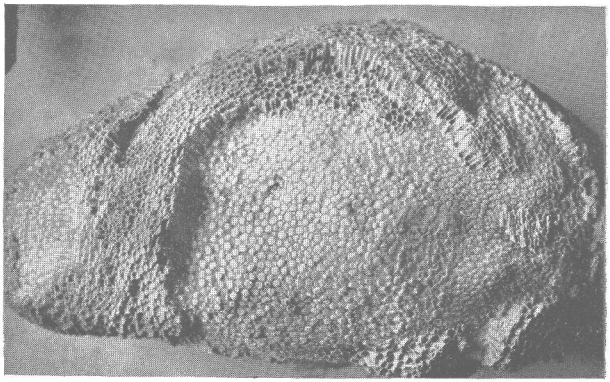


6

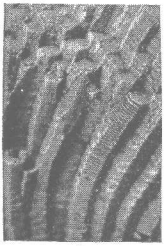
3



7

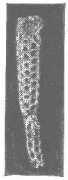


5



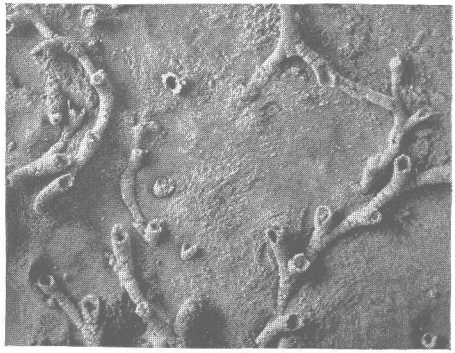
4

9



8

10



11

KEYSER FOSSILS

PLATE 107.—KEYSER FOSSILS

FIGURE

1. *Aulopora* cf. *A. schohariae* Hall.

   Attached to a massive bryozoon. Keyser limestone; 1½ miles northwest of Palo Alto, Highland County. U. S. N. M. 97714.

2–5. *Favosites helderbergiae* Hall.

   2, 4, × 2. 5, whole head; 2, direct view of 5, to show size and shape of coralites in transverse section; 4, side view of 5, to show radial coralites with tabulae; 3, side view of another specimen. Keyser limestone. 5, Paddy Run about 5 miles southwest of Star Tannery post office, Frederick County; 3, about 2 miles northeast of Van Buren Furnace, Shenandoah County. 2, 4, 5, U. S. N. M. 97715; 3, 97716.

6. *Ceratopora?* sp.

   Probably undescribed species. Keyser limestone; along U. S. Route 250 on the northwest slope of Lantz Mountain, Highland County. U. S. N. M. 97717.

7–9. *Cladopora rectilineata* Simpson.

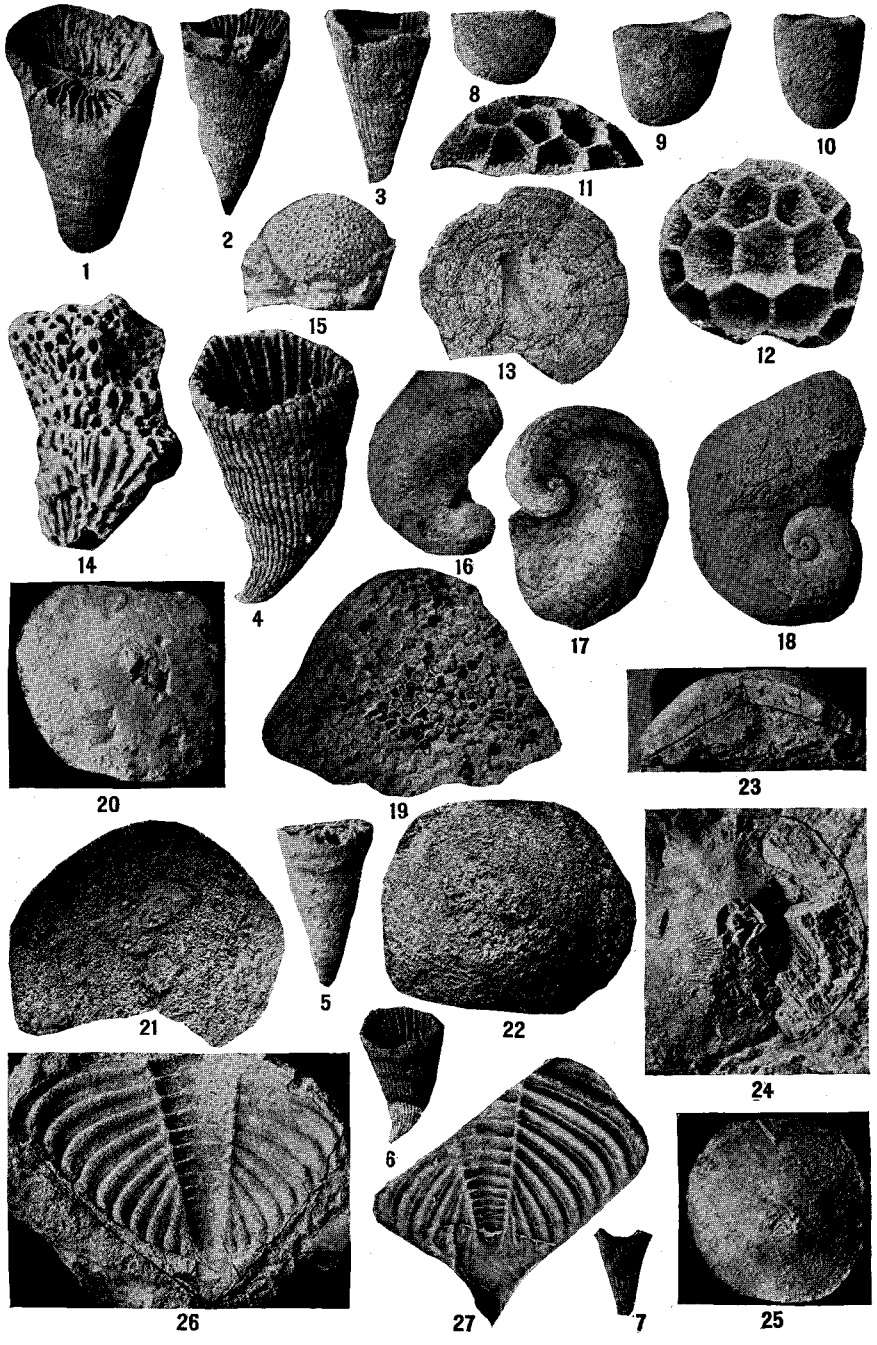
   7, × 4; 8, × 2, of same specimen. Keyser limestone. 7, 8, same locality as 6. 9, Keyser, W. Va. (courtesy of Maryland Geol. Survey, Lower Devonian, Pl. 25, fig. 4). Perhaps the best guide fossil of the Keyser. 7, 8, U. S. N. M. 97718.

10. *Cladopora multiseriata* Weller.

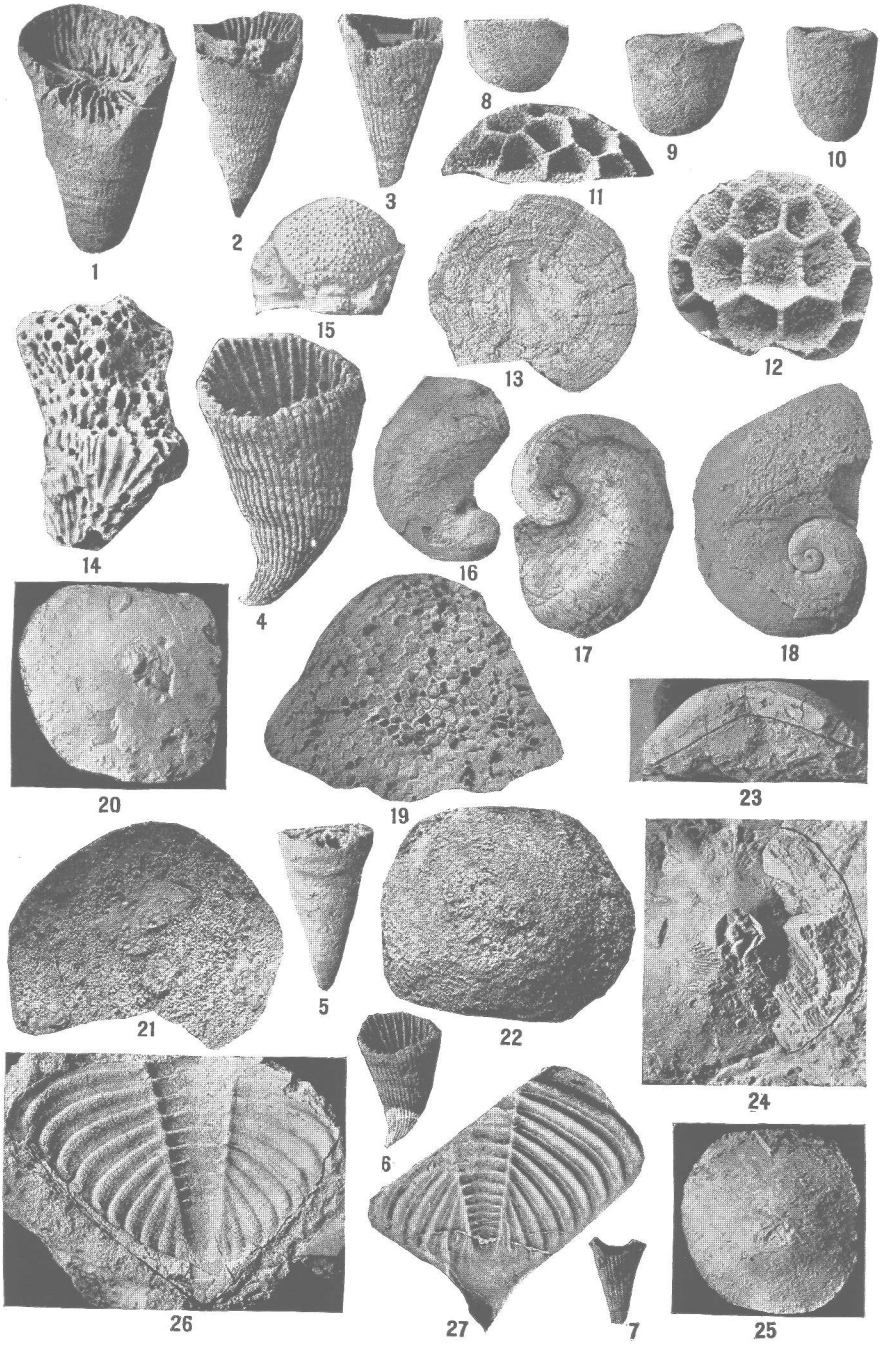
   Keyser limestone; Island Ford along U. S. Route 60 about 3½ miles southeast of Covington, Alleghany County. U. S. N. M. 97719.

11. *Ceratopora?* cf. *C.? marylandica* C. K. Swartz, × 2.

   Occurrence as 7. U. S. N. M. 97720.



KEYSER, NEW SCOTLAND, AND BECRAFT FOSSILS



KEYSER, NEW SCOTLAND, AND BECRAFT FOSSILS

PLATE 108.—KEYSER, NEW SCOTLAND, AND BECRAFT FOSSILS

FIGURE

1–7. *Streptelasma strictum* Hall.

3, same as 7, × 2; 4, same as 6, × 2. Helderberg, New Scotland member; along U. S. Route 250 on southeast slope of Bullpasture Mountain, Highland County. U. S. N. M. 97726a, 97726b, 97726c, 97726d, 97726e.

8–10. *Edriocrinus pocilliformis* Hall.

Three bases of different size and proportions. Helderberg, New Scotland member; along U. S. Route 220 about 8 miles southwest of Monterey, Highland County. One of the most distinctive New Scotland fossils. U. S. N. M. 97727a, 97727b, 97727c.

11–13. *Pleurodictyum lenticulare* (Hall).

Lateral, calycinal, and basal views of a specimen. Helderberg, New Scotland member; along U. S. Route 60 just east of Covington, Alleghany County. U. S. N. M. 97728.

14. *Striatopora* or *Cladopora* sp., × 3.

Helderberg, probably Keyser member; at Island Ford along U. S. Route 60 about 4 miles east of Covington, Alleghany County. U. S. N. M. 97729.

15. *Phacops logani* Hall.

Helderberg, Becraft member; along State Route 311 about 1 mile south of Newcastle, Craig County. U. S. N. M. 97730.

16, 17. *Platyceras trilobatum* Hall.

16, occurrence as 1; 17, occurrence as 8; U. S. N. M. 97731, 97934.

18. *Platyceras gebhardi* Conrad.

Occurrence as 1. U. S. N. M. 97732.

19. *Favosites conicus* Hall.

Occurrence as 1. U. S. N. M. 97733.

20–25. *Aspidocrinus scutelliformis* Hall.

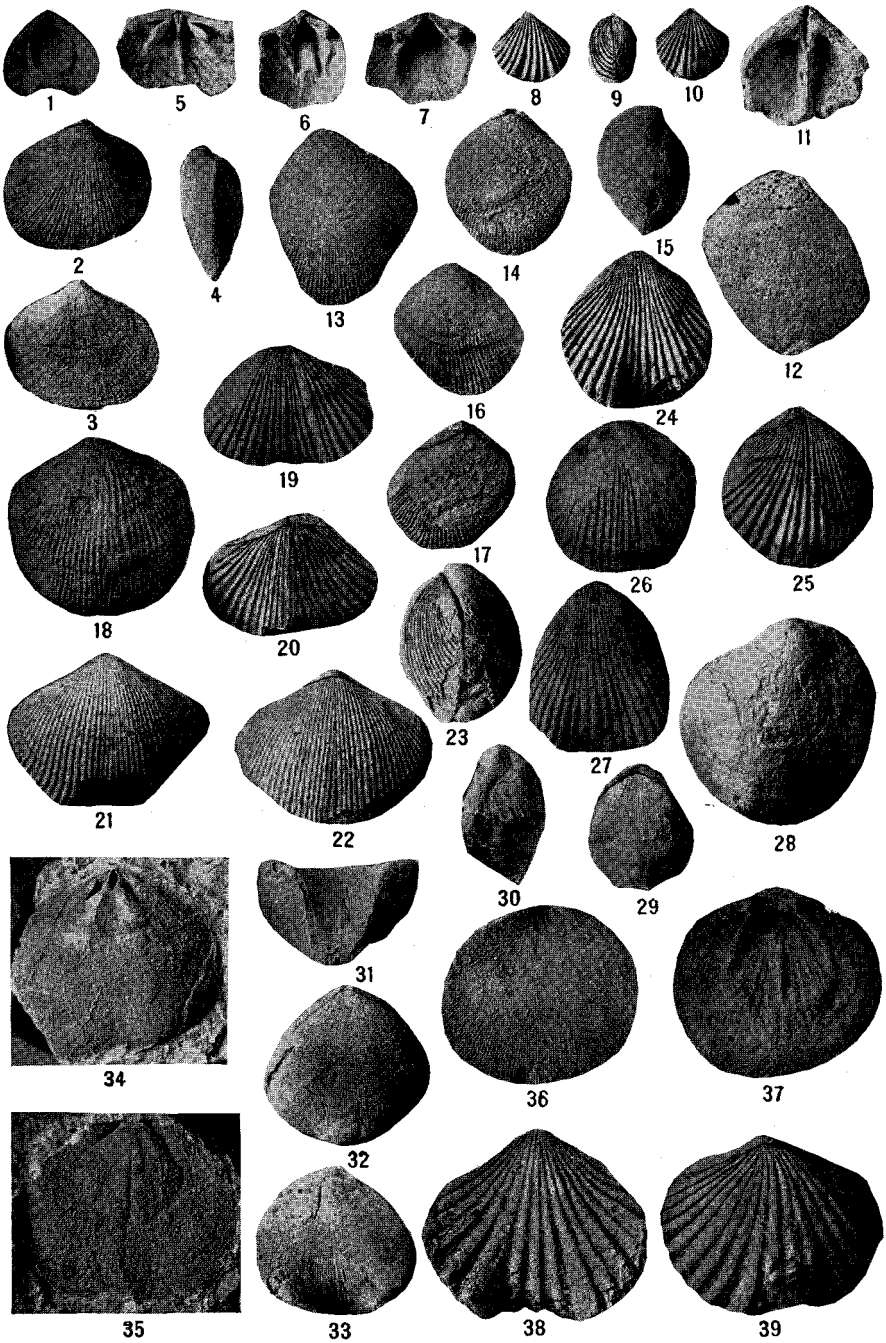
20, 22, 24, 25, external molds of the lower side of basal discs; 21, external mold of the upper side of a basal disc, concave toward the observer; 23, transverse section of

FIGURE

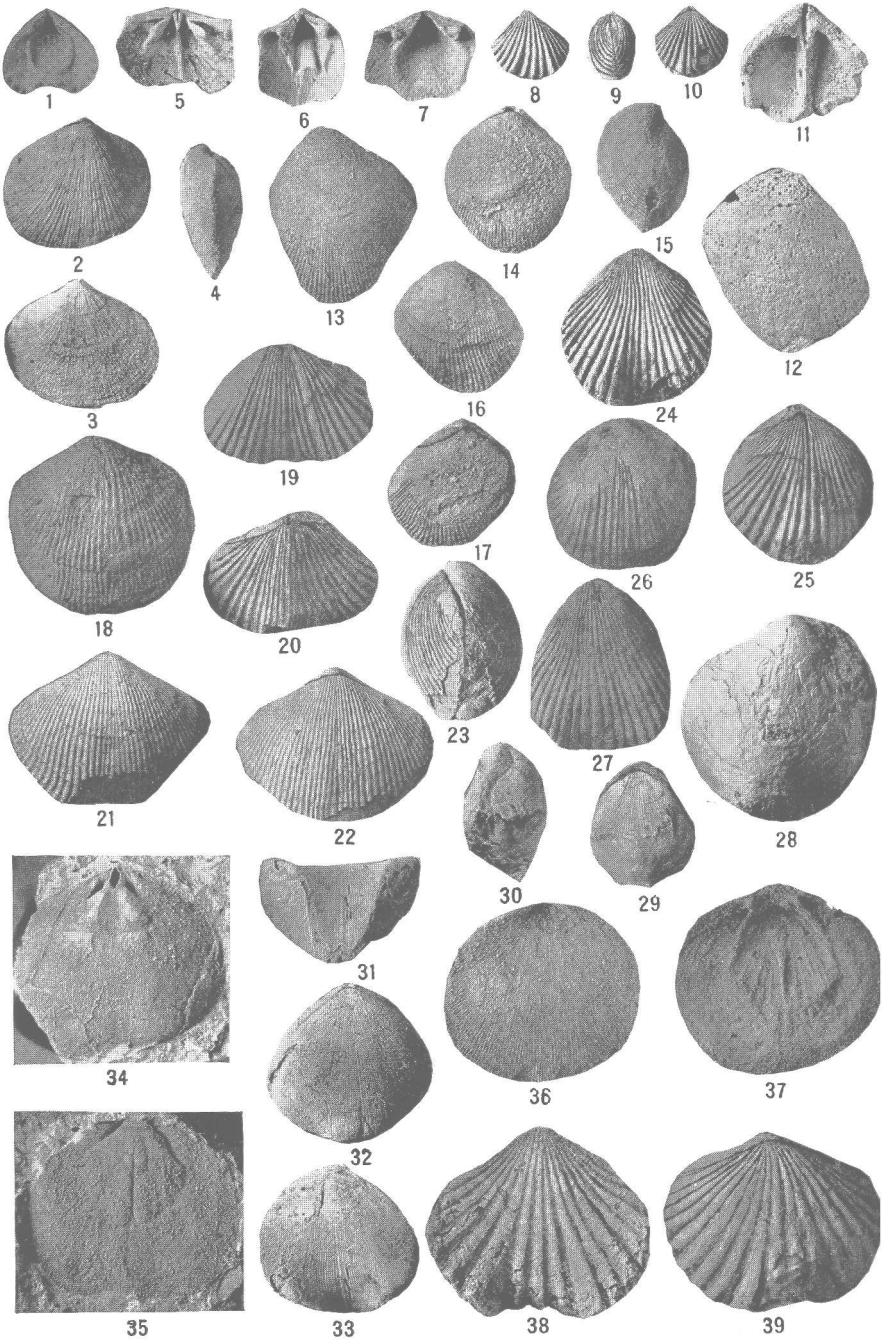
a basal disc filled with matrix. The specimen of 24 retains part of the basal disc (on the right). Helderberg limestone, Becraft member. 21, 22, from sandstone boulders at base of southeast slope of Wolf Creek Mountain and just east of junction of Wilderness Creek with Hunting Camp Creek, Bland County; 20, 23-25, northeast slope of Stone Mountain about 5 miles northeast of Honaker, Russell County. The specimens of 21, 22, may be another species which F. M. Swartz has named *Aspidocrinus caroli.* They are in coarse-grained sandstone and coated with manganese or iron oxide. This fossil is so abundant in the Becraft limestone of the Helderberg Mountains in New York that the Becraft was originally named the Scutella limestone. U. S. N. M. 97734a, 97735a, 97735b, 97734b, 97734c, 97734d.

26, 27. *Dalmanites pleuroptyx* (Green).

External molds of two tails. Concave toward the observer. Helderberg, New Scotland member. 26, along road in gorge of Jackson River through Morris Hill-Coles Mountain, Alleghany County; 27, same locality as 8. Fragments of this trilobite are common in the New Scotland. U. S. N. M. 97736, 97737.



KEYSER, NEW SCOTLAND, AND BECRAFT FOSSILS



KEYSER, NEW SCOTLAND, AND BECRAFT FOSSILS

PLATE 109.—KEYSER, NEW SCOTLAND, AND BECRAFT FOSSILS

FIGURE

1. *Eatonia peculiaris* (Conrad).

Ventral interior. Helderberg, New Scotland member; along U. S. Route 250 on the southeast slope of Bullpasture Mountain, Highland County. U. S. N. M. 97738.

2–7. *Rhipidomella oblata* (Hall).

2-4, dorsal, ventral, and profile views of a whole specimen; 5, dorsal interior; 6-7, ventral interiors. Helderberg, New Scotland member; along U. S. Route 220 half a mile north of Pinckney and 8 miles southwest of Monterey, Highland County. 2-4, U. S. N. M. 97740a; 5, 6, 7, 97740b, 97740c, 97740d.

8–10. *Camarotoechia litchfieldensis* (Schuchert).

Ventral, profile, and dorsal views of a whole specimen. Keyser limestone; 1½ miles northwest of Palo Alto, Highland County. (See Pl. 105, figs. 16-21.) U. S. N. M. 97681c.

11, 12. *Gypidula coeymanensis* var. *prognostica* Maynard.

11, interior of a ventral valve; 12, exterior of a fragment of another ventral valve. Keyser limestone?; along U. S. Route 250 on the northwest slope of Lantz Mountain, Highland County. U. S. N. M. 97741a, 97741b.

13–17. *Rensselaeria subglobosa* Weller.

13, 14, ventral and dorsal valves of different specimens; 15-17, profile, ventral, and dorsal views of a nearly whole but slightly distorted specimen. Occurrence as 2. 13, 14, U. S. N. M. 97742a, 97742b; 15-17, 97742c.

18. *Atrypa reticularis* (Linné).

Ventral valve. Helderberg, Becraft member; entrance to fair grounds and airport, Bluefield, W. Va. U. S. N. M. 97743.

19, 20. *Trematospira multistriata* (Hall).

Ventral and dorsal views of a specimen. Helderberg, New Scotland member; along U. S. Route 250 about 2 miles northwest of McDowell, Highland County. U. S. N. M. 97744.

FIGURE

21–23. *Trematospira equistriata* Hall and Clarke.
Ventral, dorsal, and profile views of a specimen. Occurrence as 2. U. S. N. M. 97935.

24, 25. *Uncinulus abruptus* (Hall).
Ventral and dorsal views of a specimen. Occurrence as 1. U. S. N. M. 97745.

26, 27. *Uncinulus,* species not determined.
Dorsal and ventral valves of different specimens; may be two species. Helderberg, Becraft member; along State Route 311 about 1 mile south of Newcastle, Craig County. U. S. N. M. 97746a, 97746b.

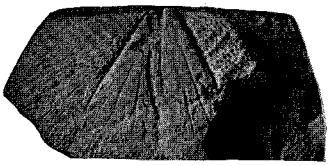
28. *Meristella lata* (Hall).
Ventral valve. Occurrence as 26. U. S. N. M. 97747.

29, 30. *Eatonia peculiaris* (Conrad).
Dorsal and profile views of a narrow and partly exfoliated specimen. Occurrence as 26. U. S. N. M. 97739.

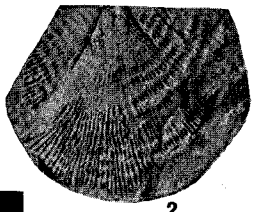
31–33. *Eatonia singularis* (Vanuxem).
Anterior, dorsal, and ventral views of a large, well preserved specimen. Helderberg, New Scotland member; along U. S. Route 60 just east of Covington, Alleghany County. U. S. N. M. 97748.

34–37. *Rhipidomella assimilis* (Hall)?
34, internal mold of a dorsal valve; 35, internal mold of a ventral valve; 36, external mold of a ventral valve; 37, interior of a ventral valve. Helderberg, Becraft member. 34-36, manganese ore pit on Flat Top Mountain 1 mile northwest of Hollybrook, Giles County; 37, locality as 2. U. S. N. M. 97749a, 97749b, 97749c, 97751.

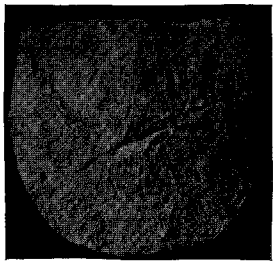
38, 39. *Eatonia medialis* (Vanuxem).
Ventral and dorsal views of two specimens. Helderberg, New Scotland member. 38, Pinckney, 4 miles southwest of Vanderpool, Highland County; 39, same locality as 1. Common fossil of the New Scotland member. U. S. N. M. 97936, 97750.



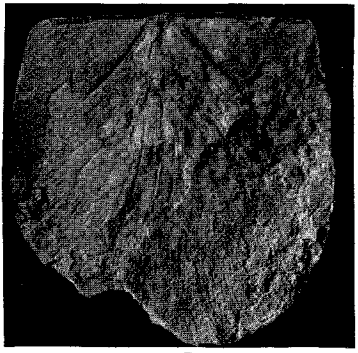
1



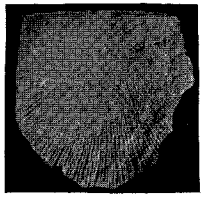
2



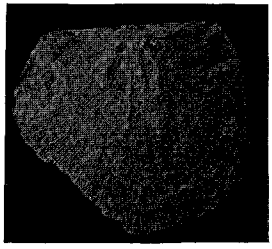
3



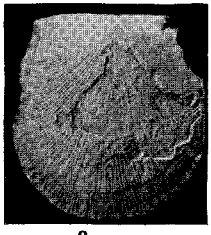
5



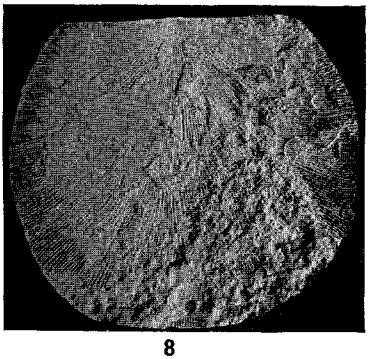
4



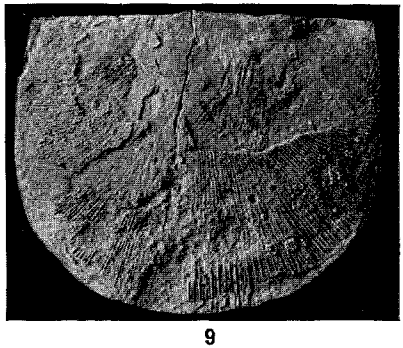
7



6

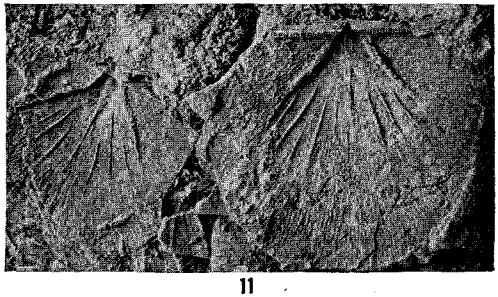


8



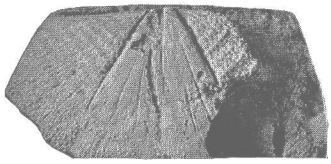
9

10

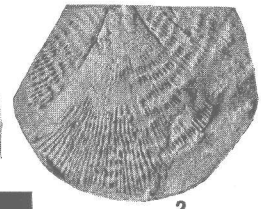


11

NEW SCOTLAND AND BECRAFT FOSSILS

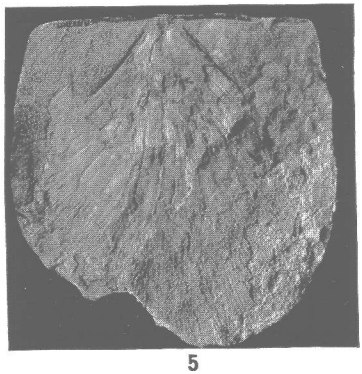


1

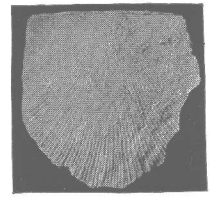


2

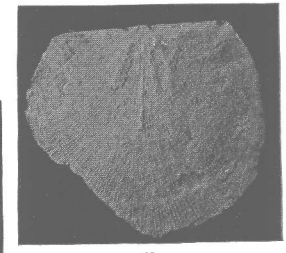
3



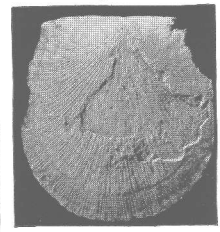
5



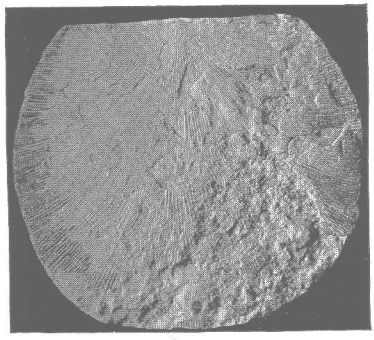
4



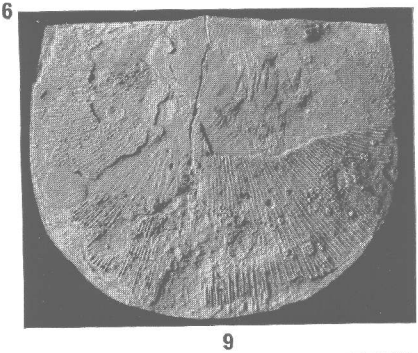
7



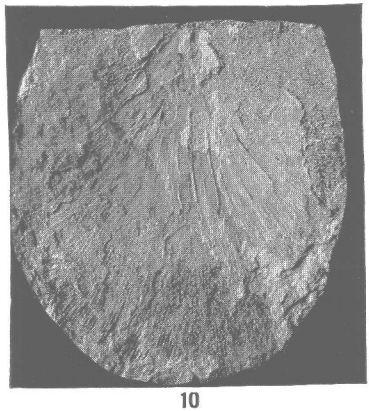
6



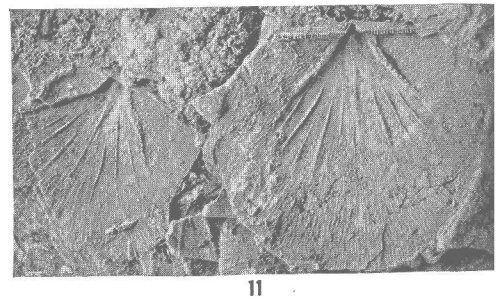
8



9



10



11

NEW SCOTLAND AND BECRAFT FOSSILS

PLATE 110.—NEW SCOTLAND AND BECRAFT FOSSILS

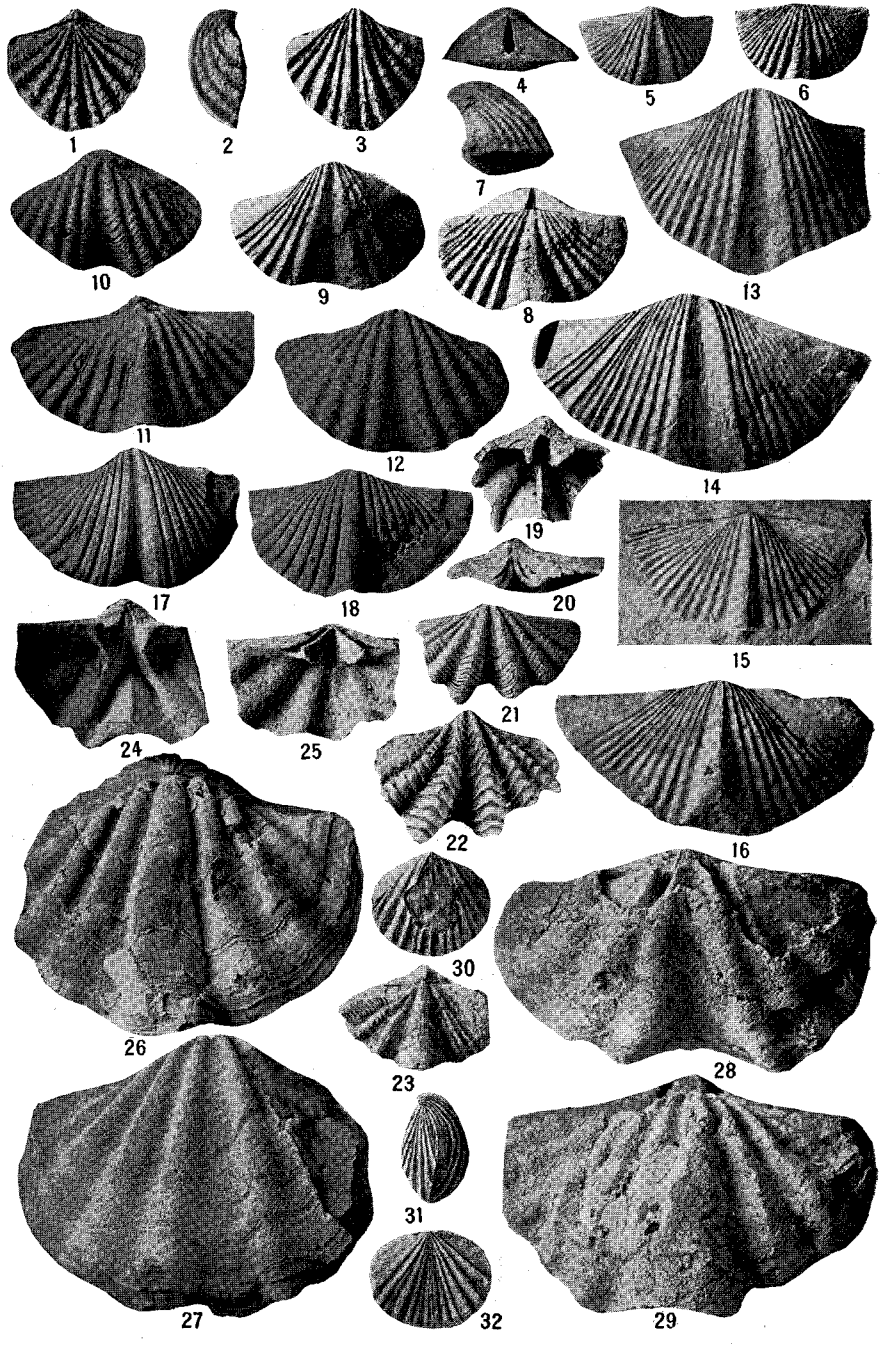
FIGURE

1, 2. *Leptostrophia becki* (Hall).

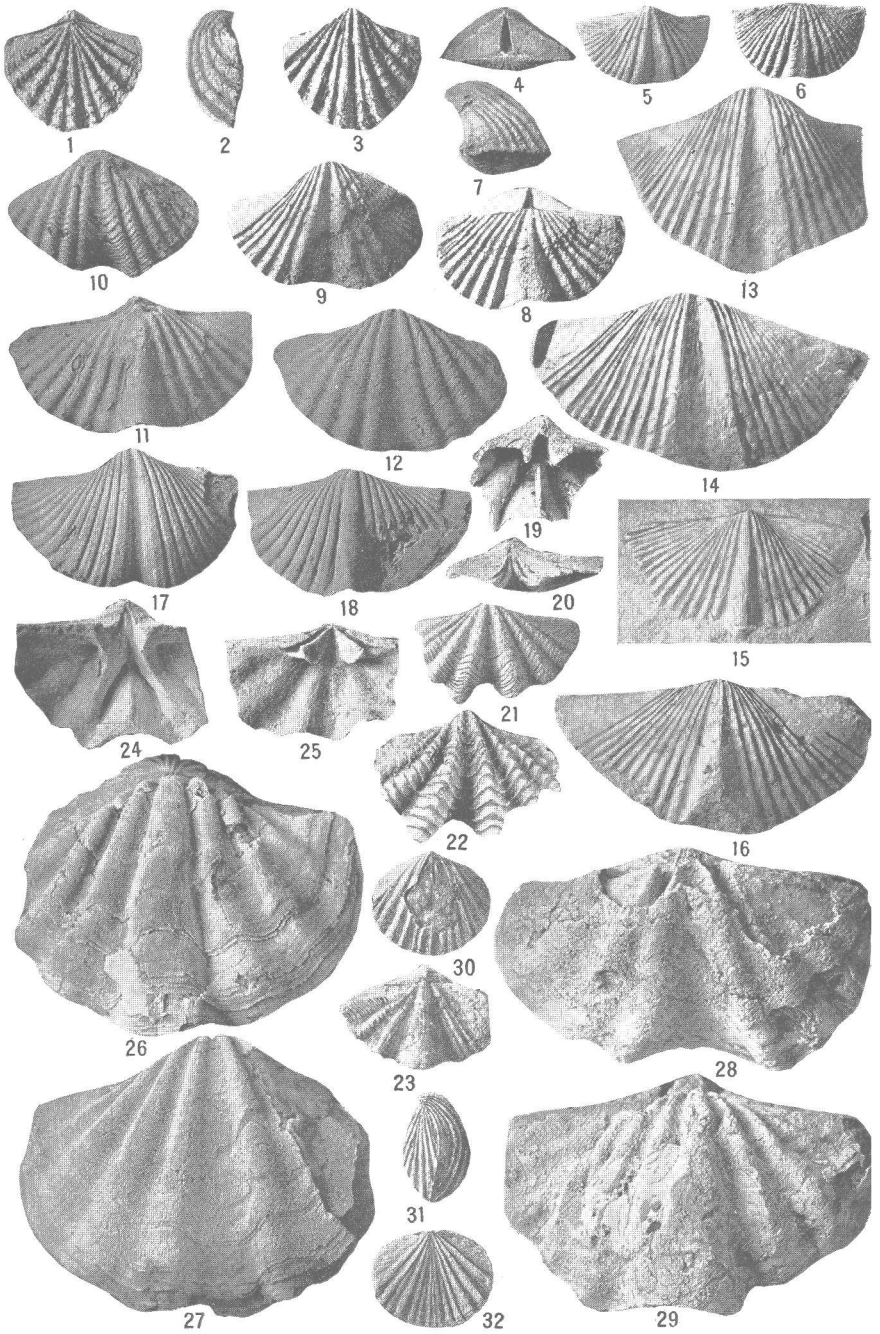
1, internal mold of ventral valve; 2, partially exfoliated ventral valve showing the characteristic concentric ridges below the beak. Helderberg, New Scotland member; along U. S. Route 250 on the southeast slope of Bullpasture Mountain, Highland County. U. S. N. M. 97721a, 97721b.

3–11. *Stropheodonta planulata* (Hall).

3, 4, 6, 8, 9, ventral valves; 5, internal mold of ventral valve shown in 10; 7, interior of dorsal valve; 10, 11, interiors of ventral valves. The identification of the specimen of 9, and its reference to the Becraft are doubtful. It is a broader form than the other specimens referred to *S. planulata* and the striae are coarse and fine alternating. Helderberg limestone, Becraft member. 3, 6, 7, 8, along State Route 311 about 1 mile south of Newcastle, Craig County; 4, 5, 10, 11, manganese ore pit on Flat Top Mountain about 1 mile northeast of Hollybrook, Giles County; 9, road along Narrow Passage Creek, 1½ miles southwest of gap at northeast end of Massanutten Mountain, Shenandoah County. 3, 4, 6, 8, 9, U. S. N. M. 97722a, 97723a, 97722b, 97722d, 97724; 5, 10, 97723b; 7, 11, 97722c, 97723c.



NEW SCOTLAND AND BECRAFT FOSSILS



NEW SCOTLAND AND BECRAFT FOSSILS

PLATE 111.—NEW SCOTLAND AND BECRAFT FOSSILS

FIGURE

1–3. *Atrypina imbricata* (Hall), × 2.

Dorsal, profile, and ventral views of a whole specimen. Helderberg limestone, New Scotland member; along U. S. Route 250 on the southeast slope of Bullpasture Mountain, Highland County. U. S. N. M. 97752.

4–9. *Cyrtina varia* Clarke.

4-6, posterior, ventral, and dorsal views of a whole specimen; 7-9, profile, dorsal, and ventral views of a whole specimen. Helderberg limestone, New Scotland member. 4-6, Pinckney, 8 miles southwest of Monterey, Highland County; 7-9, along U. S. Route 60 just east of Covington, Alleghany County. 4-6, U. S. N. M. 97753; 7-9, 97754.

10–12. *Spirifer cyclopterus* Hall.

10, 12, ventral valves; 11, dorsal valve. Different individuals. Helderberg limestone, New Scotland member. 10, 11, along State Route 42 about 2 miles northwest of Newcastle, Craig County; 12, same locality as 7. U. S. N. M. 97755a, 97755b, 97856.

13. *Spirifer concinnus* Hall.

Ventral valve. Helderberg limestone, Becraft member; along State Route 311 about 1 mile south of Newcastle, Craig County. U. S. N. M. 97857.

14–16. *Spirifer concinnus progradius* Swartz.

14, ventral valve; 15, 16, dorsal valves. Occurrence as 13. U. S. N. M. 97858a, 97858b, 97858c.

17, 18. *Spirifer* cf. *S. concinnus* Hall.

Ventral and dorsal views of the only specimen found. Occurrence as 7. U. S. N. M. 97859.

19–23. *Delthyris* (*Spirifer*) *perlamellosus* (Hall).

19, 22, × 2. 19, 20, interiors of ventral valves; 21, 22, ventral valves; 23, dorsal valve. This fossil and the next, *Spirifer macropleurus,* are the most distinctive fossils of the New Scotland. Occurrence as 1. U. S. N. M. 97860a, 97860b, 97860c, 97860d, 97860e.

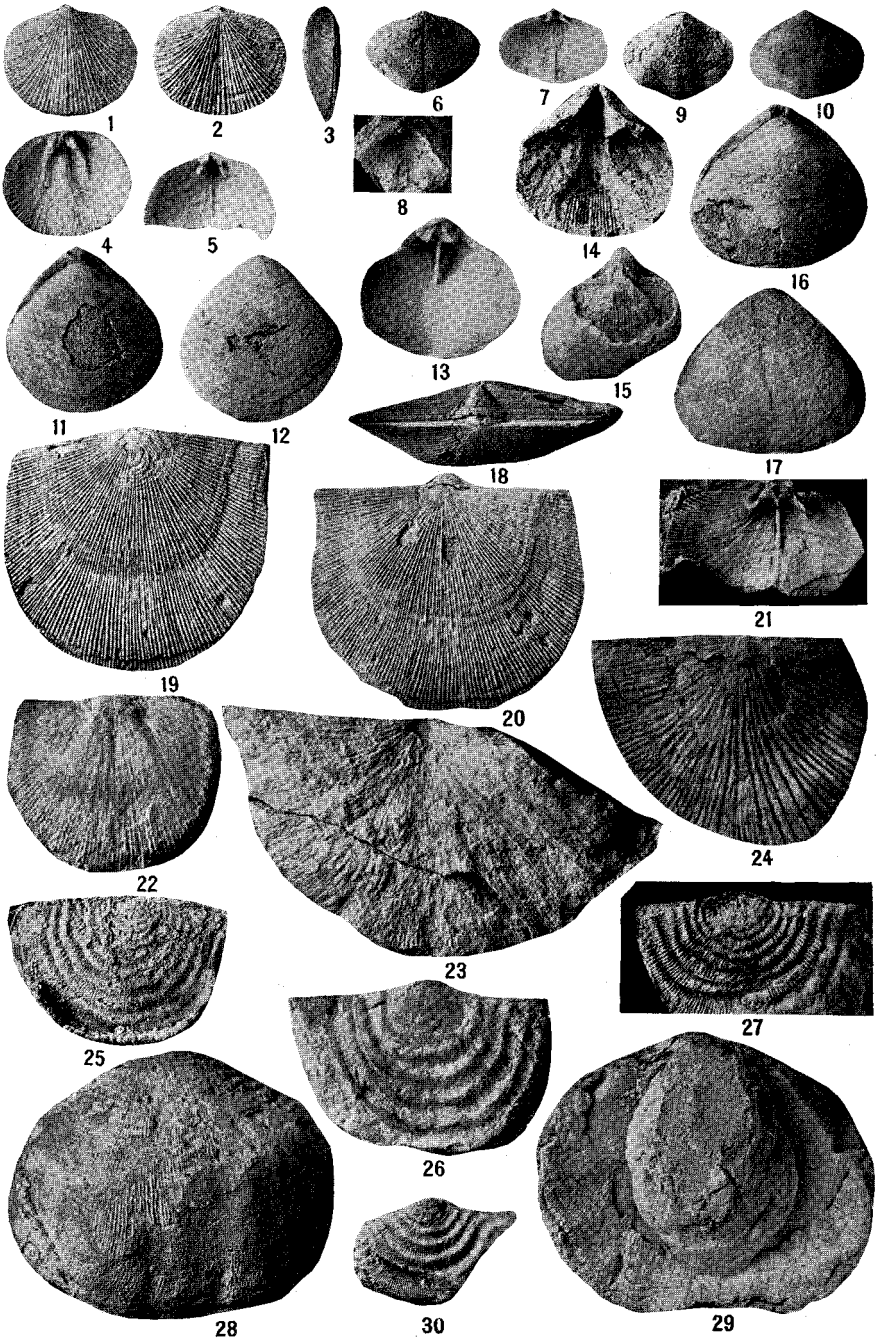
FIGURE

24–29. *Spirifer macropleurus* (Conrad).

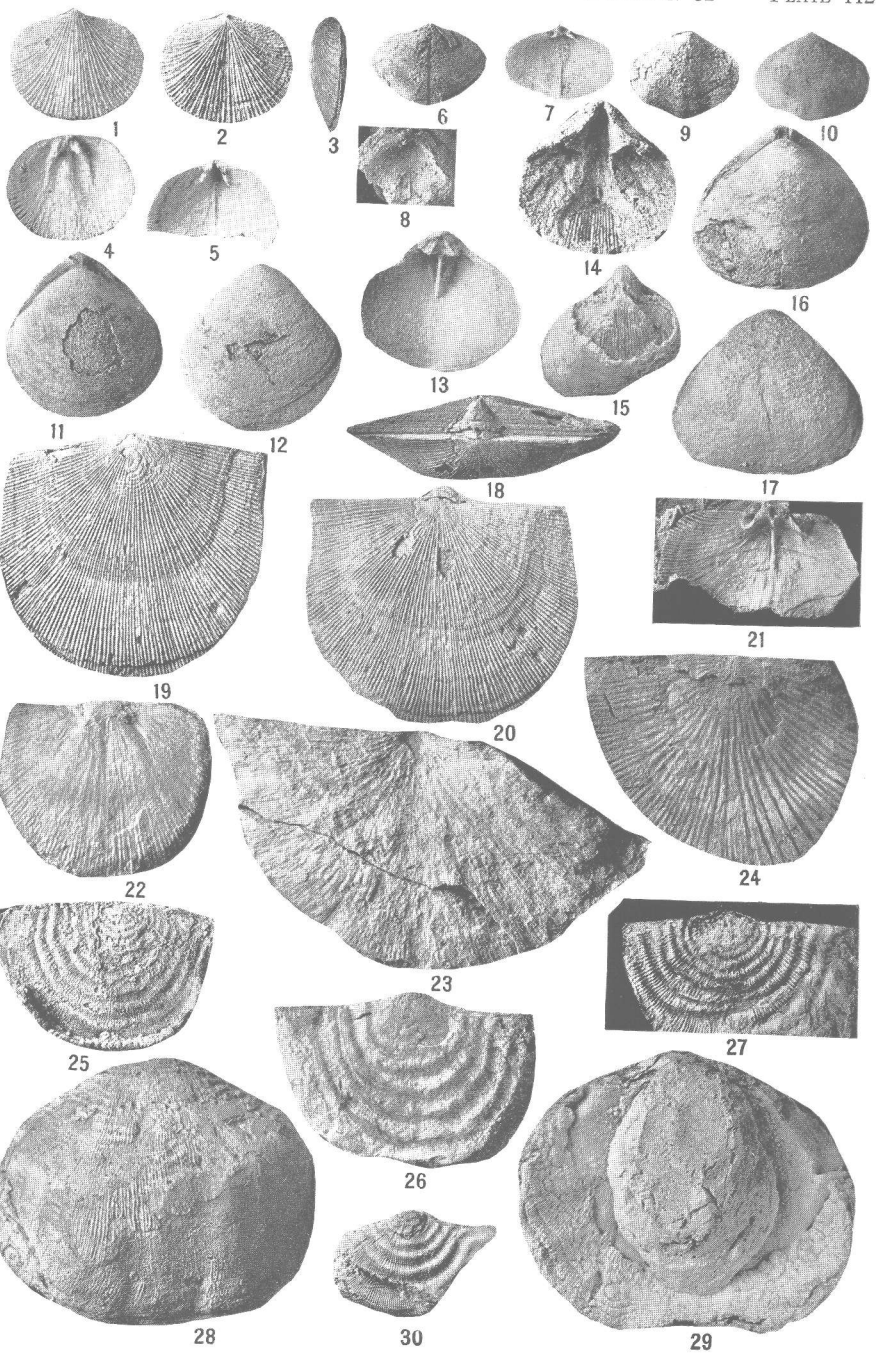
24, interior of a ventral valve; 25, interior of a dorsal valve; 27, 28, ventral valves; 26, 29, dorsal exteriors of two nearly complete individuals. Occurrence as 1. 24, 25, U. S. N. M. 97861a, 97861b; 26, 27, 97861c; 28, 29, 97861d.

30–32. *Anoplotheca concava* (Hall), × 2.

Ventral, profile, and dorsal views of an entire silicified specimen. Occurrence as 1. U. S. N. M. 97862.



NEW SCOTLAND AND BECRAFT FOSSILS



NEW SCOTLAND AND BECRAFT FOSSILS

PLATE 112.—NEW SCOTLAND AND BECRAFT FOSSILS

FIGURE

1–5. *Platyorthis planoconvexa* (Hall).

1-3, ventral, dorsal, and profile views of a specimen; 4, dorsal interior; 5, ventral interior. Helderberg limestone, New Scotland member; along U. S. Route 60 just east of Covington, Alleghany County. 1-3, U. S. N. M. 97863a; 4, 5, 97863b, 97863c.

6–10. *Nucleospira elegans* Hall?

6, internal mold of a ventral valve, showing the impression of the median septum; 7, interor of a dorsal valve; 8, interior of a broken ventral valve showing the low thin septum extending nearly to the front; 9, 10, dorsal and ventral views of a whole specimen. Helderberg limestone, New Scotland member; along railroad about half a mile northwest of Hot Springs, Bath County. 6-8, U. S. N. M. 97864a, 97864b, 97864c; 9, 10, 97864d.

11–15. *Meristella symmetrica* Schuchert.

11, 12, dorsal and ventral views of a specimen; 13, interior of a dorsal valve; 14, ventral interiors of different specimens; 14, shows the striated surface of the large rostral cavity characteristic of *Meristella;* 15, ventral valve exfoliated on the umbo and showing the mold of the large striated rostral cavity. Helderberg limestone, New Scotland member. 11-13, 15, same locality as 1; 14, along U. S. Route 250 on the southeast slope of Bullpasture Mountain, Highland County. 11, 12, U. S. N. M. 97865a; 13-15, 97865b, 97866, 97865c.

16, 17. *Meristella lata* (Hall).

Dorsal and ventral valves. 16, occurrence as 14; 17, Becraft limestone, along State Route 311 about 1 mile south of Newcastle, Craig County. U. S. N. M. 97867, 97868.

18–22. *Schellwienella woolworthana* (Hall).

18-20, posterior, ventral, and dorsal views of a complete individual; 21, interior; 22, mold of interior of dorsal valve. Helderberg limestone. 18-20, locality as 1; 21, locality as 17; 22, Becraft member, along State Route 42 about 1 mile northeast of Newcastle, Craig County. 18-20, U. S. N. M. 97869; 21, 22, 97870, 97871.

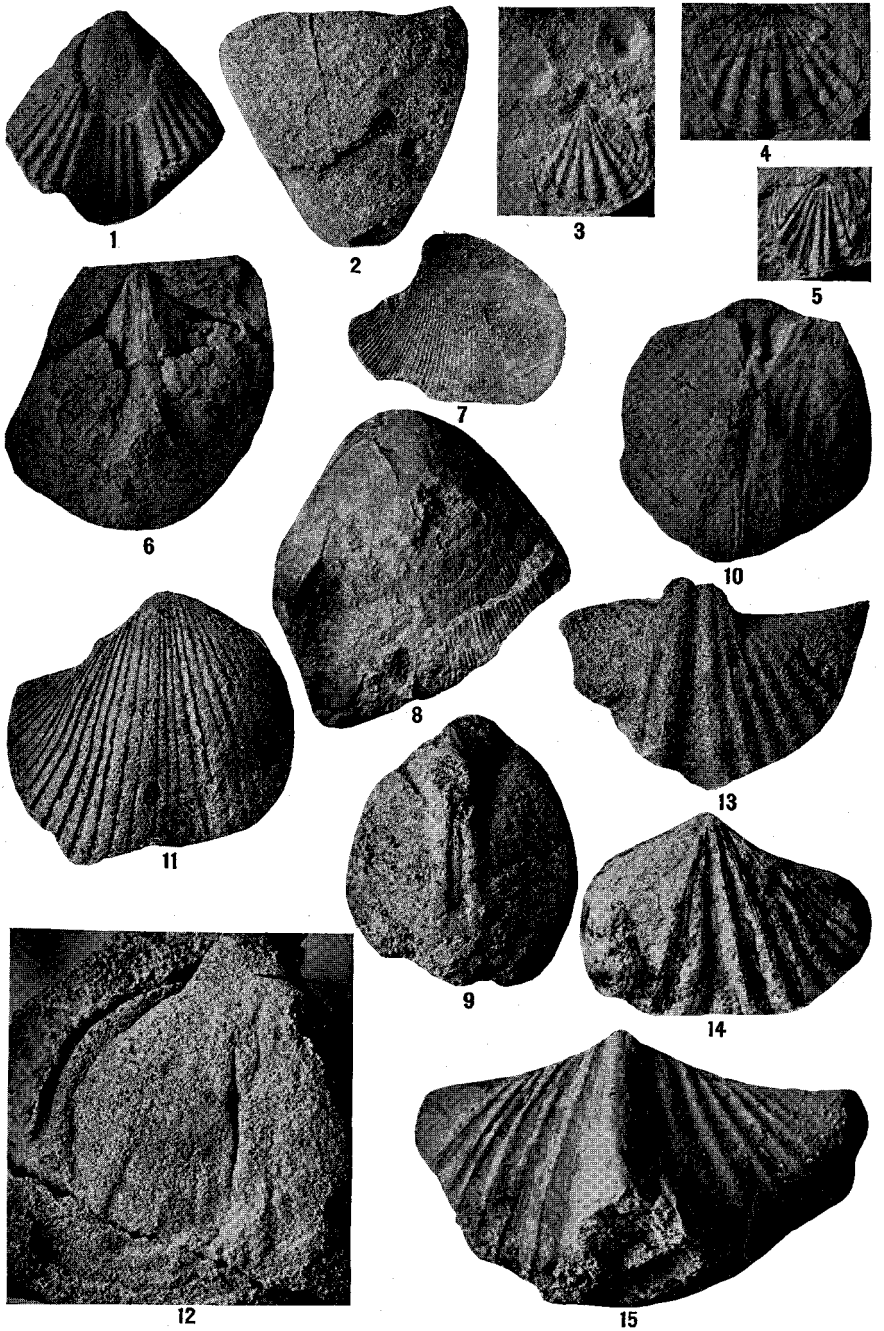
FIGURE

23, 24. *Strophonella punctulifera* (Conrad).

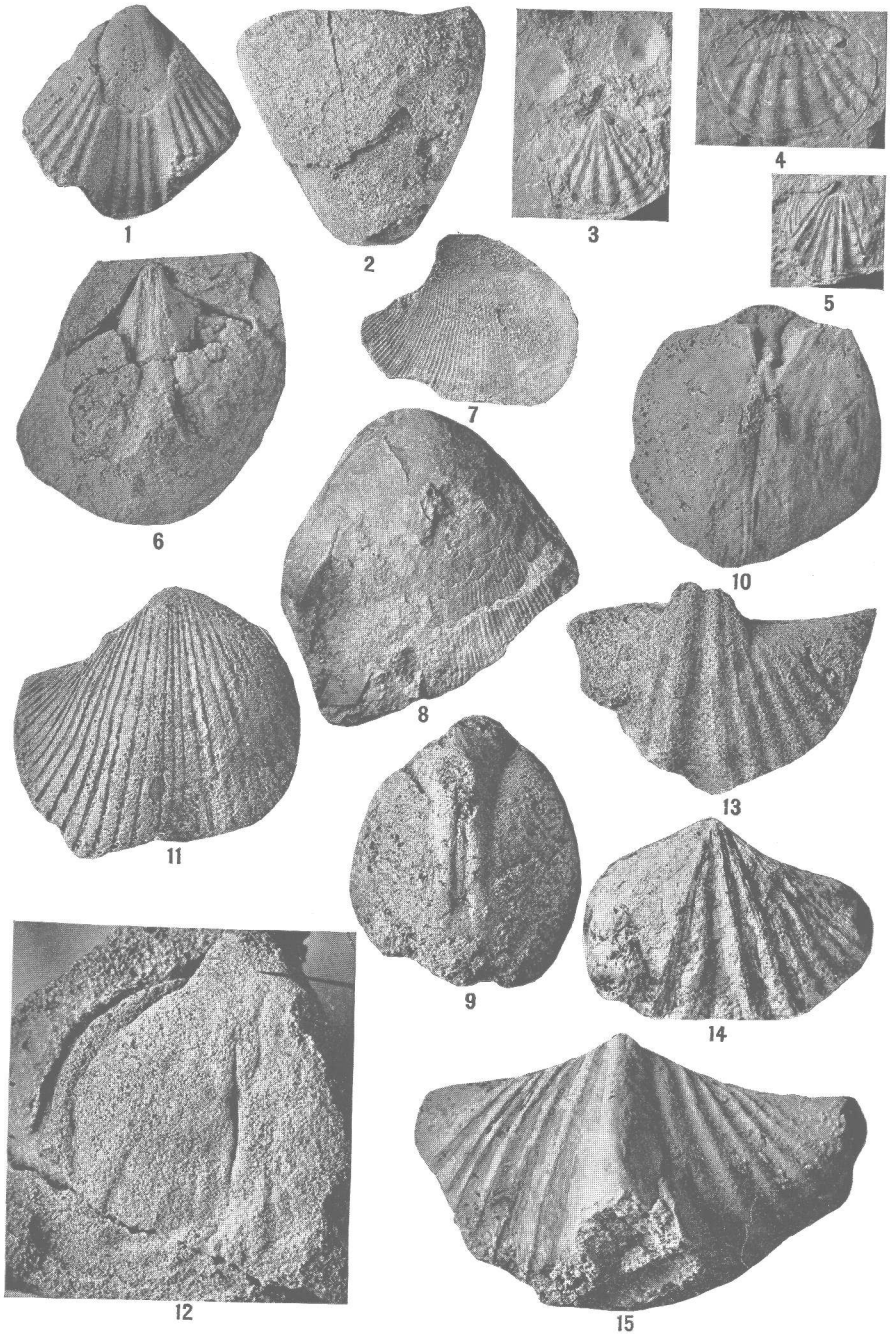
23, internal mold of a dorsal valve; 24, interior of a dorsal valve showing a small area of the external mold of the valve where the shell is exfoliated. Helderberg limestone, New Scotland member; along U. S. Route 220 at Pinckney, 8 miles southwest of Monterey, Highland County. U. S. N. M. 97872a, 97872b.

25–30. *Leptaena rhomboidalis* (Wilckens).

25-27, 30, ventral valves; 28, oblique view of a ventral valve of a large individual; 29, dorsal view of the same specimen. (The hump in 29 is encrusting chert.) 25, 27, 30, occurrence as 14; 26, occurrence as 23; 28-29, occurrence as 1. 25-27, U. S. N. M. 97873a, 97874, 97873b; 28, 29, 97875; 30, 97873c.



ORISKANY FOSSILS



ORISKANY FOSSILS

PLATE 113.—ORISKANY FOSSILS

FIGURE

1. *Uncinulus* aff. *U. pyramidatus* (Hall).

   Internal mold of a ventral valve. Oriskany sandstone; along old road to Shannon Gap on Walker Mountain 5 miles northwest of Marion, Smyth County. U. S. N. M. 97876.

2. *Edriocrinus sacculus* Hall.

   Base. Oriskany sandstone; between Monterey and Straight Creek, Highland County (exact locality unknown). U. S. N. M. 97877.

3–5. *Anoplotheca flabellites* (Conrad)?

   4, × 2. Dorsal valves. Associated with *Orbiculoidea* and *Styliolina*. In 3 feet of shale near middle of 35 feet of Oriskany sandstone. Northwest slope of Morris Hill about 1½ miles south of Greenwood, Alleghany County. U. S. N. M. 97878a, 97878b, 97878c.

6. *Meristella lata* (Hall).

   Internal mold of ventral valve. Oriskany sandstone; along State Route 16 about 5 miles north of Marion, Smyth County. U. S. N. M. 97879.

7–9. *Rensselaeria marylandica* var. *symmetrica* Schuchert?

   7, external mold of part of a ventral (?) valve concave toward the observer; 8, ventral valve; 9, internal mold of a dorsal valve. Oriskany sandstone; along U. S. Route 60 at Island Ford about 4 miles east of Covington, Alleghany County. U. S. N. M. 97880a, 97880b, 97880c.

10. *Rensselaeria?* sp.

   Associated with *Spirifer arenosus*. Occurrence as 6. U. S. N. M. 97881.

11. *Spirifer arenosus* (Conrad).

   Impression of an external mold of a ventral valve. This is one of the most common and characteristic Oriskany fossils. Occurrence as 6. U. S. N. M. 97882.

12. *Hipparionyx proximus* Vanuxem?

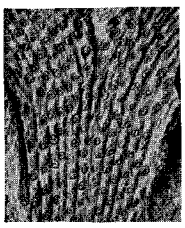
   Internal mold of a ventral valve. This may be *Rhipidomella musculosa*. Oriskany sandstone; along southeast slope

FIGURE

of Walker Mountain on Bear Creek road about 5 miles northeast of Marion, Smyth County. U. S. N. M. 97883.

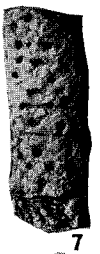
13–15. *Spirifer murchisoni* Castelnau.

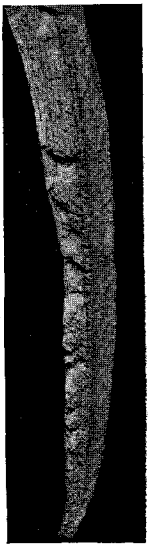
Oriskany sandstone. 13, along U. S. Route 21 at summit of Walker Mountain, Wythe County; 14, same locality as 6; 15, same locality as 1. U. S. N. M. 97884, 97885, 97886.

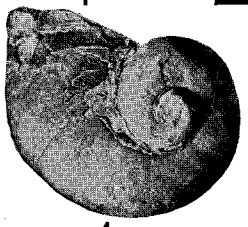

1


2


3


7

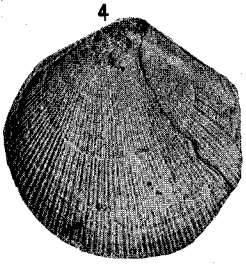

12

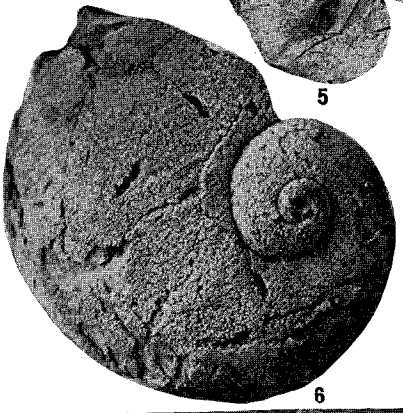

4

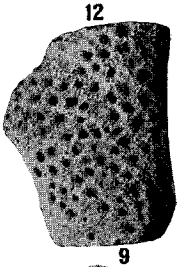

17


5

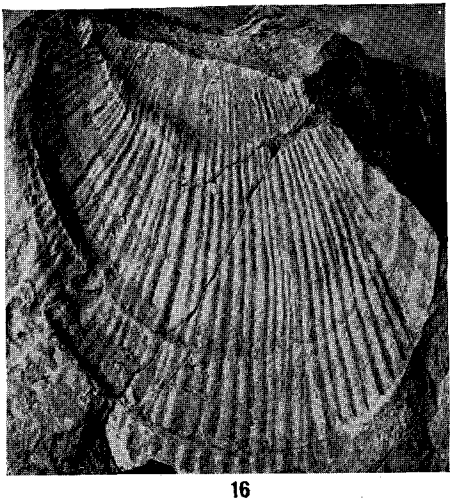

8

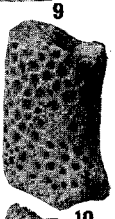

13

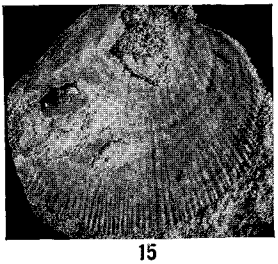

6

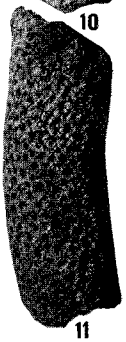

9


14

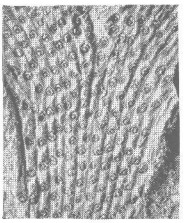

16

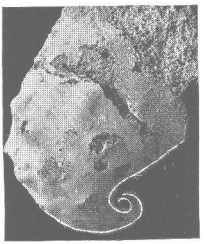

10


15

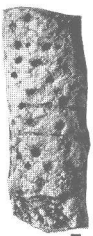

11

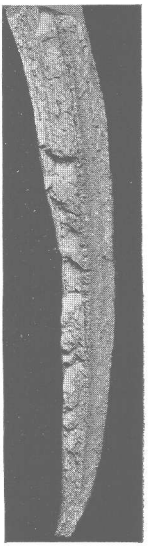
ONONDAGA FOSSILS

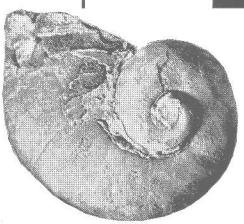

1


2


3


7

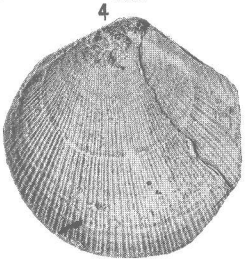

12

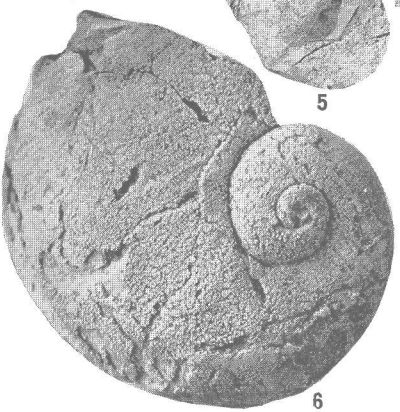

4

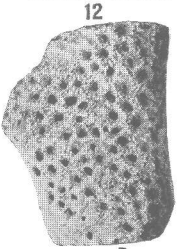

17


5

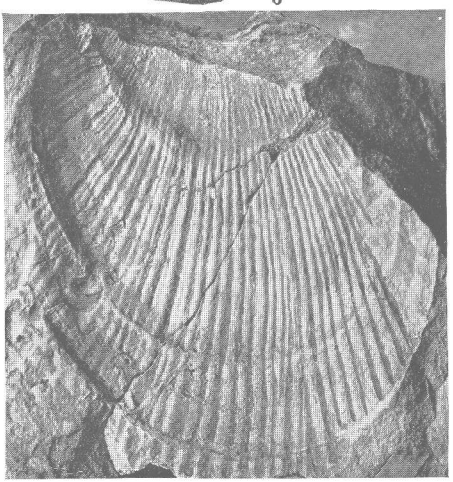

8

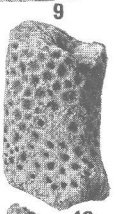

13

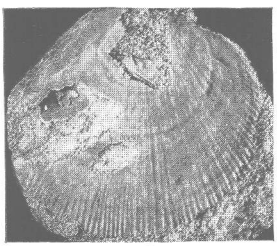

6

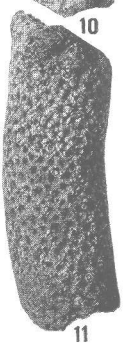

9


14


16


10


15


11

ONONDAGA FOSSILS

PLATE 114.—ONONDAGA FOSSILS

FIGURE

1. *Cystodictya ovatipora* (Hall), × 4.
   Onondaga limestone; southeast slope of Clinch Mountain about 500 feet north of State Route 42 and one-fourth of a mile east of U S. Route 19, Washington County. U. S. N. M. 97887.

2. *Platyceras dumosum* Conrad.
   Onondaga limestone; Seven Springs, Washington County. U. S. N. M. 97888.

3. *Platyceras dumosum rarispinum* Hall.
   Occurrence as 2. U. S. N. M. 97889.

4, 5. *Platystoma lineatum* Conrad.
   Apical and aperatural views. Onondaga limestone; just northwest of gap at northwest entrance of Burkes Garden, Tazewell County. U. S. N. M. 97890.

6. *Strophostylus?* cf. *S. varians* Hall.
   Onondaga limestone; along State Route 91 at McCall Gap through Walker Mountain, Washington County. U. S. N. M. 97891.

7, 8. *Dendropora neglecta* Rominger.
   Onondaga limestone; on southeast slope of Walker Mountain about 2 miles northeast of Lyons Gap, Smyth County. U. S. N. M. 97892a, 97892b.

9. *Favosites* cf. *F. proximus* Davis.
   Onondaga limestone; along southeast slope of Clinch Mountain, near base, on Locust Branch 2 miles north of Saltville, Smyth County. U. S. N. M. 97893.

10, 11. *Favosites* cf. *F. limitaris* Rominger.
   Occurrence as 9. U. S. N. M. 97894a, 97894b.

12. *Machaeracanthus peracutus* Newberry.
   Fin spine of a sharklike fish. Occurrence as 1. U. S. N. M. 97895.

13. *Aviculopecten pecteniformis* (Conrad).
   External mold of right valve. (For internal mold, see fig. 15.) Onondaga limestone; along southeast slope of Flat Top Mountain, near base, 2 miles southwest of Tannersville, Tazewell County. U. S. N. M. 97896.

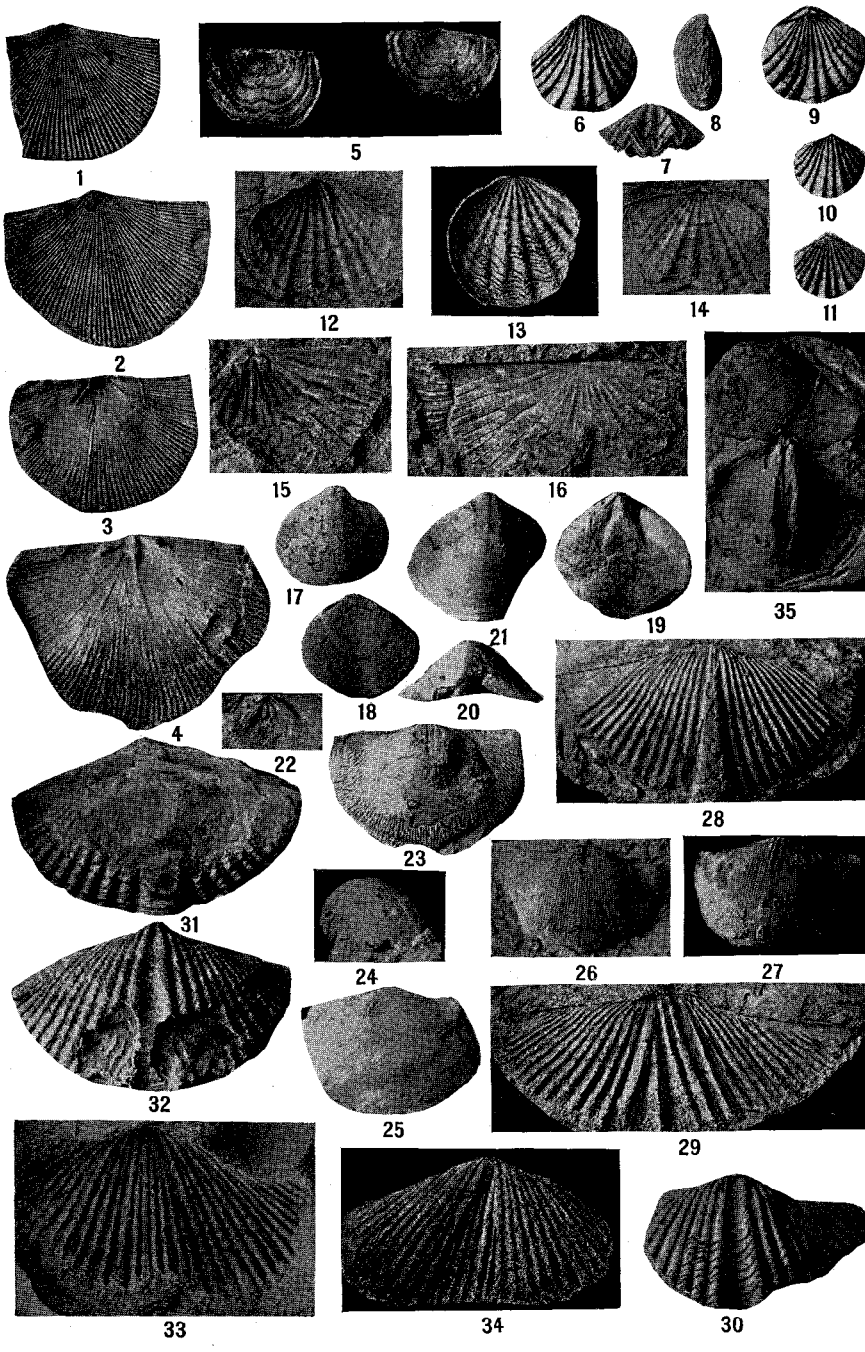
FIGURE

14. *Lyriopecten* cf. *L. parallelodontus* Hall.
External mold of a left valve. Occurrence as 13. U. S. N. M. 97897.

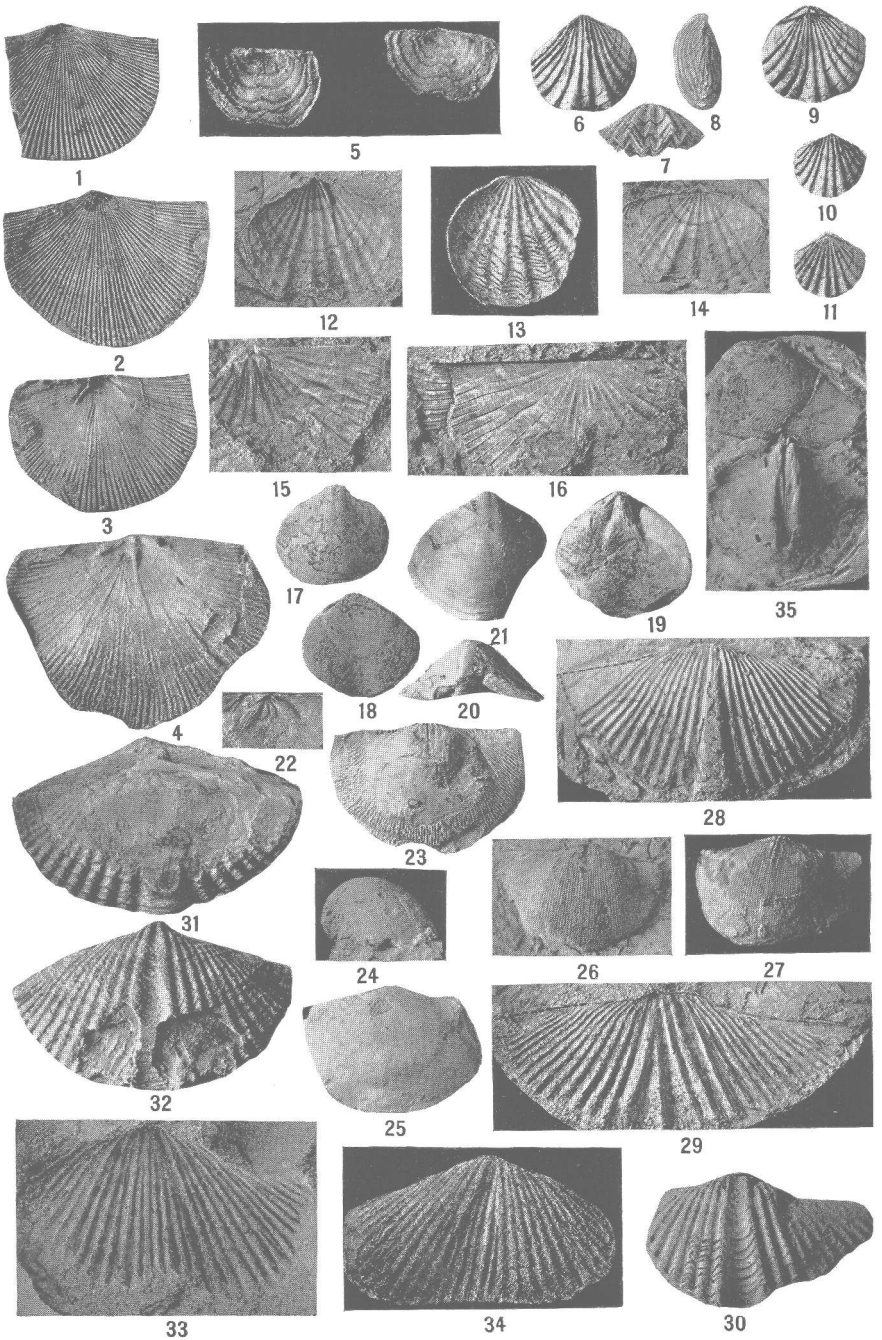
15. *Aviculopecten pecteniformis* (Conrad).
Internal mold of right valve of 13. Occurrence as 13. U. S. N. M. 97896.

16. *Panenka* cf. *P. multiradiata* Hall.
External mold of a left valve. Onondaga limestone; along road to Fetzer Gap about 2 miles east of Van Buren Furnace, Shenandoah County. U. S. N. M. 97898.

17. *Cypricardinia indenta* (Conrad), × 4.
Internal mold of a left valve. Occurrence as 1. U. S. N. M. 97899.



ONONDAGA FOSSILS



ONONDAGA FOSSILS

PLATE 115.—ONONDAGA FOSSILS

FIGURE

1–4. *Schuchertella pandora* (Billings).

1, 2, external molds of ventral valves; 3, 4, impressions of internal molds of ventral and dorsal valves. Onondaga limestone; at Seven Springs, Washington County. U. S. N. M. 97900a, 97900b, 97900c, 97900d.

5. *Ambocoelia?*, × 2.

External molds of dorsal valves. Onondaga limestone; at southeast entrance to Iron Gate Gorge about 1½ miles southeast of Clifton Forge, Alleghany County. U. S. N. M. 97901.

6–14. *Anoplotheca acutiplicata* (Conrad).

6-9, ventral, anterior, profile, and dorsal views of a whole specimen; 10, 11, ventral and dorsal views of a small specimen; 12, 14, external molds of ventral and dorsal valves of the common size; 13, external mold of a ventral valve, concave to the observer. Onondaga limestone. Universally distributed and one of the principal guide fossils of the Onondaga in Virginia. 6-11, southeast slope of Clinch Mountain on Locust Branch about 2 miles northeast of Saltville, Smyth County; 12, 14, same locality as 1; 13, along State Route 311 about 1 mile southeast of Newcastle, Craig County. 6-9, U. S. N. M. 97902a; 10, 11, 97902b; 12, 97903a; 13, 97904; 14, 97903b.

15, 16. *Stropheodonta* cf. *S. patersoni* (Hall).

Internal and external molds of a dorsal valve. 4 to 8 fine striae between the coarse ones. Onondaga limestone; along southeast slope of Clinch Mountain about 500 feet north of State Route 42 and one-fourth of a mile east of U. S. Route 19, Washington County. U. S. N. M. 97905.

17–21. *Pentagonia unisulcata* (Conrad).

17, 18, dorsal and ventral valves, internal molds of a specimen; 19-21, ventral, posterior, and dorsal views of an internal mold. Onondaga limestone. 17, 18, about 2 miles west of Tannersville, Tazewell County; 19-21, Locust Branch about 2 miles northeast of Saltville, Smyth County. 17, 18, U. S. N. M. 97906; 19-21, 97907.

FIGURE

22–27. *Eodevonaria* (*Chonetes*) *arcuata* (Hall).

22, internal mold of a dorsal valve; 23, internal mold of a ventral valve; 24, 27, profile and ventral views of a specimen; 25, 26, ventral views of two specimens. Onondaga limestone. 22, 24, 27, same locality as 17; 23, same locality as 15; 25, same locality as 6; 26, southeast slope of Clinch Mountain along road on Rich Creek, 6 miles due west of Saltville, Smyth County. This is another guide fossil of the Onondaga. 22, 23, U. S. N. M. 97909a, 97916; 24, 27, 97909b; 25, 26, 97910, 97911.

28–30. *Spirifer macrus* Hall.

28, dorsal valve; 29, external mold of dorsal valve; 30, ventral valve retaining the characteristic growth lines. These lines are faintly preserved on 28, 29. Onondaga limestone. 28, 30, along State Route 80 about 2 miles northeast of Hayter Gap village, Washington County; 29, southeast slope of Walker Mountain, 2 miles northeast of Lyons Gap, Smyth County. U. S. N. M. 97912a, 97913, 97912b.

31, 32. *Spirifer macrus* Hall?

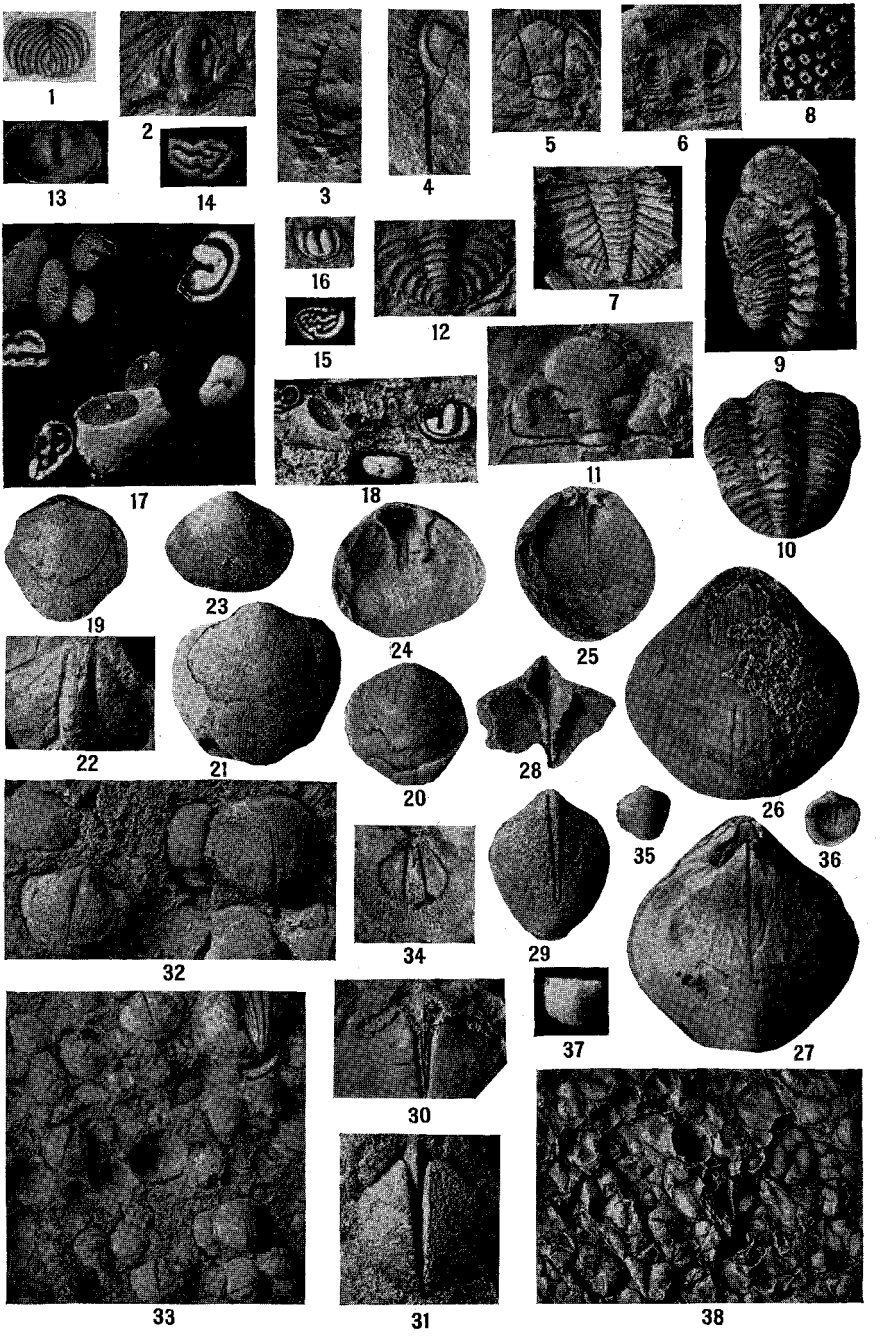
Probably a variant of *S. macrus* like the specimen figured by Hall (Paleon. N. Y., vol. 4, pl. 27, figs. 26 and 27). Onondaga limestone; vicinity of Hayter Gap village, Washington County. U. S. N. M. 97914.

33, 34. *Spirifer divaricatus* Hall.

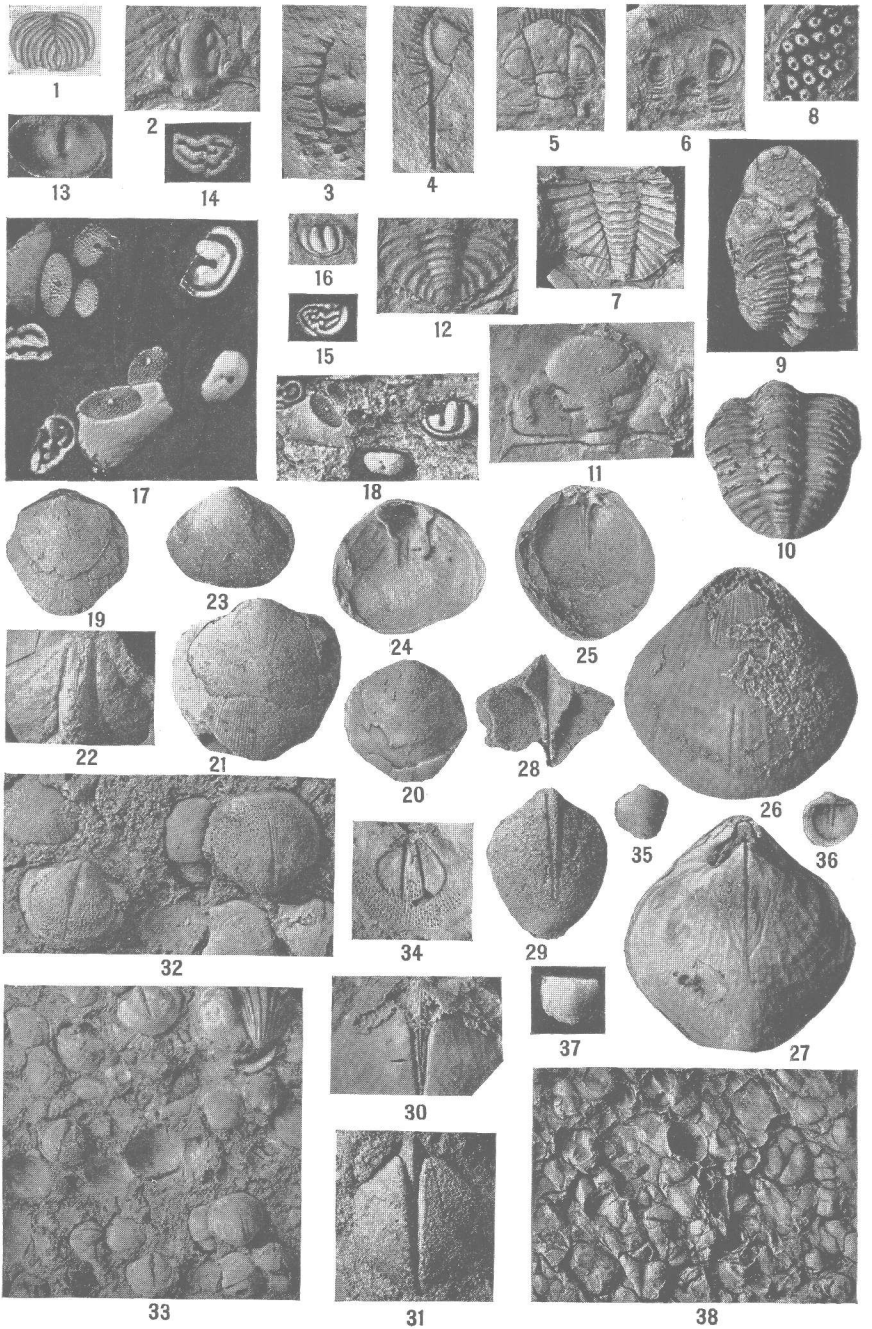
33, external mold of a ventral valve; 34, clay impression from the same. Occurrence as 1. Strongly marked by zigzag transverse growth lines that do not show distinctly in the figures. U. S. N. M. 97915.

35. *Pentagonia unisulcata* (Conrad).

Internal mold of dorsal valve. Onondaga limestone; half a mile northeast of the intersection of U. S. Route 19 and State Route 42, Washington County. U. S. N. M. 97908.



ONONDAGA FOSSILS



ONONDAGA FOSSILS

PLATE 116.—ONONDAGA FOSSILS

FIGURE

1–4. *Acidaspis callicera* Hall and Clarke.

1, drawing of a tail from a photograph, × 8; 2, internal mold of a head with the notched anterior border plainly visible under a magnifier; 3, 4, fragments of free cheeks. Onondaga limestone; along road to Fetzer Gap 2 miles east of Van Buren Furnance, Shenandoah County. U. S. N. M. 97917a, 97917b, 97917c, 97917d.

5–7. *Odontocephalus aegeria* Hall.

5, 6, internal and external molds of a head; 7, tail. Onondaga limestone. 5, 6, along U. S. Route 220 about 1½ miles southeast of Clifton Forge, Alleghany County; 7, along State Route 311 about 1 mile south of Newcastle, Craig County. 5, 6, U. S. N. M. 97918; 7, 97919.

8–10. *Phacops cristata* Hall?

8, part of eye, × 4; 9, thorax and head; 10, thorax and tail. Onondaga limestone; along southeast slope of Clinch Mountain at Locust Branch about 2 miles northeast of Saltville, Smyth County. U. S. N. M. 97920a, 97920b, 97920c.

11, 12. *Dalmanites aspectans* Conrad?

Head and tail. Occurrence as 1. U. S. N. M. 97921a, 97921b.

13. *Kloedenia?*, × 3.

On slab with *Acidaspis callicera*. Occurrence as 1. U. S. N. M. 97922.

14, 15. *Octonaria stigmata* Ulrich?

Right valve. 14, impression of 15, × 6⅔; 15, external mold, × 4. Onondaga limestone; Seven Springs, Washington County. U. S. N. M. 97923.

16. *Bollia ungula* Jones, × 4.

The same species also on 17, 18. Occurrence as 14. U. S. N. M. 97924.

17, 18. *Favulella* (*Amphissites?, Bythocypris*) *favulosa* (Jones).

The punctate specimens. 17, right specimen, × 6¾; 18, lower specimen, internal molds of the same left valve, × 4; 17, lower center, and 18, left, external molds show-

FIGURE

ing a central pustule that is the mold of the central pit shown in the impression; 17, upper left, wax impression of group in 17, lower center, showing the external appearance of *Favulella* which has a distinct pit in the center; 17, upper right, *Bollia ungula;* left corner, *Octonaria stigmata.* Occurrence as 14. These three ostracodes together with *Anoplotheca acutiplicata* occur on the same slab. The assemblage is persistent from Pennsylvania to southern Virginia and any one of the species is an index of the Onondaga. U. S. N. M. 97925.

This fossil was described as *Bythocypris favulosa* by Jones in 1886. *Amphissites*? was suggested orally to the author while Part I of this volume was being prepared, and that name was used. After Part I had gone to press, the genus was named *Favulella* by F. M. Swartz and F. M. Swain, Bull. Geol. Soc. of America, vol. 52, pp. 438-439, 1941.

19–22. *Beachia suessana* (Hall)?

19, 20, dorsal and ventral views of a specimen; 21, ventral valve of another specimen; 22, internal mold of the umbonal cavity of a ventral valve. Occurrence as 8. 19, 20, U. S. N. M. 97926a; 21, 22, 97926b, 97926c.

23–25. *Charionella scitula* Hall.

23, clay impression of the external mold of a ventral valve; 24, same of the internal mold of a ventral valve; 25, same of the dorsal valve. Onondaga limestone; in gap in Little North Mountain about 3½ miles northwest of Forestville, Shenandoah County. U. S. N. M. 97927a, 97927b, 97927c.

26, 27. *Meristella nasuta* (Conrad).

Ventral and dorsal views of a nearly complete specimen. Onondaga limestone. Specimen was given by a man who lives on the outcrop of the Onondaga half a mile east of U. S. Route 19 and just north of State Route 42, Washington County. U. S. N. M. 97928.

28–31. *Amphigenia curta* (Meek and Worthen).

28, interior of a ventral valve; 29-31, internal molds of ventral valves. Onondaga limestone. 28, 30, 500 feet north of State Route 42 and one-fourth of a mile east of U. S. Route 19, Washington County; 29, 31, Big Stone Gap,

FIGURE

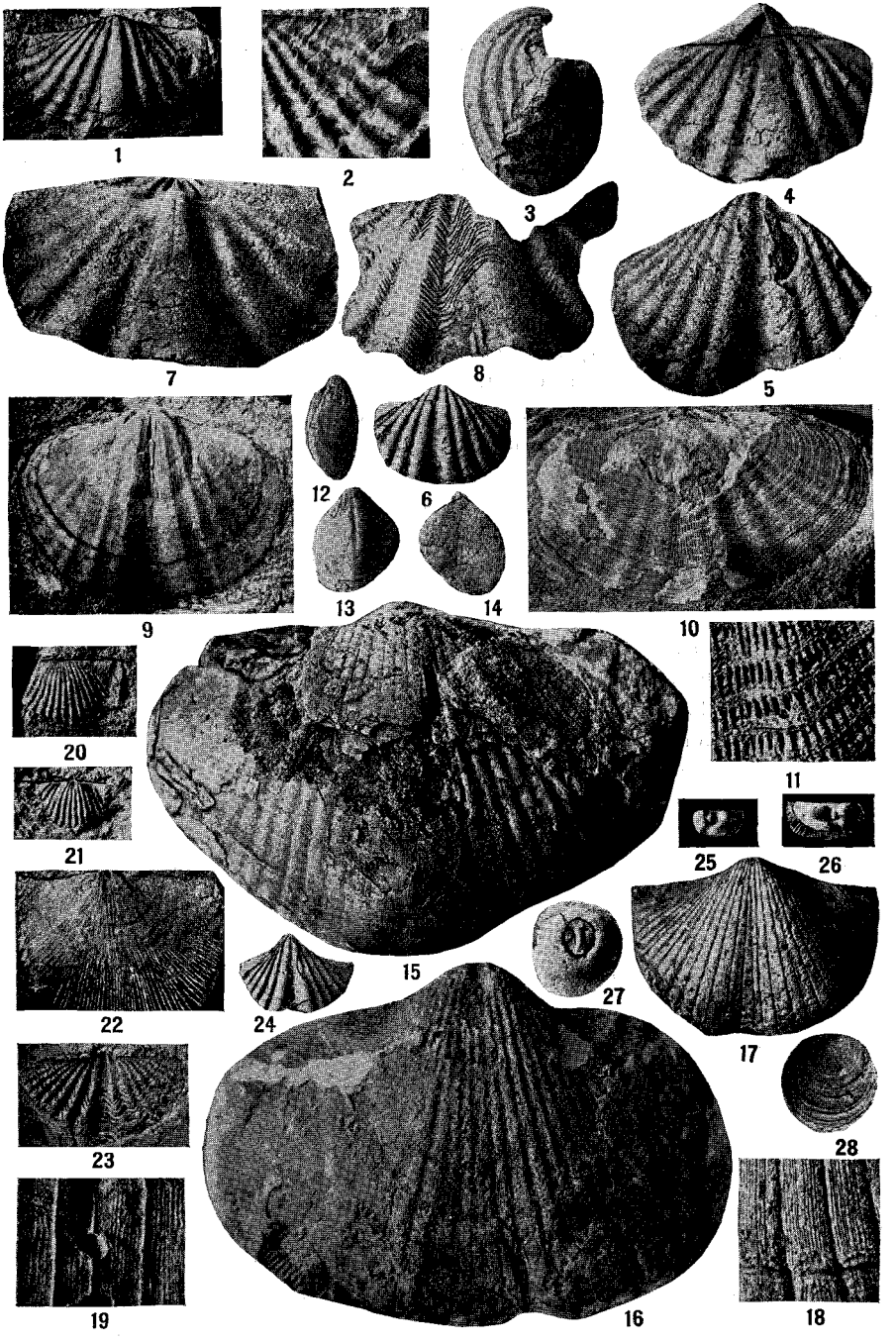
Wise County. U. S. N. M. 97930a, 97929a, 97930b, 97929b.

32–37. *Anoplia nucleata* (Hall).

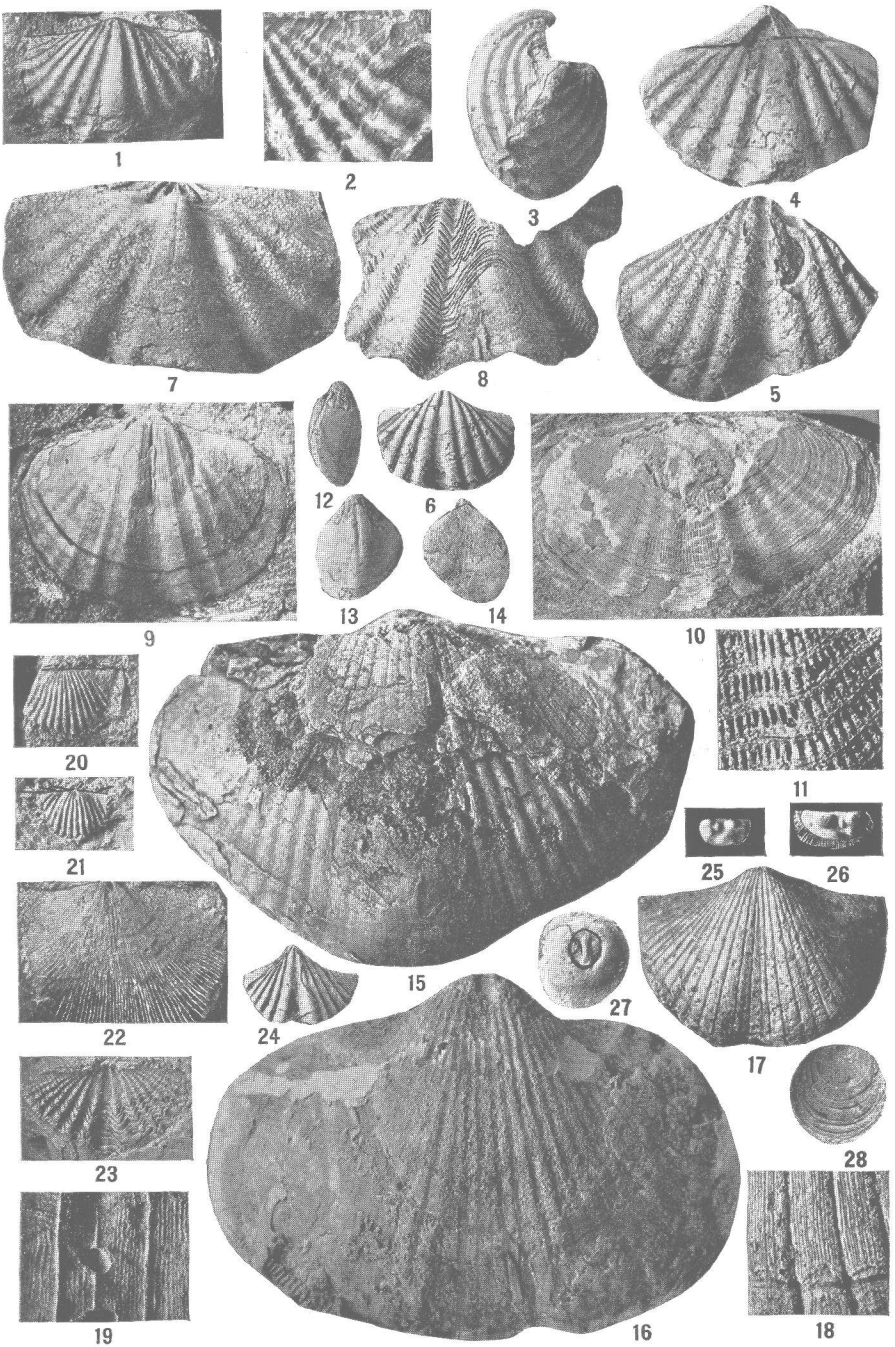
33, part of a slab with many individuals, mainly internal molds of ventral valves; 32, part of 33, × 2; 34, internal mold of a dorsal valve on the rock of which 33 is a part, × 2; 35, ventral valve; 36, interior of 35; 37, external mold of a concave dorsal valve. Onondaga limetsone. 32-34, along southeast slope of Clinch Mountain on road along Rich Creek 6 miles due west of Saltville, Smyth County; 35-37, same locality as 8. *Anoplia nucleata* is common in the Onondaga in southwestern Virginia, and is not known in any other formation in the State. 32-34, U. S. N. M. 97932; 35, 36, 97931a; 37, 97931b.

38. *Ambocoelia* sp., × 2.

Small piece of shale crowded with these minute shells. So far as observed, this species occurs only in crowded aggregates as shown in this figure. Onondaga limestone; along U. S. Route 21 half a mile south of Hicksville, Bland County. Common in southwestern Virginia. Very plentiful in top of the Onondaga at Hayfield, Frederick County. U. S. N. M. 97933.



ONONDAGA FOSSILS



ONONDAGA FOSSILS

PLATE 117.—ONONDAGA FOSSILS

FIGURE

1–6. *Spirifer duodenarius* (Hall).

1, internal mold of a dorsal valve; 2, part of external mold of a dorsal valve, × 4, showing ornamentation of fine cancellated lines, not reproduced in figure; 3, 4, profile and dorsal views of the same specimen; 5, 6, ventral valves of other specimens. Onondaga limestone. 1, 3, 4, 6, Locust Branch about 2 miles north of Saltville, Smyth County; 2, 5, Webb farm just north of State Route 42 ahd half a mile east of U. S. Route 19, Washington County. 1, 2, U. S. N. M. 97937a, 97938a; 3, 4, 97937b; 5, 6, 97938b, 97937c.

7, 8. *Delthyris raricosta* Conrad.

7, internal mold of a dorsal valve; 8, impression of the external mold of 7. Sandstone in Onondaga; Big Stone Gap, Wise County. U. S. N. M. 97939.

9–11. *Elytha fimbriata* (Conrad).

9, internal mold of a ventral valve; 10, exterior of a dorsal valve preserving the shell; 11, part of the external mold of 10, × 3, showing the pits made by the projecting, elongate nodes ornamenting the exterior of the shell. Onondaga limestone; at Seven Springs, Washington County. 9, U. S. N. M. 97940a; 10, 11, 97940b.

12–14. *Centronella glansfagea* Hall.

Profile, ventral, and dorsal views of an internal mold of a whole specimen. Occurrence as 9. U. S. N. M. 97941.

15–19. *Spirifer planicostatus* (F. M. Swartz).

Swartz[a] described this species as *S. arenosus* var. *planicostatus,* but as *S. arenosus* lacks the linear striae and differs in other respects, this is plainly a different species.

15, partly exfoliated silicified dorsal valve; 16, impression of an external mold of a ventral valve; 17, slightly exfoliated silicified ventral valve of a smaller specimen; 18, part of the exterior of a valve preserving the fine lineation, × 4; 19, part of the external mold of a valve showing the fine lineation, × 4. Onondaga limestone. 15, 17, 18,

[a] Swartz, F. M., U. S. Geol. Survey Prof. Paper 158C, p. 56, Pl. 9, figs. 13-15, 1929.

FIGURE

same locality as 1. 16, 19, along southeast slope of Clinch Mountain about 1 mile northwest of Hayter Gap village, Washington County. U. S. N. M. 97942a, 97943a, 97942b, 97942c, 97943b.

20, 21. *Chonetes mucronatus* Hall, × 2.

Internal molds of two ventral valves, the smaller showing at the left cardinal angle the long spine parallel to the hinge line, characteristic of the species. Onondaga limestone; one-fourth of a mile north of State Route 42 and half a mile east of U. S. Route 19, Washington County. U. S. N. M. 97944a, 97944b.

22. *Stropheodonta perplana* (Conrad).

Internal mold of a dorsal valve. Onondaga limestone; 2 miles southwest of Tannersville, Tazewell County. U. S. N. M. 97945.

23. *Spirifer varicosus* Hall.

External mold of a dorsal valve showing the imprints of the strongly imbricating growth lines. Onondaga limestone; in gap of Little North Mountain 3½ miles northwest of Forestville, Shenandoah County. U. S. N. M. 97946.

24. *Cyrtina hamiltonensis* Hall.

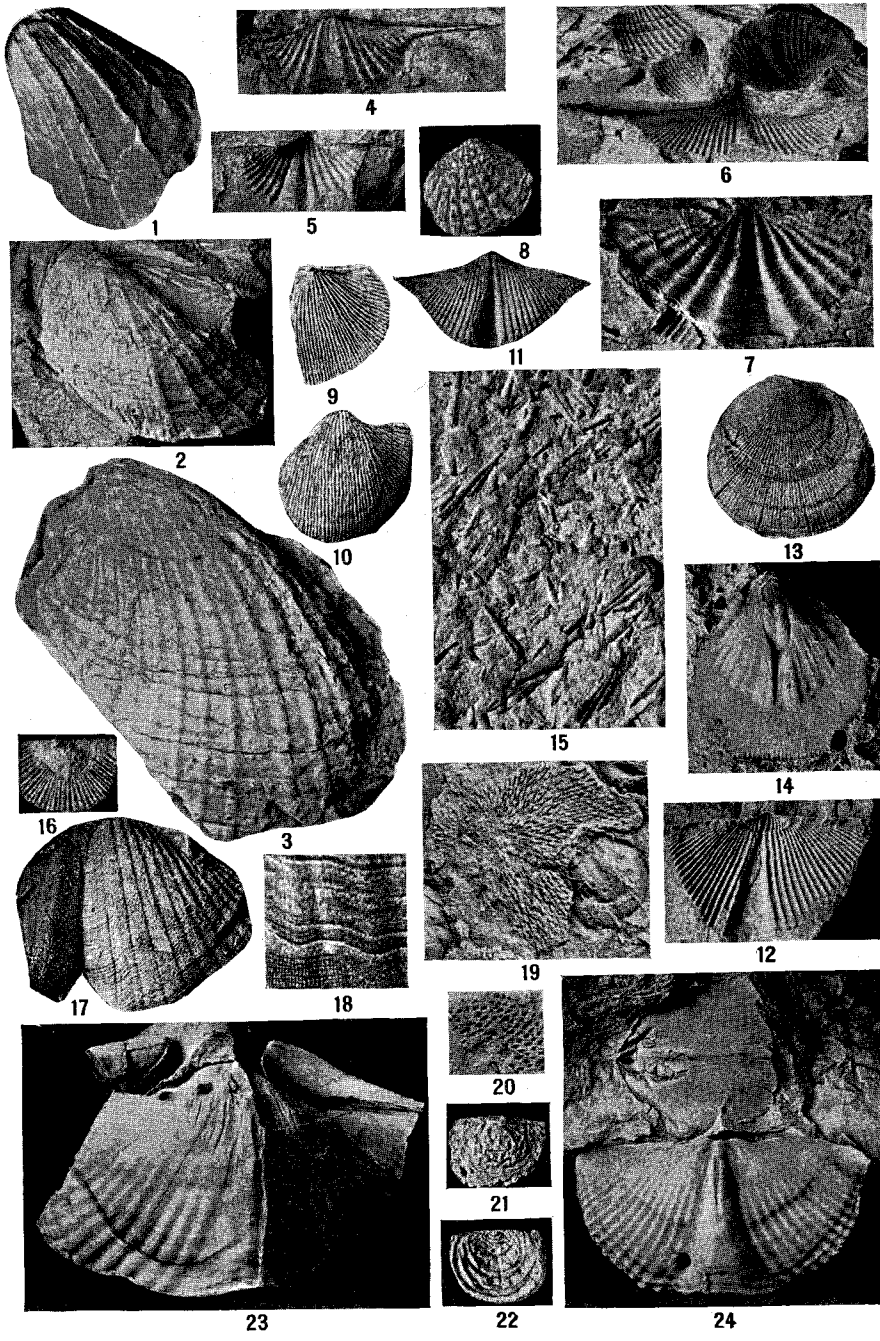
A silicified ventral valve. Occurrence as 1. U. S. N. M. 97947.

25, 26. *Hollina armata* (Ulrich), × 4.

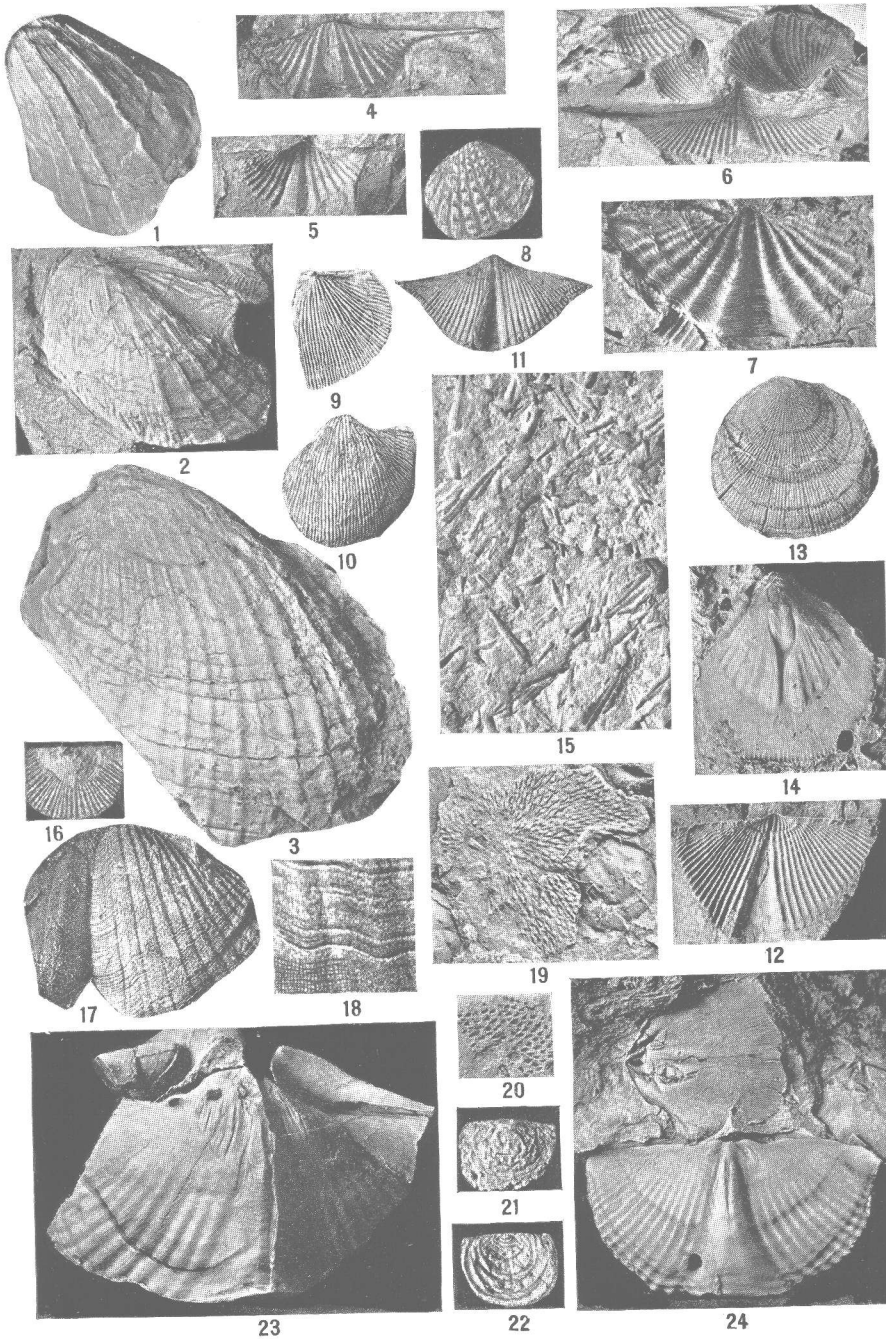
Right and left valves. Onondaga limestone; half a mile northeast of intersection of U. S. Route 19 and State Route 42, Washington County. U. S. N. M. 97948a, 97948b.

27, 28. *Pholidops areolata* Hall, × 1⅓.

Internal and external molds of a ventral valve. Occurrence as 25. U. S. N. M. 97949a, 97949b.



MARCELLUS AND HAMILTON FOSSILS



MARCELLUS AND HAMILTON FOSSILS

PLATE 118.—MARCELLUS AND HAMILTON FOSSILS

FIGURE

1–3. *Pterinea flabellum* (Conrad).

Fragments of 3 left valves. Hamilton member of the Romney shale; Green Springs, Frederick County. U. S. N. M. 97950a, 97950b, 97950c.

4–7. *Spirifer mucronatus* (Conrad).

4, internal mold of a ventral valve; 5, 6, external molds of ventral valves; 6, shows the normal expression of the species; 7, external mold of a dorsal valve; the mucronate extension of the hinge line on the left has been broken off. The transverse growth lines shown on this specimen are present on all the other specimens but are too faint to show in the photographs. Hamilton shale. 4, 5, Cedar Grove, Frederick County; 6, Dietrich in the Passage Creek Valley of Massanutten Mountain, Shenandoah County; 7, same locality as 1. U. S. N. M. 97951a, 97951b, 97952, 97953.

8. *Buchiola halli* Clarke.

Right valve. Marcellus shale; along State Route 42 half a mile northeast of Hayter Gap village, Washington County. U. S. N. M. 97955.

9, 10. *Chonetes coronatus* (Conrad).

9, internal mold of a ventral valve, left half broken away; 10, impression from the external mold of the same specimen. Hamilton shale; at the intersection of roads about 2 miles northeast of Liberty Furnace, Shenandoah County. U. S. N. M. 97956.

11, 12. *Spirifer audaculus* (Conrad).

11, impression of an external mold of a ventral valve; 12, external mold of a dorsal valve. Occurrence as 9. U. S. N. M. 97958a, 97958b.

13, 14. *Rhipidomella vanuxemi* (Hall).

13, impression of an external mold of a ventral valve; 14, internal mold of a ventral valve. Occurrence as 9. U. S. N. M. 97959a, 97959b.

15. *Styliolina fissurella* (Hall), × 4.

Small piece of shale thickly covered with this fossil. Several specimens show the median fissure in the surface

FIGURE

of the shell. A guide for Middle and lower Upper Devonian formations (Onondaga to upper Millboro) in which it is abundant and universally distributed. Marcellus shale?; along road on west side of New River about 1 mile northeast of Narrows, Giles County. U. S. N. M. 97960.

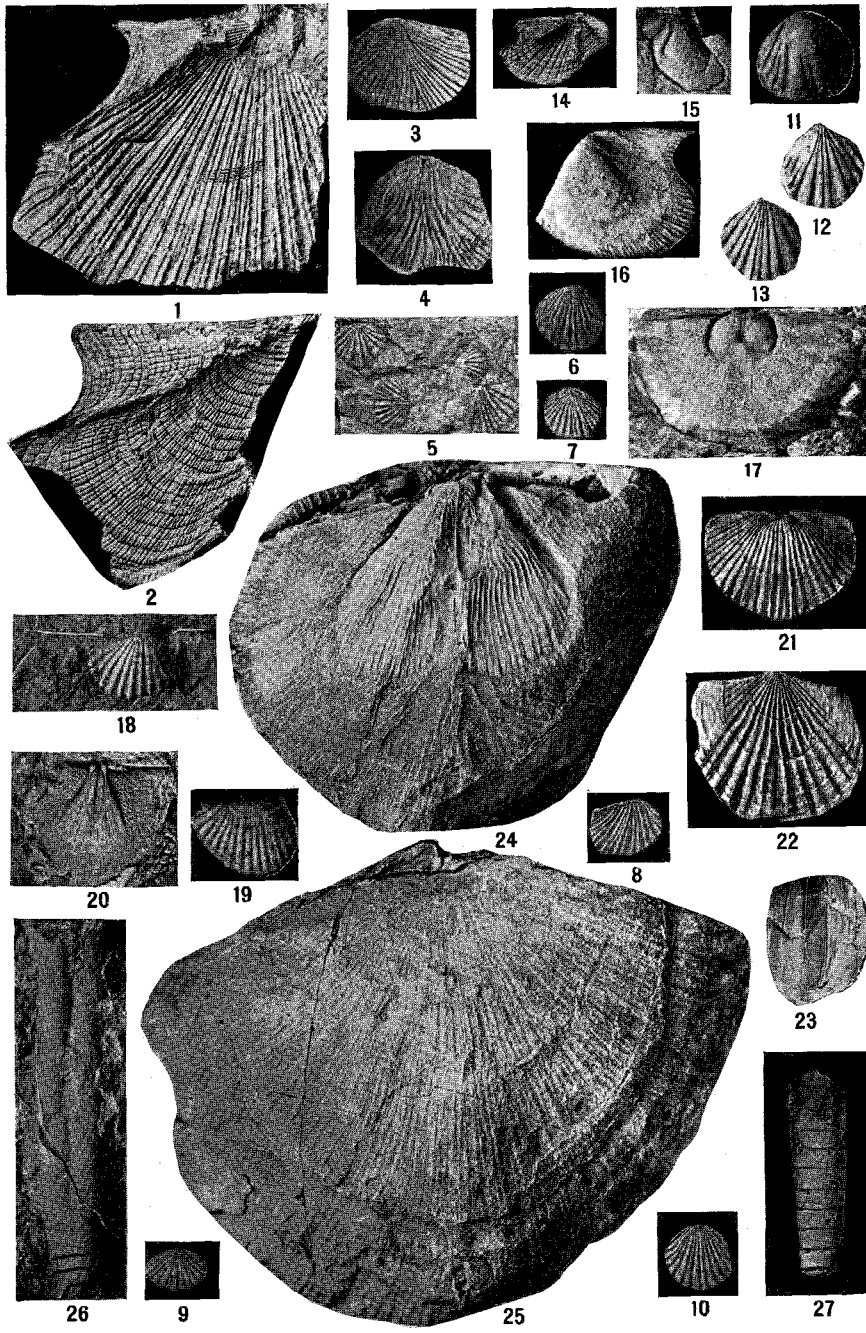
16. *Chonetes lepidus* Hall, × 4.
Occurrence as 8. U. S. N. M. 97957.

17, 18. *Spirifer granulosus* (Conrad).
17, impression of an external mold of a ventral valve; 18, part of 17, × 4, to show granulated surface. Occurrence as 9. U. S. N. M. 97961a. (See also figs. 23, 24.)

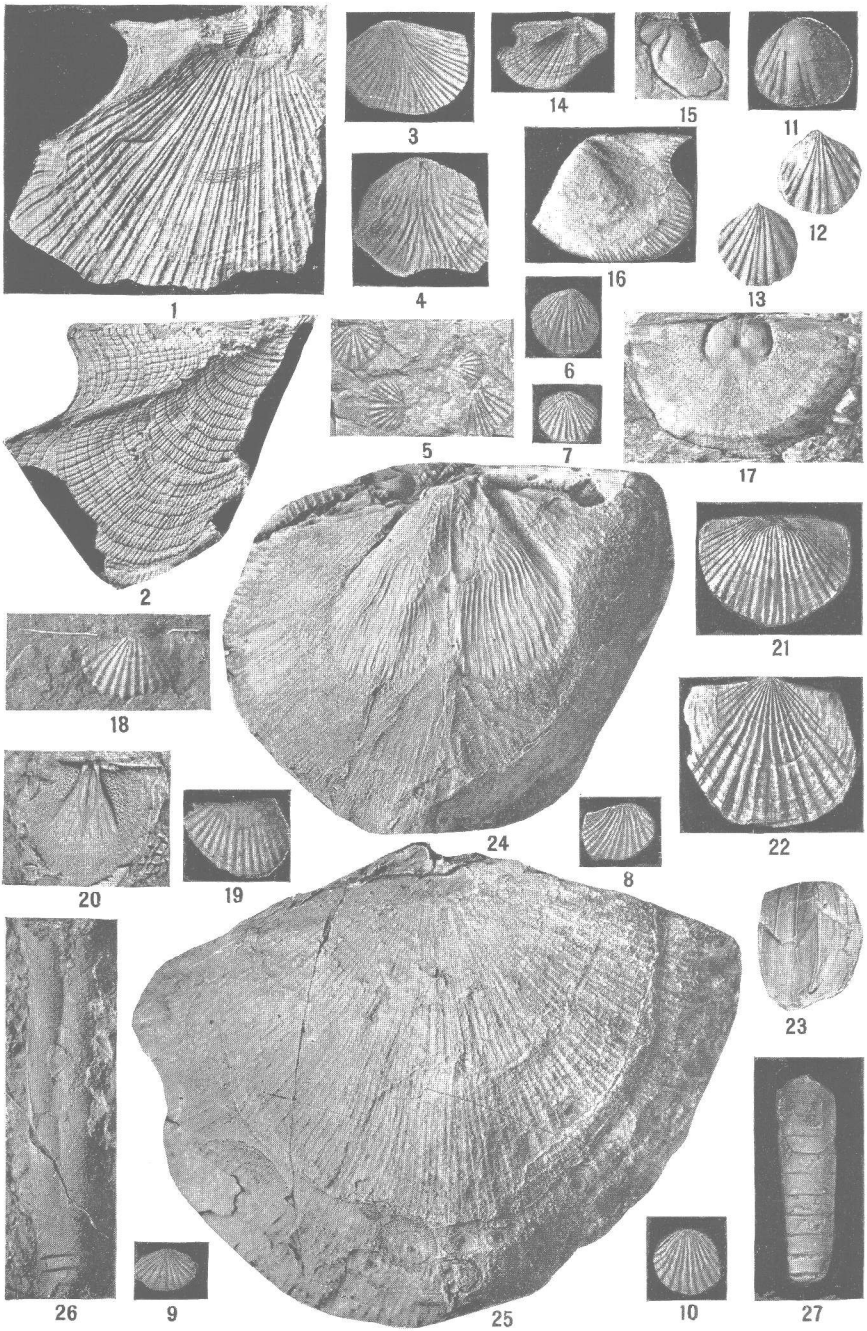
19, 20. *Paleschara* sp., × 4.
A lamellar bryozoon. Marcellus shale. Rare but widely distributed fossil of the Marcellus. 19, same locality as 8; 20, along road half a mile southeast of Waiteville, Monroe County, W. Va., just above Onondaga chert. U. S. N. M. 97962, 97963.

21, 22. *Strophalosia truncata* (Hall), × 2.
21, internal mold of a ventral valve; 22, exterior of the concave dorsal valve preserving the shell substance. Occurrence as 8. U. S. N. M. 97964a, 97964b.

23, 24. *Spirifer granulosus* (Conrad).
Internal molds of two dorsal valves. Occurrence as 9. U. S. N. M. 97961b, 97961c. (See also figs. 17, 18.)



MARCELLUS AND HAMILTON FOSSILS



MARCELLUS AND HAMILTON FOSSILS

PLATE 119.—MARCELLUS AND HAMILTON FOSSILS

FIGURE

1. *Lyriopecten interradiatus* Hall.

External mold of a left valve. Hamilton shale; Green Springs, Frederick County. U. S. N. M. 97965.

2. *Actinopteria decussata* Hall.

External mold of a left valve. Hamilton shale; along road 2 miles northeast of Liberty Furnace, Shenandoah County. U. S. N. M. 97966.

3–10. *Leiorhynchus limitare* (Vanuxem)?

Romney or Millboro shale, Marcellus horizon. 3, 4, along U. S. Route 21 about 3 miles southeast of the summit of Walker Mountain, Wythe County; 5, 7-10, along road at southeast base of Ingles Mountain about 1½ miles south of Radford, Pulaski County; 6, road on Hughes Creek about one-fourth of a mile north of the mouth and 12 miles north of Covington, Alleghany County. This species shows considerable variation in number and size of ribs. A collection from the Marcellus near Central City (Milesburg), Center County, Pa., includes the same forms which are there associated with *Paleschara,* as found at a number of places in Virginia as far south as Hayter Gap, Washington County. U. S. N. M. 97967a, 97967b, 97968a, 97969, 97968b, 97968c, 97968d, 97968e.

11–13. *Leiorhynchus mysia* Hall, × 2.

12, 13, dorsal and ventral views of a whole specimen; 11, ventral view of a slightly larger specimen. Associated with *Tornoceras uniangulare?* and *Schizobolus truncatus.* Marcellus shale; along State Route 42 half a mile northeast of village of Hayter Gap, Washington County. U. S. N. M. 97970a, 97970b.

14–16. *Actinopteria muricata* Hall.

14, external mold of left valve; 15, internal mold of a left valve, × 2; 16, internal mold of the posterior part of a left valve, × 4. Marcellus shale; half a mile south of Waiteville, Monroe County, W. Va. U. S. N. M. 97971a, 97971b, 97971c.

FIGURE

17. *Douvillina? inequistriata* (Conrad)?
Internal mold of a ventral valve. Occurrence as 2. U. S. N. M. 97972.

18, 19. *Chonetes mucronatus* Hall.
Ventral valves. 18, shows the characteristic long hinge spine extending parallel to the hinge line. Occurrence as 11. U. S. N. M. 97973a, 97973b.

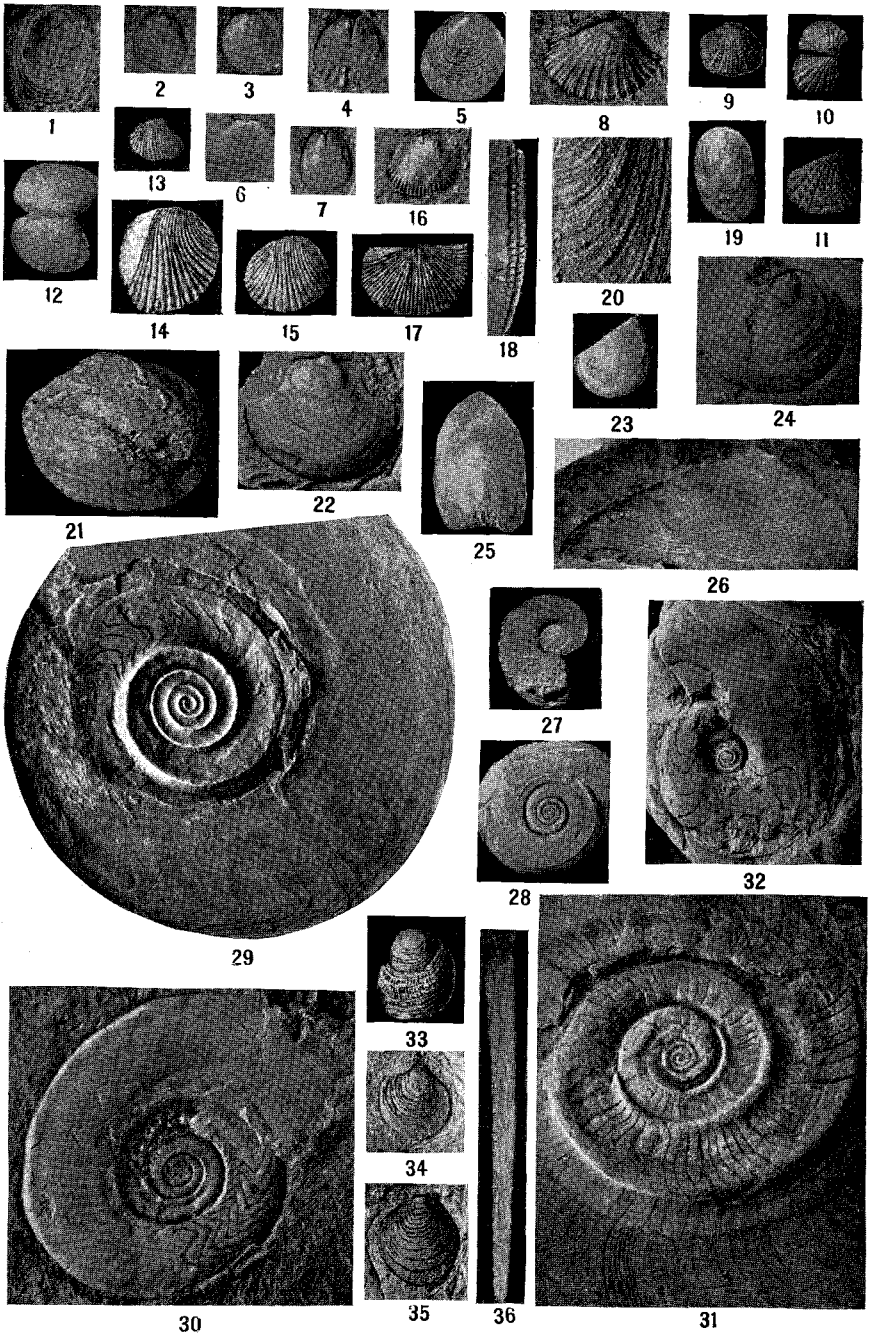
20. *Stropheodonta perplana* (Conrad).
Internal mold of a dorsal valve. Occurrence as 2. U. S. N. M. 97974.

21, 22. *Tropidoleptus carinatus* (Conrad).
Internal molds of two ventral valves. Occurrence as 2. U. S. N. M. 97975a, 97975b. (See Plate 123, figs. 11-13.)

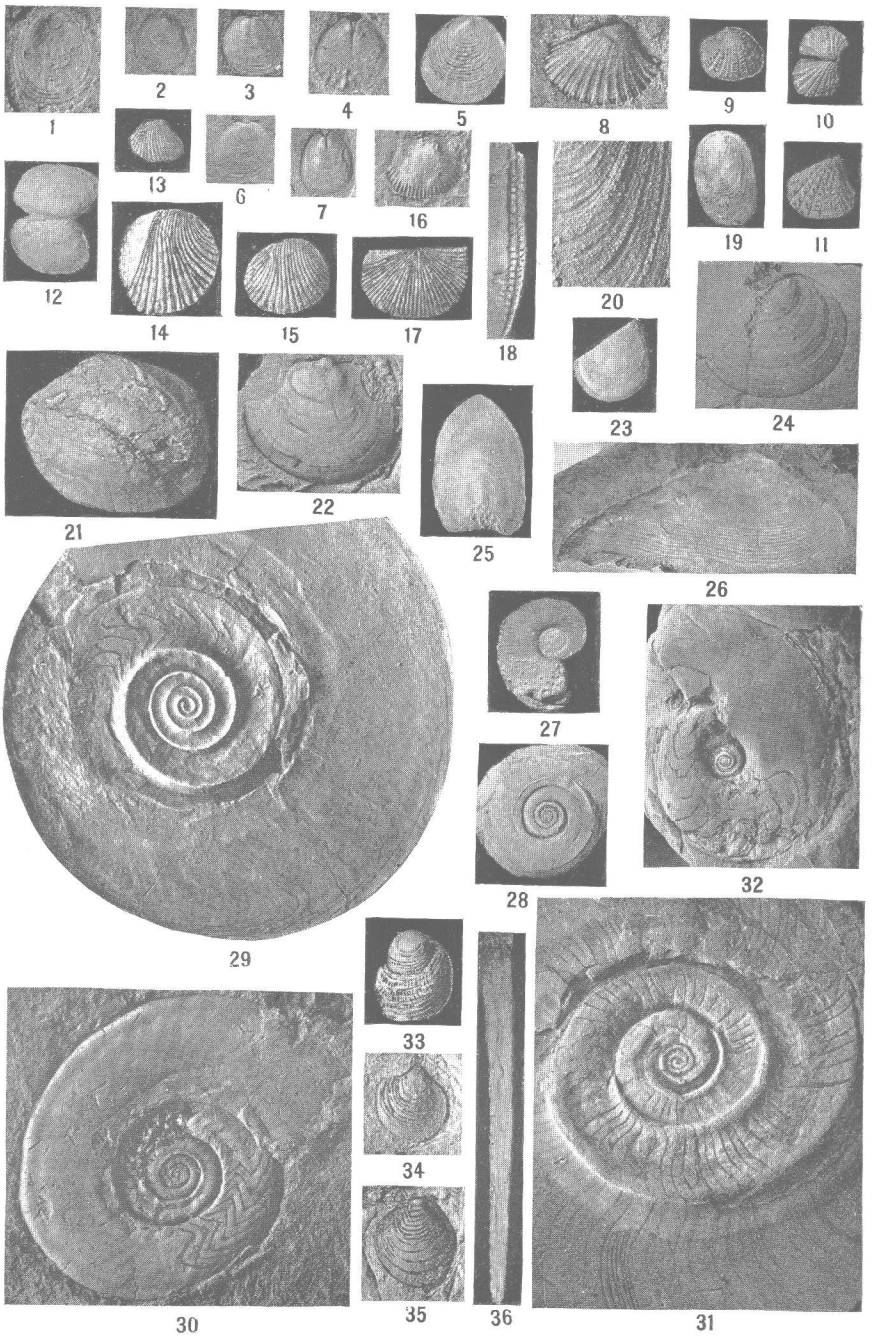
23. *Nucleocrinus strichteri* Rowley?
Hamilton shale; half a mile northwest of Dietrich in the Passage Creek valley of Massanutten Mountain, Shenandoah County. U. S. N. M. 97976.

24, 25. *Stropheodonta concava* Hall.
24, internal mold of a ventral valve; 25, internal mold of a dorsal valve. Occurrence as 2. U. S. N. M. 97977a, 97977b.

26, 27. *Orthoceras* sp., × 2.
Pyritized. 26, exterior of living chamber crushed in middle. Occurrence as 8. U. S. N. M. 98000a, 98000b.



MARCELLUS, NAPLES, AND BRALLIER FOSSILS



MARCELLUS, NAPLES, AND BRALLIER FOSSILS

PLATE 120.—MARCELLUS, NAPLES, AND BRALLIER FOSSILS

FIGURE

1–7. *Schizobolus concentricus* (Vanuxem), × 2.

1, external mold of a dorsal valve; 2, 5, internal molds of dorsal valves; 3, 4, 6, 7, internal molds of ventral valves. Millboro shale. 1, 3, 5, 6, Marcellus horizon; about 2½ miles southwest of village of Hayter Gap, Washington County; 2, 7, basal Portage, Naples horizon; along State Route 42 half a mile northeast of the village of Hayter Gap, Washington County; 4, Marcellus horizon; same locality as 2, but just below bed with *Leiorhynchus mysia* (Pl. 119, figs. 11-13). U. S. N. M. 97978a, 97979a, 97978b, 97980, 97978c, 97978d, 97979b.

8. *Honeoyea* cf. *H. erinacea* Clarke.

Slightly longer and of less height than *H. erinacea*. Millboro shale, Naples horizon; along southeast slope of Rich Mountain just below sharp angle in State Route 87 and about 1 mile north of the entrance to Burkes Garden, Tazewell County. U. S. N. M. 97981.

9, 10. *Buchiola retrostriata* (von Buch), × 2.

9, internal mold of left valve; 10, internal mold of both valves. 9, Brallier shale, near bottom; along road on Beaver Fork ¾ of a mile south of Bluefield, Va.; 10, occurrence as 8. U. S. N. M. 97982, 97983.

11. *Buchiola halli* Clarke.

Internal mold of a right valve. Millboro shale, probably Marcellus horizon; along the Lee Highway just northwest of the crest of Draper Mountain and about 1 mile south of Pulaski, Pulaski County. U. S. N. M. 97954.

12. *Palaeoneilo* cf. *P. petilla* Clarke.

Occurrence as 9. U. S. N. M. 97984.

13–15. *Paracardium doris* Hall, × 2.

13, left valve; 14, 15, right valves. Millboro shale, Naples horizon. 13, along Bennetts Run 2 miles northwest of Bergton, Shenandoah County; 14, 15, along U. S. Route 50 half a mile west of Burlington, Mineral County, W. Va. These specimens are from a good collection made

FIGURE

by G. W. Stose. They are evidently from the bed designated Genesee by the West Virginia Geological Survey. (See Geology of Mineral County.) As this fossil is apparently not reported from the Genesee, as restricted by Clarke, it is believed that the black shale, designated "Genesee" by the Maryland and West Virginia geological surveys, is not Genesee but Portage, and representative of the Naples beds of Clarke. *Paracardium doris* is probably the most common and most persistently distributed fossil of the Naples beds and is a guide fossil of those beds from New York to Tennessee. 13, U. S. N. M. 97985.

16, 17. *Chonetes lepidus* Hall, × 4.

Ventral valves. Occurrence as 8. U. S. N. M. 97986a, 97986b.

18. *Pteridichnites biseriatus* C. K. Swartz.

Brallier shale, base; along road on Beaver Fork at the right angle, three-fourths of a mile southeast of Bluefield, Va. Most common fossil of the Brallier. U. S. N. M. 97987.

19, 20. *Lingulipora williamsana* Girty.

19, part of a valve; 20, part of same to show punctuate shell structure, × 4. Brallier shale; along railroad one-fourth of a mile south of Raven, Tazewell County. U. S. N. M. 97988.

21, 22. *Ontaria halli* Clarke.

Left and right valves. Occurrence as 8. U. S. N. M. 97989a, 97989b.

23. *Lunulicardium* cf. *L. eriense* Clarke.

Marked by very fine radiating lines. Brallier shale; Gala station on Chesapeake and Ohio Railway about 5 miles northwest of Eagle Rock, Botetourt County. U. S. N. M. 97990.

24. *Lunulicardium* cf. *L. pilosum* Clarke.

Marked by very fine radiating lines. Occurrence as 8. U. S. N. M. 97991.

25, 26. *Spathiocaris emersoni* Clarke?

Occurrence as 8. U. S. N. M. 97992a, 97992b.

FIGURE

27–31. *Probeloceras lutheri* Clarke.

27, 31, external molds showing the fine curving lines of ornamentation, × 4. Between the coarser lines shown are several fine hairlike lines not shown except by retouching in the lower part of 31. *28*, external mold (?) showing faint surface markings; *29*, 30, internal molds showing the zigzag sutures of the plicated septae, × 2. *28*, Brallier shale along Walker Creek 5 miles west of Marion, Smyth County; *27*, occurrence as *2*; *29*-31, occurrence as 8. U. S. N. M. 97993, 97994, 97995a, 97995b, 97995c.

32. *Manticoceras patersoni* (Hall).

Internal mold. Occurrence as 8. U. S. N. M. 97996.

33. *Palaeotrochus praecursor* Clarke.

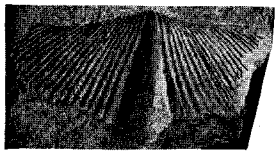
Occurrence as 8. U. S. N. M. 97997

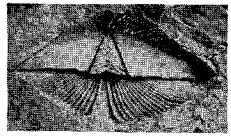
34, 35. *Pterochaenia fragilis* (Hall), × 2.

34, left valve, not correctly posed; 35, right valve. Millboro shale, Naples horizon; 1 mile northeast of White Sulphur Springs, W. Va. U. S. N. M. 97998a, 97998b.

36. *Bactrites gracilior* Clarke.

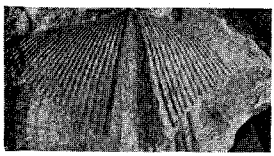
One of the most common fossils of the Naples horizon. Occurrence as 8. U. S. N. M. 97999.

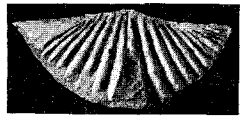

1

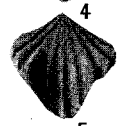

3

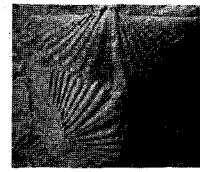

4

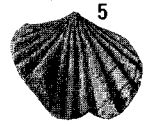

13

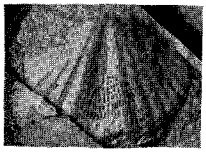

2

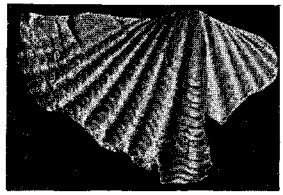

15

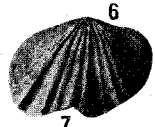

5


16

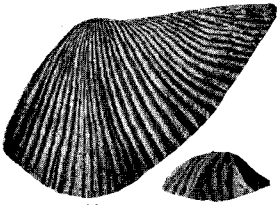

6


17

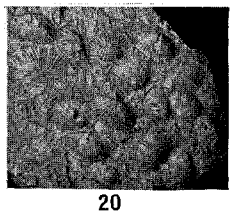

14


7

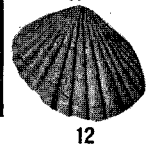

21

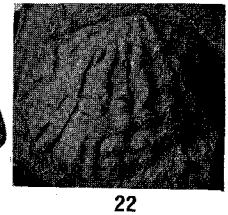

18

9

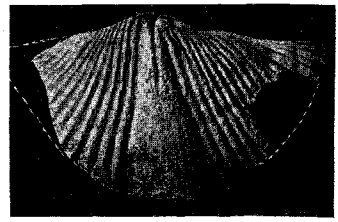

20


11

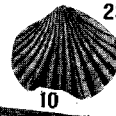

12

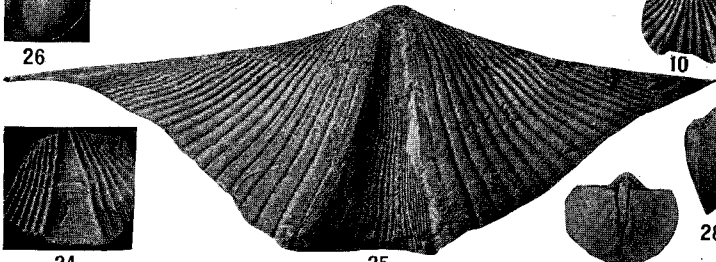

22


19


23


26


10

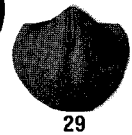

25


8

24

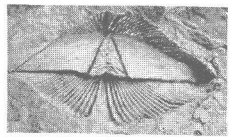

27

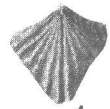

28

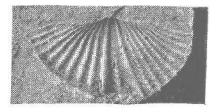

29

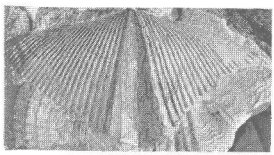
CHEMUNG FOSSILS

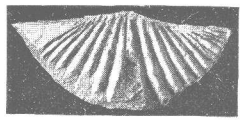

1

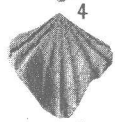

3

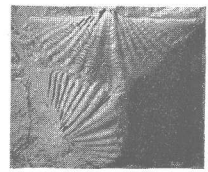

4

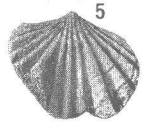

13

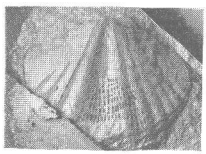

2

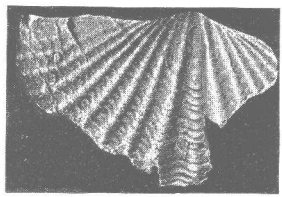

15

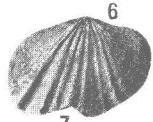

5


16


6

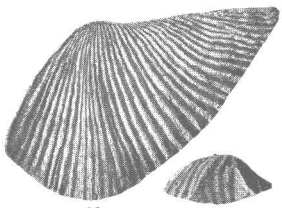

17


14

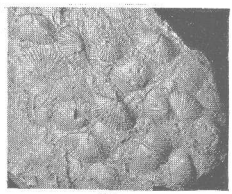

7


21

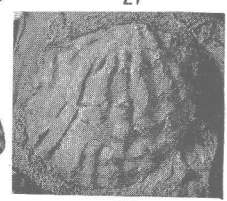

11


18

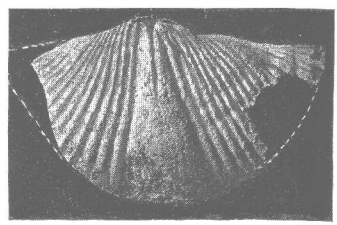
9


20

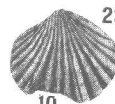

12


22

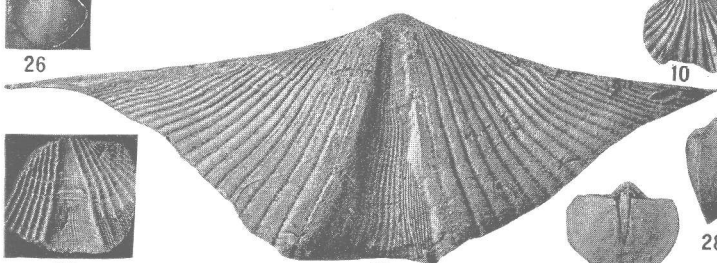

19


23


26


10


8


25

24


27


28


29

CHEMUNG FOSSILS

PLATE 121.—CHEMUNG FOSSILS

FIGURE

1–3. *Spirifer marcyi* Hall?

1, external mold of a dorsal valve, concave toward the observer; 2, external mold of a ventral valve, also concave toward the observer; 3, external mold of the area of the ventral valve showing the delthyrium, the dorsal valve, and the overhanging posterior margin of the ventral valve. It should be viewed from the left side. This species was originally described as from the Hamilton, but Williams and Tarr[a] cite it from the Chemung in the Ithaca region, New York. Chemung formation, near bottom; along Little Back Creek 750 feet above its junction with State Route 501 and 2½ miles northwest of Mountain Grove, Bath County. U. S. N. M. 98001a, 98001b, 98001c.

4–10. *Camarotoechia contracta* (Hall).

4, 5, dorsal and ventral views of an internal mold; 6, 7, ventral and dorsal views of another specimen; 8-10, dorsal, front, and ventral views of another specimen. Chemung formation. 4-7, gorge of Reed Creek through Brushy Mountain about 3 miles northwest of Blacklick, Wythe County; 8-10, top of Chemung along U. S. Route 21 about 1½ miles north of Bland, Bland County. 4, 5, U. S. N. M. 98002a; 6, 7, 98002b; 8-10, 98003.

11, 12. *Camarotoechia congregata* (Conrad).

Ventral and dorsal valves. Chemung formation; along U. S. Route 21 about 2 miles north of Bland, Bland County. U. S. N. M. 98004a, 98004b.

13–16. *Spirifer* (*Delthyris*) *mesicostalis* (Hall).

13, 14, external molds of dorsal valves; 14, × 2, to show zigzag transverse lamellae; 15, internal mold of the dorsal valve preserving an inner film of the shell; 16, internal mold of a ventral valve (upper) and of a dorsal valve (lower) showing the rib in the sinus of the ventral valve and the furrow on the fold of the dorsal valve. This is the most characteristic feature of the species. These two specimens have unusually long mucronate extensions of the hinge line. Ranges from the Portage (Brallier)

[a] Williams, H. S. and Tarr, R. S., U. S. Geol. Survey Geol. Atlas, Watkins Glen-Catatonk folio (No. 169), 1909.

FIGURE

through the Chemung. Chemung formation. 13, 14, State line at head of Lick Run about 10 miles northeast of Durbin, W. Va.; 15, same locality as 1; 16, about 1½ miles northeast of Orkney Springs, Shenandoah County. U. S. N. M. 98005a, 98005b, 98006, 98007.

17. *Elytha fimbriata* (Conrad).

Impression of the external mold of the ventral valve. Occurrence as 1. U. S. N. M. 98008.

18, 19. *Spirifer disjunctus* Sowerby.

18, impression from an external mold of part of a dorsal valve; 19, external molds of ventral valves. Note ribs on fold of 18 and in sinus of 19, and compare with 1, 2, 23. Chemung formation. 18, along U. S. Route 60 about 2 miles east of White Sulphur Springs, W. Va.; 19, along State Route 91 half a mile north of Broadford, Smyth County. Probably the most abundant Chemung fossil, but good specimens are rare in Virginia. U. S. N. M. 98009, 98010a, 98010b.

20. *Chonetes scitulus* Hall.

Slab with several specimens. Chemung formation; at Red Mill 1½ miles north of Gap Mills, Monroe County, W. Va. U. S. N. M. 98011.

21, 22. *Atrypa spinosa* Hall.

Clay impressions of external molds. 21, ventral valve; 22, dorsal valve. Coarser and more strongly nodose ribs than in the common and normal examples. Occurrence as 18. U. S. N. M. 98012a, 98012b.

23–25. *Spirifer mesistrialis* Hall.

23, internal mold of a dorsal valve; 24, external mold of a dorsal valve; 25, impression of an external mold of a ventral valve. All show the absence of ribs on the fold and in the sinus. 24, shows the fine striae on both ribs and folds, and 25 those on the fold that suggest the name. Both features are characteristic of the species. Chemung formation. 23, 24, along road midway between Little North Mountain and Supin Lick Mountain about 4 miles southeast of Orkney Springs, Shenandoah County; 25, Tioga County, N. Y. U. S. N. M. 98013a, 98013b, 4251.

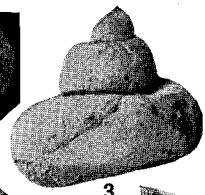
FIGURE

26–29. *Ambocoelia umbonata* (Conrad).

26, impression of an external mold of a ventral valve; 27-29, dorsal, profile, and ventral views of an internal mold of a whole specimen, × 2. Chemung formation; float from Shenandoah Mountain in deep ravine 2½ miles northeast of Williamsville, Bath County. 26, U. S. N. M. 98014a; 27-29, 98014b.


1

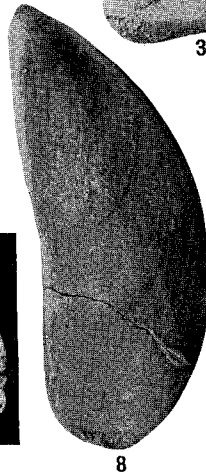

5


3

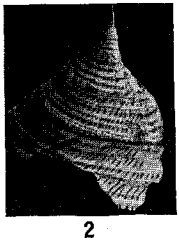

6

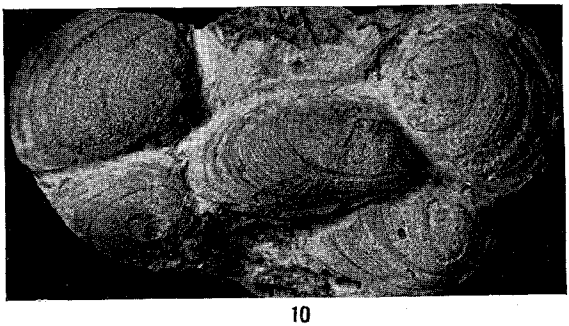

7

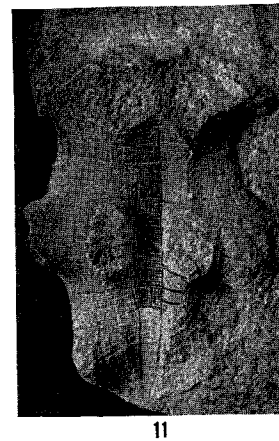

4

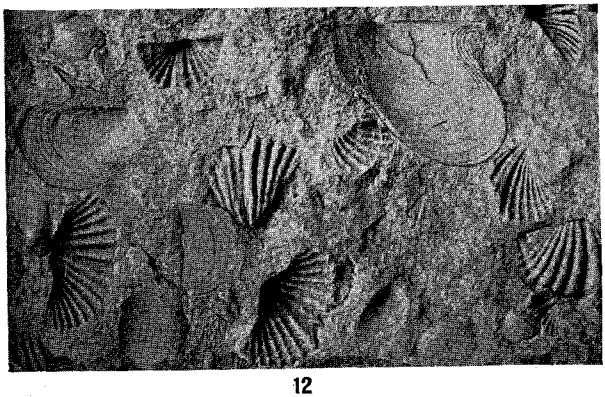

8

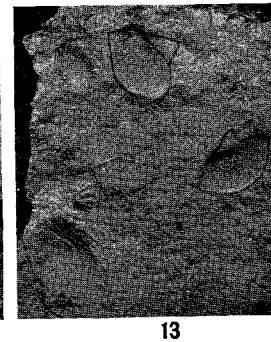

9


2


10

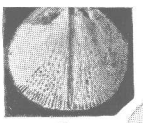

11

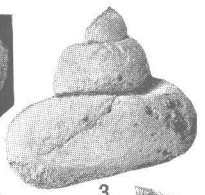

12


13

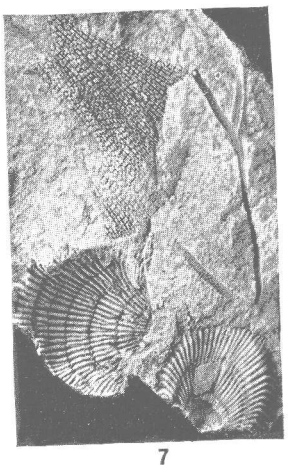
CHEMUNG FOSSILS


1


5


3

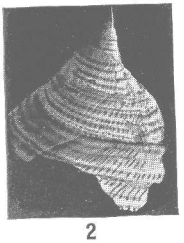

6

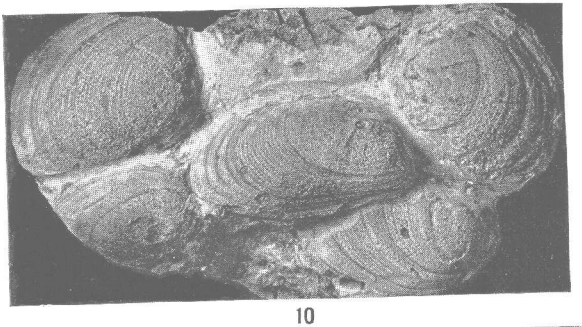

7

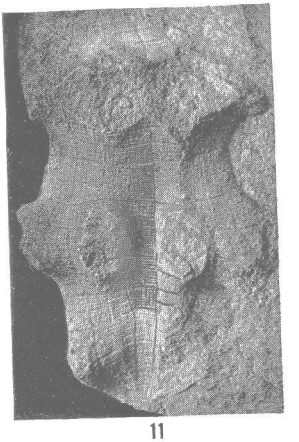

4

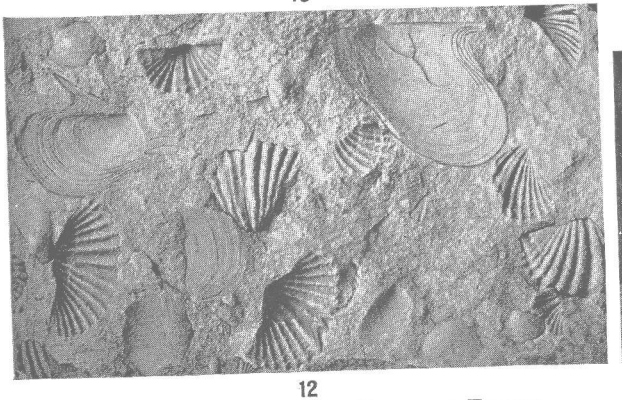

8


9


2


10


11


12


13

CHEMUNG FOSSILS

PLATE 122.—CHEMUNG FOSSILS

FIGURE

1–3. *Cyclonemina multistriata* Clarke and Swartz.

1, impression from an external mold; 2, external mold of another specimen, concave toward the observer, to show ornamentation; 3, internal mold of a third specimen. Chemung formation; along U. S. Route 250 about 3 miles west of Jennings Gap, Augusta County. U. S. N. M. 98015a, 98015b, 98015c.

4. *Cyclonemina crenulistriata* Clarke and Swartz.

Impression from an external mold. Occurrence as 1. U. S. N. M. 98016.

5. *Rhipidomella vanuxemi* (Hall)?

Internal mold of dorsal valve. Chemung formation; near mouth of Little Back Creek about 2½ miles northwest of Mountain Grove, Bath County. (See Pl. 123, figs. 9 and 10.) U. S. N. M. 98017a.

6, 7. *Rhombopora* sp.

7, external mold of a branching specimen on right; 6 part of 7, × 4. The *Rhombopora* is the most common and widely distributed bryozoan in the Chemung. Shows also species of *Fenestrellina* and two specimens of *Atrypa reticularis*. Chemung formation; along U. S. Route 60 about 2 miles east of White Sulphur Springs, W. Va. U. S. N. M. 98018.

8. *Modiola praecedens* Hall.

Left valve. Chemung formation; Brushy Mountain 6 miles west of Marion, Smyth County. U. S. N. M. 98019.

9. *Mytilarca chemungensis* (Conrad).

Left valve. Associated with *Spirifer disjunctus*. Chemung formation; half a mile west of Broadford, Smyth County. U. S. N. M. 98020.

10. *Edmondia subovata* Hall.

Left valve (upper left corner) and right valves. Chemung formation; along old Staunton-Parkersburg pike 5 miles northwest of Buffalo Gap, Augusta County. U. S. N. M. 98021.

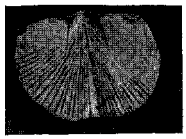
FIGURE

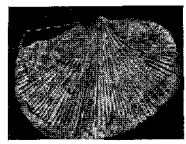
11. *Hydnoceras tuberosum* Conrad.
Occurrence as 6. U. S. N. M. 98022.

12. Slab with *Leptodesma potens* Hall (right); *L. agassizi* Hall (left); and molds of *Spirifer (Delthyris) mesicostalis* Hall. Chemung formation; State line at head of Spring Run in the northwest corner of Highland County. U. S. N. M. 98023, 98024, 98025.

13. *Leptodesma sociale* Hall.
Occurrence as 12. U. S. N. M. 97079.

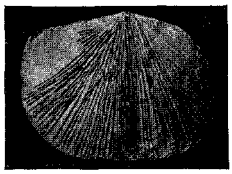

1


2

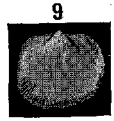

4

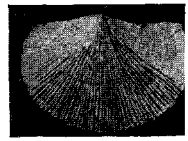

5

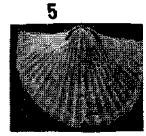

7


3

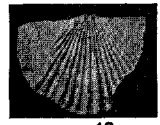

9


10

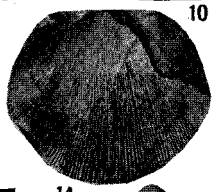


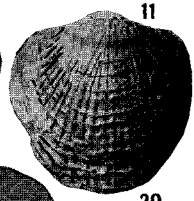

12

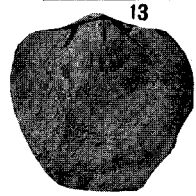

6
11

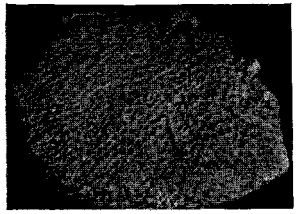

13

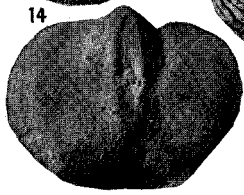

8


14


20

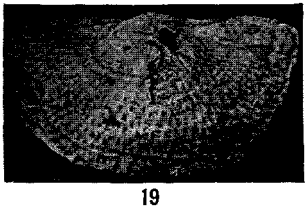

21


18


15


22


23


19

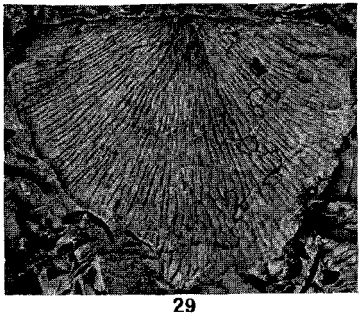

16

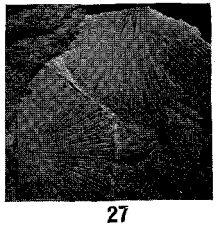

24


17


25

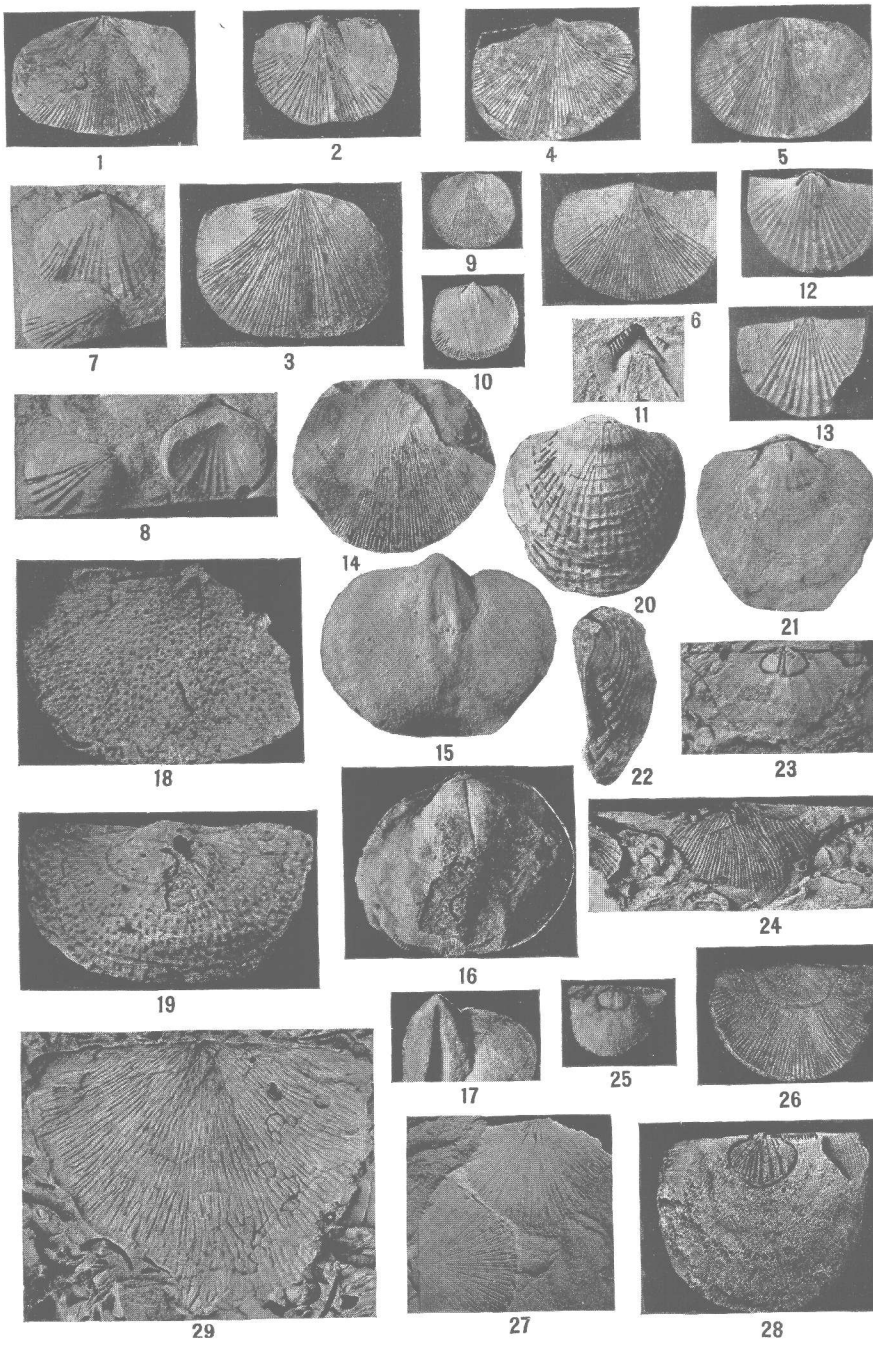

26


29


27


28

CHEMUNG FOSSILS



CHEMUNG FOSSILS

PLATE 123.—CHEMUNG FOSSILS

FIGURE

1–6. *Carniferella carinata* or *C. tioga* (Hall)?

These two species closely resemble each other, as noted by Hall. 1, internal mold of a dorsal valve; 2, internal mold of a ventral valve; 3, impression of an external mold of a dorsal valve; 4, external mold of a ventral valve; 5, external mold of a dorsal valve; 6, impression of 4, showing the actual exterior of the shell. Chemung formation, near base; along road on Little Back Creek about 750 feet north of State Route 501 and 2½ miles northwest of Mountain Grove, Bath County. This genus is apparently confined to the Chemung formation. U. S. N. M. 98026a, 98026b, 98026c, 98026d, 98026e.

7, 8. *Leiorhynchus mesicostale* (Hall).

7, (upper), internal mold of a ventral valve; 8, (left), internal mold of a dorsal valve. Occurrence as 1. U. S. N. M. 98027a, 98027b.

9, 10. *Rhipidomella vanuxemi* (Hall)?

9, ventral valve; 10, internal mold of a ventral valve. Occurrence as 1. (See Pl. 122, fig. 5.) U. S. N. M. 98017b, 98017c.

11–13. *Tropidoleptus carinatus* (Conrad).

11, internal mold of a dorsal valve showing the pits made by the teeth of the crenulated socket plates characteristic of the genus. 12, internal mold of a ventral valve; 13, external mold of a dorsal valve. Occurrence as 1. (See Plate 119, figs. 21, 22.) U. S. N. M. 98028a, 98028b, 98028c.

14–17. *Schizophoria striatula* Schlotheim?

14, impression from an external mold of a ventral valve; 15, internal mold of a ventral valve; 16, internal mold of a dorsal valve; 17, internal mold of a fragment of a ventral valve showing the strong muscular impression of the umbonal cavity. Presumably owing to this, the specific name *impressa* was given by Hall. Occurrence as 1. U. S. N. M. 98029a, 98029b, 98029c, 98029d.

FIGURE

18, 19. *Productella hirsuta* Hall.

Internal molds of dorsal and ventral valves. Chemung formation; one-fourth of a mile northwest of summit of Price Mountain in the southwest corner of the Eagle Rock quadrangle, Craig County. U. S. N. M. 98030a, 98030b.

20–22. *Atrypa reticularis* (Linné).

Ventral, dorsal, and profile views. Occurrence as 1. U. S. N. M. 98031.

23, 24. *Douvillina extensa* Butts, n. sp.

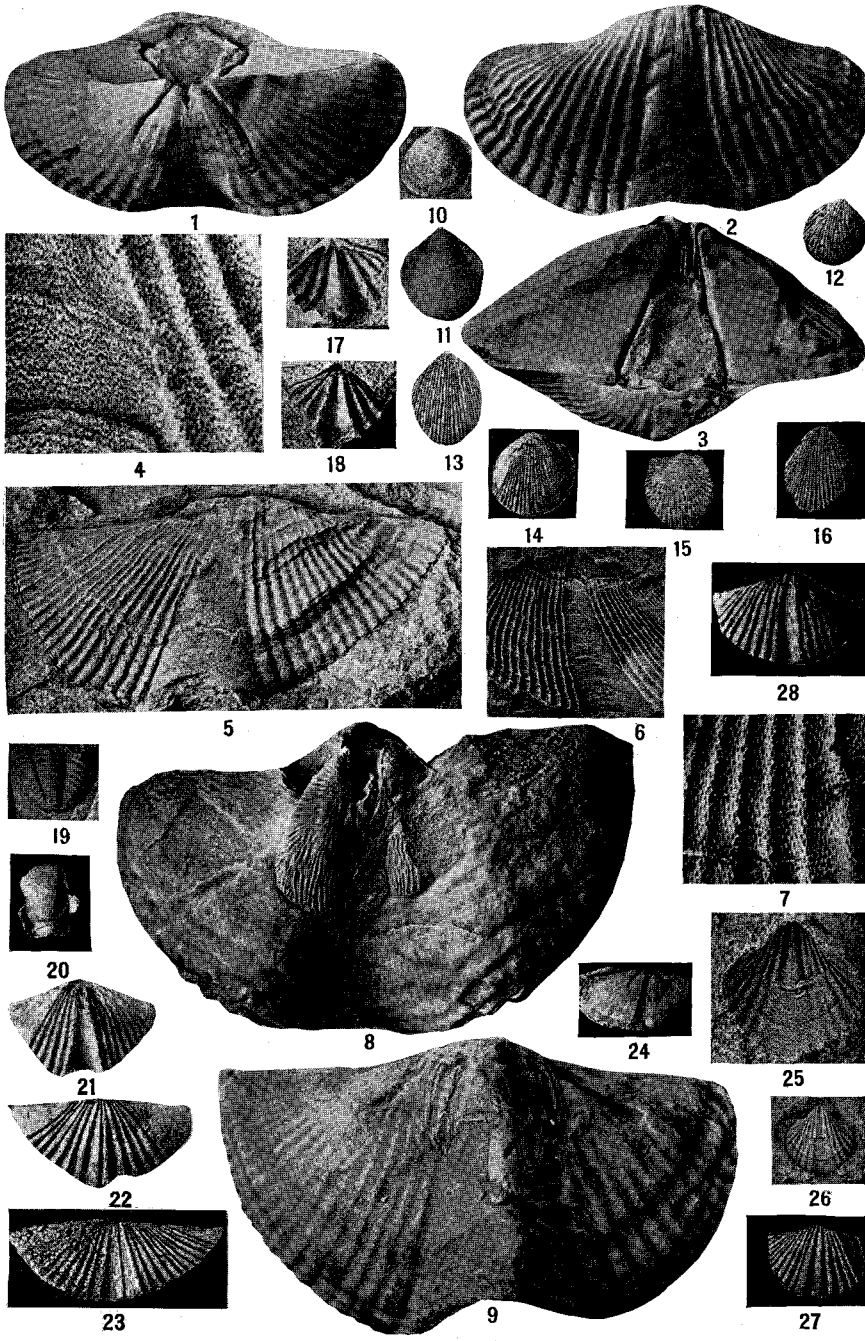
Distinguished by very extended cardinal extremities, coarser and more numerous primary costae than in *D. mucronata,* and by only one or two intermediate, fine striae instead of four or five as in *D. mucronata* (cf. Fig. 27). 23, internal mold of a ventral valve, with mucronate extremities broken off; 24, impression from an external mold of a ventral valve. Chemung formation; along U. S. Route 60 about 1 mile west of State line and 2 miles east of White Sulphur Springs, W. Va. Cotypes: U. S. N. M. 98032a, 98032b.

25–28. *Douvillina mucronata* (Hall) ?.

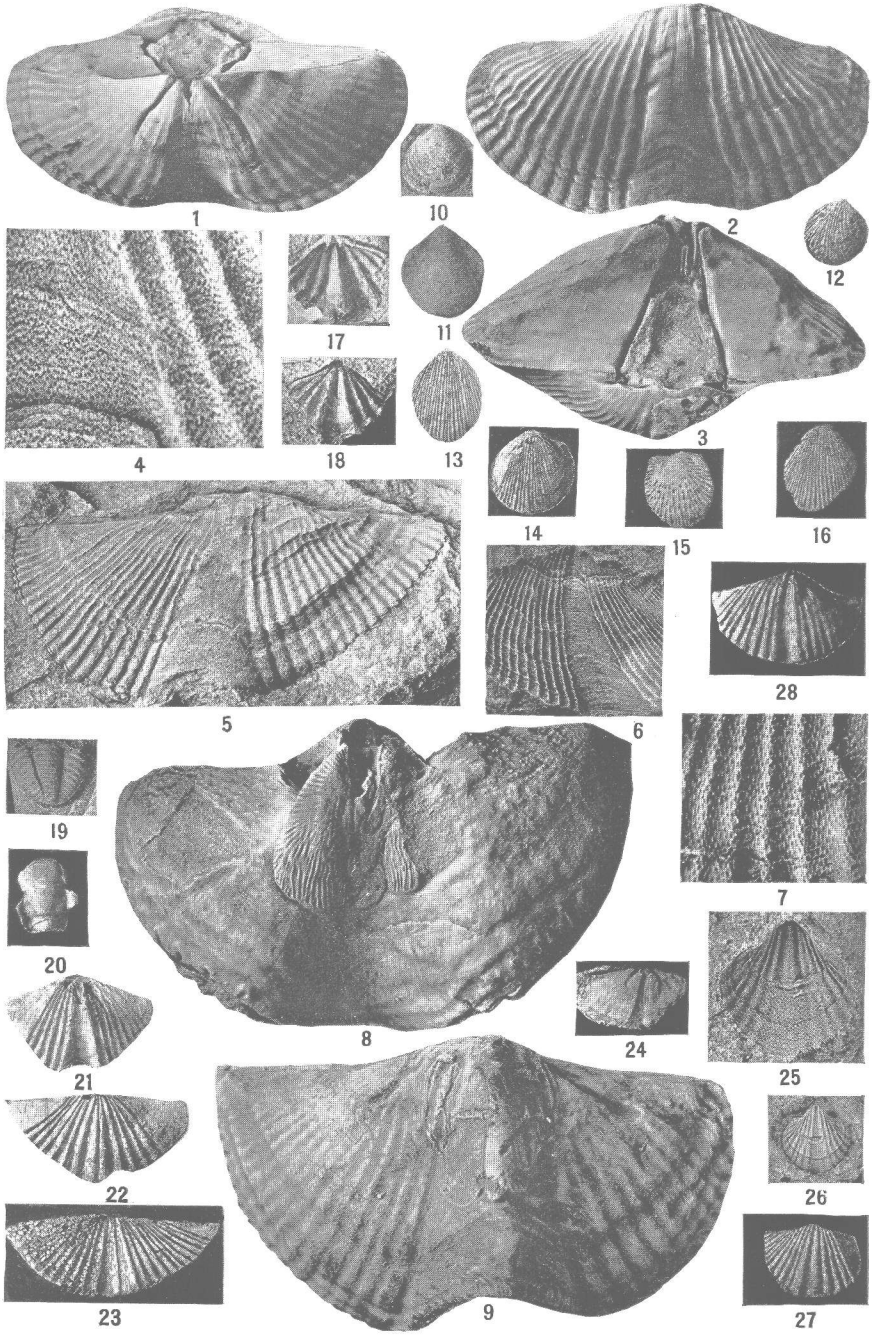
25, 28, internal molds of ventral valves; 26, external mold of a ventral valve showing the muscle scar; 27, internal mold of a ventral valve (left) and of the dorsal valve (right). Chemung formation. 25, same locality as 23; 26, along U. S. Route 250 on southeast slope of Shenandoah Mountain, Augusta County; 27, occurrence as 1. Supposed to be about 200 feet below the horizon of 1; 28, at State line 5 miles east of Frost, W. Va. 25, 28, U. S. N. M. 98037, 98033; 26, 98034; 27, 98035.

29. *Stropheodonta perplana* Conrad, var. *nervosa* Hall.

External mold of a ventral valve. Occurrence as 23. U. S. N. M. 98036.



PRICE AND NEW PROVIDENCE FOSSILS



PRICE AND NEW PROVIDENCE FOSSILS

PLATE 124.—PRICE AND NEW PROVIDENCE FOSSILS

FIGURE

1–9. *Syringothyris texta* (Hall).

1, 8, internal molds of ventral valves; 2, 9, internal molds of dorsal valves; 3, posterior view of an internal mold showing the syrinx and the filling of its internal tube; 5, internal mold of a dorsal valve; 6, external mold of part of a dorsal valve; 4, 7, views of small parts of the surface of two specimens to show "twilled cloth" pattern of ornamentation, × 4; 4, external mold; 7, impression of an external mold showing the actual surface of the shell. 1-3, New Providence formation; along Monon Railroad half a mile north of Farrabee Station, Washington County, Ind.; 4-9, Price formation. 4-6, along U. S. Route 21 about 6 miles northwest of Wytheville, Wythe County; 7, railroad cut in gap through Pine Mountain 2 miles east of Cassard, Scott County; 8, 9, exact locality unknown, donated by a person living at Raven, Tazewell County. *Syringothyris* can be distinguished from *Spirifer* by the "twilled cloth" ornamentation shown in 4, 6, 7, and by the syrinx shown in 3. It is also differentiated from *Spirifer disjunctus* by the lack of ribs on the fold and in the sinus. 1-3, U. S. N. M. 98039; 4, 98040a; 5, 6, 98040b; 8, 9, 90666.

10. *Athyris ohioensis* (Winchell).

Price formation; along road 1¾ miles southwest of Bandy, Tazewell County. U. S. N. M. 98041.

11. *Centronella?* sp.

Price formation; shale pit half a mile south of Richlands, Tazewell County. U. S. N. M. 98042.

12–16. *Productus,* one or more species.

12, impression from an external mold of a ventral valve; 13, 14, 16, internal molds of ventral valves; 15, external mold of a dorsal valve. These seem to correspond to small species occurring in the Cuyahoga formation of Ohio and named by Herrick *P. rushvillensis* and *P. nebrascensis.* Certain specific identification is hardly possible with the material at hand and without Ohio material for comparison. The Virginia species seem certainly to be the same as those of Ohio. Price formation. 12, 13, 16, along

FIGURE

railroad through Pine Mountain 2 miles east of Cassard, Scott County; 14, 15 (Maccrady shale?), 500 feet west of Sunbright station (Hortons Summit) on the Southern Railway at the south end of Powell Mountain, Scott County. U. S. N. M. 98044a, 98044b, 98043a, 98043b, 98045.

17, 18. *Spiriferina solidirostris* (White).

18, interior of a ventral valve; 17, impression from the same showing the slit made by the septum. Occurrence as 10. U. S. N. M. 98046.

19, 20. *Phillipsia meramecensis* Shumard.

Tail and head. Price (Maccrady?); same locality as 14. U. S. N. M. 98047a, 98047b.

21–24. *Spirifer winchelli* Herrick?.

21, 24, internal molds of ventral valves; 22, internal mold of a dorsal valve; 23, external mold of the same valve. Occurrence as 10. 21, 24, U. S. N. M. 98049a, 98048; 22, 23, 98049b.

25, 26. *Spiriferella? schucherti* (Rowley).

25, external mold of a ventral valve, × 2; 26, impression from the same specimen; 25 shows fine pits made by low spines or pustules on the exterior of the shell. This form was described from specimens obtained in the lower Burlington limestone of Missouri, and referred by Weller with doubt to *Spiriferella*. He had no specimens showing the internal characters, but remarked that if a median septum were present, the form would be referred to *Spiriferina*. As shown in both figures, a very low median septum is present indicating *Spiriferina*. Price (Maccrady?); same locality as 14. U. S. N. M. 98050.

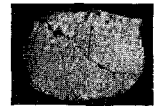
27, 28. *Spirifer* cf. *S. striatiformis* as figured by Herrick[a].

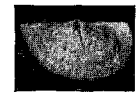
27, impression of an external mold of a ventral valve; 28, internal mold of a ventral valve. Occurrence as 10. U. S. N. M. 98051a, 98051b.

[a] Denison Univ. Bull., Jour. Sci. Labs., vol. 3, pl. 3, fig. 23, 1888.

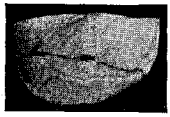

1

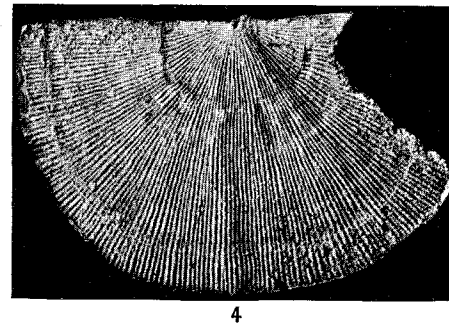

3

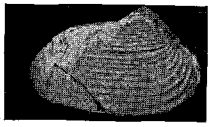

7


5

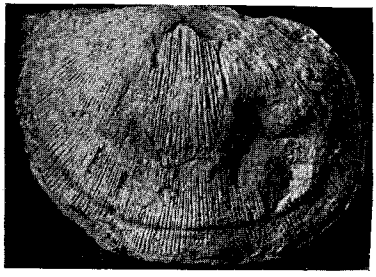

6

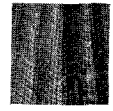

2

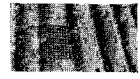

4

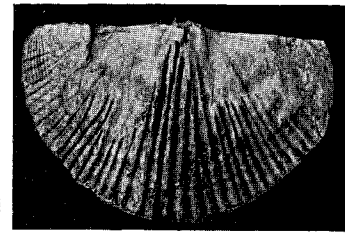

10


11 12

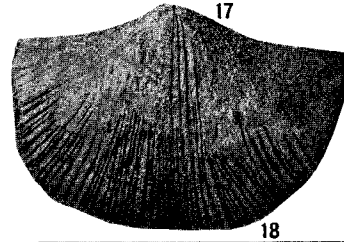

13

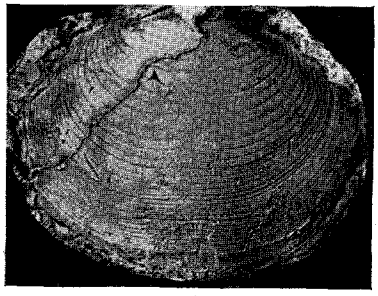

16

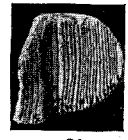

15


17

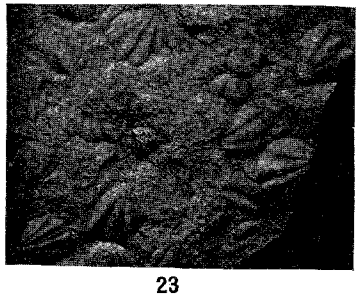

19 20

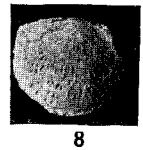

18

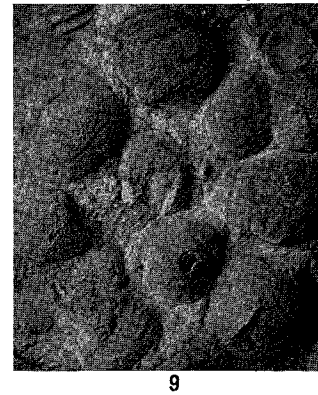

14


21

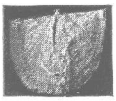

22

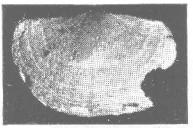

23

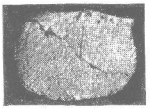

8

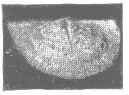

9

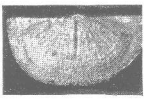
PRICE AND NEW PROVIDENCE FOSSILS

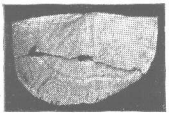

1

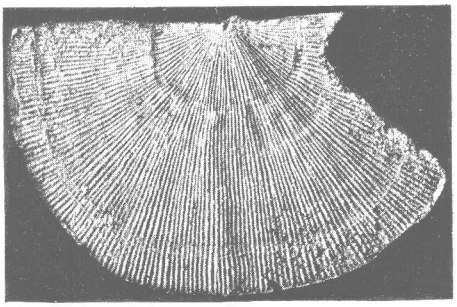

3

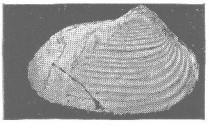

7


5

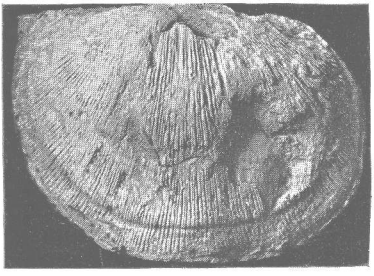

6

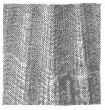

2

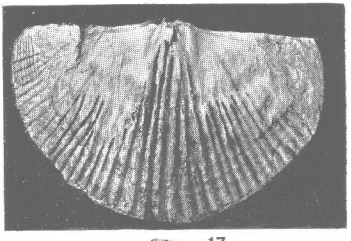

4

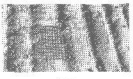

10


11 12

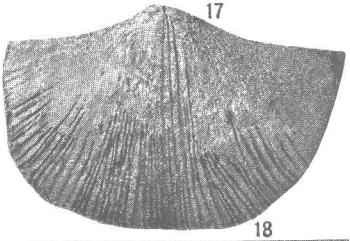

13

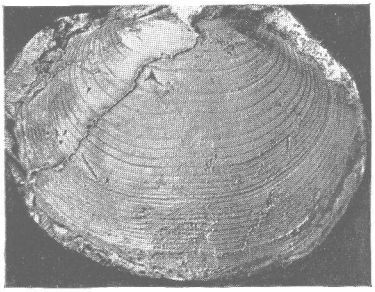

16


17


15


19 20


18

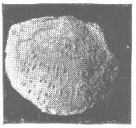

14


21


22


9


23


8

PRICE AND NEW PROVIDENCE FOSSILS

PLATE 125.—PRICE AND NEW PROVIDENCE FOSSILS

FIGURE

1. *Chonetes* sp.?

Internal mold of a ventral valve. Price formation; along U. S. Route 21 on Stony Creek 6 miles northwest of Wytheville, Wythe County. U. S. N. M. 98052.

2–4. *Chonetes shumardanus* De Koninck.

2, 3, external molds of ventral valves; 4, external mold of a dorsal valve showing the extremely fine striae, × 4. Price formation. 2, (Maccrady?), 500 feet west of Sunbright station (Hortons Summit) on the Southern Railway at south end of Powell Mountain, Scott County; 3, 4, along State Route 84 about 1 mile southeast of Richlands, Tazewell County. U. S. N. M. 98053, 98054a, 98054b.

5, 6. *Chonetes illinoisensis* Worthen?

Ventral valves, internal molds. Occurrence as 1. U. S. N. M. 98055a, 98055b.

7–9. *Productella concentrica* (Hall)?

7, internal mold of a dorsal valve; 8, external mold of a dorsal valve showing spine bases; 9, slab with several molds, mostly external, of dorsal valves. Price formation; north slope of Brushy Mountain 1½ miles north of Ceres, Bland County. U. S. N. M. 98056a, 98056b, 98056c.

10. *Allorisma consanguinatum* Herrick?

Price formation; shale pit 1 mile west of railroad station at Richlands, Tazewell County. U. S. N. M. 98057.

11, 12. *Cypricardinia scitula* Herrick.

11, also with *Bucanopsis* sp.? Price formation. 11, cut on north slope of Pine Mountain 2 miles east of Cassard, Scott County; 12, along State Route 82 about 1 mile northwest of Cleveland, Russell County. U. S. N. M. 98058, 98059.

13, 14. *Reticularia pseudolineata* (Hall).

13, internal mold of a ventral valve; 14, clay impression of the external mold of a ventral valve. Occurrence as 11. U. S. N. M. 98060a, 98060b.

FIGURE

15–18. *Spirifer striatiformis* Meek.

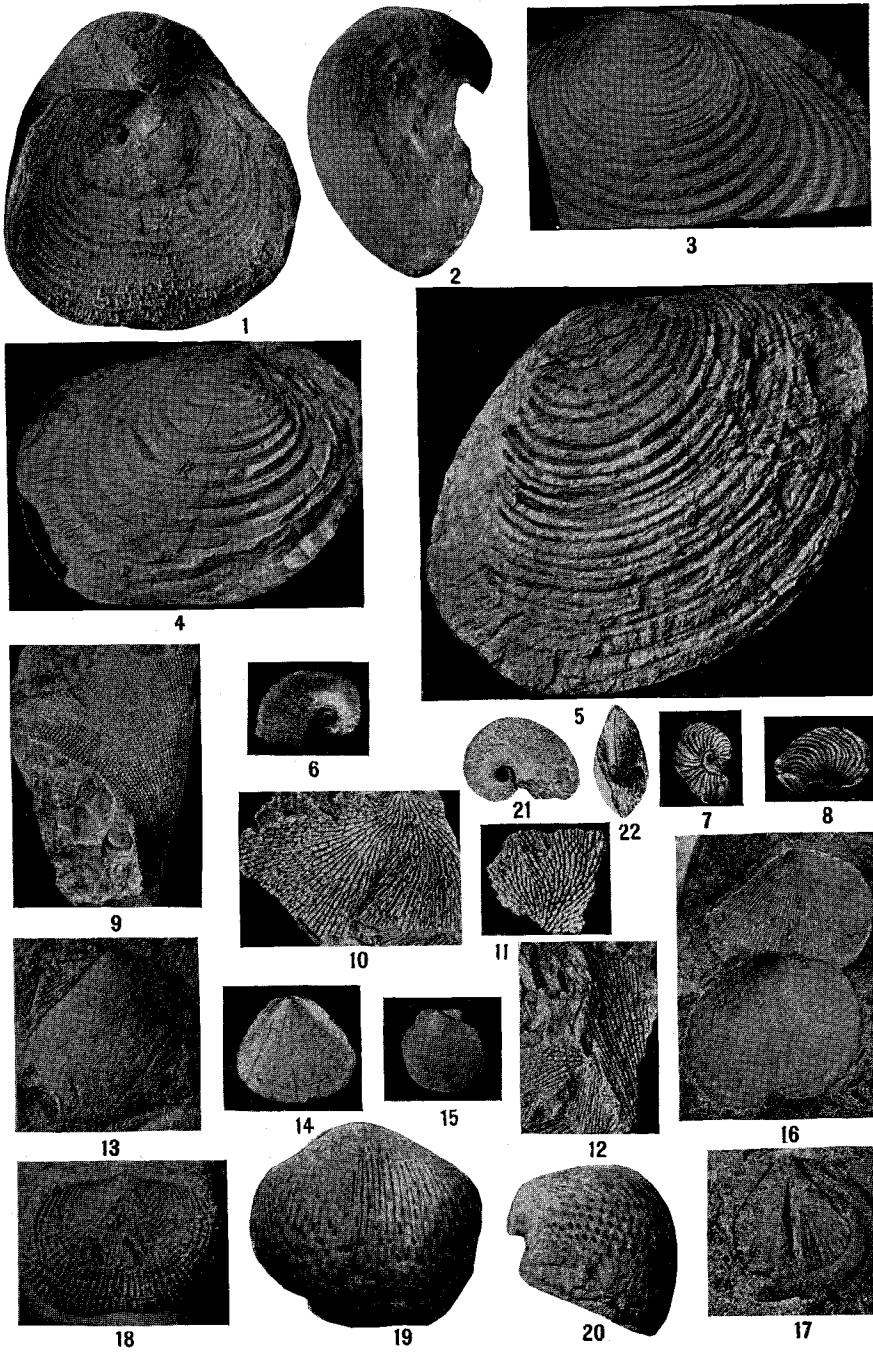
15, 16, × 4. 15, part of an external mold to show striae; 16, impression of the external mold of another specimen; 17, internal mold of a dorsal valve; 18, impression of the external mold of a ventral valve. 16, New Providence formation; about 1 mile south of Morehead, Rowan County, Ky.; 15, 17, 18, Price formation; 1¾ miles southwest of Bandy, Tazewell County. U. S. N. M. 98065, 98061a, 98061b, 98061c.

19–22. *Euphemites galericulatus* (Winchell).

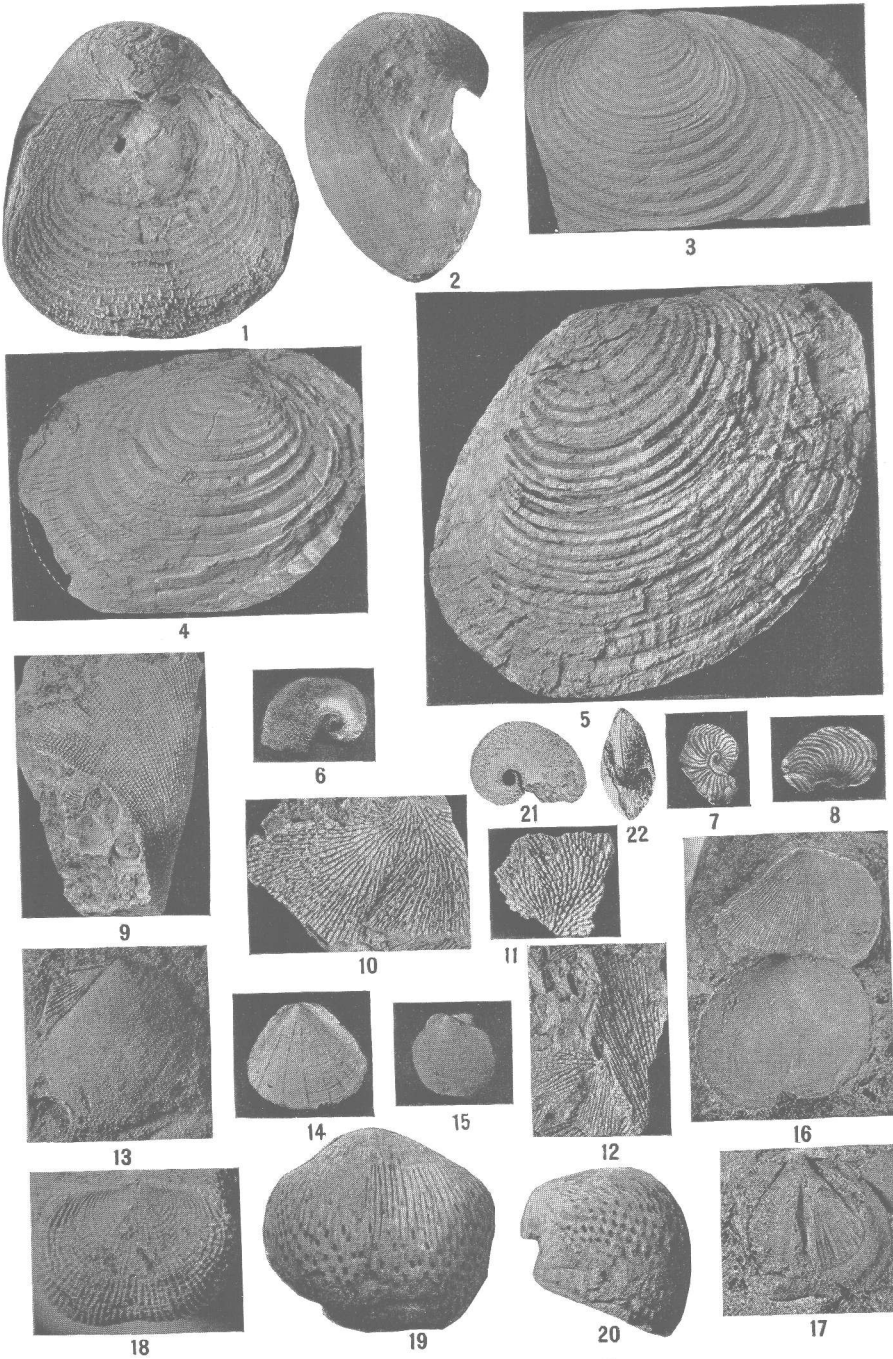
19, drawing representing the external shape and markings, dorsal view. (After Herrick, Bull. Denison Univ., Jour. Sci. Labs., vol. 3, pl. 9, fig. 32a, 1888); 20, internal mold, side view, preserves faint lines as in 19; 21, external mold, dorsal view, concave toward the observer, × 2. The parallel lines are furrows made by ridges on the outside of the shell. 22, internal mold (above) and external mold (below). 19, Cuyahoga formation; Licking County, Ohio; 20-22, Price formation. 20, 21, along Lee Highway about three-fourths of a mile south of the Norfolk and Western Railway station at Pulaski; 22, same locality as 12. This species is fairly common in the marine Price of southwestern Virginia. It is also said to be common in Licking County, Ohio. The type specimens were obtained from the Marshall group of Michigan. 20-22, U. S. N. M. 98062a, 98062b, 98063.

23. *Leiorhynchus?*, apparently an undescribed species.

Occurrence as 7. U. S. N. M. 98064.



PRICE, WARSAW, AND ST. LOUIS FOSSILS



PRICE, WARSAW, AND ST. LOUIS FOSSILS

PLATE 126.—PRICE, WARSAW, AND ST. LOUIS FOSSILS

FIGURE

1. *Echinoconchus alternatus* (Norwood and Pratten).
Dorsal view. Warsaw formation; 3 miles east of Union, Monroe County, W. Va. U. S. N. M. 98066.

2. *Productus* (*Dictyoclostus*) *inflatus* McChesney?
Profile view. St. Louis limestone; Little Stone Gap, Wise County. (See pl. 128, figs. 1-8.) U. S. N. M. 98067a.

3–5. *Posidonomya* or *Caneyella?* sp.
3, left valve; 4, 5, right valves. Warsaw formation; along railroad about half a mile south of Mathieson Alkali Works, Saltville, Smyth County. U. S. N. M. 98068a, 98068b, 98068c.

6–8. *Oxydiscus cyrtolites* (Hall).
6, internal mold, side view; 7, 8, impressions of external molds. Price formation; shale pit 1 mile west of railroad station at Richlands, Tazewell County. This is another characteristic Cuyahoga fossil occurring commonly in the Price of southwestern Virginia but generally in a fragmentary condition. U. S. N. M. 98069a, 98069b, 98069c.

9. *Fenestrellina tenax* (Ulrich).
External mold of the non-celluliferous surface. Price formation; Pine Mountain 2 miles east of Cassard, Scott County. U. S. N. M. 98070.

10, 11. *Fenestrellina regalis* (Ulrich)?
External molds of the non-celluliferous surface. Occurrence as 9. U. S. N. M. 98071a, 98071b.

12. *Fenestrellina herrickana* (Ulrich).
External mold of the non-celluliferous surface. Occurrence as 9. U. S. N. M. 98072.

13–15. *Streblopteria media* Herrick?
13, left valve; 14, 15, right valves, anterior ears partly broken away. Price formation (Maccrady?); 500

FIGURE

feet west of Sunbright station (Hortons Summit) on the Southern Railway at south end of Powell Mountain, Scott County. U. S. N. M. 98073a, 98073b, 98073c.

16, 17. *Rhipidomella oweni* Hall and Clarke.

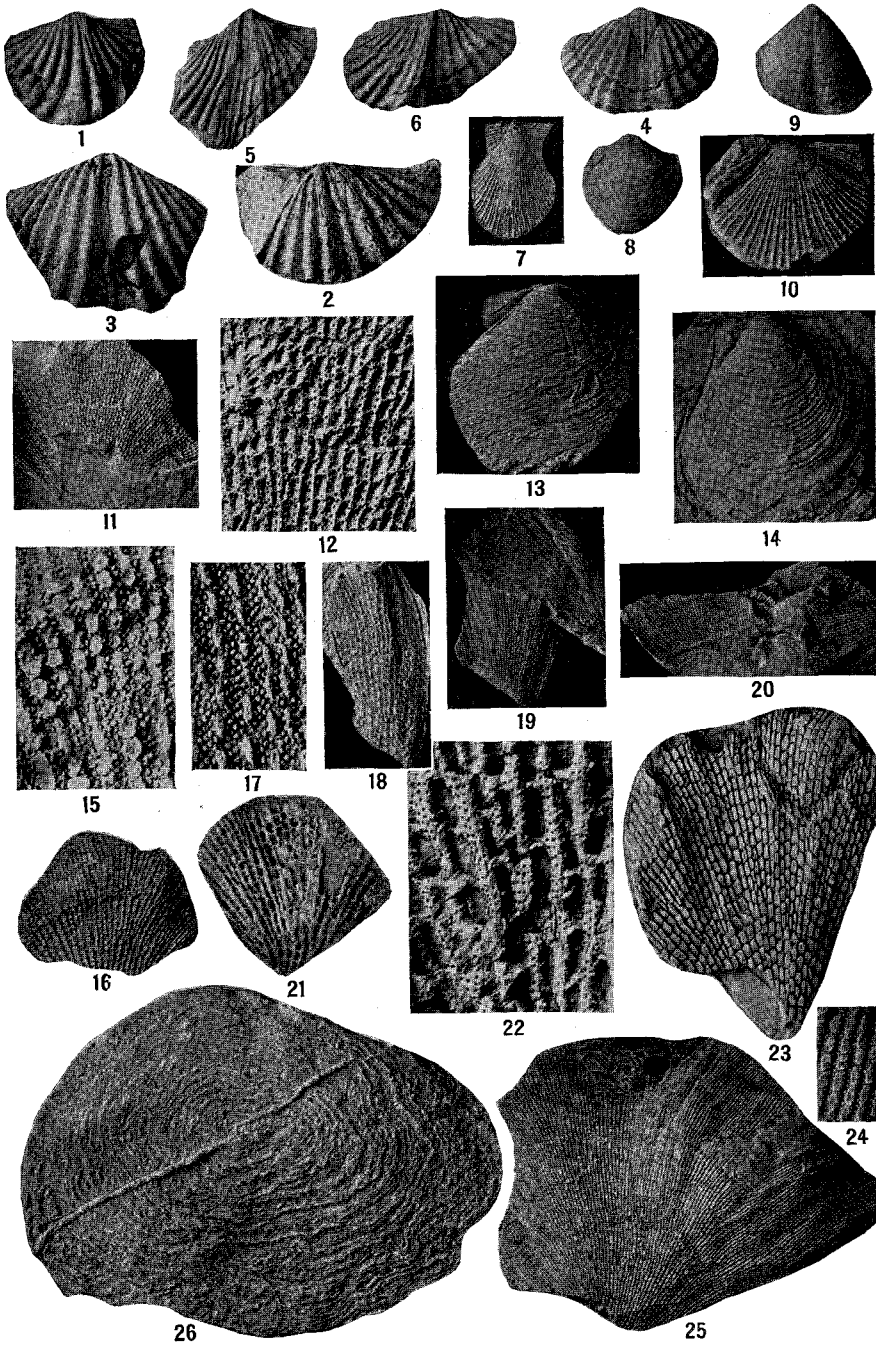
16, external molds of ventral valves; 17, internal mold of a ventral valve. Price formation; along U. S. Route 19 about 2 miles west of Bluefield, Va. 16, U. S. N. M. 98074a, 98074b; 17, 98074c.

18–20. *Productus* (*Dictyoclostus*) *burlingtonensis* Hall.

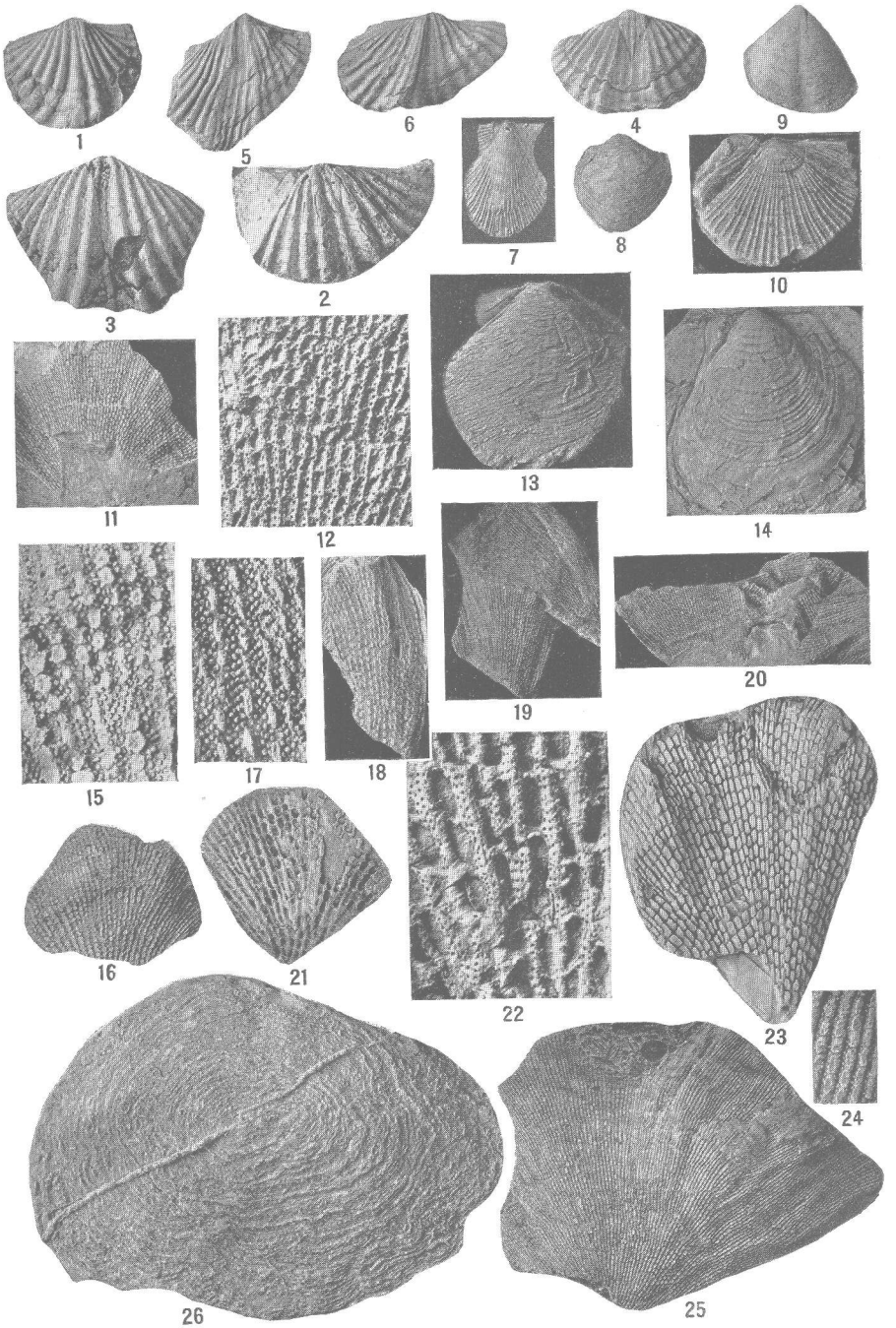
18, external mold of a dorsal valve; 19, 20, ventral and profile views of an internal mold of a ventral valve. Occurrence as 16. 18, U. S. N. M. 98075a; 19, 20, 98075b.

21, 22. *Oxydiscus cyrtolites* (Hall).

Side and edge views. Cuyahoga formation; Licking County, Ohio. (After Herrick, Denison University Bull., Jour. Sci. Labs., vol. 3, pl. 2, fig. 27, 1888.)



WARSAW AND ST. LOUIS FOSSILS



WARSAW AND ST. LOUIS FOSSILS

PLATE 127.—WARSAW AND ST. LOUIS FOSSILS

FIGURE

1–4. *Spirifer bifurcatus* Hall.

1, dorsal valve; 2-4, ventral valves. 1-3, St. Louis limestone. 1, 2, about 2 miles southwest of Bandy, Tazewell County; 3, one-fourth of a mile south of Adria, Tazewell County; 4, Warsaw limestone; along river bluff 1 mile east of Saltville, Smyth County. U. S. N. M. 98076a, 98076b, 98077, 98078.

5, 6. *Spirifer leidyi* Norwood and Pratten.

Ventral and dorsal valves. Occurrence as 4. U. S. N. M. 98079a, 98079b.

7. *Aviculopecten?* sp.

Warsaw limestone; near river about 1½ miles northwest of Blackwell, Washington County. U. S. N. M. 98080.

8. *Cliothyridina hirsuta* (Hall).

Warsaw limestone; about 1 mile west of Ravens Nest and 3 miles northeast of Mendota, Washington County. U. S. N. M. 98081.

9. *Composita trinuclea* (Hall).

Occurrence as 8. U. S. N. M. 98082.

10. *Aviculopecten monroensis* Worthen?

Occurrence as 7. U. S. N. M. 98083.

11, 12. *Fenestrellina serratula* (Ulrich).

11, external mold of the celluliferous surface in shale; 12, impression of part of 11, × 4. Occurrence as 4. U. S. N. M. 98084a.

13. cf. *Aviculopecten?* sp.; possibly *Crenipecten,* × 2.

Internal mold of a ventral valve. Another small specimen shows faint radiating striae. Occurrence as 7. U. S. N. M. 98085.

14. *Aviculopecten?* sp.; possibly *Crenipecten.*

Warsaw limestone; along railroad half a mile southwest of Mathieson Alkali Works, Saltville, Smyth County. U. S. N. M. 98086.

FIGURE

15, 16. *Polypora biseriata* Ulrich.

External mold of the celluliferous face. 15, part of 16, ×4. Occurrence as 4. U. S. N. M. 98087.

17, 18. *Polypora varsoviensis* Prout.

External mold of the celluliferous face. 17, part of 18, × 4. Contains more rows of pores than *P. biseriata*. Occurrence as 4. U. S. N. M. 98088.

19. *Fenestrellina serratula* (Ulrich)?

Seems to vary slightly from *F. serratula* in size of fenestrules. Occurrence as 4. U. S. N. M. 98089.

20. *Fenestrellina tenax* (Ulrich).

Also *F. serratula* (right). The difference in the size of the fenestrules in *F. tenax* and *F. serratula* is shown by these figures. Occurrence as 4. U. S. N. M. 98090.

21–23. *Fenestralia sancti-ludovici* Prout.

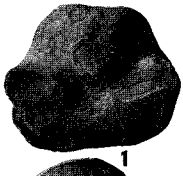
21, impression of an external mold of the celluliferous surface; 22, part of the same, × 4; 23, external mold of the noncelluliferous surface. Distinguished from *Fenestrellina* by having two rows of cells on each side, and from *Polypora* by having a distinct crest, or carina (shown faintly in 22) separating the pairs of cell rows. A guide fossil of the Warsaw limestone. Occurrence as 4. 21, 22, U. S. N. M. 98091a; 23, 98091b.

24, 25. *Fenestrellina serratula* (Ulrich).

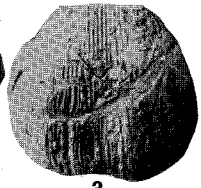
External molds of the celluliferous surface in shale. 24, part of 25, × 4. Occurrence as 4. U. S. N. M. 98084b.

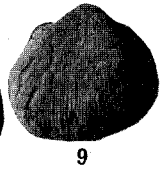
26. Calcareous algae; genus and species undetermined.

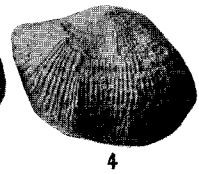
St. Louis limestone; along State Route 82 about 1¼ miles northwest of Cleveland, Russell County. Common, locally abundant, in the St. Louis in southwestern Virginia. A layer several inches thick in the quarry at the Mathieson Alkali Works, Saltville, is made up largely of these forms. U. S. N. M. 40248.


1

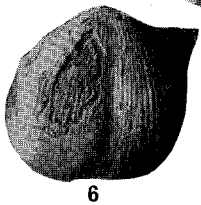

2

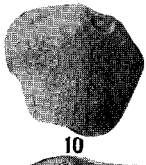

3

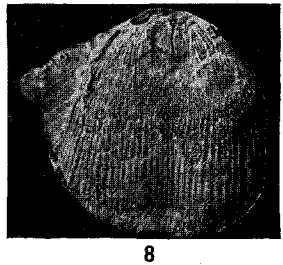

9

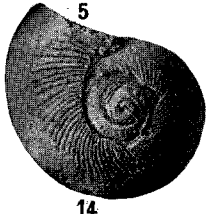

4


5

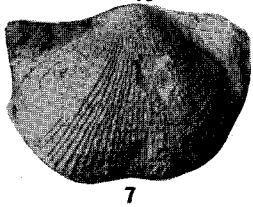

6

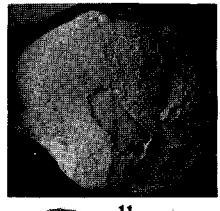

10

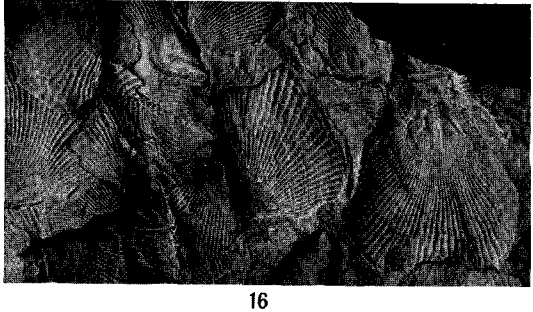

8

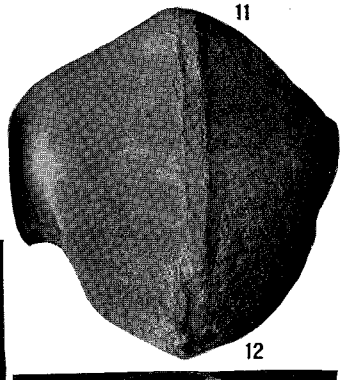

14

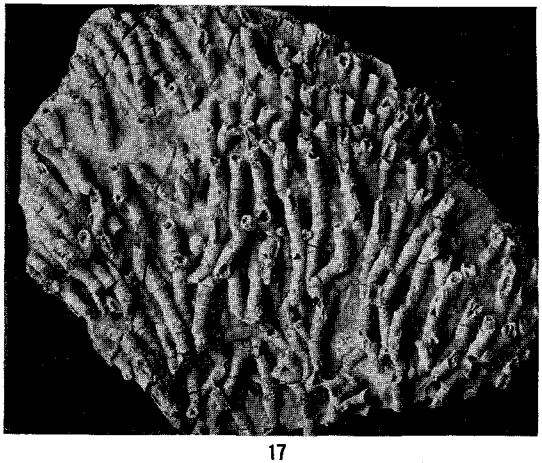

15

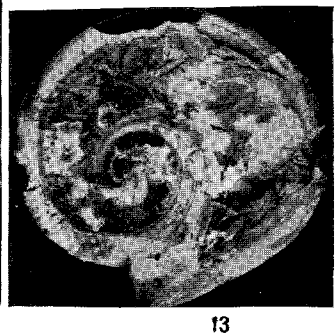

7


11

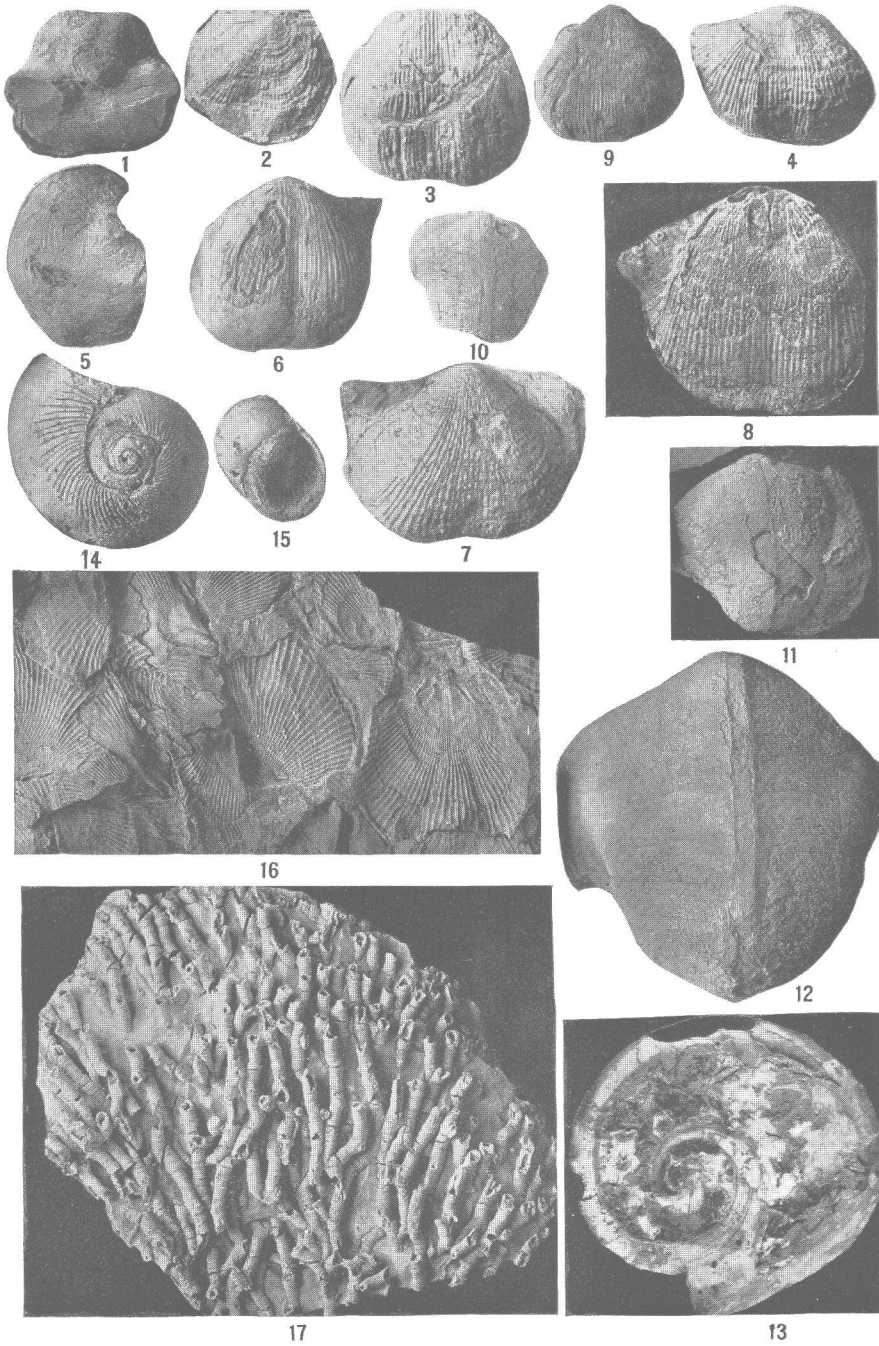

16


12


17


13

WARSAW AND ST. LOUIS FOSSILS



WARSAW AND ST. LOUIS FOSSILS

PLATE 128.—WARSAW AND ST. LOUIS FOSSILS

FIGURE

1–8. *Productus* (*Dictyoclostus*) *inflatus* McChesney?

1, posterior view of a ventral valve; 2, external mold of a dorsal valve; 3, 4, 6-8, ventral valves; 5, profile view of 6. 1-7, St. Louis limestone. 1-4, along State Route 80 just south of Holston River and 1½ miles northwest of Lindell, Washington County; 5, 6, 1⅛ miles south of Big Moccasin Gap, Scott County; 7, Little Stone Gap, Wise County; 8, Warsaw limestone; along road just north of Holston River opposite the mouth of Finley Creek and 2 miles southwest of Hayter Gap village, Washington County. 1-4, U. S. N. M. 98093a, 98093b, 98093c, 98093d; 5, 6, 98094; 7, 8, 98067b, 98095.

9. *Productus* (*Linoproductus*) *altonensis* Norwood and Pratten?

Ventral valve. St. Louis limestone; 2 miles southwest of Bandy, Tazewell County. U. S. N. M. 98096.

10–13. *Bellerophon sublaevis* Hall.

10, fragment of a specimen of about the usual size; 11, fragment of a larger specimen; 12, a very large, nearly complete specimen; 13, section through the middle of a specimen. All completely silicified. St. Louis limestone; along road about 1 mile northwest of Bandys Chapel (Baptist Valley), Tazewell County. U. S. N. M. 98097a, 98097b, 98097c, 98097d.

14, 15. *Strophostylus carleyanus* (Hall).

14, × 2. Apical and apertural views of the same specimen. Occurrence as 10. U. S. N. M. 98098.

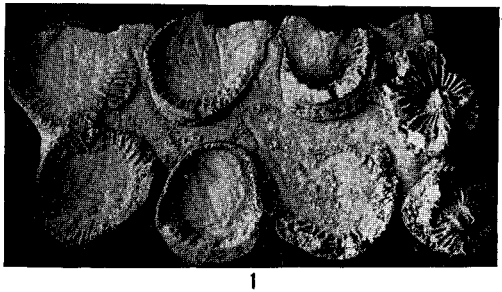
16. *Tetracamera?* sp.

Slab with several specimens. In bed of black shale about 20 feet thick in the Warsaw limestone, 100 feet below the St. Louis limestone; along U. S. Route 19 about one-eighth of a mile south of bridge over Holston River and 2 miles northwest of Greendale, Washington County. U. S. N. M. 98099.

17. *Syringopora virginica* Butts, n. sp.

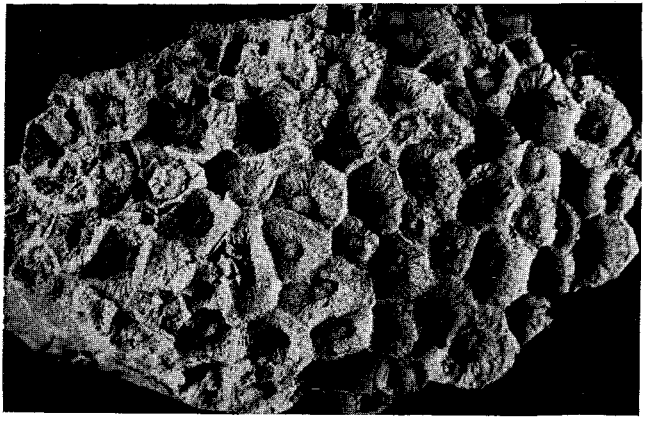
Moderately dense, somewhat irregularly branching coralites 1.5 mm. in diameter. In the mature portions the coralites are subparallel and separated from each other

by about twice the width of the individual coralites. They commonly send out a branch every 4 to 6 mm. Very similar to a specimen in the National Museum labeled as *S. ramulosa* (name preoccupied), from the St. Louis limestone at Glasgow Junction, Ky. This is the most common fossil in the St. Louis limestone in Virginia, occurring on the weathered surface of the black limestone in most exposures, often in the same layers with *Lithostrotionella,* and also where *Lithostrotionella* is absent. As no *Syringopora* has been noted in any other formation in Virginia, it is a guide fossil of the St. Louis in the State. St. Louis limestone; along State Route 82 about 1¼ miles northwest of Cleveland, Russell County. Holotype: U. S. N. M. 98100. Description by Josiah Bridge.

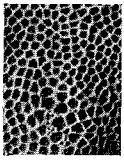


1

2

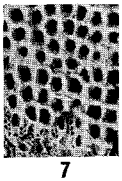


3

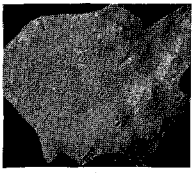


4

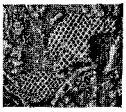
5



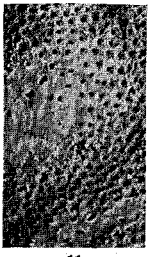
7



10

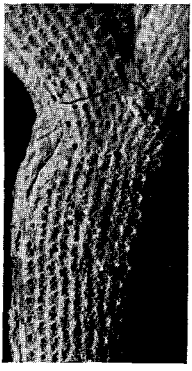


6

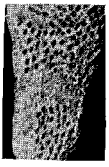


11

8



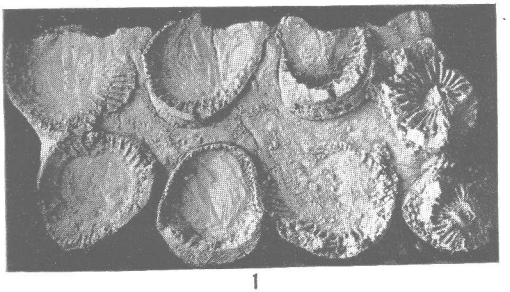
12



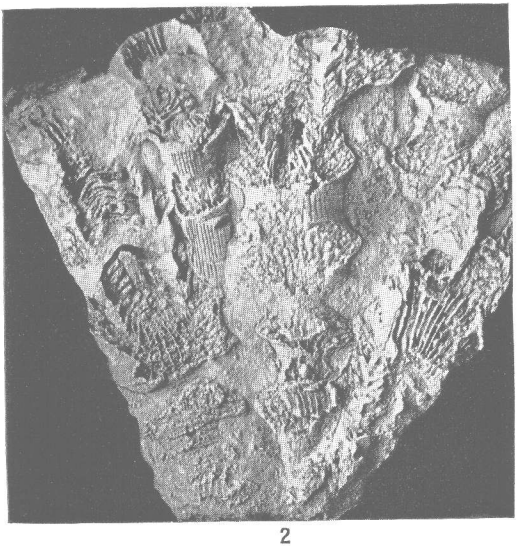
9

13

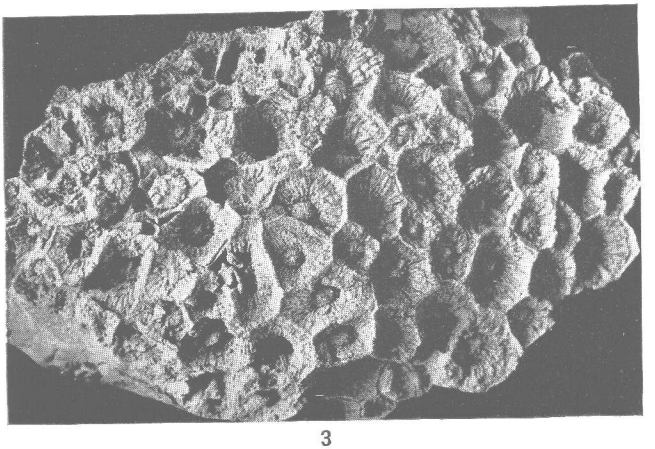
WARSAW AND ST. LOUIS FOSSILS



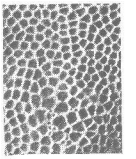
1



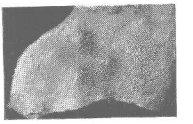
2



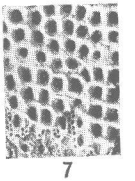
3



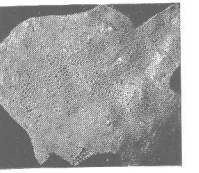
4



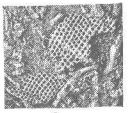
5



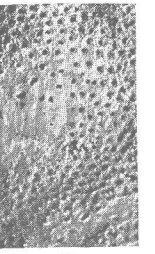
7



10



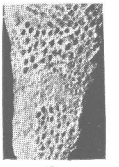
6



11

8

12



9

13

WARSAW AND ST. LOUIS FOSSILS

PLATE 129.—WARSAW AND ST. LOUIS FOSSILS

FIGURE

1, 2. *Lithostrotionella prolifera* (Hall).

1, calycinal view; 2, side and sectional view. Note that the cylindrical coralites are not in contact. St. Louis limestone; just south of Adria and 4 miles north of Tazewell, Tazewell County. U. S. N. M. 98101a, 98101b.

3. *Lithostrotionella "canadensis"* (Castelnau).

Calycinal view. Note that the polygonal coralites are in contact. St. Louis limestone; along State Route 82 about 1¼ miles north of Cleveland, Russell County. *Lithostrotionella prolifera* and *L. "canadensis"* are the chief guide fossils of the St. Louis limestone. U. S. N. M. 98102.

4, 5. *Tabulipora tuberculata* (Prout).

4, part of 5, × 4. Warsaw limestone; one-fourth of a mile east of Ravens Nest and 4 miles northeast of Mendota, Washington County. U. S. N. M. 98103.

6, 7. *Hemitrypa proutana* Ulrich.

6, noncelluliferous side; 7, part of 6, × 4, showing cells at bottom. Occurrence as 4. U. S. N. M. 98104.

8, 9. *Rhombopora simulatrix* Ulrich?

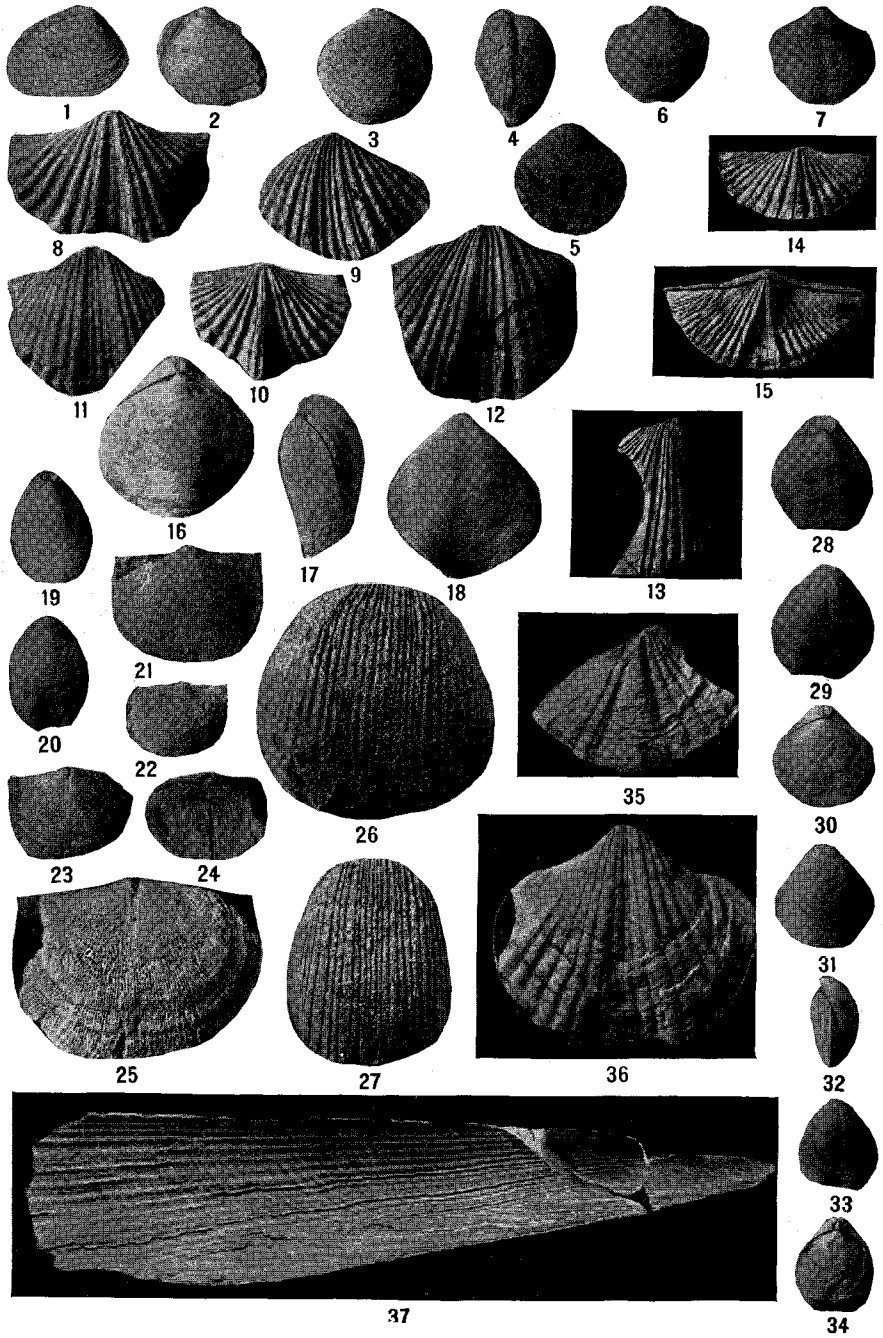
9, part of 8, × 4. Warsaw limestone; along U. S. Route 19 just south of bridge over Holston River and 2 miles northwest of Greendale, Washington County. U. S. N. M. 98105.

10, 11. *Dichotrypa flabellum* (Rominger).

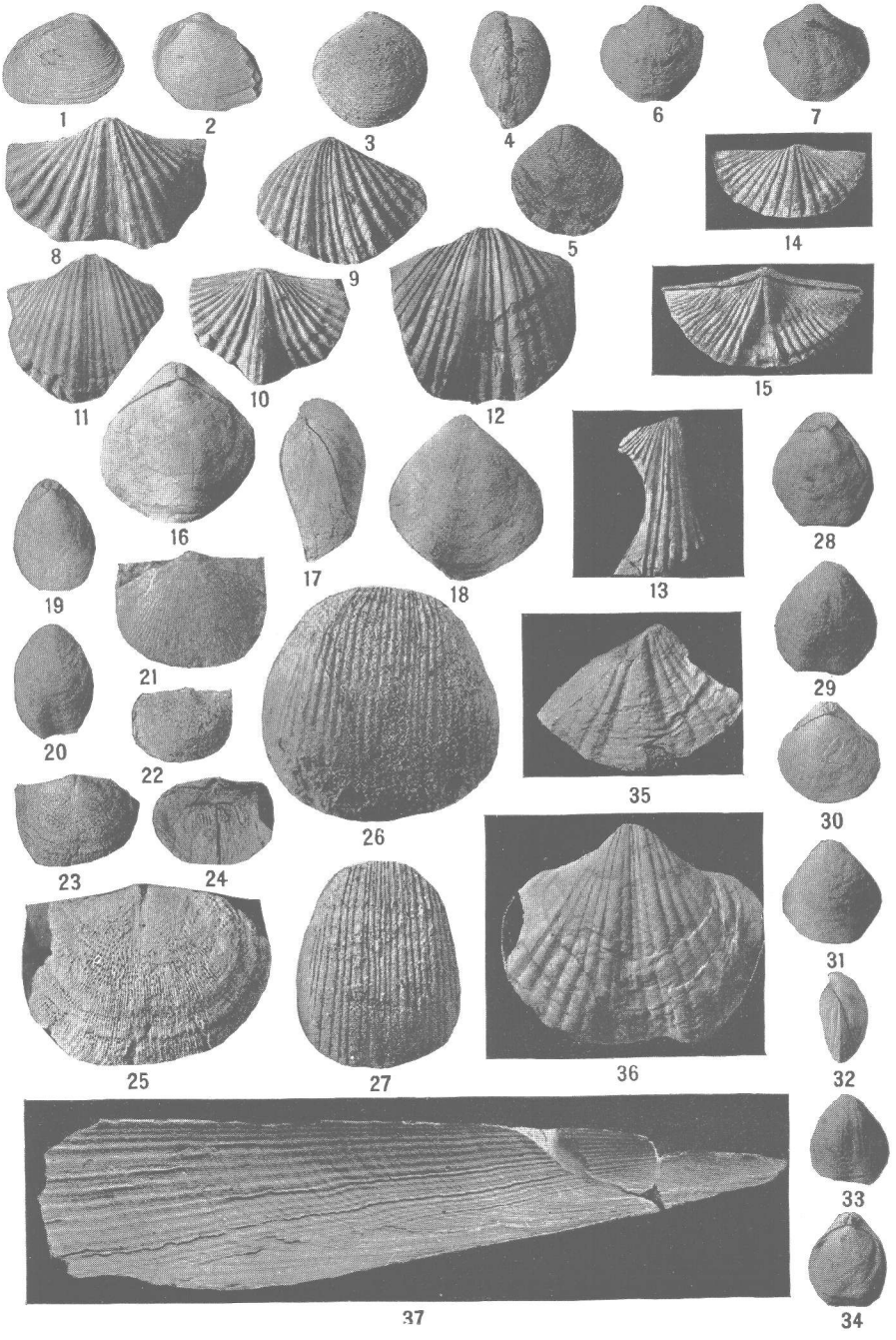
11, part of 10, × 4. St. Louis limestone; along State Route 80 just south of Holston River and 1½ miles northwest of Lindell, Washington County. U. S. N. M. 98106.

12, 13. *Cystodictya lineata* Ulrich.

12, part of 13, × 4. Warsaw limestone; along bluff by riverside about 1 mile northeast of the railroad station at Saltville, Smyth County. U. S. N. M. 98107.



ST. LOUIS, STE. GENEVIEVE, GASPER, GLEN DEAN, AND PENNINGTON FOSSILS



ST. LOUIS, STE. GENEVIEVE, GASPER, GLEN DEAN, AND PENNINGTON FOSSILS

PLATE 130.—ST. LOUIS, STE. GENEVIEVE, GASPER, GLEN DEAN, AND PENNINGTON FOSSILS

FIGURE

1, 2. *Astartella?* sp.

Right and left valves. St. Louis limestone; 1⅛ miles south of Big Moccasin Gap, Scott County. U .S. N. M. 98108a, 98108b.

3–7. *Cliothyridina sublamellosa* (Hall).

3-5, dorsal, profile, and ventral views of a specimen; 6, 7, dorsal and ventral views of another specimen. 3-5, Gasper limestone; three-fourths of a mile south of Union, Monroe County, W. Va.; 6, 7, Pennington formation; along U. S. Route 19 half a mile northwest of Greendale, Washington County. 3-5, U. S. N. M. 98109; 6, 7, 98110.

8–10. *Spirifer leidyi* Norwood and Pratten.

8, 9, ventral valves; 10, dorsal valve. St. Louis limestone; along road about 1 mile northwest of Baptist Valley, Tazewell County. Associated with *Lithostrotionella prolifera.* U. S. N. M. 98111a, 98111b, 98111c.

11–13. *Spirifer increbescens* Hall.

11, 12, ventral valves; 13, fragment of a dorsal valve. Glen Dean limestone; along Southern Railway in the gorge of Powell River about 1 mile northwest of the town of Big Stone Gap, Wise County. U. S. N. M. 98112a, 98112b, 98112c.

14, 15. *Spiriferina transversa* (McChesney).

Dorsal and ventral valves. Occurrence as 11. U. S. N. M. 98113, 98114.

16–18. *Composita subquadrata* (Hall).

Dorsal, profile, and ventral views of a whole specimen. Occurrence as 11. U. S. N. M. 98115.

19, 20. *Dielasma arkansanum* Weller.

Dorsal and ventral views of a whole specimen. Occurrence as 6. U. S. N. M. 98116.

21–25. *Chonetes chesterensis* Weller.

21, ventral valve preserving the shell, × 2; 22, internal mold of a ventral valve; 23, 24, ventral and dorsal views of an internal mold of a whole specimen; 25, same as

FIGURE

23, × 2. 21, 23-25, occurrence as 11; 22, Gasper limestone; about 1½ miles west of Bluefield, Va. 21, 22, U. S. N. M. 98119a, 98117; 23, 25, 98119b.

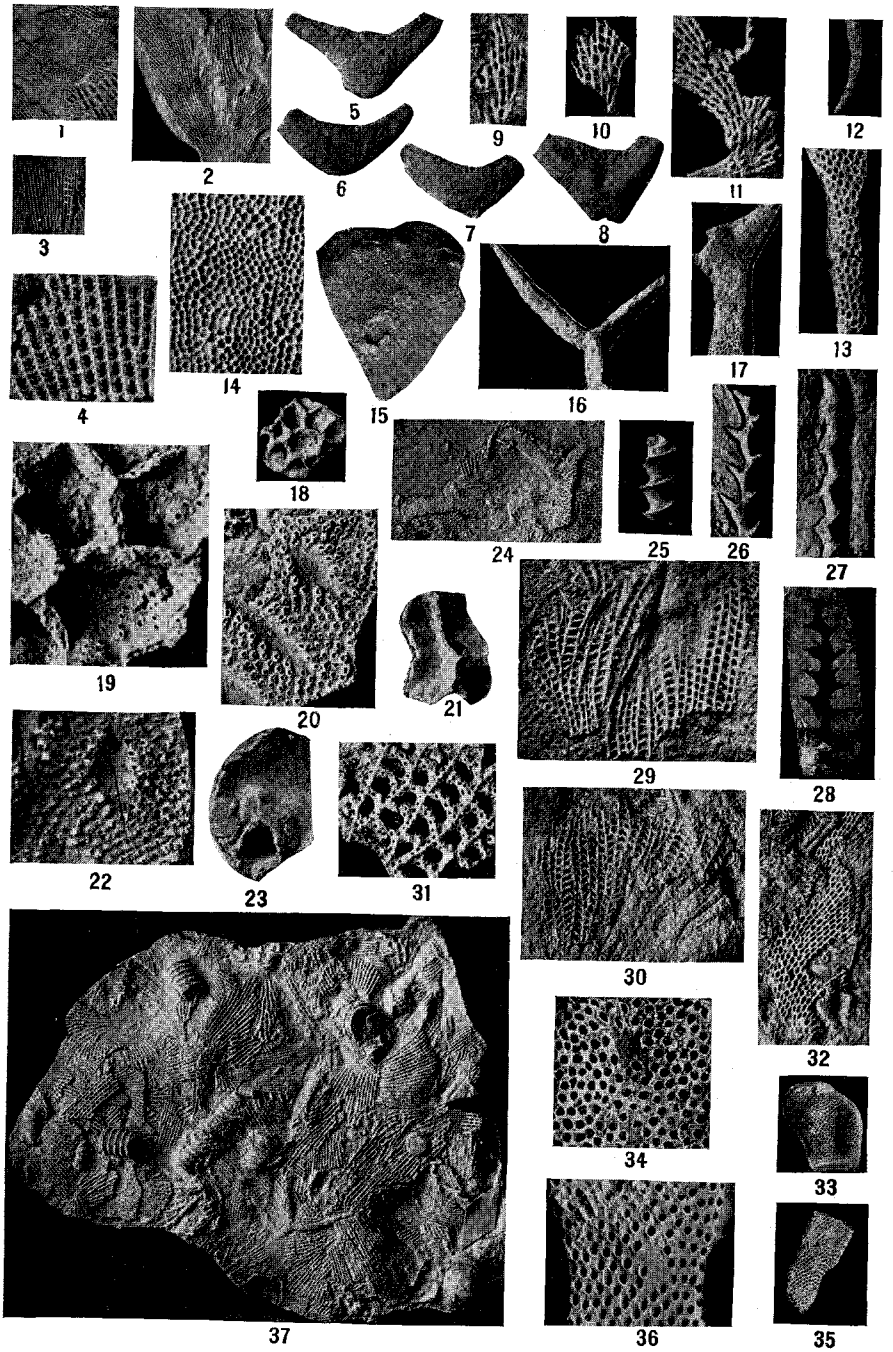
26. *Productus* (*Dictyoclostus*) *parvus* Meek and Worthen, × 2.
Ventral valve. Ste. Genevieve limestone; along U. S. Route 19 about 1½ miles west of Bluefield, Va. *Platycrinus penicillus* in the same bed. U. S. N. M. 98118.

27. *Productus* (*Dictyoclostus*) *scitulus* Meek and Worthen, × 2.
Ventral valve. St. Genevieve limestone; along U. S. Route 19 about one-third of a mile south of bridge over Holston River and 1½ miles northwest of Greendale, Washington County. Associated with *Platycrinus penicillus*. U. S. N. M. 98120.

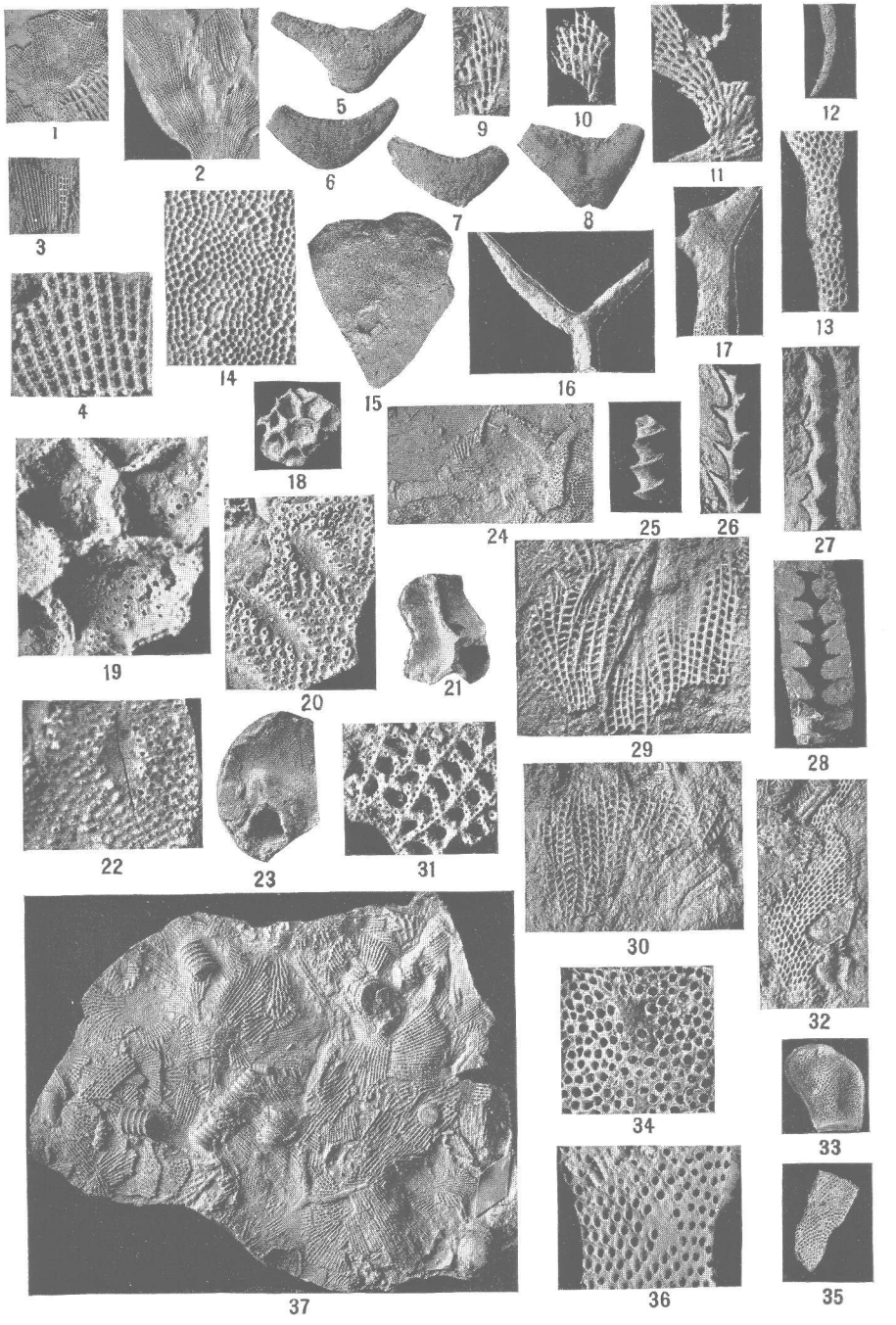
28–34. *Girtyella indianensis* (Girty)?
28-31, dorsal and ventral views of two whole specimens; 32-34, profile, ventral, and dorsal views of another specimen. Occurrence as 6. 28, 29, U. S. N. M. 98121a; 30, 31, 98121b; 32-34, 98121c.

35, 36. *Brachythyris chesterensis* Butts.
35, fragment of a dorsal valve; 36, ventral valve. Gasper limestone; Abbs Valley 1 mile east of Pocahontas, W. Va. U. S. N. M. 98122a, 98122b.

37. *Sulcatopinna missouriensis* (Swallow).
External mold of a left valve. Pennington formation; railroad cut in gorge of Opossum Creek about 5 miles southwest of Gate City, Scott County. It also occurs on the Southern Railway one-fourth of a mile northeast of Benham, and at locality of 6. Washington County. U. S. N. M. 98123.



STE. GENEVIEVE, GASPER, AND GLEN DEAN FOSSILS



STE. GENEVIEVE, GASPER, AND GLEN DEAN FOSSILS

PLATE 131.—STE. GENEVIEVE, GASPER, AND GLEN DEAN FOSSILS

FIGURE

1, 2. *Fenestrellina tenax* (Ulrich).

Noncelluliferous and celluliferous surfaces. The smaller size of the fenestrules in this species than those in *F. serratula* can be seen by comparison with the retouched right side of 3. A small part of a species with larger fenestra, probably *F. cestriensis,* on lower margin. Gasper limestone; along U. S. Route 19 about 3 miles northeast of Bluefield, W. Va. U. S. N. M. 98124a, 98124b.

3, 4. *Fenestrellina serratula* (Ulrich).

External molds of the celluliferous surface showing the proximal parts of the matrix filling the cells. 4, part of 3, × 4. Occurrence as 1. U. S. N. M. 98125.

5–8. *Lyropora ranosculum* Ulrich.

Portions of the noncelluliferous U-shaped supporting arms of 4 specimens. The fenestrelinid network enclosed by the arms has been broken away. Gasper limestone; along U. S. Route 58 in the Greendale syncline near Gaines Chapel about 2 miles southeast of Hilton, Scott County. U. S. N. M. 98126a, 98126b, 98126c, 98126d.

9–11. *Polypora cestriensis* Ulrich.

9, 10, parts of the noncelluliferous sides of two specimens; 11, celluliferous side of another specimen. Occurrence as 1. U. S. N. M. 98127a, 98127b, 98127c.

12, 13. *Rhombopora* cf. *R. minor* Ulrich.

13, part of 12, × 2. Occurrence as 1. U. S. N. M. 98128.

14, 15. *Tabulipora tuberculata* (Prout).

14, part of 15, × 4. Glen Dean limestone; in face of the Pinnacle northwest of Cumberland Gap village, Tennessee. U. S. N. M. 98129.

16, 17. *Prismopora serrulata* Ulrich.

Two poorly preserved specimens but showing the characteristic cross section, and the celluliferous surface very faintly in 17. The triangular cross section is shown at the lower end of the specimen of 16. Occurrence as 14. Associated with *Pentremites canalis* and *Pentremites brevis.* U. S. N. M. 98130a, 98130b.

FIGURE

18, 19. *Glyptopora michelinia* (Prout).

19, part of 18, × 4. Gasper limestone; 1 mile east of Shrader, Tazewell County. U. S. N. M. 98131.

20–23. *Glyptopora punctipora* Ulrich?

21, 23, silicified fragments. Possibly specimen 21 is *G. michelinia.* 20, × 4; 22, part of 23, × 4. Gasper limestone. 20, along U. S. Route 19 (old location) 3 miles northeast of Bluefield, W. Va.; 21-23, same locality as 5. 20, U. S. N. M. 98133; 21, 98132a; 22, 23, 98132b.

24. *Cystodictya labiosa* Weller.

Occurrence as 1. U. S. N. M. 98134.

25. *Archimedes communis* Ulrich.

Occurrence as 14. U. S. N. M. 98135.

26, 27. *Archimedes distans* Ulrich, or *A. meekanus* (Hall).

Glen Dean limestone. 26, along Southern Railway in gorge of Powell River about 1 mile north of Big Stone Gap, Wise County; 27, same locality as 14. U. S. N. M. 98136, 98138.

28. *Archimedes proutanus* Ulrich.

Section through center of axis. Gasper? limestone; along Norfolk and Western Railway half a mile northeast of Bluefield, Va. U. S. N. M. 98139.

29, 30. *Septopora subquadrans* Ulrich.

Noncelluliferous and celluliferous surfaces. Occurrence as 26. U. S. N. M. 98140a, 98140b.

31. *Septopora cestriensis* Prout, × 4.

Gasper limestone; along U. S. Route 19 (old location) 3 miles northeast of Bluefield, W. Va. U. S. N. M. 98092.

32. *Fenestrellina cestriensis* (Ulrich).

Noncelluliferous surface. Occurrence as 26. U. S. N. M. 98137.

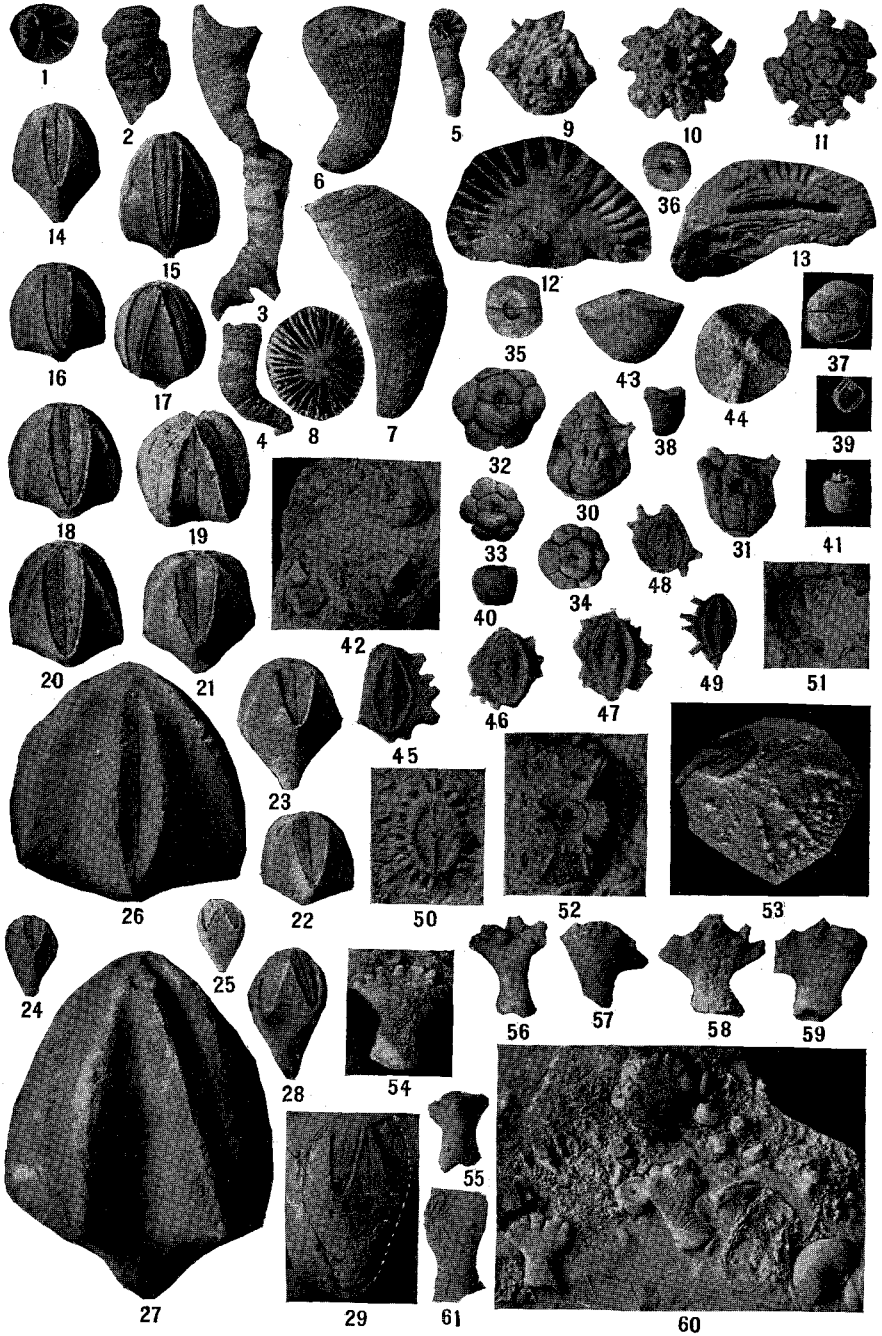
33, 34. *Meekopora eximia* Ulrich.

34, part of 33, × 4. Gasper limestone; 3 miles northeast of Bluefield, W. Va. U. S. N. M. 98141.

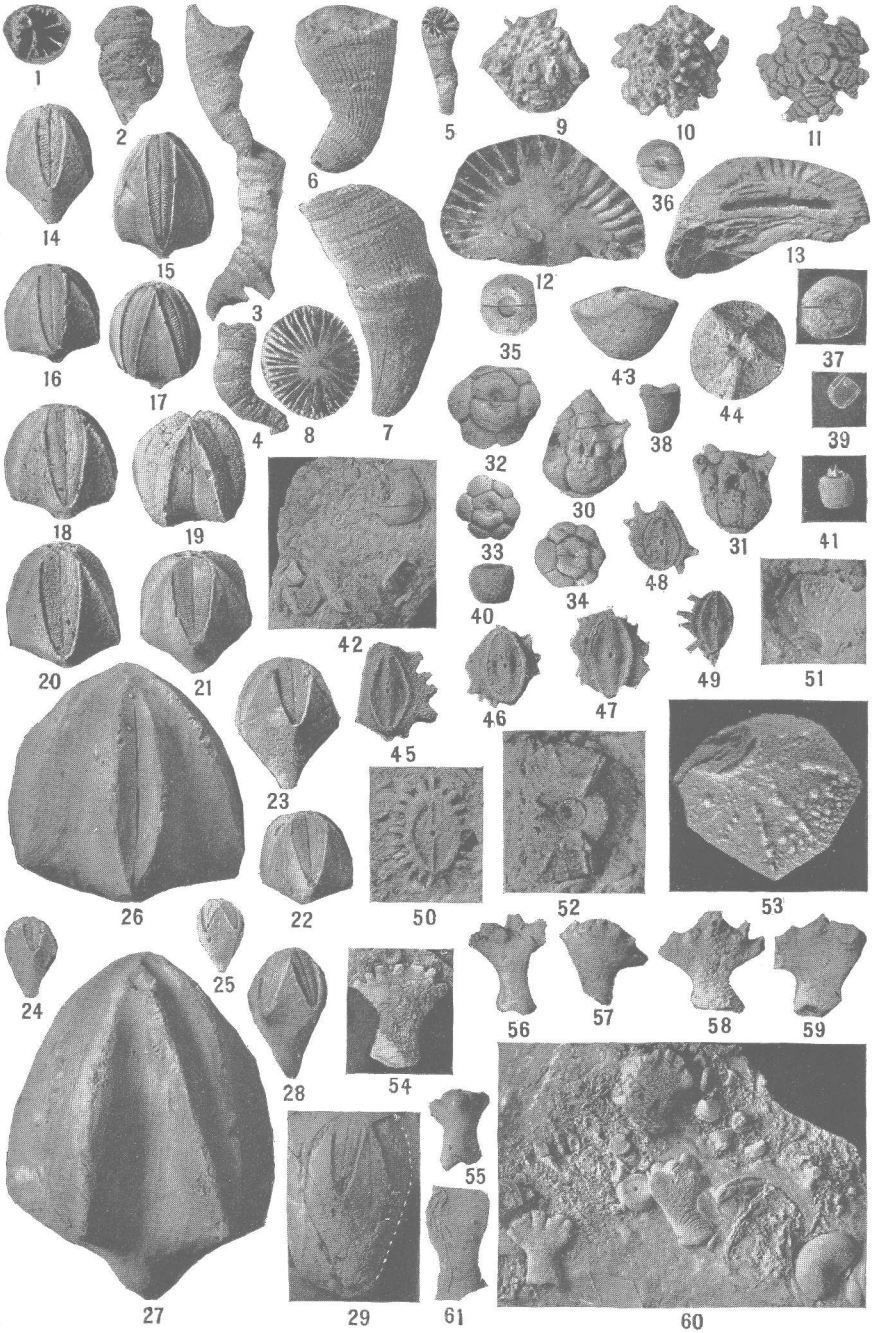
FIGURE

35, 36. *Meekopora clausa* Ulrich.
36, part of 35, × 4. Occurrence as 26. U. S. N. M. 98142.

37. Slab with *Fenestrellina,* mostly *F. tenax* and *F. serratula.* Occurrence as 33. U. S. N. M. 98143.



GASPER AND GLEN DEAN FOSSILS



GASPER AND GLEN DEAN FOSSILS

PLATE 132.—GASPER AND GLEN DEAN FOSSILS

FIGURE

1–5. *Cystelasma quinqueseptatum* Ulrich.

1, 5, calycinal views showing the principal septae; 5, calycinal view of 4; 2-4, side views of several specimens. Ste. Genevieve limestone; along road on Toole Creek 1¾ miles north of Whites Mill, Washington County. 1-3, U. S. N. M. 98144a, 98144b, 98144c; 4, 5, 98144d.

6–8. *Zaphrentis spinulosa* Milne-Edwards and Haime.

Gasper limestone; along U. S. Route 58 near Gaines Chapel, 2 miles southeast of Hilton, Washington County. U. S. N. M. 98145a, 98145b, 98145c.

9–11. *Globocrinus unionensis* (Worthen).

Side, dorsal, and basal views. Occurrence as 6. U. S. N. M. 98146.

12, 13. *Campophyllum? gasperense* Butts.

12, calycinal view; 13, side view of a fragment preserving a few tabulae and part of the calyx. Rare in Virginia. Gasper limestone; 1 mile east of Shraders, Tazewell County. U. S. N. M. 98147.

14. *Pentremites welleri* Ulrich.

Gasper limestone; quarry at Nemours, Mercer County, W. Va. U. S. N. M. 98148.

15. *Pentremites biconvexus* Ulrich.

Occurrence as 14. U. S. N. M. 98149.

16, 17. *Pentremites planus* Ulrich (*P. godoni* De France?)

Occurrence as 14. U. S. N. M. 98150a, 98150b.

18–20. *Pentremites "godoni"* Ulrich, not De France.

Gasper limestone. 18, same locality as 14; 19, 20, along road about 1 mile northwest of Bandys Chapel (Baptist Valley), Tazewell County. Depressed ambulacral areas, such as occur in this species, are practically absent from all *Pentremites* occurring below the Gasper limestone. As *P. "godoni"* is common and easily identifiable, it is a guide fossil of the Gasper. U. S. N. M. 98151, 98152a, 98152b.

FIGURE

21. *Pentremites canalis* Ulrich.
Glen Dean limestone; in face of the Pinnacle just northwest of the village of Cumberland Gap, Tenn. U. S. N. M. 98153.

22. *Pentremites brevis* Ulrich.
Occurrence as 21. U. S. N. M. 98154.

23. *Pentremites patei* Ulrich.
Occurrence as 14. U. S. N. M. 98155.

24, 25. *Pentremites pyriformis* Say?
Occurrence as 6. U. S. N. M. 98156a, 98156b.

26, 27. *Pentremites macalleyi* Schuchert.
Lower one-fourth of the Bluefield shale (Golconda horizon?); about 1 mile southwest of Glenlyn in Mercer County, W. Va. U. S. N. M. 98157a, 98157b.

28. *Pentremites pyramidatus* Ulrich.
Occurrence as 21. U. S. N. M. 98158.

29. *Pentremites gemmiformis* Hambach?
Gasper limestone; in Abbs Valley about 1 mile southwest of Boissevain, Tazewell County. U. S. N. M. 98159.

30–34. *Talarocrinus cornigerus* (Shumard).
30, 31, two crowns without the arms; 32-34, basal views of three specimens that may belong to this species showing row of six radial plates. The two semicircular, basal plates should be noted. Gasper limestone. 30-32, same locality as 14; 33, same locality as 29; 34, just north of U. S. Route 58 and 2 miles southwest of Fido, Scott County. U. S. N. M. 98160a, 98160b, 98160c, 98161, 98162.

35–42. *Talarocrinus,* species undetermined.
35-37, bases; 38-42, radial plates; 39, 42, (lower left), interior surfaces of radial plates. 41 retains the base of the arm. Gasper limestone. 35, 36, same locality as 29; 37, 42, along U. S. Route 19 (old location) 3 miles northeast of Bluefield, W. Va.; 38, 39, 41, along U. S. Route 19 about 1 mile northwest of Greendale, Washington County; 40, same locality as 14.

FIGURE

The genus *Talarocrinus* is not known to occur in beds as old as the Ste. Genevieve (Fredonia) limestone of Virginia and central and eastern Kentucky, nor in beds younger than the Gasper limestone anywhere. As the genus can be identified by the scattered U-shaped, radial plates or by single basal plates, it is a dependable guide fossil of the Gasper limestone east of central Kentucky. U. S. N. M. 98163a, 98163b, 98164a, 98165a, 98165b, 98166, 98165c, 98164b.

43, 44. *Agassizocrinus* cf. *A. ovalis* Miller and Gurley?

Side and ventral views of the infrabasal disc. Occurrence as 19. U. S. N. M. 98167.

45–53. *Platycrinus penicillus* Meek and Worthen=*P. huntsvillea* Wachsmuth and Springer.

All × 2 except 53. 45-50, stem plates; 51-53, parts of bases. 53, same as 51, × 4, differently posed. The elliptical, spiny stem plates and tricarinate bases are characteristic of this species. Ste. Genevieve (Fredonia) limestone. 45-49, along U. S. Route 19 about 1½ miles west of Bluefield, Va.; 50, top of Newman Ridge just west of Blackwater, Lee County; 51-53, slab along State Route 80 about 1 mile north of Lindell, Washington County. This is the main guide fossil of the Ste. Genevieve. The separated stem plates can commonly be found on weathered surfaces of limestone and are sufficient evidence of its Ste. Genevieve age. U. S. N. M. 98168a, 98168b, 98168c, 98168d, 98168e, 98169, 98170a, 98170b.

54–60. *Pterotocrinus serratus* Weller.

54-60, detached wing plates; 60 has also half of a base of *Talarocrinus*. Occurrence as 37. Widely distributed in the Gasper of southwest Virginia. It is another good guide fossil of the formation. U. S. N. M. 98171a, 98171b, 98171c, 98171d, 98171e, 98171f, 98172.

61. *Pterotocrinus spatulatus* Wetherby.

A detached wing plate. Occurrence as 21. U. S. N. M. 98173.

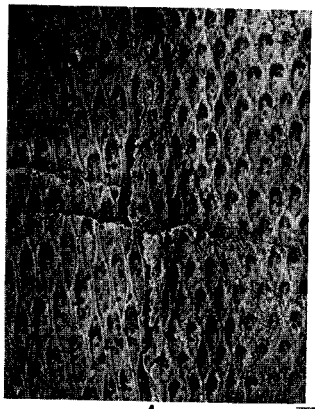
PRICE PLANT FOSSIL

PRICE PLANT FOSSIL

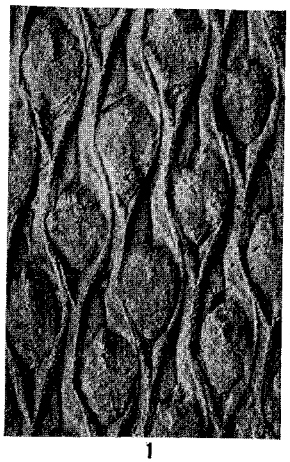
PLATE 133.—PRICE PLANT FOSSIL

FIGURE

1. *Triphyllopteris lescuriana* (Meek).
   Photograph of the type specimen, × ⅔; inset in upper left hand corner is a trilobate punule, × 4. Price formation; Lewis tunnel, three-fourths of a mile east of Alleghany Station, Alleghany County. U. S. N. M. 1447.

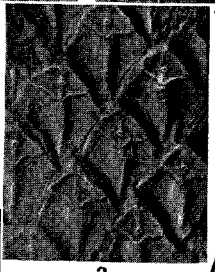

4

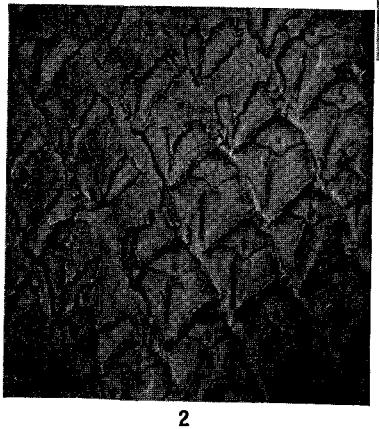

5

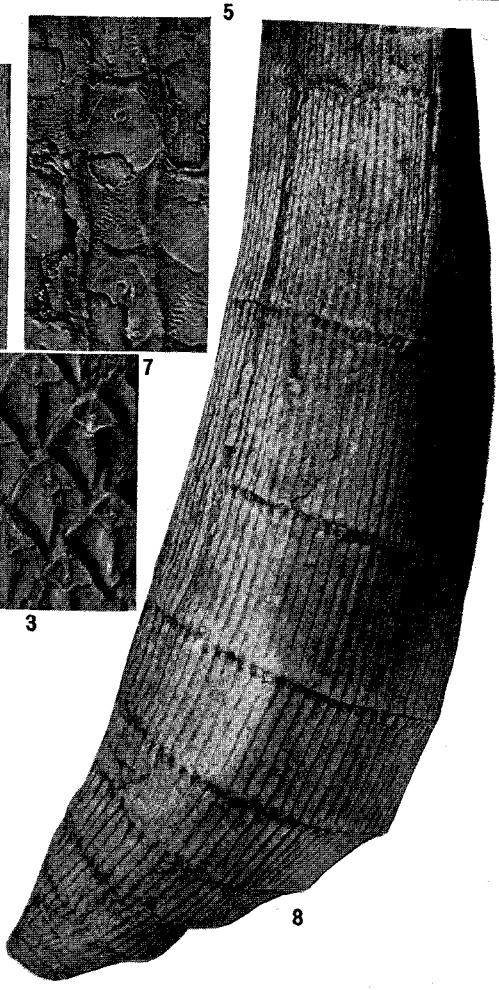

1


6

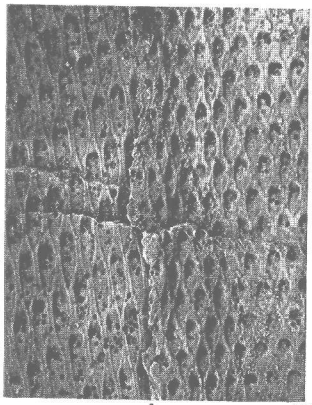
7


3

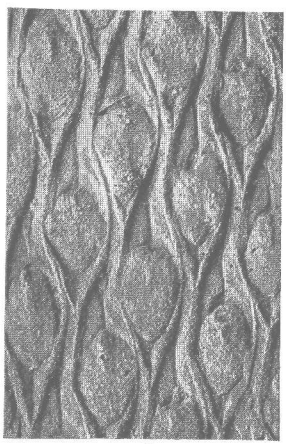

2

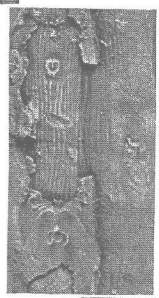

8

MISSISSIPPIAN AND PENNSYLVANIAN PLANT FOSSILS

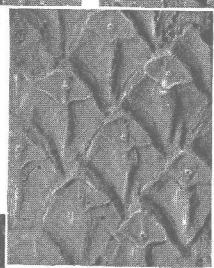

4


5

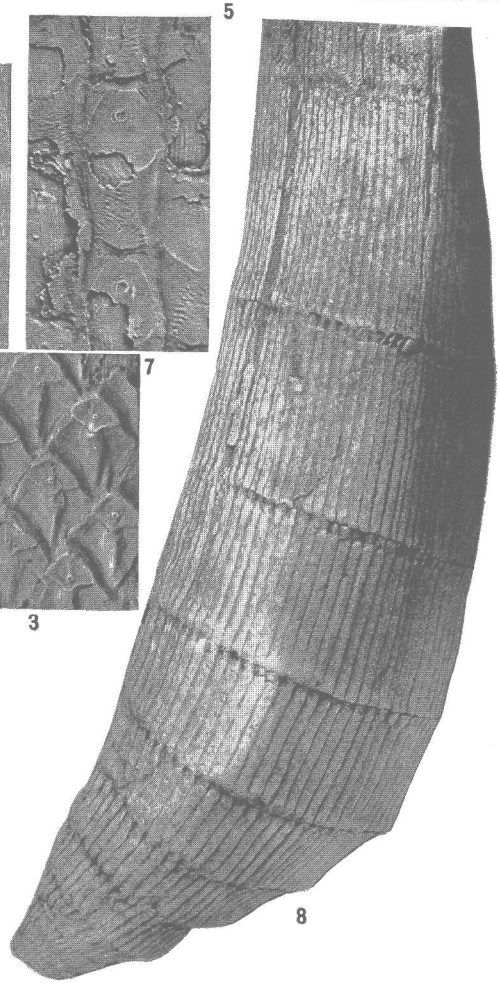

1


6

7


3


2


8

MISSISSIPPIAN AND PENNSYLVANIAN PLANT FOSSILS

PLATE 134.—MISSISSIPPIAN AND PENNSYLVANIAN PLANT FOSSILS

FIGURE

1. *Lepidodendron* sp.

The name means scale tree. Mold in sandstone of inside of stem showing the form and oblique arrangement of leaf bases characteristic of the genus. Compare this with the stem or branch of a pine tree and note the similarity to the diagonal rows of scars on the pine where the leaves have been shed. *Lepidodendron* has no relation to the pine; its nearest living relative is the common club moss (*Lycopodium*). The large oval bodies in the centers of the rhombic leaf cushions are produced by the adhesion of portions of the leaf cushions to the rock.

2, 3. *Lepidodendron obovatum* Sternberg.

2, external mold of a branch after the leaves had been shed. In places thin films of the carbonized bark, or cortex, are adhering. 3, wax squeeze of part of 2. This shows the actual external appearance of the stem after shedding the leaves. The small point in each leaf scar marks the spot where the midrib or central nerve emerged from the stem and entered the leaf.

4. *Lepidodendron scobiniforme* Meek.

External mold of a part of a stem. Price formation, Merrimac coal bed; Brushy Mountain north of Price Forks, Montgomery County. The small leaf scars are characteristic of the Pocono-Price species of *Lepidodendron*. U. S. N. M. 20348.

5–7. *Sigillaria mamillaris* Brongniart.

5, part of stem; 6-7, parts of 5, showing form and arrangement of the leaf bases, × 2. *Sigillaria* means seal tree from the resemblance of the leaf base scars to a seal. The distinguishing feature of this tree is the vertical parallel flutings of the stem and the arrangement of the leaves upon them in vertical rows instead of in oblique rows as in *Lepidodendron*. Other species of *Sigillaria* occur in the Coal Measures of Virginia.

8. *Calamites suckowi* Brongniart.

Internal mold of a hollow stem filled with sand. These are among the commonest of Coal Measures plants. They

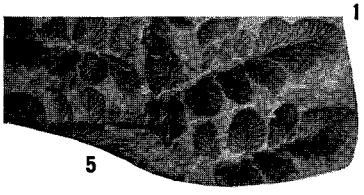
are related to the modern horsetails and scouring rushes (*Equisetum*). The characteristic features are the joints or nodes and the narrow fluting of the internodes. The small round impressions on the ribs just below the nodes are the scars left by the slender, and in some cases needle-like, leaves.

1

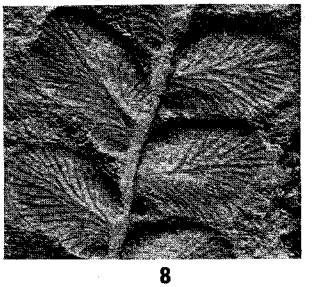
2

7

4

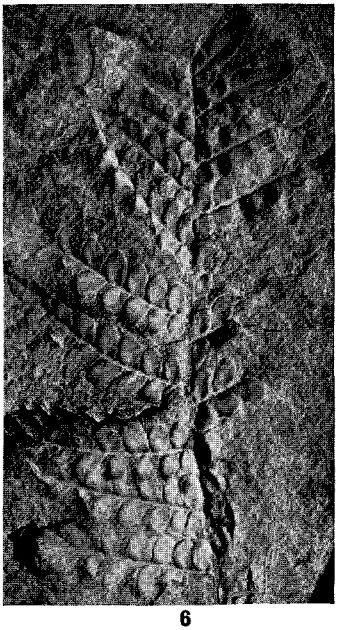


5



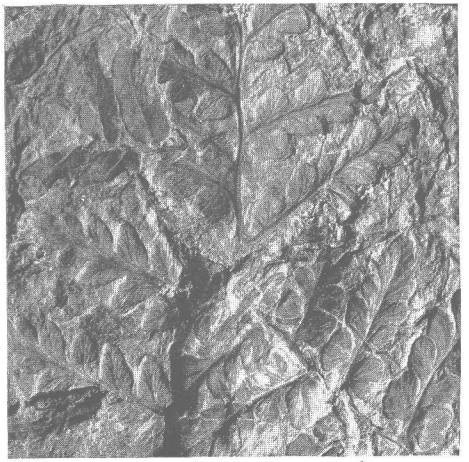
8

3



6

POTTSVILLE PLANT FOSSILS

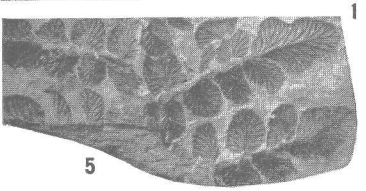


1

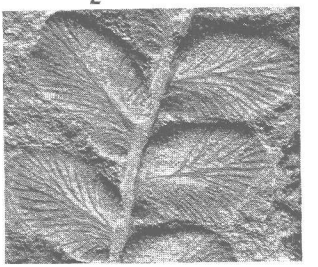
4

2

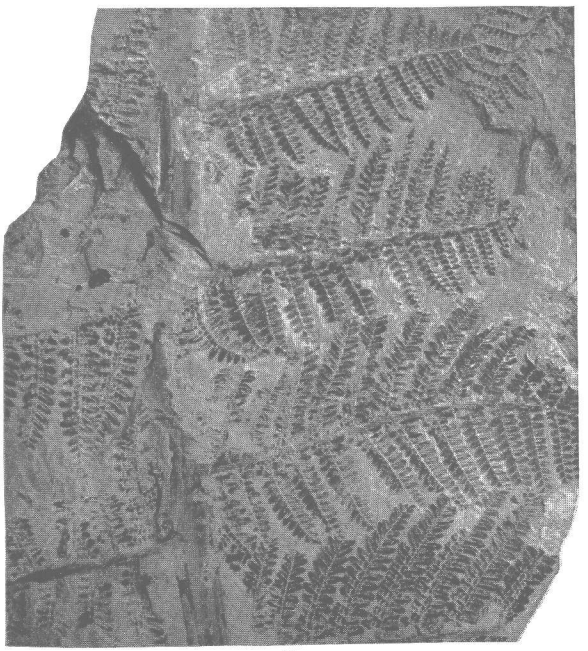
7



5



8



3

6

POTTSVILLE PLANT FOSSILS

PLATE 135.—POTTSVILLE PLANT FOSSILS

FIGURE

1, 2. *Mariopteris pottsvillea* D. White.

1, impression of a part of a frond in shale; 2, diagrammatic drawing (by David White) of a pinna, × 2. (From U. S. Geol. Survey 20th Ann. Rept., Pt. 2, pl. 190, fig. 3a.) Lower Pottsville. 1, Welch formation; three-fourths of a mile south of Squire Jim, McDowell County, W. Va.; 2, Lykens No. 4 coal, at Lincoln colliery in the southern anthracite coal basin, Pennsylvania. 1, U. S. N. M. 40247.

3–5. *Neuropteris smithii* Lesquereux.

3, × ⅓, part of a slab with an unusually large and well-preserved part of a frond; 4, × 2, enlargement of two pinnae showing the nervation of the pinnules; 5, × 2, enlargement of a small part to show the lobation of the pinnnules in some parts of the fronds. Black Creek coal bed; Warrior, Jefferson County, Ala. (University of Alabama collection.) Occurs in the lower and middle Coal Measures of Virginia.

6–8. *Neuropteris pocahontas* D. White.

6, impression of a part of a frond in shale; 7, diagrammatic drawing (by David White) of a pinna, × 2. (From U. S. Geol. Survey 20th Ann. Rept., Pt. 2, pl. 191, fig. 5a.) 8, part of a pinna of the original of 6 with several leaflets, × 4. Lower Pottsville. 6, 8, Fire Creek coal, Sewell, W. Va.; 7, Pocahontas coal, Gillam, W. Va. Reported in the Lee formation near Little Stone Gap, Wise County, Va. 6, 8, U. S. N. M. 40246.

INDEX