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UNIVERSITY OF DELAWARE

DELAWARE GEOLOGICAL SURVEY

REPORT OF INVESTIGATIONS NO. 21

GUIDE TO COMMON CRETACEOUS FOSSILS OF DELAWARE

BY

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GUIDE TO COMMON CRETACEOUS FOSSILS OF DELAWARE

ABSTRACT

This guide contains illustrations of fossils from Delaware Geological Survey Bulletin No. 3 ("Marine Upper Cretaceous Formations of the Chesapeake and Delaware Canal") and Report of Investigations No. 7 ("An Invertebrate Fauna from the Upper Cretaceous of Delaware"). The identifications have been revised to be as accurate as possible so that this guide will be useful to those fossil collectors interested in classifying their "finds."

For further information, the collector should consult the Delaware Geological Survey and the references listed.

INTRODUCTION

This "Guide to Common Cretaceous Fossils of Delaware" is largely a reprint of illustrations of fossils from Delaware Geological Survey Bulletin No. 3 ("Marine Upper Cretaceous Formations of the Chesapeake and Delaware Canal") and Report of Investigations No. 7 ("An Invertebrate Fauna from the Upper Cretaceous of Delaware"). Bulletin No. 3 has been out of print for many years, and only a few copies of Report of Investigations No. 7 remain.

Because the Chesapeake and Delaware Canal (C and D Canal) is one of the most fossiliferous areas in the Atlantic Coastal Plain, much interest has developed in Delaware fossils. The Canal area has been known to be highly fossiliferous since the geologic investigations of Booth (1841) and earlier. Current interest in Canal fossils is so high that it is the chief subject of

inquiry to the Delaware Geological Survey by the general public. This guide has been prepared to fulfill this need for information.

The identifications are as accurate as possible, bearing in mind the following: most of the specimens used for the reprinted plates are no longer available to be checked for identification accuracy or possible revision. Also, there is some question among paleontologists concerning the validity of identifying species, particularly naming new species, based on internal molds, because necessary features for distinction are not always preserved. Many of the illustrated fossils are internal molds.

Therefore, with these reservations about the validity of some of the names relative to a sound biological concept, this guide is offered as containing the best available identifications. A collector interested in the intricacies of taxonomy should pursue the identification further.

ACKNOWLEDGMENTS

The staff of the Delaware Geological Survey aided in the preparation of this guide. Norman F. Sohl, U. S. National Museum, Washington, D. C., reviewed the reprinted fossil identifications and made corrections and suggestions. Thanks also go to Horace G. Richards and Earl Shapiro, Academy of Natural Sciences of Philadelphia, for their advice on identifications of the fossils. The United States Army Corps of Engineers, Philadelphia District, has jurisdiction over federally held lands at the C and D Canal. Albert J. Depman of that office reviewed this manuscript. The Corps has cooperated with those interested in fossils by preserving certain sections of the Canal bank and by allowing fossil collecting for educational and scientific purposes. Senator Boggs also has been helpful in this effort.

PREVIOUS STUDIES

Previous research in this area is summarized by Groot, Organist, and Richards (1954). Shortly after the original C and D Canal was completed, Morton (1829) published a report on fossils of the area. Booth (1841) did a more detailed study of the geology of the State

and mentioned several collecting localities at the Canal. Other early geologists who worked in this area are Clark (1895, 1897, 1904, 1907, 1916) and Chester (1884). In 1937, C. W. Carter took advantage of widening operations at the Canal and made the first modern study. His stratigraphy is essentially the same as that most recently adopted by the Delaware Geological Survey (Pickett, 1970).

Horace G. Richards (1958, 1962, 1963) of the Academy of Natural Sciences in Philadelphia is a recognized authority on Coastal Plain fossils. Norman F. Sohl of the U. S. National Museum is a leading authority on Cretaceous Mollusca, particularly the Gastropoda.

Foraminifera from the Canal outcrops were studied by Mumby (1961). Olsson (1960) studied Foraminifera from the Cretaceous of this area. Fossil pollen and spores were studied by Groot and Penny (1960) and by Gray and Groot (1966).

A regional discussion of the stratigraphy is provided by Owens, Minard, Sohl, and Mello (1970).

GEOLOGIC HISTORY OF THE CHESAPEAKE AND DELAWARE CANAL AREA

The geologic map (Figure 1) shows the Cretaceous units present in the C and D Canal area. Table 1 contains descriptions of these formations.

The oldest Coastal Plain unit in Delaware, the Potomac Formation, was deposited on ancient crystalline rocks of the basement complex from the latter part of Early Cretaceous time into Late Cretaceous time. Streams transported clays and sands from the Appalachians in the northwest and the sediments were deposited here probably in a deltaic environment.

The overlying white sands and lignitic black silts of the Magothy Formation are separated from the Potomac Formation by an unconformity. The Magothy indicates the transition from older nonmarine sediments to the later marine deposits. Another small unconformity separates the Magothy from the overlying marine Upper Cretaceous rocks. Magothy sediments were deposited in a shoreline environment containing elements of strand line, barrier island, and lagoonal conditions.

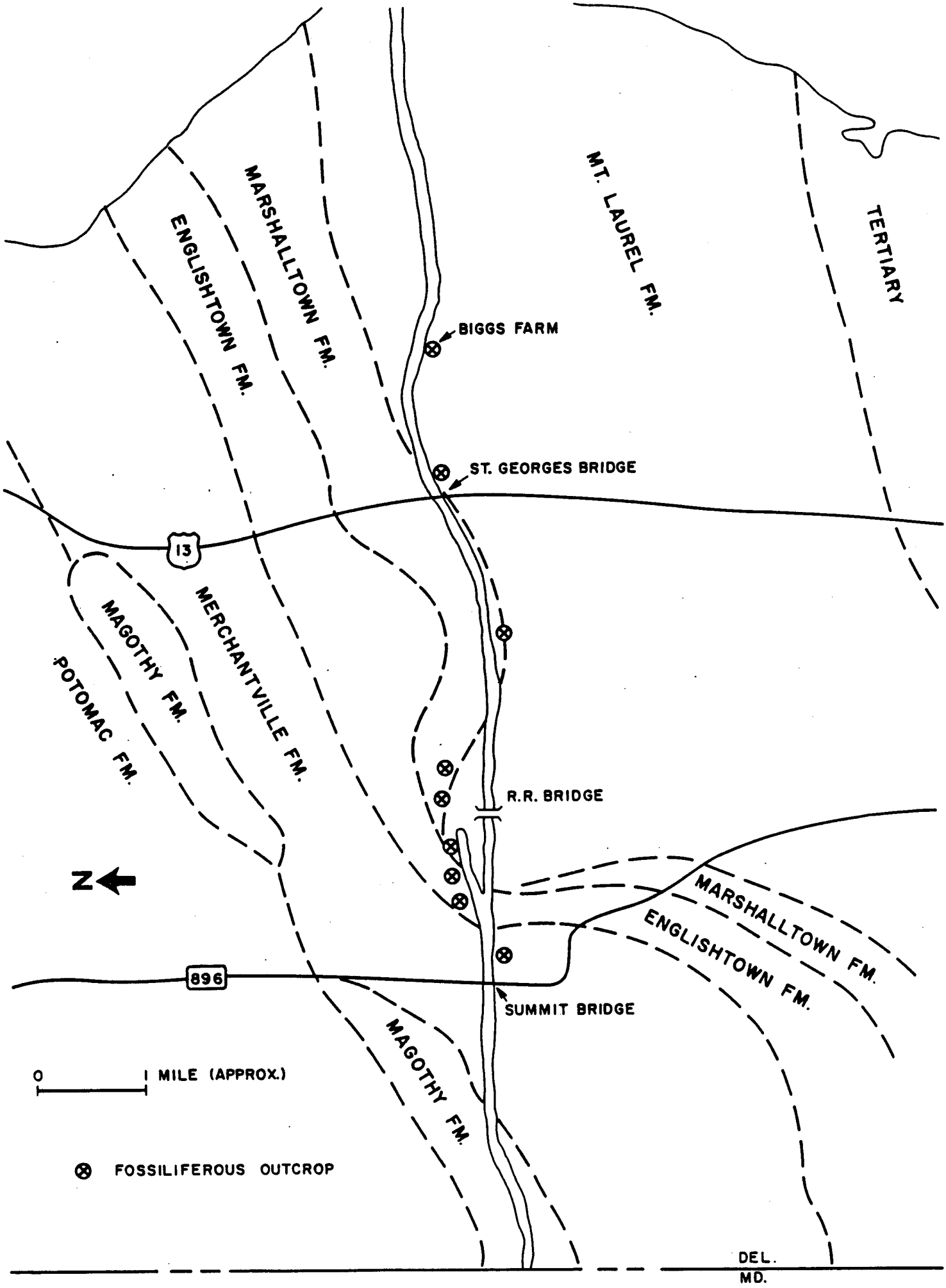

FIGURE 1. GEOLOGY OF THE CHESAPEAKE AND DELAWARE CANAL.

Table 1. Descriptions of Cretaceous Formations.

Mount Laurel Formation - Gray, green, to red-brown, glauconitic, fine to medium quartz sand with some silt. Extensively burrowed.

Marshalltown Formation - Dark greenish gray, massive, highly glauconitic, very silty fine sand.

Englishtown Formation - Light gray and rust-brown, well-sorted, micaceous, sparingly glauconitic fine sand with thin interbedded layers of dark gray silty sand. Upper sands are extensively burrowed.

Merchantville Formation - Dark gray to dark blue, micaceous, glauconitic sandy silt and silty fine sand; very sticky when wet.

Magothy Formation - White and buff, well-sorted clean quartz sand with beds of gray and black clayey silt containing much lignite and sulfide minerals.

Potomac Formation - Variegated red, gray, purple, yellow and white, occasionally lignitic, silts and clays containing interbedded white, gray, and rust-brown fine quartz sands.

A sequence of varied marine sedimentary rocks was deposited essentially continuously from Late Cretaceous to at least Middle Eocene time. The oldest Cretaceous sediments above the Magothy form the Matawan Group, consisting of the Merchantville, Englishtown, and Marshalltown Formations (Pickett, 1970). None of these units persist very far into the subsurface, so the Matawan is assigned formational status at depth a few miles south of the C and D Canal. The Merchantville, Marshalltown, and Mount Laurel sediments were probably deposited in fairly shallow, open marine, perhaps embayed areas as evidenced by the presence of the mineral glauconite and marine fossils. However, lithology and fossil burrows indicate that the Englishtown represents a shoreline environment in which sea level was dropping. Paleocene and Eocene sediments are found several miles south of the C and D Canal. There is no sedimentary record of the geologic history in the Canal area between Eocene and Pleistocene time.

Much later, during Pleistocene time, the advance and retreat of the continental glaciers brought about changes in sea level and in the streams draining into Delaware. The Pleistocene Columbia Formation, consisting mostly of coarse sand and gravel, was deposited on the stream-channeled surface of the truncated Cretaceous and Tertiary beds. In the Canal area a major north-south "channel" is located in the St. Georges area, a lesser one near Summit Bridge, and one near the Maryland-Delaware state line.

LOCATIONS OF FOSSILIFEROUS OUTCROPS

The best locations for collecting fossils are indicated on the geologic map (Figure 1).

Most fossils found at the Canal are "Steinkerns." These are internal molds left when the shell filled with mud which later hardened and the original shell dissolved.

"Biggs Farm," about one mile east of south St. Georges, is a famous locality where over 200 species of molluscs and other fossils have been found in the Mount Laurel Formation. Today, "Biggs Farm" is an 8-foot high bluff left by the Corps of Engineers as a break in the rip-rap along the Canal.

Slump blocks in the embankments along the Canal frequently expose fossils. A stabilized slump in the

Marshalltown Formation is located about one mile west of south St. Georges. It contains numerous species of pelecypods (clams) and gastropods (snails).

The area near the Pennsylvania Railroad Bridge contains bluffs 50 to 60 feet high on the north bank near the old channel of the C and D Canal. These excellent exposures reveal the Merchantville, Englishtown, Marshalltown Formations and, in places, a thin top layer of the Mount Laurel Formation. The bluffs are not as highly fossiliferous as other outcrops at the Canal, but are especially noted for the Ophiomorpha (crustacean) and other types of burrows at the top of the Englishtown Formation (Plate 5, Fig. 7).

The Merchantville Formation, containing well-preserved large specimens, up to 2 feet in diameter, of the ammonite Placenticeras (not shown in the reprinted plates), is exposed at low tide between the rip-rap and the water's edge between Summit Bridge and the cable crossing about one-half mile east on the south bank of the Canal.

Abundant fossils are found in the spoil piles, particularly on the north bank, between the Railroad Bridge and St. Georges. This dredged material is a mixture of the six Cretaceous formations present in the Canal area.

All the above locations are on federally controlled lands. The U. S. Army Corps of Engineers, who have jurisdiction over these lands, requires that bank stabilization not be destroyed by over-collecting. It is against federal law to collect fossils from the Canal reservation for later sale; however, small-scale collecting for private collections is permitted. It is wise to avoid wading in the water as there is a 35-foot deep channel just offshore. The Corps prefers that collections be made from spoils piles, away from the water. In this connection, plans are being made for a designated fossil collecting area near the north end of the Pennsylvania Railroad Bridge.

The Delaware Geological Survey urges the conservation of these scientifically and educationally important fossil localities. It would be appreciated if unusual "finds" are brought to the attention of the author.

EXPLANATION OF PLATES

(Formation names indicate origin of specimen, the species is not necessarily restricted to that formation.)

PLATE I

Figure

1. *Cliona cretacica* Fenton and Fenton, sponge in *Exogyra sp.* (X1). Mount Laurel Formation.
2. *Hemiaster sp.* (Morton), echinoid, (X1). Englishtown Formation.
3. *Gervilliopsis ensiformis* (Conrad), pelecypod, (X1). Merchantville Formation.

4, 5. *Cucullaea neglecta* Gabb, pelecypod, (X1). Marshalltown Formation.

6. *Cucullaea vulgaris* Morton, pelecypod, (X1). Merchantville Formation.
7. *Glycimeris mortoni* (Conrad), pelecypod, (X5/8). Merchantville Formation.
8. *Inoceramus proximus* Tuomey, pelecypod, (X1). Englishtown Formation.
9. *Ptennipteria? sp.*, pelecypod, (X1).
10. *Pteria laripes* (Morton), pelecypod, (X1).
11. *Pulvinites argenteus* Conrad?, pelecypod, (X1). Merchantville Formation.
12. *Ostrea monmouthensis* Weller?, pelecypod, (X1). Marshalltown Formation.
13. *Ostrea falcata* Morton, pelecypod, (X1). Marshalltown Formation.
14. *Ostrea mesenterica* Morton, pelecypod, (X1-1/2). Mount Laurel Formation.

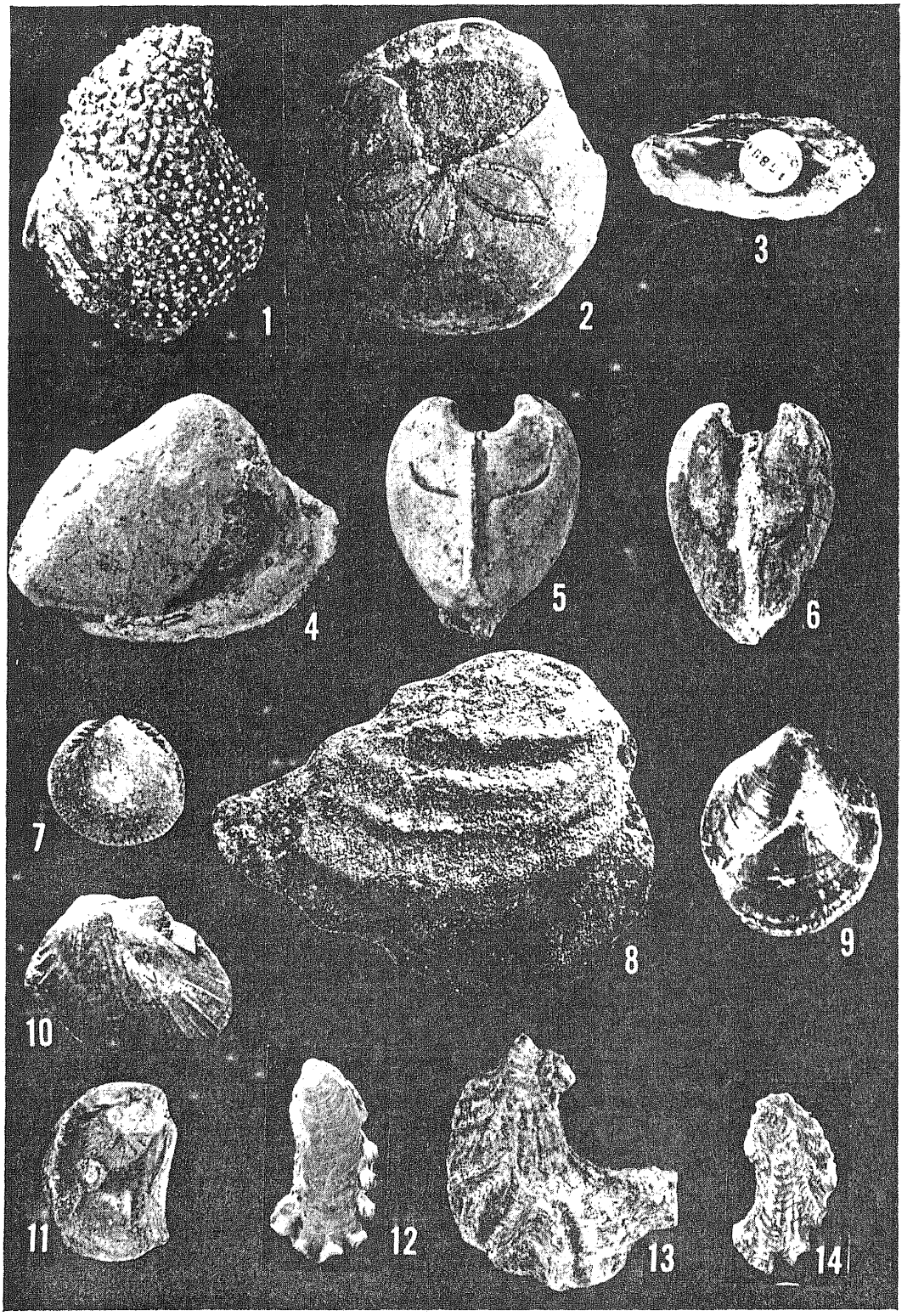
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PLATE II

Figure

1. Exogyra ponderosa Roemer, pelecypod, (X1/2). Marshalltown Formation.
2. Exogyra ponderosa erraticostata Stephenson?, pelecypod, (X1/2). Marshalltown Formation.
3. Exogyra costata Say, pelecypod, (X1). Mount Laurel Formation.
4. Pyncnodonte mutabilis (Morton), pelecypod, (X1/2). Marshalltown Formation.
5. Pecten whitfieldi Weller, pelecypod, (X2). Marshalltown Formation.
6. Anomia tellinoides Morton, pelecypod, (X1). Mount Laurel Formation.
7. Lithophaga ripleyana Gabb, pelecypod, (X1-1/2). Mount Laurel Formation.

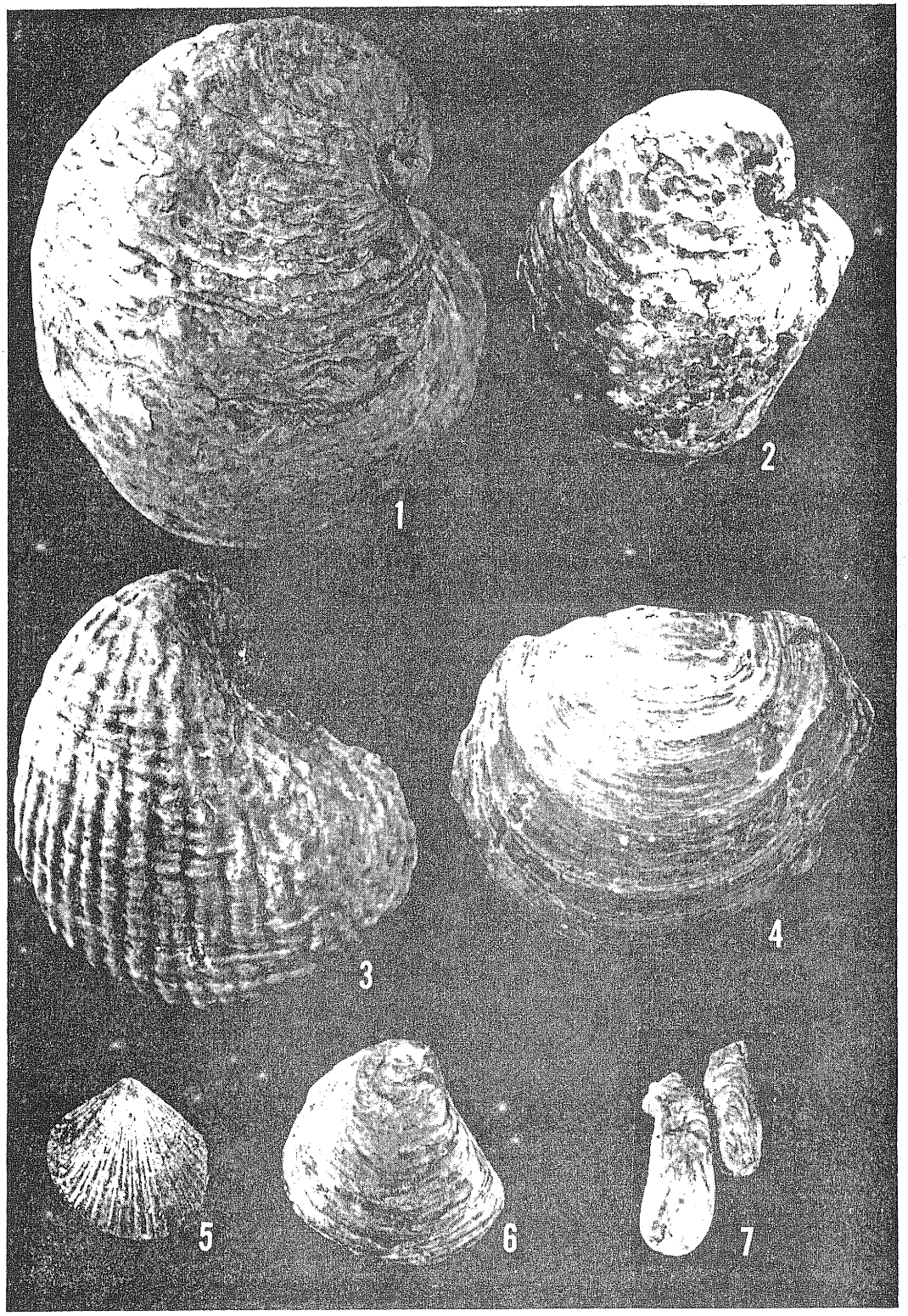
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PLATE III

Figure

1. *Pholadomya occidentalis* Morton, pelecypod, (X1). Merchantville Formation.
2. *Liopistha protexta* (Conrad), pelecypod, (X1). Marshalltown Formation.
3. *Cymella bella* Conrad var., pelecypod (X3). Merchantville Formation.
4. *Crassatella* sp., pelecypod, (X1). Mount Laurel Formation.

5, 6. *Granocardium tenuistriatum* (Whitfield), pelecypod, (X1). Marshalltown Formation.

7. *Trachycardium* cf. *C. longstreeti* Weller, pelecypod, (X2). Merchantville Formation?
8. *Linearia metastriata* Conrad, pelecypod, (X1). Merchantville Formation.
9. *Unicardium umbonata* (Whitfield), pelecypod, (X1). Marshalltown Formation.
10. *Corbula bisulcata* Gabb, pelecypod, (X1-1/2). Mount Laurel Formation.
11. *Panopea decisa* Conrad, pelecypod, (X1). Merchantville Formation.
12. *Cyprimeria* cf. *C. excavata* (Morton), pelecypod, (X1). Marshalltown Formation.

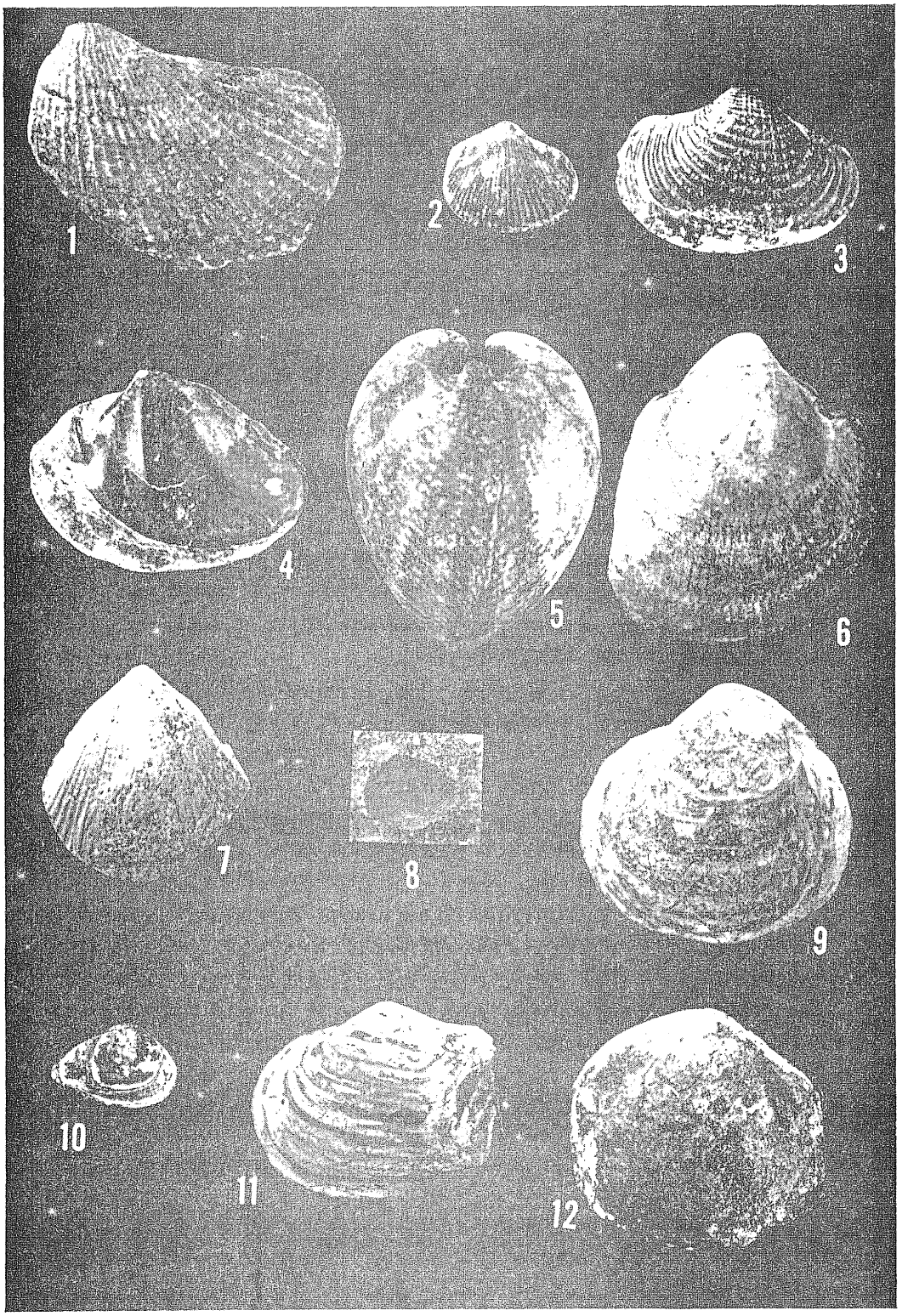
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PLATE IV

Figure

1. Gyrodes crenata (Conrad)?, gastropod, (X1). Marshalltown Formation.
2. Turritella encrinoides Morton?, gastropod, (X1-1/2). Marshalltown Formation.
3. Turritella trilira Johnson, gastropod, (X2). Mount Laurel Formation.
4. Piestochilus bella (Gabb), gastropod, (X1). Merchantville Formation.
5. Volutomorpha? delawarensis Gabb, gastropod, (X1). Chesapeake and Delaware Canal.
6. Volutomorpha conradi (Gabb), gastropod, (X1). Merchantville Formation.
7. Avellana bullata (Morton), gastropod, (X1). Marshalltown Formation.
8. Napulus octoliratus (Conrad), gastropod, (X1-1/2). Marshalltown Formation?
9. Pyropsis sp. (Tuomey), gastropod, (X1).. Marshalltown Formation.
10. Anchura? sp. Conrad?, gastropod, (X1). Marshalltown Formation.

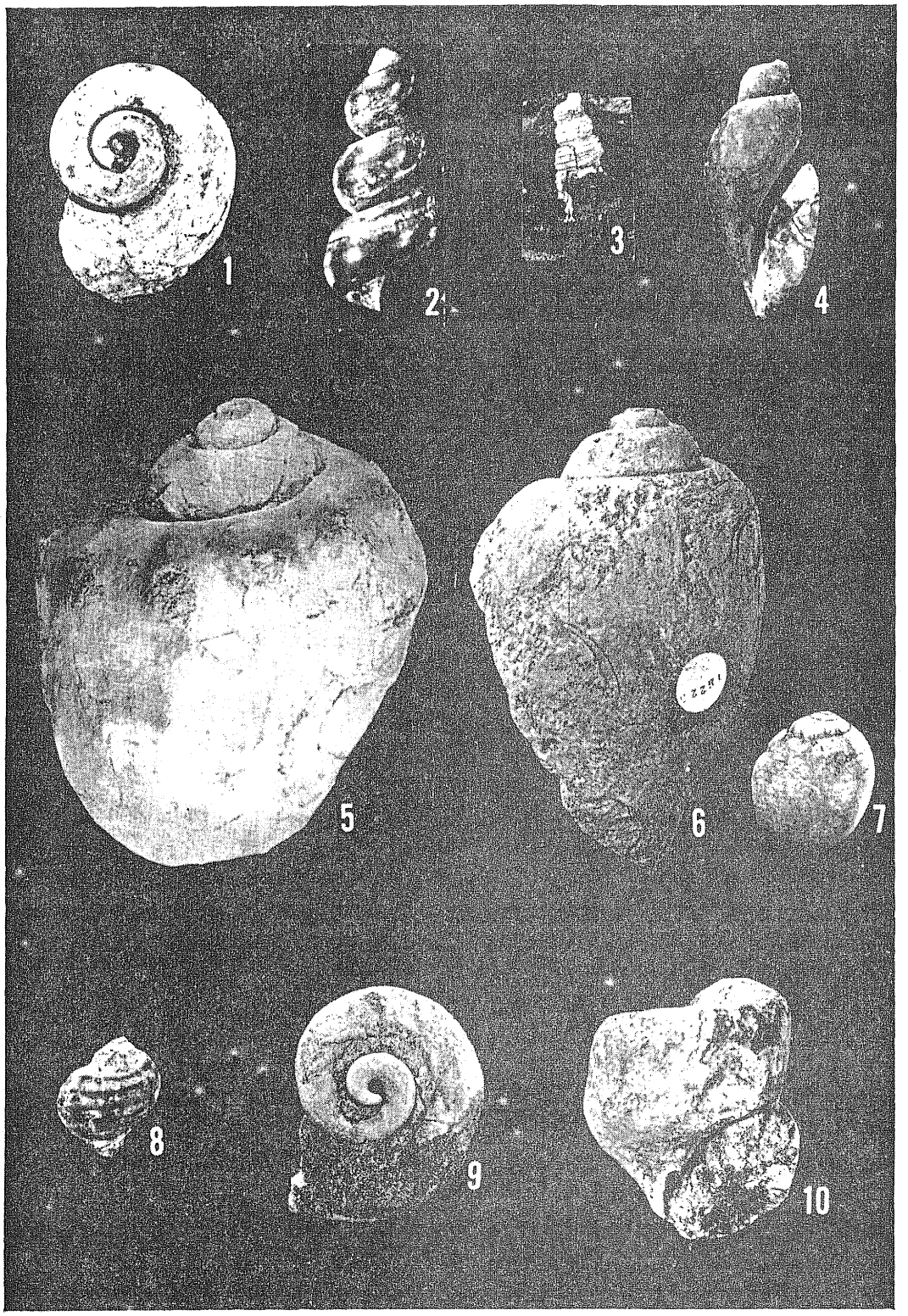
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PLATE V

Figure

1, 2. *Belemnitella americana* (Morton), cephalopod (squid), (X1). Mount Laurel Formation.

3, 4. *Callianassa mortoni* Pilsbry, crustacean (crab claw), (X1). Merchantville Formation.

5. *Menabites (Delawarella) delawarensis* (Morton), cephalopod, (X1). Merchantville Formation.

6. *Baculites ovatus* Say, cephalopod, (X1). Mount Laurel Formation.

7. *Ophiomorpha nodosa* Lundgren, burrow of the mud-shrimp *Callianassa*, (X1). Englishtown Formation.

8. *Thalassinoides sp.*, crustacean burrow, (X1). Marshalltown Formation?

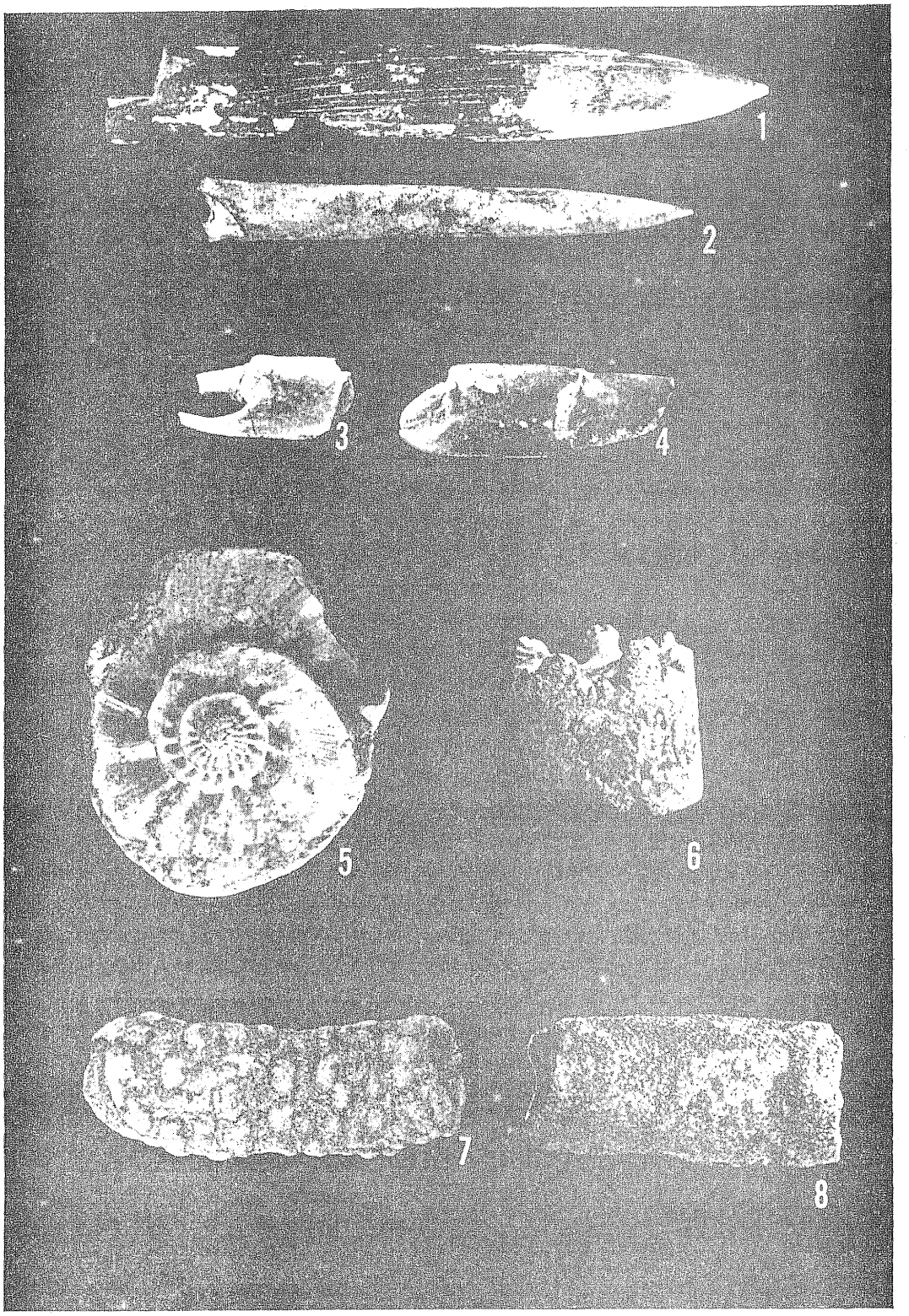
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PLATE VI

(All from Biggs Farm locality)

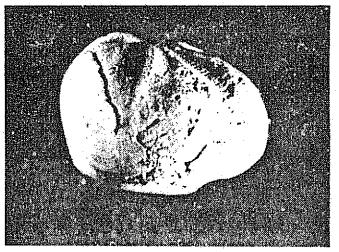
Figure

1a,b. Hemiaster sp., echinoid, (X1.2).

2. Serpula sp., annelida?, (X4).

3. Terebratulina cooperi Richards and Shapiro n. sp., brachiopod, (X4).

4. Terebratulina cooperi Richards and Shapiro n. sp., brachiopod, growth series.



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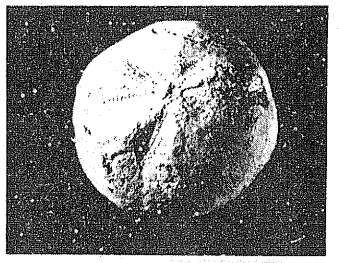

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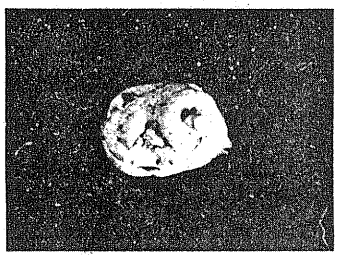

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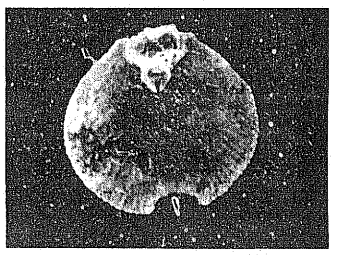

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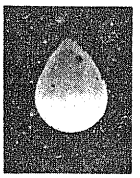

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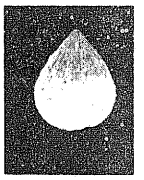

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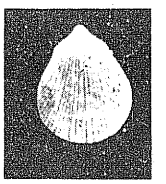

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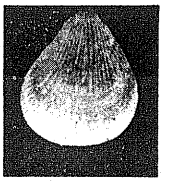

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PLATE VII

(All from Biggs Farm locality; all pelecypods)

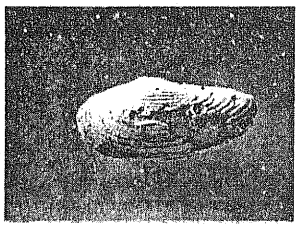
Figure

1. *Nuculana pittensis* (Stephenson), (X3).
2. *Nuculana stephensoni* Richards, (X2).
3. *Nemodon enfaulensis* (Gabb), (X2).
4. *Nemodon grandis Sohli* Richards and Shapiro n. subsp., (X2).
5. *Postligata crenata* Wade, (X2.2).
6. *Pteria sp.*, (X2)
7. *Lucina parva* Stephenson, (X3).

8a,b. *Ostrea mesenterica*? Morton, (X1).

9. *Protocardia parahillana* Wade, (X3).
10. *Isocardia bulbosa* Stephenson, (X3).
11. *Solyma sp.*, (X2).

12a,b. *Tellina georgiana* Gabb, (X2).



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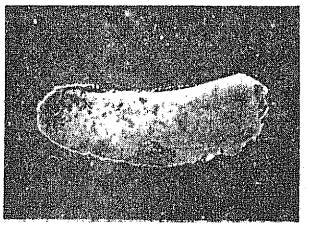

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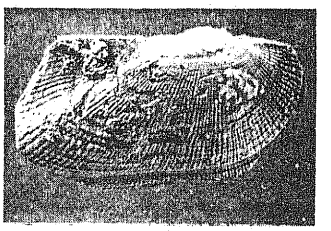

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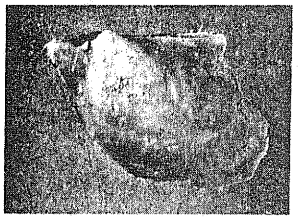

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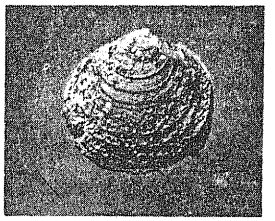

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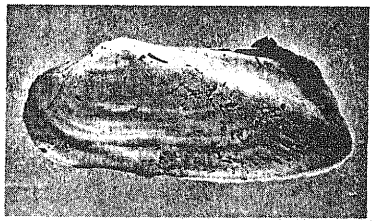

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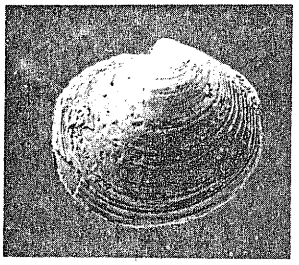

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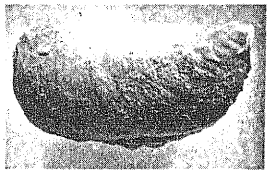

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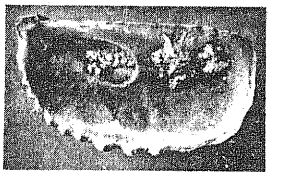

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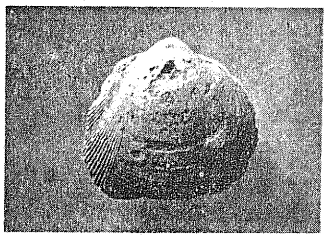

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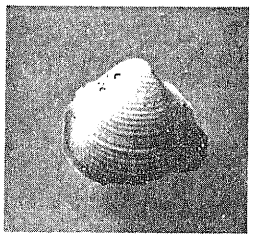

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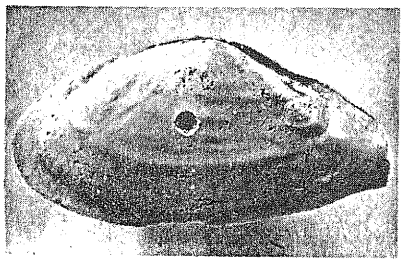

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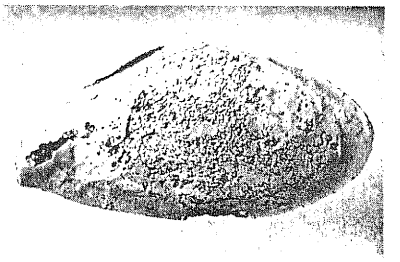

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PLATE VIII

(All from Biggs Farm locality; all gastropods)

Figure

1a,b,c. Calliomphalus americanus Wade, (X3).

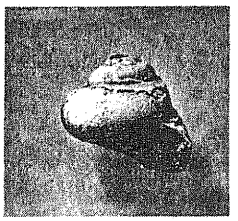
2a,b,c. Calliomphalus nudus Sohl, (X3).

3a,b. Belliscala crideri Stephenson, (X2).

4a,b,c. Margaritella sp., (X3).

5a,b,c. Architectonica cf. A. voragiformis Stephenson, (X2).

6a,b,c. Calliomphalus sp., (X3).



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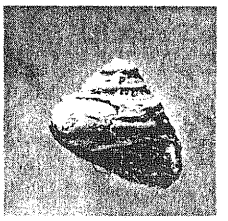

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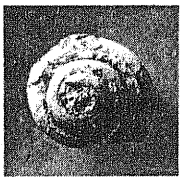

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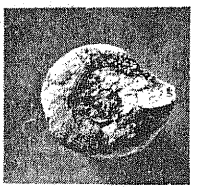

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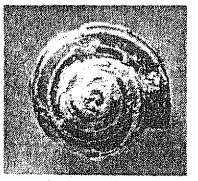

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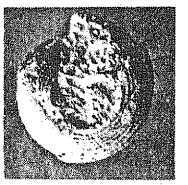

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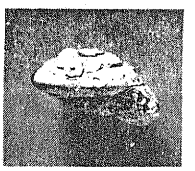

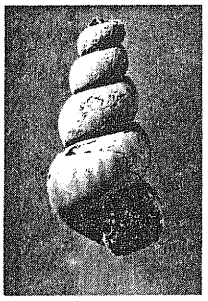

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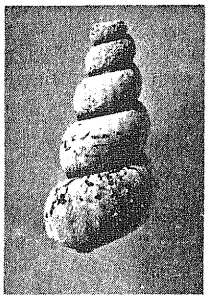

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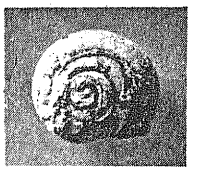

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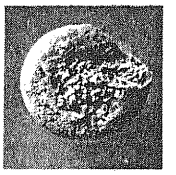

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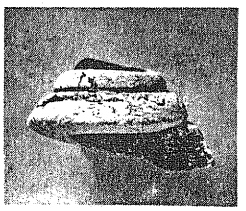

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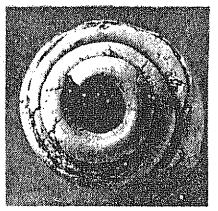

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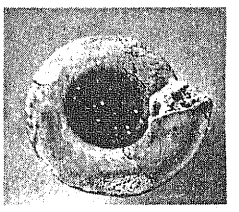

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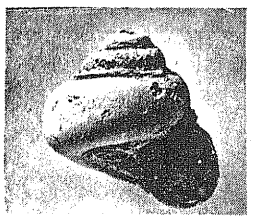
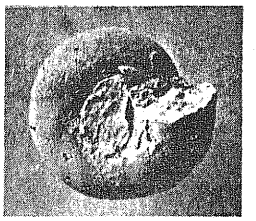


6 a

6 b



6 c

PLATE IX

(All from Biggs Farm locality; all gastropods)

Figure

1a,b. *Cerithium weeksi* Wade, (X3).

2a,b. *Morea cancellaria corsicanensis* Stephenson, (X2).

3a,b,c. *Cypraea grooti* Richards and Shapiro, n. sp., (X2).

4a,b. *Rhombopsis marylandicus* (Gardner), (X2).

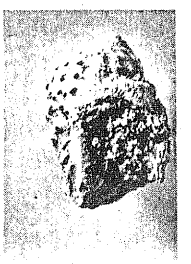
5a,b. *Acteon? throckmortoni* Stephenson, (X2).

6a,b,c. *Goniocylichna sp.*, (X4.5).

7a,b,c. *Anisomyon jessupi* Richards and Shapiro n. sp., (X2).

1 a

1 b



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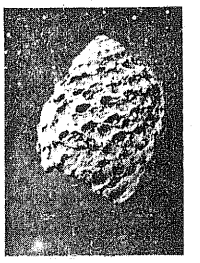

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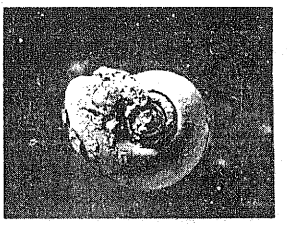
3 a



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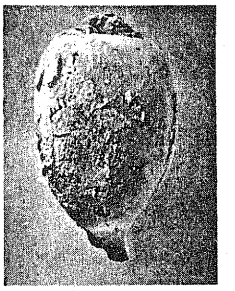

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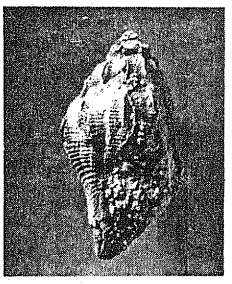

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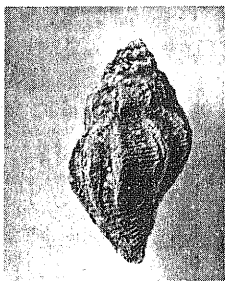

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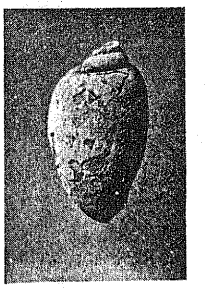


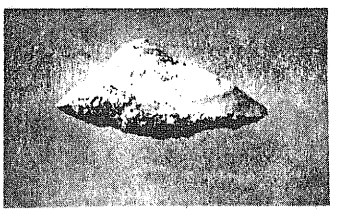
5 b

6 a

6 b

6 c

7 a



7 b

7 c

OTHER FOSSILS

Fish and reptilian bones, including vertebrae and teeth are found in the Cretaceous deposits at the C and D Canal, mostly in the Marshalltown and Mount Laurel Formations.

Lignitized wood, frequently encrusted with pyrite is found mostly in the Magothy and Merchantville Formations.

All formations contain trace fossils, mainly crustacean and worm burrows and borings.

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