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INARTICULATE BRACHIOPODS OF THE SILICA FORMATION  
(DEVONIAN), OHIO AND MICHIGAN

BY

R. D. HOARE AND D. L. STELLER  
Bowling Green State University



MUSEUM OF PALEONTOLOGY  
THE UNIVERSITY OF MICHIGAN  
ANN ARBOR

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2. Two unusually well-preserved trilobites from the Middle Devonian of Michigan and Ohio, by Erwin C. Stumm. Pages 33–35, with 1 plate.
3. The corals of the Middle Devonian Tenmile Creek Dolomite of northwestern Ohio, by Erwin C. Stumm. Pages 37–44, with 3 plates.
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18. Devonian bioherms of the Michigan Basin, by Erwin C. Stumm. Pages 241–247, with 2 plates and 4 text-figures.
19. *Silicaster*, a new genus of Devonian starfish, by Robert V. Kesling. Pages 249–261, with 4 plates and 2 text-figures.

# INARTICULATE BRACHIOPODS OF THE SILICA FORMATION (DEVONIAN), OHIO AND MICHIGAN

R. D. HOARE AND D. L. STELLER  
Bowling Green State University

ABSTRACT—Fifteen species representing ten genera of inarticulate brachiopods are described from the Silica Formation (Middle Devonian) exposed in the North Quarry of the Medusa Portland Cement Company west of Sylvania, Ohio, and the Martin-Marietta Quarry in Augusta Township, Washtenaw County, Michigan. The greatest abundance of specimens was found in unit 9 in the Medusa Quarry, approximately 12 feet above the base of the formation.

*Philhedra crenistriata* (Hall), *P. sheldoni* (White), *P. stewarti* Fenton & Fenton, *Petrocrania hamiltoniae* (Hall), *Acanthocrania chilmanae* n. sp. and *Lingulodiscina marginalis* (Whitfield) are commonly found attached to articulate brachiopods, bryozoan colonies, or rugose corals. *Lingula ligea* Hall, *L. spatulata* Vanuxem, *L. compta* Hall & Clarke, *L. cf. L. rectilatera* Hall, *Dignomia alveata* (Hall), *Trigonoglossa truncata* (Cleland), ?*Craniops hamiltoniae* (Hall), *Orbiculoidea doria* (Hall), and *Roemerella grandis* (Vanuxem) are also present but normally are found as isolated valves along bedding planes in the shales.

## INTRODUCTION AND PREVIOUS WORK

THE SILICA FORMATION of Middle Devonian age has produced a prolific fauna of well-preserved specimens for collectors since extensive exposures were opened in the quarrying operations west of Sylvania, near Silica, in Lucas County, Ohio. An additional exposure of the formation has been made in the Junction Quarry on the west edge of the village of Junction, south of Defiance, Ohio. Stumm & Chilman (1967) report exposures of the formation in the recent operations of the Martin-Marietta Company in Augusta Township, Washtenaw County, Michigan. Most of the specimens included in this study came from exposures in the North Quarry of the Medusa Portland Cement Company, located just northwest of the intersection of Brint and Centennial Roads, SE  $\frac{1}{4}$  sec. 7, T. 9 S., R. 6 E., Lucas County, Ohio. A few specimens, forming parts of the descriptions and illustrations, were obtained from the Martin-Marietta Quarry in Augusta Township, Washtenaw County, Michigan.

The Silica Formation in Lucas County, Ohio, has been divided into 25 stratigraphic units by Ehlers, Stumm, & Kesling (1951). The notations as to stratigraphic unit numbers in the systematic descriptions relate to this division. The greatest number of inarticulate brachiopods was collected from unit 9, approximately 12 feet above the base of the formation. Stratigraphic positions of the specimens from the Martin-Marietta Quarry are unknown.

Inarticulate brachiopods have been known from the Silica Formation since 1927 when Stewart published the initial paper on the fauna. In this paper two species, *Petrocrania hamil-*

*toniae* (Hall) (= *Craniella hamiltoniae* Hall) and *Crania* sp., were recognized. Further systematic studies on this group have not been published, as shown in the checklist of Silica invertebrates by Stumm & Chilman (1967).

D. G. Nussmann (1961), in an unpublished Master's thesis at The University of Michigan ("Ecology and pyritization of the Silica Formation, Middle Devonian, of Lucas County, Ohio"), discussed the fossils and their occurrence in Lucas County. He noted the presence of *Petrocrania hamiltoniae* (Hall) in units 5-7, 9, 10, and 14 and *Philhedra crenistriata* (Hall) in units 7 and 9. D. L. Steller (1965), in an unpublished Master's thesis at Bowling Green State University ("The epifaunal elements on the Brachiopoda of the Silica Formation"), described the epifauna on brachiopods in the Medusa Portland Cement Company North Quarry. She found *Petrocrania hamiltoniae* (Hall), *Philhedra crenistriata* (Hall), and *Lingulodiscina marginalis* (Whitfield) attached to various species of articulate brachiopods. In a short paper describing the epifauna attached to a specimen of *Paraspirifer bownockeri* (Stewart), specimens of *Lingulodiscina marginalis* (Whitfield) were illustrated by Hoare & Steller (1967).

Much of the early systematic work on North American Devonian inarticulate brachiopods was done by Hall (1859, 1860, 1867). Numerous other systematic papers dealing with Devonian faunas include discussion of one or more forms. The most recent discussion was by Griesemer (1965) in his study of the Middle Devonian brachiopods of southeastern Wisconsin.

The specimens described in this report are

in the repository of the Museum of Paleontology, University of Michigan (UMMP) or in the repository of the Department of Geology, Bowling Green State University (BGSU).

#### ACKNOWLEDGMENTS

The authors wish to acknowledge the gift of specimens from Mrs. Ruth Beiswenger of Huron, Ohio, Mrs. Ruth Berner Chilman of Detroit, Michigan, and Mr. Allan Luft of La-Salle, Michigan. The Museum of Paleontology, University of Michigan made numerous specimens available for study on a loan basis through the courtesy of Prof. Erwin C. Stumm. Several of these specimens were a gift to the Museum by Mrs. Chilman. We wish to express our appreciation to Prof. E. C. Stumm, Prof. C. A. Arnold and Prof. R. V. Kesling for reviewing the manuscript and for their helpful suggestions.

Our thanks are also due the Medusa Portland Cement Company which allowed access to their property for collecting purposes.

#### SYSTEMATIC DESCRIPTIONS

Phylum BRACHIOPODA Dumeril  
 Class INARTICULATA Huxley  
 Order LINGULIDA Waagen  
 Superfamily LINGULACEA Menke  
 Family LINGULIDAE Menke  
 Genus LINGULA Bruguiere  
 LINGULA LIGEA Hall  
 Pl. 1, figs. 1, 2

*Lingula ligea* HALL, 1867, p. 7-8, pl. 1, fig. 2; PROSSER & KINDLE, 1913, p. 126-127, pl. 8, fig. 6; CLARKE & SWARTZ, 1913, p. 547-548, pl. 47, figs. 6-7.

*Description.*—Shell evenly elliptical in outline with lateral margins smoothly curved and terminating rather abruptly at anterior margin. Posterior margin not sharply set off from lateral

margins. Anterior outline truncated. Shell convexity low, highest just anterior to umbo and sloping uniformly to the anterior margin. Surface marked by fine, closely spaced growth lines. Shell material thin and phosphatic. Growth hemiperipheral.

Two specimens respectively 10.9 mm and 13.5 mm long, 6.5 mm and 6.7 mm wide.

*Discussion.*—Three separated valves form the basis for the above description. Although somewhat fragmentary they seem to agree well with Hall's (1867) original description. These specimens differ from *Lingula compta* Hall & Clarke by having a relatively narrower shell form and coarser growth lines. *L. spatulata* Vanuxem is a narrower form with an acuminate posterior shape and finer growth lines. *L. rectilatera* Hall has nearly parallel lateral margins, an obtuse posterior margin, and coarser growth lines.

*Occurrence.*—Three specimens from unit 9.

*Repository.*—UMMP 57136.

LINGULA SPATULATA Vanuxem  
 Pl. 1, figs. 3-5

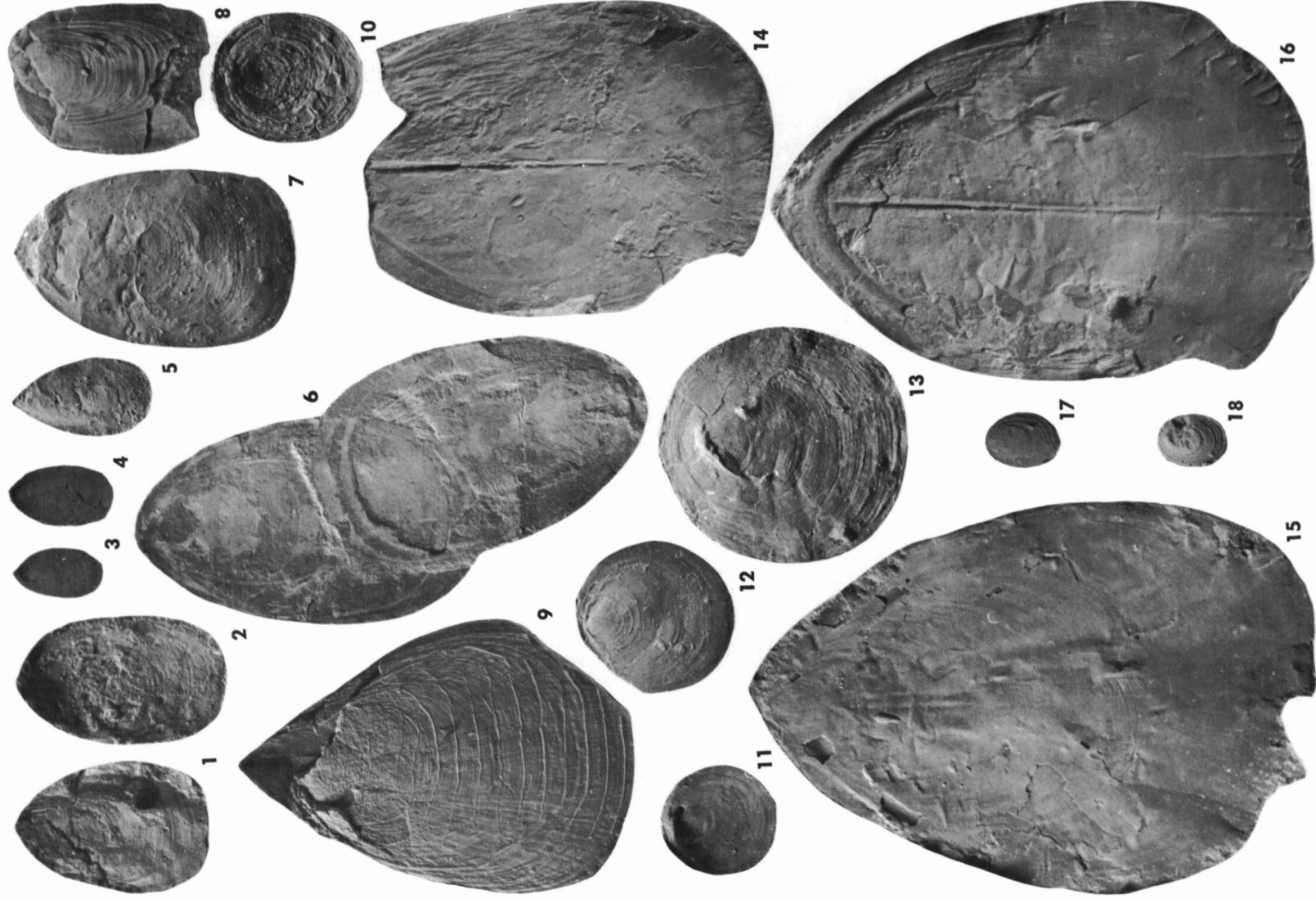
*Lingula spatulata* VANUXEM, 1842, p. 168, fig. 3; HALL, 1843, p. 223, fig. 3; 51:3; —, 1867, p. 13, pl. 1, fig. 1; SAVAGE, 1931, pl. 32, figs. 4-5; CLARKE & SWARTZ, 1913, p. 548, pl. 47, fig. 8.

*Description.*—Shell small, narrowly elongate, with obtusely pointed posterior margin and sharply rounded anterior margin. Greatest width near mid-length. Convexity low, greatest just anterior to umbonal areas and lateral slopes gently convex. Shells marked by widely spaced growth lines, some more pronounced than others. Shell material thin and phosphatic. Growth hemiperipheral.

Specimens ranging from 2.1 mm to 7.0 mm

#### EXPLANATION OF PLATE 1 All figures $\times 3$ , except as noted

- Figs. 1, 2 —*Lingula ligea* Hall. Pedicle? and brachial? interior views of same specimen, unit 9, UMMP 57136, North Quarry, Medusa Portland Cement Co.  
 3-5 —*Lingula spatulata* Vanuxem. 3, 4, brachial? valves,  $\times 6$ , unit 18, UMMP 56615; 5, pedicle?, valve, unit 9, UMMP 56698, North Quarry, Medusa Portland Cement Co.  
 6, 7 —*Lingula compta* Hall & Clarke. Pedicle and brachial valves of same specimen, UMMP 57144, and pedicle? valve, UMMP 56601, unit 9, North Quarry, Medusa Portland Cement Co.  
 8 —*Lingula* cf. *L. rectilatera* Hall. Brachial? view, unit 7?, UMMP 56616, North Quarry, Medusa Portland Cement Co.  
 9 —*Trigonoglossa truncata* (Cleland). Brachial view with external mold of beak area, unit 9, UMMP 57148, North Quarry, Medusa Portland Cement Co.  
 10-13—*Orbiculoidea doria* (Hall). 10, brachial interior view, unit 9, UMMP 57153; 11, brachial interior view, unit 7, UMMP 57152; 12, brachial valve, unit 18, UMMP 56605; 13, brachial valve, unit 7, UMMP 57151, North Quarry, Medusa Portland Cement Co.  
 14-16—*Dignomia alveata* (Hall). Brachial valves with partial molds, unit 9, UMMP 56614, 57146, 56593, North Quarry, Medusa Portland Cement Co.  
 17, 18—?*Cranioiops hamiltoniae* (Hall). Brachial valves,  $\times 6$ , unit 7?, UMMP 56617, 57150, North Quarry, Medusa Portland Cement Co.



in length and 1.2 mm to 3.9 mm in width. Average length and width of seven specimens: 3.56 mm and 2.04 mm respectively.

*Discussion.*—*Lingula spatulata* differs from other species of this genus in the Silica Formation by its narrow, elongate form. It is similar to *L. milwaukeeensis* Cleland but differs in being wider in the posterior region.

*Occurrence.*—Nine specimens from unit 9.

*Repository.*—UMMP 56594, 56598, 56613, 56615, 57137–57142.

#### LINGULA COMPTA Hall & Clarke

Pl. 1, figs. 6, 7

*Lingula compta* HALL & CLARKE, 1892, p. 171, pl. 1, fig. 16.

*Lingula* cf. *L. compta* PROSSER & KINDLE, 1913, p. 128, pl. 8, fig. 11.

*Description.*—Shell large and broadly spatulate in form. Posterior margin produced, rounding smoothly into lateral margins which continue to diverge until past mid-length. Anterior margin broadly rounded to somewhat truncate, curving strongly into lateral margins. Convexity low and surface slopes uniform. Shell marked by numerous fine lines of growth which may be pronounced at various stages of growth. Shell material thin and phosphatic. Growth hemiperipheral.

Specimens ranging in length from 13.3 mm to 17.8 mm and in width from 7.9 mm to 10.7 mm. Average length and width of four specimens: 14.97 mm and 9.1 mm respectively.

*Discussion.*—*Lingula compta* is the largest form of this genus known from the Silica Formation. Differences with other species described here have been noted under those discussions. It is most similar to *L. complanata* Williams but is a relatively narrower form.

*Occurrence.*—Eight specimens from unit 9 and one specimen from unit 11.

*Repository.*—UMMP 56601, 56610–56612, 57143–57145.

#### LINGULA cf. L. RECTILATERA

Pl. 1, fig. 8

*Lingula rectilatera* HALL, 1859, p. 156, pl. 9, figs. 6–8; GRIESEMER, 1965, p. 247, pl. 1, figs. 6–7.

*Lingula* cf. *L. delia* CLELAND, 1911, p. 70, pl. 12, fig. 1.

*Description.*—Shell rectilinear in outline with nearly parallel lateral margins. Anterior margin broadly truncate and posterior margin not produced. Shell convexity high, greatest about one-fourth of length from beak. Median

areas of valve flattened and lateral slopes steep in posterior half of shell. Shell surface marked by closely spaced, coarse lines of growth. Shell material relatively thick and phosphatic. Growth hemiperipheral.

A partial specimen 8.2 mm wide at mid-length and approximately 14.0 mm long.

*Discussion.*—One fragmentary specimen is here compared with *Lingula rectilatera*. The general configuration of the specimen agrees with the original description of Hall (1859) and with that of Griesemer (1965). The anterior portion of this specimen is missing and the beaks are partially crushed making comparisons difficult.

*L. spatulata* Hall differs from *L. rectilatera* in being more narrowly elliptical and having finer surface ornamentation. *L. compta* Hall & Clarke has finer surface ornamentation and is more rounded anteriorly.

*Occurrence.*—One specimen, probably from unit 7.

*Repository.*—UMMP 56616.

#### Genus DIGNOMIA Hall

##### DIGNOMIA ALVEATA (Hall)

Pl. 1, figs. 14–16

*Lingula alveata* HALL, 1867, p. 12–13, pl. 2, figs. 14–15. *Lingula (Dignomia) alveata* HALL & CLARKE, 1892, p. 230, pl. 1, figs. 12–13.

*Dignomia alveata* ROWELL (in MOORE), 1965, p. 263, fig. 158:4.

*Description.*—Shell relatively large, broadly spatulate in outline, with greatest width in anterior third. Cardinal margin forms angle of about 103° rounding evenly into slightly curved lateral margins. Shell surfaces marked by numerous closely spaced growth lines. Shell material thin and phosphatic. Growth hemiperipheral.

On internal surface, brachial valve with two broad, rounded ridges diverging from the beak and paralleling the valve margins for a distance of one-third the length. Narrower, long, median ridge extending from beak for two-thirds of the valve length.

Two nearly complete brachial valves 28.5 mm and 29.0 mm long, 20.5 mm and 23.4 mm wide.

*Discussion.*—*Dignomia alveata* is a distinctive form among the inarticulate brachiopods on the basis of its shape and internal ridges. No other species of this genus has been found in the Silica Formation.

*Occurrence.*—Three specimens from unit 9.

*Repository.*—UMMP 56593, 56614, 57146.

Genus TRIGONOGLOSSA Dunbar & Condra  
TRIGONOGLOSSA TRUNCATA (Cleland)

Pl. 1, fig. 9

*Lingula palaeformis* WHITFIELD, 1882, p. 324, pl. 25, fig. 10.

*Glossina truncata* CLELAND, 1911, p. 68, pl. 12, fig. 6.

*Trigonoglossa truncata* GRIESEMER, 1965, p. 246, pl. 1, figs. 1-2.

*Description*.—Shell longer than wide with greatest width in the anterior half of the shell. Beak area nearly right-angled, extending into gently curved lateral margins. Anterior margin slightly convex to nearly straight, rounding sharply into lateral margins. Surface marked by numerous, closely spaced growth lines visible in broad, flat interspaces between narrow, elevated, concentric fila. Growth lines and ridges not coinciding in pattern. Shell gently convex with greatest convexity just anterior to umbo. Beak angle ranging from 76° to 88°, averaging 84°. Concentric ridges 1.0 to 1.2 mm apart on the anterior median portion of the valve. Shell material thin and phosphatic. Growth hemiperipheral.

Two specimens, one 4.2 mm long and 2.8 mm wide, the other 22.2 mm long and 14.8 mm wide.

*Discussion*.—*Trigonoglossa truncata* differs from *T. flabellula* Girty by having a smaller beak angle, wider spaced elevated fila, and a more elongate outline. *T. irvinensis* (Foerste) is more elliptical in shape and *T. casteriana* Girty has more closely spaced elevated fila than *T. truncata*.

*Occurrence*.—Four specimens from unit 9.

*Repository*.—UMMP 56609, 57147-57149.

Family CRANIOPSIDAE Williams

Genus CRANIOPS Hall

?CRANIOPS HAMILTONIAE (Hall)

Pl. 1, figs. 17, 18

*Pholidops hamiltoniae* HALL, 1860, p. 92; —, 1867, p. 32, pl. 3, figs. 6-9; — & CLARKE, 1892, pl. 7, figs. 14-17; PROSSER & KINDLE, 1913, p. 132, pl. 9, fig. 8.

*Description*.—Shell very small, elongate oval in outline, slightly wider in the posterior half. Brachial valve gently convex with beak approximately one-fourth length from the posterior margin and greatest height at the umbo. Surface marked by numerous, strongly developed, concentric growth lines. Shell material calcareous and impunctate. Growth holoperipheral. Pedicle valve and internal features not observed.

Two specimens averaging 2.0 mm in length

and 1.5 mm in width. Height of one brachial valve approximately 0.4 mm.

*Discussion*.—Two small specimens, apparently brachial valves, form the basis for the above description. The general shape and calcareous shell composition of the specimens indicates their assignment to *Craniops*. Without seeing the internal features of the valves this designation must be considered questionable.

*Occurrence*.—Two specimens, probably from unit 7.

*Repository*.—UMMP 56617, 57150.

Order ACROTRETIDA Kuhn

Superfamily DISCINACEA Gray

Family DISCINIDAE Gray

Subfamily ORBICULOIDEINAE Schuchert & LeVene

Genus ORBICULOIDEA d'Orbigny

ORBICULOIDEA DORIA (Hall)

Pl. 1, figs. 10-13

*Discina doria* HALL, 1867, p. 19, pl. 2, figs. 19-22.

*Orbiculoidea doria* SCHUCHERT, 1897, p. 228; KINDLE, 1901, p. 579-580, pl. 3, fig. 7.

*Orbiculoidea wardi* CLELAND, 1911, p. 85, pl. 12, figs. 14-16.

*Orbiculoidea* cf. *O. doria* GREISEMER, 1965, p. 251, pl. 1, figs. 10-11.

*Description*.—Shell small to moderate in size, slightly ovate to near circular in outline. Brachial valve moderately convex with beak posterior of valve center, nearly terminal in some larger specimens, and pointed posteriorly. Surface marked by coarse growth lines and very fine radial striae. Interior surface smoother than exterior but reflecting growth lines and striae. Pedicle valve not observed. Shell material thin and phosphatic. Growth holoperipheral.

Two nearly complete specimens averaging 8.0 mm in length and 7.5 mm in width. Smaller and larger fragmentary specimens present.

*Discussion*.—*Orbiculoidea doria* is distinguished from other species of this genus by the brachial beak which may terminate almost at the posterior border, the radial striations, and more strongly developed growth lines. Some of the specimens tentatively included under this designation may belong to other species but because of their incompleteness cannot be differentiated with certainty.

*Occurrence*.—Common in unit 9 and also found in units 7 and 18.

*Repository*.—UMMP 56592, 56595, 56602-56605, 56607, 56608, 56618, 57151-57157.

Genus LINGULODISCINA Whitfield  
LINGULODISCINA MARGINALIS (Whitfield)  
Pl. 2, figs. 3-5

- Discina marginalis* WHITFIELD, 1882, p. 325, pl. 25, fig. 11.  
*Orbiculoidea marginalis* HALL & CLARKE, 1892, p. 127, pl. 4F, fig. 17.  
*Lingulodiscina marginalis* CLELAND, 1911, p. 84, pl. 12, figs. 11-13; STAINBROOK, 1942, p. 606, pl. 88, figs. 43, 45-46; GRIESEMER, 1965, p. 250, pl. 1, figs. 8-9.  
? *Crania* sp. STEWART, 1927, p. 34.

*Description*.—Shell of medium size, rounded to suboval in shape. Brachial valve with beak located near posterior margin, strongly convex with greatest height near mid-length and lateral and anterior slopes steeply convex. Pedicle valve interior with pedicle track extending from apex to near posterior margin. Margins of pedicle tract strongly raised on surface forming a rectilinear structure with a low, thin median septum extending onto the anterior half of valve. Lirium partially closing track. Brachial valve marked by numerous, closely spaced growth lines. Concentric, raised fila on the pedicle valve. Shell material thin and phosphatic. Growth holoperipheral in pedicle valve and hemiperipheral in the brachial valve.

Seven specimens ranging in length from 5.7 mm to 10.1 mm and in width from 5.3 mm to 9.5 mm, averaging 7.9 mm and 7.1 mm respectively. One uncrushed specimen with exfoliated brachial valve 6.9 mm long, 5.5 mm wide, and 2.2 mm high.

*Discussion*.—*Lingulodiscina marginalis* can be differentiated from specimens of the genus *Orbiculoidea* by the posterior position of the brachial beaks in most specimens. The difference in growth pattern of the two valves is also distinctive.

*Occurrence*.—Seventeen specimens from unit

9 in the Medusa Portland Quarry and three specimens from the Martin-Marietta Quarry.

*Repository*.—UMMP 57158, 57352, 57353 and BGSU 2688-2690.

Genus ROEMERELLA Hall & Clarke  
ROEMERELLA GRANDIS (Vanuxem)  
Pl. 2, figs. 1, 2

- Orbicula grandis* VANUXEM, 1842, p. 152-153, fig. 37:4.  
*Discina grandis* HALL, 1859, p. 406-407, pl. 92, figs. 1a-d; —, 1867, p. 17-18, pl. 1, fig. 18; pl. 2, figs. 32-33.  
*Roemerella grandis* KINDLE, 1901, p. 580, pl. 2, figs. 9-10.

*Description*.—Shell relatively large, wider than long, and subcircular in outline. Brachial valve strongly convex, beak posterior of center and inclined posteriorly. Surface marked by fine, closely spaced growth lines and narrow, raised, widely spaced, concentric fila. Pedicle valve with long, narrow, pedicle track extending from near apex to two-thirds the distance to posterior margin. Surface marked by numerous, widely spaced, narrow, concentric fila. Shell material thick and phosphatic. Growth holoperipheral.

One large pedicle valve 34.4 mm long and 39.1 mm wide. Partly crushed brachial valve 8.3 mm long and 8.5 mm wide.

*Discussion*.—Two isolated pedicle valves and one brachial valve form the basis for the above description. Some question exists as to the taxonomic assignment since the specimens are flattened or partially crushed and the concave nature of the pedicle valves and the elevation of the pedicle track has been destroyed. The width-length ratio appears correct for *R. grandis*.

*Occurrence*.—Three specimens from unit 9.

*Repository*.—UMMP 56596, 56606, 57159.

EXPLANATION OF PLATE 2  
All figures  $\times 3$ , except as noted

- FIGS. 1, 2 —*Roemerella grandis* (Vanuxem). Pedicle valve,  $\times 1$ , and partially crushed brachial valve, unit 9, UMMP 57159, 56596, North Quarry, Medusa Portland Cement Co.  
3-5 —*Lingulodiscina marginalis* (Whitfield). Brachial valve, brachial interior mold, pedicle valve, unit 9, BGSU 2690, 2689, 2688, North Quarry, Medusa Portland Cement Co.  
6, 7 —*Acanthocrania chilmanae* n. sp. Brachial valve of paratype and brachial valve of holotype, unit 7, UMMP 57355, 57354, North Quarry, Medusa Portland Cement Co.  
8, 9 —*Philhedra stewartii* Fenton & Fenton. 8, brachial valve, unit unknown, UMMP 57359, Martin-Marietta Quarry; 9, brachial valve,  $\times 6$ , unit 9, UMMP 56595, North Quarry, Medusa Portland Cement Co.  
10-12 —*Philhedra sheldoni* (White). 10, 11, brachial valves, unit 7, UMMP 57358, 57171, North Quarry, Medusa Portland Cement Co., 12, brachial interior view, unit unknown, UMMP 57356, Martin-Marietta Quarry.  
13-15 —*Petrocrania hamiltoniae* (Hall). Brachial valve, brachial valve, brachial interior view, unit 9, UMMP 57162, 57161, 57167, North Quarry, Medusa Portland Cement Co.  
16, 17 —*Philhedra crenistriata* (Hall). Brachial valves, Unit 7, UMMP 57168, 57170, North Quarry, Medusa Portland Cement Co.



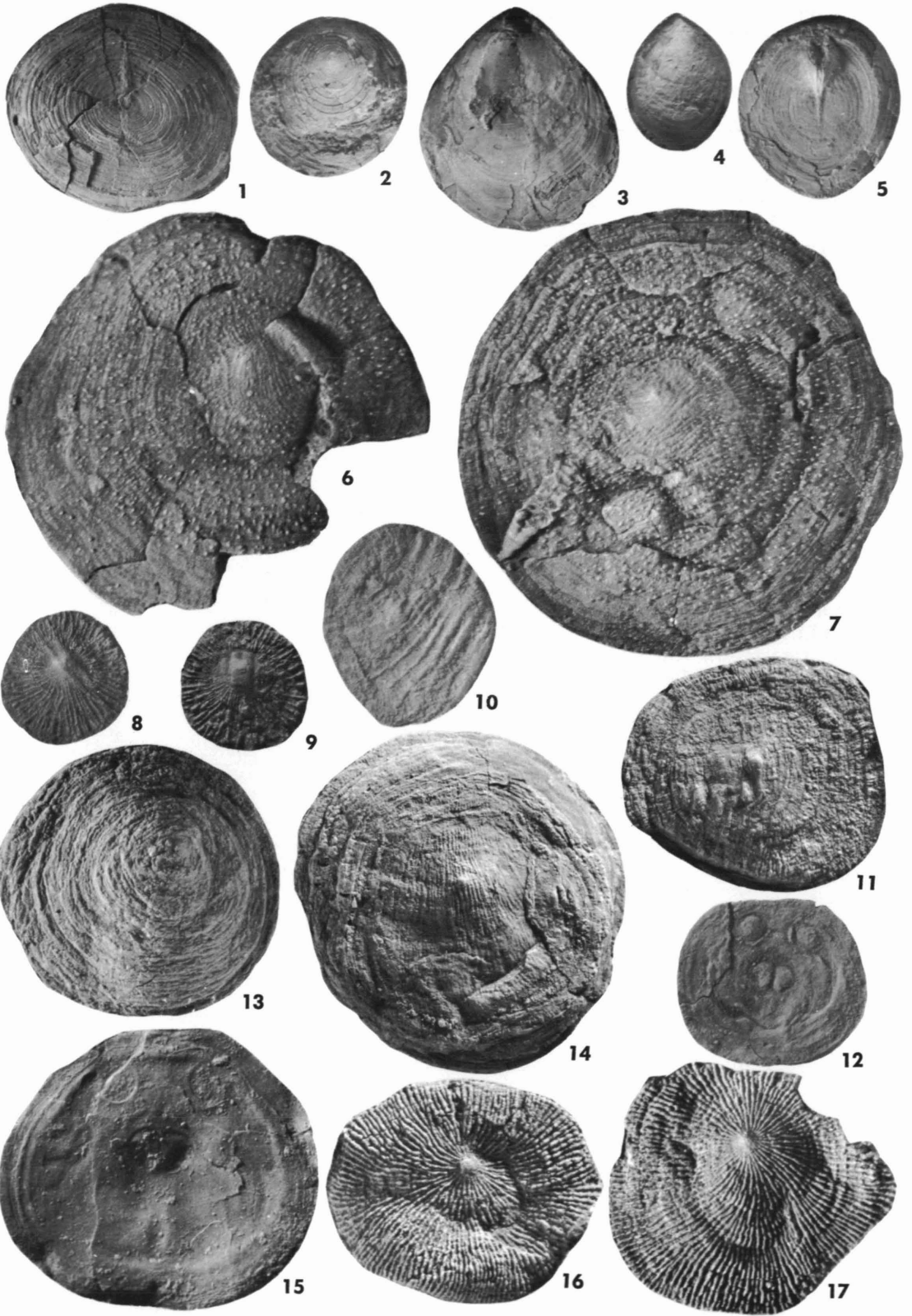


PLATE 2

Suborder CRANIIDINA Waagen  
 Superfamily CRANIACEA Menke  
 Family CRANIIDAE Menke  
 Genus ACANTHOCRANIA Williams  
 ACANTHOCRANIA CHILMANAE n. sp.  
 Pl. 2, figs. 6, 7

*Description*.—Shell moderately large and subcircular in outline. Brachial valve with beak located just posterior of center and inclined posteriorly. Surface marked by numerous concentric lines of growth, more prominent near valve margin, closely spaced and faint radiating costellae, and numerous small, projecting or recumbent spines. The spines widely spaced, about 5–7 per square mm near the beak and 3–5 per square mm near the valve margin. Faint replica of the ornamentation of the host shell present in places. Shell material calcareous and punctate. Growth holoperipheral. Pedicle valve and interior features of valves not observed.

Two brachial valves, the smaller 22.3 mm long, 22.1 mm wide, and 3.4 mm high, and the larger 23.2 mm long, 24.1 mm wide, and 5.1 mm high.

*Discussion*.—*Acanthocrania chilmanae* differs from *A. spiculata* (Rowley), from the Louisiana Limestone in Missouri, by having fewer and more widely spaced spines. The faint pattern of costellae is similar to that of *Philhedra sheldoni* (White).

*Type Locality*.—Unit 7 of the Silica Formation exposed in the North Quarry of the Medusa Portland Cement Co., northwest of the intersection of Brint and Centennial Roads, SE  $\frac{1}{4}$  sec. 7, T. 9 S, R. 6 E., Lucas County, Ohio.

*Occurrence*.—Two specimens, known only from the type locality.

*Repository*.—Holotype, UMMP 57354; paratype, UMMP 57355.

Genus PETROCRANIA Raymond  
 PETROCRANIA HAMILTONIAE (Hall)  
 Pl. 2, figs. 13–15

*Crania hamiltoniae* HALL, 1860, p. 77, figs. 4–5; —, 1867, p. 27–28, pl. 3, figs. 17–23.

*Craniella hamiltoniae* HALL & CLARKE, 1892, p. 148, 153, pl. 41, figs. 3–16; KINDLE, 1901, p. 582–583, pl. 3, fig. 5; CLELAND, 1911, p. 86, pl. 12, figs. 7–8; PROSSER & KINDLE, 1913, p. 131, pl. 9, figs. 1–7; CLARKE & SWARTZ, 1913, p. 549–550; STEWART, 1927, p. 35, pl. 3, fig. 8.

*Petrocrania* cf. *P. hamiltoniae* GRIESEMER, 1965, p. 254, pl. 1, fig. 18.

*Petrocrania hamiltoniae* ROWELL (in MOORE), 1965, p. 290–291, fig. 181:7.

*Description*.—Shell moderately large, subquadrate to broadly ovate to subcircular in out-

line. Brachial valve broadly convex with beak located slightly posterior of center and inclined posteriorly. Surface marked with numerous, concentric, irregular growth lines, and commonly conforming to the surface ornamentation of its host. On internal surface of brachial valve, a relatively narrow and flattened margin; a pair of widely separated adductor muscle scars near the posterior margin; and a smaller, closely spaced pair of adductor muscle scars, commonly elevated, just posterior of center of valve. Shell material calcareous and punctate. Growth holoperipheral. Pedicle valve not observed.

Eight brachial valves ranging from 2.6 to 21.2 mm in length and from 3.0 to 21.4 mm in width. Average length 14.0 mm and average width 14.7 mm. Average height of four specimens 3.1 mm.

*Discussion*.—*Petrocrania hamiltoniae* is the most abundant inarticulate brachiopod found in the Silica Formation. Specimens are normally found cemented to shells of other brachiopods although they may be attached to corals and bryozoans or other organisms. The outline of the shell is controlled, in part, by the configuration of the surface to which it is attached.

*P. inflata* Cooper and *P. leoni* (Hall) have much stronger convex form to the brachial valves than does *P. hamiltoniae*. *P. aurora* (Hall) is more quadrate in outline.

*Occurrence*.—Commonly found in units 4–19.

*Repository*.—UMMP 56599, 57160–57167.

Genus PHILHEDRA Koken  
 PHILHEDRA CRENISTRIATA (Hall)  
 Pl. 2, figs. 16, 17

*Crania crenistriata* HALL, 1867, p. 28, pl. 3, figs. 13–16; KINDLE, 1901, p. 581, pl. 3, fig. 1.

*Description*.—Shell of moderate size, irregularly subcircular in outline, and cemented to host. Brachial valve irregularly convex with beak located slightly posterior of center and inclined posteriorly. Surface marked by numerous, irregular, coarse, radiating costellae numbering four or five per mm. Costellae extend from beak and may be either continuous or discontinuous. Concentric growth lines, some lamellose, partly interrupting costellae. Shell material thick, calcareous, and punctate. Growth holoperipheral. Pedicle valve and internal features not observed.

Six specimens ranging from 5.1 to 14.9 mm in length and from 4.0 to 15.4 mm in width. Average length 10.5 mm and average width 10.7

mm. Four specimens averaging 2.4 mm in height.

*Discussion*.—*Philhedra crenistriata* can be distinguished from *P. sheldoni* (White) and *P. stewarti* Fenton & Fenton by the coarseness of its costellae and the fact that the costellae extend from the beak. This species attached most commonly to bryozoan colonies and less frequently to brachiopods.

*Occurrence*.—Four specimens from unit 7 in the Medusa Portland Quarry and two specimens from the Martin-Marietta Quarry.

*Repository*.—UMMP 56600, 57168–57170.

#### PHILHEDRA SHELDONI (White)

Pl. 2, figs. 10–12

*Crania sheldoni* WHITE, 1862, p. 29; KINDLE, 1901, p. 581, pl. 3, fig. 2; STAINBROOK, 1942, p. 609–610, pl. 88, figs. 41–42.

*Crania bordeni* HALL & WHITFIELD, 1872, p. 187.

*Philhedra sheldoni* STAINBROOK, 1945, p. 13, pl. 1, fig. 44.

*Description*.—Shell of moderate size, irregularly subcircular in outline, and cemented by pedicle valve. Brachial valve depressed conical in shape with beak slightly posterior of center. Surface marked by fine to coarse, concentric lines of growth crossed by numerous, 8 to 11 per mm, fine, radiating costellae. The costellae may be either continuous or discontinuous. Surface in places conforming to the ornamentation of the host shell. Brachial interior with relatively broad, flattened margin; a pair of subrounded, slightly raised posterior adductor scars; and, a pair of raised, subtriangular adductor scars just posterior of center of shell. Shell material thick, calcareous, and punctate. Growth holoperipheral. Pedicle valve not observed.

Six specimens ranging from 6.7 to 12.8 mm in length, 7.2 to 13.8 mm in width, and 1.0 to 6.4 mm in height. Average length 10.4 mm; average width, 10.7 mm; and, average height, 2.7 mm.

*Discussion*.—*Philhedra sheldoni* can be distinguished from *P. crenistriata* (Hall) by its finer and more numerous costellae. This species also shows reflections of the host shell whereas *P. crenistriata* does not. *P. stewarti* Fenton & Fenton has fewer and more widely spaced costellae.

*Occurrence*.—Two specimens from unit 7 in the Medusa Portland Quarry and four specimens from the Martin-Marietta Quarry.

*Repository*.—UMMP 57171, 57356–57358.

#### PHILHEDRA STEWARTI Fenton & Fenton

Pl. 2, figs. 8, 9

*Crania crenistriata* HALL & CLARKE, 1892, pl. 4H, fig. 12.

*Crania stewarti* FENTON & FENTON, 1924, p. 82, pl. 17, fig. 3.

*Description*.—Shell small, subcircular in outline, and cemented by the pedicle valve. Brachial valve depressed conical with beak located posterior of center. Surface marked by numerous (7 to 9 per mm), radiating, narrow costellae not reaching the beak but continuous to the valve margin. Concentric growth lines partly interrupting the costellae. Surface in places conforming to the ornamentation of the host shell. Shell material thin, calcareous, and punctate. Growth holoperipheral. Pedicle valve and internal features not observed.

Two specimens ranging from 3.6 to 6.2 mm in length, 3.5 to 6.3 mm in width, and from approximately 1.0 to 1.9 mm in height.

*Discussion*.—Distinctions between *Philhedra stewarti* and *P. crenistriata* (Hall) and *P. sheldoni* (White) are noted under the latter species. Variation in the spacing of the costellae occurs in *P. stewarti* but in general the costellae interspaces are relatively wider than in *P. crenistriata*.

*Occurrence*.—One specimen from the Medusa Portland Quarry (probably unit 7) and one specimen from the Martin-Marietta Quarry.

*Repository*.—UMMP 56595, 57359.

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