

# *Rhytidorhachis*, a new Silurian rhynchonellid brachiopod from Gotland, Sweden, and the Hudson Bay Lowlands, Canada

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## Abstract

Certain Silurian rhynchotrematid brachiopods from Europe and North America are placed in a new genus, *Rhytidorhachis*, principally on the basis of having both massive, medially conjunct deltidial plates and a septiform cardinal process. In this combination of distinctive characters, the new genus recalls the Upper Ordovician rhynchotrematids *Lepidocyclus* WANG, 1949 and *Hypsiptycha* WANG, 1949, but *Rhytidorhachis* is readily distinguished from these earlier genera by its consistently smaller shell size, absence of imbricate growth lamellae on the shell surface, and lack, or reduced development, of a median septum in the brachial valve. In form of the deltidial plates, the new genus recalls the Silurian trigonirhynchid *Rhynchotretra* HALL, 1879, but this genus lacks a cardinal process. In form of the cardinal process, the new genus resembles the Silurian rhynchotrematid *Stegerhynchus* FOERSTE, 1909, but this genus lacks conjunct deltidial plates. *Rhytidorhachis* is the only known Silurian rhynchonellid genus to have both conjunct deltidial plates and a septiform cardinal process.

At present, *Rhytidorhachis* contains two species: the upper Llandovery *R. hudsonensis* n. gen., n. sp. from the Hudson Bay Lowlands, Canada, and the upper Wenlock-lower Ludlow *Terebratula diodonta* DALMAN, 1828 from Gotland, Sweden, and the Welsh Borderlands, Great Britain. *Rhytidorhachis hudsonensis* is designated as the type species.

**Key-words:** rhynchonellid, brachiopod, Silurian, Canada, Europe.

## Résumé

Des espèces de Brachiopodes rhynchotrematides siluriens d'Europe et d'Amérique du Nord sont attribuées à un genre nouveau, *Rhytidorhachis*, principalement sur base de leurs plaques deltidiales jointives et de leur processus cardinal septiforme. Par cette combinaison de caractères distinctifs, le nouveau genre rappelle les genres rhynchotrematides *Lepidocyclus* WANG, 1949 et *Hypsiptycha* WANG, 1949 de l'Ordovicien Supérieur. Cependant, *Rhytidorhachis* se distingue aisément de ces genres plus anciens par une coquille de taille uniformément plus petite, l'absence de lamelles de croissance imbriquées sur la surface de la coquille et l'absence ou le développement réduit d'un septum médian dans la valve brachiale. Par la forme des plaques deltidiales, le nouveau genre fait penser au genre trigonirhynchide silurien *Rhynchotretra* HALL, 1879, mais ce genre ne possède pas de processus cardinal. Par la forme du processus cardinal, le nouveau genre ressemble au genre rhynchotrematide silurien *Stegerhynchus* FOERSTE, 1901, mais ce genre n'a pas de plaque deltidiales jointives. *Rhytidorhachis* est le seul genre rhynchonellide silurien connu, possédant à la fois des plaques deltidiales jointives et un processus cardinal septiforme.

Actuellement, deux espèces sont incluses dans le genre *Rhytidorhachis*: *R. hudsonensis* n.gen., n.sp. du Llandovery Supérieur des Hudson Bay Lowlands au Canada et *Terebratula diodonta* DALMAN, 1828 du

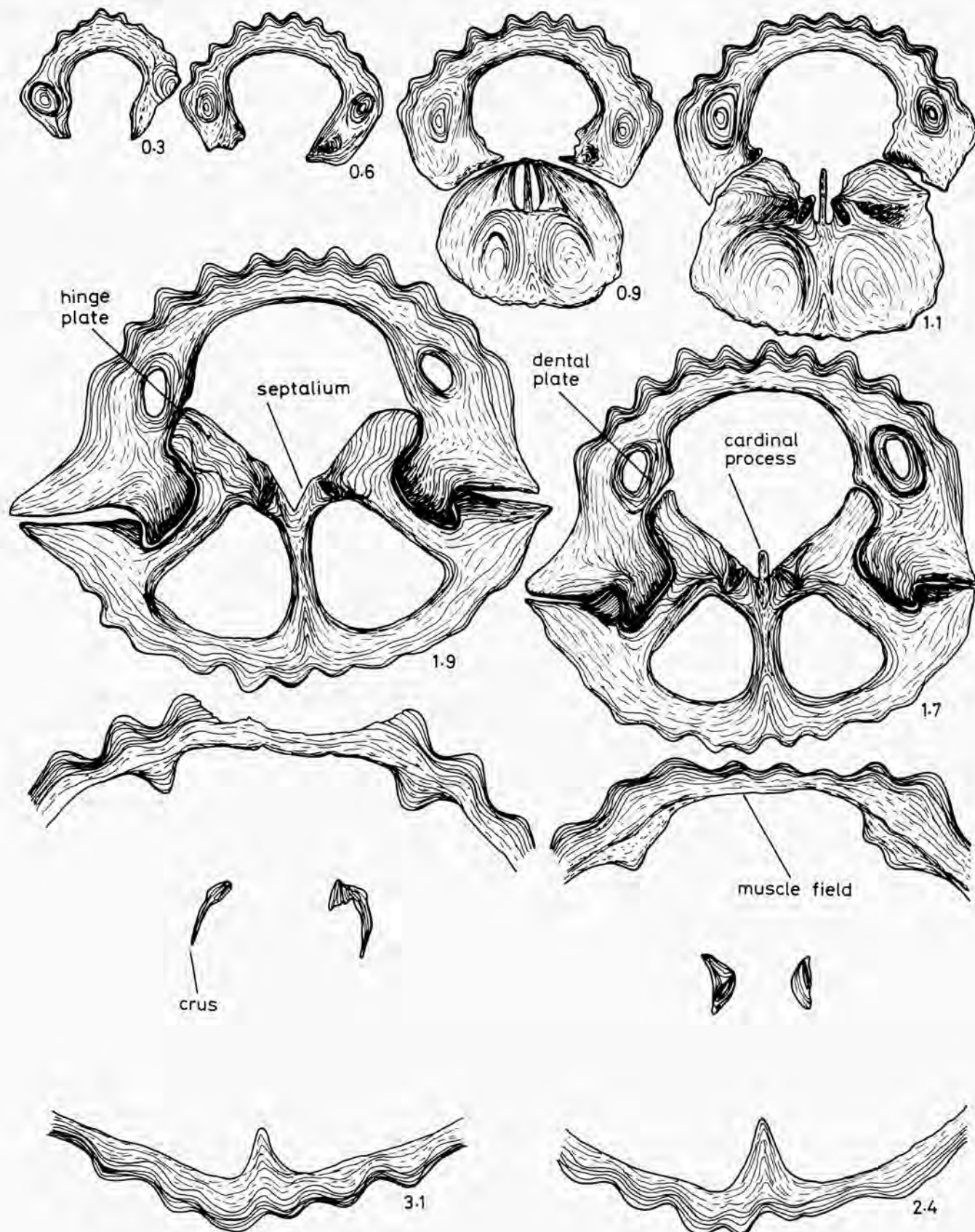
Wenlock Supérieur-Ludlow Inférieur du Gotland, en Suède et des Welsh Borderlands, en Grande Bretagne. *Rhytidorhachis hudsonensis* est désigné comme espèce-type.

**Mots-clefs:** Rhynchonellide, Brachiopode, Silurien, Canada, Europe.

## Introduction

In a recent study of the rhynchonellid brachiopods from the lower Silurian rocks of the Hudson Bay Lowlands, Canada, a unique rhynchotrematid species was discovered; it is distinguished mainly by having both massive, medially conjunct deltidial plates and a septiform cardinal process. Unlike the Upper Ordovician rhynchotrematid genera, *Lepidocyclus* WANG, 1949 and *Hypsiptycha* WANG, 1949, which also have these two features, the Hudson Bay specimens are consistently smaller, lack imbricating growth lamellae on the exterior of the shell, and lack, or have at best weakly developed, a median septum in the brachial valve. Among previously known rhynchotrematids of Silurian age, the combination of medially conjunct deltidial plates and a septiform cardinal process is observed only in *Terebratula diodonta* DALMAN, 1828 from Gotland, Sweden, and the Welsh Borderlands, Great Britain.

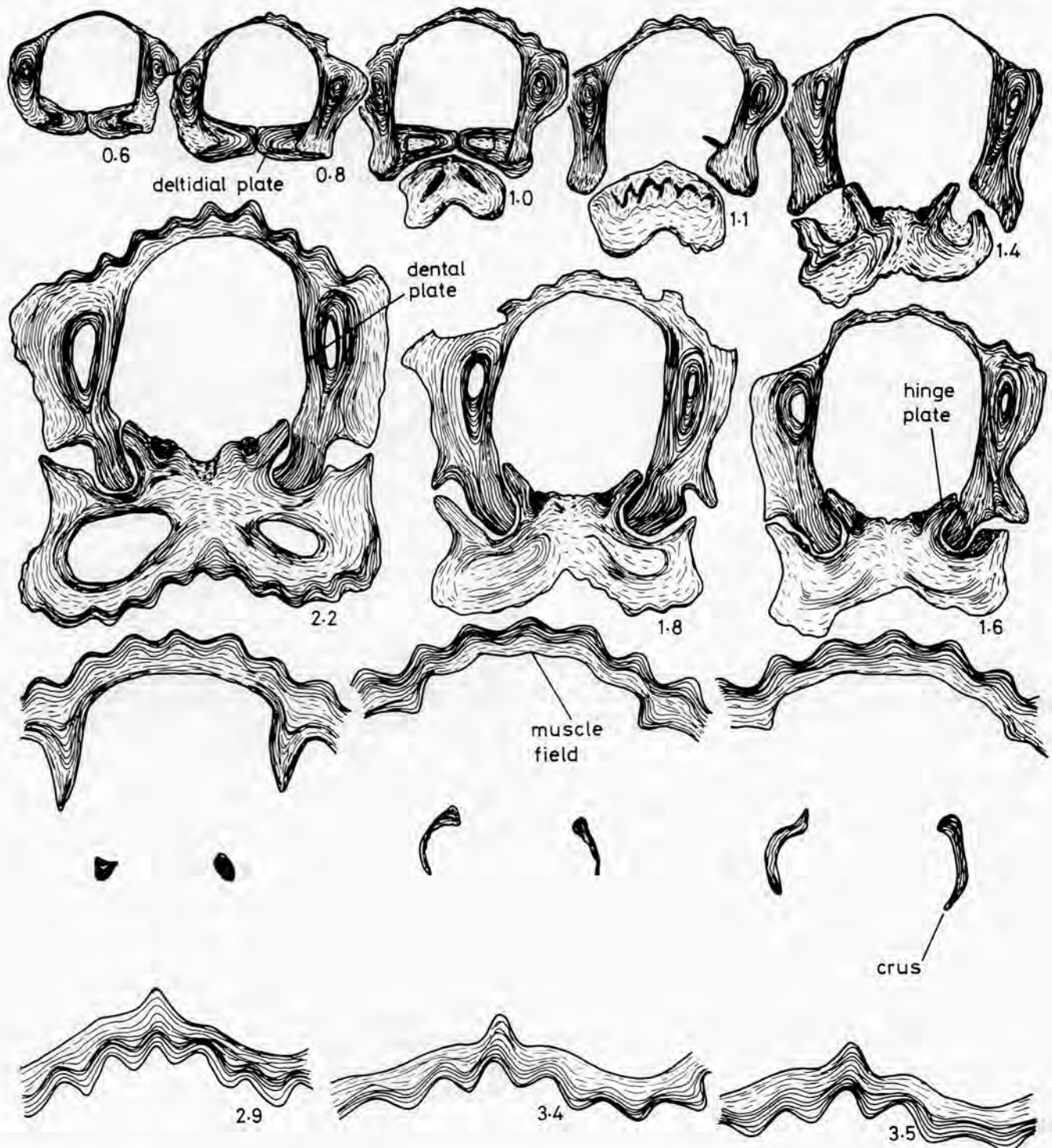
*Terebratula diodonta* has been regarded in the past as a species closely related to *Terebratula borealis* VON BUCH, 1834; LINDSTRÖM (1861), DAVIDSON (1869), and St. JOSEPH (1937a), for example, looked upon *T. diodonta* as a variant of *T. borealis*. These same authors, moreover, independently recognized the inappropriateness of the older generic assignments and placed the species in the most suitable rhynchonellid genus known at the time; Lindström and Davidson referred the species to *Rhynchonella* FISCHER, 1809, St. Joseph to *Camartoechia* HALL & CLARKE, 1893. In more modern studies of Paleozoic rhynchonellids, the presence or absence of a cardinal process and of medially conjunct deltidial plates has been shown to have taxonomic value at the generic and even familial levels (SCHMIDT & MCLAREN, 1965; AMSDEN, 1983). On the basis of their septiform cardinal processes, therefore, "*T.*" *diodonta* and "*T.*"



Text-fig. 1. – Serial sections of *Stegerhynchus borealis* (VON BUCH, 1834), hypotype GSC 94696 from Lickershamn 1, Gotland, upper Visby Beds, lower Wenlock (LAUFELD, 1974; BASSETT & COCKS, 1974). x16.

*borealis* were transferred to *Stegerhynchus* (RUBEL & ROZMAN, 1977; COCKS, 1978). "*T.*" *diodonta*, however, shows two important characteristics that distinguish it from all other species of *Stegerhynchus*: first, it has massive, medially conjunct, and anteriorly hollow deltidial plates and, second, it lacks a median septum in the brachial valve. Apart from "*T.*" *diodonta*, the only

rhynchonellid species from Gotland that exhibit either medially conjunct deltidial plates or septiform cardinal process are *Stegerhynchus borealis* and *Rhynchotrete cuneata* (DALMAN, 1828). *S. borealis* carries the septiform cardinal process but lacks the medially conjunct deltidial plates (Text-fig. 1, Pl. 1, Figs. 7, 12; see also ST. JOSEPH, 1937a; RUBEL & ROZMAN, 1977); *R. cuneata*



Text-fig. 2. – Serial sections of *Rhynchotrete cuneata* (DALMAN, 1828), hypotype BB 87813 from Bryten, near Klinte, Klinteberg Limestone, upper Wenlock-lower Ludlow. Note the massive deltidial plates. x16.

carries the medially conjunct deltidial plates but lacks a cardinal process, septiform or otherwise (Text-fig. 2, Pl. 2, Figs. 11-22; see also ST JOSEPH, 1937b; RUBEL & ROZMAN, 1971). Externally, moreover, these three species from Gotland display contrasted types of surface sculpturing: *S. borealis* has fine, uniform growth lines (Pl. 1, Figs. 1-6), "*T.*" *diodonta* coarse, non-imbricating rugae (Pl. 2, Figs. 6-9), and *R. cuneata* fine growth lines crossed by equally fine, costella-like ridges between the costae (Pl. 2, Figs. 11-17). The taxonomic value of these external features, however, remains uncertain.

The distinctive combination of morphological features recognized in the Hudson Bay shells (to be named *Rhytidorhachis hudsonensis* n. gen., n. sp.) and "*T.*" *diodonta* is believed to have taxonomic value at the generic level. All species hitherto assigned to *Stegerhynchus*, except for "*T.*" *diodonta*, lack medially conjunct deltidial plates (JONES, 1981). Likewise, all species assigned to *Rhynchotreta* lack a cardinal process. The new genus, *Rhytidorhachis*, is proposed, therefore, formally to recognize the unique combination of key morphological features present in "*T.*" *diodonta* from Gotland and the Welsh Borderlands and in the allied species from the Hudson Bay Lowlands.

*Rhytidorhachis* is the only Silurian rhynchonellid genus with both conjunct deltidial plates and a septiform cardinal process. Separation of the genus from *Stegerhynchus* is comparable to that of *Hiscobeccus* AMSDEN, 1983 from *Lepidocyclus* WANG, 1949 in which presence or absence of deltidial plates is used as a diagnostic, intergeneric, morphological feature.

### Systematic paleontology

The type specimens are deposited in the collections of the Geological Survey of Canada in Ottawa (GSC) and the British Museum (Natural History) in London (BB).

Order RHYNCHONELLIDA KUHN, 1949  
 Superfamily RHYNCHONELLACEA GRAY, 1848  
 Family RHYNCHOTREMATIDAE SCHUCHERT, 1913

Genus *Rhytidorhachis* n. gen.

#### Derivation of Name

From the Greek *rhytido-*, wrinkle, and *rhachis*, ridge. *Rhytidorhachis* is a singular, feminine noun, which refers to the coarse growth rugae of "*T.*" *diodonta*, the better-known, and, historically, the older species now referred to the new genus.

1828 *Terebratula*; DALMAN, p. 142, pl. 6, figs. 4a-d.  
 1858 *Rhynchonella*; SCHMIDT, p. 211.  
 1861 *Rhynchonella*; LINDSTRÖM, p. 365.  
 1869 *Rhynchonella*; DAVIDSON, p. 174, pl. 21, figs. 22, 23.

1883 *Rhynchonella*; DAVIDSON, p. 151, pl. 10, fig. 4.  
 1937a *Camarotoechia*; ST JOSEPH, p. 46.  
 1974 *Ferganella*; BASSETT & COCKS, p. 26, pl. 8, figs. 2a-d.  
 1977 *Stegerhynchus*; RUBEL & ROZMAN, p. 227, pl. 7, figs. 7-10; pl. 8, figs. 1-5; pl. 9, figs. 1-5; pl. 10, figs. 1a,b,d-f.  
 1978 *Stegerhynchus*; COCKS, p. 148.

#### Type Species

*Rhytidorhachis hudsonensis* n. gen., n. sp. Ekwana River Formation, upper Llandovery, Little Current River, Hudson Bay Lowlands.

#### DIAGNOSIS

Medium-sized, subtriangular rhynchotrematid shells with massive, medially conjunct deltidial plates, septiform cardinal process, and median septum of brachial valve absent or reduced.

#### DESCRIPTION

Shell medium-sized (*sensu* JIN, 1989, p. 13), subtriangular, with acute apical angle, moderately to strongly convex, with brachial valve equal to, or much deeper than, pedicle valve. Hingeline short, curved. Pedicle-valve umbono narrow, with erect to suberect beak and submesothyriddid foramen. Delthyrium covered by thick medially conjunct deltidial plates. Sulcus developed in anterior two-thirds to three-fourths of pedicle valve, bearing one to three costae. Brachial-valve beak buried in pedicle-valve umbonal cavity. Fold of brachial valve occupied by two to four costae. Costae strong, simple, or with anterior bifurcation and intercalation. Concentric sculpturing ranging from fine growth lines to coarse rugae.

Dental plates fused to lateral shell wall for most of length, supporting large teeth. Muscle field well impressed, with small adductor scars enclosed by diductor scars. Septalium absent or poorly developed. Median septum absent or low. Hinge plates large, thick. Cardinal process septiform. Crura radulifer.

#### REMARKS

The new genus most closely resembles the Upper Ordovician genera *Lepidocyclus* WANG, 1949 and *Hypsiptycha* WANG, 1949 in possessing both medially conjunct deltidial plates and a septiform cardinal process, but it differs in its much smaller shell size, lack of imbricate growth lamellae on the shell exterior, and absence or weak development of a median septum in the brachial valve. *Rhytidorhachis* differs from *Stegerhynchus* principally in carrying medially conjunct deltidial plates, and from *Rhynchotreta* principally in having a cardinal process. LOPUSHINSKAYA (1976) established a new subgenus, *Stegerhynchella* (*Tungussotoechia*); its type species, *Stegerhynchella tungussensis* LOPUSHINSKAYA, 1972, is similar to *Rhytidorhachis hudsonensis* in its bifurcation and intercalation of the costae on the fold and in the sulcus. But as LOPUSHINSKAYA (1972, p. 186, pl. 48, fig. 19) stated, *S. (Tungussotoechia) tungussensis* has an "open

delthyrium, with both sides marked by shallow depression". One of the most important characteristics of *Rhytidorhachis* is the presence of a pair of medially conjunct deltidial plates covering the delthyrium. The closely related genera, *Stegerhynchus*, *Stegorhynchella*, and *Tungussotoechia*, invariably lack medially conjunct deltidial plates and, therefore, differ strikingly from *Rhytidorhachis*.

*Rhytidorhachis* probably evolved from the Upper Ordovician *Lepidocyclus-Hypsitycha* stock.

#### Species assigned

*Terebratula diodonta* DALMAN, 1828.

*Rhytidorhachis hudsonensis* n.sp.

#### Age and Distribution

Silurian (late Llandovery-early Ludlow). Gotland, Sweden; Welsh Borderlands, Great Britain; Hudson Bay Lowlands, Canada.

*Rhytidorhachis diodonta* (DALMAN, 1828)

Pl. 1, Figs. 17-22; Pl. 2, Figs. 1-10;

Pl. 3, Figs. 21, 23, 24; Text-figs. 3, 4.

1828 *Terebratula diodonta* DALMAN, p. 142, pl. 6, figs. 4a-d.

1858 *Rhynchonella diodonta* (Dalman); SCHMIDT, p. 211.

1861 *Rhynchonella borealis* (von Schlotheim) var. *diodonta* (Dalman); LINDSTRÖM, p. 365.

1869 *Rhynchonella borealis* (von Schlotheim) var. *diodonta* (Dalman); DAVIDSON, p. 174-175, pl. 21, figs. 22, 23 (*non* fig. 21).

1883 *Rhynchonella diodonta* (Dalman); DAVIDSON, p. 151, pl. 10, fig. 4.

1937a *Camarotoechia borealis* (von Schlotheim) var. *diodonta* (Dalman); ST. JOSEPH, p. 46.

1974 *Ferganella diodonta* (Dalman); BASSETT & COCKS, p. 26, pl. 8, figs. 2a-d (lectotype selected).

1977 *Stegerhynchus diodontus* (Dalman); RUBEL & ROZMAN, p. 227, pl. 7, figs. 7-10; pl. 8, Figs. 1-5; pl. 9, figs. 1-5; pl. 10, figs. 1a, b, d-f.

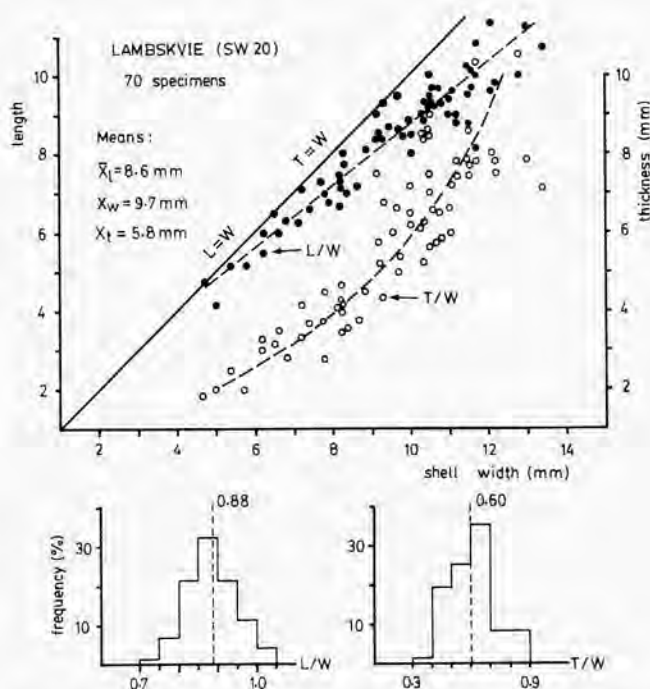
1978 *Stegerhynchus diodonta* (Dalman); COCKS, p. 148.

#### Type Specimens

Lectotype selected by BASSETT & COCKS (1974, pl. 8, figs. 2a-d). Klinteberg Beds, Klinteberg, Gotland, upper Wenlock-lower Ludlow.

#### DESCRIPTION

(based on collections from the Hemse Marls, Lambskvie, Gotland). Shell small to medium-sized (*sensu* JIN, 1989, p. 13), with mean length 8.6 mm, width 9.7 mm, thickness 5.8 mm (Text-fig. 3), subtriangular to subrhomboidal, unequally biconvex, with brachial valve approximately twice as deep as pedicle valve. Hingeline short, curved, attaining about one-third of shell width. Anterior commissure sulciphate due to deep median groove between two costae on fold. Pedicle-valve umbo narrow,



Text-fig. 3. — Shell dimensions of *Rhytidorhachis diodonta* (DALMAN, 1828), a sample from Lambskvie, Gotland, Hemse Marls, upper Wenlock-lower Ludlow (BASSETT & COCKS, 1974). The shells become increasingly transverse and convex with ontogeny; Note the wide variation in shell convexity of adult forms.

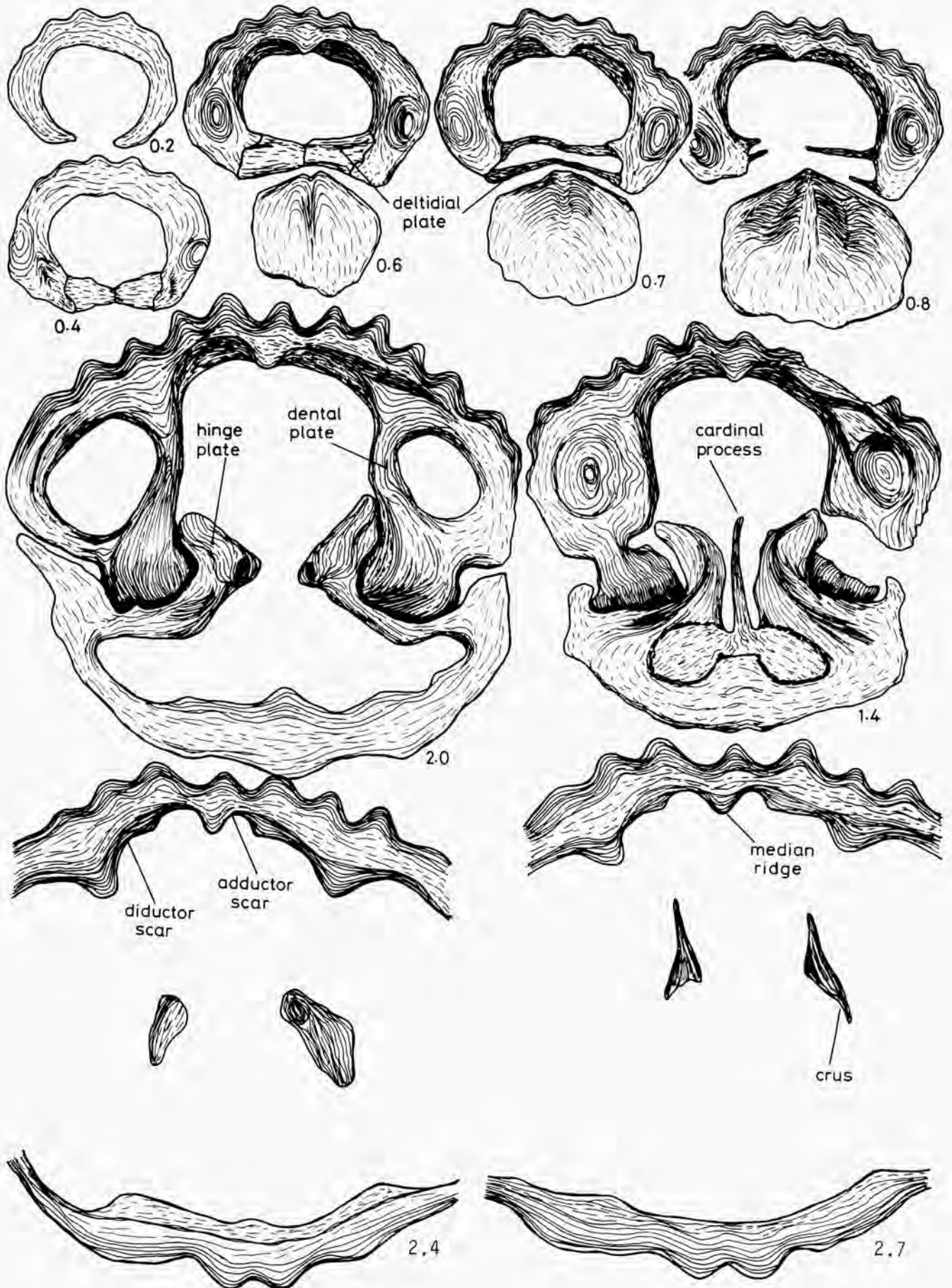
weakly convex, rising 1.0-1.5 mm above hingeline, with apical angles less than 90°. Beak erect to suberect, with submesothyridid foramen. Delthyrium covered by thick, medially conjunct, anteriorly hollow deltidial plates (Text-fig. 4; Pl. 1, Figs. 17, 22; Pl. 3, Figs. 21, 23). Sulcus narrow, deep, developed in anterior three-fourths of valve, bearing one costa. Brachial-valve umbo strongly convex, with beak buried in pedicle-valve umbonal cavity. Fold formed by two strong, high costae. Each shell flank occupied by four or five simple, coarse, subrounded costae. Concentric rugae prominent, non-imbricate, forming zig-zag crests of costae, averaging two per 1 mm around anterior margin.

Dental plates low, thick, fused to lateral shell wall posteriorly, supporting large, rounded teeth. Muscle field deeply impressed, with prominent median ridge; small adductor scars enclosed by large diductor scars. Septalium and median septum absent. Hinge plates large, thick, subparallel to each other posteriorly, divergent at about 90° anteriorly. Cardinal process high, septiform. Crura thick, radulifer.

COLLECTIONS (188 specimens from Gotland): Lambskvie (Locality SW 20, 120 specimens), Garnudden 2 (SW 37, 68 specimens), Hemse Marls, upper Wenlock-lower Ludlow.

*Rhytidorhachis hudsonensis* n. sp.

Pl. 3, Figs. 1-17, 20, 22; Text-figs. 5-6.



### Derivation of Names

After the Hudson Bay Lowlands, where the species occurs.

### Type Specimens

Four complete, calcareous specimens (Pl. 3, Figs. 1-17, 20, 22): holotype, GSC 94702; paratypes, GSC 94703, GSC 94704, GSC 94705 (serially sectioned, Text-fig. 6).

### Type Locality and Type Stratum

GSC locality 80536, south bank of Little Current River, 50°52'N, 85°30'W, Hudson Bay Lowlands. Ekwan River Formation, upper Llandovery.

### DIAGNOSIS

Small to medium-sized, moderately convex shells of *Rhytidorhachis*, with poorly developed septalium, low median septum, and thick cardinal process.

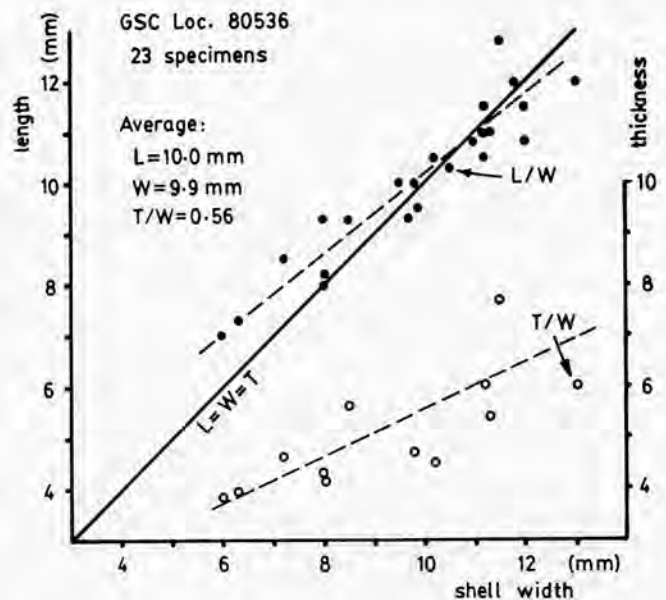
### DESCRIPTION

Shell small to medium-sized (*sensu* JIN, 1989, p. 13), average length 10,0 mm, width 9,9 mm (Text-fig. 5), subtriangular to subpentagonal, nearly equibiconvex with low convexity (average thickness/width ratio 0,56). Hingeline attaining one-fourth to one-third of shell width. Anterior commissure uniplicate. Pedicle-valve umbo narrow, gently convex, rising 1,5-2,0 mm above hingeline, with suberect beak and submesothyridid foramen. Delthyrium covered by relatively thick, medially conjunct deltidial plates. Sulcus well developed in anterior two-thirds of valve, occupied by two costae, these increasing to three near anterior margin by intercalation. Brachial-valve umbo nearly flat, with beak buried in pedicle-valve umbonal cavity. Fold low, carrying three costae, these increasing to four in some specimens by bifurcation of median costa near anterior margin. Each shell flank occupied by four to six costae, increasing near anterior margin by bifurcation (b.v.) or intercalation (p.v.).

Dental plates low, thin, fused to lateral shell wall along most of their length. Teeth large, rounded. Muscle field well impressed, with small adductor scars enclosed by diductor scars (Text-fig. 6). Septalium absent or poorly delimited. Hinge plates relatively large, divergent from each other at about 135°. Cardinal process thick, septiform. Median septum low. Crura radulifer.

### REMARKS

The new species differs from *Rhytidorhachis diodonta* in shape (particularly by being less transverse), the common bifurcation and intercalation of the costae, lack of coarse growth rugae, presence of a low median septum, and shallower muscle field with a less prominent median ridge.



Text-fig. 5. — Shell dimensions of *Rhytidorhachis hudsonensis* n. sp., a sample from the Little Current River (GSC Loc. 80536), Hudson Bay Lowlands, Ekwan River Formation, upper Llandovery (NORFORD, 1981). Note that the shells become increasingly transverse and flattened with ontogeny.

### COLLECTIONS

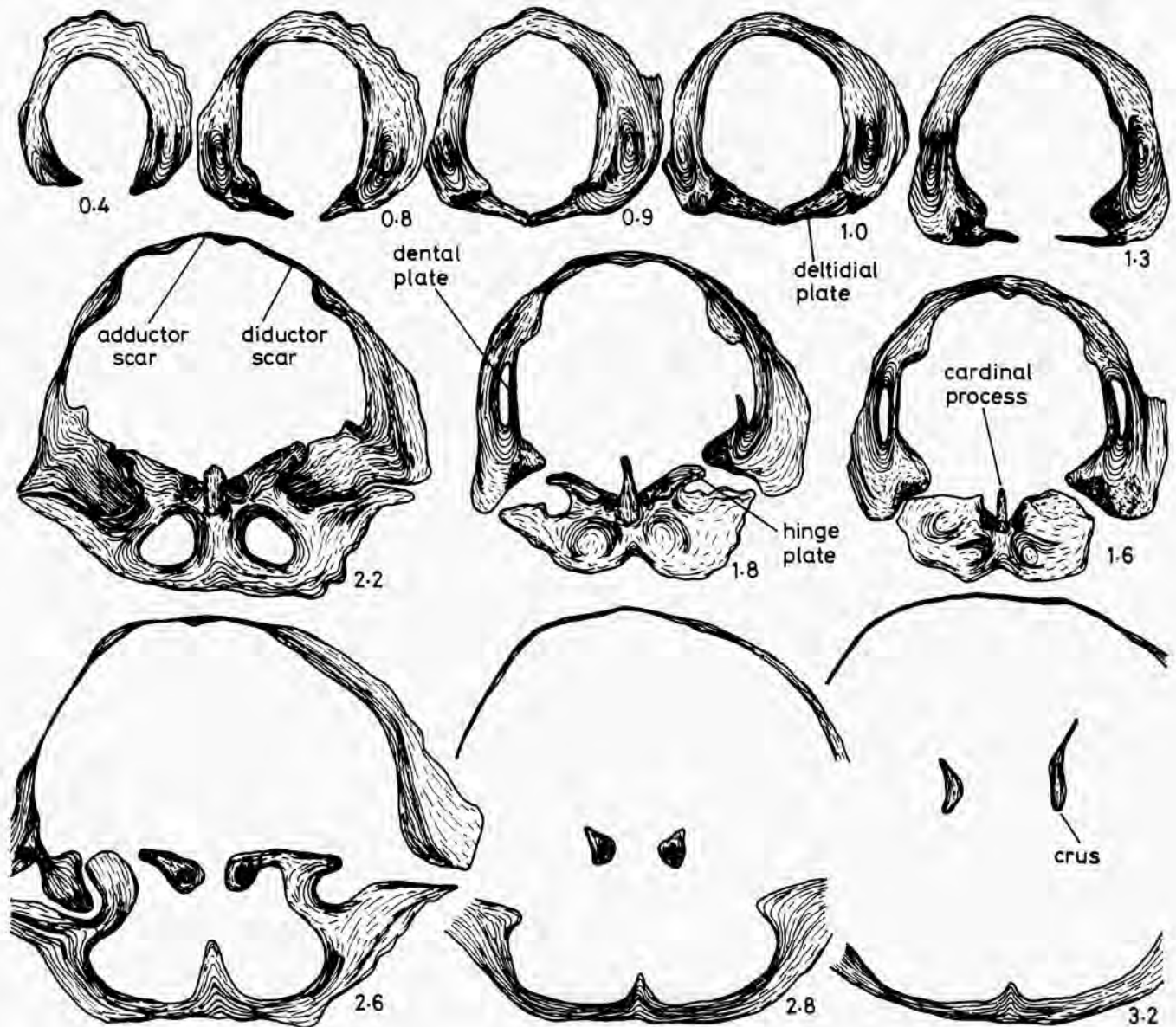
(total 43 specimens from the Ekwan River Formation, Hudson Bay Lowlands, Canada):

GSC Loc. 80022 (14 specimens), north bank of Little Current River, 50°52'N, 85°13,5'W. GSC Loc. 80536 (29 specimens), south bank of Little Current River, 50°52'N, 85°30'W.

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◁ Text-fig. 4. — Serial sections of *Rhytidorhachis diodonta* (DALMAN, 1828), hypotype GSC 94700 from Hemse Marls (upper Wenlock-lower Ludlow), Lambskvie, Gotland. Note the thick, anteriorly hollow deltidial plates, blade-like cardinal process, deep muscle field with conspicuous median ridge, and absence of a median septum. x16.



Text-fig. 6. – Serial sections of *Rhytidorhachis hudsonensis* n. sp., paratype GSC 94705 from the Little Current River (GSC Loc. 80536), Ekwon River Formation. Note the conjunct deltidial plates, thick cardinal process, and low median septum. x16.

## References

- AMSDEN, T.W., 1983. Upper Bromide Formation and Viola Group (Middle and Upper Ordovician) in eastern Oklahoma. Pt. 3, The Late Ordovician brachiopod genera *Lepidocyclus* and *Hiscobeccus*. *Oklahoma Geological Survey, Bulletin* 132: 36-44.
- BASSETT, M.G. & COCKS, L.M.R., 1974. A review of Silurian brachiopods from Gotland. *Fossils and Strata*, 3: 56 pp.
- COCKS, L.M.R., 1978. A review of British Lower Palaeozoic brachiopods, including a synoptic revision of Davidson's Monograph. *Monographs of the Palaeontographical Society*, 131: 256 pp.
- DALMAN, J.W., 1828. Uppställning och Beskrifning af de i sverige funne Terebratuliter. *Kungliga Vetenskapsakademien Handlingar*, 3: 85-155.
- DAVIDSON, T., 1866-1871. A monograph of the British fossil Brachiopoda. 3 (7), Silurian. *Monographs of the Palaeontographical Society*, 1 (1866), pp. 1-88; 2 (1867), pp. 89-168; 3 (1869), pp. 169-248; 4 (1871), pp. 249-397.
- DAVIDSON, T., 1882-1883. A monograph of the British fossil Brachiopoda. 5, Devonian and Silurian Supplements. *Monographs of the Palaeontographical Society*, 1 (1882), pp. 1-134; 2 (1883), pp. 135-242.
- FISCHER DE WALDHEIM, G., 1809. Notice des fossiles du gouvernement de Moscou. Moscow. 35 pp.



- FOERSTE, A.F., 1909. Fossils from the Silurian formations of Tennessee, Indiana, and Kentucky. *Bulletin of the Scientific Laboratories of Denison University*, 14: 61-107.
- GRAY, J.E., 1848. On the arrangement of the Brachiopoda. *Annals and Magazine of Natural History*, series 2, 2: 435-440.
- HALL, J., 1879. The fauna of the Niagara Group. *New York State Museum of Natural History, Report* 28: 98-203.
- HALL, J., & CLARKE, J.M., 1892-1894. An introduction to the study of the genera of Palaeozoic Brachiopoda. *New York State Geological Survey, Palaeontology of New York*, 8 (1), pp. 1-367 (1892); 8 (2), pp. 1-317 (1893); 8 (2), pp. 319-394 (1894).
- JIN, J., 1989. Late Ordovician-Early Silurian rhynchonellid brachiopods from Anticosti Island, Quebec. *Biostratigraphie du Paléozoïque*, 10: 127 pp.
- JONES, B., 1881. The Silurian brachiopod *Stegerhynchus*. *Palaeontology*, 24: 93-113.
- KUHN, O., 1949. Lehrbuch der Paläozoologie. Stuttgart, E. Schweizerbart. Verlagsbuchhandlung. 326 pp.
- LAUFELD, S., 1974. Reference localities for paleontology and geology in the Silurian of Gotland. *Sveriges Geologiska Undersökning*, series C, 705: 1-172.
- LINDSTRÖM, G., 1861. Bidrag till kännedomen om Gotlands brachiopoder. *Öfversigt af K. Vetenskapsakademiens Förhandlingar*, Stockholm, [for 1960], 17: 337-382.
- LOPUSHINSKAYA, T.V., 1972. Novyye siluriyskiye rinkhonnellid sibirskoi platformy. In: Zanina, I. Ye. (editor), *Novyye Vidy Drevnikh Rasteniy i Bespozvonochnykh SSSR*, pp. 186-187. Akademiya Nauk SSSR, Moskva, "Nauka".
- LOPUSHINSKAYA, T.V., 1976. Brachiopody i stratigrafiya siluriyskikh otlozheniy severa sibirskoy platformy. Ministerstvo Geologii SSSR, SNIIGiMS, Vypusk 199: 94 pp. Novosibirsk, Zapadno-sibirskoye knizhnoye izdatelstvo.
- NORFORD, B.S., 1981. The trilobite fauna of the Silurian Attawapiskat Formation, northern Ontario and northern Manitoba. *Geological Survey of Canada, Bulletin* 327: 37 pp.
- RUBEL, M.P. & ROZMAN, Kh.S., 1977. Novyye brachiopody Rhynchonellacea iz Silura Estonii. In: KALJO, D. (editor), *Fatsii i Fauna Silura Pribaltiki*, pp. 213-239. Akademiya Nauk Estonskoi SSR, Institut Geologii, Tallin.
- SCHMIDT, F., 1858. Untersuchungen über silurischen Formationen von Ehtland, Nord-Livland und Oesel. *Archiv für die Naturkunde Liv- Ehst- und Kurlands*, Erste Serie, 2: 247 pp.
- SCHMIDT, H. & MCLAREN, D.J., 1965. Paleozoic Rhynchonellacea. In: MOORE, R.C. (editor), *Treatise on Invertebrate Paleontology*, pt. H: 552-597. Geological Society of America and University of Kansas Press.
- SCHUCHERT, C., 1913. Class 2. Brachiopoda. In: VON ZITTEL, K.A., *Text-book of Palaeontology*, 1, 2nd Edition (translated and edited by EASTMAN, C.R.), pp. 355-420. London, Macmillan and Co., Ltd.
- ST. JOSEPH, J.K.S., 1937a. On *Camarotoechia borealis* (VON BUCH, 1834, ex. SCHLOTHEIM, 1832). *Geological Magazine*, 74: 33-48.
- ST. JOSEPH, J.K.S., 1937b. On *Rhynchotretra cuneata* (DALMAN), 1828, with a diagnosis of the genus *Rhynchotretra* Hall, 1879. *Geological Magazine*, 74: 161-176.
- VON BUCH, L., 1834. Über Terebrateln. *Abhandlungen der Deutschen Akademie der Wissenschaften*, Berlin, [for 1833], pp. 21-144.
- WANG, Y., 1949. Maquoketa Brachiopoda of Iowa. *Geological Society of America, Memoir* 42: 55 pp.

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#### PLATE I

Figs. 1-16. — *Stegerhynchus borealis* (VON BUCH, 1834).

Three calcareous shells from the upper Visby Beds (lower Wenlock), Lickershamn 1, Gotland. 1-6, hypotype GSC 94693. Note the fine growth lines punctuated by relatively thick ones (1-5, x4; 6, x10). 7-11, hypotype GSC 94694, a shell with only two costae in the sulcus, x4. 12-16, hypotype GSC 94695. Note the open delthyrium. Fibre-like deposits on the shell surface are composed of pyrite, x4.

Figs. 17-22. — *Rhytidorhachis diodonta* (DALMAN, 1828).

Hypotype GSC 94697, collected from the Hemse Marls (upper Wenlock-lower Ludlow), Lambskvie, Gotland. Note the coarse, non-imbricate rugae and medially conjunct deltidial plates (17-21, x4; 22, x16).

PLATE 1

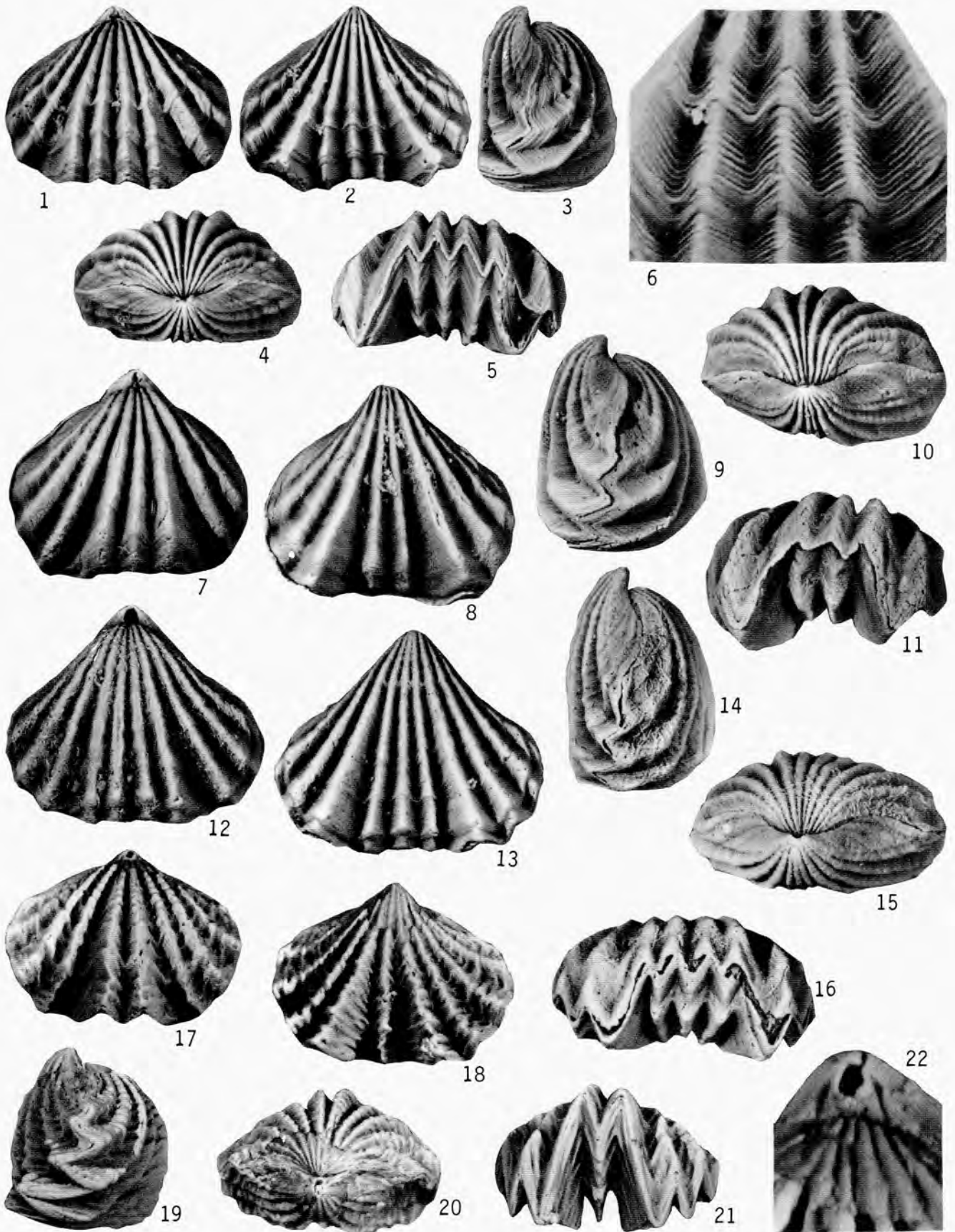
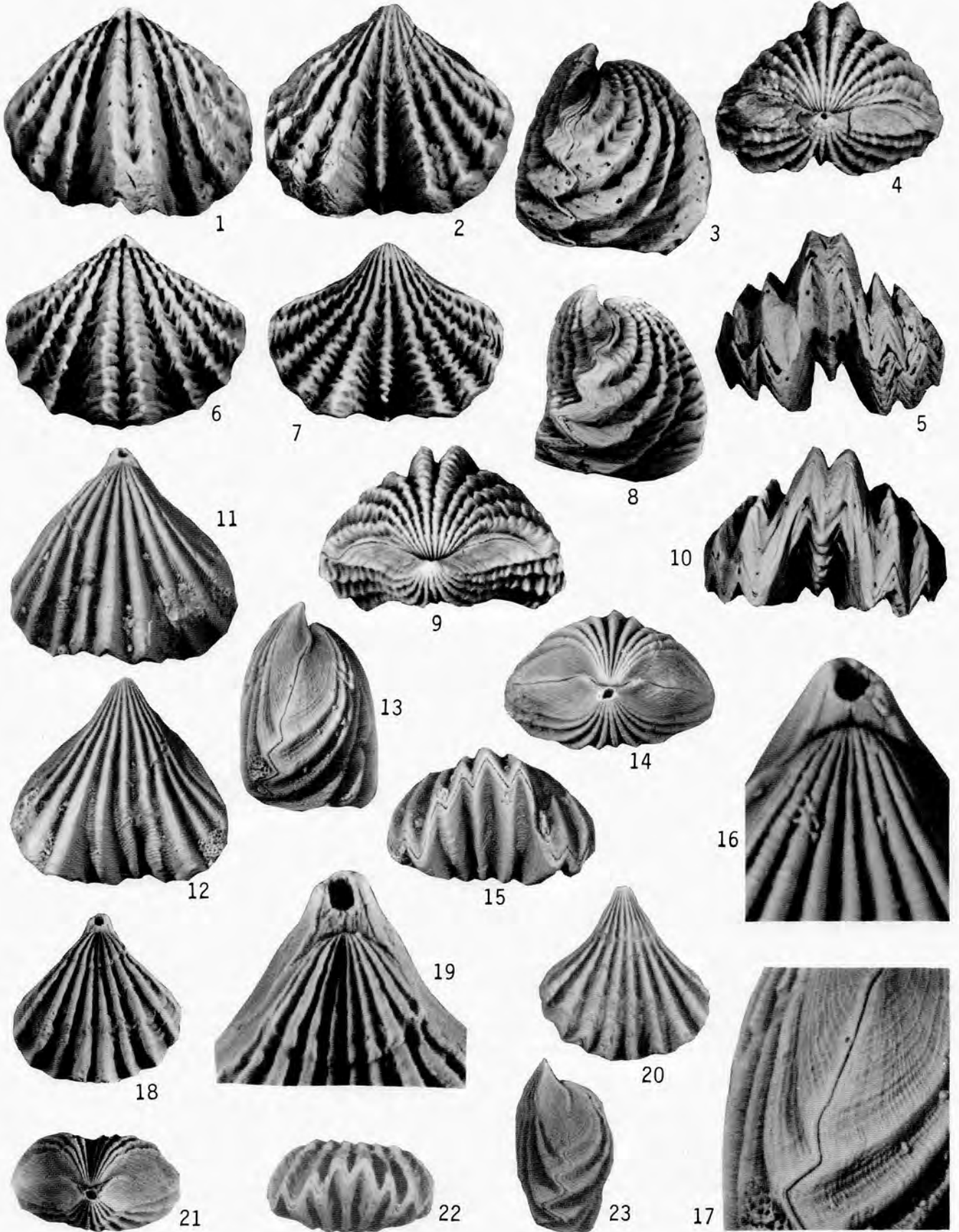


PLATE 2



## PLATE 2

- Figs. 1-10. – *Rhytidorhachis diodonta* (DALMAN, 1828).  
Two calcareous shells from the Hemse Marls, Lambskvie, Gotland. 1-5, hypotype GSC 94698, a shell with obvious borings in the brachial valve, x4. 6-10, hypotype GSC 94699, a shell with deltidial plates broken off, x4.
- Figs. 11-23. – *Rhynchotreta cuneata* (DALMAN, 1828).  
Two calcareous shells from Gotland. 11-17, hypotype GSC 94701, collected from the upper Visby Beds (lower Wenlock), Lickershamn 1. Note the conjunct deltidial plates, fine growth lines, and radiating “costellae” between costae around lateral commissure (11-15, x3; 16, 17, x9). 18-23, hypotype BB 87812 (British Museum), collected by F.A. BATHER in 1893 from the Klinteberg Limestone, Bryten, near Klinte (18, 20-23, x3; 19, x10).

## PLATE 3

- Figs. 1-17, 20, 22. – *Rhytidorhachis hudsonensis* n. sp.  
Three calcareous shells (weathered nearly to internal moulds) from the Ekwan River Formation (upper Llandovery), Little Current River (GSC Loc. 80536), Hudson Bay Lowlands. 1-6, holotype GSC 94702. Note the conjunct deltidial plates and submesothyrigid foramen (1-5, x3; 6, x12). 7-12, paratype GSC 94703, foramen not well exposed (7-11, x3; 12, x12). 13-17, paratype GSC 94704. Note the bifurcation and intercalation of costae, x3. 20, paratype GSC 94705 (refer to Text-fig. 6), medially conjunct deltidial plates, 1.0 mm from apex, x24. 24, paratype GSC 94705, thick, septiform cardinal process, 1.8 mm from apex, x24.
- Figs. 18, 19. – *Rhynchotreta cuneata* (DALMAN, 1828).  
Hypotype BB 87813, Klinteberg Limestone, upper Wenlock-lower Ludlow, Bryten, Gotland. Note the massive, medially conjunct, anteriorly hollow deltidial plates: 18, 0.8 mm from apex, 19, 1.0 mm from apex, x20.
- Figs. 21, 23, 24. – *Rhytidorhachis diodonta* (DALMAN, 1828).  
Hypotype GSC 94670, Hemse Marls, upper Wenlock-lower Ludlow, Lambskvie, Gotland. 21, 23, medially conjunct, anteriorly hollow deltidial plates, 0.6, 0.7 mm from apex, x16. 24, high, septiform cardinal process sitting directly on shell floor, 1.4 mm from apex, x16.

PLATE 3

