

Parallelepipedorhynchus castellum, a new late Frasnian rhynchonellid brachiopod species from Trélon (Dinant Basin, France)

by Paul SARTENAER

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Abstract

Late Frasnian specimens from the southern flank of the Dinant Basin, France, previously identified as *Hypothyridina cuboides*, are assigned to a new species, *Parallelepipedorhynchus castellum*.

Keywords: *Parallelepipedorhynchus castellum* n. sp., rhynchonellid, brachiopod, late Frasnian, France.

Résumé

Parallelepipedorhynchus castellum n. sp. est fondé pour une espèce du Frasnien supérieur du bord méridional du Bassin de Dinant, France, connue précédemment sous le nom d'*Hypothyridina cuboides*.

Mots-clés: *Parallelepipedorhynchus castellum* n. sp., Rhynchonellide, Brachiopode, Frasnien supérieur, France.

Introduction

Two quarries, called “carrières du Château Gaillard”, have been successively exploited near Trélon (Avesnois, Département du Nord, France) until the early 1970s. The species described in the present paper comes from the last quarry, the “nouvelle carrière du Château Gaillard”, that was shut down in 1973, and is now partly flooded. LECOMPTE (1936) gave lists of brachiopods collected from this quarry and identified by E. Maillieux. *Hypothyridina cuboides* (J. de C. SOWERBY, 1840) is

included in these lists. SARTENAER (2003, pp. 35-36, 43) indicated that the various reported Frasnian “*H. cuboides*” were not only different from one region to another, but within each of these regions. He mentioned in particular that collections of “*H. cuboides*” from the Dinant Basin were under examination. This resulted so far in the establishment of the late Frasnian genus *Parallelepipedorhynchus* SARTENAER, 2006, type species *P. trapezoides* SARTENAER, 2006. The species described in the present paper forms part of this ongoing revision.

Systematic Palaeontology

Family *Parallelepipedorhynchidae* SARTENAER, 2006

Genus *Parallelepipedorhynchus* SARTENAER, 2006

Parallelepipedorhynchus castellum n. sp.

Pl. 1, Figs 1-40; Text-Fig.1; Tables 1-2

All specimens are deposited in the collections of the Royal Belgian Institute of Natural Sciences with registration numbers prefixed IRScNBa.

Derivatio nominis

Castellum (Latin, neuter) = name for a fortification called “Château Gaillard”. The name draws attention to the locality from which the species comes. It must be used as a noun, standing in apposition.

Types, locus typicus, and stratum typicum

All types come from the “nouvelle carrière du Château Gaillard” near Trélon (Avesnois, Département du Nord, France) on the southern flank of the Dinant Basin (Trélon 1:50,000 geological map XXVIII-7, 1970). Late Frasnian, lower part of the Late *Palmatolepis rhenana* Zone.

Holotype: IRScNBa12450 (Pl.1, Figs 6-10). 11 paratypes, 9 of which are figured. Paratypes A: IRScNBa12451 (Pl.1, Figs 1-5), B: IRScNBa12452 (Pl.1, Figs 11-15), C: IRScNBa12453 (Pl.1, Figs 16-20), D: IRScNBa12454, E: IRScNBa12455 (Pl.1, Figs 21-25), F: IRScNBa12456, G: IRScNBa12457 (Pl.1, Figs 31-35), H: IRScNBa12458 (Pl.1, Figs 26-30), I: IRScNBa12459 (Pl.1, Figs 36-40). Paratypes J: IRScNBa12460 and K: IRScNBa12461 (Text-Fig.1).

Material

111 specimens examined: 102 collected by V. Ebbighausen, in 1985, among which the holotype and paratypes A to I, and 9, including paratypes J and K, collected by R. Smith in 1974. 97 specimens are in good state of preservation, 10 satisfactory, and 4 poor.

Description

Shell of small to medium size. Profile gibbous, strongly dorsibiconvex [length slightly greater or slightly smaller than thickness, sometimes nearly equal, dorsal valve around 2 times thickness of ventral valve (between 61 and 70 %, mostly 63 to 66 % of shell thickness)]. Shell outline transverse (length about 3/4 to about 5/6 of width), rounded trapezoid, greatest width posterior to mid-length (between 29 and 49 % of shell length anterior to the ventral beak). Cardinal margin with rounded extremities, slightly flattened, sticking out, length of hinge line between 76 and 90 % of shell width. Anterior and lateral commissures sharp, anterior commissure serrated, lateral commissures slightly, sometimes almost not, undulated by the costae. Lateral

parts of the anterior commissure at right or slightly obtuse angle to the lateral commissures. Sulcus and fold well developed, start at the anterior border of the umbonal region. Angle of the cardinal commissure between 145° and 155° (mostly 145° to 150°).

Ventral valve thickest at 1/4 -1/3 shell length (between 28 and 41 % of shell length anterior to the ventral beak), low, strongly curved medially. Sulcus starts between 35 and 52 % of shell length or between 35 and 43 % of the unrolled length of the valve, narrow, width at front between 47 and 62 % (mostly between 49 and 58 %) of shell width, only moderately deep and well delineated towards margin, bottom flat. Flanks very gently convex. Beak slightly to strongly incurved. Umbo, broad, evenly and strongly curved. Interarea wide (mostly between 52 and 62 % of shell width), low, concave, defined by faint ridges. No deltidial plates seen. Tongue moderately high to high, with subrectangular outline, tending to become vertical in its uppermost part, top of tongue slightly posterior to shell length, and located lower than the highest point of the shell, i.e. between 15 and 30 % of shell thickness.

Dorsal valve thickest anterior to mid-length (between 50 and 63 % of shell length anterior to the ventral beak). In transverse profile, valve high, semi-elliptical. Outer flanks deflected ventrally to be almost vertical near commissure. Fold is commonly clearly defined but remains low throughout, top flat to gently convex. Umbo broad, strongly swollen, extends posteriorly beyond ventral umbo. Measurements of ten specimens, of which eight have been photographed, are given on Table 1.

in mm	Paratype A	Holotype	Paratype B	Paratype C	Paratype D	Paratype E	Paratype F	Paratype G	Paratype H	Paratype I
l	17.2	16.7	16.3	15.5	15.2	14.3	13.6	12.7	12.3	10.5
w	22.7	19.7	18.9	18.5	19.1	18.4	18.4	14.8	15.6	14.3
lvv unrolled	(27.5)	26.5	24.5	23	22	22	23.5	19	19.5	18
t	16.4	15	14.9	15.2	13.3	13.2	15	10.2	11.6	11.6
tvv	5.5	5.5	5.2	4.7	4.1	4.4	4.5	3.5	3.9	4.5
tdv	10.9	9.5	9.7	10.5	9.2	8.8	10.5	6.7	7.7	7.1
l/w	0.76	0.85	0.86	0.84	0.77	0.78	0.74	0.86	0.79	0.73
t/w	0.72	0.76	0.79	0.82	0.67	0.72	0.82	0.69	0.74	0.81
t/l	0.95	0.90	0.91	0.98	0.88	0.92	1.1	0.80	0.94	1.1
apical angle	(130°)	130°	135°	135°	130°	138°	137°	136°	136°	132°
angle of the cardinal commissure	145°	145°	150°	147°	150°	152°	154°	145°	148°	150°

Table 1 — Measurements of 10 specimens; figures in parentheses estimates. Abbreviations: l = length, w = width, t = thickness, vv = ventral valve, dv = dorsal valve.

Median costae			Parietal costae			Lateral costae		
Number of costae	Number of specimens	%	Number of costae	Number of specimens	%	Number of costae	Number of specimens	%
3/2	10	10	0	89	85.5	5/6	3	3
4/3	76	74.5	0-1/0-1	5	5	6/7	11	11.25
5/4	13	12.5	1-0/1-0	7	6.5	7/8	26	26.5
6/5	3	3	1-1/1-1	3	3	8/9	26	26.5
	102	100		104	100	9/10	20	20.5
						10/11	11	11.25
						11/12	1	1
							98	100

Table 2 — Number of median, parietal and lateral costae.

The general costal formula in median, parietal, and lateral categories derived from at least 75 % of the specimens is $\frac{4 \text{ to } 5}{3 \text{ to } 4}; 0; \frac{6 \text{ to } 9}{7 \text{ to } 10}$. Ratios of costae are given in Table 2. Costae well marked (with the exception of the external lateral costae, which only slightly undulate the commissure), low, absent from umbos and cardinal margins. Median costae few, angular with rounded top, coarser than lateral costae. Lateral costae very low. Parietal costae rarely present. Sulcus-bounding costae usually divided on one side or on both. No spine-like projections and accommodating grooves developed. Width of median costae at front varies around 1.5 mm.

Transverse serial sections of two specimens (paratype J, IRScNBa12460 and K, IRScNBa12461) are shown on Text-Fig. 1.

Shell thick posteriorly. Teeth stout, short, cyrtomatodont, not supported by dental plates. Dorsal internal structures delicate. No cardinal process, nor septum. Hinge plate divided. Outer hinge plates thin, passing without sign of crural bases into elongated appendices. Crura short, raduliform, oval in section. Crura and crural appendices remain close together.

Comparison

P. castellum n. sp. and *P. trapezoides* SARTENAER, 2006, the type species of the genus, are similar in most characters. The new species can easily be separated by its smaller size, the largest specimen having the size of the smallest specimen of *P. trapezoides*, and by a different distribution of costae: $\frac{4 \text{ to } 5}{3 \text{ to } 4}; 0; \frac{6 \text{ to } 9}{7 \text{ to } 10}$ for *P.*

castellum, $\frac{4 \text{ to } 5}{3 \text{ to } 4}; \frac{1-0}{1-0} \text{ to } \frac{2-1}{2-1}; \frac{12 \text{ to } 16}{13 \text{ to } 17}$ for *P. trapezoides*.

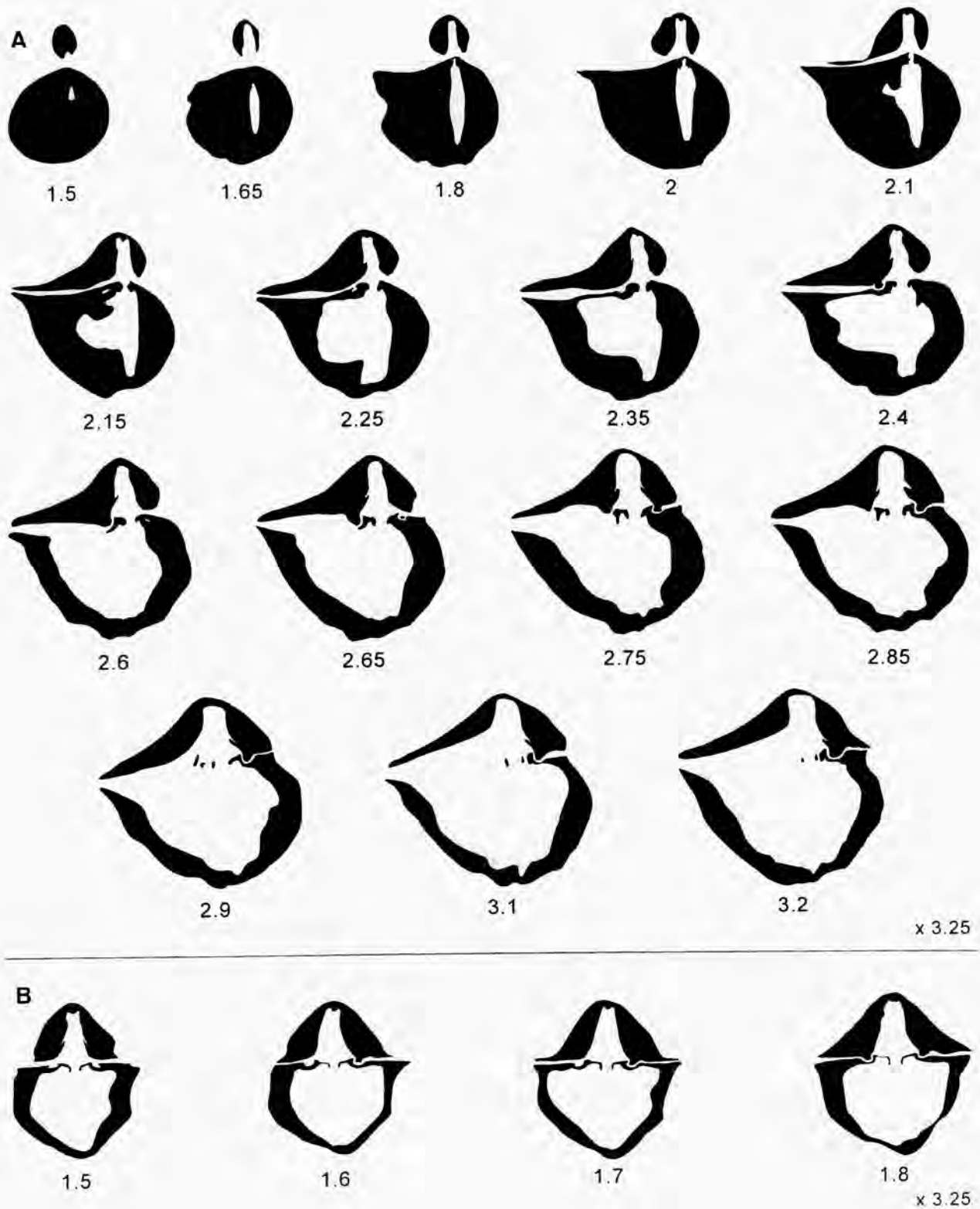
The similar number of median costae in both species

needs to be considered, because ratio $\frac{4}{3}$ corresponds to 74.5 % of specimens of *P. castellum*, and only 16.5 % of specimens of *P. trapezoides*, and ratio $\frac{5}{4}$ to 12.5 and 66.65 % of specimens respectively; still, it must be borne in mind that only 12 specimens of *P. trapezoides*, compared to the 111 specimens of *P. castellum*, were at the author's disposal when the genus *Parallelepipedorhynchus* was established. Moreover, *P. castellum* has a usually more deeply serrated anterior commissure, especially if one considers the difference in size of the two species, and a slightly less obtuse angle of the cardinal commissure.

The differences between *P. trapezoides* and *H. cuboides*, type-species of the genus *Hypothyridina*, have been thoroughly discussed in SARTENAER (2006).

Stratigraphic position and geographic location

The reef, cropping out in the "nouvelle carrière du Château Gaillard", is located in the westernmost part of the Frasnian stretch on the southern flank of the Dinant Basin. It is one of the numerous "F2j" reefs of the southern flank of the Dinant Basin and the Philippeville Massif, ranging in age from the late Early to the early Late *Palmatolepis rhenana* conodont Zone as stated by SARTENAER (2006, p. 58). It is composed of a lower red zone less than 10 m thick, a middle grey zone more than 30 m thick, and an upper red zone 10 to 15 m thick (thicknesses are taken from LECOMPTE, 1936). Above the "essentially crinoidal" 1.8 m thick red limestone mentioned by LECOMPTE (1936, pp. 41, 42, 56-57; 1956, p.18) at the top of the reef there are 3.5 m of greyish-green to green shales alternating with crinoidal beds 5 to 40 cm thick in the lower two metres. These 3.5 m and the succeeding 5.5 m of shales were called "shales of "Matagne" aspect" by SARTENAER (1977,



Text-Fig. 1 — *Parallelepipedorhynchus castellum* n. sp. Distances are measured in mm from dorsal umbo. A - Paratype J, IRScNBa12460; measurements: length = 14.4 mm, width = 16.3 mm, thickness = 15.1 mm. B - Paratype K, IRScNBa12461; measurements: length = 15.9 mm, width = 18.1 mm, thickness = 15.1 mm.

p. 73), who defined them as follows (1970, p. 346): “aspect que revêtent des schistes très et finement feuilletés, à cassure olivâtre à verdâtre, se débitant en esquilles fines et contenant quelques nodules aplatis, de rares lentilles calcareuses, dont certaines montrent parfois la structure cone-in-cone, et une faune naine pour la plus grande partie”. It is in these shales that *Pammegetherhynchus merodae* SARTENAER, 1977 was collected.

Are we dealing with a reef or not? The question has often been raised. It is not like the other “F2j” reefs, and that’s for sure. The two main reasons related to its stratification and to the predominant role played by crinoids were underlined by LECOMPTE (1936, pp. 40, 76, 80; 1956, p.18), who wrote: “c’est un récif bien stratifié”, “la lentille organogène de Trélon est avant tout une masse à crinoïdes. On trouve ceux-ci de la base au sommet et leur rôle est nettement prépondérant”, “on ne peut pas lui [à la lentille calcaire exploitée] appliquer le terme de récif coralligène. Le rôle de polypiers, et celui des stromatopores également...est absolument insignifiant”, “les Crinoïdes envahissent le récif et prennent la prédominance sur les Coraux”.

Other important differences from other “F2j” reefs are the presence of crinoidal beds and “*Hypothyridina cuboides*” above the reef (see above), and the abundance of “*H. cuboides*” at various levels of the reef, especially in its middle zone. The structure of the reef allowed hundreds of specimens to be collected in the course of time.

As stated by SARTENAER (1977, p. 73), the “couches riches in Crinoïdes” at the top of the “bioherme” have been considered in the explanation of the geological map 1:50,000 of Trélon XXVIII-7 (1970, p. 7) as indicating the beginning of the embedding of the reef. This opinion is shared by the author, who considers this 1.8 m thick unit plus the succeeding 3.5 m mentioned above as a distinctive member above the reef, that, due to its uniqueness, does not deserve a formal name.

Parallelepipedorhynchus castellum n. sp. has been collected in the upper part of the middle zone of the reef, i.e., according to TOURNEUR (1982, p. 98), in the lower part of the Late *Palmatolepis rhenana* Zone in terms of the conodont zonation.

The quarry is located around 30 km to the W of the two outcrops (cemetery quarry at Boussu-en-Fagne on the southern flank of the Dinant Basin, and railroad cut SW of the village of Neuville in the Philippeville Massif) from which specimens of the type species *P. trapezoides* of similar age were collected.

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- Paul SARTENAER
Department of Palaeontology
Royal Belgian Institute of Natural Sciences
Rue Vautier 29, B-1000 Brussels, Belgium
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Explanation of Plate 1

All figures are natural size

Parallelepipedorhynchus castellum n. sp.

- Figs 1-5 — Paratype A, IRScNBa12451. Dorsal, ventral, anterior, posterior, and lateral views.
Costal formula: $\frac{4}{3}; 0; \frac{9}{10}$.
- Figs 6-10 — Holotype, IRScNBa12450. Dorsal, ventral, anterior, posterior, and lateral views.
Costal formula: $\frac{4}{3}; 0; \frac{9}{10}$.
- Figs 11-15 — Paratype B, IRScNBa12452. Dorsal, ventral, anterior, posterior, and lateral views.
Costal formula: $\frac{4}{3}; 0; \frac{9}{10}$.
- Figs 16-20 — Paratype C, IRScNBa12453. Dorsal, ventral, anterior, posterior, and lateral views.
Costal formula: $\frac{4}{3}; 0; \frac{8}{9}$.
- Figs 21-25 — Paratype E, IRScNBa12455. Dorsal, ventral, anterior, posterior, and lateral views.
Costal formula: $\frac{4}{3}; 0; \frac{8}{9}$.
- Figs 26-30 — Pparatype H, IRScNBa12458. Dorsal, ventral, anterior, posterior, and lateral views.
Costal formula: $\frac{3}{2}; 0; \frac{7}{8}$.
- Figs 31-35 — Paratype G, IRScNBa12457. Dorsal, ventral, anterior, posterior, and lateral views.
Costal formula: $\frac{4}{3}; 0; \frac{6}{7}$.
- Figs 36-40 — Paratype I, IRScNBa12459. Dorsal, ventral, anterior, posterior, and lateral views.
Costal formula: $\frac{3}{2}; 0; \frac{6}{7}$.

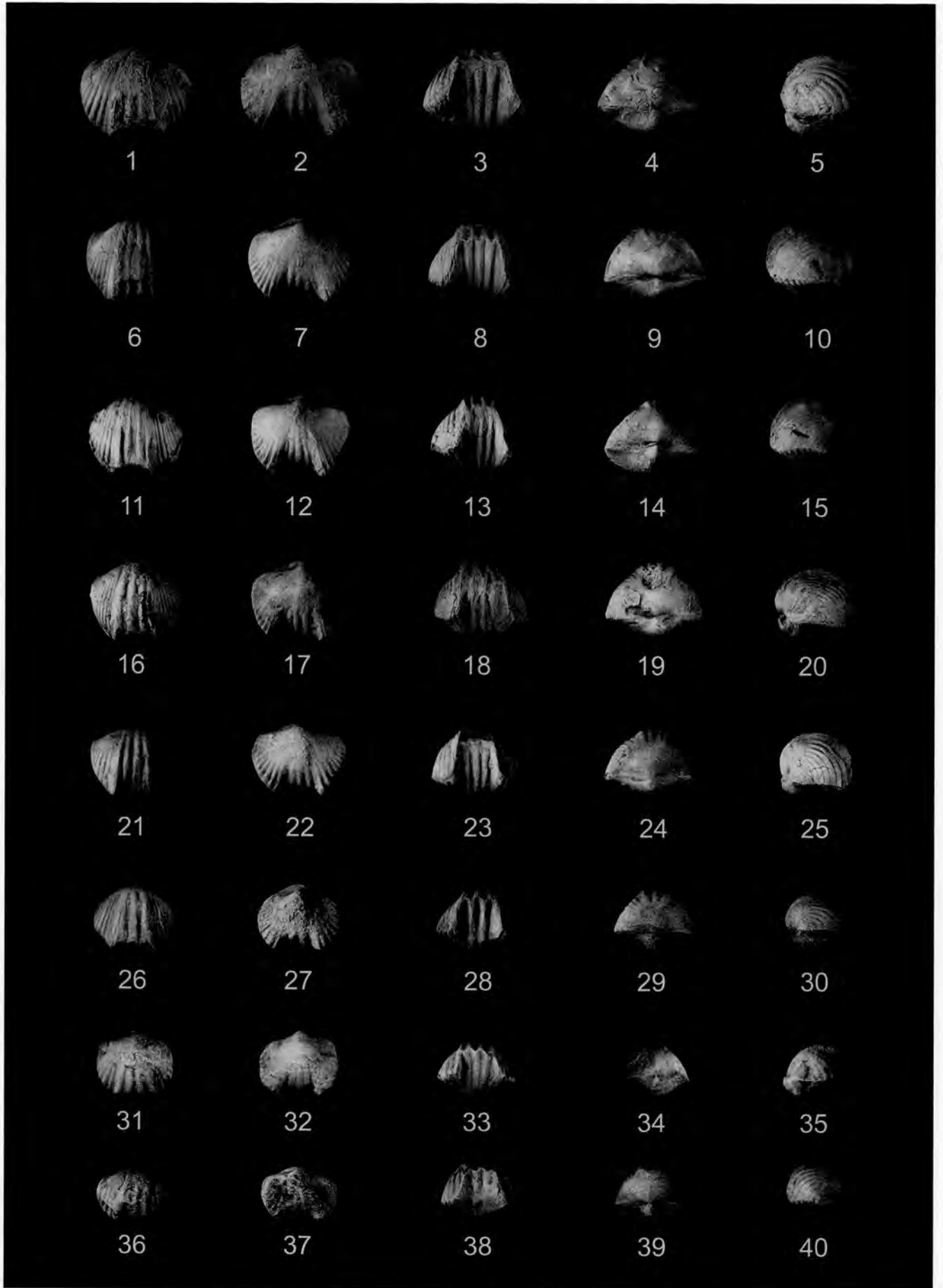


PLATE 1

