UDK 56(497.1) CODEN: PLTSA 3 YU ISSN 0552-935
JUGOSLAVENSKA AKADEMIJA ZNANOSTI I UMJETNOST.
ACADEMIA SCIENTIARUM ET ARTIUM SLAVORUM MERIDIONALIUA,
PA L AE O NT O LO G I A JU G O S L A V I C A

Sv. 35 (1986)

JASENKA SREMAC

MIDDLE PERMIAN BRACHIOPODS FROM THE VELEBIT MTS. (CROATIA, YUGOSLAVIA)

SREDNJOPERMSKI BRAHIOPODI VELEBITA
(HRVATSKA, JUGOSLAVIJA)

PALAEONT. JUGOSL. Jugosl. akad.	35	1—43	9 Text-figs. 15 Plates 1 Table	ZAGREB	November 1986

Z A G R E B 198 6.

JUGOSLAVENSKA AKADEMIJA ZNANOSTI I UMJETNOSTI
ACADEMIE YOUGOSLAVE DES SCIENCES ET DES ARTS

RAZRED ZA PRIRODNE ZNANOSTI
CLASSE DES SCIENCES NATURELLES

Adresa uredništva *(Adresse de la rédaction):*

YU — 41000 ZAGREB, Braće Kavurića 1

Palaeontologia jiugoslavica br. 35 tiskana je sredstvima Republičke samoupravne interesne zajednice za znanstveni rad SR Hrvatske br. III

(Palaeontologia jugoslavica No. 35 est financée par l'Association autogestionelle des intéressés de la République Socialiste de Croatie No. III)

Tisak: IKRO »Mladost«, OOUR Tiskara, Zagreb, Gundulićeva 24

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UDK 564.8:551.736(497.13) Original Scientific Paper
Izvorni znanstveni rad

MIDDLE PERMIAN BRACHIOPODS FROM THE VELEBIT MTS. (CROATIA, YUGOSLAVIA)

JASENKA SREMAC*

Project N. 5

From the Middle Permian black limestones in the area of Brušane and Baške Oštarije a nich brachiopod fauna has been collected. Thirty-eight different forms have been described, including several new species, new genus *Megatschernyschewia* and new family Ramovsiiinidae with genus *Rampvsina*.

Iz crnih vapnenaoa srednjeg perma nia području između Đrušana i Baških Oštarija prikupljena je i determinirana bogata brahiopodna fauna. Opisano je trideset osam različitih oblika, među kojima i više novih vrsta, novi rod *Megatschernyschewia,* te nova familija Ramovsiiinidae s rodom *Ramovsina*.

1. INTRODUCTION

During the complex geological investigations in the Velebit Mts. performed by Professor M. Salopek and his working group in the period from 1935 to 1938, a rich Upper Palaeozoic flora and fauna were collected. Microfossils from Velebit and Lika have been subjected to detailed investigations, while the data on the Upper Palaeozoic macrofauna are rather poorly represented in palaeontological literature.

Brachiopod fauna from the *»Neoschwagerina craticulifera* — zone« (Middle Permian, Murghabian) is extremely rich (thirty-eight forms with a large number of specimens) and peculiar, containing many new forms. Therefore it undoubtedly deserves to be presented in detail.

Acknowledgments

I express my sincere gratitude to: Professor V. Kochansky-Devide, D. Sc., member of the Yugoslav Academy of Sciences and Arts and Professor A. Ramovs, D. Sc., from Ljubljana, for their support and suggestions; Professor A. Sokac, D. Sc., for help in collecting literature; Professor L. Pesic, D. Sc., from Belgrade for instructions in preparation techniques.

I am especially indebted to Professor K. Nakamura, D. Sc. (Hokkaido University, Sapporo) and R. Grant, D. Sc. (U. S. National Museum, Washington) for fruitful discussions on new taxa.

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X-ray analysis of the interior skeleton elements was made at the Radiology Department of the Orthopedic Clinic, Faculty of Medicine, Zagreb. H. Malinar, B. Sc. made polyester moulds of the destroyed specimens. R. PavieSic, A. Truhan, M. Grm, R. Peternel, M. Sc. and S. Boromisa, B. Sc. prepared the artwork and photography.

2. BRACHIOPOD COMMUNITIES

Well preserved brachiopods (38 different froms) have been found at four localities (text-fig. 1).

Large specimens with thick shell-walls, often asymmetrical in shape and ornamentation, prevail at Milasnovac, the road-section and at point 1001. Most of them lived unattached among the main reef-builders (Calcispongia. Algae and Bryozoa) together with gastropods, cephalopods and bivalves. Coral communities *(Waagenophyllum* sp). have been found sporadically. Reef brachiopod communities are characterized by a small number of taxa, but an enormous number of specimens (text-figs. 2, 3).

In contrast, the area of Crne grede represented a calm marine environment, which enabled the colonisation of a much larger number of brachiopods, predominantly productoid taxa. Productoids (one or two representatives of each form) were anchored by spines in the muddy substrate. Larger shells *(Ramovsina)* were also supported by gutters. A large number of specimens of attached forms *(Keyserlingina* and *Leptodus)* have been found in the separate stratum (text-figs. 2, 3) (Sremac 1986).

3. SYSTEMATIC DESCRIPTIONS

Precise determination of many brachiopod taxa includes the study of the internal skeleton elements. Therefore serial sections were prepared for the new forms of *Enteletes, Martinia* and *Ramovsina.* X-radiography was not applicable to the specimens from the Velebit Mts. because of the slight contrast between the infill (limestone) and the shell-material (calcite).

Systematics of the higher taxonomical categories has been taken from R. C. Moore (edit.), 1965.

The material is inventoried in the Scientific collection of the Department of Geology and Palaeontology, Faculty of Sciences and Mathematics, Zagreb.

3.1 Order: Orthida Schuchert & Cooper, 1932
Suborder: Orthidina Schuchert & Cooper, 1932
Superfamily: Enteletacea Waagen, 1884
Family: Enteletidae Waagen, 1884
Subfamily: Enteletinae Waagen, 1884
Genus: *Enteletes* Fischer de Waldheim, 1825

Enteletes microplocus Gemmellaro, 1899
PI. 1, figs. 1 a-e

1899. *Enteletes microplocus,* Gemmellaro, p. 147, pi. 28, figs. 40—46.
1934. *Enteletes microplocus,* Solignac & Berkaloff, p. 13.

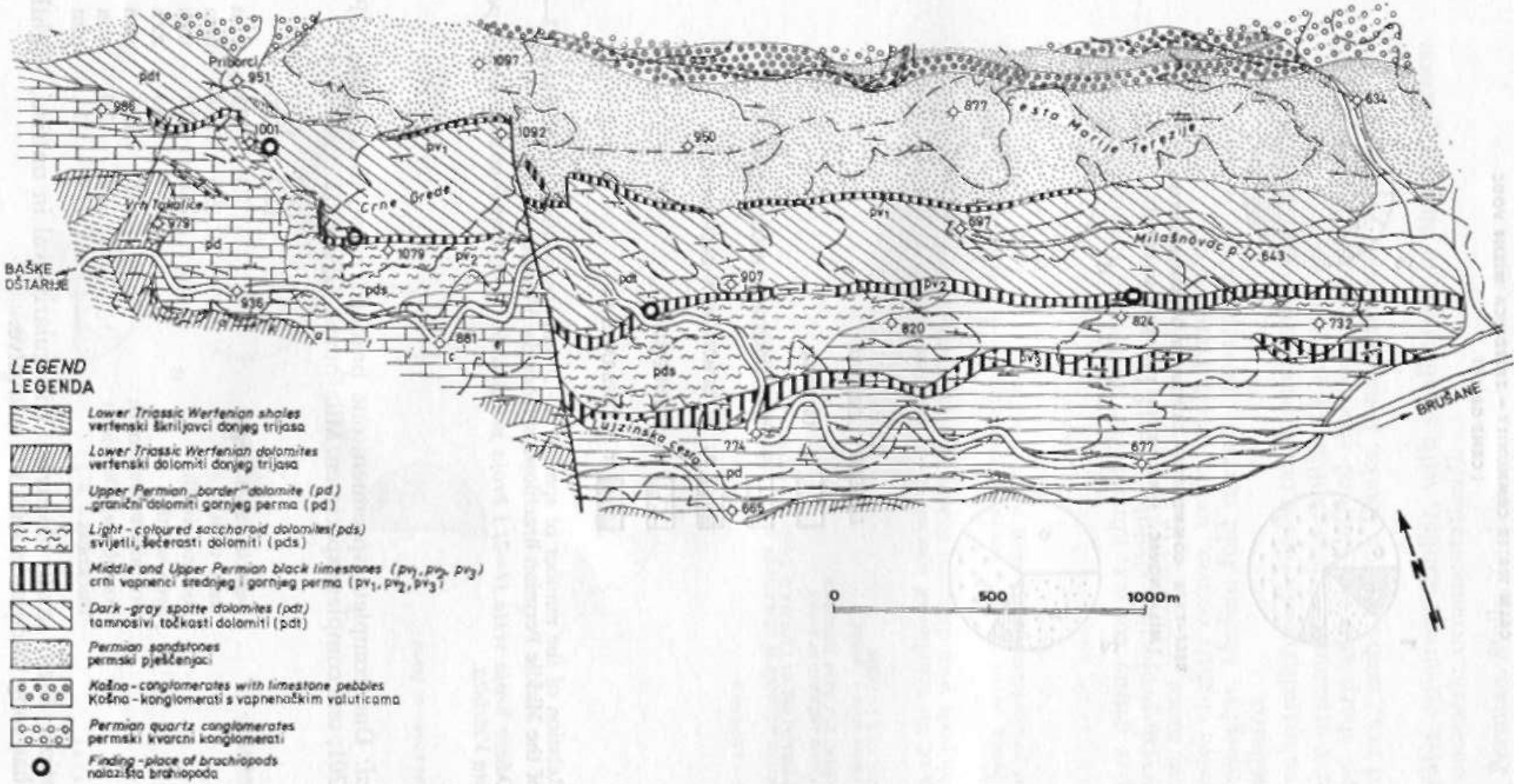

Fig. 1. Geological map of the area between Brušane and Baške Oštarije (after Salopek 1942, modified).

Sl. 1. Geološka karta područja između Brušana i Bakših Oštarija (prema Salopeku 1942, dopunjeno).

CALM WATER COMMUNITY - ZAJEDNICA MIRNE VODE

(CRNI GREDI)

REIF-TYPE COMMUNITY— ZAJEDNICA GREBENSKOG TIPA

(MILAÜNOVAC, 4-1001, MSIDI THE ROAD-UZ CESTU)

LEGEND-LEGENDA:

1 1 O 0RTHI0A

1+ +i P STR0PH0MEN1DA-PRODUCTIDINA

OL STROPHOMENIDA -OlDHAMINIDINA

S SPIRIFERIDA

Wffli 'EREBRATULIDA

Fig. 2. Relation of the number of species (1—2) and the number of specimens (3—4) of the Middle Permian brachaopods from the Velebit Mts.

SI. 2. *Odnos broja vrsta (Ž—2) i broja primjeraka (3—4) brahiopoda srednjeg perma Velebita.*

Material: **One complete specimen, one brachial valve, Crne grede, GPZ 1200, 1201; one complete specimen, Milašnovac, GPZ 1202.**

		GPZ 1202	GPZ 1200	
Measurements:	pedicle valve length	17.3	19.7	mm
	total width	19.6	21.4	mm
	surface width	21.8	22.2	mm
	area width	10.1	10.3	mm
	brachial valve length	17.5	18.6	mm
	dorsal surface width	22.0	22.0	mm
	thickness	13.9	12.1	mm

Description: **Shell small, biconvex, triangularly-oval in outline, slightly wider than long. Maximum width at midvalve.**

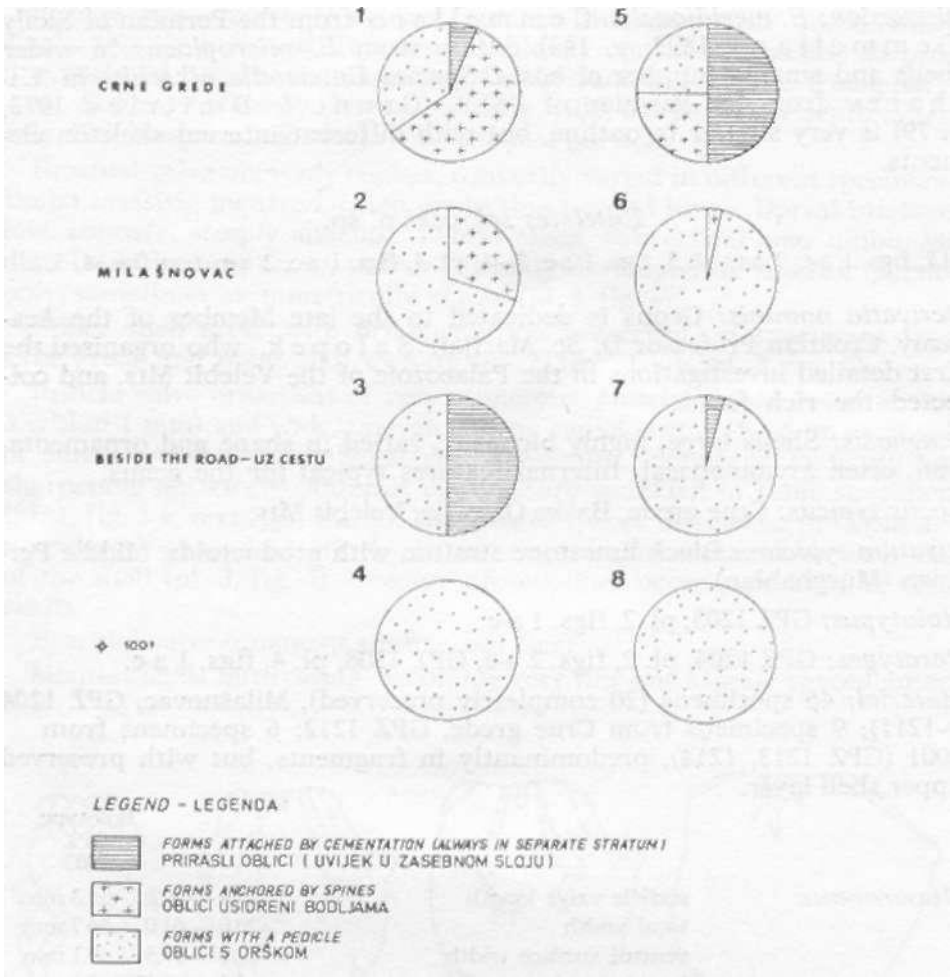

Fig. 3. Relation of the number of species (1—4) and the number of specimens (5—8) of brachiopods with different modes of attachment (Middle Permian, Velebit Mts.).

SI. 3. Odnos broja^ vrsta (1—4) i broja primjeraka (5—8) brahiopoda s različitim načinom pričvršćivanja (srednji perm, Velebit).

Pedicle valve gently convex, almost flat on flanks. Umbo prominent, slightly incurved, projecting slightly beyond hinge line. Apical angle 90°. Sulcus narrow, more prominent in anterior portion.

Brachial valve slightly convex, umbo small. Flanks steep, flat or gently concave on margins. Median fold narrow, inconspicuous. Anterior commissure crenellated.

Traces of subparallel tooth-plates occur near umbo of pedicle valve.

Pedicle valve ornament of fine capillae (5 in 1 mm width). Costae (9—12 in number) sharp and well defined anteriorly, becoming obscure and round-shaped near umbo and on flanks. Intercostae round-shaped, wider than costae.

Brachial valve ornament similar, with small nodes in anterior portion (traces of concentric ornamentation?).

Occurrence: Permian. Sicily, Tunisia.

Discussion: E. meridionalis Gemmellaro from the Permian of Sicily (Gemmellaro 1899, p. 143) differs from *E. microplocus* in wider shells and smaller number of costa. Species *Enteletella nikschitschi* Licharev from the Permian of USSR (Grunt & Dmitriev 1973, p. 79) is very similar in outline, but with different internal skeleton elements.

Enteletes salopeki n. sp.

Pl.2, figs. 1 a-e, 2 a-e; pi. 3, Pigs. 1 a-e, 2—4; pi. 4, figs. 1 a-e, 2 a-e; text figs. 4, 5.

Derivatio nominis: Genus is dedicated to the late Member of the Academy, Croatian Professor D. Sc. Marijan Salopek, who organised the first detailed investigations in the Palaeozoic of the Velebit Mts. and collected the rich fauna.

Diagnosis: Shells large, highly biconvex, varied in shape and ornamentation, often asymmetrical. Internal features typical for the genus.

Locus typicus: Crne grede, BaSke Ostarije, Velebit Mts.

Stratum typicum: Black limestone stratum with productoids, Middle Permian (Murghabian).

Holotypus: GPZ 1203, pi. 2, figs. 1 a-e.

Paratypes: GPZ 1204, pi. 2, figs. 2 a-e, GPZ 1208, pi. 4, figs. 1 a-e.

Material: 46 specimens (20 completely preserved), Milasnovac, GPZ 1204—1211); 9 specimens from Crne grede, GPZ 1212; 6 specimens from 1001 (GPZ 1213, 1214), predominantly in fragments, but with preserved upper shell layer.

			holotype GPZ 1203
Measurements:	pedicle valve length	17.1--49.6	36.3 mm
	total width	20.0--61.0	56.7 mm
	ventriail surface width	22.7--87.5	69.1 mm
	length/width	0.8-- 0.95	0.8 mm
	area width	9.4--43.2	28.2 mm
	delthynium width	3.0--10.6	9.4 mm
	brachial valve leneth	17.6--51.7	39.9 mm
	dortsal surface width	26.5--83.7	69.4 mm
	thickness	8.8--45.0	32.8 mm

Remark: In the late Professor Salopek's notes these specimens were named *Enteletes ostariacus*.

Description: Shells large, globose, dorsibiconvex, often asymmetrical and varied in shape.

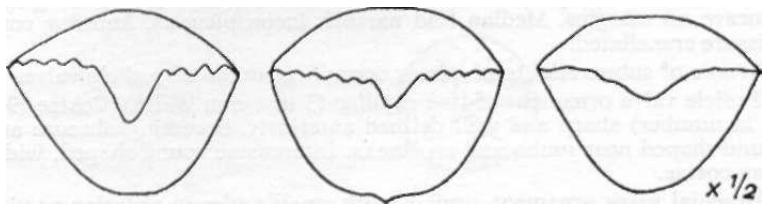

Fig. 4. *Enteletes salopeki* n. sp. Different shape of the anterior commissure.
SI. 4. Enteletes salopeki n. sp. Različiti oblici prednje komisure.

Pedicle valve unevenly convex, greatest thickness near umbo. Umbo small, slightly incurved. Interarea shallowly concave, apsacline to procline, striated parallel to hinge line. Delthyrium wide, open, triangularly--oval. Sulcus shallow, V-shaped, variably wide, increasing in depth anteriorly. Flanks spreading, steeper in umbonal portion.

Brachial valve unevenly convex, convexity varied in different specimens. Umbo massive, incurved, often projecting beyond hinge. Dorsal interarea low, concave, steeply anacline. Flanks steep, subvertical near umbo. Median fold obscure, acute, narrow, usually developed in anterior portion only, sometimes asymmetrically placed (pi. 3, fig. 4).

Upper shell layer with ornamentation preserved on specimens from Crne grede and point 1001 locality (pi. 2, figs. 1 a-b, pi. 3, fig. 2).

Pedicle valve ornament of very numerous, closely placed costellae (2—3 within 1 mm) and wide, uneven, strong radial costae (5—6 on each side of sulcus). Costae in umbonal region obscure, increasing in width and sharpening anteriorly. Anterior commissure wrinkled in some specimens (pi. 1, fig. 2 e, text figs. 5 a, b). Intercostal spaces increasing in depth and becoming V-shaped anteriorly. In some specimens costae cover only half of the shell (pi. 3, fig. 3). Obscure growth-lines occur anteriorly in some shells.

Brachial valve ornament similar, but finer.

Mantle canals bifurcating, becoming very fine and closely spaced anteriorly.

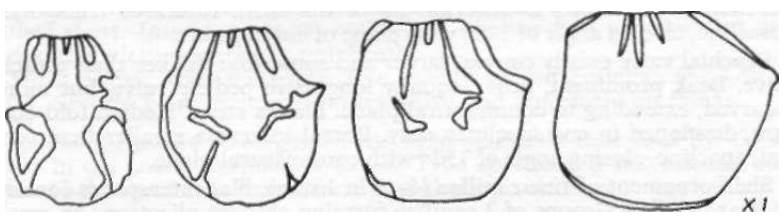

Fig. 5. *Entéleles salopeki* n. sp. Transverse serial seclions of a complete specimen, GPZ 1210.

SI. 5. Entéleles salopeki n. sp. Serijski presjeci kroz čitav primjerak, GPZ 1210.

Interior of pedicle valve with dental plates and thin median septum extending almost half shell length. Dental plates diverging from umbo at angle of about 26°. Brachiophorae in brachial valve prominent, extending 1/3 shell length.

Occurrence: During the Upper Carboniferous and the Permian genus *Enteletes* was widespread, especially in tropic seas.

Discussion: E. salopeki differs from *E. waageni* Gemmellaro from the Permian of Sicily (Gemmellaro 1899, p. 144) in lower convexity, dorsal/ventral area ratio and more obscure growth lines. *E. lamarckii* Fischer de Waldheim from Thailand (Yanagida 1976, p. 177) is similar in shape and ornamentation, but it is smaller and less convex, interior skeleton elements are shorter and median septum is markedly longer than dental plates.

Subfamily: Schizophoriinae Schuchert & Le Vene, 1929
Genus: *Orthotichia* Hall & Clarke, 1892

Orlhotichia derbyi Waagen, 1884

PI. 1, figs. 2 a-e

1884. *Orthis derbyi,* Waagen, p. 565, pi. 56, figs. 2, 5, 6
1934. *Orthotichia derbyi,* Grabau, p. 10. pi. 1. figs. 5—8
1936. *Orthotichia derbyi,* Grabau, p. 54, pi. 3, figs. 9—10

Material: 2 complete specimens (GPZ 1215, 1216), 2 brachial valves (GPZ 1217), Milasnovac; 1 pedicle valve (GPZ 1218), Crne grede.

		GPZ 1216	GPZ 1215	
Measurements:	pedicle valve length	16.8	14.7	mm
	total width	20.2	16.4	mm
	ventral surface width	24.5	19.9	mm
	area width	9.0	6.5	mm
	brachial valve length	17.6	15.8	mm
	dorsal surface width	27.1	21.2	mm
	thickness	13.0	11.5	mm

Description: Pedicle valve triangularly-oval. Umbo acute, prominent, slightly incurved. Apical angle 97°. Maximum convexity in umbonal region, median portion almost flat, anterior region slightly incurved. Sulcus flat, fan-shaped, developed in anterior 2/3 of the shell. Intcrarea triangular, apsacline, closing angle of 115° with plane of commissure.

Brachial valve evenly convex, larger and somewhat thicker than pedicle valve. Beak prominent, acute, equally long as in pedicle valve, but more incurved, extending to commissural plane. Flanks steep. Median fold obscure, developed in one specimen only. Dorsal interarea smaller than ventral, anacline, closing angle of 150 with commissural plane.

Shell ornament of fine capillae (4—5 in 1 mm). Flat interspaces equally wide as capillae. Groups of 3 capillae forming obscure plications on smaller shell. Obscure, uneven radial folds occur in anterior portion of brachial valve in larger specimen. Growth lines become more prominent anteriorly. Widely spaced concentric lines produce a step at visceral/anterior border in some shells.

Occurrence: O. derbyi has been found in the Permian of Pakistan, Mongolia and China, while the subspecies *O. derbyi demissa* occurs in Trogkofel beds of the Karavanke Mts. (Heritsch 1938, p. 93) and Slovenia (Ramovs & Kochansky-Devide 1965, p. 350).

Discussion: Specimens from Pakistan described by Waagen are not .sulcate. Species *O. minuta* (Abich) from the Permian of USSR (Ruzentsev & Sarytchewa 1965) is similar in shape and size, but it is more convex and narrowly sulcate.

Orthotichia magnifica Grabau, 1936

PI. 1, figs. 3 a-f

1936. *Orthotichia magnifica,* Grabau, p. 57, pi. 4, figs. 1—3

Material: 2 complete specimens, 1 pedicle valve, GPZ 1219—1220, MilaSnovac.

		GPZ 1219	GPZ 1220	
Measurements:	**pedicle valve length**	**38.1**	**33.7**	**mm**
	total width	**42.3**	**38.6**	**mm**
	ventral surface width	**52.3**	**48.9**	**mm**
	area width	**23.2**	**17.5**	**mm**
	delthyriutn width	**7.1**	**7.8**	**nun**
	brachial valve length	**38.3**	**34.9**	**mm**
	dorsal surface width	**62.5**	**53.1**	**mm**
	thickness	**28.1**	**25.2**	**mm**

Description: Shell dorsibiconvex, very large.

Pedicle valve triangularly oval. Umbo acute, almost as long as in brachial valve, slightly incurved. Maximum thickness in visceral portion. Area highly triangular, almost catacline; delthyrium wide, triangular. Umbonal flanks steep, concave, spreading anteriorly. Sulcus developed in anterior 2/3 of shell, U-shaped, shallow, slightly increasing in width anteriorly. Anterior commissure with tonguelike extension.

Shell surface with closely-spaced, rounded costellae (3 in 1 mm width). Upper shell layer partly preserved, showing numerous unevenly placed nodes, especially near anterior margin (pi. 1, fig. 3 f). Concentric wrinkles appearing in anterior portion.

Mantle canals wide, bifurcating at half the shell length and again near anterior margin.

Brachial valve evenly convex, triangularly-oval in outline. Beak wide, incurved, projecting beyond hinge line, but not over plane of commissure. Umbonal flanks steep, slightly concave, spreading anteriorly. Hinge line rather short. Interarea almost orthocline. Median fold obscure, but anterior commissure markedly uniplicate.

Shell surface with numerous fine, evenly spaced costellae (3—4 in 1 mm). Several knots scattered on midvalve and anteriorly on flanks.

Discussion: Species *O. magnified* has; been primarily described by Grabau in the Lower Permian of China. Type specimen is not sulcate, but some of the specimens from China bear shallow sulcus.

3.2. Order: Strophomenida öpik, 1934
Suborder: Strophomenidina öpik, 1934
Superfamily: Davidsoniacea King, 1850
Family: Orthotetidae Waagen, 1884
Subfamily: Derbyinae Stehli, 1954
Genus: *Plicatoderbya* Thomas, 1937

Plicatoderbya sp. (n. sp. ?)

PI. 1, figs. 4 a-e

Material: 1 complete and 1 damaged specimen, GPZ 1221, 1222, Milasno-

		GPZ 1221	
Measurements:	pedicle valve length	34.3	mm
	total width	41.6	mm
	ventral surface width	46.0	mm
	area width	32.0	mm
	brachial valve length	25.8	mm
	dorsal surface width	44.9	mm
	thickness	16.2	mm

Description: Pedicle valve rather large, oval in outline, unevenly moderately convex. Sulcus shallow, narrow. Umbo truncated, incurved leftwards. Area prominent, flat, steeply apsacline, markedly asymmetrical. Pseudodeltidium with V-shaped convex median portion demarcated by narrow groove. Convex portion with another median groove in one specimen. Area slightly striated parallel to hinge.

Brachial valve less convex; beak not projecting beyond hinge line.

Shell evenly ornamented by costae and three orders of costellae. Ventral costae trapezium-shaped in cross section, bearing 2—3 first order costellae. Intercostal spaces narrower than costae, flat. Costae anteriorly replaced with numerous, evenly spaced costellae. Costae on brachial valve triangularly-oval in cross-section, narrower than interspaces. Three orders of costellae can be distinguished.

Occurrence: Genus *Plicatoderbya* has to date been known only from the Lower Permian of North America.

Discussion: Specimens from the Velebit Mts. differ from other *Derbyina* in outline. Unfortunately, only one complete specimen was not enough to establish the new species.

Suborder: Productidina W a a g e n , 1883

Superfamily: Strophalosiacea S c h u c h e r t , 1913

Family: Ramovsiinidae n. fam.

Distinguishing characteristics: Large Strophalosiacea, probably derived from aulostegids, but with spiny interarea and wide gutter along lateral and anterior margins. Cardinal process peculiar, massive, quadrilobate.

Occurrence: Middle Permian, Murghabian.

Genus: *Ramovsina* n. gen.

Derivatio nominis: Genus is dedicated to Professor D. Sc. A. R a m o v J , Slovenian stratigrapher and palaeontologist, who has published numerous papers on the Palaeozoic and palaeozoic brachiopods in Slovenia.

Diagnosis: Shell large, flattened, subrectangular in outline, with broad gutterlike extension along flanks and anterior portion of pedicle valve. Ventral interarea broad, covered with spine scars.

Genoholotypus: Ramovsina likana n. gen., n. sp., Middle Permian, Murghabian, Velebit Mts.

Species assigned to the genus: Type species only.

Description: Shell large, wider than long, subrectangular in outline.

Pedicle valve moderately convex, almost flat in umbonal region, becoming more convex anteriorly. Umbo projecting slightly beyond hinge. Flanks spreading, becoming steeper anteriorly. Ears slightly concave or flat. Sulcus wide, shallow, originating posterior to midvalve. Pedicle valve bordered with ventrally deflected frill. Hinge approximately equal to maximum shell width. Interarea prominent, variable in height, covered with spine bases. Delthyrium narrow, closed anteriorly by V--shaped lophidium and posteriorly by convex elytridium.

Brachial valve slightly concave; ears flattened; inconspicuous fold in anterior third of shell. Interarea absent.

Both valves covered with closely placed striae. Concentric ornament inconspicuous, better preserved on visceral disc and on trail. Four types

of spines can be distinguished according to preserved spine bases: (1) numerous minute suberect spines on both valves (endospines ?); (2) numerous coarser erect spines on ventral interarea and dorsal ears; (3) several scattered coarse spines on both valves; (4) coarse spines in radially placed rows on ventral ears.

Cardinal process massive, quadrilobate, composed of two round-shaped median lobes, each with one deep median incision, and two equally large lateral lobes (pi. 6, fig. 3 c, text-fig. 6 g).

Ramovsina likana n. sp.

PI. 5, figs. 1 a-e, 2 a-e; pi. 6, figs. 1 a-b, 2 a-b, 3 a-b; text-figs. 6 a-g.

1986. *Ramovsina likana,* S r e m a c, p. 85, fig. 1

Derivatio nominis: Lika = province in Croatia in which the Velebit Mts. with brachiopod findings are located.

Diagnosis: Extremely flat, large, transversely-rectangular Strophalosiacea with wide, ventrally deflected frill. Ears prominent, covered with spine scars. Ventral interarea large, also with spine bases. Cardinal process quadrilobate.

Locus typicus: Baske Ostarije, Crne grede, Velebit Mts.

Stratum typicum: Black limestone stratum with productoids, Middle Permian, Murghabian.

Holotypus: GPZ 1223, pi. 5, figs. 1 a-d.

Paratypes: GPZ 1224, pi. 5, figs. 2 a-c; GPZ 1225, pi. 6, figs. 1 a-c.

Material: 6 specimens, including 4 with both valves more or less preserved, GPZ 1223—1226; 2 fragmentary pedicle valves, GPZ 1227—1228, Crne grede.

Measurements:	holotype GPZ 1223	paratype GPZ 1224	paratype GPZ 1225	GPZ 1226	GPZ 1227	
length without frill	42.0	43.3	46.4	45.3	47.5	mm
total length	48.0	62.0	55.5	?	?	mm
width without frilil	45.6	57.4	52.0	55.2	55.0	mm
total width	55.0	97.4	57.2	?	63.0	mm
surface width	56.2	p	?	63.0	62.0	mm
area width	33.5	38.3	41.2	?	?	mm
area height	6.5	4.7	7.7	p	?	mm
dorsal valve length	38.6	37.6	35.7	38.0	?	mm
thickness	15.8	15.1	12.0	11.5	?	mm

Description: Shell large, convex-concave, transversely rectangular in outline, extremely flat.

Umbonal and visceral portions of pedicle valve almost flat. Umbo usually distorted, not too prominent. Convexity increasing anteriorly. Variably wide gutterlike extension around flanks and anterior margin. Angle between valve and frill 80—220°. Frill width up to 29 mm (pi. 5, fig. 2a). Flanks spreading, becoming steeper anteriorly. Ears prominent, triangular in outline, demarcated by shallow groove. Sulcus inconspicuous, wide and shallow, originating anterior to midvalve. Anterior commissure bearing shallow sinus. Hinge line wide, ventral interarea steeply apsacline, gently convex and short, covered with numerous, unevenly quincuncially arranged hollow spine bases (pi. 5, fig. 1 b). Delthyrium narrow, closed anteriorly by V-shaped lophidium. Convex elytridium visible in holotype only (pi. 5, fig. 1 b).

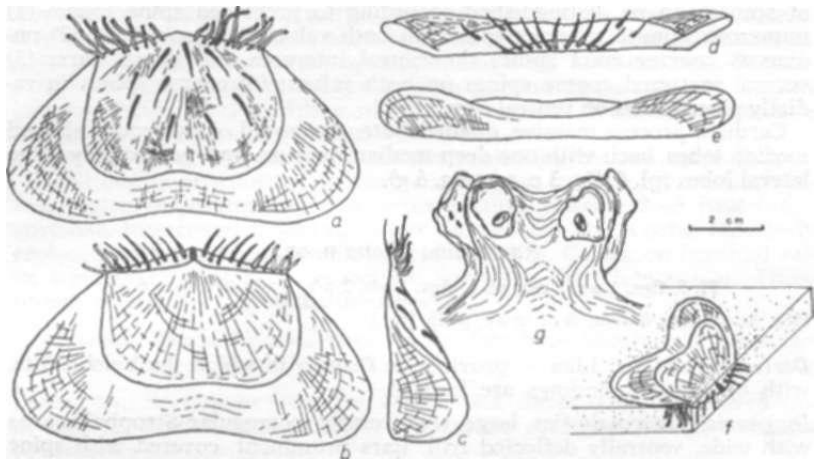

Fig. 6. *Ramovsina likana* n. gen., n. sp. Reconstruction: (a) venitral, (b) dorsal, (c) side, (d) posterior, (e) anterior view; (f) living position; (g) cardinal process (acetate peel), enlarged.

SI. 6. Ramovsina likana n. gen., n. sp. Rekonstrukcija: (a) ventralno, (b) dorzalno, (c) bočno, (d) straga, (e) sprijeda, (f) poloiaj ljušture na muljevitom dnu, (g) kardinalni nastavak (acetatna folija), uvećano.

Brachial valve rectangular, slightly concave in umbonal region, increasing in concavity anteriorly. Ears flattened, prominent. Median fold obscure, appearing in anterior portion.

Upper shell layer with very fine, closely placed capillae (3—4 in 1 mm width) preserved only sporadically (pi. 5. fig. 2 e). Concentric ornament of fine growth-lines and several variably developed rugae, becoming more prominent on visceral disc, ears and frill (pi. 5, fig. 2 d). Quincuncially arranged bases of erect spines appear on pedicle valve, particularly in umbonal and visceral portion. Coarser, inclined anchoring spines in 2—3 radial rows on ears of pedicle valve. Specimens with damaged shell walls covered with numerous minute scars (endospines ?), elongated in umbonal and visceral regions, and oval along margins. Brachial valve covered with quincuncially arranged oval scars, particularly on ears (pi. 6, fig. 1 c); no coarser spines.

Cardinal process with two main lobes, each with one deep central incision. Two lateral lobes equally large, but rectangular in outline (pi. 6, fig. 3 c, text-fig. 6 g).

Discussion: Variable extensions of shell margins are rather common among productoids. They are most expressed in aulostegids, but appear also in overtoniids, margini ferids, dictyoclostids and some other groups. In contrast, the spine arrangement (spines on ventral interarea) and peculiar cardinal process distinguish our samples from any other known brachiopod form.

Professor D. Sc. Koji N a k a m u r a (Hokkaido University, Sapporo) and D. Sc. Richard G r a n t (U.S. National Museum, Washington) attested the establishment of the new family.

Family: Aulostegidae Muir-Wood & Cooper, 1960
Subfamily: Echinosteginae Muir-Wood & Cooper, 1960
Genus: *Sphenosteges* Muir-Wood & Cooper, 1960

Sphenosteges sp. (n. sp. ?)

PI. 5. figs. 3 a-e

Material: 1 complete specimen, GPZ 1229, MilaSnovac.

		GPZ 1229	
Measurements:	pedicle valve length	12.1	mm
	total width	9.5	mm
	surface width	15.0	mm
	area width	5.8	mm
	brachial valve length	9.1	mm
	thickness	5.3	mm

Description: Shell small, longer than wide.

Pedicle valve moderately convex, drop-shaped, slightly asymmetrical. Umbo acute; flanks steeper in umbonal region. Shallow sulcus originating as wide flattening at midvalve, increasing in depth anteriorly. Interarea narrow, highly triangular, steeply apsacline, shallowly concave. Apical angle 60 . Delthyrium closed with narrow convex lophidium. Umbonal portion swollen.

Brachial valve unevenly oval, flat in posterior portion, becoming slightly concave anteriorly. Median fold obscure, developed near anterior margin only.

Pedicle valve ornament of uneven, poorly defined concentric wrinkles. Very small, closely spaced spine scars occur upon flanks, increasing in size at visceral and anterior portion of shell. Bases of erect spines scarce, generally placed on midvalve, increasing in size anteriorly. Spine arrangement uneven.

Discussion: One well preserved specimen was not enough to establish the new species, though it differs from any other known form.

S. *hispidus* (Girty) from the Permian of U. S. A. (Muir-Wood & Cooper 1960, p. 108) is larger, spines on pedicle valve are prostrate, brachial valve ornament consists of numerous fine radial capillae.

Sphenosteges sp.

PI. 6, figs. 4 a-c

Material: 2 damaged pedicle valves, GPZ 1230—1231, Crne grede.

		GPZ 1231	GPZ 1230	
Measurements:	pedicle valve length	32.5	34.5	mm
	total width	24.0	26.3	mm

Description: Pedicle valve medium, drop-shaped. Umbo acute, prominent, projecting high above hinge. Convexity moderate; maximum thickness at 2/3 length from umbo. Flanks spreading. Sulcus obscure, shallow, originating as flattening anterior to umbo.

Numerous oval spine scars visible in anterior portion and on flanks. Umbonal portion with radially arranged spine ridges.

Discussion: Genus *Sphenosteges* has been found in the Permian of Utah (U. S. A.).

Family: Spyridiophoridae Muir-Wood & Cooper, 1960

Genus: *Spyridiophora* Cooper & St eh 11, 1955

Spyridiophora reticulata (King), 1930

PI. 6, figs. 6 a-b

1930. *Marginifera reticulata.* King, p. 89, pi. 22, figs. 3—10

1960. *Spyridiophora reticulata,* Muir-Wood & Cooper, p. 144, pi. 31, figs. 8—16

1975. *Spyridiophora reticulata,* Cooper & Grant, p. 887, pi. 231, figs. 32—34; pi. 251, fig. 11; pi. 252, figs. 1—57; pi. 253, figs. 1—9, 11—36; pi. 457, figs. 1—5

Material: 1 pedicle valve, GPZ 1232, Crne grede.

		GPZ 1232	
Measurements:	pedicle valve length	6.4	mm
	total width	9.0	mm

Description: Pedicle valve triangularly-oval, moderately convex. Umbo prominent, acute. Apical angle 68 '. Flanks steep. Sulcus rounded, originating at umbo, slightly increasing in width anteriorly.

Ornament of radial and concentric wrinkles. Costae numerous (2—3 in 1 mm), narrow, blunt, evenly spaced. Rugae fine, also closely spaced (2—3 in 1 mm), uneven. Rugae not crossing costae, but appearing between them only, producing unevenly rectangular hollows, more prominent in central part of anterior portion.

Discussion: Our specimen corresponds to juvenile specimens from the Permian of Texas (U. S. A).

Spyridiophora cf. *compacta* Cooper & Grant, 1975

PI. 6, figs. 5 a*

1975. *Spyridiophora compacta.* Cooper & Grant, p. 886, pi. 251, figs. 1—10

Material: 5 pedicle valves, GPZ 1233—1234, Crne grede.

Measurements:	pedicle valve length	4.3— 9.0	mm
	total width	4.5—15.8	mm

Description: Pedicle valve rectangular or trapezium shaped, weakly to moderately convex. Maximum width along hinge line. Umbo small, not projecting above hinge. Triangularly-oval median portion; ears large, flat or shallowly convex. Sulcus obscure, wide. Visceral portion flat.

Costae crossed by rugae, producing small knots on pedicle valve, especially on flanks. Costae evenly spaced, rather wide, round-shaped. Only 2—3 costae in sulcus, as well as costae demarcating ears originate at umbo. Other costae parallel to costae in sulcus, branching from bordering costae. Radial ornament on ears obscure, almost parallel to hinge

line, also originating at bordering costae. Rugae better marked in umbonal portion and on ears. Number of costae: 2 bordering ears, 6—8 on midvale, 3—4 on ears.

Discussion: S. compacta from the Permian of Texas is similar in shape, size and ornament, but specimens from Velebit are rather thin. Species *»Productus« margaritatus* Mansuy from the Permian of Indochina (Mansuy 1913, p. 28) and China (Huang 1932, p. 30) is very similar, but with finer ornament.

Family: Tschernyschewiidae Muir-Wood & Cooper, 1960.

Genus: *Tschernyschewia* Stoyanow, 1910

Tschernyschewia cf. *typica lata* Simic, 1933

Pl. 7, figs. 6 a-b

1933. *Tschernyschewia typica* Stoyanow, var. *lata,* Sdtm 5c, p. 38, pi. 2, figs. 6

1958. *Tschernyschewia typica lata,* Ramovs, p. 526

1963. *Tschernyschewia typica lata,* Stoianovic-Kuzenko, p. 171. pi. 4, fies. 6—7

1963. *Tschernyschewia typica* Stoyanow var. *lata* Simic, Schreter p. 112, pi. 4, figs. 6—8

Material: 2 badly preserved pedicle valves, GPZ 1235—1236, Crne grede.

		GPZ 1235	GPZ 1236	
Measurements:	pedicle valve length	11.1	9.0	mm
	total width	16.3	12.8	mm
	surface width	20.6	17.1	mm

Description: Pedicle valve triangularly-oval, moderately convex. Umbo incurved; flanks steep, especially in umbonal portion. Wide sulcus originating anterior to umbo, increasing in width and depth anteriorly. Anterior commissure weakly sinuated. Trace of median septum visible on umbo of one specimen.

Pedicle valve ornament of oblique, 1 mm long, quincuncially arranged spine ridges, decreasing in length anteriorly and on flanks. Several widely spaced concentric wrinkles on midvalve; numerous fine, closely spaced wrinkles in anterior portion.

Discussion: T. typica lata has been found in the Upper Permian beds of Western Serbia, Slovenia, Montenegro and Hungary. Type specimens described by Simic (1933, p. 38) are larger and show no concentric ornament.

Genus: *Megatschernyschewia* n. gen.

Derivatio nominis: Genus is similar to *Tschernyschewia,* which also appears in Permian beds and possesses prominent median septum in pedicle valve.

Diagnosis: Medium to large Tschernyschewiidae differing from *Tschernyschewia* in large ventral interarea and slightly incurved, almost straight umbo.

Genoholotypus: Megatschernyschewia longiseptata longiseptata n. gen., n. sp., n. subsp., Middle Permian, Murghabian, Velebit Mts.

Species other than type species assigned to the genus:

Megatschernyschewia longiseptata transversa n. gen., n. sp., n. subsp., *Megatschernyschewia kochanskae* n. gen., n. sp.

Description: Shell triangular to elongately oval in outline.

Pedicle valve moderately convex. Venter shallowly sulcate, sulcus originating at umbo. Greatest width in anterior third of shell length. Umbo acute, slightly incurved, often split along median septum. Interarea prominent, wide and rather high. Delthyriiim narrow, fissure-shaped, closed by pseudodeltidium. Flanks of umbonal region steep, spreading in anterior portion.

Brachial valve flattened to slightly convex in umbonal region, faintly concave anteriorly.

Umbonal portion with minute, closely placed, elongate spine ridges with prostrate spine scars, replaced anteriorly and on flanks by suberect finer spine basis. Spine scars irregularly quincuncially arranged.

Interior of pedicle valve with high plate-like median septum extending across body cavity, decreasing in Flight anteriorly, and forming rounded right angle distally. Septum surface slightly striated, particularly in incurved region.

Discussion: Shell outline and the long median septum recall *Tschernyschewia,* but *Pscudotschernyschewia* possesses an extremely high interarea, the umbo is not incurved, and it is larger in size.

D. Sc. Richard Grant in discussion through correspondence did not agree with establishing the new genus. Nevertheless, I believe that extremely high interarea requires the new taxonomic category. My opinion is supported by Professor D. Sc. Anton Raraovs, and Professor D. Sc. Koji Nakamura, who examined the fossil material.

Megatschernyschewia longiseptata longiseptata n. gen., n. sp., n. subsp.

PI. 7, figs. 1 a-f, 2 a-e

Derivation nominis: longiseptata = with long septum.

Diagnosis: Triangularly-oval *Megatschernyschewia* with extremely high median septum extending almost whole shell length.

Locus typicus: Crne grede, Baske OStarije.

Stratum typicum: Black limestone stratum with productoids, Middle Permian, Murghabian.

Holotypus: GPZ 1237, pi. 7, figs. 1 a—f.

Paratypus: GPZ 1238, pi. 7, figs. 2 a—e.

Material: 2 complete specimens (GPZ 1237—1238), 1 pedicle valve, 1 brachial valve (GPZ 1239), Crne grede.

		GPZ 1237	GPZ 1238	GPZ 1239/1	GPZ 1239/2	
Measurements:	pedicle valve length	37.3	28.0	25.1	23.7	mm
	total width	38.6	28.2	27.6	21.0	mm
	surface width	51.2	36.9	34.8	?	mm
	area width	31.8	16.0	*1*	13.0	mm
	area height	12.3	4.0	?	2.6	mm
	brachial valve length	25.0	23.7	?	15.6	mm
	thickness	14.5	12.2	?	?	mm

Description: Pedicle valve of medium size, triangularly oval in outline. Median portion moderately convex, bell-shaped in paratype. Umbo prominent, slightly incurved. Apical angle 120°. Interarea faintly concave, medium size, somewhat longer and flattened in holotype. Delthyrium narrowly triangular. Flanks steep and rounded in umbonal region, spreading anteriorly. Sulcus shallow, originating just anterior to umbo, slightly increasing in width and depth anteriorly to produce short, rounded tongue.

Brachial valve slightly convex, resupinate in anterior portion. Umbo lying almost in hinge line. Median fold narrow and inconspicuous.

Umbonal region ornamented by closely placed, radially elongated spine ridges, irregularly quincuncially arranged, laterally and anteriorly replaced by numerous minute spine bases.

Pedicle valve interior with very high plate-like median septum, deviding valves almost in half. Septum elevated, strongly rounded distally, almost reaching anterior margin. Septum surface obscurely wrinkled, especially in curved portion (pi. 7, fig. 1 f).

Discussion: Similar species *T. typica* from the Permian of Armenia (Stoyanow 1916, p. 33) differs from *Megatschernyschewia* in smaller interarea, markedly incurved umbo, wider shells and larger hinge line.

Megatschernyschewia longiseptata transversa n. gen., n. sp., n. subsp.

Pl. 7, figs. 3 a-c

Derivatio nominis: transversa transverse (wider than long).

Diagnosis: Medium size *Megatschernyschewia* with short, wide valves.

Locus typicus: Crne grede, BaSke Ostarije, Velebit Mts.

Stratum typicum: Black limestone stratum with pioductoids, Middle Permian, Murghabian.

Holotypus: GPZ 1240, pi. 7, figs. 3 a—e.

Material: 1 pedicle valve, Crne grede.

		GPZ 1240	
Measurements:	pedice vailve length	18.5	mm
	total width	26.2	mm
	surface width	32.0	mm

Description: Pedicle valve triangularly-oval, moderately convex. Greatest width at midvalve. Flanks markedly rounded, anterior commissure widely arcuated. Umbo small, faintly incurved; hinge line short, sloping towards umbo. Apical angle 130°. Maximum thickness in posterior 1/3 of valve. Visceral portion almost flat, anterior portion swollen. Flanks spreading. Sulcus originating anterior to umbo, developed as flattening on visceral portion, increasing in depth and width anteriorly. Sinus on anterior commissure inconspicuous. Trace of median septum visible in umbonal portion.

Shell ornament of closely placed, quincuncially arranged spine scars. Stair-shaped anterior portion indicating uneven rate of growth.

Discussion: M. longiseptata lata differs from *M. longiseptata longiseptata* in shorter shells, smaller apical angle and stair-shaped anterior portion.

Megatschernyschewia kochanskae n. gen., n. sp.

PL 8, figs. 1 a-e, 2 a-e

Derivatio nominis: Species is dedicated to Academician Professor D. Sc. Vanda Kochansky-Dévidé, Croatian biologist and palaeontologist, who took part in geological investigations of the Velebit Mts. since 1935, devoted herself to elaboration of Palaeozoic microfossils of this area, and was the first to investigate the brachiopod faunas from Brusane and Baske Ostarije.

Diagnosis: Large, elongate-oval *Megatschernyschewia* with very prominent, high ventral interarea.

Locus typicus: Crne grede, Baske Oëtarije.

Stratum typicum: Black limestone stratum with productoids. Middle Permian, Murghabian.

Holotypus: GPZ 1241, pi. 8, figs. 1 a—e.

Paratypus: GPZ 1242, pi. 8, figs. 2 a—e.

Material: 2 partly damaged specimens (GPZ 1241, 1242), 2 pedicle valves (GPZ 1243), Crne grede.

		GPZ 1241	GPZ 1242	GPZ 1243/1	GPZ 1243/2	
Measurements:	pedicle valve length	55.2	49.8	43.3	49.9	mm
	total width	38.0	37.4	35.2	?	mm
	surface width	56.8	58.1	54.9	?	mm
	area width	28.5	31.2	22.3	?	mm
	area height	10.3	16.0	7.3	13.3	mm
	brachial valve length	41.0	32.0	?	35.5	mm
	thickness	17.5	16.7	?	20.4	mm

Description: Shell large, elongate, triangularly-oval in outline.

Pedicle valve evenly, moderately convex. Flanks steep. Umbo slightlv incurved, usually split along septum. Interarea almost orthocline, prominent, highly triangular, transversely partitioned in paratype (pi. 8, fig. 2 b). Delthyrium narrow, fissure-shaped. Sulcus along whole shell, very shallow and wide, producing short, broadly rounded tongue on anterior commissure.

Brachial valve almost flat or slightly convex in umbonal portion, becoming slightly concave anteriorly. Median fold wide, inconspicuous.

Pedicle valve ornamented by irregularly scattered, radially elongated spine ridges in umbonal region, replaced anteriorly and on flanks by numerous very fine, oval spine bases.

Pedicle valve interior with plate-like median septum, similar to that of *Megatschernyschewia longiseptata,* but shorter, not quite reaching to midvalve in holotype (pi. 8, fig. 12), somewhat larger in paratype (pi. 8, fig. 2 e), and with more prominent wrinkles in incurved region.

Discussion: Exterior appearance is similar to that of aulostegids, particularly to *Wyatkina,* which is abundant in the Permian of USSR, but with prominent plate-like median septum typical for Tschernyschewiidae.

Megatschernyschewia sp. (n. sp. ?)

PI. 7, figs. 4 a-c, 5 a-b

Material: 2 pedicle valves, 1 fragment of pedicle valve, GPZ 1244—1246, Crne grede.

		GPZ 1245	GPZ 1244	
Measurements:	pedicle valve length	26.2	36.7	mm
	total width	26.2	49.0	mm
	surface width	36.9	68.1	mm

Description: Pedicle valve large, oval, markedly convex. Greatest thickness in 1/3 shell length. Umbo swollen, projecting beyond wide hinge line. Visceral and anterior portions almost perpendicular in largest specimen (otherwise distorted). Flanks steep, subvertical. Ears prominent, spreading. Sulcus wide, very shallow, originating anterior to umbo. Lateral margins rounded, almost perpendicular to hinge line. Area medium size, triangular.

Long plate-like median septum extending more than 2/3 shell length. Shell surface with closely spaced spine scars, more numerous and smaller anteriorly, on flanks and ears. In one specimen 2—3 weak, uneven concentric wrinkles appear near anterior margin.

Discussion: Specimens from the Velebit Mts. are similar in outer morphology to the species *Echinoconchus punctatus* (Sowerby), which was widespread in the Carboniferous of Europe, Asia, Africa and North America (Muir-Wood & Cooper 1960, p. 243). Material is, unfortunately, too badly preserved to establish the new species.

Megatschernyschewia sp.

Pl. 8, figs. 3 a-c

Material: 1 partly damaged pedicle valve, GPZ 1247, Crne grede.

		GPZ 1247	
Measurements:	pedicle valve length	38.3	mm
	total width	44.6	mm
	surface width	66.1	mm

Description: Pedicle valve elongate, moderately convex, with prominent umbonal portion. Greatest thickness on umbonal/visceral border. Visceral region almost flat, anterior region swollen. Cross section rectangular, with steep, subvertical flanks and weakly concave median portion. Interarea slightly concave. Pseudodeltidium narrow.

Spine scars elongate on visceral portion; small, numerous oval scars anteriorly and on flanks. Uneven, obscure concentric wrinkles appear near anterior margin.

Discussion: This shell might represent a deformed *M. kochanskae.*

Superfamily: Productacea Gray, 1840

Family: Overtoniidae Muir-Wood & Cooper, 1960

Subfamily: Overtoniinae Muir-Wood & Cooper, 1960

Genus: *Krotovia* Fredericks, 1928

Krotovia wallaciana (Derby), 1874

Pl. 9, figs. 5 a—b

1902. *Productus Wallacei,* Tschemyischew, p. 270, pi. 30, fig. 8; pi. 40, figs. 19

1960. *Krotovia wallaciana,* Muir-Wood & Cooper, p. 188.

Material: 1 pedicle valve, GPZ 1248, Crne grede.

Measurements:			
	pedicle valve length	3.9	mm
	total width	4.4	mm

Description: Pedicle valve small, evenly convex. Umbo prominent, incurved. Posterior margin straight, representing maximum width of shell. Posterior and lateral margins almost perpendicular; anterior commissure arcuated. Flanks steeper in umbonal region. Ears prominent, flat, demarcated by shallow groove.

Pedicle valve ornament of numerous pustulae, quincuncially arranged on rugae. Rugae wide, round-shaped, unevenly high and interspaced, more prominent in anterior portion.

Occurrence: K. wallaciana has been found in the Upper Carboniferous of Brazil for the first time, and it is also known from the Upper Carboniferous of the Ural Mts.

Discussion: Our specimen is similar to juvenile shells of *Avonia youngiana* (Davidson) (Muir-Wood 1928, p. 36), but *Avonia* is larger, and ornamented with elongate spine ridges.

Family: Margiferidae Stehli, 1954

Subfamily: Marginiferinae Stehli, 1954

Genus: *Marginifera* Waagen, 1884

Marginifera magniplicata (Huang), 1932

Pl. 9, fig. 3

1932. *Product us (Marginifera) magniplicatus,* Huang, p. 25, pi. 1, figs. 15—17
1936. *Marginifera magniplicata,* Grabau, p. 167, pi. 14, figs. 17—19
1965. *Marginifera magniplicata,* Ruzentsev & Sarytscheva, pi. 37, figs. 2—4

Material: 3 pedicle valves, GPZ 1249—1250, Milasnovac;
2 pedicle valves, GPZ 1251, Crne grede.

Measurements:			
	pedicle valve length	5.5—11.0	mm
	total width	6.4—14.5	mm

Description: Pedicle valve rectangularly oval, markedly convex. Greatest thickness at 1/3 length from umbo. Umbo wide, swollen, projecting beyond hinge line. Hinge representing maximum width of shell. Flanks subparallel, almost perpendicular to median portion. Ears small. Sulcus wide, obscure.

Shell ornament of 9—10 costae, wide and roundly triangular in cross section, decreasing in height posteriorly and on flanks. Intercostae shallow, round-shaped, wider than costae, unevenly spaced (1—2 mm). Several minute spine scars on costae, near anterior margin. In several specimens traces of concentric ornamentation occur as small knots on costae in visceral portion.

Discussion: Species *M. magniplicata* has been found in the Permian of SW China, USSR and Greenland. Type specimens from China bear two rows of spines on ears. Similar species *M. sexcostata* from the Permian of USSR (Grunt & Dmitriev 1973, p. 103) is ornamented with 6 costae and marked spine scars.

Genus: *Paramarginifera* Fredericks, 1916

Paramarginifera himalayensis (Diener), 1899

Pl. 9, figs. 1 a—c

1899. *Marginifera himalayensis*, Djener, p. 39, pi. 2, figs. 1—7; pi. 6. figs. 1—2
1903. *Marginifera himalayensis*, Diener, p. 104, 129, pi. 5, figs. 5, 6, 27
1915. *Marginifera himalayensis*, Diener, p. 79, pi. 8, fig. 9

Material: 1 damaged pedicle valve, GPZ 1252, Crne grede.

Measurements:			
pedicle valve length	24.6	mm
hinge line width	35.3	mm
mid width	31.0	mm

Description: Pedicle valve rather large, convex, rectangularly-oval in outline. Umbo prominent, incurved, projecting high above hinge line. Maximum width at hinge. Apical angle 80°, angle of beak ridges 95°. Sulcus most expressed in visceral portion. Flanks steep. Ears prominent, demarcated by wide, shallow grooves.

Costae (maximum 10 in number) low, wide, occurring in sulcus only; intercostae narrower, shallow. Minute spine scars appear on whole shell; several unequally arranged larger scars, more prominent in anterior portion. No spines on ears. Wide obscure rugae occur in umbonal region.

Occurrence: P. himalayensis has been found in the Permian of the Himalayas and USSR, and related forms occur in the Permian of Tunisia (Solignac & Berkaloff 1934, p. 10) and Slovenia (Ramov§ 1958, p. 501).

Discussion: Diener's specimens from the Permian of the Himalayas bear more numerous, closely spaced, evenly arranged narrow costae, and marked reticulation in posterior portion.

Species *M. typica* Waagen, also from the Permian of the Himalayas (Waagen, 1884, p. 717) is similar in shape, but it differs from *M. himalayensis* in blunt ear margins, deeper sulcus, converging costae in sulcus and a row of spines in groove demarcating the ears.

Paramarginifera cf. *himalayensis* (Diener)

Pl. 9, fig. 2

Material: 1 damaged pedicle valve, GPZ 1253, Crne grede.

Measurements:		
pedicle valve length	13.0	mm
total width	20.6	mm

Description: Pedicle valve markedly convex, maximum width along hinge line. Umbo wide, blunt, strongly incurved, projecting beyond hinge line. Visceral portion almost perpendicular to anterior region. Flanks steep; visceral disc/flanks angle 108°. Sulcus increasing in depth anteriorly, but equally wide.

Concave brachial valve with low median fold, visible in cross section only.

Pedicle valve ornament of unevenly wide costae, bluntly triangular in cross section. Costae more expressed on ridges demarcating sulcus, wider and widely spaced on flanks. Intercostae rounded. Costae bifurcating anteriorly, varied in number (17—20). Obscure thickenings on costae

in umbonal portion and on flanks might represent traces of concentric ornament. Numerous minute spine scars scattered on whole shell; several larger scars on ridges demarcating flanks.

Discussion: Bifurcation of costae appears on several specimens of *P. himalaycnsis* from the Permian of the Himalayas (Diener 1899, p. 39), but specimens from Diener's collection have larger ears, less incurved umbo, more numerous costae and well marked reticulation.

Subfamily: Costispiniferinae Muir-Wood & Cooper, 1960

Genus: *Liosotella* Cooper, 1953

Liosotella sp. (n. sp. ?)

Pl. 9, figs. 4 a-e

Material: 1 complete specimen, GPZ 1254, Milasnovac.

Measurements:			
	pedicle valve length	14.6	mm
	total width	26.0	mm
	surface width	35.9	mm
	brachial valve length	13.3	mm
	thickness	10.5	mm

Description: Shell small, subrectangular in outline, markedly wide. Maximum width along hinge line.

Pedicle valve highly convex. Umbo short, incurved. Greatest thickness at midvalve. Flanks, umbonal and anterior portion evenly steep. Thin, incurved ears demarcated by groove. Thin gutter along flanks and anterior portion, only partly preserved. Sulcus wide, shallow, occurring on anterior 2/3 of shell.

Brachial valve deeply concave, with low median fold in anterior third of shell. Ears almost flat, demarcated by shallow groove.

Pedicle valve ornament of c. 20 low, rounded costae, well expressed in sulcus, wider and more interspaced on flanks. Minute elongate spine scars appear on visceral portion; 5 larger oval scars on flanks.

Brachial valve ornament obscure. Several oval scars on midvalve. Ears with closely placed minute scars, elongate parallel to hinge line.

Discussion: This species differs from other marginiferids in peculiar shape and ornament. Unfortunately, one specimen was not enough to establish the new species.

Waagenoconcha cf. *gangelica* (Diener), 1897

Pl. 9, fig. 7

1897. *Productus gangeticus,* Diener, p. 23, pl. 1, figs. 1–2; pi. 2, fig. 3
1915. *Productus gangeticus.* Diener, p. 77, pi. 8, fig. 6

Material: 1 brachial valve, GPZ 1255, Crne grede.

Measurements:			
	brachial valve length	28.2	mm
	total width	38.0	mm
	area width	26.5	mm

Description: Brachial valve slightly convex, flat to concave in anterior portion. Median fold obscure, increasing in width anteriorly. Ears small, convex.

Brachial valve ornament of numerous minute spine scars, better preserved in anterior portion. Spines prostrate, quincuncially arranged. Ears and flanks with numerous closely placed minute oval scars.

Brachial valve interior with minute trilobate cardinal process, projecting laterally into horizontal ridges along hinge line.

Discussion: D i e n e r ' s specimens from the Permian of the Himalayas are larger with more prominent spine scars.

Waagenoconcha sp. (n. sp. ?)

PI. 9, figs. 9 a-d

Material: 1 pedicle valve, GPZ 1256, Cine grede.

Measurements:			
	pedicle valve length	16.2	mm
	total width	18.7	mm
	surface width	27.0	mm
	area width	16.1	mm

Description: Pedicle valve subrcctangular in outline, thick, evenly convex. Umbo prominent, incurved, projecting high above hinge line. Angle of beak ridges 96 . Hinge line long, straight. Greatest width at midvalve. Flanks steep; ears short, slightly concave. No sulcus, but shell flattened medianly. Anterior commissure almost straight.

Numerous obscure rounded costae (7 costae in 5 mm width) appear in anterior portion. Intercostae shallow, wider than costae. Weak growth lines cover whole shell surface. Wide »ribbons« demarcated by ridges composed of several closely placed growth lines. Numerous evenly placed spine scars appear primarily on »ribbons«. 2—3 rows of large scars bordering ears. Spines on anterior portion prostrate.

Occurrence: Genus *Waagenoconcha* was widespread in North and South America, Europe, Asia and Australia in the Upper Carboniferous and the Permian.

Family: Dictyoclostidae S t e h 1 i, 1954

Subfamily: Dictyoclostinae S t e h 1 i, 1954

Genus: *Tyloplecla* M u i r - W o o d & C o o p e r, 1960

Tyloplecia sp.

PI. 9, figs. 6 a-b

Material: 1 pedicle valve, GPZ 1257, Crne grede.

Measurements:			
	pedicle valve length	34.0	mm
	total width	31.9	mm
	surface width	48.1	mm
	area width	19.0	mm

Description: Pedicle valve oval, trapezium-shaped. Visceral portion highly convex. Umbo markedly incurved, projecting beyond hinge line. Apical angle 92°. Umbonal and anterior portions subparallel, almost perpendicular to visceral disc. Flanks subvertical, then swollen, spreading anteriorly. Ears small, slightly concave. Sulcus shallow, wide.

Pedicle valve ornament of 3 wide, low costae in suclus. Obscure radial wrinkles occur on flanks; inconspicuous rugae on visceral and anterior

portions. Minute, closely placed, scattered spine scars more expressed anteriorly and on flanks. Several large spine scars appear in umbonal and visceral portion.

Occurrence: Genus *Tyloplecta* has been found in the Permian of Asia and Europe.

Family: Linoproductidae S t e h 1 i, 1954

Subfamily: Linoproductinae S t e h 1 i, 1954

Genus: *Linoproductus* C h a o, 1927

Linoproductus lineatus (W a a g e n), 1884

PI. 9, figs. 9 a-c

1884. ***Productus*** *lineutus,* Waagen, p. 673, pi. 66, figs. 1—2; pi. 67, fig. 3
1902. *Productus lineatus,* Tschernyschew, p. 284, pi. 48, fig. 4
1903. *Productus lineatus,* Diener, p. 138, pi. 7, fig. 1
1905. *Productus lineatus,* Stuckcnbcrg, p. 72, pi. 8, fig. 2
1913. *Productus lineatus,* M a n s u y, p. 36, pi. 2, fig. 15; pi. 3, fig. 1
1927. *Linoproductus lineatus,* Chao, p. 129, pi. 15, figs. 25—27
1931. *Linoproductus (Linoproductus) lineatus,* Heritsch, p. 16, pi. 4, figs. 117—120
1931. *Productus (Linoproductus) lineatus,* Grabau, p. 293, pi. 29, figs. 25—27
1935. *Linoproductus lineatus,* Si mac, p. 142
1940. *Linoproductus lineatus,* Simic, p. 92
1958. *Linoproductus lineatus lineatus,* Ramovs, p. 515, pi. 6, fig. 1; pi. 7, fig. 1; pi. 8, fig. 1

Material: 1 pedicle valve, GPZ 1258, Crne grede.

Measurements:			
	pedicle valve length	45.0	mm
	surface length	79.9	m m
	total width	37.7	mm

Description: Pedicle valve swollen, evenly convex. Umbo prominent, incurved, projecting beyond hinge line. Umbonal and anterior portions almost parallel. Flanks steep. Ears small, convex, clearly demarcated. Lateral commissures slightly concave, anterior commissure arcuate.

Pedicle valve ornament of fine, closely placed costellae and quincuncially arranged minute spine scars.

Occurrence: This species was widespread in the Upper Carboniferous and the Permian of USSR, Mongolia, China and Indochina. It was also found in the Upper Carboniferous of Lika and NW Bosnia and the Upper Permian of Slovenia.

Discussion: W a a g e n ' s specimens from the Permian of the Himalayas are somewhat larger, with larger ears and expressed lineation.

Linoproductus sp.

PI. 9, figs. 10 a-c

Material: 1 pedicle valve, GPZ 1259, Crne grede.

Measurements:			
	pedicle valve length	33.1	mm
	surface length	50.8	mm
	total width	31.6	mm
	area width	23.2	mm

Description: Pedicle valve thick, evenly convex, suboval in outline. Lateral and anterior commissures evenly rounded; posterior margin straight. Umbo prominent, incurved, extending to hinge line. Flanks steep, concave in posterior portion.

Pedicle valve ornament of fine evenly spaced costellae (3—4 in 1 mm), well expressed on flanks.

Discussion: Our specimen differs from *L. cora* (d'Orbigny) which was widespread in the Upper Carboniferous and the Permian in wider shells, spreading flanks and higher convexity.

Suborder: Oldhaminidina Williams, 1953
Superfamily: Lyttoniacea Waagen, 1883
Family: Lyttoniidae Waagen, 1883
Genus: *Keyserlingina* Tschernyschew, 1902

Keyserlingina filicis velebitica n. subsp.
Pl. 10, figs. 3 a-b, 4 a-c, 5, text-fig. 7

? 1900. *Oldhamina* ? cf. *filicis,* Schellwien, p. 62, pi. 9, figs. 19—22

Derivatio nominis: Subspecies has been named for the Velebit Mts. in which it was found. In Salopek's notes it was described as *K. filicis velebitana.*

Diagnosis: Small, cap-like shells, varied in shape and size, attached by umbonal region. Median lobe narrow; lateral lobes prominent, spreading from umbo.

Locus typicus: Crne grede, Baske Ostarije.

Stratum typicum: Lense of dark, bituminous limestone interbedded within the productoid limestone, Middle Permian, Murghabian.

Holotypus: GPZ 1260, pi. 10, figs. 4 a—c, text-fig. 7/1.

Paratypus: GPZ 1262, pi. 10, fig. 5, text-fig. 7/2.

Material: 36 specimens, primarily in fragments (GPZ 1260—1264), Crne grede.

			holotype GPZ 1260	
Measurements:	pedicle valve length	15.3 — 31.6	23.9	mm
	total width	13.7 — 23.1	18.0	mm
	thickness	12.9 — 19.3	18.6	mm

Description: Pedicle valve conical to cylindrical, varied in size. Posterior portion flat to slightly concave. Umbo commonly blunt. Cicatrix of attachment smooth, striated with concentric lines, or covered with unevenly scattered knots, or knots on parallel ridges (pi. 10, fig. 5, text-fig. 7/2 c). Cicatrix ornament depending on base of attachment (other shells, bryozoan branchlets). Median lobe narrow; lateral lobes (3—5 in number) spreading anteriorly at angle 40—60°. Lateral lobes in umbonal portion damaged by attachment, in anterior portion covered with prominent rugae. Rugae uneven, sometimes bifurcating, well expressed on posterior flat portion of valve, and near anterior margin.

Occurrence: K. filicis has been up to date known only from the Lower Permian of the Ural Mts. (Tschernyschew 1902, p. 474, pi. 42, figs. 16—17) and Trogkofel beds from Trzic (Dolzanova soteska) with small number (c. 10) of specimens.

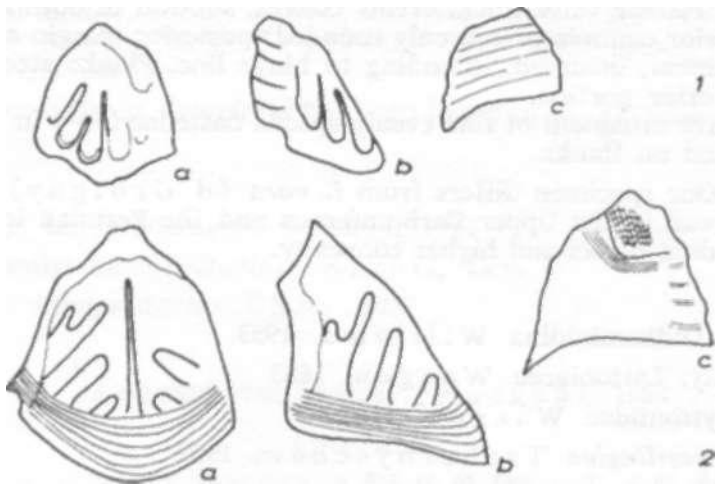

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Fig. 7. *Keyserlingina filicis velebitica* n. subsp.
1. (a) ventral, (to) lateral and (c) dorsal side of the holotype, GPZ 1260.
2. (a) ventral, (b) lateral and (c) dorsal side of the paratype, with evenly ornamented cicatrix of attachment, GPZ 1262.

SI. 7. Keyserlingina filicis velebitica n. subsp.
1. (a) yentralna, (b) bočna i (c) dorzalna strana holotipa, GPZ 1260.
2. (a) ventralna, (b) bočna i (c) dorzalna strana paratipa s pravilno skulpturiranim cikatriksom pričvr.ićenja, GPZ 1262.

Discussion: Specimens from the Ural Mts. are more oval in shape, with shorter posterior portion, and lateral lobes almost perpendicular to median septum, or spreading. Specimens from the Karavanke Mts. are more similar in shape, but smaller, and with wider median lobe.

Genus: *Leptodus* Kayser in Richthofen, 1882
(= *Lyttonia* Waagen, 1883)

Leptodus nobilis (Waagen), 1883

PI. 10, figs. 1 a-b, 2

1883. *Lyttonia nobilis,* Waagen, p. 398, pi. 29, figs. 1—3; pi. 30, figs. 1, 2, 5, 6, 8
1899. *Lyttonia nobilis,* Ddener, p. 99, pi. 10, fig. 15
1905. *Lyttonia nobilis,* Noething, p. 140, pi. 17, figs. 1—2; pi. 18, figs. 1—11
1913. *Lyttonia richthofeni* Kayser var. *nobilis,* Bukowski, p. 11—12
1913. *Lyttonia nobilis,* Mansuy, p. 123, pi. 13, fig. 10
1914. *Lyttonia nobilis,* Mansuy, p. 32, pi. 6, fig. 7; pi. 7, fig. 1
1924. *Lyttonia nobilis,* Albrecht, p. 289, pi. 1, fig. 1
1930. *Lyttonia nobilis,* de Gregorio, p. 30
1931. *Lyttonia nobilis,* Simic, p. 116
1931. *Lyttonia nobilis,* Grabau, p. 285, pi. 28, figs. 3—6
1932. *Lyttonia nobilis,* Sdmic, p. 25
1932. *Lyttonia nobilis,* Huang, p. 89, pi. 7, figs. 9—10; pi. 8, figs. 8—9; pi. 9, figs. 1—8
1933. *Lyttonia nobilis,* Huang, p. 93, pi. 11, fig. 22
1933. *Lyttonia Richthofeni* Kayser var. *nobilis,* Parona, p. 12, figs. 10—18
1933. *Lyttonia nobilis,* Simic, p. 49, pi. 4, fig. 1
1934. *Lyttonia nobilis,* Solignac & Berkaloff, p. 10
1958. *Leptodus nobilis,* Ramov§, p. 497, pi. 2, fig. 3; pi. 10, fig. 3
1963. *Leptodus* cf. *nobilis,* Stojanovic-Kuzenko, p. 170, pi. 4
1963. *Leptodus nobilis,* Schreter, p. 107, pi. 3, figs. 5—8
1965. *Peptodus nobilis,* Ruzentsev & Sarytcheva, pi. 39, figs. 6—8
1976. *Leptodus nobilis,* Grant, p. 162, pi. 43, figs. 18—19

Material: 40 specimens, predominantly in fragments, GPZ 1265—1267, Crne grede; 1 specimen from 1001, GPZ 1268; 1 specimen from shale near 734, Brusane, GPZ 1269; 1 specimen from spotted dolomite beside the road Gospic — Karlobag, near Paripov jarak trench, GPZ 1270.

Measurements:			
	pedicle valve length	25.0 — 92.8	mm
	total width	28.1 — 51.1	mm
	thickness	4.5— 8.7	mm

Description: Shell large, elongate-oval. Shell morphology depending on rate of growth and base of attachment (high rate of growth produces pear-shaped shells). Shell attached by underside of pedicle valve. Cicatrix of attachment large, unevenly oval, often with oval scars. Flanks steep, subvertical.

Pedicle valve ornament of prominent growth lines. Endopuncta appearing on moulds.

Septal plate with two parallel sub median lobes. Space between median lobes partitioned into segments. Lateral lobes long, narrow, with parallel sides and rounded distal ends; lateral lobes perpendicular to median lobe, distal ends slightly incurving towards umbo, especially in umbonal portion. Lobes covered with evenly spaced tubercles (10—11 in 10 mm). Lobe width (2.5—3 mm) and interspace (c. 1 mm) similar in all specimens. Number of septal pairs 10 in 30 mm length. Larger specimen with more than 27 septa. Puncta obscure, larger and less expressed than in type specimens.

Occurrence: L. nobilis was widespread in the Permian seas. It was described from India, Pakistan, Mongolia, China, Japan, Indochina, Tunisia, USSR, Italy, North America and Yugoslavia (Slovenia, Croatia, W. Serbia, Montenegro).

Discussion: Type specimens from the Permian of Pakistan have different punctation, more interspaced septae and have no tubercles on lateral lobes. Tubercles are well expressed on specimens from the Upper Permian of China (Grabau 1932, p. 85, pi. 7, fig. 10; pi. 9, figs. 1^) and Hungary (Schreter 1963, p. 107, pi. 3, fig. 5).

3.3. Order: Spiriferida Waagen, 1883
Suborder: Athyrididina Johnson & Staton, 1964
Superfamily: Athyridacea M'Coy, 1844
Family: Athyrididae M'Coy, 1844
Subfamily: Athyridinae M'Coy, 1844
Genus: *Spinger ella* Waagen, 1883

Spirigerella sp.
Pl. 12, figs. 3 a^b

Material: 1 damaged specimen, 1 pedicle valve, GPZ 1271—1272, Crne grede.

Measurements:		GPZ 1271	GPZ 1272	
	pedicle valve width	24.3	25.2	mm
	area width	7.2	?	mm

Description: Shell medium, elongately-oval.

Pedicle valve moderately convex. Umbo swollen, almost perpendicular to visceral portion, projecting much above hinge line. Greatest thickness in posterior region, anterior portion almost flat. Flanks steep, concave near umbo, spreading anteriorly.

Brachial valve partly preserved, oval, evenly convex, with prominent beak. Dorsal area covered with ventral umbo.

Shell ornament of thin, rounded, widely spaced striae. Interspaces shallow, flat, equally wide (c. 0.4 mm). Obscure, low, uneven rugae appear in posterior 1/3 of one specimen.

Discussion: Subspecies S. *derbyi kweichowensis* Grabau from the Lower Permian of China (Grabau 1934, p. 113) is similar in shape and size, but with smooth shell surface.

Suborder: Spiriferidina Waagcn, 1883

Superfamily: Reticulariacea Waagen, 1883

Family: Elythidae Fredericks, 1919 (1924)

Genus: *Phricodothyris* George, 1932

Phricodothyris dispar (Diener), 1911

Pl. 16, figs. 1 a-e

1911. *Martinia dispar,* Diener, p. 4, pi. 1, fig. 1

Material: 1 damaged specimen, GPZ 1273, 1001, Baske OStarije.

Measurements:			
	pedicle valve length	34.9	mm
	total width	44.5	mm
	area width	25.0	mm
	brachial valve length	34.2	mm
	thickness	21.0	mm

Description: Shell transversely oval, rather large and extremely wide.

Pedicle valve partly damaged, evenly moderately convex. Umbo not preserved. Hinge line rather short. Sulcus V-shaped, shallow and narrow, more prominent in anterior portion. Anterior commissure with short tongue. Flanks spreading.

Brachial valve slightly convex in umbonal and median portion, anterior concave. Umbo slightly projecting above hinge. Inconspicuous fold in anterior portion.

Microornament of fine growth lines, well expressed near anterior margin and on flanks. Minute spine scars partly preserved along growth lines.

Discussion: One single specimen which was found to date in the Permian of the Himalayas shows no spine scars, probably because the upper shell layer was destroyed by weathering (Diener 1911, p. 4). Similar form appears among the specimens of *Martinia triquetra* Gemmellaro described by Tschernyschew (1902, p. 178), while the type specimens of the same species from the Permian of Sicily (Gemmellaro 1899, p. 171) show no similarity with our specimens.

Phricodothyris sp.

PI. 15, figs. 4 a-c

Material: 1 pedicle valve, GPZ 1274, Crne grede.

Measurements:			
pedicle valve length	17.6	mm
surface length	22.4	mm
total width	17.2	mm

Description: Pedicle valve of medium size, rhomb-shaped. Umbo prominent, acute, incurved. Greatest convexity in umbonal portion. Flanks steep, concave near umbo, spreading anteriorly. Sulcus originating as flattening on visceral disc, increasing in width and depth anteriorly. Anterior commissure with wide, short tongue. Area narrow, badly preserved.

Pedicle valve ornament of numerous growth-lines, with obscure spine scars. Wide rugae, more prominent in visceral portion, indicating irregular growth. Shell anterior with very fine radial capillae.

Discussion: Species *Martiniopsis orientalis* Tschernyschew from the Upper Carboniferous of the Ural Mts. is similar in shape and size, but less elongate, more deeply sulcate, and with obscure rugae (Tschernyschew 1902, p. 172).

Family: Martinidae Waagen, 1883

Genus: *Martinia* M'Coy, 1844

Martinia cf. *orbicularis* Gemmellaro, 1899

PI. 14, figs. 3 a-c

1899. *Martinia orbicularis,* Gemmellaro, p. 165, pi. 33, figs. 16—22
1902. *Martinia orbicularis,* Tschernyschew, p. 185, pi. 17, figs. 1—3, 14
1911. *Martinia orbicularis,* Diener, p. 6, pi. 3, fig. 1
1934. *Martinia orbicularis,* Solignac & Berkaloff, p. 13
1938. *Martinia orbicularis,* Heritsch, p. 85, pi. 3, fig. 17
1938. *Martinia orbicularis,* Simic, p. 145

Material: 2 pedicle valves, 1 brachial valve, GPZ 1275—1276, Milasnovac.

Measurements:		GPZ 1276	GPZ 1275	
pedicle valve length	23.6	15.7	mm
total width	22.9	16.4	mm
surface width	30.0	22.8	mm
area width	10.9	3.8	mm
area height	3.8	1.2	mm
di'llhyrium width	8.1	?	mm

Description: Pedicle valve small, oval to almost circular in outline, moderately convex. Umbo prominent, acute, slightly incurved, projecting high above hinge line. Flanks concave near umbo, anteriorly spreading. Angle of beak ridges 92°. Greatest thickness in umbonal portion. No sulcus. Ventral interarea catacline, high, with wide delthyrium.

Brachial valve less convex, oval, with short umbo. Convexity even; no fold.

Upper shell layer partly preserved, with numerous fine, closely placed growth-lines, especially in anterior portion. Costellae obscure, appearing on pedicle valve only, narrow, round-shaped, unevenly widely spaced.

Occurrence: M. orbicularis has been found in the Permian of Tunisia, the Himalayas, China and Slovenia (Bohinjska Bela), as well as in the Upper Carboniferous of the Ural Mts. and Montenegro (Veli Kr§).

Discussion: G e m m e l l a r o ' s specimens from the Permian of Sicily are larger, obscurely sulcate, with more spaced growth-lines.

Martinia velebitica n. sp.

PI. 11, figs. 1 a-e, 2; pi. 12, figs. 1 a-e, 2; pi. 13, figs. 1 a-e; pi. 14, figs. 1 a-e, 2 a-e; pi. 15, Tigs. 1 a-e, 2 a-e, text-figs. 8, 9

Derivatio nominis: Species is named for the Velebit Mts. where it was found. The late Professor S a 1 o p e k in his notes named this form: *»Spirifer velebitanus«, »Brachythyrina velebitana«* and *»Martinia velebitana«.*

Diagnosis: Very large, triangularly oval, markedly biconvex *Martinia.* Microornament of obscure growth-lines and costellae. No macroornament. Ventral interarea highly triangular; delthyrium wide, open. Spiralia perpendicular to commissural plane.

Locus typicus: Milasnovac, beneath the point 820, Brusane.

Stratum typicum: Block of black limestone, Middle Permian, Murghabian. The block was destroyed by an explosion in 1936, but fragments with brachiopod fauna can still be found below the point 820. This species also occurs at three other localities.

Holotypus: GPZ 1277, pi. 11, figs. 1 a—e.

Paratypes: GPZ 1279, pi. 12, figs. 1 a—e; GPZ 1281, pi. 13, figs. 1 a—e.

Material: C. 100 more or less well preserved specimens from Milasnovac, GPZ 1277—1287; 23 specimens from the road section near Paripov jarak, GPZ 1288; 12 specimens from Crne grede, GPZ 1289; 4 specimens from the point 1001, GPZ 1290. About 50 specimens are completely preserved, while the others appear in fragments.

			holotype GPZ 1277	
Measurements.	**pedicle valve length**	**31.0 — 79.0**	**62.6**	**mm**
	total width	**38.5 — 86.7**	**69.0**	**mm**
	surface width	**51.5 — 1192**	**90.2**	**mm**
	area width	**17.5 — 55.9**	**42.6**	**mm**
	rirvvi **hftiphl 7 0**	**— 14.1**	**14.1**	**mm**
	delthyrium width	**8.1 — 21.8**	**21.8**	**mm**
	brachial vallve length	**28.9 — 58.7**	**51.0**	**mm**
	dorsal surface width	**44.1 — 91.0**	**84.9**	**mm**
	length/width	**0.85 1.0**	**0.9**	**mm**
	thickness	**23.0 — 51.1**	**43.9**	**mm**

Description: Shells large, smooth, markedly biconvex, triangularly-oval in outline. Length/width ratio varied.

Pedicle valve highly convex, variably wide, but often equidimensional. Umbo massive, incurved, projecting high above hinge line, but not reaching plane of commissure. Apical angle 60—90°, in most cases c. 75°. Umbonal slopes steep, sometimes concave. Hinge line variably wide, but always shorter than maximum shell width. Greatest thickness in most cases in visceral portion or near umbo. Convexity curve regular. Sulcus shallow, narrow, originating anterior to umbo, increasing in width and

depth anteriorly. Elongate specimens usually bearing well marked sulcus, with tonguelike extension on anterior commissure (pi. 13, fig. 1 e, text-fig. 8 c). Specimens with obscure sulcus almost without tongue (pi. 15, fig. 2 e, text-fig. 8 a).

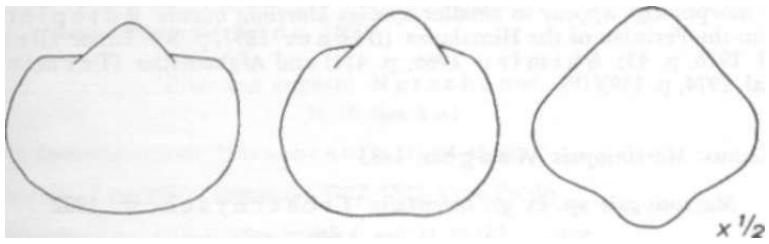


Fig. 8. *Mai tinta velebitica* n. sp. Different shape of the pedicle valve.

SI. *8. Martinia velebitica n. sp. Različiti oblici ventralne ljuske.*

Ventral interarea highly triangular, strongly striated parallel to hinge line (pi. 14, fig. 1 d), or perpendicular to hinge (pi. 12, fig. 1 d). Area often straight and almost perpendicular to plane of commissure, but in some shells shallowly concave or oblique. Delthyrium triangular, sometimes rather wide, in adult shells straitened, demarcated by pair of narrow triangular plates.

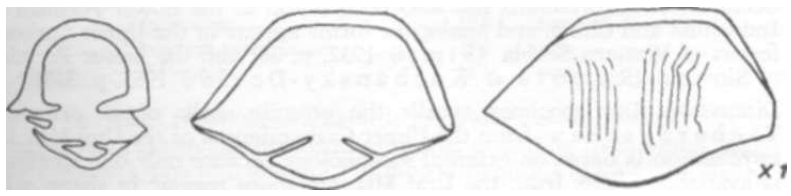
Pedicle valve surface almost smooth. Microornament of fine growth-lines and unevenly spaced costellae. Costellae on flanks closely placed; rounded and narrower than intercostae on midvalve. Number of costellae 8 in 10 mm width on median portion of shell.

Moulds with marked mantle canals, narrowly bifurcating in anterior portion (pi. 15, figs. 1 b, 2 b).

Brachial valve less convex, transversely-oval. Convexity curve even, greatest thickness at midvalve. Umbo slightly projecting above hinge line. Median fold visible near anterior margin, in some shells originating at umbo, or lacking. Specimens with tongue resupinate anteriorly.

Brachial valve ornament same as in pedicle valve.

A pair of short, wide, diverging strips extending 1/3 shell length appear on both sides of dorsal beak (pi. 12, fig. 2), but sectioning of several specimens showed spiralia as only internal skeleton element (pi. 11, fig. 2, text.-fig. 9). Spiralia composed of c. 10 curves more or less perpendicular to plane of commissure.



Ftg. 9. *Martinia velebitica* n. sp. Trartsverse serial sections of a complete specimeri, GPZ 1286.

SI. 9. Martinia velebitica n. sp. Serijski presjeci kroz čitav primjerak, GPZ 1286.

Discusión: Specimens from the Velebit Mts. are extremely large. Rather similar species *Spirifer sokolovi* Tschernyschew from the Upper Carboniferous of the Ural Mts. (Tschernyschew 1902, p. 166) and Productus-limestones of Cambodia (Mansuy 1913, p. 70) is smaller, less convex, with almost vertical area and no tongue. Smooth shells and similar morphology appear in smaller species *Martinia nucula* Rothpletz from the Permian of the Himalayas (Diener 1897, p. 50), Timor (Broili 1916, p. 43; Shimizu 1966, p. 414) and Afghanistan (Termier et al. 1974, p. 139).

Genus: *Martiniopsis* Waagen, 1883

Martiniopsis sp. ex gr. *orientalis* Tschernyschew, 1902
Pl. 15, figs. 3 a-d

!902. *Martiniopsis orientalis,* Tschernyschew, p. 172, pi. 19, figs. 7—12
1905. *Martiniopsis orientalis,* Stuckenberg, p. 52
1913. *Martiniopsis,* Mansuy, p. 79, pi. 8, fig. 15
1934. *Martiniopsis orientalis,* Grabau, p. **94,** pi. 6, figs. 10—11

Material: 1 complete specimen, GPZ 1291, Crne grede.

Measurements:			
	pedicle valve length	25.2	mm
	total width	26.3	mm
	surface width	37.5	mm
	area width	20.0	mm
	brachial valve length	23.0	mm
	dorsal surface width	32.0	mm
	thickness	18.0	mm

Description: Shell biconvex, rectangular in outline.

Pedicle valve strongly convex. Umbo acute, prominent, projecting high above hinge line, strongly incurved. Apical angle 67°. Interarea wide, longitudinally and transversely striated. Flanks steep, concave at umbo, spreading anteriorly. Hinge line straight, almost as wide as widest median portion. Lateral commissure perpendicular to hinge and anterior commissure. Umbonal and visceral portions triangularly-oval, evenly convex, with fine, growth-lines. Anterior portion rectangular, with step-like growth lines indicating irregular growth. Sulcus very narrow, shallow, obscure, extending from visceral portion, somewhat asymmetrically placed.

Brachial valve weakly convex, almost flat, rectangularly-oval in outline. Umbo minute, flanks spreading; no fold. Rate of growth as in pedicle valve.

Shell microornament of fine radial striae and growth lines, irregular in anterior portion.

Occurrence: M. orientalis has also been found in the Lower Permian of Indochina and China, and analogous forms appear in the Upper Carboniferous of Western Serbia (Simic 1932, p. 20) and the Lower Permian of Slovenia (Ramovs & Kochansky-Devide 1965, p. 365).

Discussion: Our specimen recalls the juvenile shells of *M. orientalis* Tschernyschew from the Upper Carboniferous of the Ural Mts. Determination is based on external morphology because only one specimen is available. Shells from the Ural Mts. are more regular in shape, with steeper interarea and more prominent sulcus and fold. Rectangular shells appear in *Martinia rectangularis* Grabau from the Permian of Mongolia (Grabau 1931, p. 189), but *M. rectangularis* is smaller, more oval in shape and with umbo less incurved.

3.4. Order: Terebratulida W a a g e n, 1883
Suborder: Terebratulidina W a a g e n, 1883
Superfamily: Dielasmatacea S c h u c h e r t, 1913
Family: Dielasmatidae S c h u c h e r t, 1913
Genus: *Dielasma* K i n g, 1859

Dielasma angusta N e t s c h a e w, 1911
PI. 10, figs. 6 a-f

1911. *Dielasma augusta,* Netschaew, p. 111, pi. 15, fig. 2

Material: 1 complete specimen, GPZ 1292, Crne grcde.

Measurements:			
	pedicle valve length	12.5	mm
	total width	5.1	mm
	brachial valve length	11.4	mm
	thickness	3.4	mm

Description: Shells small, elongate, drop-like, with greatest width in anterior portion.

Pedicle valve evenly convex; flanks steep, spreading anteriorly. Umbo prominent, with large circular foramen.

Brachial valve less convex, regular in shape.

Both valves with fine growth-lines; several lines more prominent, producing a »stair« on visceral/anterior border.

Discusión: Type specimens from USSR, Kazanian in age, are somewhat larger. Similar species *D. elongatum* S c h l o t h e i m i s wider and sulcate. *D. elongatum* is common in the Upper Carboniferous and the Permian sediments of USSR (Netschaew 1911, p. 109), China (Grabau 1936, p. 278), Mongolia (Grabau 1931, p. 72) and Greenland (Dunbar 1955, p. 177). It has also been found in Yugoslavia in Trogkofel beds from Ortnek (Ramovs & Kochansky-Devidé 1965, p. 48).

Dielasma cf. *plica* K u t o r g a, 1842
PI. 10, figs. 7 a-c

1902. *Dielasma plica,* Tschcrnyschew, p. 34, pi. 2, figs. 3, 4; pl. 4, figs. 5—7
1903. *Dielasma plica,* Diener, p. 44, pl. 2, fig. 2
1905. *Dielasma plica,* Stuckenberg, p. 32
1960. *Dielasma plica,* Ramovs, p. 187

Material: 1 partly damaged sepcimen, GPZ 1293, Crne grede.

Measurements:			
	pedicle valve length	19.5	mm
	total width	15.8	mm
	brachial valve length	18.6	mm
	thickness	11.3	mm

Description: Shell medium, elongate, triangularly-oval in outline.

Pedicle valve evenly convex. Shallow sulcus extending from umbo, markedly increasing in width anteriorly. Umbo with elliptical foramen; flanks convex.

Brachial valve markedly convex, triangularly-oval in cross section. Flanks steep, umbo between flanks 75°.

Microornament of fine growth-lines.

Occurrence: Except in USSR similar forms have been found in the Permian of the Himalayas, Dolomite Mts. (M e r 1 a 1930, p. 75) and Vitanjski niz in Slovenia (R a m o v S, 1960, p. 187).

Discussion: Specimens described by T s c h e r n y s c h e w from the Upper Carboniferous of the Ural Mts. are smaller, with deeper and narrower sulcus.

Family: Noto thy rididae L i k h a r e v, 1960

Genus: Notothyris W a a g e n, 1882

Notothyris cf. *mediterranea* (G e m m e 11 a r o), 1899

Pl. 10, figs. 9 a-d

1899. *Rostranteris méditerraneum,* Gem mei laro, p. 108, pl. 26, figs. 1—6; pl. 27, fig. 59

1903. *Notothyris mediterranea,* Dieneir, p. 38, pl. 2, figs. 14, 15; p. 94, pl. 3, fig. 14

1912. *Notothyris mediterranea,* Yakovlev, p. 16, pl. 5, figs. 16—18

Material: 1 complete specimen, 3 pedicle valves, GPZ 1294, 1295, Crne grede.

		GPZ 1294
Measurements:	pedicle valve length	6.4 — 7.4 mm
	total width	5.2 — 6.1 mm
	brachial valve length	6.1 mm
	thickness	4.5 mm

Description: Shell small, biconvex, elongately-pentagonal in outline. Umbo prominent, incurved; foramen wide, oval.

Pedicle valve evenly and moderately convex, with 4 low, wide folds separated by shallow, narrow interspaces. In one specimen 2 median folds converging and joining into one median fold. Umbonal portion smooth.

Brachial valve with 3 prominent radial folds extending from umbo.

Microornament of very fine growth-lines.

Discussion: Type specimens from Sicily are somewhat larger, with dorsal fold not extending towards umbo. Similar shell ornament appears in species *N. exilis* (G e m m e 11 a r o), also from the Permian of Sicily (G e m m e l l a r o 1899, p. 107), Himalayas (D i e n e r 1903, p. 39) and Karavanke Mts. (S c h e l l w i e n 1900, p. 103), but it is larger in size, more rounded in outline, with fold on brachial valve near the anterior margin only.

Superfamily: Cryptonellacea T h o m s o n, 1926

Family: Cryptonellidae T h o m s o n, 1926

Genus: *Texarina* C o o p e r & G r a n t, 1976

Texarina parallela C o o p e r & G r a n t, 1976

Pl. 10, figs. 8 a-d

1976. *Texarina parallela,* Cooper & Grant, p. 2834, pl. 764, figs. 64—68

Material: 2 complete specimens, GPZ 1296—1297, Crne grede.

LIST OF THE MIDDLE PERMIAN BRACHIOPODS FROM VELEBIT AND LIKA / POPIS BRAHIOPODA SREDNJEG PERMA VELEBITA I LIKE — FINDING PLACES OF PERMIAN BRACHIOPODS / NALAZIŠTA PERMSKIH BRAHIOPODA	EUROPE – EVROPA: YUGOSLAVIA – JUGOSLAVIJA: VELEBIT MT.: CRNE GREDE	VELEBIT MT.: MILAŠNOVAC	VELEBIT MT.: + 1001	VELEBIT MT.: ROAD SECTION / UZ CESTU	SLOVENIA / SLOVENIJA	BOSNIA / BOSNA	W. SERBIA / Z. SRBIJA	MONTENEGRO / CRNA GORA	EUROPE – EVROPA: GREENLAND – SPITZBERGEN	GREAT BRITAIN / VEL. BRITANIJA	ITALY / ITALIJA	GREECE / GRČKA	HUNGARY / MADŽARSKA	USSR / SSSR	ASIA – AZIJA: AFGHANISTAN / AFGANISTAN	PAKISTAN (SALT RANGE)	MONGOLIA – HIMALAYA / MONGOLIJA – HIMALAJA	CHINA / KINA	INDOCHINA / INDOKINA	JAPAN	INDONESIA / INDONEZIJA	AMERICA – AMERIKA: S. AMERICA / J. AMERIKA	N. AMERICA / S. AMERIKA	AFRICA: TUNISIA – W. SAHARA / TUNIS – Z. SAHARA	AUSTRALIA	CARBONIFEROUS: LOWER – DONJI	CARBONIFEROUS: UPPER – GORNJI	PERMIAN: LOWER – DONJI	PERMIAN: UPPER – GORNJI
1. Enteletes microplocus Gemmelaro	+	+									+													+					
2. E. salopeki n. sp.	+	+	+																										
3. Orthotichia derbyi (Waagen)	+	+	+		+											+	+	+											
4. O. magnifica Grabau		+																+											
5. Plicatoderbya sp. (n. sp.?)		+																											
6. Ramovsina likana n. gen, n. sp.	+																												
7. Sphenosteges sp. (n. sp.?)		+																											
8. Sphenosteges sp.	+																												
9. Spyridiophora reticulata (King)	+																						+						
10. S. cf. compacta Cooper & Grant	+																						+						
11. Tschernyschewia cf. typica lata Simić	+				+		+	+					+	+		+		+											
12. Megatschernyschewia longiseptata longiseptata n. gen., n. sp., n. subsp.	+																												
13. Megatschernyschewia longiseptata transversa n. gen., n. sp., n. subsp.	+																												
14. Megatschernyschewia kochanskae n. gen., n. sp.	+																												
15. Megatschernyschewia sp. (n. sp.?)	+																												
16. Megatschernyschewia sp.	+																												
17. Krotovia wallaciana (Derby)	+													+								+							
18. Marginifera magniplicata (Huang)	+	+							+					+				+											
19. Paramarginifera himalayensis (Diener)	+				+									+			+												
20. P. cf. himalayensis (Diener)	+																												
21. Liosotella sp. (n. sp.?)		+																											
22. Waagenoconcha cf. gangetica (Diener)	+																+												
23. Waagenoconcha sp. (n. sp.?)	+																												
24. Tyloplecta sp.	+																												
25. Linoproductus lineatus (Waagen)	+				+	+								+		+	+	+	+	+	+	+	+	+	+				
26. Linoproductus sp.	+																												
27. Keyserlingina filicis velebitica n. subsp.	+																												
28. Leptodus nobilis (Waagen)	+			+	+		+	+			+	+	+	+		+	+	+	+	+			+	+					
29. Spirigerella sp.	+																												
30. Phricodothyris dispar (Diener)			+														+												
31. Phricodothyris sp.	+																												
32. Martinia cf. orbicularis Gemmelaro		+			+			+			+			+			+	+						+					
33. M. velebitica n. sp.	+	+		+																									
34. Martiniopsis sp., ex. gr. orientalis Tschernyschew	+																												
35. Dielasma angusta Netschaew	+													+															
36. D. cf. plica Kutorga	+										+			+			+												
37. Notothyris cf. mediterranea (Gemmelaro)	+										+			+			+		+		+								
38. Texarina parallela Cooper & Grant	+																						+						

LEGEND: / LEGENDA:

+ Finding place of the species / Nalazište vrste

Geographic distribution of the genus / Geografska rasprostranjenost roda (after Moore, 1965 / prema Moore, 1965)

— Stratigraphic range of the species / Stratigrafski raspon vrste

Stratigraphic range of the genus / Stratigrafski raspon roda (after Moore, 1965 / prema Moore, 1965)

TABLE 1.
TABELA 1.

		GPZ 1296	GPZ 1297	
Measurements:	pedicle valve length	15.0 —	15.2	mm
	total width	13.5 —	9.9	mm
	brachial valve length	14.0 —	15.0	mm
	thickness	8.7 —	14.0	mm

Description: Shell small, elongate, subpentagonal in outline. Lateral commissures in one specimen almost parallel, in other one slightly diverging.

Pedicle valve evenly moderately convex. Sulcus extending from umbo, markedly increasing in width and depth anteriorly. Flanks convex, very narrow, closing angle 73—85°.

Brachial valve convex; flanks steep, especially in umbonal portion. Narrow fold bifurcating anteriorly.

Shell surface smooth.

Occurence: T. *parallela* hais to date been found only in the Permian (Word) of West Texas.

4. CONCLUSION

Brachiopod fauna from the area of Brusane and Baske Ostarije in the Velebit Mts. contains 38 different forms, including the new family Ramovsiinidae with *Ramovsina* n. gen. The new genus *Megatschernyschewia* with several new species, as well as two new species of *Enteletes* and *Martinia* and new subspecies of *Keyseiiingina* have been also described. Reef-type community and calm water community can be distinguished. The great number of samples of the new taxa and 12 new species and subspecies point out the endemic character of the fauna.

Most of the genera from Velebit and Lika belong to the indo-armenian type of fauna, which colonized the Upper Palaeozoic tropic and subtropic seas of Europe, Asia and America. Great similarity with Soviet, Himalayan, Chinese and Italian brachiopod faunas has been observed (table 1).

Stratigraphic significance of the Upper Palaeozoic brachiopods is rather small, because the majority of the species occur in the Carboniferous and range to the end of the Permian. Nevertheless, due to their functional morphology, they can be of great help in palaeoenvironmental reconstructions.

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SREDNJOPERMSKI BRAHIOPODI VELEBITA (HRVATSKA, JUGOSLAVIJA)

Na području Brušana i Baških Oštarija u crnim vapnencima srednjeg perma prikupljena je bogata brahiopodna fauna. Opisano je trideset osam različitih oblika, među kojima i jedna nova porodica (Ramovsiinidae) s rodom *Ramovsina,* te novi rod *Megatschernyschewia* s nekoliko novih vrsta. Opisane su i nove vrste rodova *Enteletes* i *Martinia,* kao i nova podvrsta roda *Kejserlingina*. Među oblicima kojima je utvrđena samo generička pripadnost ima također nekoliko novih vrsta koje nisu imenovane jer su primjerci malobrojni ili loše sačuvani (tabela 1).

Za determinaciju većine brahiopoda potrebno je proučiti elemente unutrašnjeg skeleta. U tu svrhu načinjeni su za nove taksone serijski prerezi. Rendgensko snimanje pokazalo se nepodesnim za naše primjerke zbog premalog kontrasta između materijala ljušture i okolnog sedimenta.

Brahiopodi su sabrani na četiri nalazišta, koja se međusobno razlikuju po tipu faune.

U području Milašnovca, kote 1001, kao i na izdanku uz cestu Gospić-Karlobag prevladavaju krupni primjerci debelih ljuštura i često asimetričnog oblika i ornamentacije. Većina vrsta živjela je slobodno, u šupljinama između glavnih grebenotvoraca (Calcispongiae, Brvozoa, vapnenačke alge) zajedno s puževima, školjkašima i glavonošcima. Mjestimično se nalaze i ostrižišta golemih aberantnih školjkaša *Tanchintongia,* kao i koraljne zajednice *(Waagenophyllum* sp). Asimetrične ljušture vjerojatno su posljedica ograničenosti životnog prostora. Fauna je vrlo jednolična, ali obiluje brojem primjeraka (si. 3 i 4). Tako je npr. iz milašnovačkog bloka izvađeno stotinjak primjeraka vrste *Martinia velebitica.*

Za razliku od nalazišta grebenskog tipa, područje Crnih greda je u srednjem permu predstavljalo mirniju marinsku sredinu, koja je omogućila naseljavanje znatno većeg broja brahiopodnih taksona. Veći dio faune čine sitni produktidi, koji su živjeli usidreni bodljama u mulju, a zastupljeni su malim brojem primjeraka. Krupni oblici su redovito spljošteni (npr. *Ramovsina)* i vjerojatno su se održavali na površini muljevitog supstrata pomoću bodlji i široke povlake. Izuzetno brojni oldhaminoidi koji su živjeli prirasli na čvrstoj podlozi, nađeni su u zasebnom sloju.

Većina determiniranih vrsta pripada indo-armenskom tipu faune, što navodi već Salopek (1942), koja je u gornjem paleozoiku naseljavala tropska i suptropska područja Evrope, Azije i Amerike. Najviše sličnih oblika nađeno je u SSSR (Donec, Pamir, Ural, Timan, Armenija), na Himalaji i u Kini, dok među evropskim nalazištima najviše sličnosti pokazuju naslage Sosio sa Sicilije (tabela 1). Srednjopermski vapnenci s brahiopodima nađeni su i na Bledu i Bohinjskoj Beli u Sloveniji, no brahiopodna fauna još nije detaljno obrađena (Kochanskv-Devide & Ramovš 1955, Flugel et al. 1984).

Stratigrafsko značenje gornjopaleozojskih brahiopoda je uglavnom malo jer se većina vrsta javlja već u karbonu, a proteže se do kraja perma. Naprotiv, proučavanje funkcionalne morfologije ljuštura može biti od velike pomoći pri rekonstrukcija okoliša (Sremac, 1986).

PLATE — *TABLA* 1

1. *Enteletes microplocus* G e m m e l l a r o

Ventral (a), dorsal (b), side (c), posterior (d) and anterior (e) views of a complete specimen, x 1.

Venitiralna (a), dorzalna (b), bočna (c), stražnja (d) i prednja (e) strana čitavog primjerka, x 1.

GPZ 1200, Crne grede.

2. *Orthotichia derbyi* (W a a g e n)

Ventral (a), dorsal (b), side (c), posterior (d) and anterior (e) views of a complete specimen, x 1.

Ventralna (a), dorzalna (b), bočna (c), stražnja (d) i prednja (e) strana čitavog primjerka, x 1.

GPZ 1215, Milašnovac.

3. *Orthotichia magnifica* G r a b a u

Ventral (a), dorsal (b), side (c), posterior (d) and anterior (e) views of a specimen, x 1. Enlargement, x 2, of the exterior of the pedicle valve showing the details of ornament (f).

Ventralna (a), dorzalna (b), bočna (c), stražnja (d) i prednja (e) strana primjerka, x 1. Povećanje, x 2, površine ventralne ljuske s detaljima ornamentacije (f).

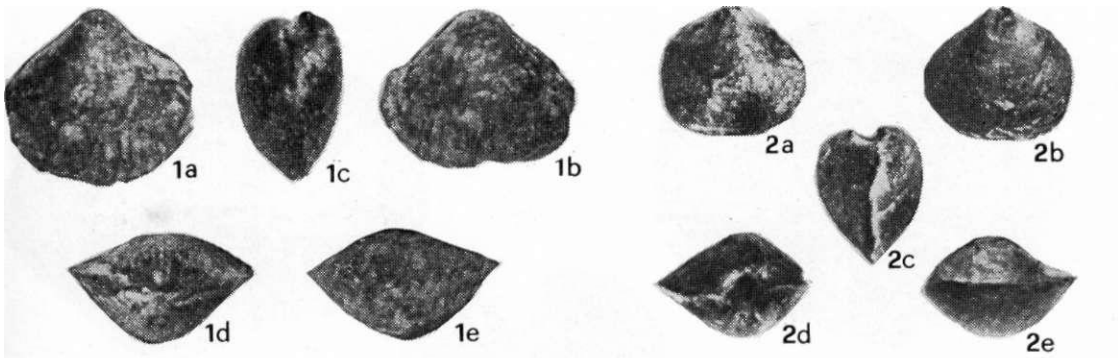
GPZ 1219, Milašnovac.

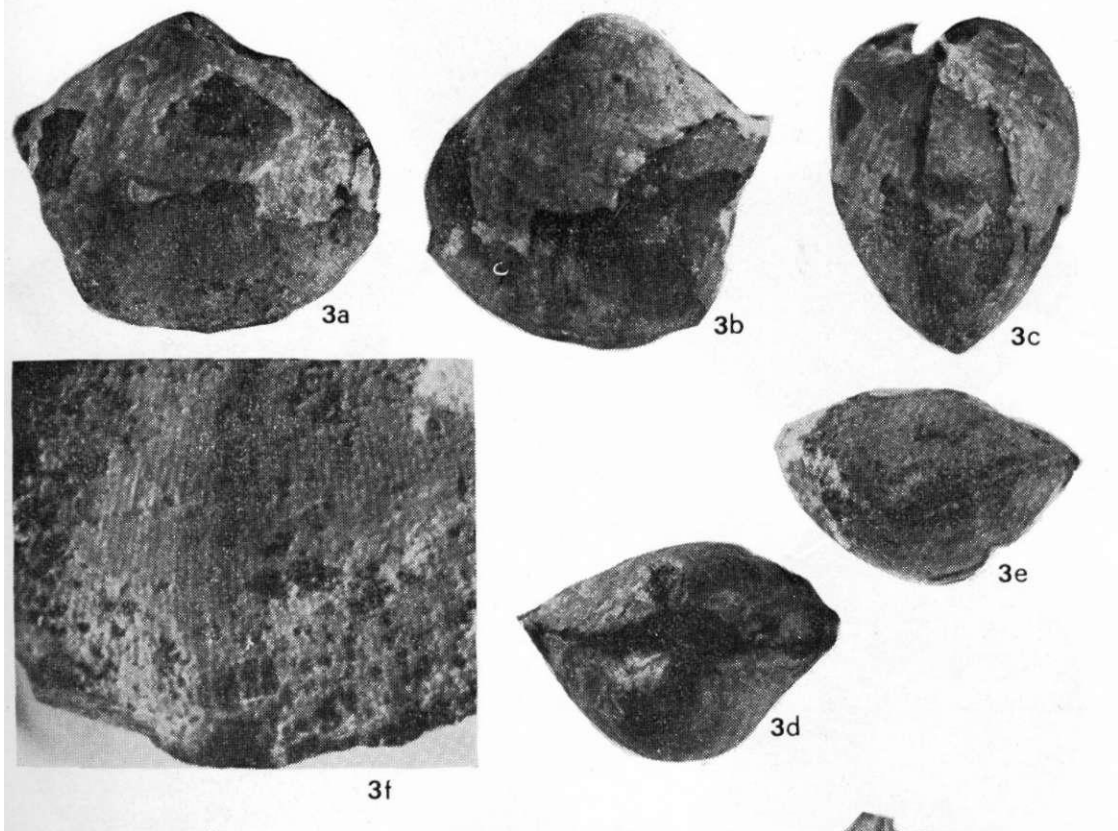
4. *Plicatoderbya* sp. (n. sp. ?)

Ventral (a), dorsal (b), side (c), posterior (d) and anterior (e) views of a specimen, x 1.

Ventralna (a), dorzalna (b), bočna (c), stražnja (d) i prednja (e) strana primjerka, x 1.

GPZ 1221, Milašnovac.


1a
1c
1b
2a
2b
2c
1d
1e
2d
2e


3a
3b
3c
3e
3d
3f

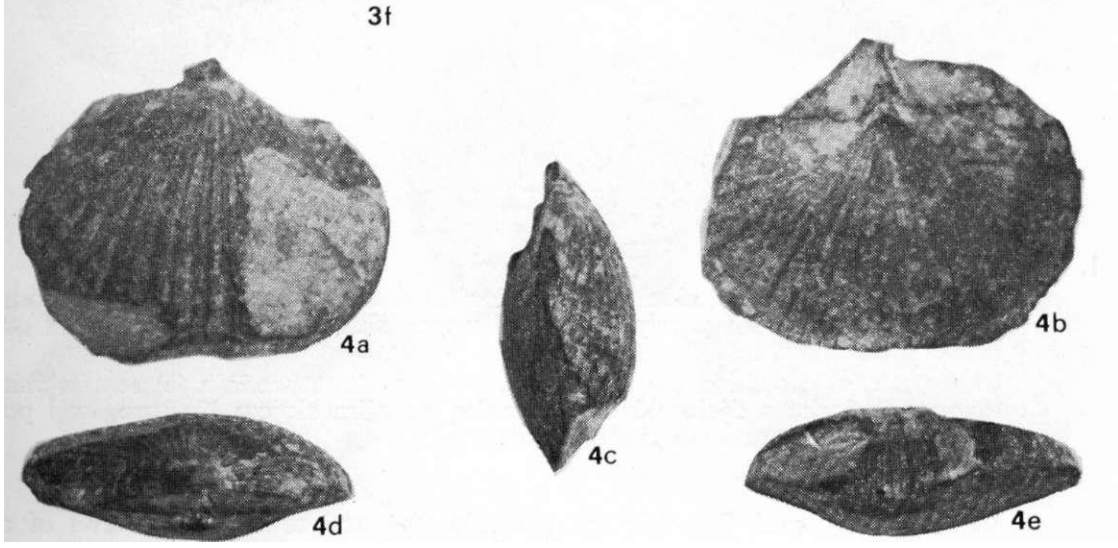

4a
4c
4b
4d
4e

PLATE — *TARLA 2*

1, 2. *Enteletes salopcki* n. sp.

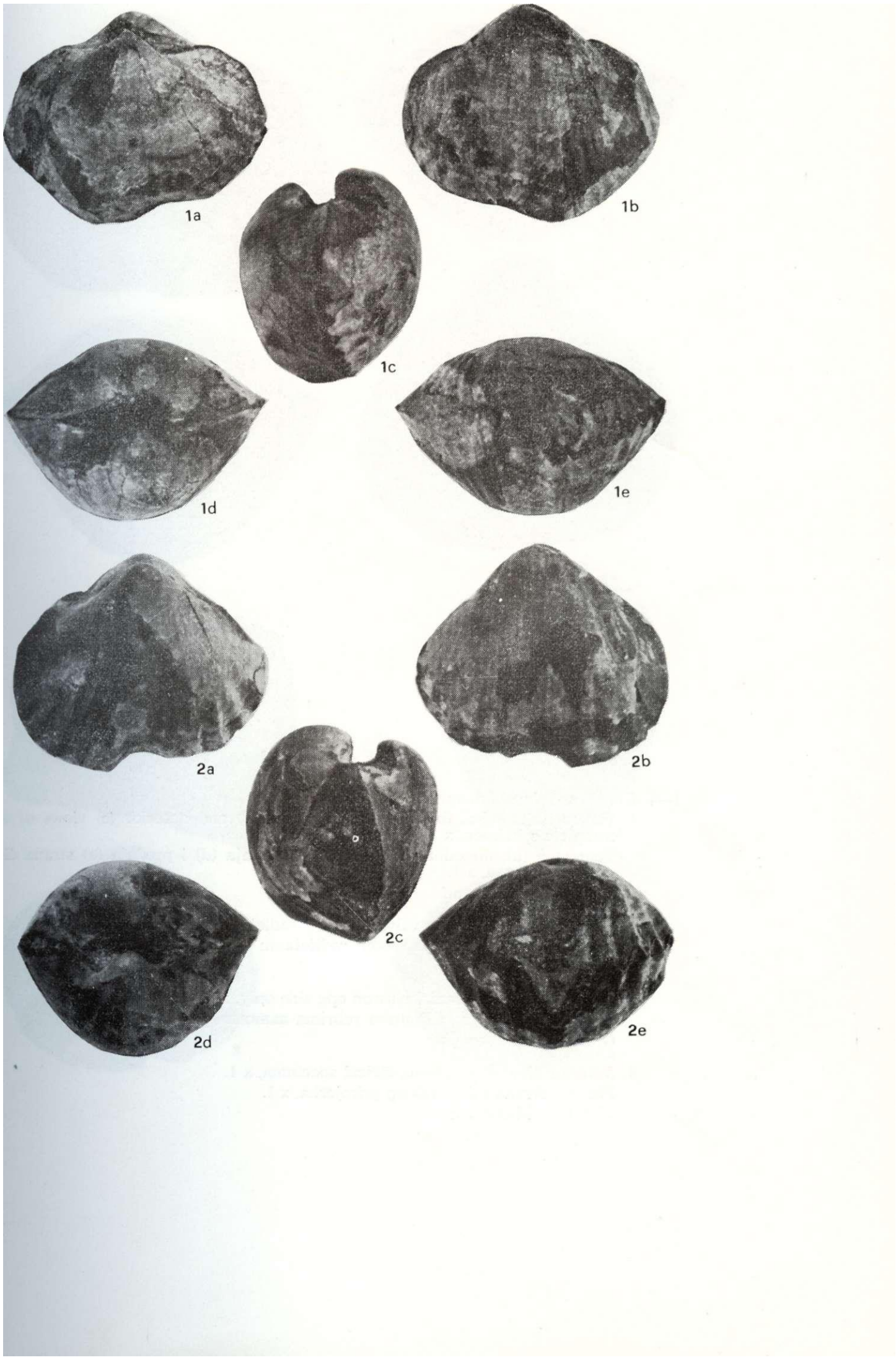
1. Ventral (a), dorsal (b), side (c), posterior (d) and anterior (e) views of a complete specimen, with partly preserved upper shell laver showing radial ornament, holotype, x 1.

   Ventralna (a), dorzalna (b), bočna (c), stražnja (d) i prednja (e) strana čitatavog primjerka s djelomično sačuvanim gornjim slojem ljušture, koji pokazuje radijalnu ornamentaoiju, hOlotip, x 1.

   GPZ 1203, Crne grede.

2. Ventral (a), dorsal (b), side (c), posterior (d) and anterior (e) views of a complete specimen with prominent ribs, paratype, x 1.

   Ventralna (a), dorzalna (b), bočna (c), stražnja (d) i prednja (e) strana primjerka s izrazitim rebrima, paratip, x 1.
   GPZ 1204, MHašnovac.


1a
1b
1c
1d
1e
2a
2b
2c
2d
2e

1—4. *Entelctes salopeki* ***a.*** **sp.**

1. Ventral (a), dorsal (b), sido (c), posterior (d) and anterior (e) views of complete specimen, x 1.
Ventralna (a), dor/alna (b), bočna (c), stražnja (d) i prednja (c) strana lavog primjerka, x 1.
GPZ 1205, Milašnovac.

2. Exterior of the pedicle valve showing radial ornamentation, x 1.
Ventralna ljuska sa sačuvanom radijalnom ornamentacijom, x 1.
GPZ 1213, 1001.

3. Pedicle valve with radial ribs on one side only, x 1.
Ventralna ljuska s radijalnim rebrima samo na jednoj strani, x 1.
GPZ 1206, Milašnovac.

4. Anterior view of an asymmetrical specimen, x I.
Prednja strana asimetričnog primjerka, x 1.
(>l»7. 1207, Milašnovac.

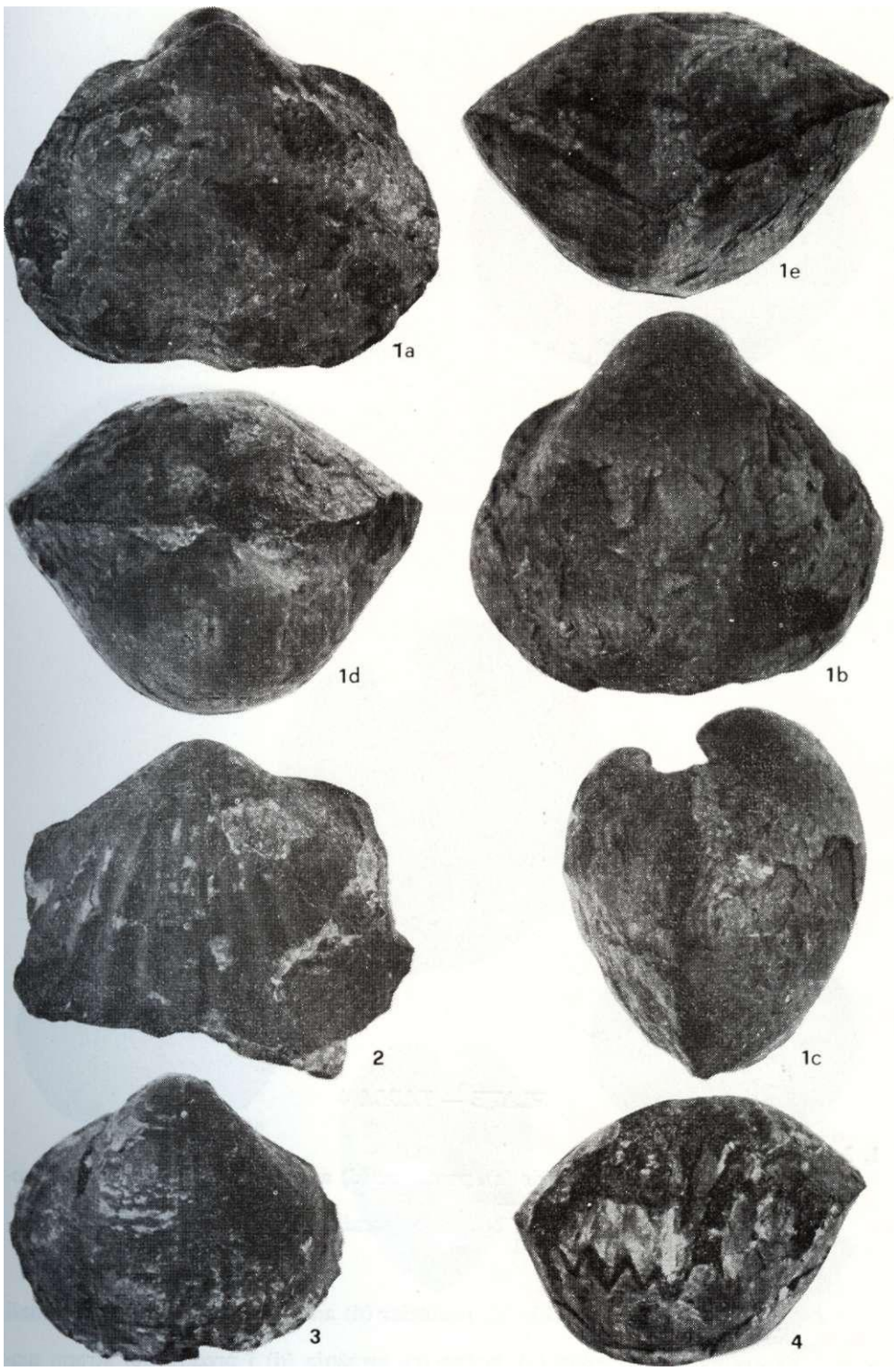

1e
1a
1d
1b
2
1c
3
4

PLATE — *TABl.A* 4

1, *2. Enteletes salopeki* n. sp.

1. Ventral (a), dorsal (b), side (c), posterior (d) and anterior (c) views of a complete specimen, paratype, **X** 1.

   Ventralna (a), dorzalna (b), bočna (c), stražnja (d) i prednja (e) strana čitavog piijmjerka, para tip, x I.

   GPZ 1208, Milašnovac.

2. Ventral (a), dorsal (b), side (c), posterior (d) and anterior (e) views of a small specimen, x 1.

   Ventralna (a), dorzalna (b), bočna (c), stražnja (d) i prednja (e) strana manjeg pi imjerka, x 1.

   GPZ 1209, Milašnovac.

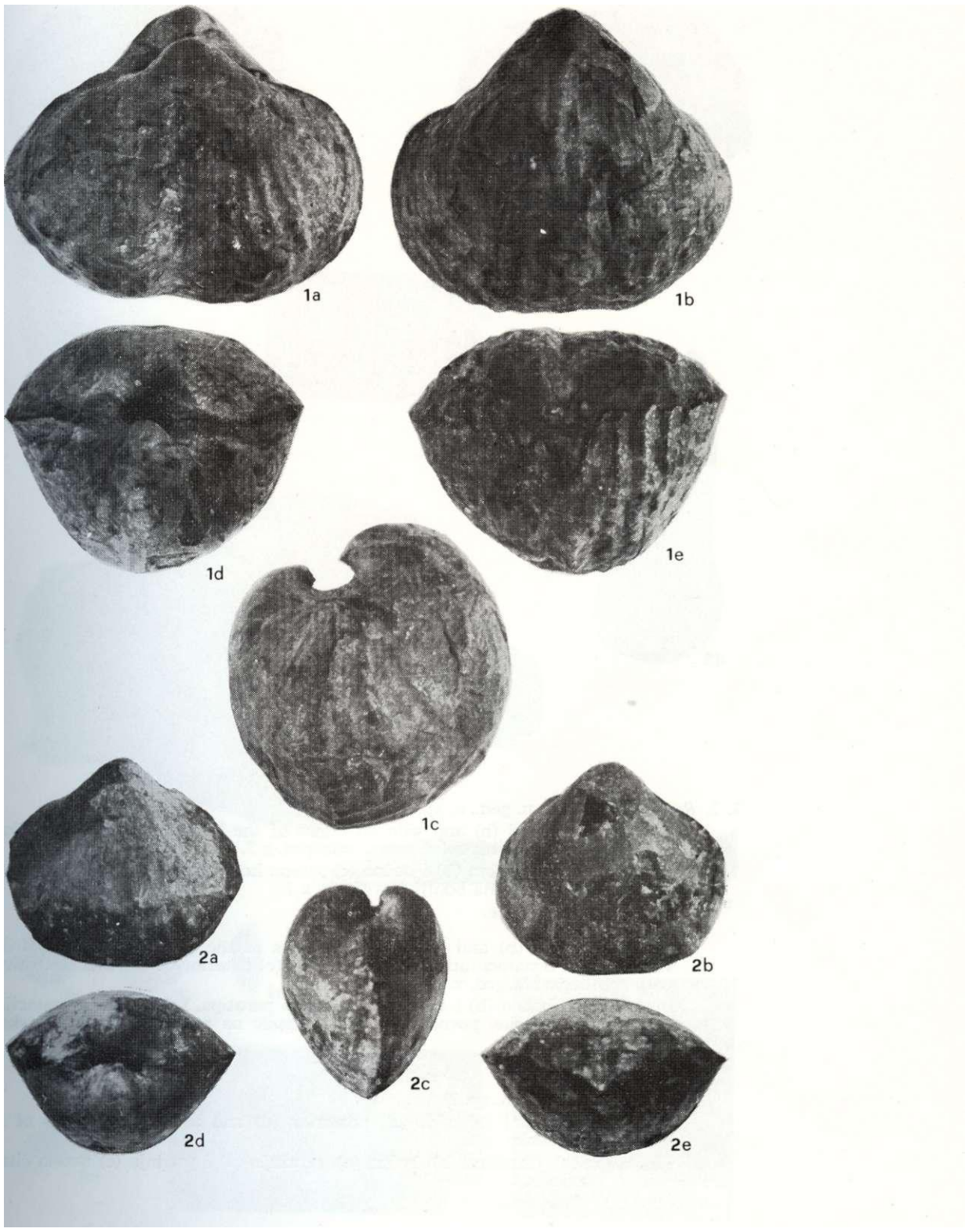

1a
1b
1d
1e
1c
2a
2b
2c
2d
2e

PLATE — *TABLA* 5

1, 2. *Ramovsina likaiia* n. gen., n. sp.

1. Ventral (a), dorsal (b) and side (c) views of the hololypc, x 1; (d) exterior of the ventral car with spine scars, enlarged, x 2.

   Ventraloa (a), dorzalna (b) i bočna (c) strana holotipa, x 1; (d) površina ventralne uske s ožiljcima bodlji, povećano, x 2.

   GPZ 1223, Crne grede.

2. Dorsal (a), side (b) and posterior (c) views of the paratype, x 1; (d) frill surface with ornamentation, enlarged, x 2; (e) exterior of the brachial valve with capillac, enlarged, x 2.

   Dorzalna (a), bočna (b) i stražnja (c) sirana pairatipa, x 1; (d) ornamentacija na površini povlake, povećano, x 2; (e) kapile na površini dorzalne ljuske, povećano, x 2.

   GPZ 1224, Ome grede.

3. *Sphenosteges* sp. (n. sp. ?)

   Ventral (a), dorsal (b), side (c), posterior (d) and anterior (e) views of a complete specimen, x 1.

   Ventralna (a), dorzalna (b), bočna (c), stražnja (d) i prednja (e) strana čitavog primjerka, x 1.

   GPZ 1229, Crne grede.

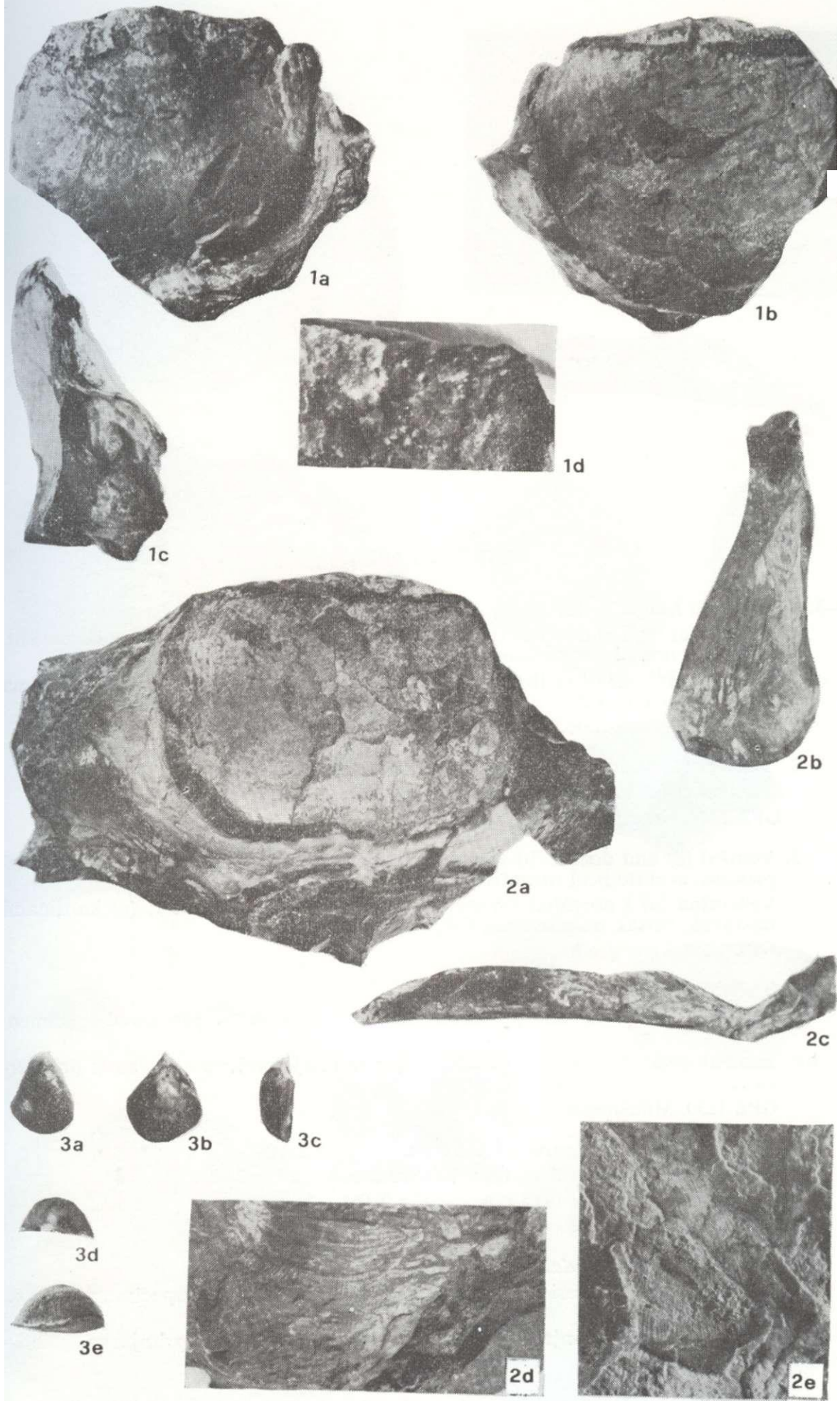

1a
1b
1c
1d
2a
2b
2c
2d
2e
3a
3b
3c
3d
3e

PLATE — *TABLA 6*

. *Ramovsina lìkana* n. gon., n. sp.

1. Dorsal (a) and posterior (b) views of the paratype, x 1; (c) enlargement, x 2, of the dorsal ear showing spine scars.
Dor/.alna (a) i stražnja (b) strana paratipa, x 1; (c) clor/.alna uska s ožiljcima bodlji, povećano, x 2.
GPZ 1225, Crne grede.

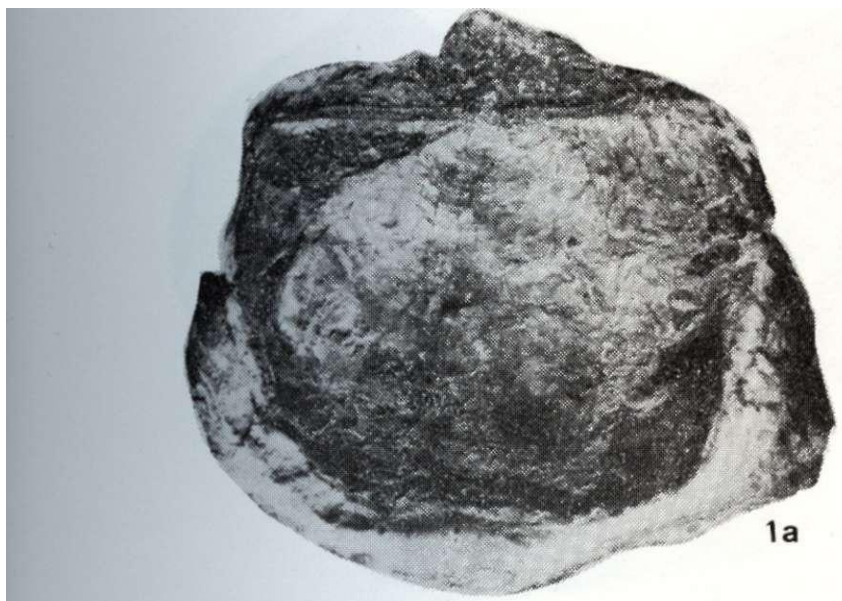
2. Ventral (a) and posterior (b) views of a pedicle valve, x 1.
Ventralna (a) i stražnja (b) strana oštećenog primjerka, x 1.
GPZ 1227, Crne grede."

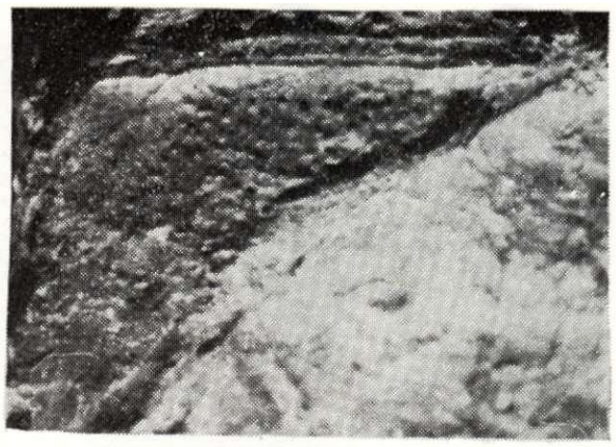
3. Ventral (a) and dorsal (b) views of an incomplete specimen, x 1; (c) cardinal process, acetate peel (negative), x 3.
Ventralna (a) i dor/.alna (b) strana oštećenog primjerka, x 1; (c) kardinalni nastavak, otisak na acelatnoj foliji (negativ), x 3.
GPZ 1226, Crne grede.

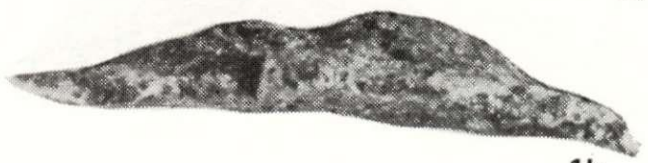
4. *Sphenosteges* sp.
Ventral (a), side (b) and posterior (c) views of a partly preserved specimen, x I.
Ventralna (a), bočna (b) i stražnja (c) strana djelomično sačuvanog primjerka, x 1.
GPZ 1230, Milašnovac.

5. *Spyridiophora* cf. *corn pacta* Cooper & Grani
Exterior of the ventral valve, x 1 (a) and enlarged, x 2 (b).
Ventralna ljuska, x 1 (a) i povećana, x 2 (b).
GPZ 1233, Crne grede.

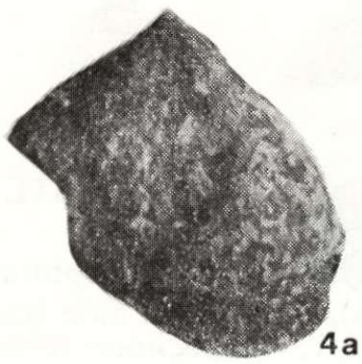
6. *Spyridiophora reticulata* (King)
Ventral (a) and anterior (b) views of a partly preserved specimen, approx. x 1.
Ventralna (a) i prednja (b) strana djelomično sačuvanog primjerka, približno x 1.
GPZ 1232, Crne grede.


1a

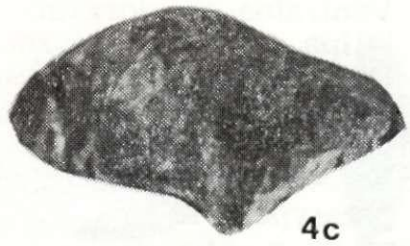

1c

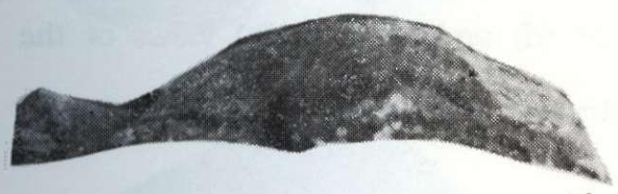

1b

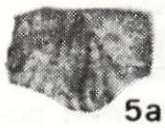

2a

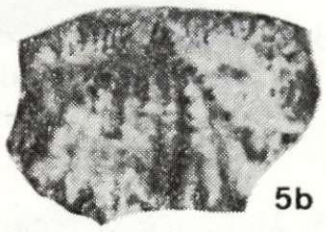

4a

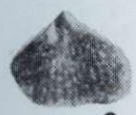

4b


4c


2b

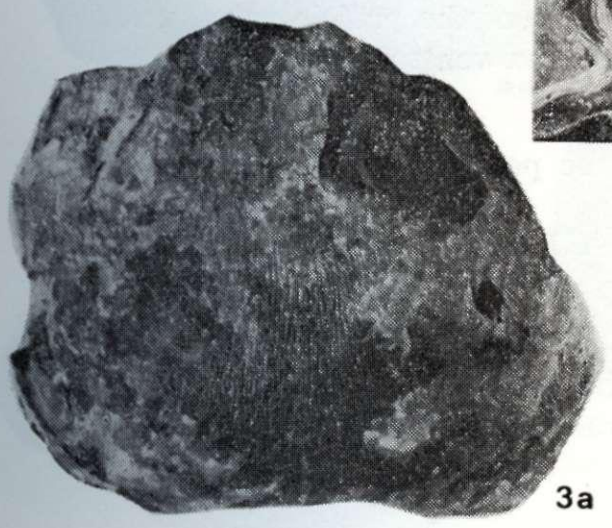

5a

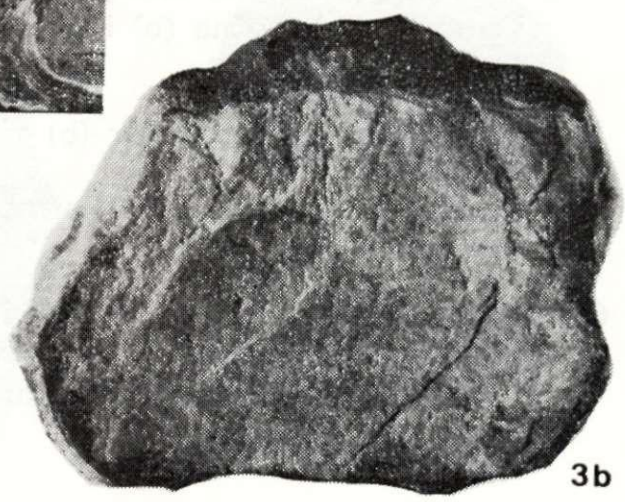

5b


6a


6b


3c


3a


3b

2. *Megatschernyschewia longiseptaia tongiseptata* n. gen., n. sp., n. subsp.

1. Ventral (a), doaisal (b), side (c), posterior (d) and anterior (e) views of the holotype, x 1; (f) specimen sectioned longitudinally to show the large median septum of the pedicle valve, x 1.
Ventralna (a) dor/alna (b), bočna (c), stražnja (d) i prednja (e) strana hc-lolipa, x 1; (f) uzdužno presječen holotip s dugim mcdijalnim septumom u vent ral noj ljusci, x 1.
GPZ 1237, Crne grede.

2. Ventral (a), dorsal (b), side (c), posterior (d) and anterior (e) views of the paratype, x 1.
Ventralna (a), dorzalna (b), bočna (c), stražnja (d) i prednja (e) strana para-lipa, x 1.
GPZ 1238, Crne grede.

3. *Megatschernyschewia tongiseptata transversa* n. gen., n. sp., n. subsp.
Ventral (a), side (b) and posterior (c) views of the hololype, x 1.
Ventralna (a), bočna (b) i stražnja (e) strana hoilotipa, x 1.
GPZ 1240, Crne grede.

5. *Megatschernyschewia* sp. (T>. sp. ?)

4. Ventral (a), side (b) and posterior (c) views of the pedicle valve, x 1.
Ventralna (a), bočna (b) i stražnja (c) strana ventralne ljuske, x 1.
GPZ 1244, Crne grede.

5. Ventral (a) and posterior (b) view of the pedicle valve of the smaller specimen, x 1.
Ventralna (a) i stražnja (b) strana manjeg primjerka, x 1.
GPZ 1245, Crne grede.

6. *Tschernyschewia ci. typica lata* S i m ić
Ventral (a) and posterior (b) views of the pedicle valve, x 1.
Ventralna (a) i stražnja (b) strana ventralne ljuske, x 1.
GPZ 1235, Crne grede.

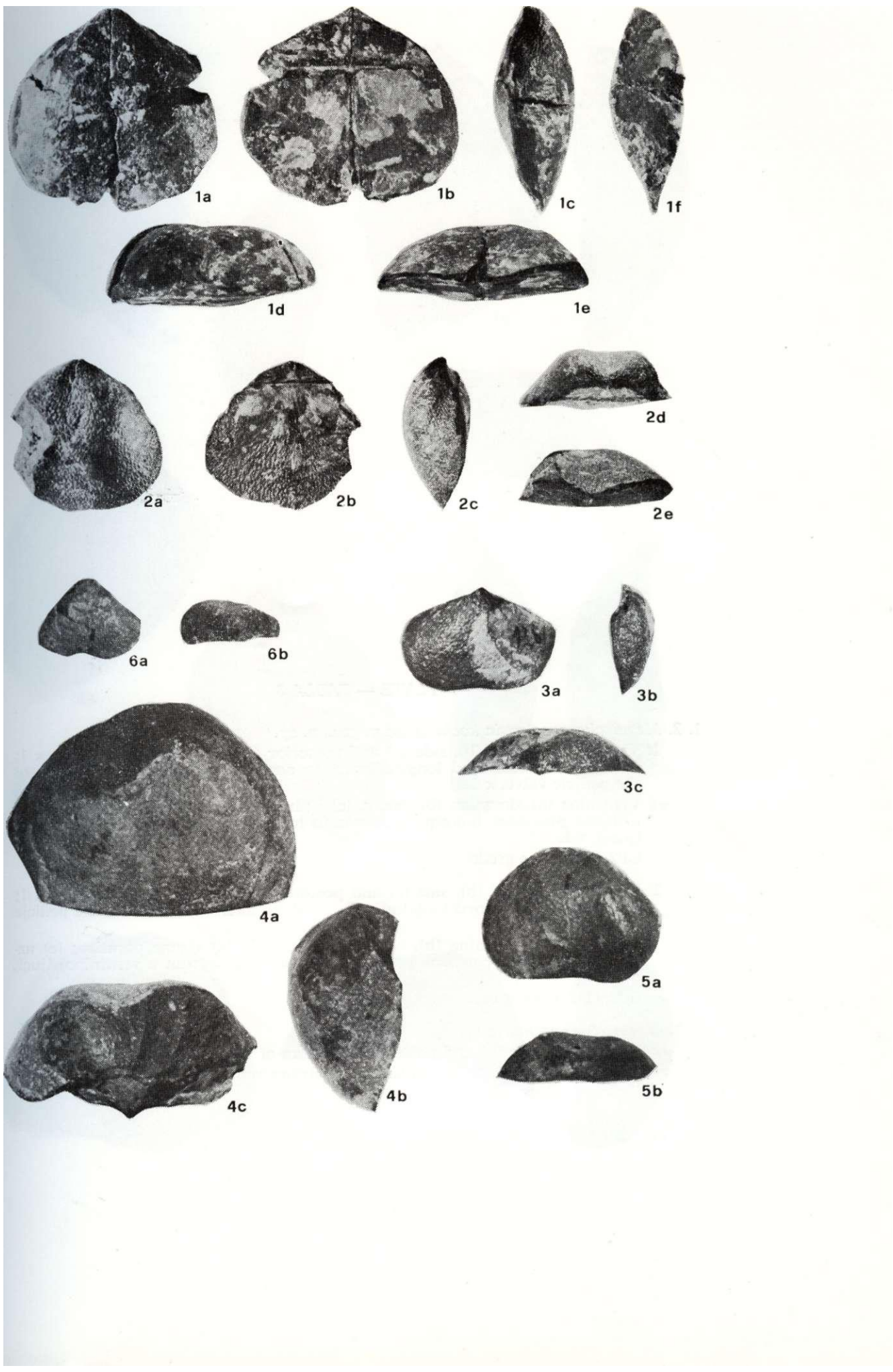

1a
1b
1c
1f
1d
1e
2a
2b
2c
2d
2e
6a
6b
3a
3b
3c
4a
5a
4c
4b
5b

PLATE — *TABLA* 8

1, ***2. Megatschernyschewia kochanskae*** n. gen., n. sp.

1. Ventral (a), dorsal (b), side (c) and posterior (d) views of the holotype, x 1; (e) specimen sectioned longitudinally to show wrinkled median septum of the pedicle valve, x 1.

   Ventralna (a), doirzalna (b), bočna (c) i stražnja (d) strana holotipa, x 1; (e) uzdužno presječen holotip s naboranim medijalnim septumom u ventralnoj ljusci, x 1.

   G PZ 1241, Crne grede.

2. Ventral (a), dorsal (b), side (c) and posterior (d) views of the paratype, x 1; (e) specimen sectioned longitudinally to show median septum of the pedicle valve, x I.

   Ventralna (a), dorzalna (b), bočna (c) i stražnja (d) strana paratipa; (e) uzdužno presječen primjerak gdje se vidi medijalni septum u ventralnoj ljući, x I.

   GPZ 1242, Crne grede.

3. *Megatschernyschewia* sp.

   Ventral (a), side (b) and posterior (c) views of the pedicle valve, x 1.

   Ventralna (a), bočna (b) i stražnja (c) strana ventralne ljuske, x 1.

   GPZ 1247, Crne grede.

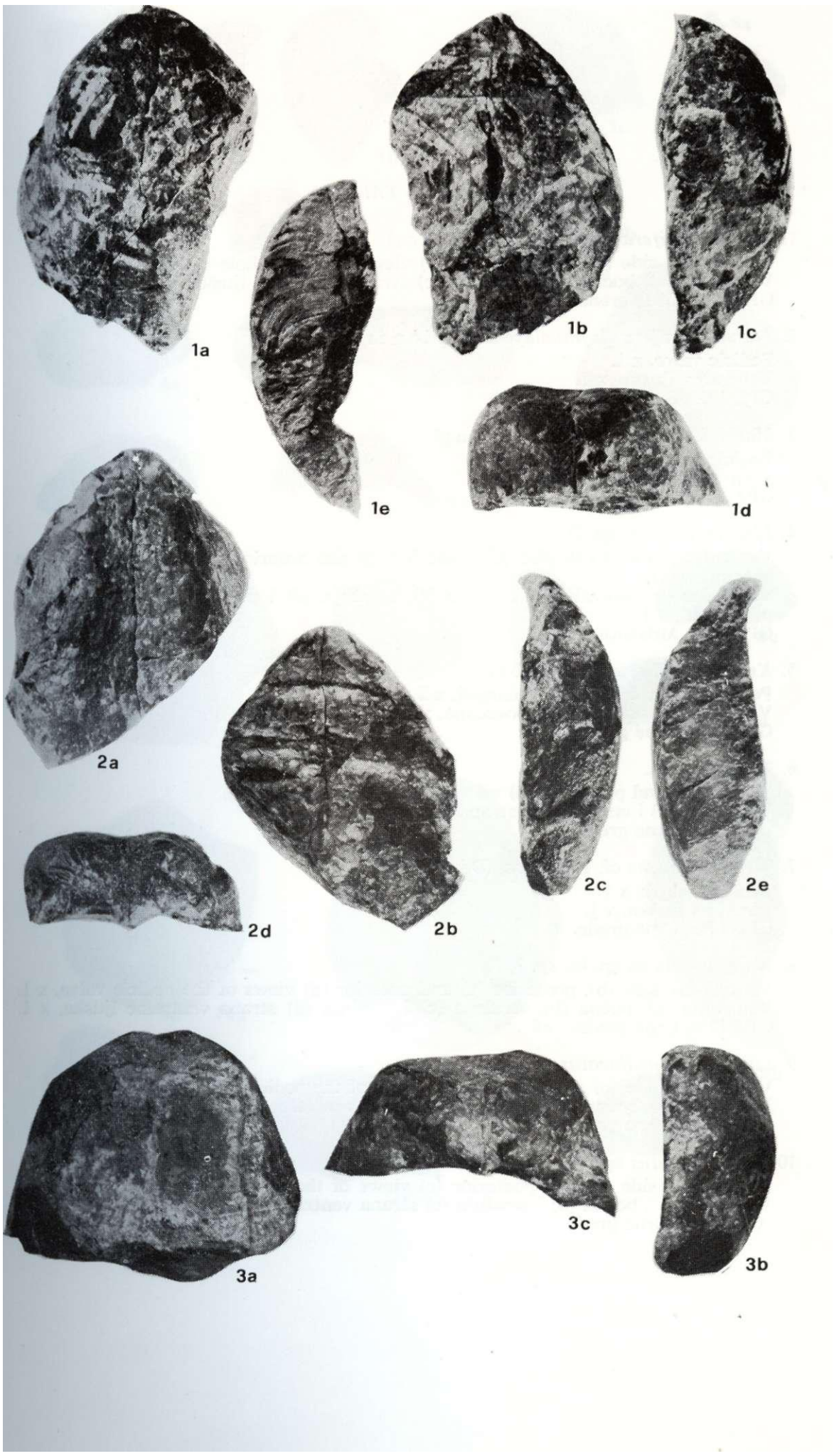

1a
1b
1c
1e
1d
2a
2b
2c
2e
2d
3a
3c
3b

PLATE — *TABLA 9*

1. ***Paramarginifera himalayensis*** (Diener)
   Ventral (a), side (b) and posterior (c) views of the pedicle valve, x 1.
   Ventralna (a), bočna (b) i stražnja (c) strana vent.ralne ljuske, x 1.
   GPZ 1252, Crne grede.

2. *Paramarginilera ci. himalayensis* (Diener)
   Pedicle valve, x 1.
   Ventralna Ljuska, x 1.
   GPZ 1253, Crne grede.

3. *Marginifcra magniplicala* (Huang)
   Pedicle valve, x 1.
   Vemtralna ljuska, x 1.
   GPZ 1249, Milašnovac.

4. *Liosotelta* sp. (n. sp. ?)
   Ventral (a), dorsal (b), side (c), posterior (d) and anterior (e) views of a complete specimen, x 1.
   Ventralna (a), dorzalna (b), bočna (c), stražnja (d) i prednja (e) strana čitavog primjerka, x 1.
   GPZ 1254, Milašnovac.

5. *Krolovia wallaciana* (Derby)
   Pedicle valve, x I (a) and enlarged, x 2 (b).
   Ventralna ljuska, x 1 (a) i povećana, x 2 (b).
   GPZ 1248, Crne grede.

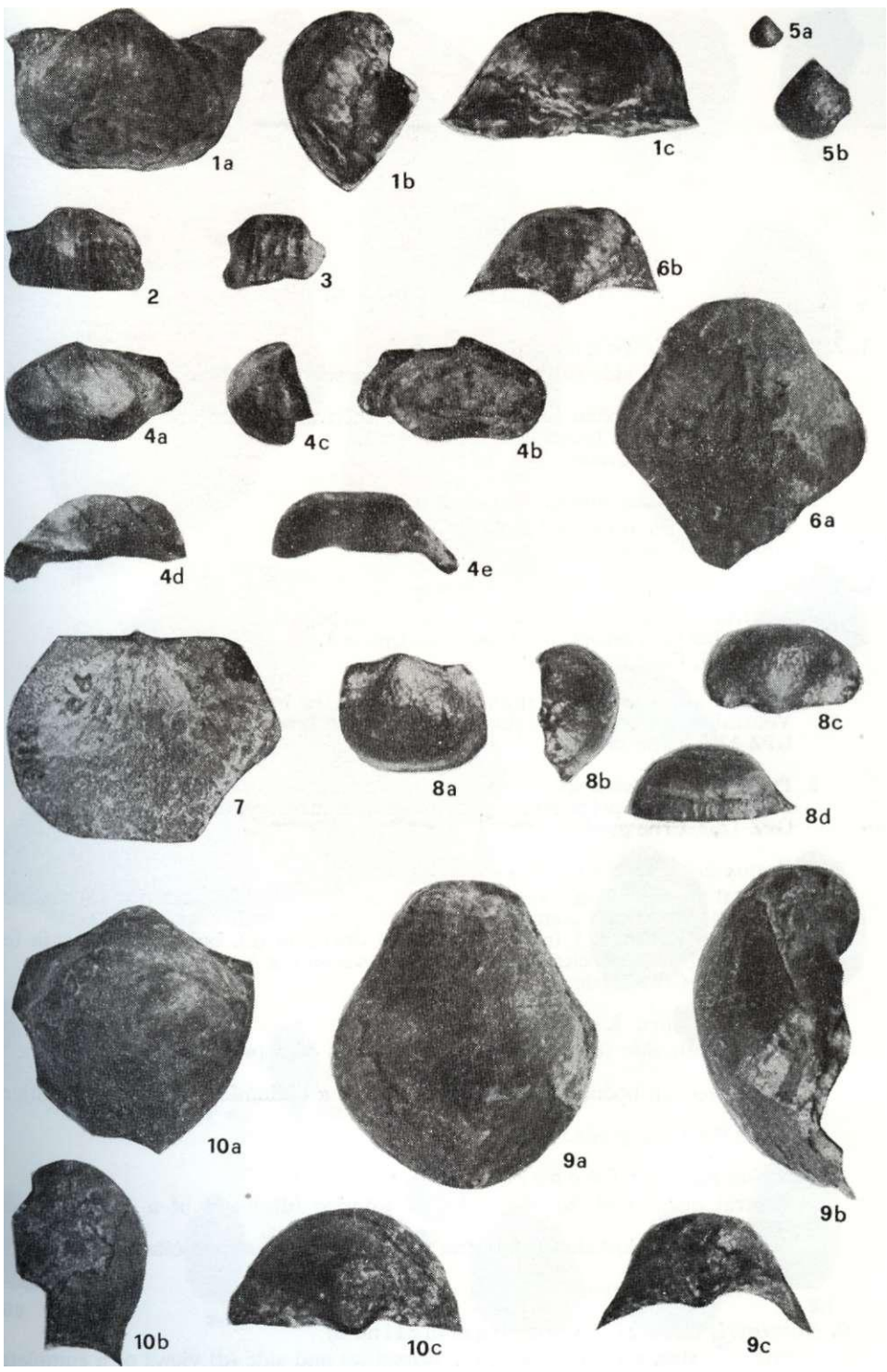
6. *Tyloplecta* sp.
   Ventral (a) and posterior (b) views of the pedicle valve, x 1.
   Ventralna (a) i stražnja (b) strana ventral ne ljuske, x 1.
   GPZ 1257, Crne grede.

7. *Waagenoconcha ci. gangetica* (Dičner)
   Brachial valve, x 1.
   Dorzalna ljuska, x 1.
   GPZ 1255, Crne grede.

8. *Waagenoconcha* sp. (n. sp. ?)
   Ventral (a), side (b), posterior (c) and anterior (d) views of the pedicle valve, x 1.
   Ventralna (a), bočna (b), stražnja (c) i prednja (d) strana ventralne ljuske, x 1.
   GPZ 1256, Crne grede.

9. *Linoproduclus linealus* (Waagen)
   Ventral (a), side (b) and posterior (c) views of the pedicle valve, x 1.
   Ventralna (a), bočna (b) i stražnja (c) strana ventralme ljuske, x 1.
   GPZ 1258, Crne grede.

10. *Linoproduclus* sp.
    Ventral (a), side (b) and posterior (c) views of the pedicle valve, x 1.
    Ventralna (a), bočna (b) i stražnja (c) sirana ventralne ljuske, x 1.
    GPZ 1259, Crne grede.


1a
1b
1c
5a
5b
2
3
6b
4a
4c
4b
6a
4d
4e
7
8a
8b
8c
8d
10a
9a
9b
10b
10c
9c

PLATI". — TABLA ¡O

1, 2. *Leptodus* ***nobilis*** (Waagen)

1. Dorsal (a) and sick' (b) views of a well porserved specimen, showing nodulai »sepla«, x 1.
Dorzalna (a) *i* bočna (b) strana dobro sačuvanog primjerka, s dobio vidljivim čvorićima na lateralnim séptima, X I.
GPZ 1265, Crne grede.

2. Three specimens grown over each other, x 1/2.
Tri primjerka srasla jedan na drugom, x 1/2.
GPZ 1266, Crne grede.

3—5. *Keyserlingina jilicis velebilica* n. subsp.

3. Ventral (a) and side (b) views oi the paratype, x 1.
Ven traína (a) i bočna (b) strana pa nabina, x 1.
GPZ 1261, Crne grede.

4. Ventral (a), side (b) and dorsal (c) views of the hololype, x 1.
Ventralna (a), bočna (b) i dorzalna (c) Strana holotipa, x 1.
GPZ 1260, Crne grede.

5. Posterior view of a specimen showing regular ornament, x 1.
Stražnja strana primjerka s pravilnom ornamentadjom, x I.
GPZ 1262, Crne grede.

6. *Dielasma augusta* Netschacw

Ventral valve, x I (a); ventral (b), dorsal (c), side (d), posterior (c) and anterior (f) views al a complete specimen, enlarged, x 2.
Ventralna ljuska, x 1 (a); ventralna (b) dorzalna (c), bočna (d) stražnja (e) i prednja (f) strana čitavog primjerka, povećano, x 2.
GPZ 1292, Crne grede.

7. *Dielasma* ef. *plica* Kulorga

Ventral (a), side (b) and posterior (c) views of a partly damaged specimen, x 1.
Ventralna (a), bočna (b) i stražnja (c) strana djelomično oštećeno« primjerka. x 1.
GPZ 1293, Crne grede.

8. *Texarina parallela* Cooper & Grant

Ventral (a), dorsal (b), side (c) and anterior (d) views of a complete specimen, x 1.
Ventralna (a), dorzalna (b), bočna (c) i prednja (d) strana čitavog primjerka, x 1.
GPZ 1296, Crne grede.

9. *Notothyris* cf. *mediterránea* (Gemmellaro)

Pedicle valve, x 1 (a); ventral (b), dorsal (c) and side (d) views of a complete specimen, enlarged, x 2.
Ventralna ljuska, x 1 (a); ventralna (b), dorzalna (c) i bočna (d) strana čitavos? primjerka, povećano, x 2.
GPZ 1294, Crne grede.


1a
1b
2
3a
3b
4a
4b
4c
5
6a
6b
6c
6d
6e
6f
7a
7b
7c
8a
8b
8c
8d
9a
9b
9c
9d

PLATE — *TAB I. A* 11

1, 2. *Mariiniu velebitica* n. sp.

1. Ventral (a), dorsal (to), side (c), posterior (d) and anterior (e) views of the holotype, x 1.

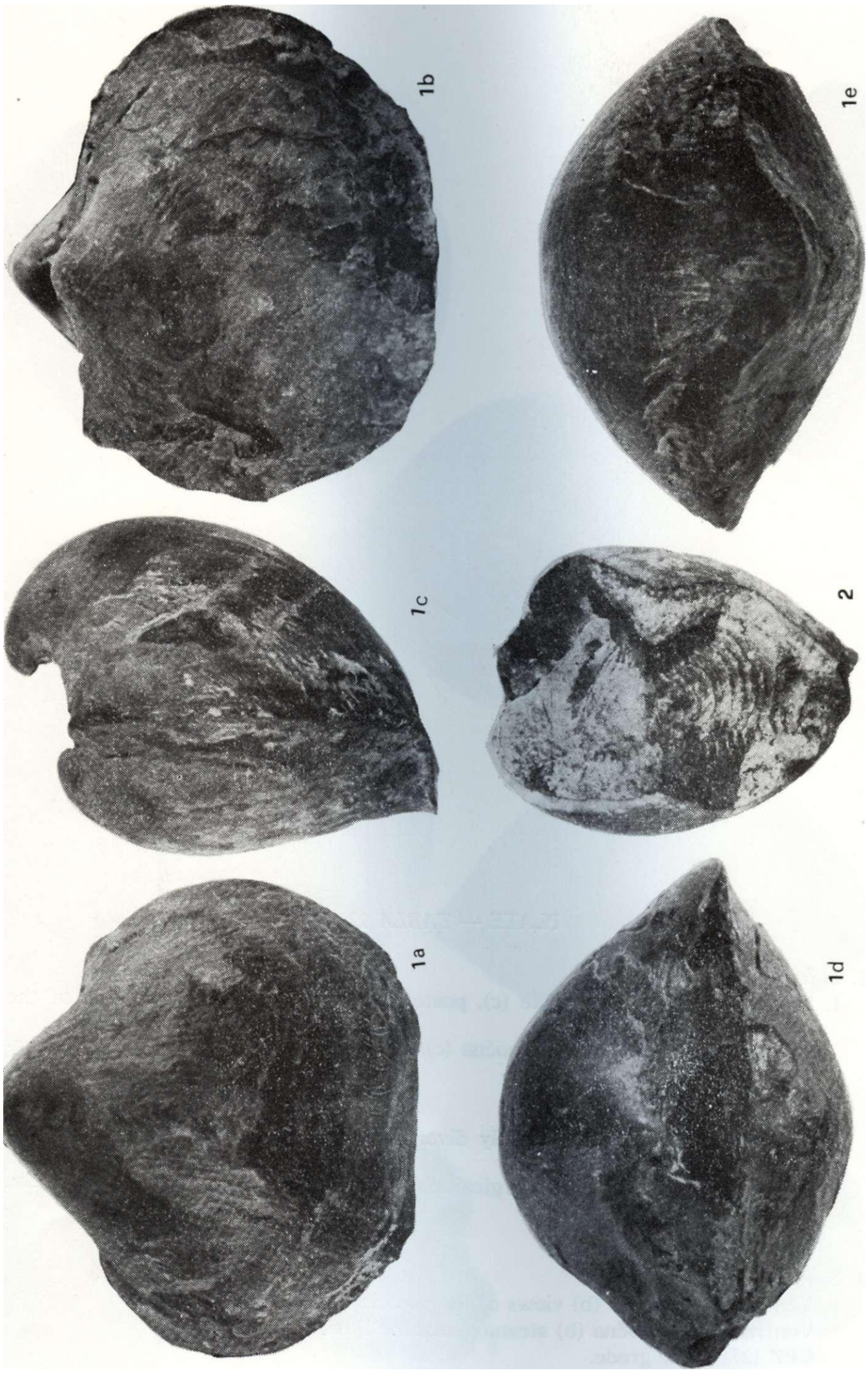
   Ventralna (a), dorzalna (b), bočna (c), stražnja (d) i prednja (e) strana holotipa, x 1.

   GPZ 1277, Milašnovac.

2. Damaged specimen showing sectioned lophophare, x I.

   Oštećeni primjerak s vidljivim lofofonom u presjeku, x 1.

   GPZ 1278, Milašnovac.



1

PLATE — *TABLA* **12**

1, *2. Mariinia velebitica* n. sp.

1. Ventral (a), dorsal (b), side (c), posterior (d) and anterior (e) views of the paratype, x 1.
   Vcntralna (a), dorzalna (b), bočna (c), stražnja (d), i prednja (e) strana paralipa, x 1.
   GPZ 1279, Milašnovac.

2. Brachial valve showing slightly diverging dark bands in the posterior portion, x 1.
   Dorzalna ljuska s blago divergirajućim tamnim trakama u stražnjem dijelu, x 1.
   GPZ 1280, Milašnovac.

3. *Spirigerella* **sp.**
   Ventral (a) and side (b) views of the pedicle valve, x 1.
   Vcntralna (a) i bočna (b) strana ventnalne ljuske, x 1.
   GPZ 1271, Crne grede.

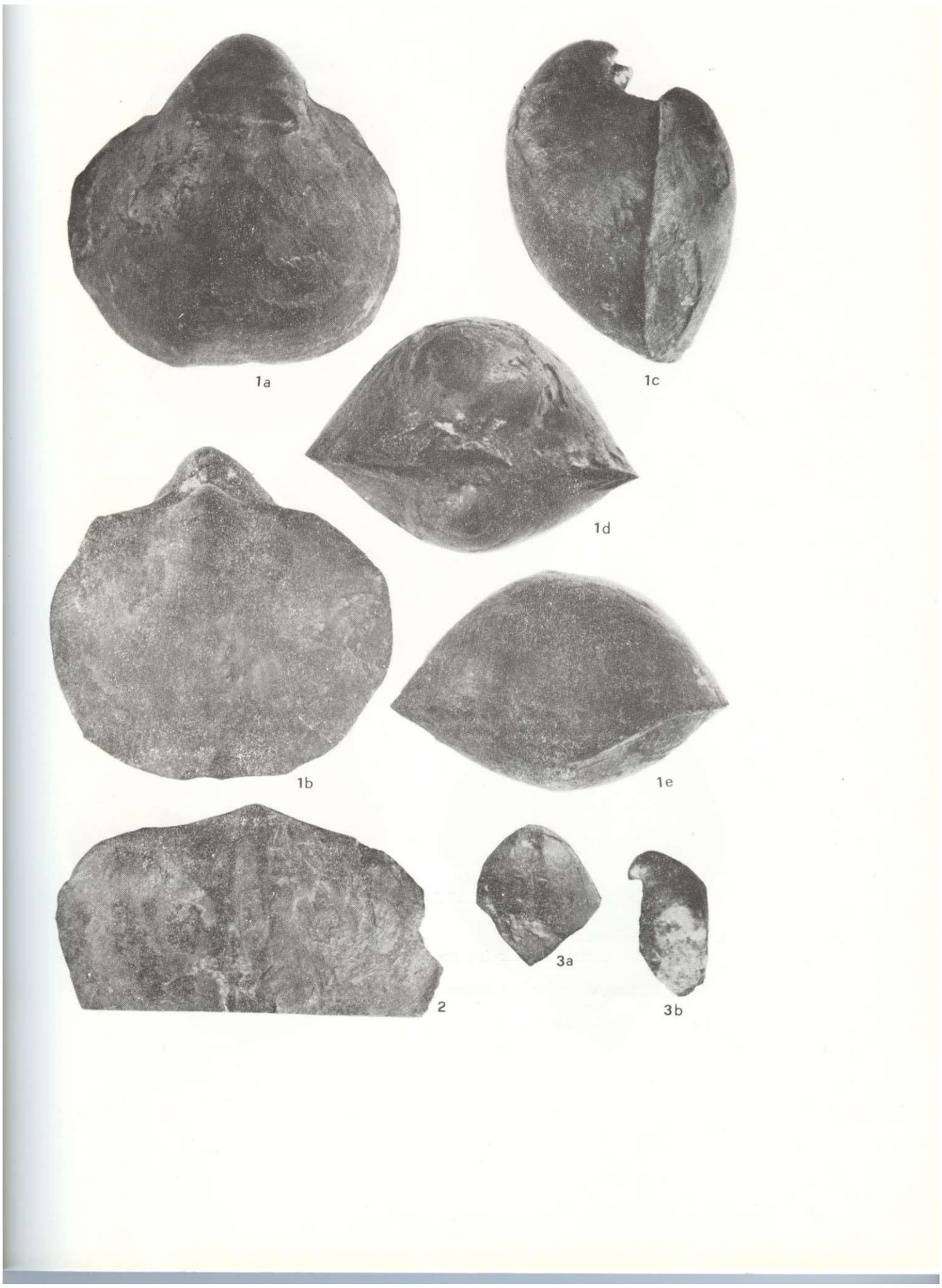

1a
1c
1d
1b
1e
2
3a
3b

PLATE — *TABLA* 13

î. *Martinia velebitica* n. sp.

Ventral (a), -dorsal (b), side (c), posterior (d) and anterior (e) views of the paratype, x 1.

Ventralna (a), dorzaLna (b), bočna (c), stražnja (d) i prednja (c) strana paratipa, x 1.

GPZ 1281, Milasnovac.

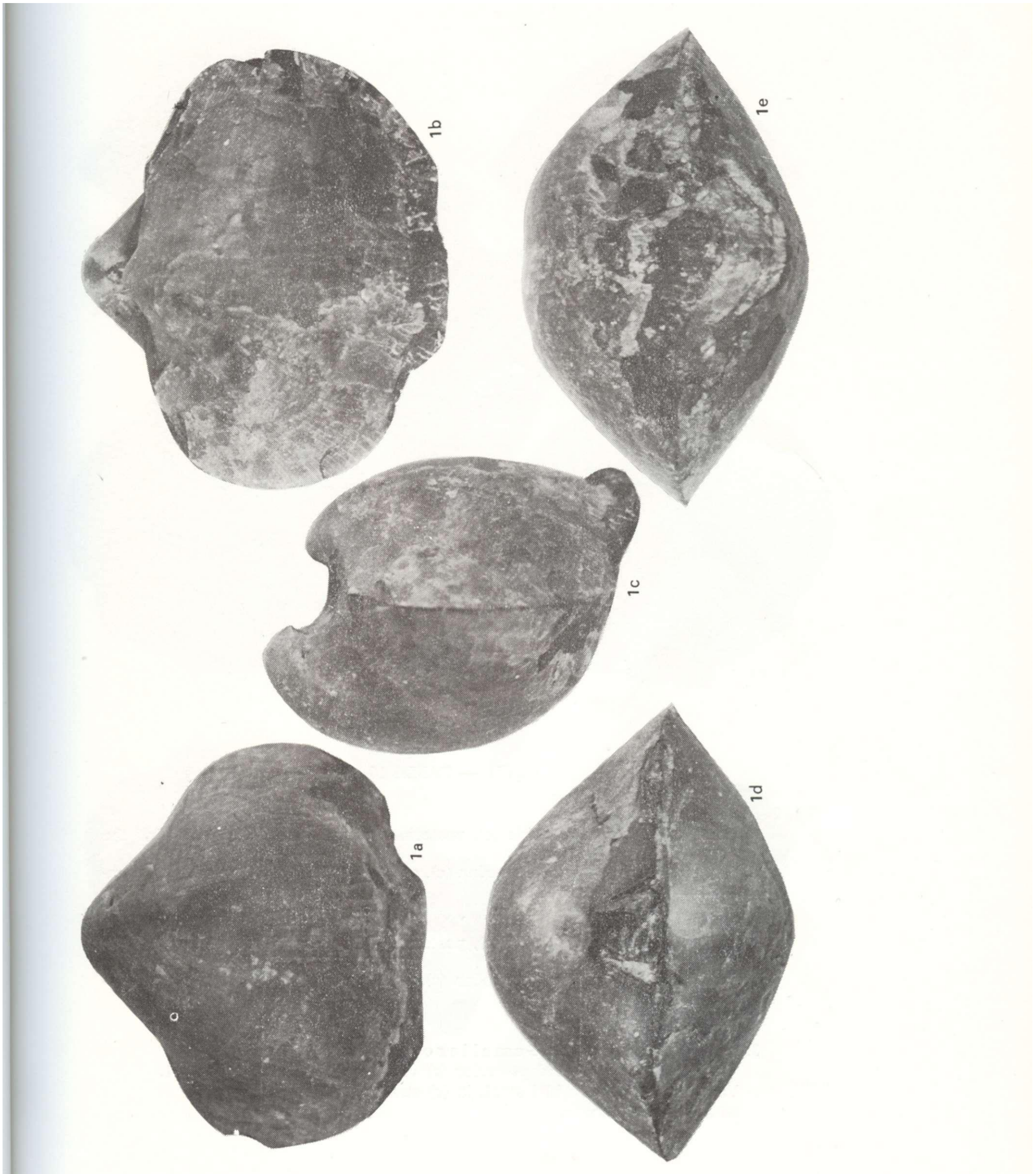

1b
1e
1c
1a
1d

PLATE — *TABLA* 14

1, *2.* ***Martinia velebitica*** n. sp.

1. Ventral (a), dorsal (b), side (c), posterior (d) and anterior (c) views of the paratype, x 1.
   Ventralna (a), dorzalna (b), bočna (e), stražnja (d) i prednja (e) strana panatipa, x 1.
   GPZ 1282, Milašnovac.

2. Ventral (a), dorsal (b), side (c), posterior (d) and anterior (e) views of the smaller specimen, x 1.
   Ventralna (a), dor/alna (b), bočna (e), stražnja (d) i prednja (e) strana manjeg primjerka, x 1.
   GPZ 1283, Milašnovac.

3. *Martinia* of. *orbicularis* G c m e l l a i r o
   Ventral (a), side (b) and posterior (c) views of the pedicle valve, x 1.
   Ventralna (a), bočna b) i stražnja (c) strana ventralne ljuske, x I.
   GPZ 1275, Milašnovac.

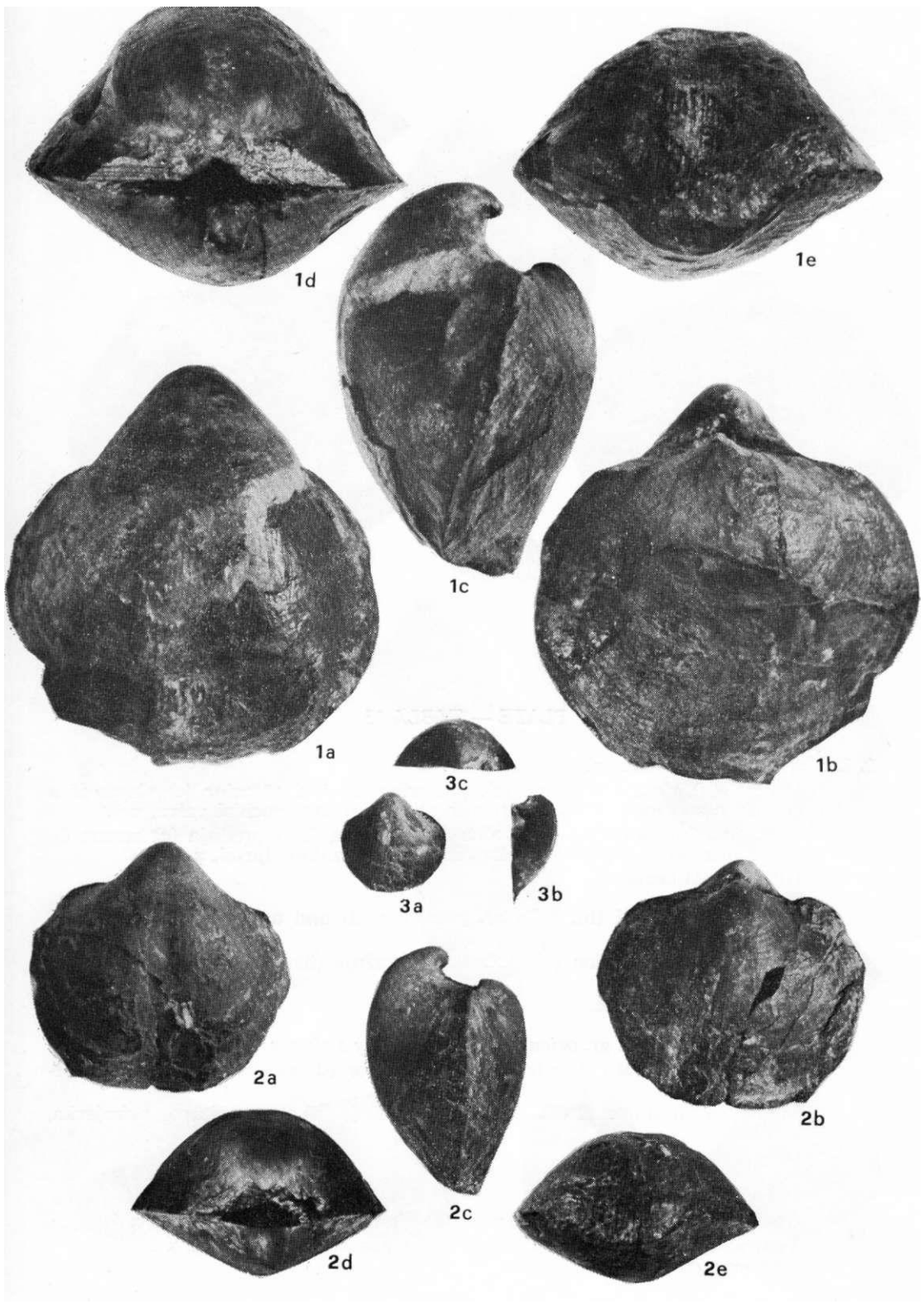

1d
1e
1c
1a
1b
3c
3a
3b
2a
2b
2c
2d
2e

PLATE — *TABLA* 15

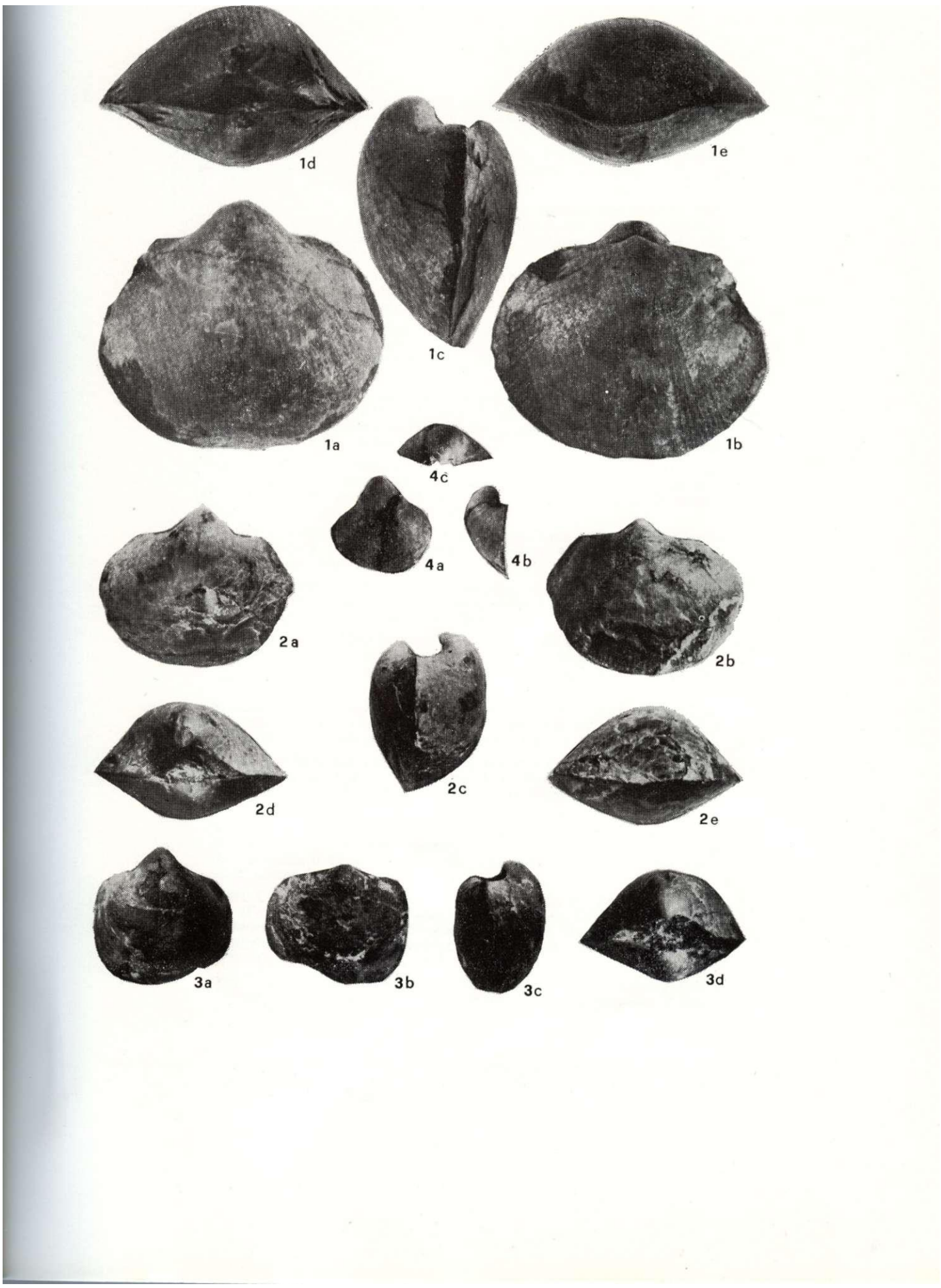
1, *2. Mcuiima velebitica* n. sp.

1. Ventral (a), dorsal (b), side (c), posterior (d) and anterior (e) views of a complete specimen, showing mantle canals on the brachial valve, x I.
Ventralna (a), doiv.alna (b), bočna (c), stražnja (d) i prednja (e) strana čitavog primjerka s plašlanim kanalima na dor/.alnoj ljusci, x 1.
GPZ 1284, Milašnovac.

2. Ventral (a), dorsal (b), side (c), posterior (d) and anterior (e) views of a small specimen, x 1.
Veatralna (a), doiv.alna <b), bočna (c), stražnja (d) i prednja (e) strana sitnog primjerka, x I.
GPZ 1285, Milašnovac.

3. *Martiniopsis* sp. ex gr. *oricntalis* T s c h e r n y s c h e w
Ventral (a), dorsal (b), side (c) and posterior (d) views of a complete specimen, x I.
Ventralna (a), dorzalna (b), bočna (c) i stražnja (d) strana čitavog primjerka, x I.
GPZ 129!, Crne grede.

4. *Phricodothyris* sp.
Ventral (a), side (b) and posterior (c) views of the pedicle valve, x 1.
Ventralna (a), bočna (b) i stražnja (e) strana ventralne ljuske, x 1.
GPZ 1274, Crne grede.


1d
1e
1c
1a
1b
4c
4a
4b
2a
2b
2c
2d
2e
3a
3b
3c
3d

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