

GERTRUDA BIERNAT

The brachiopods from the Kadzielnia limestone (Frasnian) of the Holy Cross Mts

ABSTRACT: The lowermost part of the Kadzielnia limestone contains a very differentiated brachiopod fauna, usually occurring in gregariously crowded monospecific clusters. The brachiopods constitute the richest faunistic assemblage after the stromatoporoids, tabulate and rugose corals. Twenty one brachiopod species are stated, one new; some of them are not assigned to definite species owing to the unsatisfactory state of preservation and/or insufficient number of specimens. Stratigraphically, the brachiopods all belong to the Frasnian species and indicate the lowermost part of the Kadzielnia limestone to be of Upper Devonian age.

INTRODUCTION

The present report is a further part of the redescription of the Upper Devonian brachiopods from the Holy Cross Mts. It deals with some of the Frasnian fauna from the Kadzielnia limestone outcropping in the Kadzielnia quarry at Kielce. Although the brachiopod fauna of this region has been known for many years, very little has been published on this subject up to now. In the more recent geological papers on the Holy Cross Mts only single forms are described or simply included in the list of fossils. As to the older papers (*e.g.* Zeuschner 1870, Gürich 1896) one can find only very brief descriptions of some of the brachiopods of the Kielce region. Unfortunately, most are not illustrated, especially newly erected taxons and, in addition, no typical material is preserved, so these latter remain invalid. In consequence, our knowledge of the Upper Devonian

brachiopods from the Holy Cross Mts still remains fragmentary and needs to be examined.

The described material has been collected over a number of years and comprised about 180 specimens belonging to 21 species. Most of the collection is especially valuable, as it comes from the lowermost part of the Kadzielnia limestone, which at present is not available (being under water when the quarry has been abandoned). The studied material is deposited at the Palaeozoological Institute, Polish Academy of Sciences, in Warsaw, for which the abbreviation *Z. Pal. Bp.* is used.

Acknowledgements. It is a pleasure to record many warm thanks to Docent A. Radwański and Dr. M. Szulczewski, Institute of Geology, University of Warsaw, as well as Docent A. Stasińska and J. Kaźmierczak, M. Sc., Palaeozoological Institute, Polish Academy of Sciences, Warsaw — for providing of fossil material which enriched the present collection, and for a discussions on the stratigraphy of the Kadzielnia limestone. The photographs have been taken by Mrs M. Czarnocka, and the drawings — by Mrs D. Ślawik, Palaeozoological Institute of the Polish Academy of Sciences, Warsaw.

MATERIAL

The brachiopods of the possessed collection are, in general, difficult to investigate, although on the first sight they appear to be rather well preserved and some of the species are comparatively well represented in the number of specimens. There are several reasons for this: 1) The prevailing species are of small size, e.g. *Athyris* sp., *Crurithyris globosa* (Gürich), *Fitzroyella alata* Biernat. The specimens are usually very compact and firmly attached to the matrix which makes it difficult to remove in a mechanical way (the only method possible in this case). The same applies to the species of larger size, as e.g. *Spinatrypina (Exatrypa) planata* sp.n., *Parapugnax brecciae* (Schmidt), which, in addition to crushing, always become seriously exfoliated. 2) Although some sufficiently well preserved specimens have been obtained, unfortunately their internal structure is very obscured or preserved in fragments only, due to the very strong recrystallization of the shell interior. Often only the umbonal parts of the shell, usually somewhat less recrystallized, show some details such e.g. dental plates, teeth. Wherever possible, a few series of cross sections (peels) have been prepared for almost each species but with poor results. In consequence, the identification of the shells was based mainly on the external shell morphology. 3) For each species only a few approximate shell dimensions in *mm* could be taken, no biometric measurements were made, owing to the incompleteness of the shells, including the shell deformation and distortion, very strong in many cases. All this makes a full recognition of this Frasnian faunal assemblage somewhat difficult; many specimens too poorly preserved to be identified are only shortly mentioned or rejected.

REMARKS ON STRATIGRAPHY

Only a brief report on the biostratigraphy of the Kadzielnia limestone is presented, the reason being, that the described collection of brachiopods comes, with few exceptions, from the lower part of the profile — at present partly under the water. This 12 m thick part constitutes one-fourth of the whole thickness of the limestone. More detailed data on the stratigraphy can be found in the recent paper on the Upper Devonian of the Kielce region (Szulczewski 1971).

The whole Kadzielnia limestone is of Frasnian age, but it is still difficult to estimate the age of the lower part of the Kadzielnia limestone, in accordance to the standart zonation of the Frasnian, more precisely than undifferentiated Frasnian, corresponding to the Lower and Middle Frasnian *sensu* Czarnocki (1948). Conodonts, unfortunately, are lacking here; these have been found (Szulczewski 1971) in the upper part of the Kadzielnia limestone and they show, that the Upper Frasnian *sensu* Czarnocki starts here in the *Ancyrognathus triangularis* Zone (*to I_γ*). Hence, it may be concluded that the Middle and Lower Frasnian *sensu* Czarnocki correspond to the older zones than *to I_γ*, and they, in all probability, attain in their upper part the *Ancyrognathus triangularis* Zone.

As to the other fossils, the presence of *e.g.* the stromatoporoids (Kaźmierczak 1971), rugose corals (Rózkowska 1952) or the brachiopods can be accepted as a reliable indicator that the lower part of the Kadzielnia limestone does not reach the Givetian. The species of the mentioned groups are all typical for the Frasnian, *e.g.* the stromatoporoids *Pseudostromatoporella huronensis* (Parks), *P. damnoniensis* (Nicholson), *Stromatoporella mudlakensis* (Galloway) which are known from the Frasnian of *i.a.* Canada and Ardennes (Kaźmierczak 1971). Of the rugose corals, the Frasnian species *Phillipsastraea ananas* (Goldfuss) and *Macgea supradevonica* (Penecke) do occur here. As to the brachiopods, they are also the early Upper Devonian forms, but in the present state of knowledge they throw only little light on the problem of precise age of the considered part of the Kadzielnia limestone. Some of them are known from Germany, Belgium and USSR, *e.g.* *Hypothyridina coronula* (Drevermann), *Hypothyridina nana* Nalivkin, *Parapugnax brecciae* (Schmidt), *Desquamatia (Seratrypa) pectinata* (Schröter), ranging, in general, within F2a — F2h units of the Frasnian (cf. Schmidt 1941, Copper 1967). In addition, in the lower part of the Kadzielnia limestone a few specimens of *Fitzroyella alata* Biernat have also been found. The stratigraphical position of this species has been indicated, but only indirectly, on the basis of conodonts in the Kowala profile (Szulczewski 1971), where this species occurs (Biernat 1969) in the unit lying immediately below the layers which are dated as Lower or Middle *Polygnathus asymmetricus* Zone (*to I_α*). In addition, the assemblage of corals associated with this

brachiopod species at Kowala (cf. Szulczewski 1971) shows, that the layers containing *Fitzroyella alata* Biernat are Frasnian and hence, they presumably also belong to the Lower or Middle Polygnathus asymmetricus Zone.

SYSTEMATIC DESCRIPTION

Family Enteletidae Waagen, 1884

Subfamily Schizophoriinae Schuchert & Le Vene, 1929

Genus SCHIZOPHORIA King, 1850

Schizophoria sp.

(Pl. 1, Figs 8—9)

1896. *Orthis* (*Schizophoria* King) *striatula* Schloth.; Gürich, p. 242 (partim).

Material. — Two fragmentary disarticulated specimens of brachial and pedicle valves, all exfoliated.

Dimensions (mm):

Cat. no.	length	width	no. of costellae per 1 mm, anteriorly
Z. Pal. Bp. XIV			
41 (pedicle valve)	35	7.45	2
29 (brachial valve)	34.9	4.2	2

Description. — Shell large, subquadrate in outline, convexo-plane in profile; pedicle valve weakly convex umbonally, flattened anteriorly with a median sulcus present on the anterior half of the valve; brachial valve deep, with a regular curvature in profile. Shell surface multi-costellate, costellae appear to be sharp, the separating furrows almost equal to the costellae thickness. Shell punctate, punctae small and densely spaced. Interior not studied.

Remarks. — The specimens are poorly preserved and not very suitable for comparison with the other known species of schizophorids. Only two features can, to some extent, be considered as taxonomically valuable (at specific rank), i.e. the large shell size, much exceeding that of e.g. Middle Devonian forms and the more transversely elongate shell. The former feature has been also mentioned by Gürich as characteristic for the schizophorids collected by him from the Kadzielnia limestone and recorded in association with, among others, atrypids (Gürich 1896, pp. 242—243). The other morphological features such as e.g. shell ornamentation, shell shape and outline, appearance of ventral beak are clearly of the *Schizophoria* type, but can not be used to study the differences in the degree of their development. The above specimens represent, in all probability, a separate species quite characteristic, but unfortunately the present collection does not allow for erection of a new taxon.

Family Pentameridae M'Coy, 1844

Subfamily Gypidulinae Schuchert & Le Vene, 1929

Genus GYPIDULA Hall, 1867

Gypidula (*Ivdelinia*) *rectangularis* (Torley, 1934)

(Text-fig. 1; Pl. 1, Figs 1—5)

1896. *Pentamerus biplicatus* Schnur var. c; Gürich, p. 274.

1969. *Gypidula* (*Ivdelinia*) *rectangularis* (Torley, 1934); Jux, p. 69, Pl. 16.

Material. — Ten not complete articulated and disarticulated specimens.

Dimensions (mm):

Cat. no.	length	width
Z. Pal. Bp. XIV		
21)	16.0	17.3

Description. — Shell up to medium size, biconvex — ventri-biconvex, the ventral fold and dorsal sulcus present in adult shells, developing when the shell length is, on an average, 12 mm; delthyrial plates small, conjoint on their posterior part. Shell surface smooth to weakly plicated, the plications present on the anterior half of the shell, the longest in the sulcus and on the fold, the shortest, often only marked, on the lateral slopes of the shell. As a rule, there are two to four plications each, on the fold, sulcus and on the lateral slopes of the valves. Interior of the *Gypidula* type (Fig. 1).

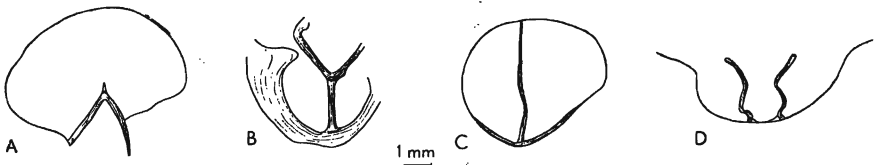


Fig. 1

Gypidula (Ivdelinia) rectangularis (Torley); internal details of four specimens Bp. XIV/37, 38, 39, 40; A—C illustrate the ventral umbo, D cruralium

Remarks. — Although the collection is fragmentary, both in the state of preservation and number of specimens, it shows some range of variability mainly in the number of surface plications, to a much lesser degree in the shell shape and outline of fold and sulcus. This is in agreement with Gürich's observations on his collection from the Kadzielnia limestone (Gürich 1896, p. 274). All specimens at hand, judging from their size and appearance of radial plications, are not, in all probability, in their full growth, the number of median plications is, however, differentiated, changing from two to four. Some of our specimens are in agreement with *Gypidula rectangularis* (Torley) including all varieties mentioned by Jux (1969).

Occurrence. — Middle Devonian — Upper Devonian; Germany, Lower Plattenkalk — Upper Plattenkalk, Refrath Beds, Devon of Bergisch; Poland — Kadzielnia limestone.

Gypidula (Devonogypa) sp.

(Text-fig. 2; Pl. 1, Figs 6—7)

Material. — Two specimens, one almost complete.

Description. — Specimens of medium size, the approximate length 19.6 mm, width posteriorly 9.5 mm, width anteriorly 19.6 mm. The shell is elongate oval, with greatly narrowing umbonal part, anterior margin more sinusous or less. On the shell surface the concentric lines are observed. Interior is showed in Fig. 2.

Remarks. — The specimens are the closest rather to those of *G. (Devonogypa) spinulosa* var. *sulcata* Jux figured by Jux (1969; Pl. 19, Fig. 4) from the Lower Frasnian of Dorp near Wuppertal. The external appearance is much the same. The only observable difference is that our specimens are more narrowly outlined posteriorly. It might be, however, not a stable feature, taking into consideration the great range of individual variability which is so characteristic for, among other, gypidulids. Unfortunately, the scarce material does not allow detailed observations in the above matter.

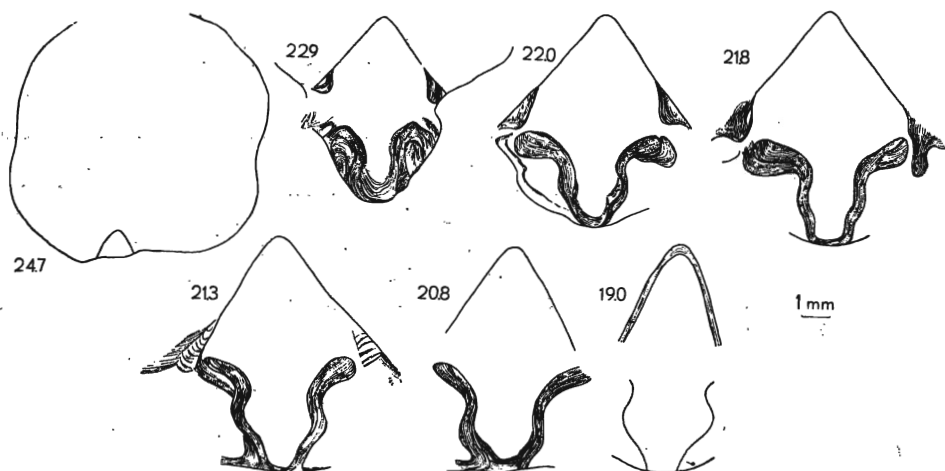


Fig. 2

Gypidula (Devonogypa) sp.; Bp. XIV/45, serial sections of adult specimen

Occurrence. — The genus is long-ranged, characteristic of Middle and Upper Devonian of Germany, and known from Lower Plattenkalk nearly throughout the Adorf Beds to about Sander shales. In the Kadzielnia limestone this is, up to now, rare form, probably limited to the lower part of the profile.

Family **Productellidae** Schuchert & Le Vene, 1929

Genus *PRODUCTELLA* Hall, 1867

Productella cf. herminae Frech, 1891

(Pl. 1, Fig. 10)

1896. *Productella herminae* Frech; Gürich, p. 219.

Remarks. — One fragmentary shell with few fragmentary spines preserved at the anterior margin. No doubt, it is a member of the genus *Productella* and in the appearance of the few surface spines, rather very dispersed on the shell surface, is very close to the Frech's species *Productella herminae*. The species is mentioned by Gürich (1896) from the Kadzielnia quarry.

Occurrence. — The species is widely distributed in the lower part of the Upper Devonian of Germany, e.g. of Harz. It is also known from the Upper Devonian (Lower Famennian) of the Ural, whereas in the Holy Cross Mountains — in the Frasnian of Trzcianka, Kostomioty (Kościelniakowska 1967) and from the Kadzielnia profile.

Family **Uncinulidae** Rzhonsnitskaya, 1956

Subfamily **Hypothyridininae** Rzhonsnitskaya, 1956

Genus *HYPOTHYRIDINA* Buckman, 1906

Hypothyridina cf. coronula (Drevermann, 1901)

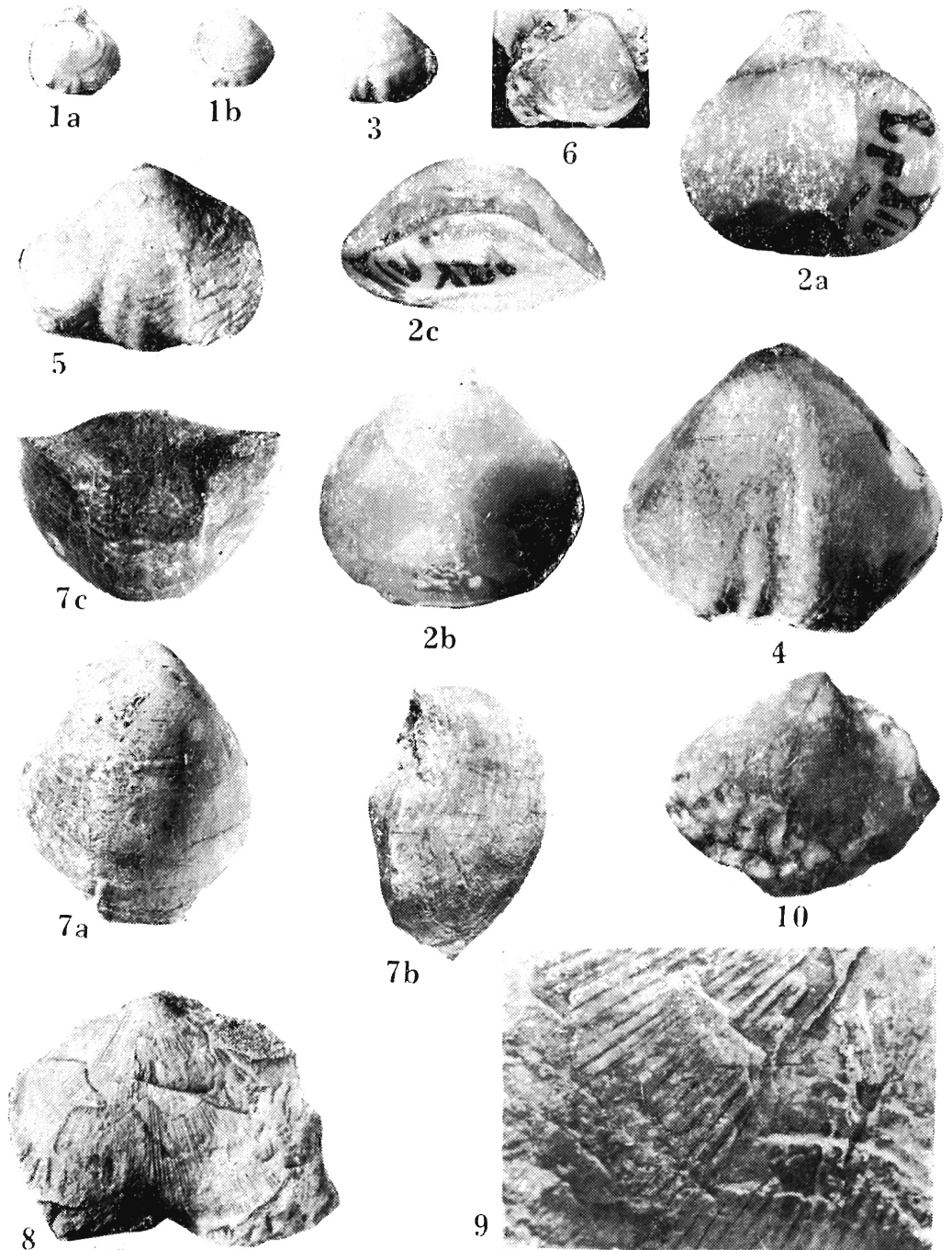
(Pl. 2, Fig. 4)

1896. *Rhynchonella cuboides* Sow.; Gürich, p. 287.

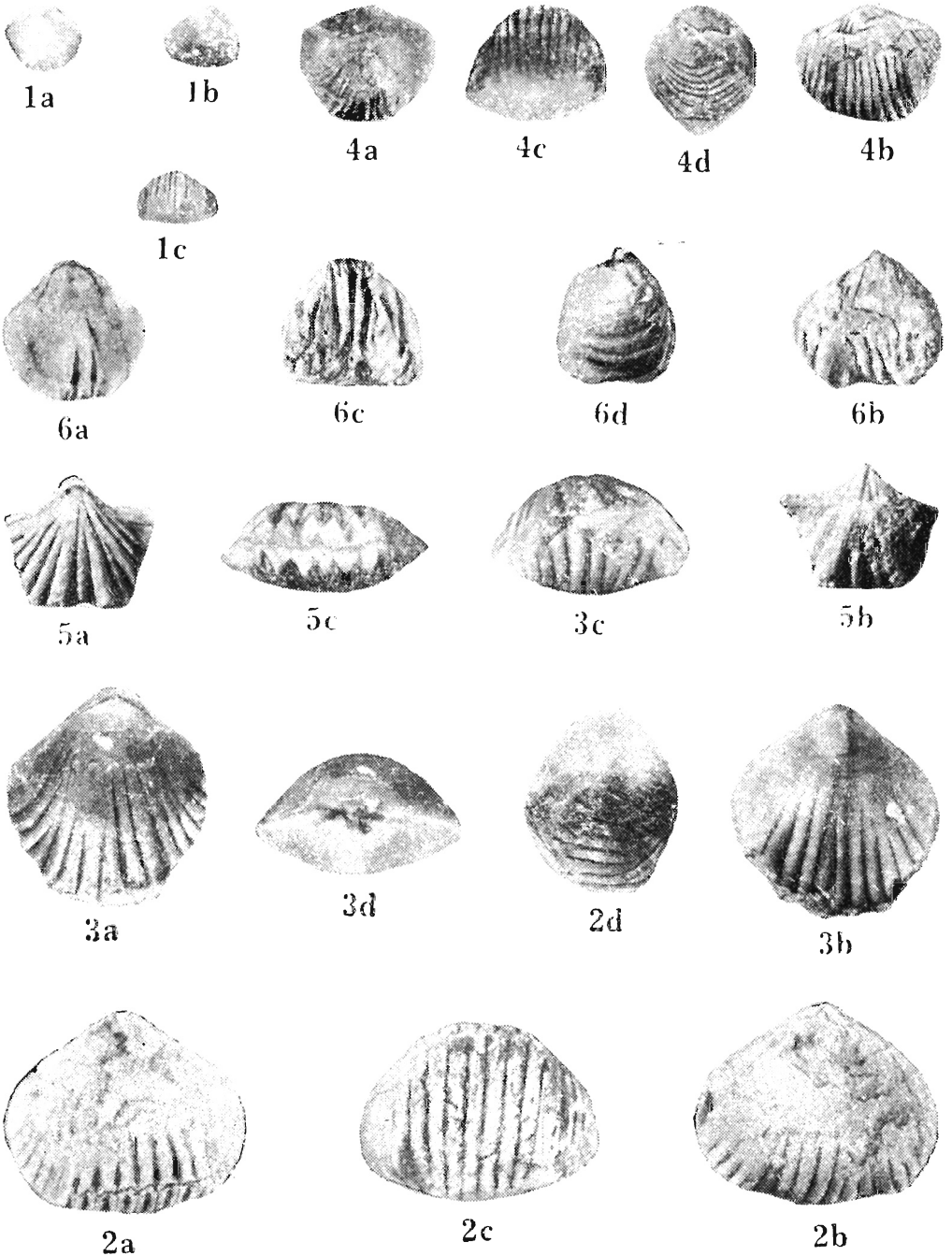
1901. *Rhynchonella (Hypothyris) coronula*; Drevermann, p. 196, Pl. 15, Figs 12–13.

Material. — One specimen, entire, with both valves closed.

Description. — Shell of medium size, 17.4 mm in length, 20.3 mm in width, 19.3



1-5 — *Gypidula (Ivdelinia) rectangularis* (Torley); 1-2 adult specimen Bp. XIV/21, a dorsal, b ventral, c anterior views, nat. size and X3; 3-4 ventral view of the specimen Bp. XIV/20, nat. size and X3; 5 ventral view of the specimen Bp. XIV/20d, X2.
 6-7 — *Gypidula (Devonogypa)* sp.; 6 specimen Bp. XIV/60, ventral view, nat. size; 7 specimen Bp. XIV/60d, a ventral, b lateral, c anterior views, X 2.
 8-9 — *Schizophoria* sp.; 8 specimen Bp. XIV/41, ventral view, nat. size; 9 the same specimen X3, fragment of the surface ornament showed.
 10 — *Productella* cf. *herminae* Frech; specimen Bp. XIV/7d, ventral view, X4.



1-3 — *Hypothyridina nana* Nalivkin; a dorsal, b ventral, c anterior, d lateral views; 1-2 specimen Bp. XIV/270 post-brefic shell, nat. size and $\times 3$; 3 specimen Bp. XIV/27a, brefic shell, $\times 3$.
 4 — *Hypothyridina* cf. *coronata* (Drevermann); post-brefic shell Bp. XIV/27, a dorsal, b ventral, c anterior, d lateral views, nat. size.
 5 — *Fitzroyella alata* Biernat; post-brefic shell Bp. XIV/28d, a dorsal, b ventral, c anterior views, $\times 3$.
 6 — *Yunanella ?globifrons* (Gürich); adult specimen Bp. XIV/8a, a dorsal, b ventral, c anterior views, nat. size.

mm in thickness, subquadrangular in outline, faintly dorsi-biconvex in profile; anterior commissure with a widely quadrangular uniplication, tongue comparatively broad, 13.7 mm in width, its anterior margin straight. Shell surface covered with low and broad costae separated by very narrow, almost linear furrows. The shell possesses 8 costae on the tongue.

Remarks. — The exterior of the specimen is very much of the *Hypothyridina* type, especially the shell shape, appearance of the tongue and radial costae. Gürich (1896, p. 287) mentioned the presence of the species *Hypothyridina cuboides* (Sow.) in the Kadzielnia limestone. This seems, however, doubtful. A specimen at hand comes, in general appearance, close to the specimens of *H. cuboides* from the Devonian of England figured by Davidson (1864; Pl. 13, Figs 18—21) and by Schmidt & McLaren (1965, Fig. 443.2). It differs, however, greatly in being shorter and wider in comparison to the English specimens and has a lesser number of radial costae on the tongue. Similar distinguishing features occur when compared to the Uralian *H. cuboides* figured by Nalivkin (1947; Pl. 21, Figs 15—16) or to the Fitzroyan species *Hypothyridina margarita* described by Veevers (1959; Pl. 10, Figs 31—35). Our specimen comes closest to the Drevermann's *H. coronula* from the Frasnian of Germany, especially in the breadth of costae and their number on the tongue, which is usually 7—9. The considered shell is, however, more transverse with shorter lateral margins and more globose than the German specimens. It might be, that the specimen in question is a member of a new species.

Occurrence. — The species is rather rare, occurring in the Frasnian; Germany — Tuffbreccia of Langenaubach near Haiger, USSR — Ural, Poland — Kadzielnia limestone.

Hypothyridina nana Nalivkin, 1951

(Text-fig. 3; Pl. 2, Figs 1—3)

1896. *Rhynchonella cuboides* Sow. var. *minor*; Gürich, p. 287 (nomen nudum).

1951. *Hypothyridina cuboides* var. *nana* var. n.; Nalivkin, p. 11, Pl. 3, Fig. 6.

Material. — Nine specimens, young and adult, including six entire shells or almost so, and two fragments of shell and of disarticulated pedicle valve.

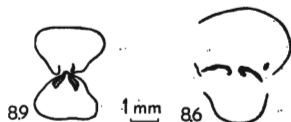
Approximate dimensions (mm):

Cat. no. Z. Pal. Bp. XIV	length	width	thickness	width of tongue	no. of costae on tongue
27a)	9.0	10.4	6.3	6.2	7
25a)	9.5	11.5	8.1	7.2	7
25b)	9.9	12.3	7.3	7.2	7

Description. — Shell of small size, subquadrangular in outline biconvex to faintly dorsi-biconvex in profile, anterior commissure with wide quadrangular uniplication; tongue comparatively broad with parallel margins and straight or almost so anterior edge. Surface costae low and broad, the separating furrows linear. On the tongue there are 6—7 costae. As to the interior, not very much can be seen on the cross section. There are discernible only very delicate dental plates, small teeth and divided hinge plate; no dorsal median septum occurs (Fig. 3).

Fig. 3

Hypothyridina nana Nalivkin; Bp. XIV/25c,
cross sections of post-brefic shell



Remarks. — The diminutive shell size is one of the main characteristics of the above form, mentioned also by Nalivkin (1951, p. 11) for the specimens from the Frasnian of the Ural. In the collection from the Kadzielnia limestone, there are both young specimens representing the brefic stage and adult forms belonging

to the post-brefic growth stage. Differences in the shell size in the above two growth groups are minimal; the brefic shell is quite rhynchonelloid in its appearance, being only slightly biconvex, and the anterior margin a little elongate anteriorly and roundly outlined (Pl. 2, Fig. 3). The adult shell is distinctly of the *Uncinulus* type with very advanced vertical growth, the vertical zone (Pl. 2, Figs 1—2) being markedly defined and quite large.

Our form is considered as conspecific with the Nalivkin's species *H. nana*. Although the illustrations of the Uralian form are not very distinct, one can recognize some other similarities with our specimens, both in the shell shape and outline, appearance of the tongue and in the shell ornament.

Occurrence. — Frasnian; USSR — Ural, Poland — Kadzielnia limestone.

Subfamily Uncinulinae Rzhonsnitskaya, 1959

Genus FITZROYELLA Veevers, 1959

Fitzroyella alata Biernat, 1969

(Pl. 2, Fig. 5)

1969. *Fitzroyella alata* n.sp.; Biernat, p. 377, Figs 1—5, Pls 1—3.

Remarks. — Only two specimens, both entire, were found in the lower part of the Kadzielnia limestone. They do not differ in comparison with those from the higher parts of the Kadzielnia limestone and from the Kowala profile (cf. Biernat 1969). Their stratigraphic position, according to the conodont dating of the Kowala profile (Szulczewski 1971), can be defined as the Lower Frasnian, Polygnathus asymmetricus Zone (to *Ia*). In the Kadzielnia limestone, they seem to pass throughout the whole profile, and their range can be defined as to *Ia* — to *Iy* (cf. Szulczewski 1971).

Family Pugnaciidae Rzhonsnitskaya, 1956

Genus PARAPUGNAX Schmidt, 1964

Parapugnax brecciae (Schmidt, 1941)

(Text-fig. 4; Pl. 3, Figs 5—10)

1896. *Rhynchonella acuminata* Mart.; Gürlich, p. 289.

1941. *Pugnax pugnax brecciae* n. subsp.; Schmidt, p. 278, Figs 6, 11.

Material. — About thirty, more or less complete specimens of different size, many fragments of shells.

Approximate dimensions (mm):

Cat. no. Z. Pal. Bp. XIV	length	width	thickness	breadth of tongue	no. of plications on tongue
11a)	25.5	35.5	16.3	20.5	—
11b)	23.5	29.1	15.6	20.1	2
14)	29.0	74.0	719.0	720.0	3

Description. — Shell slightly dorsi-biconvex in profile and almost trapezoidal in outline, rather distinctly gibbous; tongue well developed, with bottom flattened or slightly concave, not very well delimited from the lateral parts of the valve, starting usually at about half of the valve-length, wide, generally constituting about two-thirds of the whole shell width, lateral margins mostly subparallel; anterior margin changing from almost straight to nearly subogival; dorsal fold badly defined. Marginal plications, short, often subdued, except for the few sulcal plications, one to four in number, which are two to four times longer than the lateral ones. Concentric microlines regularly spaced on the shell surface, 8—9 per

1 mm, as a rule of almost equal thickness. As to the interior, no dorsal medium septum stated in the brachial valve; in the pedicle valve the dental plates are comparatively thick, almost parallel, teeth small (Fig. 4).

Remarks. — All specimens are of different size related to their different growth stage, ranging from about 15 mm in length and 17 mm in width to about 30 mm in length and 40 mm in width. They all preserve their special appearance, having the sulcal tongue comparatively well developed, without or with poorly de-

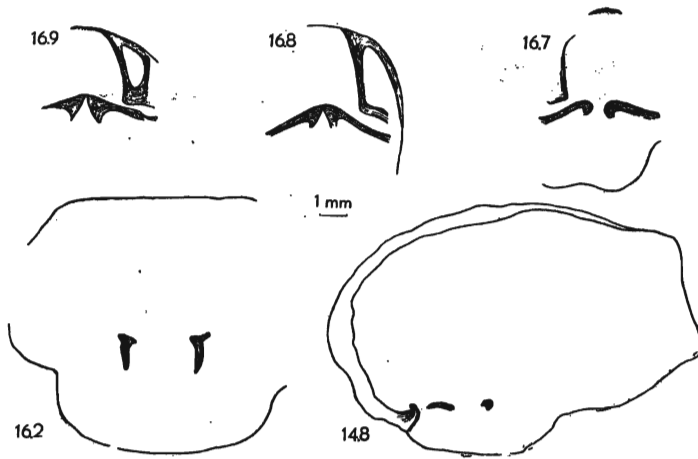


Fig. 4

Parapugnax brecciae (Schmidt); Bp. XIV/31a, serial sections of adult specimen

veloped, marginal plications and delicate, regularly spaced, all over the shell surface, concentric microlines. The changes with growth are not considerable; all morphological features develop proportionally to the shell growth. A special attention is paid to the radial plications, as their number and degree of development being changeable within species. The same feature is mentioned by Nalivkin (1930, p. 83) as characteristic for his *Pugnax acuminatus* var. *typicus* from the Upper Devonian of Turkestan.

The specimens are supposed to be conspecific with *Parapugnax brecciae* Schmidt described from the Frasnian (Überger Kalk) of Germany (Schmidt 1941; p. 278, Pl. 1, Fig. 6); the external similarities are in the number of radial plications in the sulcal tongue (2—4 in the German form and 1—4 in our) and lateral slopes, and much the same shell shape and outline. Less acute plication in our specimens is, most probably, due to the exfoliation of the shell. There is a great similarity to *Pugnax acuminatus* (Martin) from the Upper Devonian of Turkestan figured by Nalivkin (1930; Pl. 6, Fig. 11), expressed mainly in the character of radial plications — our specimens being, however, much wider. Specimens of *P. acuminatus* from Torquay, England, possess (cf. Davidson 1864—1865; Pl. 12, Figs 1—3) more numerous and much finer radial plications.

Occurrence. — Upper Devonian; Germany — Adorf Beds (Überger limestone), Tuffbreccia of Langenaubach near Überger; Poland — Kadzielnia limestone.

Family *Camarotoechiidae* Schuchert & Le Vene, 1929
 Subfamily *Camarotoechiinae* Schuchert & Le Vene, 1929
 Genus *CALVINARIA* Stainbrook, 1945
Calvinaria cf. *albertensis albertensis* (Warren, 1928)
 (Pl. 3, Figs 2—4)

1962. *Calvinaria albertensis albertensis* (Warren); McLaren, p. 26, Pl. 1, Figs 1—11.

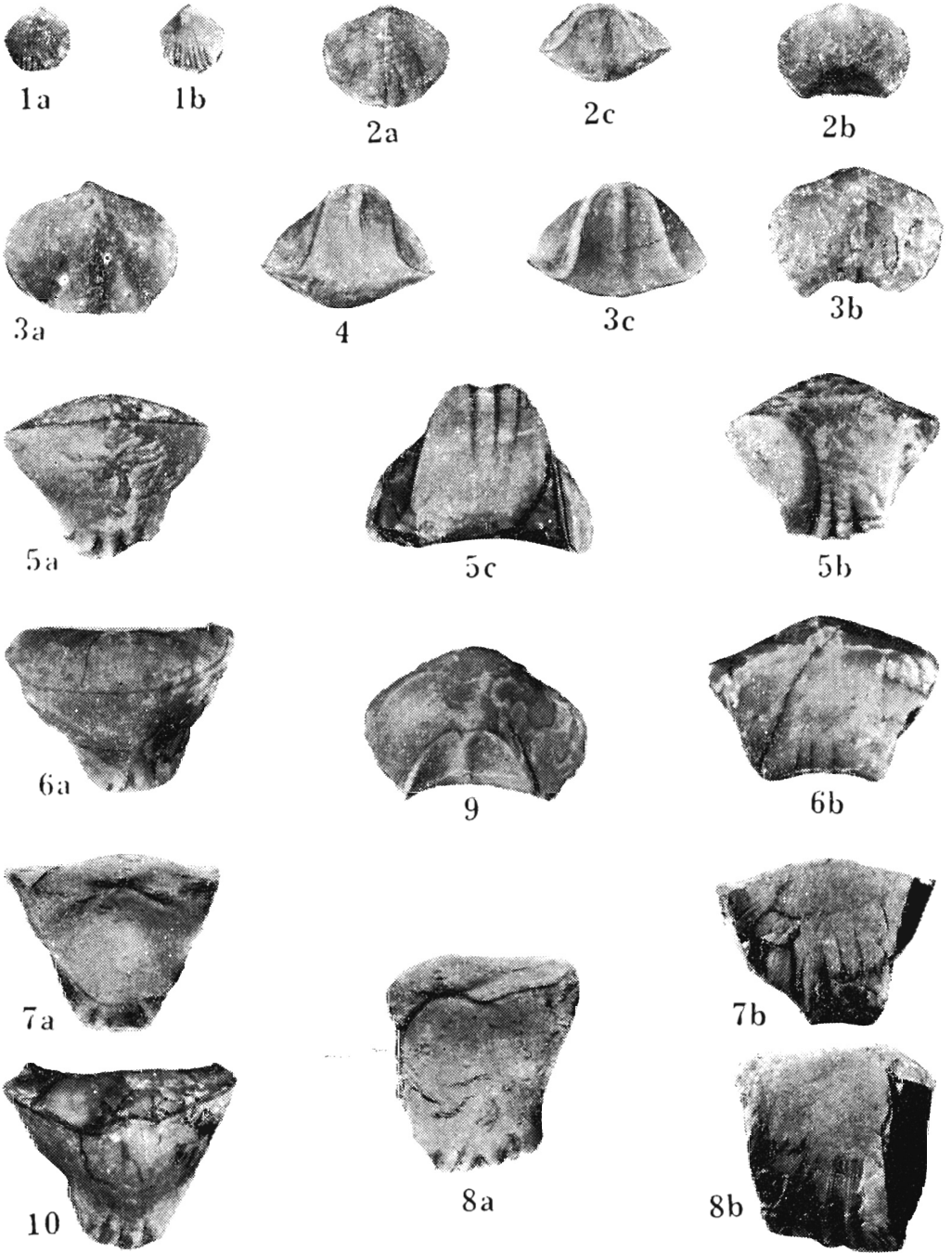
Material. — Four specimens, two or them entire.

Dimensions (mm):

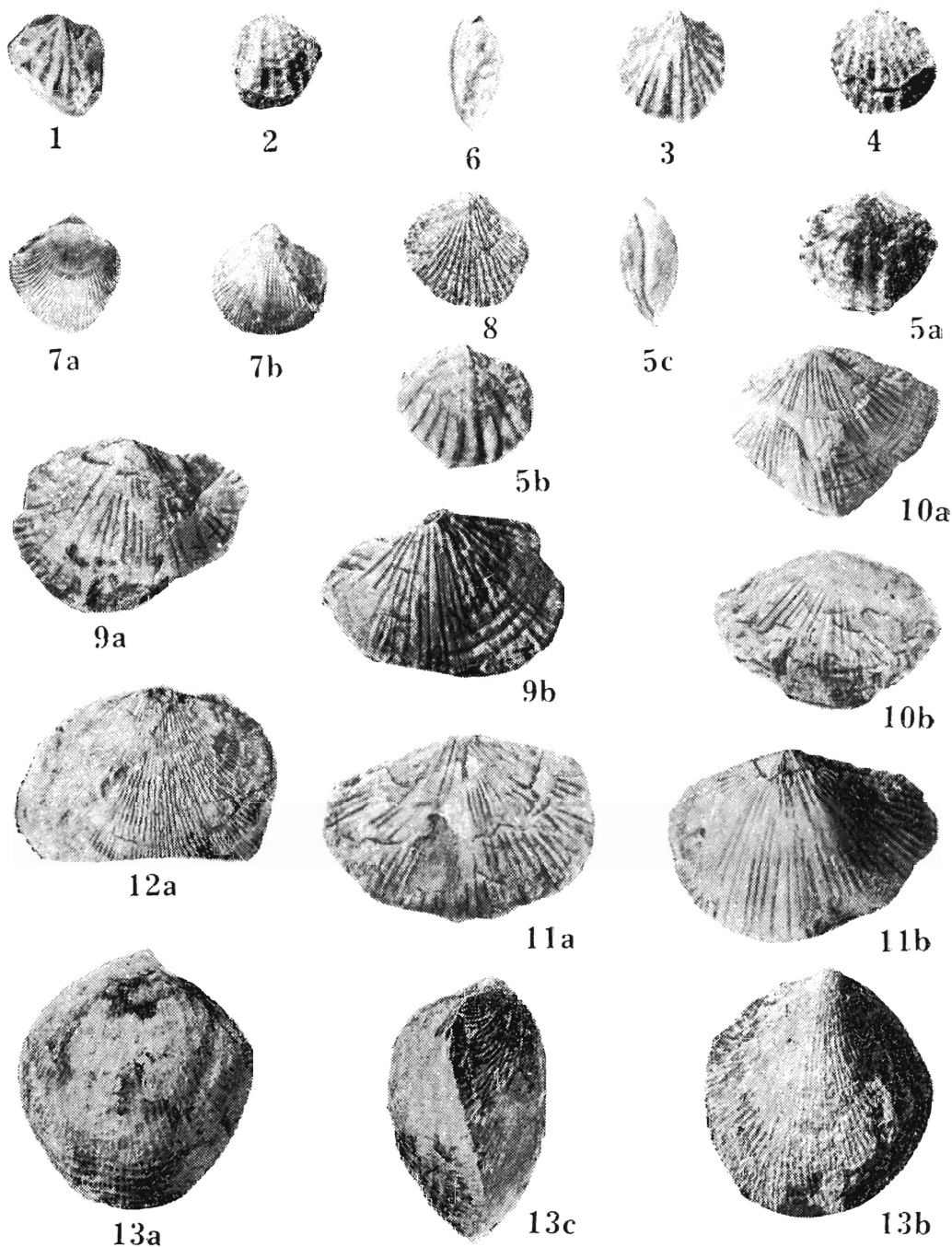
Z.	Cat. no.		length	width	thickness	width of tongue
	Pal.	Bp. XIV				
	8f)		15.8	19.9	11.0	12.0
	8e)		21.8	25.8	15.7	15.3

Description. — Shell of medium size for the genus, transversely elongate, much wider than long; moderately biconvex to dorsi-biconvex on the posterior half of the shell; hinge line straight, lateral margins rounded, anterior margin moderately sulcinate; ventral and dorsal beaks small, incurved; ventral sulcus quite well defined, slightly trigonal in outline, starting about mid-length of the valve extending into a broad and somewhat flattened to slightly concave tongue, the anterior edge of the tongue moderately arched and medially more distinctly or less incised. Dorsal fold similarly starting about mid-length of the valve, moderately elevated. Shell surface smooth or almost so, except for the two simple rounded costae on the fold and usually one in the sulcus, originating on the posterior third of the shell; the flanks being smooth or sometimes bearing a few costae weakly developed in the marginal region. As to the interior, the dental plates are very short, and dorsal medium septal ridge is marked on the umbonal part of the brachial valve; no more details of the internal structure are seen.

Remarks. — The species is quite characteristic in its external features, especially by the distinctly biconvex posterior half of the shell and the tongue with anterior edge incised medially. Our form is closely related to such forms as: „*Leiorhynchus*” *biplicatus* described from the Middle Frasnian of the Ural (Nalivkin 1960; p. 362, Pl. 85, Figs 5—7), and two Canadian forms *Calvinaria albertensis albertensis* (Warren) reported from the Southesk formation (McLaren 1962; p. 26, Pl. 1, Figs 1—11) and *Calvinaria opima* McLaren from the High River formation (McLaren 1962; p. 31, Pl. 2, Figs 1—6), both the latter forms being also from the Middle Frasnian. All these mentioned species, similarly as our form, are transversely elongated, they have similarly developed tongue with one distinct median costa on the sulcus and two on the fold, and incised anterior edge of the tongue. Our form is however larger in size, more globular posteriorly and has no or very weakly developed radial costae on the flanks (also the tongue costation being weaker). The costation of the flanks is a somewhat changeable feature in the Canadian and Russian forms; variations occur both in the number of costae and degree of their development, specimens without costae or those with very weakly developed are not rare. In addition, it is quite probable, that *Leiorhynchus biplicatus* Nalivkin is member of a genus *Calvinaria*, as it may be judged from the external morphology; unfortunately its interior is unknown.



— *Hypothyridina nana* Nalivkin; specimen Bp. XIV/27b, bryozoan shell, a dorsal, b ventral views, nat. size.
 2-4 — *Calvinaria* cf. *albertensis albertensis* (Warren); 2-3 specimens Bp. XIV/8f, 8e, a dorsal, b ventral, c anterior views; 4 specimen Bp. XIV/8g, anterior view; nat. size.
 5-10 — *Parapugnax brecciae* (Schmidt); 5-8 specimens Bp. XIV/13, 11, 12, 14, a dorsal, b ventral, c anterior views; 9-10 specimens Bp. XIV/11a, 12a, anterior and dorsal views; nat. size.



1-6 — *Spinatrypina* cf. *plicata* Rzhonsnitskaya; 1-4 specimens Bp. XIV/1-4, ventral views; 5 specimen Bp. XIV/4d, a dorsal, b ventral, c lateral views; 6 specimen Bp. XIV/4f, lateral view; nat. size.
 7-8 — *Spinatrypina* *comitata* Copper; specimens Bp. XIV/4g, 4h, 7a dorsal, 7b, 8 ventral views; nat. size.
 9-11 — *Spinatrypina* (*Exatrypa*) *planata* sp.n.; specimens Bp. XIV/8, 9, 10, a dorsal, b ventral views; 11 holotype; nat. size.
 12-13 — *Desquamatia* (*Seratrypa*) *pectinata* (Schröter); specimens Bp. XIV/34, 7, a dorsal, b ventral, c lateral views; nat. size.

Family *Yunanellidae* Rzhonsnitskaya, 1959Genus *YUNANELLA* Grabau, 1923*Yunanella ?globifrons* (Gürich, 1896)

(Pl. 2, Fig. 6)

1896. *Rhynchonella pugnus* var. *globifrons*; Gürich, p. 288, Pl. 7, Figs 2a, 2b.*Material.* — One specimen complete, to a much degree exfoliated.*Dimensions (mm):*

Cat. no.	length	width	thickness	width of sulcus
Z. Pal. Bp. XIV 8d)	21.9	20.9	16.2	13.0

Description. — Shell of medium size, dorsi-biconvex, narrowly pentagonal in outline, fold and sulcus well delimited, ventral umbo acute; surface of the shell paucicostate — the costae sharp and well preserved rather on the anterior half of the shell, there are three costae on the fold, two to three on the sulcus and four on the flanks; in addition, the whole shell surface is finely costellate — this observed on the preserved patches of the shell external layer; antero-lateral commissure distinctly serrate. On the decorticated umbonal part of the shell the traces of median dorsal septum and dental plates are detectable.

Remarks. — The general appearance of the shell, i.e. character of the radial costae which are acute and costellate shell surface suggest the assignment of the specimen to the genus *Yunanella*. The questioned specimen is, in all probability, a member of Gürich's form described and figured by him from the Kadzielnia limestone (Gürich 1896; p. 288, Pl. 7, Fig. 2); the latter is much better preserved and shows some differences in external morphology (shell wider, tongue slightly less elevated, more costae in the sulcus) but these features somewhat vary within the species as already mentioned by Gürich (1896). On the basis of the possessed material (one shell) it is impossible to determine its assignment to the known species of yunanellids.

Family *Atrypidae* Gill, 1871Genus *SPINATRYPINA* Rzhonsnitskaya, 1964*Spinatrypina* cf. *plicata* Rzhonsnitskaya, 1964

(Text-fig. 5; Pl. 4, Figs 1—6; Pl. 8, Fig. 4)

1896. *Atrypa aspera* Schloth.; Gürich, p. 273 (partim).1964. *Spinatrypina plicata*; Rzhonsnitskaya, Pl. 1, Fig. 13.*Material.* — Fifteen specimens more complete or less, many fragments of shells.*Approximate dimensions (mm):*

Cat. no.	length	width	thickness	no. of ribs on	
				brachial valve	valve pedicle
Z. Pal. Bp. XIV 1)	16.2	16.0	8.0	10	9
2)	18.0	19.6	8.3	9	10
3)	16.1	14.8	10.3	10	9

Description. — Shell small to medium size, pentagonal in outline, biconvex to slightly dorsi-biconvex with roundly outlined antero-lateral margins; ventral beak acute, orthocline, area small but distinctly marked, pedicle foramen comparatively large, deltidial plates small, discernible. Radial ribs strong, tubular to

imbricate, rarely dividing and intercalating on the anterior half of the shell. Internally — teeth small, lateral cavities comparatively large.

Remarks. — Many specimens in the collection seem to be almost indistinguishable from *Spinatrypina plicata* figured by Rzhonsnitskaya (1964; Pl. 1, Fig. 13) having very similar shell outline and shape and appearance of radial costae. Some of specimens, which in addition are slightly deformed, differ somewhat from the type specimen bearing weaker and more numerous radial costae. They are, in this

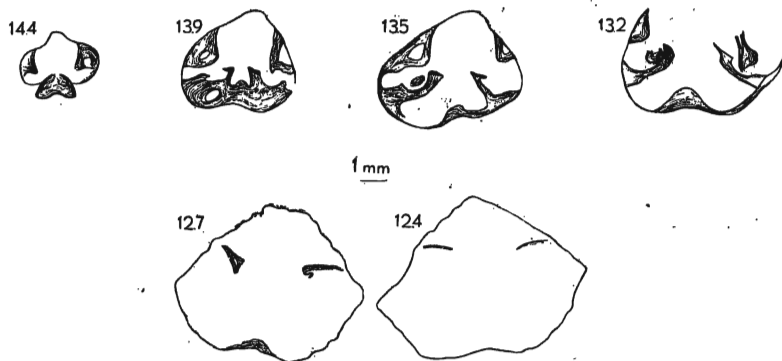


Fig. 5

Spinatrypina cf. plicata Rzhonsnitskaya; Bp. XIV/3d, serial sections of adult specimen

last mentioned feature, comparable to e.g. *Spinatrypina nana* Khal'fin figured by Rzhonsnitskaya (1964; Pl. 1, Fig. 14), which is an Upper Givetian species. All specimens at hand are considered to be the members of one species, most probably conspecific with the Frasnian *Spinatrypina plicata*.

Occurrence. — Frasnian; USSR — Kuznetsk Basin (Manticoceras intumescens Zone), Poland — Kadzielnia limestone.

Spinatrypina comitata Copper, 1967 (Text-fig. 6; Pl. 4, Figs 7—8)

1967. *Spinatrypina* (? *Spinatrypina*) *comitata* sp.n.; Copper, p. 129, Pl. 22, Figs 4—5.

Material. — Three fragmentary shells of small specimens.

Approximate dimensions (mm):

Cat. no.	length	width	thickness
Z. Pal. Bp. XIV 3a)	14.6	14.6	6.6

Description. — Shell of medium size, roundly outlined, moderately biconvex, the greatest convexity on the posterior half of the shell; shell usually longer than wide or as long as wide, widest beneath of the cardinal margin, narrowing anteriorly; ventral beak small, acutely pronounced, as a rule orthocline, area and deltidial plates small. Surface ornamentation composed of fine radial ribs, generally 1—2 per 1 mm, with rounded backs, concentric lines well seen, regularly spaced. Interior: teeth short, incurved a little inwardly, dental cavities usually small; crural bases and crura well developed, jugal plates rather short. The exact number of spires unknown; the brachidium not preserved in its full development.

Remarks. — The species is rather easy to recognize due to combination of morphological features comprising a limited shell size with the greatest biconvexity

on the posterior half of the shell, acute and generally orthocone beak and distinct surface ribbing with lamellar concentric lines.

The specimens which are here considered as conspecific with *Spinatrypina* (*?Spinatrypina*) *comitata* Copper, are associated similarly as in Germany, in the Refrath Beds, with other atrypids, mostly with the very wide, distinctly flattened

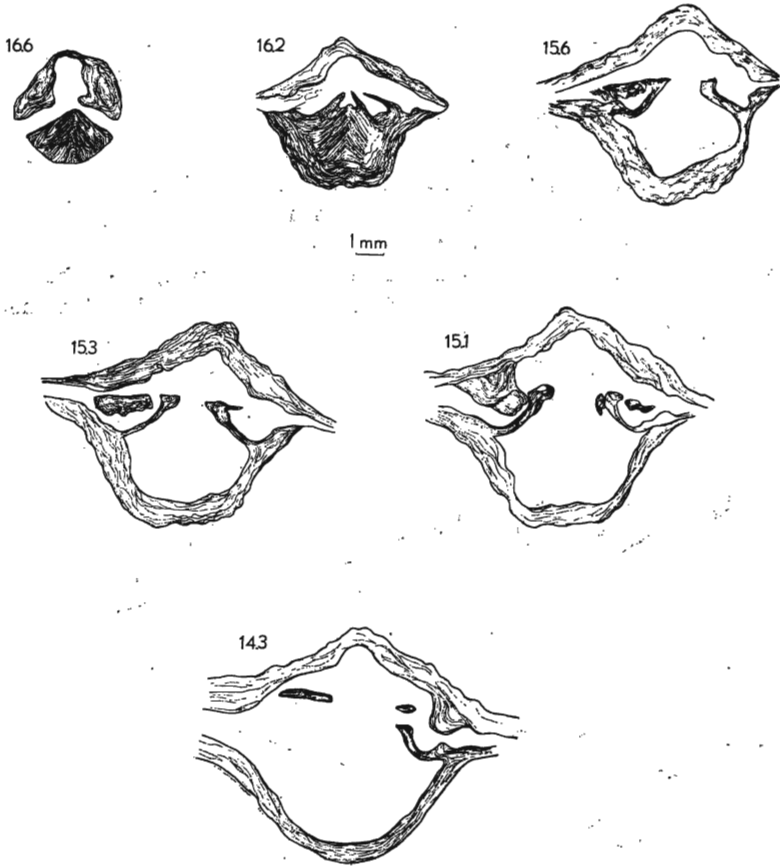


Fig. 6

Spinatrypina comitata Copper; Bp. XIV/3s, serial sections of young specimen.

spinatrypids *Spinatrypina* (*Exatrypa*) *planata* sp.n. which corresponds to the *Sp. (Ex.) explanata* (Schlotheim), and *Spinatrypina plicata* Rzhonsnitskaya.

Occurrence.— Frasnian; Germany — Refrath Beds, Steinbreche horizon (F2a); Poland — Kadzielnia limestone.

Spinatrypina (Exatrypa) planata sp.n.

(Text-fig. 7; Pl. 4, Figs 9—11; Pl. 8, Figs 2—3)

1896. *Atrypa desquamata* var. *applanata*; Gürich, p. 272 (nomen nudum).

Holotype: Bp. XIV/10, figured in Pl. 4, Fig. 11.

Type horizon: Frasnian, lower part of the Kadzielnia limestone.

Type locality: Kadzielnia quarry at Kielce, Holy Cross Mts.

Derivation of name: Latin *planata* — flattened.

Diagnosis: *Spinatrypina* of medium size, very flattened and transversely elongate, interareas exposed, radial ribs tubular.

Material. — Twenty specimens, in general well preserved; many fragments of shells.

Approximate dimensions (mm):

Cat. no.	length	width	thickness	no. of ribs per 1 mm, anteriorly
Z. Pal. Bp. XIV				
10 (holotype)	28.9	40.4	11.5	1
10a)	26.9	35.5	10.5	1
9)	25.5	32.3	11.9	2
8b)	21.4	27.0	8.8	1

Description. — Shell subequally and very moderately dorsi-biconvex, markedly wider than long with roundly outlined antero-lateral margins and anterior commissure weakly sinuous; cardinal margin about two-thirds the maximum shell width, shoulder line almost straight, areal edge sharply defined; area small, ventral beak prominent, orthocline; pedicle foramen circular. Shell surface consisting of tubular radial costae, bifurcating and intercalating usually just beneath each concentric lamella, which can be observed on the anterior half of the shell. As to the interior, the dental plates are short, lateral cavities comparatively small, teeth usually slightly inwardly bent; crural bases and crura stout, jugal plates present (Fig. 7). The full number of spiral whorls not preserved.

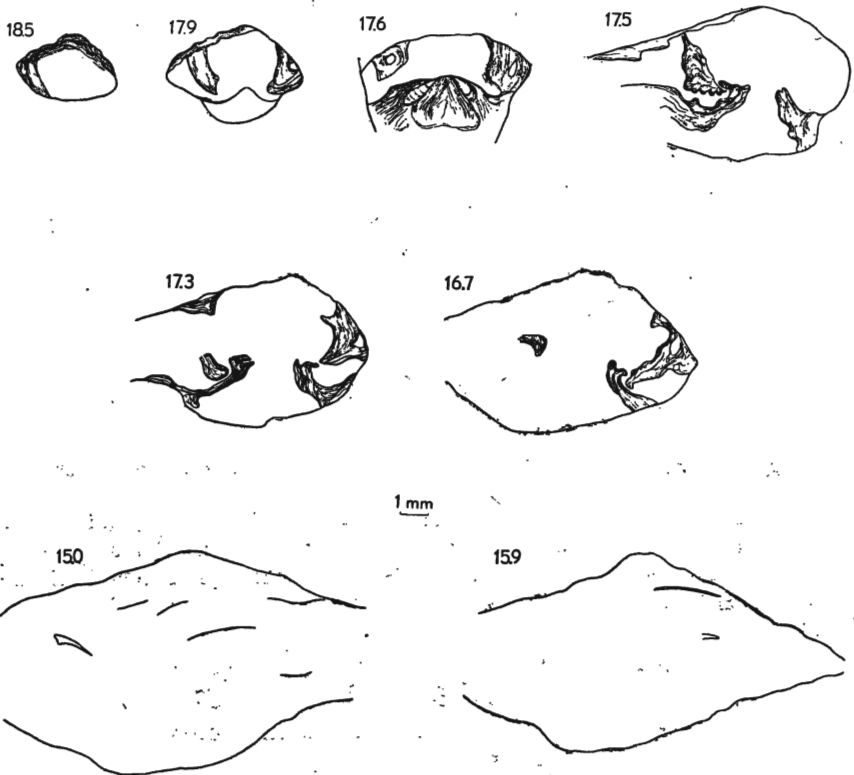


Fig. 7

Spinatrypina (Exatrypa) planata sp.n., Bp. XIV/8a, serial sections of adult specimen

Remarks. — The species is highly characteristic in its external appearance by: 1) a very planar shell, a stable feature occurring also in the juvenile individuals; 2) the shell always wider than long, this proportion preserved during growth; 3) the ventral beak acute, orthocline and area well defined; 4) the pattern of the surface ornamentation which is the same in all specimens, no variations in the thickness of radial costae occur. Also Gürich (1896, p. 272), in this original unillustrated very short description specifies a great flatness of the shell, very much like *Carinatina plana* (Kayser), giving to the Kadzielnia specimens the name *Atrypa desquamata* var. *applanata* (unfortunately nomen nudum). Our *Spinatrypina* (*Exatrypa*) *planata* sp.n. can be distinguished from the very similar *S.* (*Exatrypa*) *explanata* (Schlotheim) in being much more flat, less rectangular and more transversely elongated, also the rib coarseness is much smaller than in the Schlotheim's species (cf. Struve 1966, Fig. 7; Copper 1967, Pl. 20, Figs 1—4). Some specimens of *Atryparia? variabilis* Gedefroid from the Frasnian (F2a) of Belgium, especially that one presented by Gedefroid (1970, Fig. 9 EFG) is very much like our *S.* (*Exatrypa*) *planata* sp.n., mainly in a very transversely elongated shell, which, in addition, is also flattened, particularly the pedicle valve. The discussed Belgian specimen appears to be more subquadrangular in outline.

Genus *DESQUAMATIA* Alekseeva, 1960

Desquamatia (*Seratrypa*) *pectinata* (Schröter, 1777)

(Text-fig. 8; Pl. 4, Figs 12—13)

1967. *Desquamatia* (*Seratrypa*) *pectinata* (Schröter 1777); Copper, p. 132, Pl. 23—25.

Material. — Ten specimens of different size, in general both valves preserved but usually exfoliated, many fragments of shells.

Approximate dimensions (mm):

Cat. no.	length	width	thickness	no. of costae per 5 mm, anteriorly
Z. Pal. Bp. XIV				
33)	18.0	18.1	10.5	7
33a)	22.8	22.2	11.3	8
33b)	30.0	31.7	21.5	7
33c)	32.4	336.0	?	6

Description. — Shell to large size, convex to dorsi-biconvex, to a different degree widely ovate in outline; ventral beak small incurved, area minute, pedicle foramen obscured; lateral margins rounded, anterior margin folded in moderate way. Shell surface covered with fine radial ribs, semitubular, about 6—8 per 5 mm, concentric lamellae usually indistinctly marked due to the state of preservation, 1—2 mm spaced. As to the interior, the teeth are well developed, lateral cavities marked, crural bases bulbous, jugal processes long (Fig. 8).

Remarks. — The described specimens are very much like to *Desquamatia* (*Seratrypa*) *pectinata* (Schröter, 1777) from the Frasnian of Germany, described and figured by Copper (1967, p. 132 — especially to specimens in Pl. 25, Figs 1—2). The similarity is in the external morphology, especially in the appearance of radial costae. Some differences lie in the more elongate shell and finer radial ribs with concentric lines more closely spaced in our specimens. As to the radial ribs, Copper (1967, p. 133) mentions a great variability of thickness in the German species. *Desquamatia* (*Seratrypa*) *frasnensis* described by Gedefroid (1970; Pl. 5, Figs 1—2; Pl. 6, Figs 1—2), in comparison with our form, is more widely outlined and has thicker radial costae.

Occurrence. — Frasnian; Germany — Refrath Beds, probably restricted to the Frasnian F2b—c; Poland — Kadzielnia limestone.

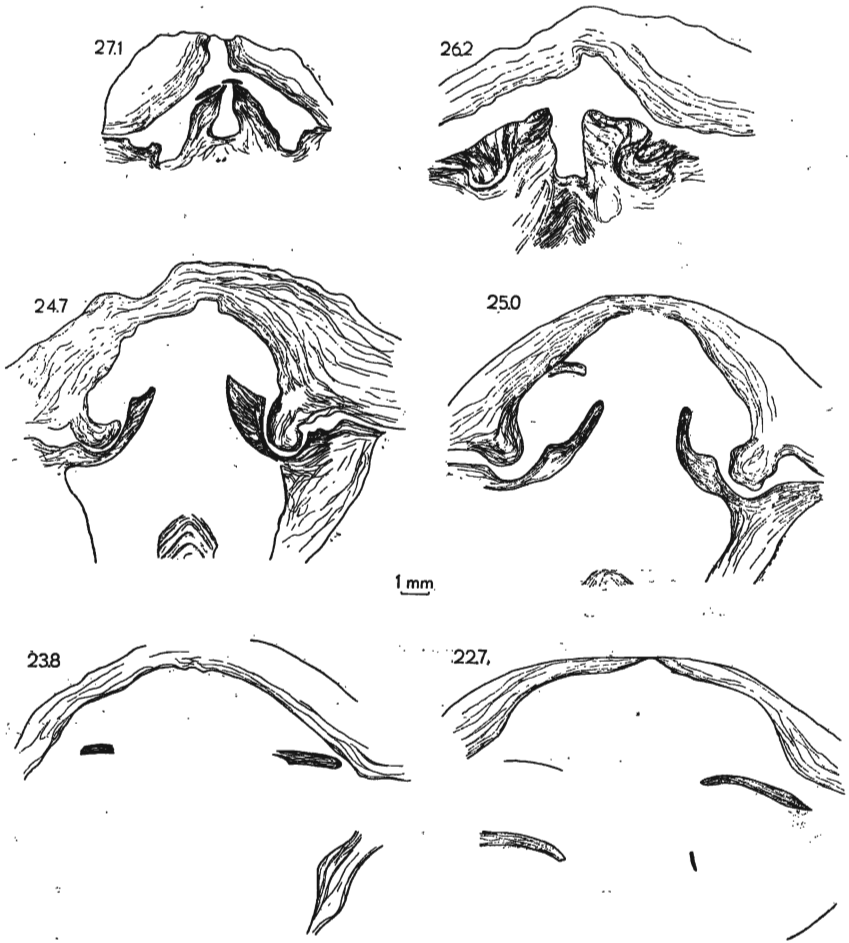


Fig. 8

Desquamatia (Seratrypa) pectinata (Schröter); Bp. XIV/33r, serial sections of adult specimen

Family *Athyrididae* M'Coy, 1844

Genus *ATHYRIS* M'Coy, 1844

Athyris sp.

(Pl. 5, Figs 4—5)

Material. — Seven specimens, three of them almost complete.

Dimensions (mm):

Cat. no.	length	width	thickness
Z. Pal. Bp. XIV 46c)	6.7	7.3	2.6
46a)	8.1	8.2	5.7
46b)	8.8	10.9	6.2

Description. — Specimens small, outline pentagonal in the largest specimens, profile almost equally biconvex, anterior commissure uniplicate. Exterior covered with concentric thickened lines very similar to those of e.g. *Athyris concentrica* (v. Buch). Interior not studied.

Remarks. — In the pentagonal shell outline our form is comparable with the Fitzroyan species *Athyris oscarensis* Veevers described by Veevers (1959; Pl. 14, Figs 1—13) which has more acute apical angle and less globose shell. *Athyris concentrica* (v. Buch) is circular to rounded in outline.

Family *Ambocoellidae* George, 1951

Genus *CRURITHYRIS* George, 1951

Crurithyris globosa (Gürich, 1896)

(Text-fig. 9; Pl. 5, Figs 2—3; Pl. 6, Fig. 12)

1896. *Martinia inflata* var. *globosa*; Gürich, p. 264, Pl. 9, Fig. 13.

Material. — Twenty five specimens more or less well preserved, many fragments of shells and valves.

Dimensions (mm):

Cat. no.	length	width	thickness
Z. Pal. Bp. XIV			
45a)	8.8	9.3	8.3
45b)	8.9	9.7	6.3

Description. — Shell small, almost equally biconvex or slightly ventri-biconvex, the brachial valve being comparatively very deep, in comparison to the other species of the genus, a feature mentioned by Gürich (1896, p. 264) as characteristic of the species; the incurved ventral umbo obscuring the posterior part of the delthyrium, delthyrial plates not very distinct. Hinge line a little shorter than the maximum shell width which occurs anteriorly to it; antero-lateral margins moderately rounded; on both valves very shallow median linear furrows occur, on the brachial valves especially those which are more convex the furrows are often obscured. Ornamentation consists of the regularly spaced concentric lines, usually thickened, but not always preserved. As to the interior, the dental plates are not observed; the adductors as slightly shown by the decorticated posterior part of the dorsal valve are elongate and narrow, running on both sides of a weak septal ridge (Fig. 9).

Remarks. — The species is characteristic by a marked biconvexity of the shell. This feature differs it from the other known species of *Crurithyris*, e.g. *Crurithyris inflata* (Schnur) figured by Vandercammen (1956; Pl. 1, Figs 10—27).

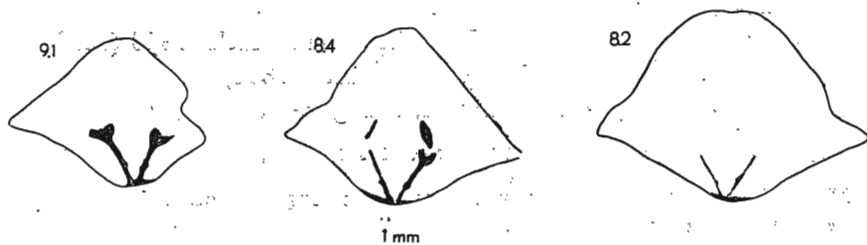


Fig. 9

Crurithyris globosa (Gürich); Bp. XIV/45c, a few cross-sections of adult specimen

Family *Spinocyrtiidae* Ivanova, 1959Genus *ADOLFIA* Gürich, 1919*Adolfia punctata* (Zeuschner, 1870)

(Pl. 5, Figs 1, 6; Pl. 6, Figs 9—10)

1870. *Spirifer punctatus*; Zeuschner, p. 264, Pl. 7, Figs 1—3.1896. *Spirifer punctatus* Zeuschner; Gürich, p. 253.

Material. — Five specimens, two of them almost complete, few fragments of shells or valves.

Dimensions (mm):

Cat. no.	length	width	thickness
Z. Pal. Bp. XIV			
30)	16.9	7.55	14.9
30h)	716.2	727.3	11.5

Description. — Shell transversely elongate, to a different degree mucronate, biconvex to slightly ventri-biconvex in profile, very transversely elongate in outline; the ventral area high, umbo slightly incurved. Ornamentation consists of radial folds, as a rule simple, 10—12 on each valve; on the ventral sulcus which is deep there is one thin median costa; on the brachial valve the median fold is divided, starting at the dorsal umbo. Microornamentation composed of a distinctly marked spine traces, single, somewhat like a drop of water, narrowed posteriorly, arranged in a quincuncial pattern sometimes forming delicate pseudoradial microcostulation. Interior not studied, the crushed ventral umbo of one specimen shows dental plates running parallel and small teeth; on the fragment of the dorsal umbo a cardinal process is discernible.

Remarks. — The species possesses the features signifying the genus *Adolfia* Gürich. The most characteristic of them are: the ventral deep sulcus with a median radial costa, the dorsal fold bifurcating anteriorly and the microsculpture of the shell surface developed as distinct spine traces. *Adolfia punctata* (Zeuschner) closely resembles the specimens of *Guerichella trelonensis* D. Le Maître, figured by Vandercammen (1966; Pl. 2, Figs 1—3, 10) from the Upper Devonian of Belgium, especially in the surface microornamentation and the general shell shape and outline. Specimens of *Adolfia deflexa* (Roemer), the type species of the genus from the Iberger Kalk — Germany, are much more subquadrate and the radial costae are more acute.

Adolfia punctata (Zeuschner) is a rare species in the Kadzielnia limestone; this is in conformity with the opinion of Zeuschner (1870, p. 265) and Gürich (1896, p. 253).

Family *Cyrtospiriferidae* Termier & Termier, 1949Genus *CYRTOSPIRIFER* Nalivkin in Fredericks 1919 (1924)*Cyrtospirifer alata* (Gürich, 1896)

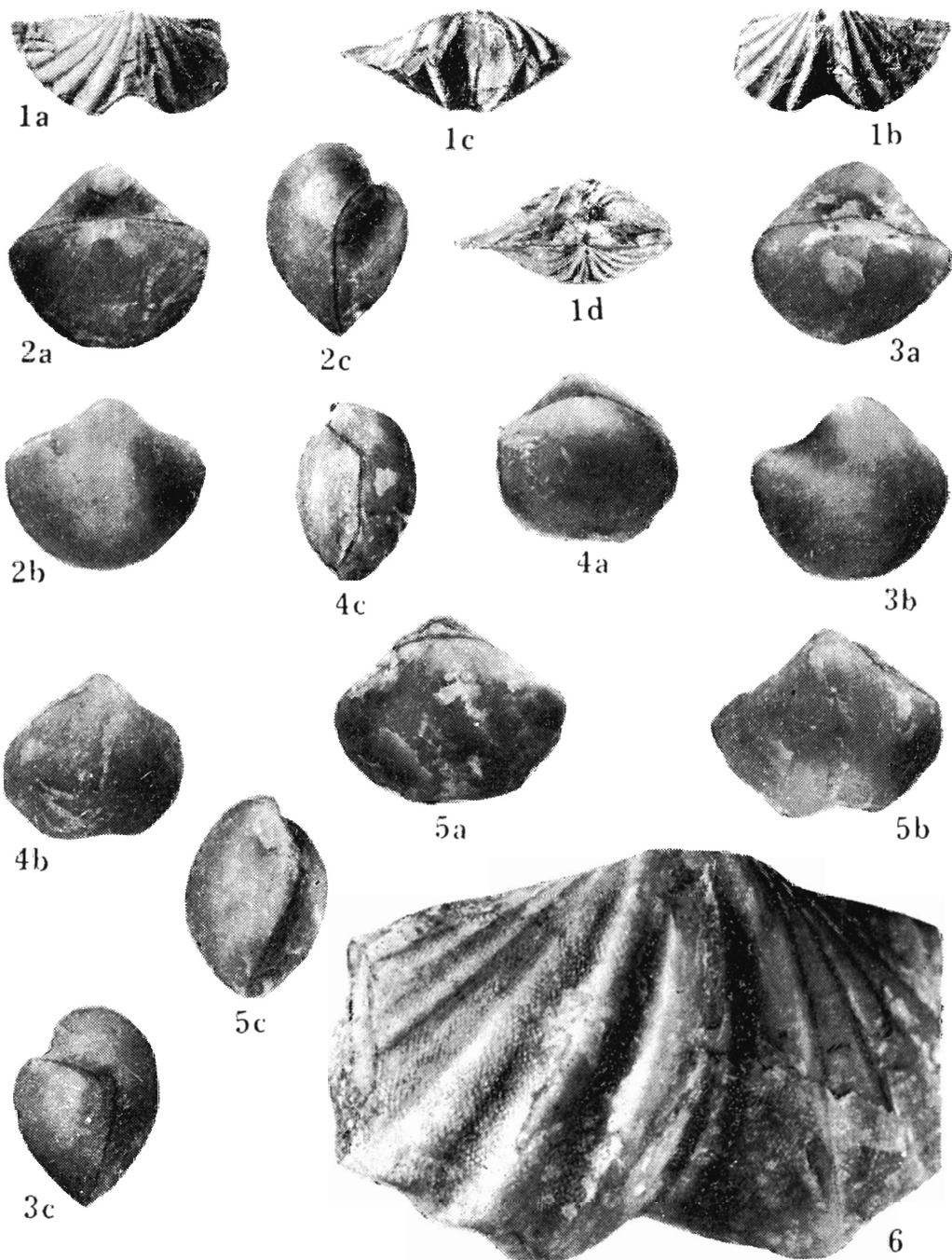
(Text-fig. 10; Pl. 6, Figs 5—7)

1896. *Spirifer canaliferus* var. *alata*; Gürich, p. 249, Pl. 9, Figs 11a, b.

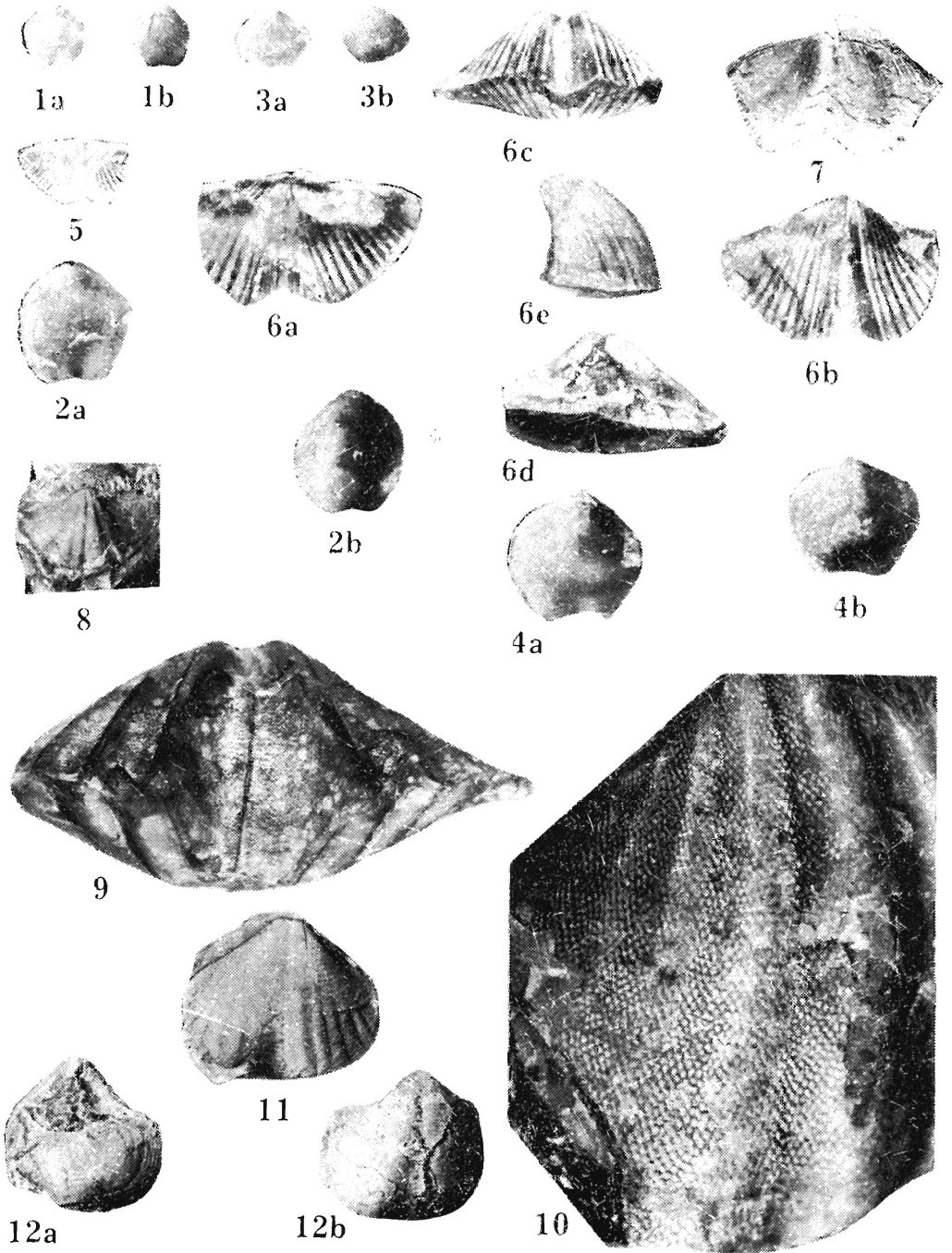
Material. — Three specimens, not complete, strongly exfoliated.

Dimensions (mm):

Cat. no.	length	width
Z. Pal. Bp. XIV		
31)	11.3	19.6



1, 6 — *Adolfia punctata* (Zeuschner); specimen Bp. XIV/30, 1a dorsal, b ventral, c anterior, d posterior views, nat. size; 6 ventral view of the same specimen $\times 4$.
 2-3 — *Crurithyris globosa* (Görrich); specimens Bp. XIV/45a, 45b, a dorsal, b ventral, c lateral views, $\times 3$.
 4-5 — *Athyris* sp.; specimens Bp. XIV/46a, 46b, a dorsal, b ventral, c lateral views, $\times 3$.



1-4 — *Dielasma sacculus* (Phillips); specimens Bp. XIV/17, 16, a dorsal, b ventral views; 1 and 3 nat. size, 2 and 4 $\times 2$.
 5-7 — *Cyrtospirifer alata* (Gürich); specimens Bp. XIV/31, 31g, 5, 7 ventral views of two specimens; 6 specimen Bp. XIV/31 in five views; $\times 2$.
 8 — *Verneuilia kadzielniae* (Gürich); specimen Bp. XIV/4g, dorsal view, nat. size.
 9-10 — *Adolfia punctata* (Zeuschner); specimen Bp. XIV/30, 9 anterior view $\times 2$, 10 fragment of the surface ornamentation $\times 8.5$.
 11 — *Undispirifer* sp.; specimen Bp. XIV/4r, ventral valve view, nat. size.
 12 — *Crurithyris globosa* (Gürich); specimen Bp. XIV/22, a dorsal, b ventral views; nat. size.

Description. — Shell of medium size and in comparison with the other species of the genus to a varying degree mucronate, the hinge extension and lateral margins rounded, anterior margin sulcate; the ventral median sulcus deep, rather acute, the dorsal fold very flat, in general barely delimited; ventral area high, umbo only little incurving, delthyrium wide at its base, constituting about one-third the length of the hinge line. Ornamentation consisting of radial costae covering the

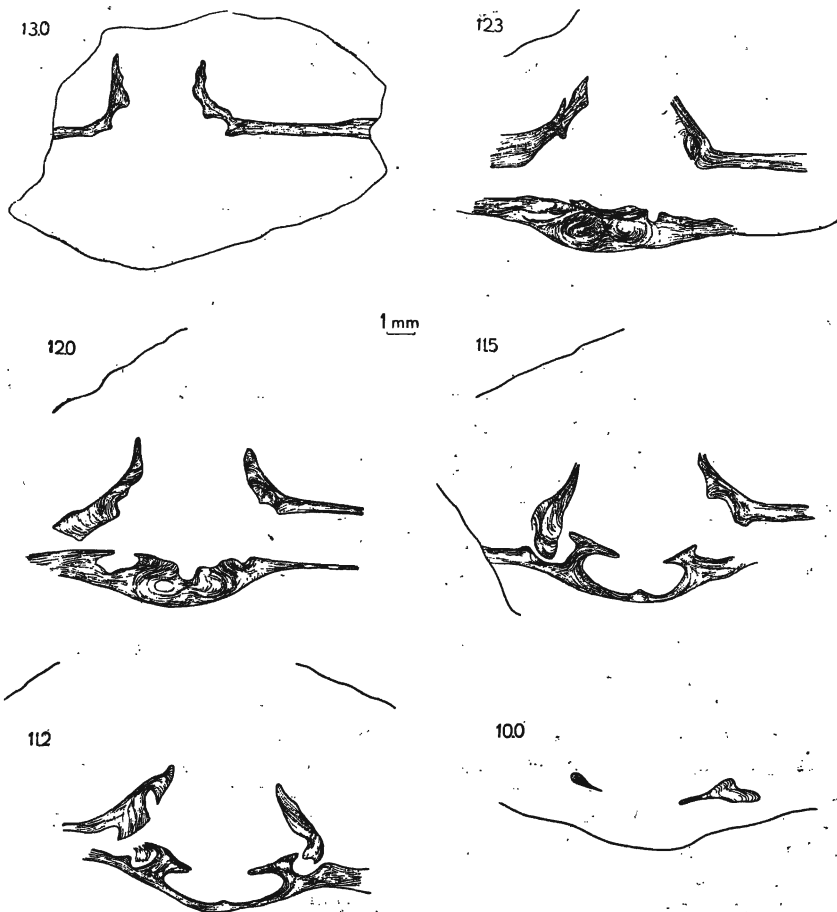


Fig. 10

Cyrtospirifer alata (Gürich); Bp. XIV/31a, serial sections of adult specimen

whole shell surface including the ventral sulcus and dorsal fold, 14 on each lateral slope of the valves, three on the walls of the sulcus and to about 8 on the fold. Although the shell is very exfoliated, easily recognized are the fine but distinct radial striae covering both the radial folds and separating furrows as also the sulcus and fold. Interior with well developed dental plates which slightly diverge anteriorly; no median septum and crural plates observed (Fig. 10).

Remarks. — The specimens discussed are quite characteristic in their external morphology, mainly by the mucronate shell and limited shell length much more than in the other species of the genus.

Family Reticulariidae Waagen, 1883
Genus *UNDISPIRIFER* Havliček, 1957

Undispirifer sp.
(Pl. 6, Fig. 11)

Material. — Two ventral valves, not complete, exfoliated.

Description. — The species seems to be of medium size, judging from the approximate length 24.8 mm, measured along midlength of the valve. The specimens, although incomplete, show some features of this genus. These are: 1) very subdued radial plications, 7—9 on each slope of the valves; 2) ventral median sulcus deepest along midlength; 3) concentric rows of single "spine" bases, although not well preserved allow to state their density as 1—3 rows per 1 mm. Of the internal structure only the dental plates are observed. These are long, about one-fourth of the whole valve length, slightly diverging anteriorly.

Remarks. — The specimens are very close to *Undispirifer undiferus* figured by Roemer (1844; Pl. 4, Fig. 6) as also by Vandercammen (1957; Pl. 1, Figs 1—2), both in the number and appearance of radial plication and appearance of concentric rows. Our specimens are less subtransverse and have much more pronounced ventral umbo.

Genus *WARRENELLA* Crickmay, 1953
Warrenella euryglossus (Schnur, 1851)
(Text-fig. 11; Pl. 7, Figs 1—5; Pl. 8, Figs 5—7)

1851. *Spirifer euryglossus* n.sp.; Schnur, p. 11.

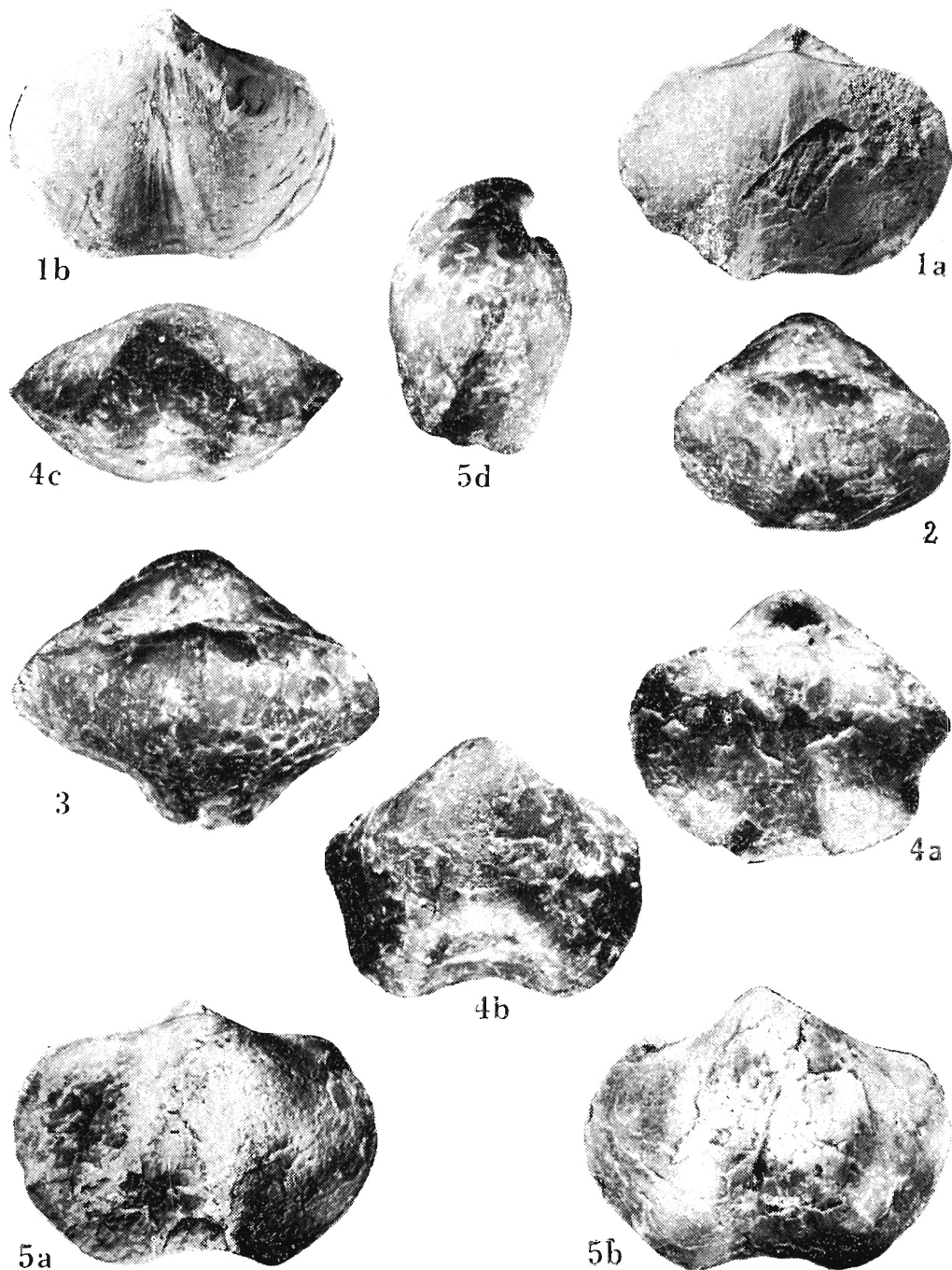
Material. — Ten specimens almost complete, some of them to a different degree deformed, all recrystallized and very exfoliated.

Dimensions (mm):

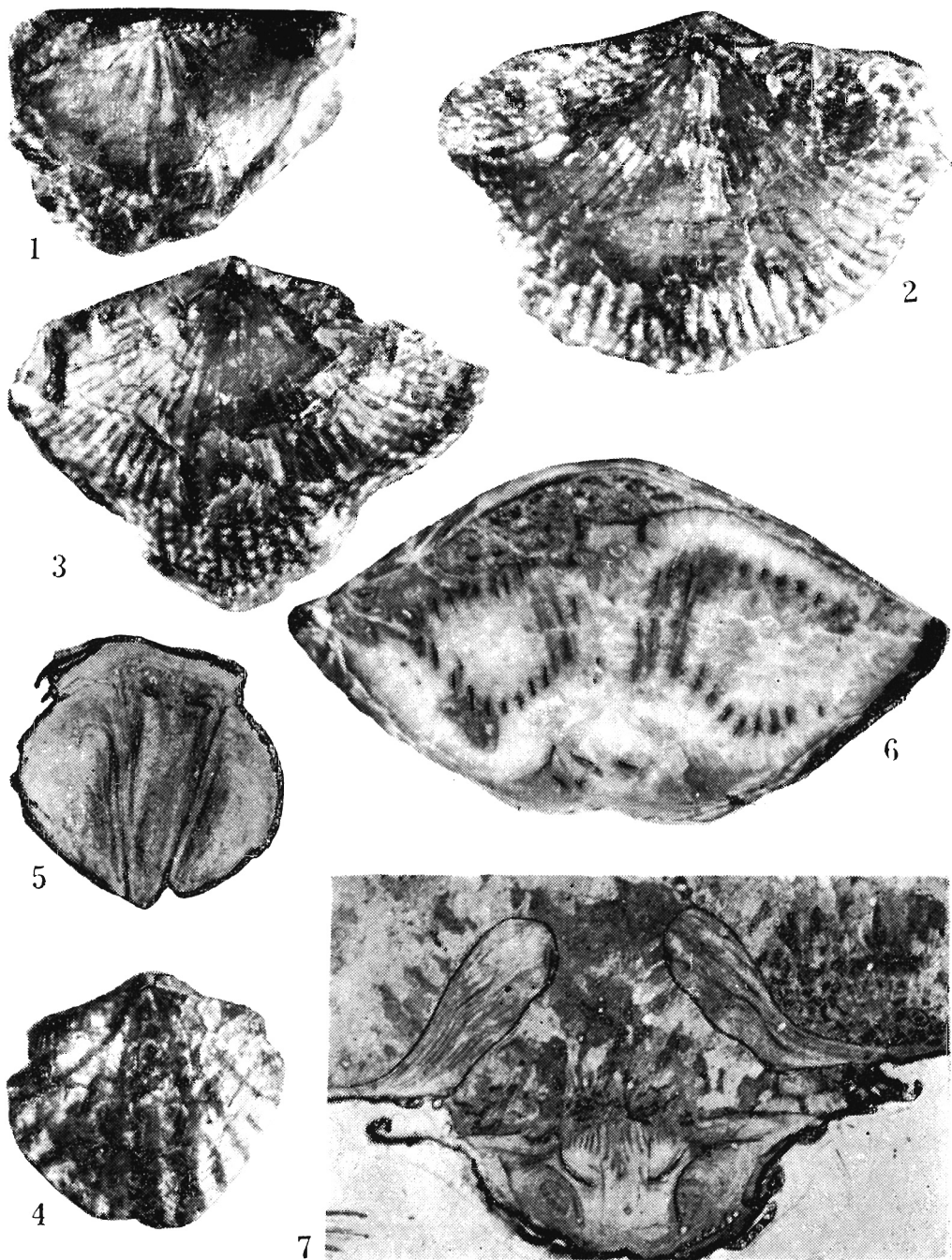
Cat. no.	length	width	thickness	width of sulcus, anteriorly
Z. Pal. Bp. XIV				
5a)	38.3	49.0	28.5	22.4
5)	738.1	49.7	22.1	19.2

Description. — Shell large, subquadrate, to a somewhat different degree, transversely elongate, sometimes very greatly; biconvex to ventri-biconvex; hinge angles roundly outlined, lateral margins distinctly arched, anterior margin uniplicate; ventral umbo comparatively not very prominent, moderately incurved; deltidial plates wide, area slightly concave, well delimited; sulcus well developed on the anterior half or on two-thirds of the valve length, of slightly varying breadth and depth; the same concerns the dorsal fold. Ornamentation is not well preserved. There are observed concentric lines fairly regularly spaced all over the shell surface, crowded anteriorly and bearing the traces of microspines arranged in a quite regular way. As to the interior, the dental plates are well developed, dorsal muscle scars well marked, dorsal septal thickening observed.

Remarks. — The species is of the type of *Warrenella euryglossus* (Schnur), type species of the genus, having *i.a.* very similar shell shape and outline, and similarly developed ventral sulcus and dorsal fold (cf. Schnur 1854; Pl. 37, Fig. 3; Boucot & al. 1965, Fig. 587 1g—j). The differences are mainly in the much larger size of the shell which is, in addition, more biconvex, and the ventral sulcus is shallower. The same features differ our specimens from the Canadian species *Warrenella eclectes* Crickmay (cf. Boucot & al. 1965; Fig. 587 1a—f). It is also very close to "*Minatothyris*" *maureri* sensu Vandercammen (1957) from the Devonian of Belgium, differing in the larger shell size, more transversely elongate shell and smaller area.



1-5 — *Warrenella euryglossus* (Schnur); 1, 4-5 three different adult specimens Bp. XIV/5, 6r, 6s, a dorsal, b ventral, c anterior, d lateral views; 2-3 dorsal view of two specimens Bp. XIV/7r, 7s; nat. size.



- 1 — *Verneulia kadzielmae* (Gürich); dorsal view of an exfoliated specimen Bp. XIV/4g figured in Pl. 6, Fig. 8, $\times 2$.
 2-3 — *Spinatrypina* (*Exatrypa*) *planata* sp.n.; dorsal view of two adult specimens Bp. XIV/9, 10a to show the ventral area and radial ornamentation, $\times 2$.
 4 — *Spinatrypina* cf. *plicata* Rzhonsnitskaya; dorsal view of the adult specimen Bp. XIV/2 to show the radial ornamentation, $\times 2$.
 5-7 — *Warrenella euryglossus* (Schnur); 5, 7 two cross sections (peels) of the specimen Bp. XIV/5a showing the dental plates and cardinal process, $\times 4$; 6 cross section of the adult specimen Bp. XIV/50 with preserved fragments of brachidium, $\times 2$.

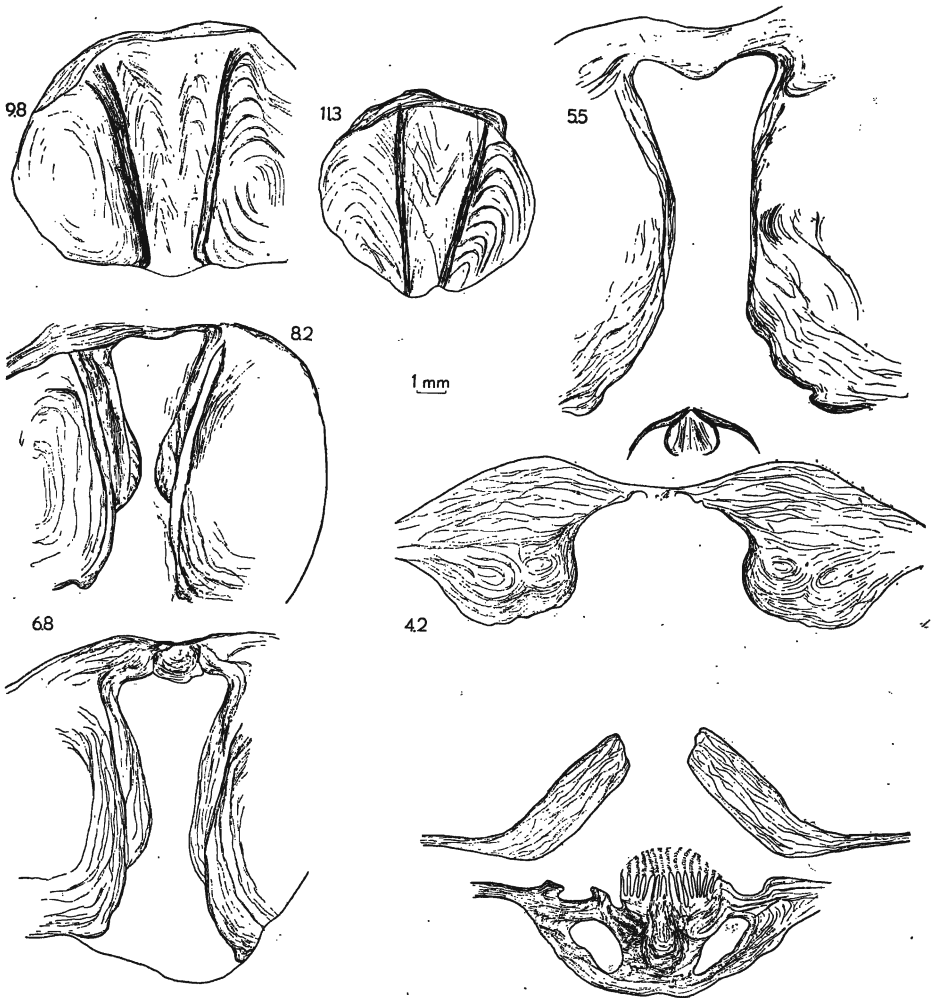


Fig. 11

Warrenella euryglossus (Schnur); Bp. XIV/5u, serial sections of adult specimen

Family uncertain

Genus *VERNEUILIA* Hall & Clarke, 1894

Verneulia kadzielniae (Gürich, 1896)

(Pl. 6, Fig. 8; Pl. 8, Fig. 1)

1896. *Spirifer kadzielniae*; Gürich, p. 254, Pl. 8, Figs 7—9.

Material. — Two badly preserved brachial valves, exfoliated.

Dimensions (mm):

Cat. no.	length	width at midlength	maximum width
Z. Pal. Bp. XIV			
4)	14.9	18.0	22.0

Description. — Although the collection is very poor, there is no difficulty in stating a close relations of the possessed specimens to *Verneuilia cheiropteryx* (d'Archiac. & de Verneuil), type species of the genus. The exterior of the dorsal valve shows the well marked median fold bounded by two distinct lateral ridges, which are separated from the fold by comparatively deep furrows. From the appearance of the latter valve it seems certain that the ventral valve possesses a quite distinct median sulcus bounded by two sharp lateral ridges, the feature characteristic of the genus. Lateral slopes are smooth. The valves are exfoliated, and some details of the dorsal interior are slightly marked — these are: the cardinal process somewhat bulbous, median septal ridge long, extending anteriorly, occupying slightly more than half the valve length; traces of muscle scars weakly discernible.

Remarks. — Gürich (1896, p. 254) mentions the presence, in his collection from the Kadzielnia limestone, of a number of specimens of this species. He considers it as very close to the German species *Verneuilia cheiropteryx*. The difference between Gürich's species and the type species from Paffrath are sufficiently distinct to be considered as at a specific rank. Our specimens have not so strongly elongated hinge extensions (the hinge extensions can be slightly, if at all, mucronous), the lateral margins being very moderately rounded, and, in all probability, the median ridges bounding the ventral sulcus are pointed but do not elongate anteriorly as in *Verneuilia cheiropteryx* (cf. Hall & Clarke 1894, Pl. 39, Fig. 1; Boucot & al. 1965, Fig. 392.1).

Family Dielasmatidae Schuchert, 1913

Genus *DIELASMA* King, 1859

Dielasma cf. *sacculus* (Martin, 1809)

(Pl. 6, Figs 1—4)

1896. *Dielasma sacculus* Martin; Gürich, p. 292.

Material. — Ten specimens articulated, very strongly recrystallized.

Dimensions (mm):

Cat. no.	length	width	thickness
Z. Pal. Bp. XIV			
16)	9.4	9.7	5.8
15)	8.9	9.3	6.1

Description. — Shell small, moderately and almost equally biconvex, the greatest biconvexity on the posterior half of the shell, subpentagonal to pentagonal in outline, as long as wide or slightly wider than long, the widest usually on the posterior half near the hinge line; postero-lateral margins rounded, lateral margins as a rule convergent anteriorly; anterior margin moderately rounded or medially indented due to the presence of short sulcal furrows of varying width. Ventral beak small, almost suberect; pedicle foramen subapical; delthyrial plates widely trigonal, pointed posteriorly. Shell punctate, the punctae well discernible and arranged in a somewhat quincuncial pattern. Shell surface covered with concentric lines, usually very weakly marked. Interior, only partly observed, shows the presence of thin dental plates moderately arched exteriorly, comparatively large dental cavities and small teeth.

Remarks — The collected specimens are slightly varying in the shell shape and outline; they are all easily recognizable by the distinctly indented anterior commissure. The considered form agrees in the morphological features such as: shell outline, appearance of the anterior half of the shell and of the anterior commissure, with "*Terebratula*" *vesicularis* de Koninck figured by Davidson (1864—1865; Pl. 1,

Fig. 29) from the English Carboniferous. The only differences are the sinuses on the anterior half of the shell much shallower, and the concentric lines less distinct. In comparison with "*T. sacculus*" figured by Davidson (1864—1865; Pl. 1, Figs 1—6) the Kadzielnia form is wider, while other morphological features appear to be the same.

FINAL REMARKS

The brachiopods occur in the lowermost part of the Kadzielnia limestone in beds developed as rather massive limestones ("biohermal" *sensu* Pajchlowa & Stasińska 1965), without or with weak stratification, where they appear in great profusion, both of species, and in some cases, of specimens. In these deposits they constitute one of the most representative and numerous group after stromatoporoids, tabulate and rugose corals. Most often they occur in the "interbiohermal" (*sensu* Pajchlowa & Stasińska 1965) parts, which are sometimes filled with the shells or their fragments so greatly, that such parts of the rock may be called the brachiopod lumachelles. The brachiopod species appear to be fully segregated and the specimens seem to preserve almost the same orientation in the rock — some evidence of an undisturbed local environment.

Frequently the brachiopods occur in nest-like clusters, especially the forms of smaller size, such as *Athyris* sp. or *Crurithyris globosa* (Gürich), where the specimens represent different growth stages, ranging, as a rule, from about 1.8 mm — 4.5 mm shell length, depending upon the final size of the shell in adult stage. The clusters are monospecific, and sometimes so crowded that they give, in places, the impression of a rock-building component. This is why, in all probability, they have been interpreted by Gürich (1896, p. 242) as banks of brachiopods (e.g. of schizophorids associated with atrypids and others). The clusters of the last-mentioned bigger forms are very rare indeed; of the possessed material only *Warrenella euryglossus* (Schnur) occurred in such a community and all the specimens (cf. Pl. 7) come from one nest (discovered by Docent A. Radwański in 1963).

Many specimens of brachiopods show various shape deformations. In the case of e.g. *Cyrtospirifer alata* (Gürich) the umbonal part of the ventral valve is twisted, being an indication of the local life conditions of the animals. Even smaller forms, such as e.g. *Athyris* sp., *Crurithyris globosa* (Gürich), *Fitzroyella alata* Biernat, or peculiarly flat *Spinatrypina* (*Exatrypa*) *planata* sp.n. are deformed, often laterally, usually dented on one side, and the shell is asymmetrical to a varying degree. This is, in all probability, evidence of a limited living space.

The brachiopod fauna of the considered environment is abundant in species, but not all is numerically well represented in specimens. The

forms of smaller size, e.g. *Crurithyris globosa* (Gürich), *Cyrtospirifer alata* (Gürich) and *Hypothyridina nana* Nalivkin, as a rule prevail. Of the bigger forms, the atrypids and parapugnaxes seem to dominate; the most numerous appears to be *Parapugnax brecciae* (Schmidt) which occurs in a greater number of specimens of different size and of rather considerably varying external appearance. Of the atrypids, comparatively abundant are spinatrypinids, especially *Spinatrypina (Exatrypa) planata* sp.n. This species is extremely characteristic in its very remarkably flat shell with the greatest width of the hinge line, like e.g. *Carinatina*, and more or less sinuous anterior commissure. Such an outline and shape of shell could be suggestive, according to Copper (1967, p. 120) of a response to rather strong environmental "laminar" currents, evidenced by the number of occurring rheotropic colonies of e.g. stromatoporoids or tabulate corals, and numerous heap-like accumulations of shells. Some forms, such as e.g. *Warrenella euryglossus* (Schnur) attain a larger size in comparison to both, the other associated brachiopod forms and to the other known Upper Devonian members of the genus — this feature being, however, rare within the considered brachiopods. Such forms as e.g. pentamerids, cyrtospiriferinids, hypothyridinids are smaller or, often, even quite small.

To sum up, the brachiopod fauna of the Kadzielnia limestone is characterized by: 1) a very differentiated assemblage of species representing a great variety of shapes, outlines, shell sizes and surface ornamentations; 2) the prevalence of smaller-sized forms; some of them may suggest the phenomenon of dwarfism, like e.g. *Cyrtospirifer alata* (Gürich), owing probably a very limited space during life; 3) a great, in some species, morphological variability, e.g. within *Parapugnax brecciae* (Schmidt), this reflecting, in all probability, the life conditions; 4) rather substantial differences, in some cases, in the shell morphology, as e.g. in *Adolfia punctata* (Zeuschner) and *Spinatrypina (Exatrypa) planata* sp.n.

It should be added, that all forms of brachiopods preserve their functional pedicle — the pedicle foramen being always present throughout the life of the animals and no gerontic individuals occur. All shells are adult but without the signs of oncoming old age.

The sedimentary environment, the brachiopods lived in, although much uniform in some aspects, such as e.g. depth of basin or temperature of water, could also offer to the animals slightly different conditions. In general, it required a special adaptive plasticity of the organisms, especially those living in a neighbourhood or in a community of coelenterates (stromatoporoids, tabulate and rugose corals). The brachiopods, as a whole, display a very active vitality during life, expressed by their great adaptative possibilities. They are animals very sensitive to environmental changes which, sometimes, are not very favourable for them. This adaptability is their most advantageous benefit, permitting them to survive and, very often, also proliferate in different conditions and in

a different association of animals. The ability to adaptations is expressed, among others, by the frequently occurring individual variability. In general, the brachiopods can be considered, as good sensitive guides to environmental changes. The often prevailing variations in their shell morphology could be valuable for ecological interpretations, what has been suggested *e.g.* by Jux (1969) and can, to some extent, be supported by the brachiopod assemblage of the Kadzielnia limestone.

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G. BIERNAT

BRACHIOPODY Z WAPIENIA KADZIELNIAŃSKIEGO W KIELCACH

(Streszczenie)

Dolna część wapienia kadzielniańskiego (stanowiąca mniej więcej 1/4 całej jego miąższości) zawiera bogaty zespół faunistyczny, złożony głównie z dominujących w nim kolonijnych jamochłonów (stromatoporoidy, denkowce i korale czteropromienne), oraz z brachiopodów. Fauna brachiopodowa jest tutaj bardzo zróżnicowana taksonomicznie, choć poszczególne gatunki nie występują jednakowo licznie. Stwierdzono obecność 21 gatunków, w tym 1 nowego, reprezentującego duże i płaskie atrypidy — *Spinatrypina (Exatrypa) planata* sp.n. Większość rozważanych brachiopodów występuje gniazdowo, niekiedy w dużych ilościach, a okazy poszczególnych gatunków w obrębie gniazd reprezentują przeważnie różne stadia wzrostowe. Zebrany materiał badawczy, ze względu na ograniczoną ilość okazów oraz niedostateczny stan zachowania (muszle przeważnie ulegają eksfolacji, a wnętrza są przekrystalizowane), nie zezwala jednak na przeprowadzenie dokładniejszych badań morfologii oraz struktury wewnętrznej poszczególnych brachiopodów.

Wszystkie opisane i zilustrowane gatunki (por. Fig. 1—11 oraz Pl. 1—8) są wieku frańskiego i wskazują, że pod względem stratygraficznym wapienie kadzielniańskie mieszczą się w granicach *F2a* — *F2h*; w dotychczasowym ujęciu (Czarnocki 1948) uznawano je za fran dolny i środkowy. Określenie dokładniejszej pozycji stratygraficznej wapieni kadzielniańskich nie może być jednak dokonane na podstawie brachiopodów; wskaźnikowe dla tych celów okazują się natomiast konodonty (por. Szulczewski 1971).

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