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Project: ECOSTRATIGRAPHY

Lower Devonian stratigraphy and brachiopods from boreholes Bachus 1 and Ursynów 1

ABSTRACT: A description is here given of 16 brachiopod species encountered in boreholes Bachus 1 and Ursynów 1. On the occurrence of other surface profiles the stratigraphy has been determined of the sediments here reached and assigned to the Gedinnian.

INTRODUCTION

In 1969 the Polish Petroleum Industry drilled borehole Ursynów 1 situated in the Warszawa basin, in 1974 borehole Bachus 1 situated in eastern Poland. The bottom part of the Ursynów 1 profile, between the depth of 2858.1 and 3001.7 m has yielded a series of dark grey mudstones with a plentiful fauna consisting mainly of lamellibranchs accompanied by rare tentaculites, brachiopod and ostracods. Similarly developed sediments have also been obtained from the Bachus 1 profile where the occurrence has been noted of greenish siltstones with lamellibranchs, tentaculites and brachiopods.

The brachiopod fauna has been worked out and described by M. Rubel from the Institute of Geology of the Estonian Academy of Sciences while the stratigraphy has been elaborated by L. Teller.

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STRATIGRAPHY

BOREHOLE BACHUS 1

The fauna collected from borehole Bachus 1 for the purpose of investigation comes only from that part of the profile representing sedi-

ments younger than the faunally documented Upper Silurian (Teller 1975), but older from the sandy-silty Old Red series overlaid by carbonaceous deposits of the Middle and Upper Devonian.

The three cored intervals at depths of 2084.0—2090.0, 2029.0—2935.0 and 1976.0—1982.0 m have yielded greenish siltstones with a fairly abundant fauna of lamellibranchs, tentaculites and brachiopods. The identified brachiopod remains come mostly from a depth between 2084.0 and 2090.0 m (Table 1). Their comparison with analogous forms from Podolian areas suggests that they represent the Gedinnian (Borszczów and Czortków). Sediments of the same age have also yielded *M. costatuloides* and *A. nieczlaviensis* in Nevada, and *M. subinterstitialis* in Salair.

Hence, it may be reasonably accepted that the cored borehole Bachus 1 profile between 1976.0—2090.0 m corresponds to the Gedinnian. The bottom boundary of the Gedinnian determined on electric logging data occurs at a depth of c.2183.0 metres.

BOREHOLE URSYNÓW 1

The brachiopod fauna collected for investigation from borehole profile Ursynów 1 comes from only a few cored intervals at a depth between 2862.1 and 3001.7 m (139.6 m). In the top there occur greenish siltstones

Table 1

Vertical distribution of the Gedinnian brachiopods in boreholes Bachus 1 and Ursynów 1

Species	Bachus 1		Ursynów 1							
	2084.0-2090.0	2029.0-2035.0	1976.0-1982.0	2995.1-3001.7	2990.0-2995.1	2973.0-2979.5	2938.1-2944.6	2913.5-2919.5	2875.7-2881.7	2862.1-2866.1
<i>Isorthis</i> / <i>Protoortezorthis</i> / <i>forficatimurcata</i> /Fuhs/	x									
<i>Tentaena</i> sp.	x									
<i>Nesodouwillina costatuloides</i> John. et al.	x									
<i>M. subinterstitialis</i> Kozl.	x	x		x	x	x				
<i>Iridistrophia praeumbraeola</i> /Kozl./	x									
<i>Gypidula pelagica</i> /Barr./	x									
<i>Sphaerirhynchia gibbosa</i> /Nikif./	x									
<i>Lanceomyonia borealiformis</i> /Siem./	x									
<i>Atrypa nieczlaviensis</i> Kozl.	x									
<i>Merista passer</i> /Barr./	x									
<i>Protathyris infantile</i> Kozl.									x	
<i>Ambocoelia praecox</i> Kozl.	x									
<i>Cyrtina</i> sp.	x	x								
<i>Howellella angustiplicata</i> /Kozl./	x	x		x	x	x	x	x		
<i>Brachyayga pentameroides</i> Kozl.						x	x	x		
<i>Mutationella podolica</i> Kozl.			x						x	x

with sandy intercalations towards the bottom passing into dark grey mudstones with a very rich fauna, chiefly of lamellibranchs associated with brachiopods, tentaculites and rare ostracods. The end of this borehole at a depth of 3001.7 m did not pierce this series.

Above the depth of 2862.1 m as far as a.2218.0 m (i.e. the electric lodding boundary with the Carboniferous) there occur disturbed silty-sandy variegated deposits with a dip of 15—30°, representing the Old Red.

The few identified brachiopod species (Table 1) when compared with analogous ones known from Podolia, as well as from borehole Bachus 1, indicate that the sediments yielding them represent the Gedinnian (Borszczów and Czortków).

PALEONTOLOGICAL DESCRIPTIONS

Superfamily *Enteletacea* Waagen, 1884

Family *Dalmanellidae* Schuchert, 1913

Genus *ISORTHIS* Kozłowski, 1929 emend. Walmsley, 1965

Subgenus *ISORTHIS* (*PROTOCOLTEZORTHIS*) Johnson et Talent, 1967
emend. Walmsley et Boucot, 1975

Isorthis (*Protocortezorthis*) *fornicatimcurvata* (Fuchs, 1919)

(Pl. 1, Figs 8—12)

1975. *Isorthis* (*Protocortezorthis*) *fornicatimcurvata* (Fuchs, 1919); Walmsley & Boucot, p. 72, Pl. 5, Figs 1—26, full synonymy.

Lectotype selected by Walmsley & Boucot (1975, p. 72).

Material. — Three complete shells, twelve dorsal and nine ventral valves from the borehole Bachus 1, depth 2084.0—2090.0 m.

Description. — Valves small, ventribiconvex, subcircular to transversally elliptical. Maximum thickness equal to about half maximum width which is near mid-length. Hinge-line straight, about half maximum width. Cardinal angles rounded, lateral margins curved, anterior commissure gently sulcate. Costellae fine, angular, increasing by bifurcation; 9—10 costellae per 3 mm at anterior margin. Ventral valve moderately convex, subcarinate; beak short, incurved; interarea gently concave, apsacline; delthyrium open, wide. Dorsal valve gently convex with shallow median sulcus widening anteriorly; beak small, incurved; interarea smaller than ventral one, anacline, flat.

Teeth with crural fossettes; low pedicle callist present. Dental plates thick. Ventral muscle field elongate, laterally bounded with erect, medially weakly concave ridges and anteriorly divided by narrow median ridge. Diductor scars terminate with elevation, from them arises a pair of subparallel vascula media. Dorsal muscle field elongate with elevated margins. Medial ridge broad, low, extends anteriorly. Transverse ridges may be developed. Adductor impressions subequal, posterior pair of them triangular. Sockets supported by socket pads. Cardinal process with narrow shaft and bilobed myophore. Brachiophores erect, diverge at about right angle.

Discussion. — The described specimens agree closely with topotypes of *I.* (*Protocortezorthis*) *fornicatimcurvata* from the Hüinghäuser Schichten (see Johnson

& Talent 1967, Pl. 21, Figs 14—22) except much stronger pallial marks and elevated margins of dorsal muscle field of the former ones.

Occurrence. — Gedinnian of Germany, northern France and Poland (Holy Cross Mountains). Early Devonian of Turkey; Pridolian to Gedinnian of Nova Scotia (see Walmsley & Boucot 1975).

Superfamily *Strophomenacea* King, 1846
 Family *Leptaenidae* Hall & Clarke, 1894
 Genus *LEPTAENA* Dalman, 1828

Leptaena sp.
 (Pl. 1, Fig. 13)

Material and discussion. — The single ventral valve from the borehole Bachus 1, depth 2084.0—2090.0 m, differs from ventral valve of *L. rhomboidalis* (cf. Bassett & Cocks 1974, p. 14, Pl. 2, Figs 7—8) in its irregular weak rugae and more rectangular shape of disc.

Family *Stropheodontidae* Caster, 1939
 Subfamily *Douvillinae* Caster, 1939
 Genus *MESODOUVILLINA* Williams, 1950
Mesodouvillina costatuloides Johnson, Boucot & Murphy, 1973
 (Pl. 2, Figs 10—15)

1929. *Stropheodonta* (*Brachyprion*) cf. *costatula* (Barrande); Kozłowski, p. 100, Pl. 3, Fig. 33.
 1954. *Stropheodonta* (*Brachyprion*) cf. *costatula* (Barrande); Nĕkiforova, p. 90, Pl. 7, Figs 11—12, non 13.
 1968. *Mesodouvillina costatula* (Barrande); Modzelewska, Pl. 27, Figs 2—3.
 1973. *Mesodouvillina costatuloides* n. sp.; Johnson & al., p. 41, Pl. 6, Figs 1—18.

Types selected by Johnson & al. (1973, p. 42).

Material. — Two complete shells, seven ventral and three dorsal valves from the borehole Bachus 1, depth 2084.0—2090.0 m.

Description. — Valves small, concave-convex, slightly geniculate anteriorly, transversely shield-shaped, moderately auriculate at cardinal margins. Hinge-line straight, corresponds to maximum width. Ventral and dorsal interareas long, flat, denticulate. Ornament consists of parvicostellate stronger costellae, situated on slightly raised crests (in anterior part of valve) and numerous finer costellae, grouped on broad U-shaped intervening sectors. The radial ornament is superposed upon concentric corrugation.

Ventral muscle field large, rhomboidal, laterally and anteriorly bounded by low ridges. Adductor scars (= corrugated surface) impressed, elongate, divided by medial groove. Diductor scars anteriorly (?) corrugated, divided by simple myophragm extending anteriorly from the muscle field. Valve interior anterolaterally faintly grooved by the impress of primary costellae, pustulose.

Discussion. — The corrugated specimens of the genus from Podolia have usually been compared with *M. costatula* (Barrande). After redescription of this old species by Havlíček (1967, p. 170, Pl. 34, Figs 7, 9—12) the name "*costatula*" has been used as before for all *costatula* type specimens from the late Silurian up to the early Devonian (see Alekseeva & al. 1970, p. 27), or only in a restricted sense (see Johnson & al. 1973, p. 42). The latter way has been preferred here. The described specimens differ from the Pridolian topotypes and some Podolian spe-

cimens of the same age in their outline, less numerous primary costellae and more strongly impressed ventral muscle field. When viewed at in the light of the proposed morphological trend of *M. subinterstitialis* (see below), the same may take place in the limits of the *M. costatuloides* as well. Then the notable variability of the specimens studied and indicated in the synonymy becomes more understandable.

Occurrence. — The Tajna Beds of Podolia and Pridolia of Nevada.

Mesodouvillina subinterstitialis Kozłowski, 1929

(Pl. 1, Figs 1—7)

1929. *Stropheodonta (Brachyprion) subinterstitialis* sp. n.; Kozłowski, p. 96, Pl. 4, Figs 1—7, Text-figs 28—29.
1954. *Stropheodonta (Brachyprion) subinterstitialis* Kozłowski; Nikiforova, p. 88, Pl. 8, Figs 1—3.
1962. *Stropheodonta subinterstitialis* Kozłowski; Modzalevskaia, Pl. 30, Figs 24—26; Pl. 33, Fig. 4.
1967. *Mesodouvillina subinterstitialis subinterstitialis* (Kozłowski); Havlíček, Pl. 34, Fig. 6, Text-fig. 66.
1970. *Mesodouvillina subinterstitialis subinterstitialis* (Kozłowski, 1929); Alekseeva & al., p. 23, Pl. 1, Figs 13—14.

Material. — Abundant in all levels; the borehole Bachus 1: 2084.0—2090.0 m, 2029.0—2035.0 m; the borehole Ursynów 1: 2995.1—3001.7 m, 2990.0—2995.1 m, 2973.0—2979.5 m.

Description. — Valves large, concave-convex, semicircular, cardinal angles slightly alate. Hinge-line straight, constituting a place of maximal width. Ventral and dorsal interareas flat, denticulate. Ornament consists of parvicostellate stronger costellae and numerous finer costellae between the former. Radial ornament superposed upon weak concentric corrugation at the posterior part of valves.

Ventral muscle field large, subtriangular, laterally bounded by narrow ridges. Adductor scars elongately oval, large diductor scars divided by low myophragm. Valve interior anteriolaterally faintly grooved by impress of costellae, pustulose. Cardinal process lobes not overhanging hinge-line, attachment seats of diductors directed ventrally or anteroventrally. Socket plates weak, widely diverging. Adductor scars posterolaterally bounded by low ridges, shorter than median ridge extending anteriorly at about half of valve length. Valve interior pustulose.

Discussion. — There are two successive subspecies (or varieties), *M. subinterstitialis subinterstitialis* and *M. subinterstitialis seretensis*, in Podolia (see Kozłowski 1929). The stratigraphic range of the former is restricted to the Borszczowian while the latter one occurs in the Czortkowan Beds. The nominal subspecies differs from *seretensis* in its more complicated ornament and absence of ventral median fold at the anterior margin. By the shape all described specimens belong to the subspecies *subinterstitialis*. The maximum number of finer costellae between the primary ones of the studied specimens vary from 2 to 14. It is noteworthy that the specimens from the lowest samples (depth interval 2084.0—2090.0 m in Bachus 1) have 10—14 finer costellae between primary ones while the specimens from the interval 2028.0—2035.0 m of the same borehole bear 3—4 costellae only. The specimens from Ursynów 1 bear also 1—3 finer costellae between the primary ones. Such ornamentation closely resembles that of the subspecies *seretensis* but, as the Ursynów specimens are poorly preserved, this cannot be definitely established by all features.

Occurrence. — Gedinnian of Podolia and Salair.

Superfamily Davidsoniacea King, 1850
 Family Chilidiopidae Boucot, 1959
 Genus *IRIDISTROPHIA* Havlíček, 1965
Iridistrophia praeumbracula (Kozłowski, 1929)
 (Pl. 2, Figs 2—5)

1929. *Schellwienella praeumbracula* sp. n.; Kozłowski, p. 105, Pl. 5, Figs 3—4, Text-fig. 33.

1954. *Schellwienella praeumbracula* Kozłowski; Nákiforova, p. 84, Pl. 8, Fig. 5.

1968. *Schellwienella praeumbracula* Kozłowski; Modzalevskaya, Pl. 30, Figs 27—29; Pl. 33, Fig. 3.

Material. — Eleven ventral and four dorsal valves, poorly preserved, from the borehole Bachus 1, depth 2084.0—2090.0 m.

Description. — Valves of medium size, resupinate, rounded, wider than long. Hinge-line straight, about nine-tenths maximum width which is near midlength. Costellae fine, rounded, covered by fine concentric filae, increasing in number by intercalation, 8—9 costellae per 5 mm at anterior margin. Ventral valve umbonally convex, anteriorly concave, interarea flat, apsacline. Pseudodeltidium triangular, large, medially convex. Teeth deltidiont, supported by thin dental plates. Interior radially grooved according to external costellae. Dorsal valve convex, with narrow and shallow median sulcus. A pair of cardinal process lobes is projected posteriorly, cardinal process is supported by discrete chilidial plates. Socket plates anterolaterally directed, they and cardinal process are joined into one transverse ridge (notothyrial platform) with small node in the middle. Shell substance impunctate.

Discussion. — Occurrence of *praeumbracula* itself is noted from the Gedinian of Kazakhstan (Ushatinskaja & Nilova 1975, p. 95), Salair (Alekseeva & al. 1970, p. 32) and Podolia (see synonymy). Along with many other names it is regarded as a synonym of *praeumbracula* (see Johnson & al. 1973, p. 38). One of them, *umbrella* Barrande, 1848 is most critical. *I. praeumbracula* differs from this species in rounded cardinal angles and, maybe, in finer ornamentation.

Occurrence. — Gedinian, widespread.

Superfamily Pentameracea M'Coy, 1844
 Family Pentameridae M'Coy, 1844
 Subfamily Gypidulinae Schuchert et Le Vene, 1929
 Genus *GYPIDULA* Hall, 1867
Gypidula pelagica (Barrande, 1848)
 (Pl. 2, Figs 6—9)

1848. *Pentamerus pelagicus* sp. n.; Barrande, p. 469, Pl. 22, Fig. 3.

1879. *Pentamerus pelagicus* (Barr.); Barrande, Pl. 22, Figs 2g and 3; Pl. 23, Figs 1—15.

1929. *Siberella cf. galeata* (Dalman); Kozłowski, p. 135, Pl. 6, Figs 1—3; Text-fig. 39.

Material. — Eighteen ventral and three dorsal valves from the borehole Bachus 1, depth 2084.0—2090.0 m.

Description. — Valves large, broadly pyriform, unequally biconvex. Ventral valve two to three times as deep as dorsal valve, with a prominent umbo and incurved ventral beak. Hinge-line nearly straight, about two-thirds maximum width. Delthyrium triangular, wide and open. Ventral palintrop strongly incurved, not sharply expressed. Ventral fold with two weak plications on its sides, with median furrow, originating in posterior part of valve. Anterior commissure intra-

plicate. Dorsal valve moderately convex, with relatively small umbo; sinus broad, shallow, originating in anterior region. Exterior of both valves bears fine concentric growth lines. Interior of both valves covered by fine corrugations and dots, especially posteriorly. Ventral median septum extends past midlength, thickens posteriorly. Outer plates divergent, extend up to midlength.

Discussion and occurrence. — The identical or related species have been described from the Lower Devonian of Gorny Altai (Kulkov 1963, p. 34, Pl. 2, Fig. 8 — *Gypidula* sp.): North-East Salair (Alekseeva & al. 1970, p. 47, Pl. 4, Fig. 4 — *G. subgaleata*), South Tjan-Shan (Malygina & Sapelnikov 1973, p. 77, Pl. 20, Figs 1—8 — *G. pelagica*), the Roberts Mountains, Nevada (Johnson & al. 1973, p. 31, Pl. 18, Figs 1—18; Pl. 19, Figs 1—12 — *G. pelagica lux*). Unfortunately, the total amount of such species is much greater than has been given above. All of them as well as most other species of *Gypidula* need a revision, starting from the designation of neotypes for the old species of Barrande. After Barrande the species *G. pelagica* occurs in the Upper Silurian and Lower Devonian. In Podolia the ribbed specimens of *Gypidula* from the Malinovets Horizon have been identified as *G. galeata dudleyensis* and the smooth ones from the Tajna Beds as *G. ?pelagica* (see Modzalevskaya 1968, Pl. 15, p. 21—23, Pl. 27, Figs 27—31). Note also an occurrence of the genus from the Skala Horizon (Boucot & Pankiivskyi 1962).

Superfamily Rhynchonellacea Gray, 1848

Family Uncinulidae Rzhonsnitskaya, 1956

Subfamily Hebetoechiinae Havliček, 1960

Genus *SPHAERIRHYNCHIA* Cooper et Muir-Wood, 1951

Sphaerirhynchia gibbosa (Nikiforova, 1954)

(Pl. 2, Figs 16—18)

1929. *Camarotoechia (Wilsonia) Wilsoni* (Sowerby); Kozłowski, p. 159, Pl. 7, Figs 27—33; Text-fig. 50; non Pl. 7, Fig. 34.

1954. *Wilsonella wilsoni* (Sow.) var. *gibbosa* var. n.; Nikiforova, Pl. 11, Fig. 5.

1973. *Sphaerirhynchia gibbosa* (Nikiforova); Johnson & al., p. 44, Pl. 23, Figs 1—11.

Material. — Three complete shells and one ventral and one dorsal valves from the borehole Bachus 1, depth 2084.0—2090.0 m.

Discussion. — A comparison with *Sphaerirhynchia wilsoni* is needed.

Occurrence. — Gedinnian of Podolia and Nevada.

Genus *LANCEOMYONIA* Havliček, 1960

Lanceomyonia borealiformis (Siemiradzki, 1906)

(Pl. 3, Figs 8—9)

1929. *Camarotoechia (Wilsonia) tarda* (Barrande); Kozłowski, p. 161, Pl. 7, Figs 1—22.

1954. *Wilsonella tarda* (Barrande); Nikiforova, p. 113, Pl. 11, Figs 9—11.

1961. *Lanceomyonia borealiformis* (Siemiradzki); Havliček, p. 112, Pl. 13, Figs 6—7.

1968. *Lanceomyonia borealiformis* (Siemiradzki); Modzalevskaya, Pl. 31, Figs 8—11.

Material. — Ten poorly preserved valves from the borehole Bachus 1, depth 2084.0—2090.0 m.

Discussion. — The specimens agree closely with the described Podolian specimens (see synonymy) in size, outline, costation in sinus and on fold, development of commissure and in lateral profile. The exception may be that the figured speci-

mens have a greater number of costae on each flank of the valve. So one can distinguish up to 9 lateral costae on the figured ventral valve in contrast to 4—5 normally indicated for the *L. borealiformis*.

Occurrence. — Gedinnian, widespread.

Superfamily Atrypacea Gill, 1871
Family Atrypidae Gill, 1871
Subfamily Atrypinae Gill, 1871
Genus ATRYPA Dalman, 1828
Atrypa nieczlaviensis Kozłowski, 1929
 (Pl. 3, Figs 10—18)

1929. *Atrypa reticularis* (Linné) var. *nieczlaviensis* var. n.; Kozłowski, Pl. 3, Figs 14—17, Pl. 9, Figs. 2—4

1973. *Atrypa nieczlaviensis* Kozłowski; Johnson & al., p. 47, Pl. 24, Figs 14—27.

Material. — Twenty five complete shells from the borehole Bachus 1, depth 2084.0—2090.0 m.

Description. — Valves subcircular to slightly elongate suboval, subequally biconvex with slightly deeper dorsal valve. Ventral beak short, incurved, appressed to the dorsal umbo. Posterior commissure with dorsal deflection. Ventral valve posteriorly carinate, anteriorly flattened with tongue-like projection, accommodated by a low rounded dorsal fold. Dorsal valve curved downward along its sides. Ornament fine, with numerous concentric growth lamellae, 9—10 costellae within 5 mm. Valves posteriorly thickened, with developed impressions of muscle fields, joined laterally by pustulose areas.

Discussion. — The name *nieczlaviensis* has been used by Kozłowski only for the atrypids from the Borszczowian. The described specimens agree closely with them. But, there are at least two critical forms, *A. reticularis* var. *tajnensis* Kozłowski (1929, p. 170, Pl. 8, Figs 8—13; Pl. 9, Fig. 1) from the Tajna Beds and *A. reticularis* var. *nieczlaviensis* Nikiforova (1954, p. 118, Pl. 12, Fig. 6) from the Malinovets Horizon, which may be conspecific with *nieczlaviensis*. The first form has thinner and more regularly spaced growth lamellae and the other one has clearly flattened dorsal valve. Note that *A. nieczlaviensis*, described from the Roberts Mountains, Nevada, differs from the specimens described here in the lack of much development of a fold and sulcus.

Occurrence. — Gedinnian of Podolia and Nevada.

Superfamily Dayiacea Waagen, 1883
Family Dayiidae Waagen, 1883
Subfamily Dayiinae Waagen, 1883
Genus DAYIA Davidson, 1881
Dayia bohémica Bouček, 1940
 (Pl. 2, Fig. 1)

1929. *Dayia navicula* (Sowerby); Kozłowski, p. 170, Pl. 5, Fig. 22, Text-fig. 59.

1954. *Dayia navicula* (Sowerby); Nikiforova, p. 132, Pl. 14, Figs 11—12.

1940. *Dayia navicula* var. *bohémica* var. n.; Bouček, p. 9, Pl. 2, Fig. 1 (rechts).

1968. *Dayia navicula bohémica* Bouček; Modzalevskaya, Pl. 25, Figs 8—10.

1977. *Dayia bohémica* Bouček, 1940; Rubel, p. 215, Pl. 3, Figs 1—3; Pl. 4, Figs 1—11, Text-fig. 3.

Material. — One dorsal valve from the borehole Bachus 1, depth 2186.0—2192.0 m.

Occurrence. — Pridolian of Europe.

Superfamily Athyridacea M'Coy, 1844
 Family Meristellidae Waagen, 1883
 Subfamily Meristinae Hall et Clarke, 1895
 Genus *MERISTA* Suess, 1851 sensu lato
Merista passer (Barrande, 1848)
 (Pl. 4, Figs 15—19)

1848. *Terebratula passer* sp. n.; Barrande, p. 26, Pl. 18, Fig. 2.

1879. *Merista passer* (Barrande); Barrande, Pl. 12, 14, 94, 135, 142.

1929. *Merista passer* (Barrande); Kozłowski, p. 220, Pl. 11, Figs 42—46, Text-figs 81—82.

Material. — One complete shell, six ventral and two dorsal valves from the borehole Bachus 1, depth 2084.0—2090.0 m.

Discussion. — Amsden (1968, p. 88) has restricted the genus *Merista* to species possessing mystrochial plates. They are absent in the otherwise identical genus *Camarium* Hall, 1859. There is still the third genus *Tyrganiella* Kulkov, 1970 (see Alekseeva & al. 1970, p. 167) differing from the former only in its relatively small shoe-lifter process. It seems that the specimens sectioned here and these sectioned by Kozłowski (1929, Text-fig. 81) have on mystrochial plates.

Occurrence. — The Pragian of Bohemia and the Borszczowian of Podolia.

Family Athyrididae M'Coy, 1844
 Subfamily Protathyridinae Boucot, Johnson et Staton, 1964
 Genus *PROTATHYRIS* Kozłowski, 1929
Protathyris infantile Kozłowski, 1929
 (Pl. 3, Figs 3—4)

1929. *Protathyris infantile* sp. n.; Kozłowski, p. 230, Pl. 11, Fig. 47.

1968. *Protathyris infantile* Kozłowski; Modzalevskaya, Pl. 25, Figs 1—3; Pl. 27, Figs 25—26.

Material. — Three poorly preserved valves from the borehole Ursynów, depth 2913.5—2919.5 m.

Comparison of the available material with the topotypes allows assignment of Polish specimens to *P. infantile* (Modzalevskaya, *oral comm.*).

Occurrence. — The Skala (Dzwinogorod Marls) and Borszczowian (Tajna Beds) of Podolia.

Superfamily Cyrtiacea Fredericks, 1919
 Family Ambocoellidae George, 1931
 Genus *AMBOCOELIA* Hall, 1860
Ambocoelia praecox Kozłowski, 1929
 (Pl. 3, Figs 1—2)

1929. *Ambocoelia praecox* sp. n.; Kozłowski, p. 196, Pl. 3, Figs 33—37, Text-figs 66—67.

Material. — Ten ventral and three dorsal valves, poorly preserved from the borehole Bachus 1, depth 2084.0—2090.0 m.

Discussion. — The specimens agree closely with the Podolian specimens described by Kozłowski under the name *Ambocoelia praecox* (see synonymy). Havliček (1959, p. 257) has assigned the species to the genus *Ambothyris*. Nevertheless, there is a low anteromedially raised area with shallow, widely divergent bounding furrows on the Podolian and Polish dorsal valves. Such a structure (and corresponding anterior commissure) is always lacking in the *Ambothyris* (see revised diagnosis of Havliček, 1959, p. 256) but it is respected for the genus *Ambocoelia* (see Johnson 1970, p. 212).

Occurrence. — The Borszczowian of Podolia.

Superfamily Suessiacea Waagen, 1883

Family Cyrtinidae Fredericks, 1912

Genus CYRTINA Davidson, 1858

Cyrtina sp.

(Pl. 3, Fig. 5)

Material. — Five poorly preserved ventral valves from the borehole Bachus 1, depth 2084.0—2090.0 m, 2029.0—2035.0 m.

Comparison. — The specimens may be considered conspecific with *Cyrtina praecedens* Kozłowski (1929, p. 207, Pl. 11, Figs 8—23), occurring in the Tajna Beds of Podolia and the Lower Devonian of the north-east Soviet Union (Aleksieva 1967, p. 102).

Superfamily Spiriferacea King, 1846

Family Delthyrididae Phillips, 1841

Genus HOWELLELLA Kozłowski, 1946

Howellella angustiplicata (Kozłowski, 1929)

(Pl. 3, Figs 6—7; Pl. 4, Figs 1—6)

1929. *Spirifer* (*Crispella*) *angustiplicatus* sp. n.; Kozłowski, p. 192, Pl. 10, Figs 10—19, Text-fig. 64.

1954. *Spirifer* (*Howellella*) *angustiplicatus* Kozłowski; Nikiforova, p. 146, Pl. 16, Figs 9—10.

1968. *Howellella angustiplicatus* (Kozłowski); Modzelewska, Pl. 31, Figs 1—5.

Material. — In all intervals indicated abundant: the borehole Bachus 1, depth 2084.0—2090.0, 2029.0—2035.0 m; the borehole Ursynów 1, depth 2995.1—3001.7, 2990.0—2995.1, 2973.0—2979.5, 2938.1—2944.6, 2913.5—2919.5 m.

Discussion. — The genus has been understood in too wide a sense (see Johnson 1970, p. 184) and the number of species assigned to it is much too large for exact comparison of the species between themselves (see also Harper 1973, p. 87). There are three species *angustiplicata*, *latisinuata* and *laeviplicata* in the Gedinian of Podolia. The Polish specimens were assigned to the first species, more exactly, to its nominal subspecies. *H. angustiplicata angustiplicata* differs from the subspecies *zaleszczykiensis* (Kozłowski, 1929, p. 194, Pl. 10, Figs 20—21) mainly in a smaller number of its lateral ribs.

Occurrence. — Gedinian of Podolia.

Superfamily Stringocephalacea King, 1850
 Family Mutationellidae Cloud, 1942
 Subfamily Brachyzyginae Cloud, 1942
 Genus *BRACHYZYGA* Kozłowski, 1929
Brachyzyga pentameroides Kozłowski, 1929
 (Pl. 4, Figs 7—12)

1929. *Brachyzyga pentameroides* sp. n.; Kozłowski, p. 244, Pl. 12, Figs 26—27, Text-figs 89C and 95.

Material. — One complete shell and two dorsal valves from the borehole Ursynów, depth 2973.0—2979.5, 2938.1—2944.6, 2913.5—2919.5 m.

Description. — Valves transversely elliptical, gently and uniformly biconvex. Weak ventral fold and shallow dorsal sulcus originating from posterior part of valves. Commissure posteriorly curved, laterally crenulated, anteriorly intraplicate. On both sides of fold up to three weak plications. Indistinct concentric growth lines cross-exterior. Dental plates divergent, developed in umbonal region. Dorsal median septum linear, extends up to midlength. Shell substance is finely punctate.

Comparison. — The best preserved specimen of the collection has relatively well developed plication on flanks of valves, in contrast with the smooth specimens described by Kozłowski.

Occurrence. — The Borszczowian of Podolia.

Subfamily Mutationellinae Cloud, 1942
 Genus *MUTATIONELLA* Kozłowski, 1929
Mutationella podolica (Siemiradzki, 1906)
 (Pl. 4, Figs 13—14)

1906. *Waldheimia podolica* Siemiradzki; Siemiradzki, p. 177, Pl. 7, Fig. 16.

1929. *Mutationella podolica* sp. n.; Kozłowski, p. 236, Pl. 12, Figs 7—25, Text-figs 89B, 92—94.

1954. *Mutationella podolica* Kozłowski; Nikiforova, p. 161, Pl. 17, Figs 5—7.

Material. — Only deformed specimens are available for the study from the boreholes Bachus 1, depth 1976.0—1982.0 m and Ursynów 1, depth 2913.5—2919.5, 2875.7—2881.7, 2862.1—2866.1 m.

Discussion. — The specimens are closely allied morphologically to *M. podolica* in all regards except that a number of plications of the former (about 70 radial costae) is higher than that in the types (up to 44 costae).

Occurrence. — The Borszczowian and Czortkowan of Podolia.

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STRATYGRAFIA I BRACHIOPODY DOLNEGO DEWONU Z OTWORÓW BACHUS 1 I URSYNÓW 1

(Streszczenie)

Przedstawiono opisy 16 gatunków brachiopodów napotkanych w wierceniach Bachus 1 i Ursynów 1, a na podstawie ich występowania w innych profilach powierzchniowych ustalono stratygrafię odwierconych osadów, zaliczając je do żedynu.

WIERCENIE BACHUS 1

Z profilu otworu Bachus 1 pobrano do opracowania faunę tylko z odcinka reprezentującego osady młodsze od udokumentowanego faunistycznie górnego syluru (Teller 1975), a starsze od serii piaszczysto-mułowcowej old-redu, na której występują węglanowe osady środkowego i górnego dewonu.

W trzech rdzeniowanych interwałach z głębokości 2084,0—2090,0, 2029,0—2935,0 i 1976,0—1982,0 m napotkano zielonkawe mułowce z dość liczną fauną małżów, tentakulitów i brachiopodów. Oznaczone brachiopody ograniczone są swym występowaniem głównie do głębokości 2084,0—2090,0 m (tab. 1), a porównanie napotkanych form z analogicznymi z rejonu Podola wskazuje, iż reprezentują one żedyn (Borszczów i Czortków). *M. Costatuloides* i *A. nieczlawiensis* stwierdzono także w osadach analogicznego wieku w Newadzie, a *M. subinterstitialis* w Sairach.

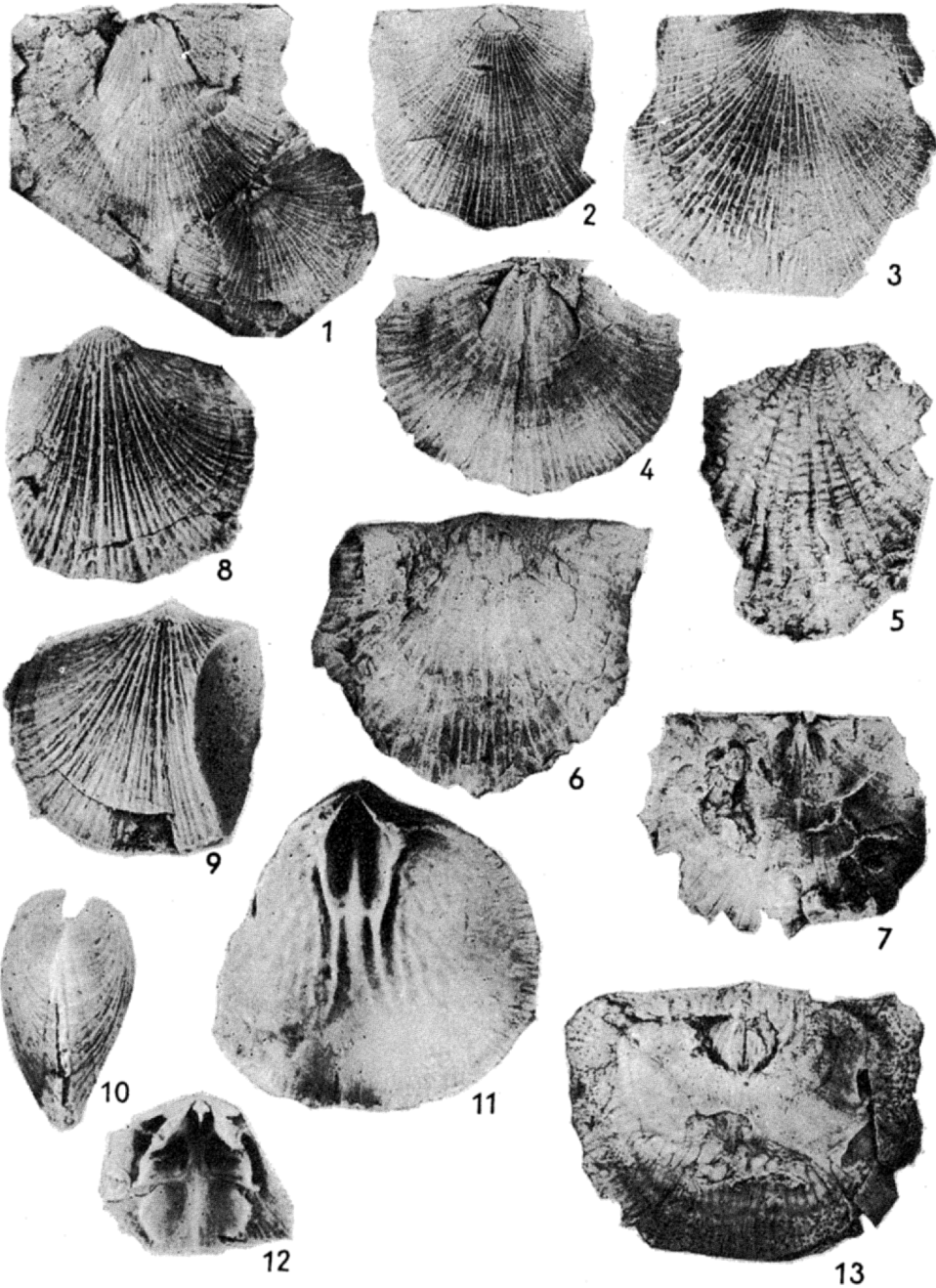
Można zatem przyjąć, że wycinek profilu otworu Bachus 1 z głębokości 1976,0—2029,0 m odpowiada żedynowi. Spągowa granica żedynu ustalona na podstawie analizy karotażu przypada na głębokości około 2183,0 m.

WIERCENIE URSYNÓW 1

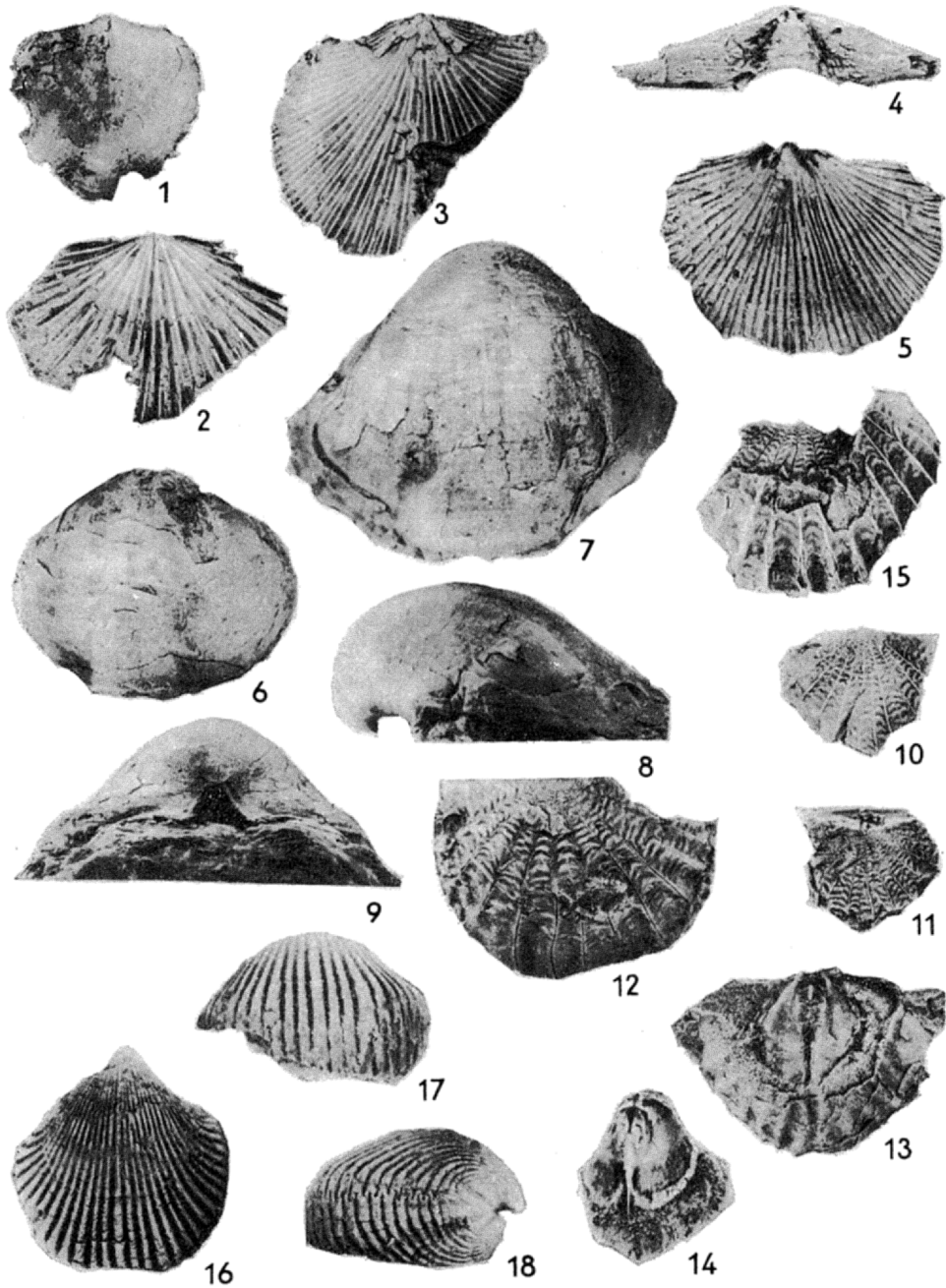
Z profilu Ursynów 1 pobrano do opracowania faunę brachiopodową tylko z kilku rdzeniowanych interwałów z głębokości 2862,1—3001,7 m (139,6 m), gdzie w górze napotkano zielonkawe mułowce z piaszczystymi wkładami, ku spągowi przechodzące w ilowce ciemnoszare z bardzo bogatą fauną głównie małżów, obok których występują brachiopody, tentakulity i rzadkie małżoraczki. Do końcowej głębokości otworu (3001,7 m) seria ta nie została przebita.

Powyżej głębokości 2862,1 m aż do ok. 2218,0 m (tj. karotażowa granica z karbonem) występują zaburzone osady mułowcowo-piaszczyste, pstre, o upadach 15—30°, reprezentujące old-red.

Stwierdzono nieliczne gatunki brachiopodów (tab. 1), których porównanie z analogicznymi znanymi z Podola, a także z profilu Bachus 1, wskazuje na żedyński (Borszczów i Czortków) wiek osadów, w których one występują.

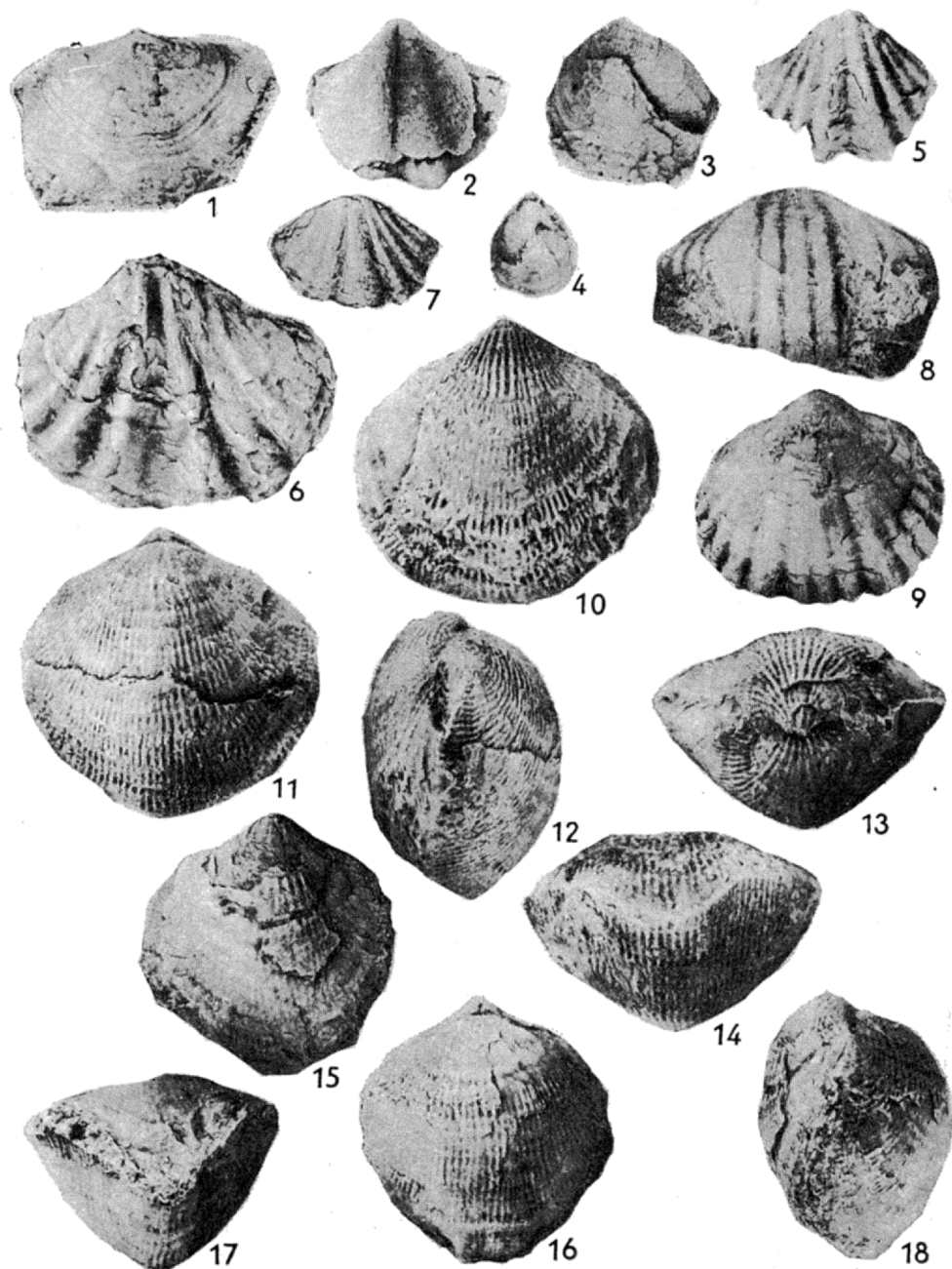


1—7 — *Mesodouvillina subinterstitialis* Kozłowski; 1, 4, 6 exfoliated ventral valve interiors, 2—3 ventral views, 5 sculpture of dorsal valve, 7 dorsal interior; $\times 2$
 8—12 — *Isorthis (Protocortezorthis) fornicatimcurvata* (Fuchs); 8—10 ventral, dorsal and lateral views, respectively, 11 ventral interior, 12 dorsal interior; $\times 3.5$
 13 — *Leptaena* sp.; exfoliated ventral valve interior; $\times 2$
 Bachus 1; 1, 3—13 from depth 2084.0—2090.0 m, 2 from 2029.0—2035.0 m

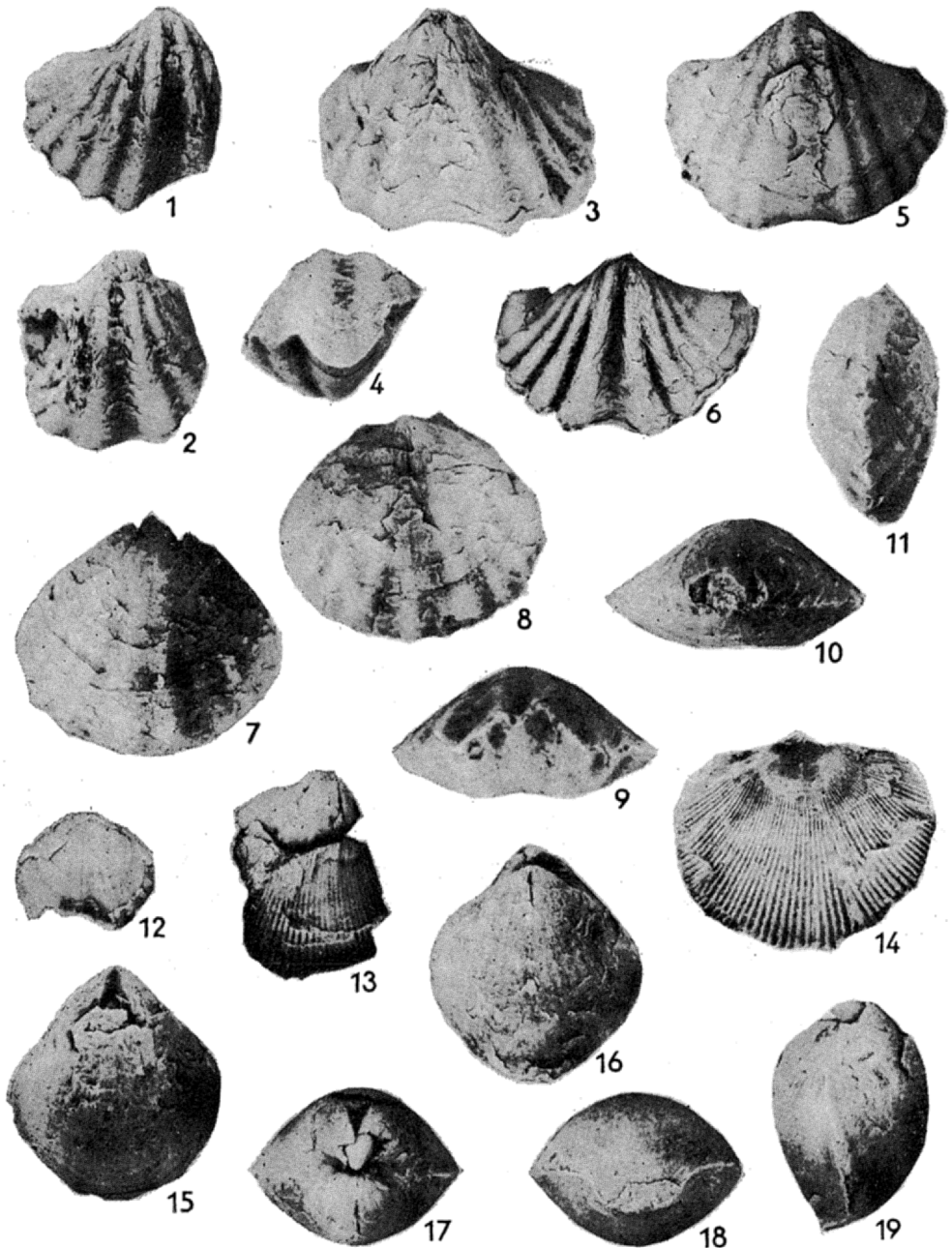


1 — *Dayia bohémica* Bouček; dorsal view.
 2—5 — *Iridistrophia praeumbracula* (Kozłowski); 2—3 dorsal views, 4 posterior view, 5 ventral view; 2—3 and 5 partly exfoliated specimens
 6—9 — *Gypidula pelagica* (Barrande); 6 dorsal view, 7—9 ventral, lateral and posterior views, respectively
 10—15 — *Mesodouvillina costatuloides* Johnson, Boucot & Murphy; 10—11 ventral and dorsal views of umbonal region, 12 — sculpture of dorsal valve (anteriorly cast), 13 interior of exfoliated ventral valve, 14 muscle field of ventral valve, 15 sculpture of ventral valve anterior
 16—18 — *Sphaerirhynchia gibbosa* (Nikiforova); ventral, anterior and lateral views, respectively

Bachus 1; 1 from depth 2186.6—2192.0 m, 2—18 from 2084.0—2090.0 m; $\times 2$



1—2 — *Ambocoelia praecox* Kozłowski; dorsal and ventral views; $\times 4$
 3—4 — *Protathyris infantile* Kozłowski; ventral and dorsal views of juvenile specimens; 2913.5—2918.5 m; $\times 5$
 5 — *Cyrtina* species; ventral view; $\times 2$
 6—7 — *Howellella angustiplicata* (Kozłowski); ventral and dorsal views; Ursynów 1, 2938.1—2944.6 m; $\times 3$
 8—9 — *Lanceomyonia borealiformis* (Siemiradzki); anterior and ventral views; $\times 2$
 10—18 — *Atrypa nieczlaviensis* Kozłowski; 10, 15 ventral views, 11, 16 dorsal views, 12, 18 lateral views, 13 posterior view, 14, 17 anterior views; $\times 2$
 All specimens from Bachus 1, depth 2084.0—2090.0 m, unless otherwise stated



1—6 — *Howellella angustiplicata* (Kozłowski); 1—2, 4—6 ventral views, 3 anterior view; 1—5 Bachus 1, 2084.0—2090.0 m; 6 Ursynów 1, 2995.1—3001.7 m; $\times 3$
 7—12 — *Brachyzyga pentameroides* Kozłowski; Ursynów 1; 7—11 ventral, dorsal, anterior, posterior and lateral views, respectively, 2913.5—2918.5 m, 12 dorsal view of partly exfoliated specimen, 2973.0—2979.5 m; $\times 3.5$
 13—14 — *Mutationella podolica* Kozłowski; 13 ventral view of umbonally exfoliated specimen, 14 dorsal view; Bachus 1, 1976.0—1982.0 m; $\times 3$
 15—19 — *Merista passer* (Barrande); ventral, dorsal, posterior, anterior and lateral views, respectively; Bachus 1, 2084.0—2090.0 m; $\times 2$