GEOLOGIA SUDETICA Vol. XIV, nr 2, 1979
PL ISSN 0072-100X

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STRATIGRAPHY OF THE ZDANÓW SERIES IN THE NORTHERN PART OF THE BARDO UNIT ON THE BASIS OF CONODONTS

CONTENTS

Abstract

In northern part of the Bardo unit, conodont fauna was ascertained in 17 exposures of the Zdanów series. 39 species of conodonts (jointly with subspecies) represent 7 genera and allow to ascribe rocks of this series to the Eifelian, Frasnian, and Famennian. These rocks were deposited in pelagic environment which lasted, despite the prior opinions, the whole Devonian Period.

INTRODUCTION

To interpret properly geological evolution of the Bardo unit was not easy because of lack of sufficiently recognised stratigraphy of the rock series outcropping in this region. This is especially true about the Zdanów series and its subsidiary lithostratigraphic units, namely: the Mikołajów shales, the Wojciechowice beds, and the Brzeźnica beds. The present author started her stratigraphic investigations of the Zdanów series in 1969 being encouraged by Kuchciński's (1964) report about the presence of foraminifers in the Wilcza beds. Her preliminary studies also revealed the occurrences of radiolarians, conodonts, and few foraminifers (Skandy 1972). The author has decided to study and search further only for conodonts because of their great stratigraphic significance. These investigations have been undertaken in north-western part of the Bardo unit (north of the river of Nysa Kłodzka) at numerous outcrops of the Mikołajów shales, Wilcza beds, and Brzeźnica beds. Omitted were the Zdanów shales as their stratigraphy is based upon graptolites (Kurałowicz 1976) and the Wojciechowice beds which crop out beyond the study area.

The conodont fauna was searched for at 28 localities but it was recognised positively only in 18 of them. The results of studies on conodonts coming from one of the latter exposures have already been published (Haydukiewicz 1974). The present paper

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deals with the results of investigations of conodont fauna in the remainder of 17 localities. They allow to define partly the biostratigraphy of the studied sediments and remarkably revise the prior opinions on geological development of the discussed part of the Sudeten Mts.

The author thanks cordially Prof. Tadeusz Gunia for his scientific tutelage. Also she is deeply grateful to Assistant Prof. Michał Szulczewski for his critical assistance and aid in identification of some specimens of conodonts. Prof. Józef Oberc and Prof. Stanisław Dżułyński are acknowledged for many useful discussions during joint field trips. Many thanks are also directed to my colleagues of Institute of Geological Sciences of the Wrocław University and Geological Department of the Polish Academy of Sciences of Wrocław, and, in particular, to Dr. Zdzisława Urbanek, Dr. Bolesław Wajsprych, and Dr. Stanisław Lorenc.

GEOLOGIC POSITION AND AGE OF THE ZDANÓW SERIES

The Zdanów series is one of the main lithostratigraphic units of the Bardo unit. In the past various names were given to this series. It was referred to as "Beds of Zdanów" by Oberc (1953, 1957, 1966) and Malinowska (1955) whereas Teller (1959, 1960) and Kuchciński (1964) employed the term "Zdanów beds". In earlier German literature it was known as "Herzogswalder Schichten" (Dathe 1904; Bederke 1924; Dahlgrün, Finckh 1924 *et al.*; Jaeger 1963, 1964).

The total thickness of the Zdanów series amounts 200 m. It is built of numerous, mutually interbedding varieties of clayey, siliceous, and silty rocks. The discussed series varies lithologically from place to place sufficiently enough to be divided into several subsidiary units referred to as the Zdanów shales, Mikołajów shales, Wojciechowice beds, Wilcza beds, and Brzeźnica beds (Oberc 1953, 1957). As fairly similar sounds of such names as "Beds of Zdanów" and "Zdanów beds" may possibly give rise to some misunderstandings they have been replaced by more general term "Zdanów series" (Skandy 1972) which is in usage throughout this paper.

The above named units still remain informal. Future investigations will probably transform them into formal ones. Then, the Zdanów series will be distinguished as a formation and its subsidiary units will acquire the rank of members.

The Zdanów series is well exposed throughout the Bardo unit and usually is in contact with Lower Carboniferous sediments (fig. 1). Most of these contacts were interpreted by Oberc (1957, 1972) as tectonic overthrusts, some others represent the unconformity obliterated during fold movements. In a few cases, the Zdanów series adheres to graptolite shales of Silurian age. At two exposures a sedimentary passage between these rocks may be observed (near the village of Zdanów and on the Łupianka Hill), the Zdanów series being represented by Zdanów shales. According to Oberc (1957), the Zdanów series (Mikołajów shales) overlies Upper Devonian limestones in the vicinity of the village of Gołogłowy; both domains are separated by overthrust. However the shales occurring above the thrust plane cannot rather be ascribed to the Zdanów series (Haydukiewicz 1977).

The present author's investigations were preceded by several writers reporting about the findings of organic fragments in the rocks of Zdanów series. In the Zdanów shales near the village of Wilcza, ostracods were found but they are devoid of stratigraphic significance. The Zdanów shales near the village of Zdanów contain Lower Devonian graptolites. They were described by Teller (1960) and Jaeger (1963, 1964). Occurrences of Middle Devonian psylophites were reported by Kuchciński (1964) from the Wilcza beds outcropping near the village of Wilcza. The above mentioned paleontological evidence once strongly influenced the prior concepts about the age of the Zdanów series (Dathe 1904; Bederke 1924; Dahlgrün, Finckh 1924; Finckh 1932; Fischer 1942; Oberc 1953; Teller 1959, 1960). Recently, however, all these views have only historical significance. Before Haydukiewicz's (1974) report on the occurrence of Upper Devonian conodont fauna in the Mikołajów shales, two different ideas concerning the age of the Zdanów series had been dominating in the literature. According to Oberc (1966, 1972, 1973), the Zdanów series is of Lower and Middle Devonian age and its subsidiary lithological units should be assigned as follows: the Zdanów shales, Mikołajów shales, Wojciechowice beds — to the Lower Devonian, the Wilcza beds and Brzeźnica beds — to the Middle Devonian. On the other hand, however, Jaeger (1964) argues that the Zdanów series was still depositing in the Upper Devonian. Both the authors developed two different concepts concerning tectogenesis of the Bardo unit. It was Oberc (1972) who

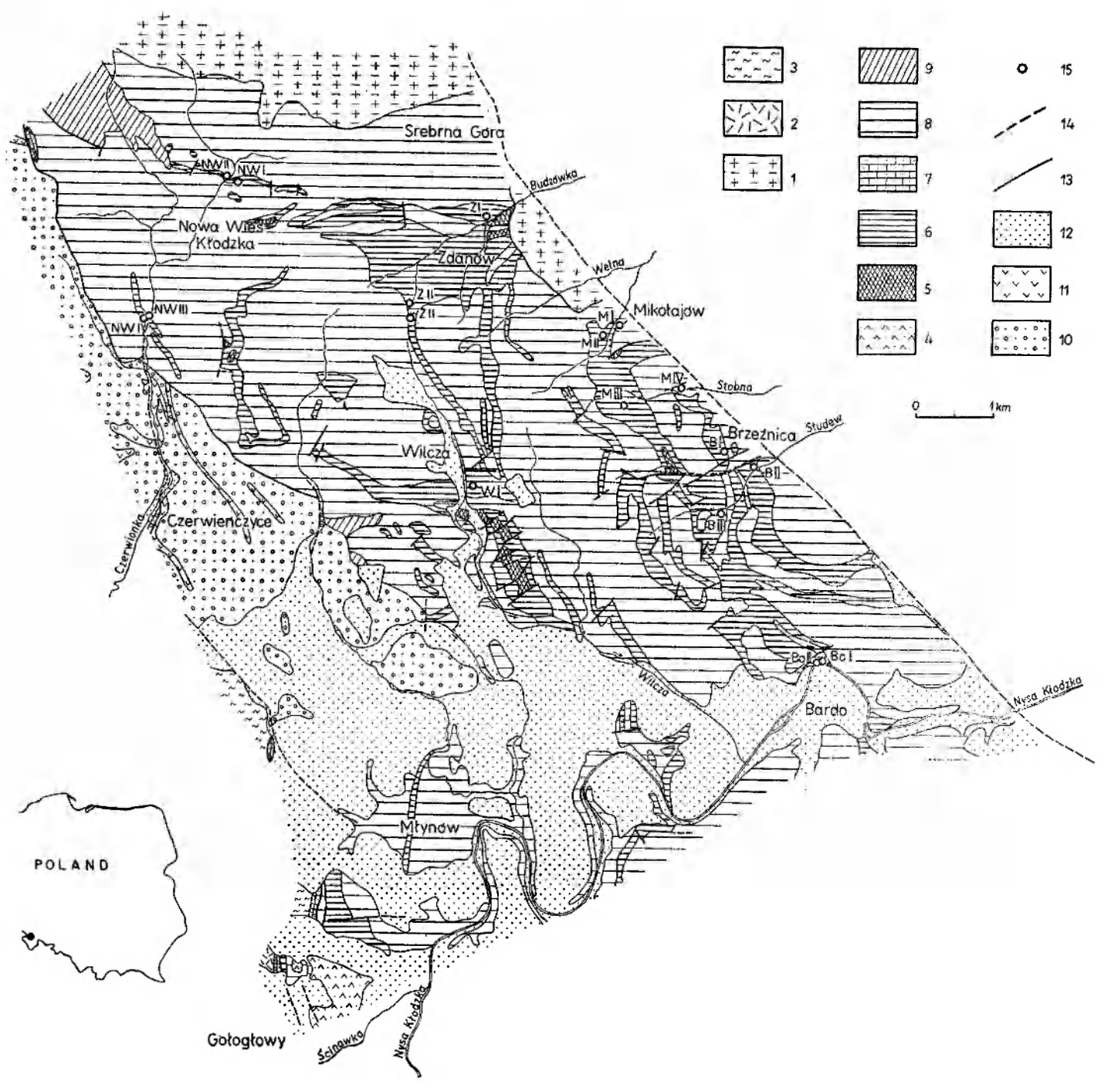

Fig. 1

Geological sketch of northern part of the Bardo unit (after Oberc 1957, simplified and completed by Wojciechowska 1966 and the author)

1 — gneisses and granite-gneisses(precambrian); *2* — mylonites (early paleozoic); *3* — chlorite and amphibole schists (early paleozoic); *4* — keratophyries (early paleozoic); *5* — graptolite shales, lidites, sandstones (ordovician?, silurian); *6* — clayey, clayey-siliceous, clayey-silty shales and siliceous rocks (devonian and lower carboniferous); *7* — limestones, conglomerates (upper devonian); *8* — graywackes, sandstones, clayey shales (upper carboniferous); *9* — conglomerates, sandstones, clayey shales (upper carboniferous); *10* — conglomerates, sandstones, clayey shales, limestones (lower permian); *11* — volcanic rocks (lower permian); *12* — gravels, sands, silts, clays, loams (quaternary); *13* — recognised dislocations; *14* — inferred dislocations; *15* — localities of conodont fauna

Szkic geologiczny północnej części struktury bardzkiej (wg Oberc 1957, uproszczony oraz uzupełniony wg Wojciechowskiej 1966 i na podstawie materiałów własnych autorki)

1 — gnejsy i granitognejsy (prekambr); *2* — mylonity (starszy paleozoik); *3* — łupki chlorytowe i amfibolowe (starszy paleozoik); *4* — keratofiry (starszy paleozoik); *5* — łupki graptolitowe, lidyty, piaskowce (ordowik?, sylur); *6* — łupki ilaste, ilasto-krzemionkowe, ilasto-mułowcowe, skały krzemionkowe (dewon i d. karbon); *7* — wapienie, zlepieńce (g. dewon); *8* — szarogłazy, zlepieńce, łupki ilaste (g. karbon); *9* — zlepieńce, piaskowce, łupki ilaste (g. karbon); *10* — zlepieńce, piaskowce, łupki ilaste, wapienie (d. perm); *11* — skały wulkaniczne (d. perm); *12* — żwiry, piaski, mułki, iły, gliny (czwartorzęd); *13* — dyslokacje stwierdzone; 14 — dyslokacje przypuszczalne; *15* — stanowiska fauny konodontowej

divided the Bardo unit into two structural stages: 1) early Hercynian stage — built of Silurian-Middle Devonian deposits which were folded during the Early Bretonian movements, 2) middle Hercynian stage — composed of Lower Carboniferous rocks which were folded jointly with earlier ones in the Sudetian Phase. Both the stages were separated by a stratigraphic gap embracing Late Devonian. These two structural stages were in common deformed once more by subsequent Asturian movements. Jaeger's (1964) stratigraphic concept gave rise to the idea assuming that the whole Bardo unit must have been folded during the Early Bretonian movements or even during the Sudetian Phase.

Quite a different interpretation of tectogenic evolution of the Bardo unit emerges recently from B. Wajsprych's (pers. comm.) sedimentological investigations. This author claims the great role of gravitational mass movements for the geological development of at least northern part of the Bardo unit. According to him, the Bardo unit should possibly be interpreted in terms of large-scale melange of Early Carboniferous (Visean) age.

CONODONTS

METHODS OF MACERATION

The conodont specimens were recovered from the siliceous, silica-clayey, and silty-clayey rocks. The rocks were treated with hydrofluoric acid of varying concentration (most frequently from 20 to 40%) in course of 10 to 60 minutes. In this way were processed samples usually having weight of 2 to 5 kg and in some cases even 10 kg. Up to nearly one-third of each sample was commonly dissoluted and desintegrated. Having performed a good deal of analyses, the author has recognised certain relationships between type of rock on the one hand and optimum time of etching and optimum acid concentration on the other hand. These relationships are illustrated in table 1. Every sample was several times soaked and etched with (HF), each time the sample processed being carefully washed and dried. The best results were achieved in course of three-fold etching. The first etching rendered a lot of conodont specimens but in a bad state and strongly corroded by acid. Not badly preserved were the specimens obtained after the second etching and their number was still high. The best preserved conodont specimens were provided after the third etching but they were largely reduced in number. All subsequent etchings produced only few conodont specimens of very low quality.

The author studied both the conodonts completely recovered from the rock samples and those still remaining onto half-etched rock surfaces.

GENERAL FEATURES OF THE CONODONT COLLECTION

222 samples were investigated micropaleontologically. 64 of them did contain the conodont fauna. 1 500 conodont specimens were obtained. 723 specimens were identifiable to species and subspecies, 283 specimens were identifiable to genus. The remainder of specimens failed any identification.

It is hard to establish the real frequency of conodonts as some became totally dissoluted while etching with hydrofluoric acid. Approximated only may be the number of specimens recovered from each kilo-

Table 1

Optimum concentration of acid and time of etching in treatment of various rocks
Optymalne stężenie kwasu i czas trawania stosowane dla różnych rodzajów skał

Rocks — Rodzaj skały	Optimum time etching Optymalny czas trawienia (min)	Optimum acid concentration Optymalne stężenie kwasu (%)
Siliceous rock and claystone with high content of cryptocrystalline silica Skała krzemionkowa i iłowiec z dużą zawartością kryptokrystalicznej krzemionki	10—30	40
Claystone with glauconite — Iłowiec z glaukonitem	20—45	40
Claystone — Iłowiec	30—40	20
Clayey siltstone — Skała ilasto-mułowcowa	30—60	20

gram of a rock sample. The Middle Devonian rocks usually provided 5 to 10 specimens and the Upper Devonian rocks rendered 10 to even 100 conodont specimens. But the real conodont frequency surely is many times higher. The most abundant conodont assemblages in terms of total number of taxa and specimens were recognised in the samples 1, 3 of the Locality NWIV, samples 3—5 of the locality BoI, sample 6 of the locality MIV, sample 3 of the locality BIII, and sample 3 of the locality NWI. The specimens recovered from the mentioned samples are best preserved. The samples themsleves were taken from claystones containing glauconite and from claystones rich in cryptocrystalline silica. In these rocks, the conodont fauna was always accompanied by radiolarians.

Most of the obtained conodonts display dark--amber colour. Only in two localities (BoI — claystones with glauconite, BoII — siliceous rocks), all the specimens were either dark-gray or completely black. Colouration of conodonts does not show any dependance upon lithology or biostratigraphic zonation.

The average size of conodont specimens ranges from 0,5 mm to 1,5 mm. Larger specimens were available only in fragments. Most of the specimens became as a rule more or less mechanically injured during maceration process. The cracks along free blade and carina being characteristic of many conodonts were usually widened to effect apparent "double" array of denticles (pls. I, *6*, *10*; II, *6*, *9*, *13*; IV, *2a*, *5a*). Surface ornamentation of conodonts often became totally obliterated by acid corrosion. It was impossible to identify such conodont specimens.

PALEONTOLOGICAL DESCRIPTIONS

The Bardo collection of conodonts cannot be grouped into multielement species (natural assemblages) as they are in a bad state and ramiform elements are scarce. Therefore, the so-called formal taxonomy is used in this paper. The collected conodont specimens were identified into 40 formal species and subsepecies representing 7 genera. The author omitted few ramiforms and cone forms in view of their insignificant stratigraphic value. Thus most of the identified species are well known from the literature and their more detailed descriptions will not be presented in this paper. Only the forms given in an open nomenclature and important for final stratigraphic conclusions will be described. The sole except is a very rare form of Polygnathus n. sp. Ziegler, Leuteritz (1970).

All the identified species have been illustrated in plates (pls. I—IV) except the species of *Palmatolepis gigas* as its only specimen had been lost before the photographs were taken.

The conodont photographs were taken by mgr J. Stachowiak. The collection is housed in the Institute of Geological Sciences of the Wroclaw University.

Genus Palmatolepis Ulrich & Bassler, 1926

Type species *Palmatolepis perlobata* Ulrich & Bassler, 1926

Palmatolepis hassi vel *Palmatolepis unicornis*

pl. I, *12*

Remarks. The specimens representing both the mentioned species may have identical platforms and ornamentation. The only difference is the presence of one or two denticles much higher than the others at the anterior free blade of *Palmatolepis unicornis*. The illustrated specimen has extremely similar platform and ornamentation to those of the above mentioned species. The broken free blade makes it, however, impossible to decide which of the two is actually in the author's collection. One may also take into account another species similar to *P. hassi* as well. Of those the species of *P. subrecta* seems to be the most probable. But the described specimen differs from the syntypes of this species, illustrated by Miller, Youngquist (1947, pl. 75; figs. 7—11), in having much wider platform and particularly its outer part.

Occurrence. Ziegler (1973, p. 282) recorded the range of *P. hassi* from the base of the *triangularis*--Zone to lower part of the *Upper gigas*-Zone (do $I\beta/\gamma$—do $I\delta$); few specimens were found even in the *Upper asymmetricus*-Zone. *P. unicornis* (Ziegler 1971, Chart 5) is reported to occur from the *Middle triangularis*-Zone to the top of the *gigas*-Zone (do I γ—do I δ). The described specimen was found in the sample 4, locality BI.

Palmatolepis cf. *quadrantinodosalobata* Sannemann, 1955

pl. I, *6*, *8—9*

Remarks. Most of the Bardo specimens display injured either outer lobe or free blade and strongly corroded platform. Despite this strong corrosion with acid, at the anterior inner platform, the thick nodes are always still visible. Their platforms and ornamentation are similar to those of *Palmatolepis quadrantinodosalobata*, though they differ a little from *P. quadrantinodosalobata* morhotype 1. The specimens devoid of free blade and having only fragments of the lateral lobe do not possess a distinct parapet; the nodes are rather randomly distributed over this very part of the platform. The specimens with well developed parapet which is covered with markedly arrayed nodes differ from morhotype 1 in having longer free blade, the free blade and carina

being less curved. The Bardo specimens differ from *P. poolei* with much larger outer lobe which occurs further to the front.

Occurrence. Ziegler (1973, p. 296) recorded the range of *P. quadrantinodosalobata* from the crepida-Zone to lower part of the *Lower rhomboidea*-Zone (do IIα—do IIβ). The Bardo specimens were recognised in the samples 4, 7, 8, 10, 11 of the locality MI and the samples 2, 6 of the locality NWII.

Palmatolepis cf. *termini* Sannemann, 1955

pl. I, *13*

Remarks. According to Sannemann's (1955 p. 149) and complementary Ziegler's (1973 p. 307) descriptions, this species has the ornamented anterior platform. At the inner anterior platform, there is an array of closely spaced nodes, which runs either in parallel to the platform margin or obliquely to it approaching the central node. The outer anterior platform is variably ornamented. Sometimes an array of nodes may occur which does not reach the central node. Randomly distributed nodes may be spread all over the very part of platform or they may be lacking at all. Some specimens of *Palmatolepis termini* have the whole platform covered with nodes (Ziegler 1962, p. 83; fig. 9). Because of the shape of platform the Bardo specimens are similar to both the above mentioned species and the species of *P. minuta minuta*. But they differ, however, from the latter in having few nodes preserved along the margin of the inner anterior platform. Unfortunately these nodes are severely injured and that is why the discussed specimens cannot be identified undoubtedly as *P. termini*.

Occurrence. Ziegler (1973, p. 308) reported the occurrence of *P. termini* from the *Middle* and *Upper crepida-* Zone (do IIα). The Bardo specimens were obtained from sample 2, locality NWII.

Genus Polygnathus Hinde, 1879

Type species *Polygnathus robusticostatus* Bischoff & Ziegler, 1957

Polygnathus n. sp. Ziegler & Leuteritz, 1970

pl. V, *1*, *2*

1970. *Polygnathus* n. sp.; Ziegler & Leuteritz, p. 713—714,

pl. VII, *7—9*

Remarks. The Bardo specimens may be assigned to the species of *Polygnathus n. sp.* illustrated earlier by Ziegler, Leuteritz, [in:] Koch *et al.* (1970, pl. 7; figs. 7—9). It should, however, be noted that the description by these authors does not conform in all detailes to the published illustration. It may be read from the text that the margin of the outer anterior platform is ornamented with denticles, the margin of the one-third inner anterior platform is smooth but the remainder of it is ornamented with short ridges. On the other hand, the illustrated specimen is ornamented along the whole length of the platform margin. The same is true about the Bardo specimens which differ from those described by Ziegler & Leuteritz in having the inner platform that occurs further to the front with respect to the outer margin.

Occurence. Ziegler, Leuteritz, [in:] Koch *et al.* (1970, p. 714) recognised the presence of this species in the *Middle costatus*-Zone (?do V/VI—do VI). The Bardo specimens were found in sample 6, locality NWIV, which is assignable to the interval from the *Upper velifer*-Zone to the *styriacus*- Zone (do IIIβ—do V), and in sample 4, locality BoII occurring in the *styriacus*-Zone (do IV—do V).

Polygnathus costatus cf. *patulus* Klapper, 1971

pl. IV, *6*

Remarks. The discussed specimen has platform, ornamentation, and adcarinal grooves greatly similar to those of *Polygnathus costatus patulus* described by Klapper (1971, p. 62—63). But its basal cavity is situated at the front of the platform whereas the typical representatives of this species have the basal pit in the midway between the front and the middle of the platform margin. The questioned specimen may easily be told from *P. costatus costatus* as its anterior platform lacks a characteristic narrowing and its adcarinal grooves are both wider and shallower.

Occurrence. According to Ziegler (1975, p. 349), the species of *P. costatus patulus* is assignable to the Eifelian and it ranges from the base of the *bidentatus*-Zone to the top of the *kockelianus*-Zone in the standard conodont zonation. The Bardo specimen was found in sample 43, locality WI.

Polygnathus cf. *robusticostatus* Bischoff & Ziegler, 1957

pl. IV, *3*

Remarks. The studied specimen is greatly similar to the typical representatives of the species of *Polygnathus robusticostatus* in having identical basal pit and ornamentation. However its platform does not display a heart-like shape so characteristic of *P. robusticostatus* (Klapper 1971, p. 66, pl. 3; figs. 23—33) and it is slightly narrower, which nearly excellently fits the specimen of *Polygnathus* cf. *robusticostatus* illustrated by Bultynck (1970, pl. 17, fig. 1). The studied specimen as well may easily be told from *P. angusticostatus* because its carina does not extend beyond the posterior platform and the adcarinal grooves are compatibly not so deep and wide (Klapper 1971, pl. 3; figs. 21—25).

Occurrence. Ziegler (1975, p. 379) reported the stratigraphic range of *P. robusticostatus* restricted only to the *bidentatus* and *kockelianus*-Zones. The

specimen in question was found in sample 5, locality ZII.

Polygnathus cf. *styriacus* Ziegler, 1957
pl. V, *9*

Remarks. According to Ziegler's description (1973, p. 383), *Polygnathus styriacus* has triangular platform. One-third portion of the anterior platform is smooth and bowed downward. The remainder of platform is granulated. The ornament is completed by a line of nodes occurring at the line of inflexion of the inner platform. Ziegler's view is that *P. styriacus* evolved from *P. granulosus*. The former, however, has more triangle outline of the platform, inflex of this platform and details of ornamention. Two specimens of the Bardo collection are greatly similar to *P. styriacus* because of shape of the platform and occasionally preserved ornament. The proper identification of this species is a little doubtful as the studied specimens are strongly injured, especially at their anterior platforms. They cannot be assigned to the species of *P. granulosus* because of this triangle platform and its characteristic inflexion.

Occurrence. According to Ziegler (1973, p. 384), *P. styriacus* occurs in the *styriacus*-Zone (doIV—doV). The Bardo specimens were recognised in samples 13 and 15, locality BII.

Genus Pseudopolygnathus Branson & Mehl, 1934
Type species *Pseudopolygnathus primus*
Branson & Mehl, 1934

Pseudopolygnathus cf. *micropunctatus*
Bischoff & Ziegler, 1956
pl. V, *5*, *8*

Remarks. Both shape of the platform and attitude, and situation of the basal cavity of the Bardo specimens are similar to those of *Pseudopolygnathus micropunctatus*. According to Bischoff's, Ziegler's (1956, p. 163) diagnosis, this species possesses the fine-punctuated platform, the feature being recognizable only under large magnification. Seen at the normally applied enlargement, the platform seems to be smooth. The smaller of the two questioned specimens has strongly corroded oral surface whereas the oral surface of the bigger one is hidden from the view. Visible fragments of the upper surface of the platform are devoid of any ornament and thus one may assume that the parts covered with rock are not ornamented either. Nevertheless, the studied specimens are not identifiable to species with the all certainity.

Occurrence. Ziegler (1962, p. 101) reported the range of *Ps. micropunctatus* from the *Upper velifer*-Zone to the *styriacus*-Zone (do IV—do V). The Bardo specimens were recognised in sample 6, locality NWIV.

CHARACTERISTICS OF FAUNAL LOCALITIES

This section deals with the descriptions of those exposures in which the rocks outcropped do contain the conodont fauna used to characterize biostratigraphy of the Zdanów series. The descriptions and photographs of conodont localities have been published in order to site precisely places of sampling (figures on photographs refer to sample number) and, most of all, to point out the so far revealed relationships between lithological varieties of the Zdanów series and their position in a stratigraphic column. Below will be successively featured the outcrops of the Wilcza beds, Mikołajów shales, and Brzeźnica beds. The description of each locality comprises general lithological characteristics, mode of occurrence of rocks, list of recognised conodonts and references to conodont zonation or intervals, consisting of several zones, which embrace the rocks of this locality.

The author failed, in most cases, to determine whether the observed successions are right-way-up or inverted; the sedimentary structures are very scarce and fauna cannot solve this problem either. Individual samples may usually be referred to rather vast interval than to any definite conodont zone. Moreover, the successively taken samples often contain the fauna assignable to various intervals. Thus, the investigated strata may be dated alternatively in dependence upon their actual upward or downward facings. Taking into account both the possibilities, the biostratigraphic position of a given rock succession has always been interpreted alternatively.

Locality WI (point 91)[1]

The outcrop is 200 m long and occurs at southern edge of the village of Wilcza, at the escarpment of the Zdanów—Wojbórz road (pl. VII). The Wilcza beds are outcropping in northern part of this exposure whereas the Zdanów shales are exposed in southern one. The Wilcza beds are represented by gray-greenish clayey and silty-clayey rocks thinly interbedded with fine-grained graywackes. Fragments of psylophites are widespread. The graywacke intercalations are absent from southern part of the Wilcza beds section; some claystones are rich in microcrystalline silica and have abundant radiolarians. All the mentioned lithological varieties are mutually interbedded, the thickness of individual beds ranging

[1] In brackets are given references to Oberc's (1957) descriptions of the same localities.

Table 2

Distribution and frekuency of conodonts in localities WI, ZI, ZII, ZIII
Rozmieszczenie i frekwencja konodontów w stanowiskach WI, ZI, ZII, ZIII

Conodonts Konodonty	Localities Stanowiska	WI				ZI			ZII			ZIII	
	Sample Próba	39	40	43	44	1	2	5	5	6	7	2	4
Polygnathus costatus costatus Klapper						1						1	
Polygnathus costatus cf. *patulus* Klapper				1									
Polygnathus eiflius Bischoff & Ziegler				1					1	1			
Polygnathus kockelianus Bischoff & Ziegler													
Polygnathus cf. *robusticostatus* Bischoff & Ziegler									1				1
Polygnathus sp.				2	1		3		2	1		3	1
Spathognathodus sp.	1			3									
Ramiform elements (formy gałązkowe)		3		31	3	1	2	1	10	7	1	5	3

from a couple to several tens centimetres. The beds dip steeply northwards or southwards as they are involved in upright tight folds accompanied by axial fractures. The magnitude of evident displacements along these fractures is hard to estimate. Certainly the same zones are repeated several times and some zones are lacking at all.

The author investigated 70 samples, 4 of them do contain conodonts but only the sample 43 provided specimens identifiable to species (tab. 2). These conodonts define the interval from the *bidentatus*--Zone to the *kockelianus*-Zone which refers to the higher portions of the Eifelian.

Locality ZI

Small, inactive quarry at southeastern end of the village of Zdanów, 100 m north of the cross-roads. Outcropping here are the Wilcza beds. They are represented by mutually interlayered gray-greenish clayey and silty rocks. The individual beds are 5 to 20 cm thick, the total thickness amounts 16 m. The bedding surfaces dip northwesterly at the angle of 60°.

Of several investigated samples only the sample 1, taken at the base of the quarry, provided one specimen identifiable to species (tab. 2). This species allows to ascribe the rocks overhere to the Eifelian. All the samples contain few radiolarians.

Locality ZII

100 m long exposure at the cutting of wood-track leading from the village of Zdanów to the Wilcza Równia, 800 m from Zdanów. The gray-greenish Wilcza beds outcrop here. Some beds contain remarkable amounts of microcrystalline silica and abundant radiolarians. The thicknesses of individual beds range from 3 to 20 cm. The beds dip generally southwesterly at the angle of 30° and occasionally in the opposite direction as they are involved in folds.

Most of the samples collected at this locality yielded the negative results. The conodonts obtained from samples 5 and 6 allow to ascribe the parent rocks to the Middle Devonian (tab. 2).

Locality ZIII

Wood-track escarpment, 20 m northwest of the cross-roads at the Wilcza Równia. Exposed are dark gray clayey-siliceous rocks intercalated with gray-greenish claystones (Wilcza beds). The former beds are usually 5 to 15 cm thick, the latter — 1 to 5 cm only. The beds dip southwesterly at the angle of 50°.

Of the collected samples only sample 2 taken from northern part of this small exposure and sample 4 from its central portion do contain conodonts identifiable to species (tab. 2). Stratigraphic range of these taxa is restricted only to the Eifelian.

Locality MI (point 77)

Abandoned quarry on northwestern slope of the unnamed hill (490 m a.s.l.) in the middle of the village of Mikołajów (pl. VIII). The Mikołajów shales exposed here are represented by gray-greenish claystones which contain varying amounts of silt-size detritic grains. The individual beds are 5 to 10 cm thick. Total thickness of the exposed Mikołajów shales is 8 m. They are overlain by coarse-grained graywackes visible at the top of the quarry. Contact zone of the two lithological varieties is fairly obliterated as the rocks are strongly crushed.

The author collected 12 samples representing every outcropped bed of the Mikołajów shales. All of them contain conodont fauna (tab. 3). The samples 1 and 3 from the base of the quarry as well as sample 12 coming from the top provided conodonts indicating that the exposed succession belongs to the interval from the *Upper rhomboidea*-Zone to the *Lower marginifera*-Zone. The fauna of sample 7, central part of quarry face, allowed to ascribe the parent bed to the *Lower rhomboidea*-Zone. Accordingly, if the

Table 3

Distribution and frequency of conodonts in locality MI
Rozmieszczenie i frekwencja konodontów w stanowisku MI

Conodonts — Konodonty	Sample — Próba											
	1	2	3	4	5	6	7	8	9	10	11	12
Palmatolepis minuta minuta Branson & Mehl	5		6	1	5	1	5	1	2	3		2
Palmatolepis glabra prima Ziegler & Huddle	41	8	20	10		1	1		1	2		3
Palmatolepis gracilis gracilis Branson & Mehl	10	4	10									1
Palmatolepis subperlobata Branson & Mehl	1		1	3			3	1		1	1	1
Polygnathus glaber glaber Ulrich & Bassler	3		1	2					3	1	1	2
Palmatolepis rhomboidea Sannemann	9		7				1					
Palmatolepis glabra pectinata Ziegler	2		3							1		1
Palmatolepis cf. *quadrantinodosalobata* Sannemann				6			1	1		2	1	
Palmatolepis cf. *regularis* Cooper							1					
Palmatolepis inflexa sensu Sandberg & Ziegler												1
Palmatolepis sp.	10	6	3	7	7	5	5		2	1	1	
Polygnathus sp.	3		3						1			
Iciodus sp.				1	1				1			
Ramiform elements (formy gałązkowe)	30	16	21	10			2	2	2	4	5	7

Table 4

Distribution and frequency of conodonts in locality MII
Rozmieszczenie i frekwencja konodontów w stanowisku MII

Conodonts — Konodonty	Sample — Próba			
	2	3	4	5
Palmatolepis sp.	5	7	1	2
Polygnathus sp.	2	2		
Ramiform elements (formy gałązkowe)		2	1	

beds are in upright position, their base and the middle will belong to the Lower rhomboidea-Zone and their top will represent the interval from the *Lower rhomboidea*-Zone to the *Lower marginifera*-Zone. In case of inverted sequence, their middle and top parts will belong to the *Lower rhomboidea*-Zone and their base will represent the interval from the *Lower rhomboidea*--Zone to the *Lower marginifera*-Zone.

Locality MII (point 78)

Small inactive quarry situated in the middle of the village of Mikołajów, near the cart-track leading westwards, 650 m east of the Dębień Hill. The Mikołajów shales are represented here by gray-greenish clayey-silty shales and gray claystones overlying the coarse-bedded graywackes. According to Oberc (1957) both the lithological varieties are separated by a thrust plane. Close to this contact, the Mikołajów shales are strongly deformed and contain graywacke intercalations. The beds are 2 to 10 cm thick and they dip at the angle of 30° to EES.

Of the samples taken at the base of the quarry only the samples 2 and 3 (southwestern face) provided but insuffciently preserved conodont specimens suggesting the interval from the *Middle* asymmetricus-Zone to the *Middle crepida*-Zone. Total thickness of beds outcropping at the base amounts 2,5 m. A few badly preserved conodonts were provided from the top of northeastern face (tab. 4)[2]. Total thickness of shales exposed on this face of the quarry is 6 m. These shales seem to represent the interval from the *Upper crepida*-Zone to the *Middle velifer*-Zone.

Locality MIII

50 m long section of the strongly deformed Mikołajów shales is exposed on the right-hand slope of the valley of Stobna Creek, 700 m northwest of the summit of the Buczek Mt. They are represented by gray-greenish and greenish clayey-siliceous rocks thinly interbedded with the clayey rocks. The individual beds are as thick as a couple to 20 cm.

Conodont fauna has so far been found only in

[2] Of the specimens obtained from the locality MII only those representing the genus of Palmatolepis are stratigraphically significant. They are in a bad state and cannot be identified to species. Nevertheless they differ from one another sufficiently enough to distinguish (samples 2 and 3 as well as 4 and 5) the mentioned intervals (see the section "Biostratigraphy").

Table 5

Distribution and frequency of conodonts in locality MIII
Rozmieszczenie i frekwencja konodontów w stanowisku MIII

Conodonts — Konodonty	Sample — Próba		
	11	12	13
Palmatolepis minuta minuta Bransosn & Mehl	1	1	
Palmatolepis glabra pectinata Ziegler	2	2	
Palmatolepis glabra prima Ziegler & Huddle	1		7
Palmatolepis marginifera duplicata Sandberg & Ziegler	1		
Spathognathodus werneri Ziegler	1		
Palmatolepis gracilis gracilis Branson & Mehl		2	
Palmatolepis distorta distorta Branson & Mehl		1	
Palmatolepis marginifera marginifera Helms		1	
Polygnathus glaber glaber Ulrich & Bassler		1	
Palmatolepis inflexa sensu Sandberg & Ziegler			1
Palmatolepis sp.	4	2	
Ramiform elements (formy gałązkowe)		1	
Simple cones (formy stożkowe)		1	

Table 6

Distribution and frequency of conodonts in locality BI
Rozmieszczenie i frekwencja konodontów w stanowisku BI

Conodonts — Konodonty	Sample — Próby		
	1	3	4
Ancyrodella gigas Youngquist	1		
Palmatolepis gigas Miller & Youngquist	1		
Palmatolepis hassi vel P. unicornis			1
Palmatolepis sp.	12		2
Polygnathus sp.	9		2
Ramiform elements (formy gałązkowe)	3	1	1

the central portion of the exposure, at 7 m thick layer. The rocks overhere are less deformed and the beds dip at the high angle to EEN. The conodonts from the base of this layer (sample 11) indicate the *marginifera*-Zone (tab. 5). The interval from the *Lower marginifera*-Zone to the *Middle velifer*-Zone is proved by fauna of the sample 12 collected 2 m further upwards. The sample 13 taken at the top of the questioned layer contains conodonts which determine the interval from the *Upper rhomboidea*-Zone (*Lower rhomboidea*?-Zone) to lower portion of the *Upper marginifera*-Zone. If the beds are in upright stratigraphic position, they represent the *marginifera*-Zone. Otherwise they belong to the interval from the *Upper* (*Lower*?)[3] *rhomboidea*-Zone to the *Upper marginifera*-Zone.

Locality BI

The gray-greenish clayey-silty and clayey Mikołajów shales crop out in a small quarry near cart-track, some 350 m northeast of the foreseter's lodge in the village of Brzeźnica. The individual clayey beds are 5—10 cm thick whereas the clayey-silty ones thicknesses ranging from 2 to 5 cm. Total thickness of the exposed shales reaches 5,3 m and the beds dip eastward at the angle of 40°. At the top, there are two thick lenses of dark gray, strongly recrystallized limestones, the longer axes of these lenses being 30 and 40 cm long. Loosened blocks of fine-grained and coarse-bedded sandstones occur over the Mikołajów shales.

Only the samples 1 and 4 collected at the base and central part of the quarry contained conodonts (tab. 6). No conodonts were obtained from the above mentioned limestone lenses. The conodonts of sample 1 indicate the *Lower gigas*-Zone and fauna of sample 4 defines the interval from the *Upper asymmetricus*-Zone to the *Upper gigas*-Zone. Accordingly, the questioned shales represent the *Lower* and *Upper gigas*-Zones when assuming their upright position. But in case of inverted sequence they would be ascribed to the *Upper asymmetricus*-Zone and the *Lower gigas*-Zone.

[3] For details see the section "Biostratigraphy".

Locality BIII

The Mikołajów shales are exposed at the bed of a small creek (right-hand tributary of the stream of Studew), some 750 m NNE of the summit of the Leszek Mt. They are represented by gray-greenish claystones having variable amount of silica. The exposure is 15 m long. The individual beds are several centimetres thick and they dip at the angle of 55° to EEN.

Only two samples (2 and 3) contained fauna of stratigraphic value (tab. 7). They were collected at the base of outcropping layer. The fauna defined the interval from the *Lower rhomboidea*-Zone to the *Lower marginifera*-Zone.

Locality BoI (point 3)

This locality is situated at the distance of 450 m counting from the last house of the village of Opolnica, along the road from Opolnica to Bardo Śląskie. Outcropping are the Mikołajów shales represented by dark, gray-greenish claystones with glauconite and cryptocrystalline silica. Their bedding planes dip monoclinally at the angle of 50° to EEN. Indi-

Table 7

Distribution and frequency of conodonts in locality BIII
Rozmieszczenie i frekwencja konodontów w stanowisku BIII

Conodonts — Konodonty	Sample — Próba	
	2	3
Palmatolepis minuta minuta Branson & Mehl	3	8
Palmatolepis glabra prima Ziegler & Huddle	11	22
Palmatolepis gracilis gracilis Branson & Mehl	1	5
Palmatolepis subperlobata Branson & Mehl	5	
Palmatolepis perlobata schindewolfi Muller		1
Palmatolepis rhomboidea Sannemann		1
Palmatolepis inflexa sensu Sandberg & Ziegler, 1973		1
Polygnathus glaber glaber Ulrich & Bassler		1
Palmatolepis sp.	5	10
Polygnathus sp.	1	3
Ramiform elements (formy gałązkowe)	5	
Simple cones (formy stożkowe)	1	

Table 8

Distribution and frequency of conodonts in locality BoI
Rozmieszczenie i frekwencja konodontów w stanowisku BoI

Conodonts — Konodonty	Sample — Próba				
	1	2	3	4	5
Palmatolepis gracilis gracilis Branson & Mehl	5	5	3	4	2
Palmatolepis glabra lepta Ziegler & Huddle	2	1	2		
Palmatolepis perlobata schindewolfi Müller	4	1			4
Palmatolepis minuta minuta Branson & Mehl	2		2	3	2
Spathognathodus werneri Ziegler	2		1	17	
Palmatolepis distorta distorta Branson & Mehl		5	9	4	2
Palmatolepis marginifera marginifera Helms		1	1	11	12
Palmatolepis glabra pectinata Ziegler		2	3		
Polygnathus glaber bilobatus Ziegler			3	1	
Polygnathus glaber glaber Ulrich & Bassler				2	3
Palmatolepis marginifera duplicata Sandberg & Ziegler				1	1
Palmatolepis marginifera n. subsp. Sandberg & Ziegler					2
Palmatolepis glabra prima Ziegler & Huddle					7
Polygnathus diversus Helms					2
Palmatolepis sp.	1	8	5	3	4
Polygnathus sp.	1		2		1
Icriodus sp.					1
Ramiform elements (formy gałązkowe)	6		7	6	2

vidual beds are several to 40 cm thick and the total thickness amounts 7,6 m. Radiolarians are abundant throughout the section.

5 samples were collected at this locality and all of them contain fairly well preserved conodonts (tab. 8). The conodonts of these samples define a couple of intervals having the common lower limit which is equivalent to the base of the *Lower marginifera*-Zone. The narrowest interval (the *Lower* and *Upper marginifera*-Zones) is defined by the fauna of sample 5 taken from the top of the outcropping shales. The conodonts provided by the successively collected samples (4, 3, 2, 1) refer to the steadily widening intervals. The sample 1 determines the interval from the *Lower marginifera*-Zone to the *Upper velifer*-Zone. Accordingly, the exposed shales may be ascribed to the undivided *marginifera*-Zone on the condition of upright stratigraphic sequence. In case of inverted succession they may be assigned even to the whole interval determined by sample 1.

Locality NWI

Small exposure of the Mikołajów shales is situated on western slope of the Orzech Hill, some 150 m EEN of church at the village of Nowa Wieś Kłodzka. These shales are represented by gray-greenish clayey-siliceous rocks containing plenty of radiolarians. The thicknesses of individual beds range from 5 to 20 cm. Thin, gray, greenish claystone intercalations are 0,5 to 4 cm thick. The beds dip at the angle of 60° southeastwards.

The conodont fauna was provided by two samples (3 and 5) collected in the middle of this exposure (tab. 9). They define the undivided *marginifera*-Zone (sample 3) and the interval from the *Lower rhomboidea*-Zone to the *Lower marginifera*-Zone (sample 5). Thus the exposed shales represent the *Lower marginifera*-Zone assuming their upright sequence or the interval from the *Lower rhomboidea*-Zone to the *Upper marginifera*-Zone in case of inverted succession.

Locality NWII (point 95)

This locality is situated at the bed of a cart-track some 160 m north of church in the village of Nowa Wieś Kłodzka. Exposed here is the 10 m thick layer of greenish Mikołajów shales underlain by fine-grained sandstones and overlain by conglomerates. At the top of this layer, there are bodies and lenses of fine-grained sandstones within the matrix of Mikołajów shales. The shales are strongly crushed and their bedding planes become unrecognizable. In places with still visible bedding, the beds dip at the angle of 70° toward northwest.

The conodont fauna was obtained from those samples that had been collected from the portions devoid of sandy inclusions. This very part of the exposed shales represents the interval from the *Upper triangularis*-Zone to the *Lower rhomboidea*-Zone. The sample 1 refers to the interval from the *Upper triangularis*-Zone to the *Upper crepida*-Zone, the sample 2 covers the *Middle crepida*-Zone, and sample 6 embraces probably the interval from the *Upper crepida*-Zone to the *Lower rhomboidea*-Zone (tab. 10). Such a stratigraphic succession points to the upright facing beds.

Locality NWIII (point 97)

Small exposure, partly covered with debris, 40 m west of highway, northern edge of the village of Czerwieńczyce. Strongly crushed Mikołajów shales are represented by gray-greenish clayey rocks with faintly marked bedding planes spaced at every 5 to 15 cm. Their total thickness is 5 m; beds dip northeastward at the angle of 50°. Three samples were taken from the thickest beds, (tab. 11). The samples 1 and 2 of western portion of this exposure contained fauna

Table 9

Distribution and frequency of conodonts in locality NWI
Rozmieszczenie i frekwencja konodontów w stanowisku NWI

Conodonts — Konodonty	Sample — Próba	
	3	5
Palmatolepis minuta minuta Branson & Mehl	4	1
Palmatolepis perlobata subsp. indet.	2	1
Palmatolepis glabra prima Ziegler & Huddle	12	6
Polygnathus glaber glaber Branson & Mehl	4	3
Palmatolepis glabra pectinata Ziegler	cf. 1	
Palmatolepis inflexa sensu Sandberg & Ziegler	2	
Polygnathus diversus Helms	1	
Palmatolepis subperlobata Branson & Mehl		1
Palmatolepis gracilis gracilis Branson & Mehl		2
Palmatolepis sp.	4	8
Polygnathus sp.	2	4
Ramiform elements (formy gałązkowe)	13	7

Table 10

Distribution and frequency of conodonts in locality NWII
Rozmieszczenie i frekwencja konodontów w stanowisku NWII

Conodonts — Konodonty	Sample — Próby		
	1	2	6
Palmatolepis minuta minuta Branson & Mehl	4	7	cf. 3
Palmatolepis tenuipunctata Sannemann	2	4	
Palmatolepis cf. *quadrantinodosalobata* Sannemann			1
Palmatolepis trianqularis → P. *quadrantinodosalobata*		1	
Palmatolepis cf. *regularis* Cooper		3	
Palmatolepis cf. *termini* Sannemann		2	
Palmatolepis glabra prima Ziegler & Huddle			1
Palmatolepis sp.	1	12	4
Polygnathus sp.	2	1	1
Icriodus sp.	1	1	
Ramiform elements (formy gałązkowe)	3	4	

Table 11

Distribution and frequency of conodonts in locality NWIII
Rozmieszczenie i frekwencja konodontów w stanowisku NWIII

Conodonts —Konodonty	Sample — Próba		
	1	2	3
Palmatolepis glabra prima Ziegler & Huddle	2	1	2
Palmatolepis minuta minuta Branson & Mehl			5
Palmatolepis minuta cf. *loba* Helms			1
Palmatolepis subperlobata Branson & Mehl			2
Palmatolepis cf. *regularis* Cooper			2
Polygnathus glaber cf. *glaber* Ulrich & Bassler			1
Palmatolepis sp.	4	1	7
Polygnathus sp.			1
Icriodus sp.			2
Ramiform elements (formy gałązkowe)	1	2	6

which determined the interval from the *Upper crepida*-Zone to the *Lower rhomboidea*-Zone. All the beds outcropping in this locality must belong to this very interval on the condition of their upward facing attitude. Assuming, however, an inverted sequence the beds would represent the interval defined by the fauna of samples 1 and 2.

Locality NWIV (point 97)

The gray-greenish Mikołajów shales containing significant amounts of glauconite and silica are exposed on the right-hand side of the Czerwionka stream, near the mouth of its left-hand tributary, northern edge of the village of Czerwieńczyce. A single layer of black siltstones 1,2 m thick occurs within these shales. Their total thickness is 6,5 m and the thicknesses of individual beds range from 5 to 20 cm. The beds dip steeply to ENE. There is no continuous section exposed but only places separated by weatherings.

The sample 1 of southern part of this locality contains conodonts indicating the *marginifera*-Zone (tab. 12). The sample 3 collected 1 m upward provides conodonts which determine the interval from the *Lower marginifera*-Zone to the *Lower velifer*-Zone. No fauna was obtained from the greenish clayey shales and black siltstones occurring in the central part of the discussed locality. The sample 6 coming from the northern portion of this exposure (uppermost shales) contain conodonts defining the interval of the *Upper velifer*-Zone and the *styriacus*-Zone.

Locality BII (point 23)

The cart-track from the village of Brzeźnica to the forester's lodge. The Brzeźnica beds are outcropping overhere in several crags scattered over the distance of some 200 m. They are represented by dark or light gray siliceous rocks, the individual beds being 2 to 40 cm thick. They are thinly intercalated with gray-greenish siliceous rocks impured with clayey substance. The massive beds of gray colour contain numerous radiolarians.

The conodonts have so far been positively recognised

Table 12

Distribution and frequency of conodonts in locality NWIV
Rozmieszczenie i frekwencja konodontów w stanowisku NWIV

Conodonts — Konodonty	Sample — Próba		
	1	3	6
Palmatolepis perlobata schindewolfi Muller	2	3	cf. 1
Palmatolepis gracilis gracilis Branson & Mehl	5	1	6
Palmatolepis glabra pectinata Ziegler	3	1	
Palmatolepis marginifera marginifera Helms	1	7	
Polygnathus glaber glaber Ulrich & Bassler	3	1	
Polygnathus diversus Helms	1	2	
Spathognathodus werneri Ziegler	7	1	
Palmatolepis minuta minuta Branson & Mehl	4		
Palmatolepis glabra prima Ziegler & Huddle	4		
Palmatolepis inflexoidea Ziegler	1		
Palmatolepis marginifera n. subsp. Sandberg & Ziegler	6		
Palmatolepis distorta distorta Branson & Mehl		32	
Polygnathus glaber bilobatus Ziegler		1	
Polygnathus n. sp. Ziegler & Leuteritz			3
Pseudopolygnathus cf. *micropunctatus* Bischoff & Ziegler			3
Icriodus sp.	1		
Palmatolepis sp.	13	7	
Polygnathus sp.		2	2
Pseudopolygnathus sp.			3
Ramiform elements (formy gałązkowe)	8	5	8

Table 13

Distribution and frequency of conodonts in locality BII
Rozmieszczenie i frekwencja konodontów w stanowisku BII

Conodonts — Konodonty	Sample — Próba						
	5	7	9	13	15	17	18
Palmatolepis gracilis gracilis Branson & Mehl	1		9	2	5	5	
Spathognathodus werneri Ziegler	2		1				
Polygnathus cf. *styriacus* Ziegler				1		1	
Palmatolepis perlobata schindewolfi Muller					1		cf. 1
Palmatolepis rugosa postera Ziegler					1	1	
Palmatolepis glabra pectinata Ziegler							1
Palmatolepis sp.	1	3	4	3			4
Polygnathus sp.			5				
Spathognathodus sp.		2		2			
Ramiform elements (formy gałązkowe)	4	43	50	6	15	22	6

only in the biggest crag at eastern part of this section (pl. IX). The Brzeźnica beds occur here as separate layers bounded by discontinuities (small thrust folds), the layers being 1 to 3 m thick. This explains the lack of succession of the conodont fauna investigated in this locality. The layers from which samples 5 and 9 have been taken, may be referred to the interval from the *Lower marginifera*-Zone to the *Upper styriacus*-Zone (tab. 13). The samples 13, 15, and 17 define the *styriacus*-Zone. The beds providing sample 18 are assignable to the interval from the *Upper crepida*--Zone to the *Middle velifer*-Zone.

Locality MIV (point 80)

The gray clayey-siliceous Brzeźnica beds are exposed at the wood-track, near its sharp turn, 550 m NNE of the summit of the Buczek Mt. The individual beds are 5 to 10 cm thick and they dip eastwards at the angle of 50°. Their total thickness is 5,3 m.

Sample 6 taken from the top of exposure provided the conodonts indicating the presence of the *styriacus*-Zone (tab. 14). The fauna assemblages recognised in other samples determine only broad intervals.

Locality BoII (point 3)

The dark-gray siliceous Brzeźnica beds are expo-

Table 14

Distribution and frequency of conodonts in locality MIV
Rozmieszczenie i frekwencja konodontów w stanowisku MIV

Conodonts — Konodonty	Sample — Próba		
	1	5	6
Palmatolepis gracilis gracilis Branson & Mehl	1	6	7
Bispathodus stabilis Branson & Mehl	1		2
Bispathodus sp. indet.	1		
Polygnathus communis communis Branson & Mehl	1		
Palmatolepis rugosa subsp. indet.		3	1
Palmatolepis perlobata cf. *schindewolfi* Muller			1
Spathognathodus werneri Ziegler			1
Polygnathus obliquicostatus Ziegler			21
Polygnathus sp.	1	1	9
Ramiform elements (formy gałązkowe)	11	12	27

Table 15

Distribution and frequency of conodonts in locality BoII
Rozmieszczenie i frekwencja konodontów w stanowisku BoII

Conodonts — Konodonty	Sample — Próba	
	4	5
Palmatolepis gracilis gracilis Branson & Mehl	5	3
Palmatolepis rugosa subsp. indet.	1	
Spathognathodus werneri Ziegler	2	
Polygnathus obliquicostatus Ziegler	9	
Polygnathus n. sp. Ziegler & Leuteritz	9	
Palmatolepis sp.	3	
Polygnathus sp.	4	1
Ramiform elements (formy gałązkowe)	24	6

sed at the side of the river of Nysa Kłodzka, 5 m above the road from Bardo to Opolnica, 370 m from the edge of the village of Opolnica. Total thickness of the exposed beds is 4 m, the thicknesses of individual beds range from several to 20 cm. All the beds are rich in radiolarians.

Only one sample (4) provided the conodont fauna which indicated the *styriacus*-Zone (tab. 15).

BIOSTRATIGRAPHY

This section deals with the features of the conodont zones and consisting of several zones intervals which have been recognised in the Zdanów series. Only a few samples contained the fauna that allowed to determine the definite conodont zones. These are the *kockelianus*-Zone, *Lower gigas*-Zone, *Middle crepida*-Zone (probably), *Lower rhomboidea*-Zone, *marginifera*-Zone, and *styriacus*-Zone. The remainder of samples provided conodonts enabling the author to distinguish merely various intervals of the Middle and Upper Devonian.

The biostratigraphic division of the Zdanów series has been based upon the conodont zonation established by Wittekindt (1965) and partly modified by Ziegler (1965, 1971) for the Middle Devonian and that of Ziegler (1962, 1969, 1971) and Sandberg & Ziegler (1973) for the Upper Devonian.

The interval from the *corniger*-Zone to the *kockelianus*-Zone was recognised at the locality ZI (sample 1) and locality ZIII (sample 3) on the basis of occurrence of the species of *Polygnathus costatus costatus* Klapper (tab. 2). The stratigraphic range of this species was assumed following Ziegler (1973, p. 347).

The interval embracing the *bidentatus* and the *kockelianus*-Zone may be referred to the part of beds outcropping in the localities WI and ZII (tab. 2). It was defined by a joint occurrence of *Polygnathus eiflius* Bischoff & Ziegler (sample 5 of locality ZII)

the form similar to *Polygnathus robusticostatus* Bischoff & Ziegler (sample 5 of locality ZII) and *Polygnathus costatus patulus* Klapper (sample 43 of locality WI). The stratigraphic range of these species was assumed after Ziegler (1973, p. 349, 355, 379).

The interval from the *bidentatus*-Zone to the *obliquimarginatus*-Zone was recognised in the locality ZII (sample 6) owing to the presence of *Polygnathus eiflius* Bischoff & Ziegler (tab. 2). According to Ziegler (1973, p. 355), this species occurs from the Late Eifelian to Early Givetian, which is equivalent to the above mentioned interval in terms of standard conodont zonation.

The *kockelianus*-Zone was recognised in the locality ZIII (sample 4) owing to the presence of index species (tab. 2).

The *varcus*-Zone and the *hermanni-cristatus*-Zone have not so far been recognised in the Zdanów series.

The interval from the *Middle asymmetricus*-Zone to the *Middle crepida*-Zone (do Iα—do IIα) is probably applicable to the beds exposed at the base of locality MII (samples 2 and 3). Scarce representatives of the genera of *Palmatolepis* and *Polygnathus* are in a bad state and therefore they are not identifiable to species even with restriction (tab. 4). All the specimens of the genus of *Palmatolepis* have broad platform with ornamentation all over it and with distinct outer lobe. These are, however, features of numerous species representing this genus and belonging to the mentioned interval.

The interval from the *Upper asymmetricus*-Zone to the *Upper gigas*-Zone (do Iβ—do Iδ) was recognised in the exposure BI (sample 4) owing to the presence of *Palmatolepis hassi* vel *P. unicornis* (tab. 6).

The *Lower gigas*-Zone (do Iγ) was recognised at the locality BI (sample 1) on the basis of joint occurrence of the species of *Ancyrodella gigas* Youngquist and *Palmatolepis gigas* Miller & Youngquist (tab. 6).

The part of shales cropping out in the locality NWII (sample 6) belongs probably to the *Middle crepida*-Zone. The author recognised positively *Palmatolepis* cf. *termini* Sannemann and transitional form of *Palmatolepis triangularis* evolving into *Palmatolepis quadrantinodosalobata* (tab. 10). The stratigraphic ranges of these forms were assumed following Ziegler (1973, p. 296, 308).

The uppermost beds of the locality NWIII (sample 3) and probably the part of shales occurring in the locality NWII (sample 6) represent the interval from the *Upper crepida*-Zone to the *Lower rhomboidea*-Zone (do IIα—do IIβ). In case of locality NWIII, this interval was determined by the coexistence of *Palmatolepis glabra prima* Ziegler & Huddle and *Palmatolepis* cf. *regularis* Cooper (tab. 11), in the latter case it was distinguished owing to the presence of *Palmatolepis glabra prima* Ziegler & Huddle and *Palmatolepis* cf. *quadrantinodosalobata* (tab. 10). The stratigraphic ranges of the mentioned species were assumed according to Ziegler (1971, Chart 6; 1973, p. 296) and Sandberg, Ziegler (1973, p. 106).

The interval from the *Upper crepida*-Zone to the *Upper marginifera*-Zone (do IIα—do IIIα) was distinguished on the basis of stratigraphic range of the species of *Palmatolepis glabra prima* Ziegler & Huddle which had been recognised in samples 1 and 2 of the locality NWIII (tab. 11).

The interval from the *Upper crepida*-Zone to the *Middle velifer*-Zone (do IIα—do IIIβ) embraces the Brzeźnica beds outcropping in the locality BII (sample 18). This interval is equal to the stratigraphic range of the species of *Palmatolepis glabra pectinata* Ziegler (Dressen, Dusar 1974, fig. 24) recognised in sample 18 (tab. 13). Also the very interval embraces probably the Mikołajów shales exposed at the top of the quarry, locality MIL The samples coming from overthere (samples 4 and 5) contained only fragments of specimens of a genus of *Palmatolepis* (tab. 4). These fragments have had still recognizable narrow smooth platform with parapet at the inner anterior part but (without the outer lobe). These are features of *Palmatolepis glabra* Ulrich & Bassler and of *Palmatolepis distorta distorta* Branson & Mehl. Having taken into account the ranges of those taxa, the present author distinguished the questioned interval.

The *Lower rhomboidea*-Zone (do IIβ) embraces the Mikołajów shales of the locality MI (sample 7). This zone has been defined on the basis of stratigraphic ranges of the coexisting taxa of *Palmatolepis rhomboides* Sannemann, *Palmatolepis* cf. *regularis* Cooper, and *Palmatolepis* cf. *quadrantinodosalobata* (tab. 3).

The interval from the *Lower rhomboidea*-Zone to the *Lower marginifera*-Zone (do IIβ) was recognised in the localities BIII (samples 2 and 3) and NWI (sample 5). The species of *Palmatolepis gracilis gracilis* Branson & Mehl and *Palmatolepis superlobata* Branson & Mehl (tabs. 3, 7, 9) were recognised in the sample 2 of the locality BIII, the sample 12 of the locality MI, and the sample 5 of the locality NWI. According to the earlier works, the uppermost range of the latter taxon was marked by the *Upper crepida*-Zone (Ziegler 1962, p. 79; 1971, Chart 6). Later it also was recognised in the *Lower marginifera*-Zone (Sandberg, Ziegler 1973, tab. 1; Dressen, Dusar 1974, tab. 3). The presence of specimens of *Palmatolepis rhomboidea* Sannemann (tabs. 3, 7) allows to recognise the above mentioned interval in the sample 3 of the locality BIII and in the samples 1 and 3, the locality MI.

The interval from the (Lower?) *Upper rhomboidea*-Zone to the *Upper marginifera*-Zone (do IIβ—do IIIα) includes the uppermost shales of the locality MIII (sample 13). It was distinguished owing to the presence of *Palmatolepis inflexa* sensu Sandberg & Ziegler (tab. 5). According to these authors (Sandberg, Ziegler 1973, p. 105), this taxon occurs undoubtedly in the upper portion of the *Upper rhomboidea*-Zone and probably does in the *Lower rhomboidea*-Zone. According to Dressen, Dusar (1974, p. 22—23; fig. 14; pl. 5, 15—20), the specimens identified by them as *Palmatolepis* cf. *inflexa* Müller are identical with those illustrated by Sandberg, Ziegler (1973, pl. 4, 7—13) as *Palmatolepis quadrantinodosa inflexa* Müller which occurs in Belgium, from the base of the *Lower marginifera*-Zone to the lower portion of the *Upper marginifera*-Zone. Taking into account the stratigraphic ranges of this taxon, given by the mentioned authors, one can assume that the discussed species occurs undoubtedly from the upper portion of *Upper rhomboidea*-Zone to the lower portion of the *Upper marginifera*-Zone and perhaps even in the *Lower marginifera*-Zone.

The undivided *marginifera*-Zone (do IIβ—do IIIα) was distinguished at four localities, namely: MIII (sample 11), BoI (sample 5), NWI (sample 3), and NWIV (sample 1). In the localities MIII and BoI, this zone was recognised on the basis of joint occurrence of *Palmatolepis marginifera duplicata* Sandberg & Ziegler (its range assumed after Sandberg, Ziegler 1973, p. 105) and *Palmatolepis glabra prima* Ziegler & Huddle (tabs. 5, 8). In the locality NWI, it was defined by the ranges of the species of *Palmatolepis inflexa* sensu Sandberg & Ziegler and *Polygnathus diversus* Helms (tab. 9), and in the locality NWIV — by that of *Palmatolepis inflexoidea* Ziegler (tab. 12). The stratigraphic range of the latter species was assumed after Dressen, Dusar (1974, p. 25).

The interval from the *Lower marginifera*-Zone to the *Lower velifer*-Zone (do IIβ—do IIIα) may be referred to the upper portion of Mikołajów shales outcropping at southern face of the locality NWIV (sample 3). This interval was distinguished on the basis of stratigraphic ranges of the following positively recognised species: *Palmatolepis marginifera marginifera* Helms, *Polygnathus diversus* Helms, *Polygnathus glaber bilobatus* Ziegler, and *Spathognathodus werneri* Ziegler (tab. 12). The stratigraphic range of first of the above mentioned species was assumed after Dressen, Dusar (1974, p. 28).

The interval from the *Lower marginifera*-Zone to the *Upper velifer*-Zone (do IIβ—do IV) was distinguished owing to the presence of *Spathognathodus werneri* Ziegler, *Palmatolepis glabra lepta* Ziegler & Huddle, and *Palmatolepis minuta minuta* Branson & Mehl (tab. 8), sample 1 of the locality BoI.

The interval from the *Lower marginifera*-Zone to the *Upper styriacus*-Zone (do IIβ—do V) was recognised in the locality BII (samples 5 and 9) on the basis of occurrence of the species of *Spathognathodus werneri* Ziegler (tab. 13).

The interval from the *Upper velifer*-Zone to the *Upper styriacus*-Zone (do IIIβ—do V) embraces probably the shales cropping out in southern part of the locality NWIV (sample 6). The recovered specimen is very similar to the taxon of *Pseudopolygnathus micropunctatus* Bishoff & Ziegler (tab. 12). The present author assumed its stratigraphic range after Ziegler (1962, p. 101).

The undivided *styriacus*-Zone (do IV—do V) was recognised in the localities BII, NWIV, and BoII. In the locality BII (tab. 13), it was distinguished owing to the presence of *Polygnathus* cf. *styriacus* Ziegler (samples 13 and 17) and *Palmatolepis rugosa postera* Ziegler (sample 15). In the localities MIV (sample 6) and BoII (sample 4), this zone was determined by the occurrence of *Polygnathus obliquicostatus* Ziegler and *Spathognathodus werneri* Ziegler (tabs. 14, 15).

DICUSSION OF THE RESULTS AND CONCLUSIONS

The Zdanów series has been distinguished so far from others Bardo unit deposits and divided into subsidiary members merely in terms of lithology. Such a criterion, though not completely useless, offers, however, fairly uncertain stratigraphic conclusions especially in the strongly tectonised areas. Therefore, in such areas, any faunal discoveries usually give rise to thorough revision of hitherto assumed lithostratigraphic divisions. For example in this very way brought about the recent findings of organic fragments in various metamorphic rocks throughout the Sudetes (Gunia, Wojciechowska 1964, 1971; Urbanek 1975, 1978; Urbanek, Baranowski, Haydukiewicz 1975; Chorowska 1975; Chorowska, Sawicki 1975, Gunia 1976). The same is true about the present author's discoveries of the conodont fauna in the rocks of Zdanów series. The based upon conodonts biostratigraphic division of the Zdanów series has greatly changed the prior opinions about the age of this series and interrelationships of its subsidiary members. On the other hand, the biostratigraphic investigations proved the former recogni-

tion of these horizons referred to as the Wilcza beds, the Mikołajów shales, and the Brzeźnica beds.

The Wilcza beds are developed as clayey and clayey-silty rocks interlayered with graywackes. These intercalations are not uniformly distributed but they group only in a certain part of the Wilcza beds. This can be well seen in the section exposed at the village of Wilcza (locality WI) as well as in some other exposures not featured in this paper. The conodont fauna has been found so far in 4 outcrops of the Wilcza beds (those devoid of graywacke intercalations). It allowed to recognise the *kockelianus*-Zone (uppermost Eifelian; tab. 16). Judging from the geological situation observed in the locality WI, one can assume that the part of Wilcza beds containing graywacke intercalations is likely younger than the *kockelianus*-Zone.

The Mikołajów shales are most widespread member of all subsidiary members of the Zdanów series outcropping over northwestern part of the Bardo unit. They may megascopically be divided into two lithological varieties. The first of them is represented by gray-greenish clayey rocks occasionally thinly interbedded with siltstones (localities: MI, MII, BI, NWII, NWIII). The other variety appears as clayey-siliceous rocks and claystones containing variable amount of silica (localities: MIII, BIII, BoI, NWI, NWIV). The rocks of the former variety contain fauna of the following conodont zones: *Lower gigas*-Zone (Upper Frasnian), *Lower rhomboidea*-Zone, and probably *Middle crepida*-Zone (Famennian). The undivided *marginifera*-Zone (Famennian) was positively recognised in all the studied outcrops of the clayey-siliceous shales; only in one case the interval younger than this zone was distinguished (tab. 16).

The Brzeźnica beds outcrop mostly in southeastern part of the study area. These are siliceous and clayey-siliceous rocks. At all the localities the undivided *styriacus*-Zone was recognised (Upper Famennian); only in one case also the interval embracing the underlying zones was found.

Lithologic features of the Zdanów series indicate that it was deposited in pelagic environment. This is confirmed by the significant dominance of clayey, clayey-siliceous, and siliceous rocks over detritic deposits which are more abundnat only in the Wilcza beds. Radiolarians are persistently widespread except the sandy (graywacke) members (representatives of the ordus of *Spumellaria*). Omitted from this paper the Zdanów shales are also developed as clayey or clayey-siliceous rocks. These shales grade continuously into Silurian graptolite shales. Thus it seems quite certain that a quiet pelagic sedimentation, in the Zdanów series basin, lasted at least from the Silurian up to the end of the Upper Devonian. The graywacke intercalations cannot be considered as shallow-marine deposits but only as evidence for occasional afflux of terrygenic material transported perhaps by turbidity currents. However, even in this case (the Zdanów series has not been sedimentologically investigated so far) one cannot assume a flysch origin of the Zdanów series as envisaged by Oberc (1966, 1977). It should be stressed that the questioned series lacks many of flysch characteristics listed by Dżułyński, Walton (1965).

The above presented arguments speaking for the continuous sedimentation of the Zdanów series (even in view of incomplete paleontologic data) are obviously valid for its subordinate members. The minimum stratigraphic ranges of these horizons may be determined on the basis of obtained biostratigraphic data and assumption about unbroken deposition of theirs (tab. 16). The Wilcza beds may at least be referred to the *kockelianus*-Zone. The Mikołajów shales embraces the interval from the *Lower gigas*-Zone to the *Upper velifer*-Zone; their clayey-silty variety corresponds to the *Lower rhomboidea*-Zone and the clayey-siliceous varieties represent the *marginifera*-Zone and the *velifer*-Zone. The Brzeźnica beds embrace at least the interval from the *Middle velifer*-Zone to the *Lower styriacus*-Zone, most of them however belonging to the undivided *styriacus*-Zone.

While dividing the Zdanów series Oberc (1957) treated some its members as lithofacial time equivalents. The lower portion of the Mikołajów shales was to correspond to the Zdanów shales, whereas the upper portion would be compatible with the Wilcza beds and Brzeźnica beds. Oberc drew his conclusion misinterpreting apparent transitions between these members visible in the outcrops. The present author's biostratigraphic division of the Zdanów series does not reject the possibility that some members are in part or entirely of the same age. On the other hand, however, both simpler and more probable seems to be the conclusion about normal stratigraphic succession within the questioned series. The lowest member is represented by the Zdanów shales undoubtedly assignable to the Lower Devonian (Kuralowicz 1976). They are overlain by the Wilcza beds in which only the uppermost Eifelian has been proved. According to the above made assumption, the Wilcza beds also may comprise the lower or even whole Givetian sequence. The Mikołajów shales are yet younger member representing Upper Frasnian and large part of the Famennian (do I–do IV). The Brzeźnica beds appear as the youngest member of the Zdanów series. The *Middle* and *Upper velifer*-Zones must be embraced by both the Mikołajów

shales and the Brzeźnica beds. Thus, the stratigraphic passage between both the members seems greatly probable. The Brzeźnica beds belong mostly to the *styriacus*-Zone (do IV—do V).

The above presented stratigraphic sequence of individual members of the Zdanów series is reflected in successive changes of lithology from the Wilcza beds with graywacke intercalations to the siliceous Brzeźnica beds. This succession evidences the steadily reducing influence of the land upon sedimentation of this series.

The present author's biostratigraphic investigations resulted in the solution of a couple of problems concerning mostly the stratigraphic position of the Zdanów series and the age of tectogenic evolution of the Bardo unit (Haydukiewicz 1974). But stratigraphy of this series has not been established in all details yet. The transition from the Mikołajów shales to Silurian graptolite shales still remains unclear as well as the passage of the former into the Zdanów shales described hitherto by Oberc (1957). In view of the above presented probable succession of the Zdanów series members, the possibility of existence of such gradations cannot be excluded. This problem will surely be solved by future biostratigraphic investigations.

Translated by Andrzej Żelaźniewicz

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STRATYGRAFIA SERII ZDANOWSKIEJ W PÓŁNOCNEJ CZĘŚCI STRUKTURY BARDZKIEJ NA PODSTAWIE KONODONTÓW

Streszczenie

WSTĘP

Brak wystarczająco dokładnej stratygrafii serii skalnych występujących w strukturze bardzkiej był jedną z głównych przeszkód w prawidłowej interpretacji rozwoju geologicznego tego regionu. Szczególnie dotyczy to serii zdanowskiej, a spośród zawartych w niej podrzędnych jednostek litostratygraficznych: łupków mikołajowskich, warstw wojciechowskich, warstw z Wilczy i warstw brzeźnickich. Stratygrafia tej serii była przedmiotem badań autorki od roku 1969. Wstępne badania wykazały, że w skałach tych występują radiolarie, nieliczne otwornice i konodonty (Skandy 1972). Ze względu na znaczenie stratygraficzne tych ostatnich dalsze prace zostały ograniczone do poszukiwań i badań tej gurpy mikrofaunistycznej. Poszukiwania były prowadzone w północno-zachodniej części struktury bardzkiej (na północ od Nysy Kłodzkiej) w licznych odsłonięciach łupków mikołajowskich, warstw z Wilczy i warstw brzeźnickich. Pominięte zostały warstwy wojciechowskie, które występują poza obszarem objętym badaniami oraz łupki zdanowskie, których część ma stratygrafię ustaloną na podstawie graptolitów (Kurałowicz 1976).

Badaniami objęto 28 odkrywek, z czego w 18 stwierdzono obecność konodontów. Wyniki badań konodontów uzyskanych z jednego z tych stanowisk zostały opublikowane uprzednio (Haydukiewicz 1974). W niniejszej pracy wykorzystany został materiał z 17 odkrywek. Na jego podstawie została częściowo ustalona biostratygrafia serii zdanowskiej. Ustalenia te mają zasadnicze znaczenie dla rewizji dotychczasowych poglądów na rozwój budowy geologicznej tej części Sudetów.

SYTUACJA GEOLOGICZNA SERII ZDANOWSKIEJ I PROBLEM JEJ WIEKU

Seria zdanowska jest jedną z głównych jednostek litostratygraficznych struktury bardzkiej. W literaturze polskiej była ona także nazywana warstwami ze Zdanowa (Oberc 1953, 1957, 1966; Malinowska 1955) lub warstwami zdanowskimi (Teller 1959, 1960; Kuchciński 1964), a w literaturze niemieckiej „Herzogswalder Schichten" (Dathe 1904; Bederke 1924; Dahlgrün, Finckh; 1924; Finckh 1932; Jaeger 1963, 1964).

Seria zdanowska o miąższości ok. 200 m składa się z różnorakich odmian skał ilastych, krzemionkowych i mułowcowych przeławicających się wzajemnie. W poszczególnych wystąpieniach wykazuje ona pewną odrębność litologiczną, co stworzyło możliwości rozdzielenia jej na kilka podrzędnych jednostek (Oberc 1953, 1957); są to łupki zdanowskie, łupki mikolajowskie, warstwy wojciechowickie, warstwy z Wilczy i warstwy brzeźnickie.

Seria zdanowska tworzy liczne wystąpienia w strukturze bardzkiej, kontaktując przeważnie z osadami dolnego karbonu (fig. 1). Według Oberca (1957, 1972) znaczna część tych kontaktów ma charakter tektonicznych nasunięć, inne stanowi powierzchnia dyskordancji zniszczona w czasie późniejszych procesów fałdowych. W kilku przypadkach seria zdanowska graniczy z łupkami graptolitowymi syluru. Na obszarze zbadanym przez autorkę zostało zaobserwowane przejście między tymi utworami (w okolicy wsi Zdanów i na wzgórzu Łupianka). W obu tych miejscach seria zdanowska jest reprezentowana przez łupki zdanowskie. W okolicy wsi Gołogłowy seria zdanowska (łupki mikołajowskie) kontaktuje z wapieniem górnego dewonu. Zdaniem Oberca (1957) jest to jedyny bezpośredni kontakt tego rodzaju. Seria ta ma być tu nasunięta na wapienie. Autorka wątpi jednak w przynależność tych łupków do serii zdanowskiej (Haydukiewicz 1977).

Do czasu rozpoczęcia badań przez autorkę uzyskano ze skał serii zdanowskiej następujące szczątki: małżoraczki z łupków zdanowskich w okolicy Wilczy (Fischer 1942), dolnodewońskie graptolity z łupków zdanowskich we wsi Zdanów (Teller 1960; Jaeger 1963, 1964) i środkowodewońskie psylofity z warstw z Wilczy we wsi Wilcza (Kuchciński 1964). Odkrycie wymienionych skamieniałości wpłynęło na zmianę wcześ-

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niejszych poglądów (Dathe 1904; Bederke 1924; Dahlgrun, Finckh 1924; Finckh 1932; Oberc 1953; Teller 1959, 1960) na wiek serii zdanowskiej. Do czasu odkrycia górnodewońskich konodontów w łupkach mikołajowskich (Haydukiewicz 1974) wiek tej serii określany był w sposób dwojaki. Oberc (1966, 1972, 1973) uważa ją za osad dolnego (łupki zdanowskie, łupki mikołajowskie i warstwy wojciechowickie) i środkowego (warstwy z Wilczy i warstwy brzeźnickie) dewonu. Nieco innego zdania jest Jaeger (1964), który przypuszcza, że seria zdanowska obejmuje również górny dewon. Z tymi poglądami wiąże się odmienny sposób przedstawienia tektogenezy struktury bardzkiej. Oberc (1972) w jej obrębie wyróżnia dwa piętra strukturalne: starowaryscyjskie, złożone z osadów sylurskich tudzież dolno- i środkowodewońskich sfałdowanych podczas ruchów wczesnobretońskich oraz środkowowaryscyjskie, reprezentowane przez utwory dolnego karbonu sfałdowane wspólnie z poprzednimi w fazie sudeckiej. Piętra te rozdziela luka stratygraficzna przypadająca na późny dewon. Całość została jeszcze raz zdeformowana w fazie asturyjskiej. Jaeger (1964) twierdzi, że skały struktury bardzkiej uległy fałdowaniu w czasie ruchów młodobretońskich lub nawet w fazie sudeckiej.

Do odmiennego ujęcia tektogenezy struktury bardzkiej prowadzą badania sedymentologiczne wykonywane przez Wajsprycha (informacja ustna). Jest on skłonny całość struktury bardzkiej traktować jako melanż wieku wizeńskiego.

KONODONTY

Konodonty zostały wypreparowane ze skał krzemionkowych, krzemionkowo-ilastych, ilastych oraz mułowcowo-ilastych. Skały te były trawione w kwasie fluorowodorowym. Po wykonaniu szeregu analiz udało się uchwycić pewne zależności pomiędzy rodzajem skały a optymalnym czasem jej trawienia w kwasie i optymalnym stężeniem kwasu (tab. 1).

Ogółem wyizolowano ok. 1500 egzemplarzy, z czego 723 zidentyfikowano do szczebla gatunkowego i podgatunkowego, 283 — do szczebla rodzajowego. Pozostałych okazów ze względu na zły stan zachowania nie udało się oznaczyć. W zebranym materiale wyróżniono 40 formalnych gatunków wraz z podgatunkami, należących do 7 rodzajów (pominięto nieliczne formy gałązkowe i stożkowe). Opisano wyłącznie formy podane w nomenklaturze otwartej (wyjątek stanowi *Polygnathus* n. sp. Ziegler & Leuteritz) i tylko te z nich, na podstawie których zostały wyciągnięte wnioski stratygraficzne.

CHARAKTERYSTYKA STANOWISK FAUNY

W niniejszej pracy zostały przedstawione opisy odkrywek, w których stwierdzono faunę konodontową wykorzystaną w ustaleniu biostratygrafii serii zdanowskiej. Kolejno zostały opisane odkrywki warstw z Wilczy, łupków mikołajowskich i warstw brzeźnickich. W opisie każdej z nich autorka podała ogólny charakter litologiczny i sposób zalegania warstw, uzupełniając go listą stwierdzonych w niej konodontów oraz wskazaniem poziomu konodontowego lub składającego się z kilku poziomów interwału, w którym mieszczą się występujące w niej skały.

BIOSTRATYGRAFIA

Podstawą dokonania biostrytygrafii serii zdanowskiej była sukcesja poziomów konodontowych ustalona przez Wittekindta (1965) i częściowo zmodyfikowana przez Zieglera (1965, 1971) — dla środkowego dewonu, przez Zieglera (1962, 1969, 1971) oraz Sandberga i Zieglera (1973) — dla górnego dewonu.

Fauna konodontowa uzyskana z nielicznych prób umożliwiła wyróżnienie konkretnych poziomów: kockelianus, dolny gigas, środkowy crepida (prawdopodobnie), dolny rhomboidea, marginifera i styriacus. Pozostałe próby dostarczyły materiału pozwalającego jedynie na wydzielenie szerszych lub węższych interwałów środkowo- i górnodewońskich.

PODSUMOWANIE WYNIKÓW I WNIOSKI

Biostratygrafia dokonana na podstawie fauny konodontowej zmienia zasadniczo dotychczasowe poglądy na wiek serii zdanowskiej jako całości, jak też na wzajemną pozycję jej poszczególnych ogniw w schemacie stratygraficznym.

Warstwy z Wilczy są wykształcone jako skały ilaste i ilasto-mułowcowe z wkładkami szarogłazów. Wkładki te nie są rozmieszczone równomiernie, lecz grupują się w pewnej części warstw z Wilczy (stanowisko WI, a także w kilku innych nie opisanych w niniejszej pracy odkrywkach). Konodonty uzyskane z tych warstw (wyłącznie z pozbawionej wkładek szarogłazowych części warstw z Wilczy) pozwoliły na wyróżnienie tylko poziomu kockelianus (najwyższy eifel; tab. 16). Z sytuacji panującej w stanowisku WI można sądzić, że część warstw z Wilczy, zawierająca wkładki szarogłazów, reprezentuje prawdopodobnie poziomy młodsze od kockelianus.

Łupki mikołajowskie megaskopowo można podzielić na dwie odmiany litologiczne. Jedną z nich są szarozielone skały ilaste zawierające cienkie wkładki mułowców (stanowiska MI, MII, BI, NWII, NWIII). Drugą stanowią skały ilasto-krzemionkowe oraz iłowce zawierające zmienną ilość krzemionki (stanowiska MIII, BIII, BoI, NWI, NWIV). W obrębie skał pierwszej odmiany litologicznej stwierdzono obecność następujących poziomów konodontowych: dolny gigas (wyższy fran), dolny rhomboidea oraz prawdopodobnie środkowy crepida (famen). We wszystkich zbadanych wystąpieniach łupków ilasto-krzemionkowych wyróżniono nierozdzielony poziom marginifera (famen), a w jednym przypadku interwał obejmujący poziomy młodsze od niego (tab. 16).

Warstwy brzeźnickie reprezentowane są przez skały krzemionkowe, podrzędnie — ilasto-krzemionkowe. We wszystkich stanowiskach stwierdzony w nich został nierozdzielony poziom styriacus (wyższy famen), a w jednym interwał obejmujący poziomy niższe.

Z przedstawionej ogólnej charakterystyki litologii poszczególnych ogniw serii zdanowskiej można sądzić, że ich sedymentacja odbywała się w środowisku pelagicznym. Przemawia za

tym znaczna przewaga skał ilastych, ilasto-krzemionkowych i krzemionkowych nad utworami detrytycznymi. We wszystkich odmianach, z wyjątkiem warstw piaszczystych, występują radiolarie. Nie opisane w niniejszej pracy łupki zdanowskie również są wykształcone jako skały ilaste i ilasto-krzemionkowe. Pomiędzy łupkami zdanowskimi a sylurskimi łupkami graptolitowymi istnieje ciągłe przejście. Można więc niemal z całą pewnością stwierdzić, że sedymentacja typu pelagenicznego w zbiorniku, w którym osadzała się seria zdanowska, trwała nieprzerwanie co najmniej od syluru do późnego dewonu włącznie.

Przyjęcie ciągłości sedymentacji serii zdanowskiej wymaga automatycznie przyjęcia ciągłości sedymentacji w obrębie jej poszczególnych ogniw. Uwzględniwszy ten warunek i wykorzystując dane biostratygraficzne, można określić ich minimalne zasięgi w schemacie stratygraficznym (tab. 16). Warstwy z Wilczy odpowiadają co najmniej poziomowi kockelianus. Łupki mikołajowskie obejmują z pewnością interwał od dolnego poziomu gigas do górnego poziomu velifer, w tym ich odmiana ilasto-mułowcowa, poziomy do dolnego rhomboidea, odmiana ilasto-krzemionkowa, poziomy marginifera i velifer. Nie zostało rozstrzygnięte, w której z wymienionych odmian mieści się górny poziom rhomboidea. Warstwy brzeźnickie obejmują co najmniej interwał od środkowego poziomu relifer do dolnego poziomu styriacus, przy czym ich większość należy do nierozdzielonego poziomu styriacus.

Przeprowadzając podział serii zdanowskiej, Oberc (1957) traktował niektóre z jej ogniw jako równowiekowe odmiany litofacjalne. Dolna część łupków mikołajowskich miała odpowiadać łupkom zdanowskim, a ich górna część warstwom z Wilczy i warstwom brzeźnickim. Biostratygrafia tej serii ustalona przez autorkę nie wyklucza możliwości, że pewne jej ogniwa są w części lub nawet w całości równowiekowe. Bardziej prawdopodobny jest jednak wniosek, że cechuje je następstwo stratygraficzne. Najniższym ogniwem są łupki zdanowskie obejmujące dolny dewon (Kurałowicz 1976). Nad nimi zalegają warstwy z Wilczy, w których stwierdzony został najwyższy eifel (prawdopodobnie obejmują również niższy lub cały żywet). Młodszym ogniwem są łupki mikołajowskie zawierające wyższy fran i znaczną część famenu. Najmłodszym ogniwem serii zdanowskiej, w zbadanej przez autorkę północno-zachodniej części struktury bardzkiej, są warstwy brzeźnickie obejmujące wyższy famen.

PLANSZE I OBJAŚNIENIA

PLATE I
PLANSZA I

1–4. *Palmatolepis subperlobata* Branson & Mehl; upper views of four hypotypes: *1* — (ING/H.20) from locality MI (sample 11); *2* — (ING/H.21) from locality BIII (sample 2); *3* — (ING/H.19) from locality MI (sample 10); *4* — (ING/H.22) from locality NWI (sample 2)

Palmatolepis subperlobata Branson & Mehl; z góry *1* — (ING/H. 20) ze stanowiska MI (próba 11); *2* — (ING/H. 21) ze stanowiska BIII (próba 2); *3* — (ING/H. 19) ze stanowiska MI (próba 10); *4* — (ING/H.22) ze stanowiska NWI (próba 2)

5. *Palmatolepis tenuipunctata* Sannemann; upper view of hypotype (ING/H. 23) from locality NWII (sample 2)

Palmatolepis tenuipunctata Sannemann; z góry; (ING/H. 23) ze stanowiska NWII (próba 2)

6, 8, 9. *Palmatolepis* cf. *quadrantinodosalobata* Sannemann; upper views of three hypotypes; *6* — (ING/H.30) juvenile specimen with longitudinal broken carina from locality MI (sample 8); *8* — (ING/H.31) platform with corroded ornamentation; specimen cut by quartz veinlet from locality MI (sample 10); *9* — (ING/H.29) specimen with broken auter lobe from locality MI (sample 4)

Palmatolepis cf. *quadrantinodosalobata* Sannemann; z góry; *6* — (ING/H.30) młodociany okaz z pękniętym podłużnie grzebieniem. Stanowisko MI (próba 8); *8* — (ING/H.31) okaz z skorodowaną ornamentacją i przecięty żyłką kwarcową. Stanowisko MI (próba 10); *9* — (ING/H.29) okaz z uszkodzonym zewnętrznym płatem. Stanowisko MI (próba 4)

7, 10. *Palmatolepis minuta minuta* Branson & Mehl; upper views of two hypotypes; *7* — (ING/H.24) from locality BIII (sample 3); *10* — (ING/H. 25) specimen with longitudinal broken carina from locality NWII (sample 3)

Palmatolepis minuta minuta Branson & Mehl; z góry; *7* — (ING/H.24) ze stanowiska BIII (próba 3); *10* — (ING/H.25) okaz z pękniętym podłużnie grzebieniem. Stanowisko NW II (próba 3)

11, 14. *Palmatolepis* cf. *regularis* Cooper; upper wiews of the hypotypes; *11* — (ING/H.26) from locality NWIII (sample 3); *14* — (ING/H. 27) specimen with corroded platform and broken carina from locality NWII (próba 2)

Palmatolepis cf. *regularis* Cooper; z góry; *11* — (ING/H. 26) ze stanowiska NWIII (próba 3); *14* — (ING/H.27) okaz ze skorodowaną platformą i zniszczonym grzebieniem. Stanowisko NWII (próba 2)

12. *Palmatolepis hassi* vel P. *unicornis;* upper view of specimen (ING/H.16) with broken platform and free blade from locality BI (sample 4)

Palmatolepis hassi vel P. *unicornis;* z góry; (ING/H.16) okaz z połamaną platformą i uszkodzonym wolnym ostrzem. Stanowisko BI (próba 4)

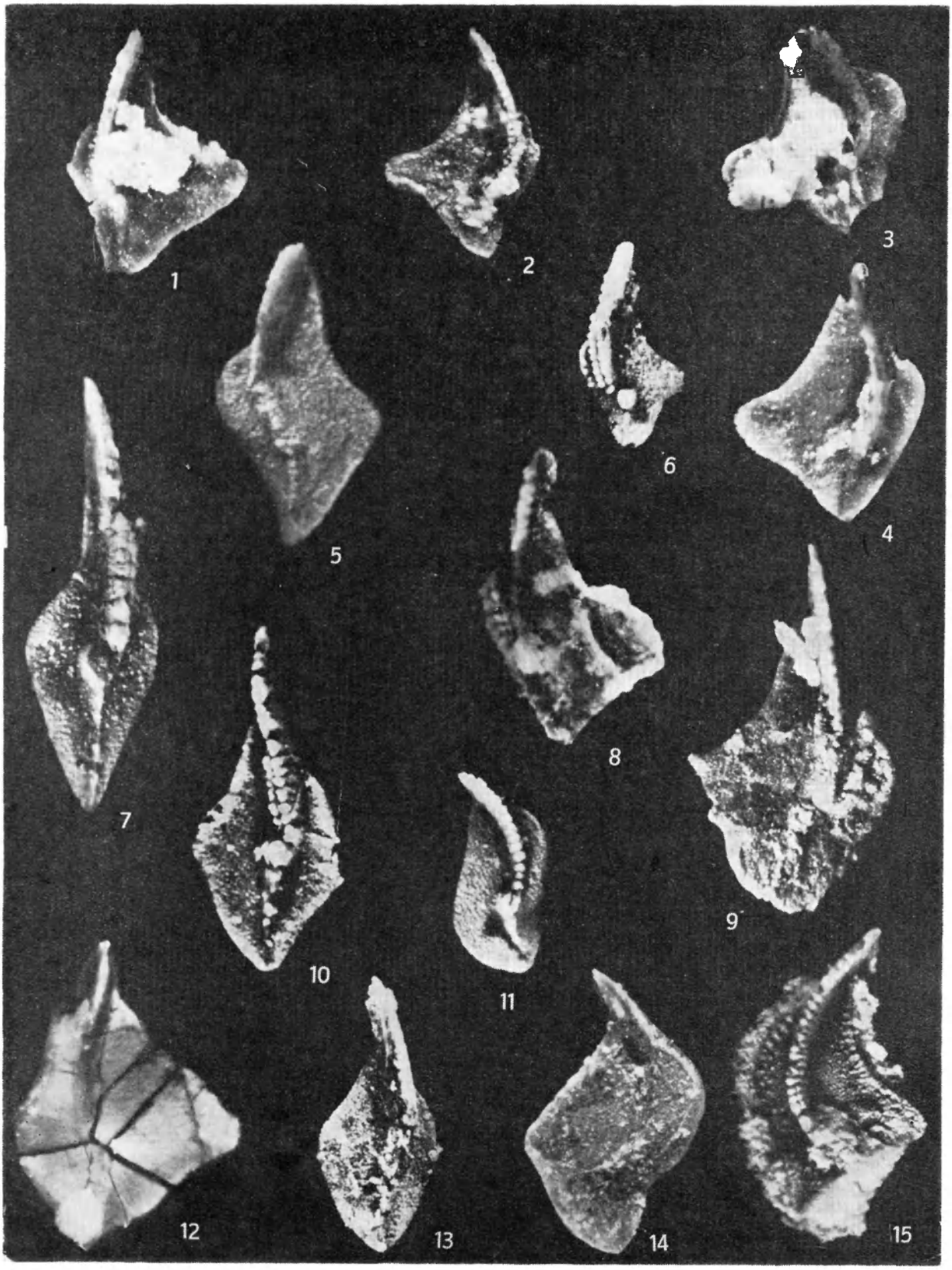
13. *Palmatolepis* cf. *termini* Sannemann; upper view of hypotype (ING/H.18) from locality NWII (sample 2); specimen with corroded ornamentation

Palmatolepis cf. *termini* Sannemann; z góry; (ING/H.18) ze stanowiska NWII (próba 2); okaz z skorodowaną ornamentacją

15. *Palmatolepis triangularis* → P. quadrantinodosalobata; upper view of specimen (ING/H.17) from locality BI (sample 4)

Palmatolepis triangularis → P. quadrantinodosalobata; z góry; (ING/H. 17) ze stanowiska BI (próba 4)

Photographs *8, 9, 12* are 35× enlarged, others ×70
8, 9, 12 powiększenie 35×, pozostałe pow. 70×



Joanna HAYDUKIEWICZ Stratigraphy of the Zdanów Series in the northern part of the Bardo Unit on the basis of conodonts
Stratygrafia serii zdanowskiej w północnej części struktury bardzkiej na podstawie konodontów

PLATE II
PLANSZA II

1, 2. *Palmatolepis distorta distorta* Branson & Mehl; upper views of the hypotypes; *1* — (ING/ /H.39) from locality NWIV (sample 3); *2* — (ING/H.40) from locality BoI (sample 3)

Palmatolepis distora distora Branson & Mehl; z góry: *1* — (ING/H.39) ze stanowiska NWIV (próba 2); *2* — (ING/H.40) ze stanowiska BoI (próba 3)

3—5. *Palmatolepis glabra prima* Ziegler & Huddle; upper views of three hypotypes; *3* — (ING/ /H.38) from locality MI (sample 1); *4* — (ING/H.37) from locality NWI (sample 3); *5* — (ING/H.36) from locality NWIII (sample 3)

Palmatolepis glabra prima Ziegler & Huddle; z góry; *3* — (ING/H.38) ze stanowiska MI (próba 1); *4* — (ING/H.37) ze stanowiska NWI (próba 3); *5* — (ING/H.36) ze stanowiska NWIII (próba 3)

6, 10. *Palmatolepis glabra lepta* Ziegler & Huddle; upper views of two hypotypes; *6* — (ING/H.45 specimen with longitudinal broken carina from locality BoI (sample 3); *10* — (ING/H.44) specimen with broken outer anterior platform from locality BoI (sample 1)

Palmatolepis glabra lepta Ziegler & Huddle; z góry; *6* — (ING/H.45) okaz z pękniętym podłużnie grzebieniem. Stanowisko BoI (próba 3); *10* — (ING/H.44) okaz z uszkodzoną przednią, zewnętrzną częścią platformy. Stanowisko BoI (próba 1)

7—9. *Palmatolepis glabra pectinata* Ziegler; upper views of three hypotypes; *7* — (ING/H.41) from locality BII (sample 18); *8* — (ING/H.42) from locality MIII (sample 12); specimen broken after identification; *9* — (ING/H.43) specimen with longitudinal broken parapet from locality BoI (sample 3)

Palmatolepis glabra pectinata Ziegler; z góry; *7* — (ING/H.41) ze stanowiska BII (próba 18); *8* — (ING/H.42) okaz uszkodzony po oznaczeniu. Stanowisko MIII (próba 12); *9* — (ING/ /H.43) okaz z pękniętym podłużnie parapetem. Stanowisko BoI (próba 3)

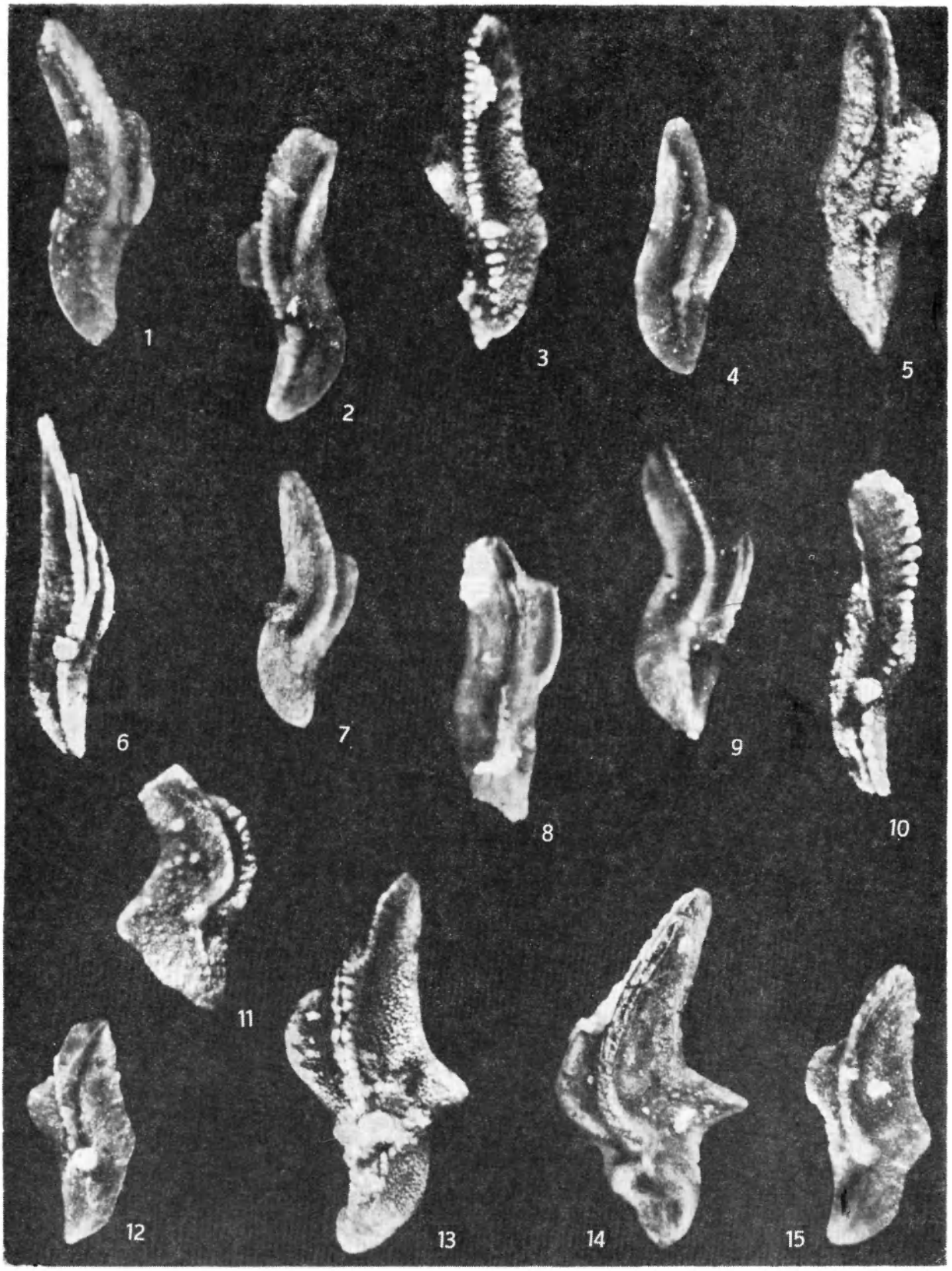
11. *Palmatolepis rugosa postera* Ziegler; upper view of juvenile hypotype (ING/H.67) from locality BII (sample 15)

Palmatolepis rugosa postera Ziegler; z góry; (ING/H.67); młodociany okaz ze stanowiska BII (próba 15)

12—15. *Palmatolepis perlobata schindewolfi* Muller; upper views of four hypotypes; *12* — (ING/ /H.48) juvenile specimen from locality BoI (sample 1); *13* — (ING/H.47) specimen with longitudinal broken carina from locality NWIV (sample 3); *14* — (ING/H.46) mature specimen with corroded carina from locality NWIV (sample 1); *15* — (ING/H.64) juvenile specimen from locality NWIV (sample 3)

Palmatolepis perlobata Schindewolfi Müller; z góry; *12* — (ING/H.48) młodociany okaz ze stanowiska BoI (próba 1); *13* — 1NG/H.47) okaz z podłużnie pękniętym grzebieniem. Stanowisko NWIV (próba 3); *14* — (ING/H.46) dorosły okaz z skorodowanym grzebieniem. Stanowisko NWIV (próba 1); *15* — (ING/H.64) młodociany okaz ze stanowiska NWIV (próba 3)

All photographs are ×70 enlarged, only 5 is ×35
Powiększenie 70 ×, tylko 5 pow. ×35



Joanna HAYDUKIEWICZ – Stratigraphy of the Zdanów Series in the northern part of the Bardo Unit on the basis of conodonts
Stratygrafia serii zdanowskiej w północnej części struktury bardzkiej na podstawie konodontów

PLATE III
PLANSZA III

1, 2. *Palmatolepis rhomboidea* Sannemann; upper views of two hypotypes; *1* — (ING/H.51) from locality MI (sample 3); *2* — (ING/H.50) from locality MI (sample 1)

Palmatolepis rhomboidea Sannemann; z góry; *1* — (ING/H.51) ze stanowiska MI (próba 3); *2* — (ING/H.50) ze stanowiska MI (próba 1)

3, 5, 6. *Palmatolepis inflexa sensu* Sandberg & Ziegler; upper views of three hypotypes; *3* — (ING/H.52) from locality MI (sample 12); *5* — (ING/H.54) from locality BIII (sample 3); *6* — (ING/H.53) small specimen from locality MIII (sample 13)

Palmatolepis inflexa sensu Sandberg & Ziegler; z góry; *3* — (ING/H.52) ze stanowiska MI (próba 12); *5* — (ING/H.54) ze stanowiska BIII (próba 3); *6* — (ING/H.53) mały okaz ze stanowiska MIII (próba 13)

4. *Palmatolepis inflexoidea* Ziegler; upper view of hypotype (ING/H.62) from locality NWIV (sample 1), specimen with broken posterior platform and corroded carina

Palmatolepis inflexoidea Ziegler; z góry; (ING/H.62) ze stanowiska NWIV, okaz z odłamaną tylną częścią platformy i skorodowanym grzebieniem

7. *Palmatolepis marginifera* n. subsp. Sandberg & Ziegler; upper view of hypotype (ING/H.63) from locality NWIV (sample 1)

Palmatolepis marginifera n. subsp. Sandberg & Ziegler; z góry; (ING/H.63) ze stanowiska NWIV (próba 1)

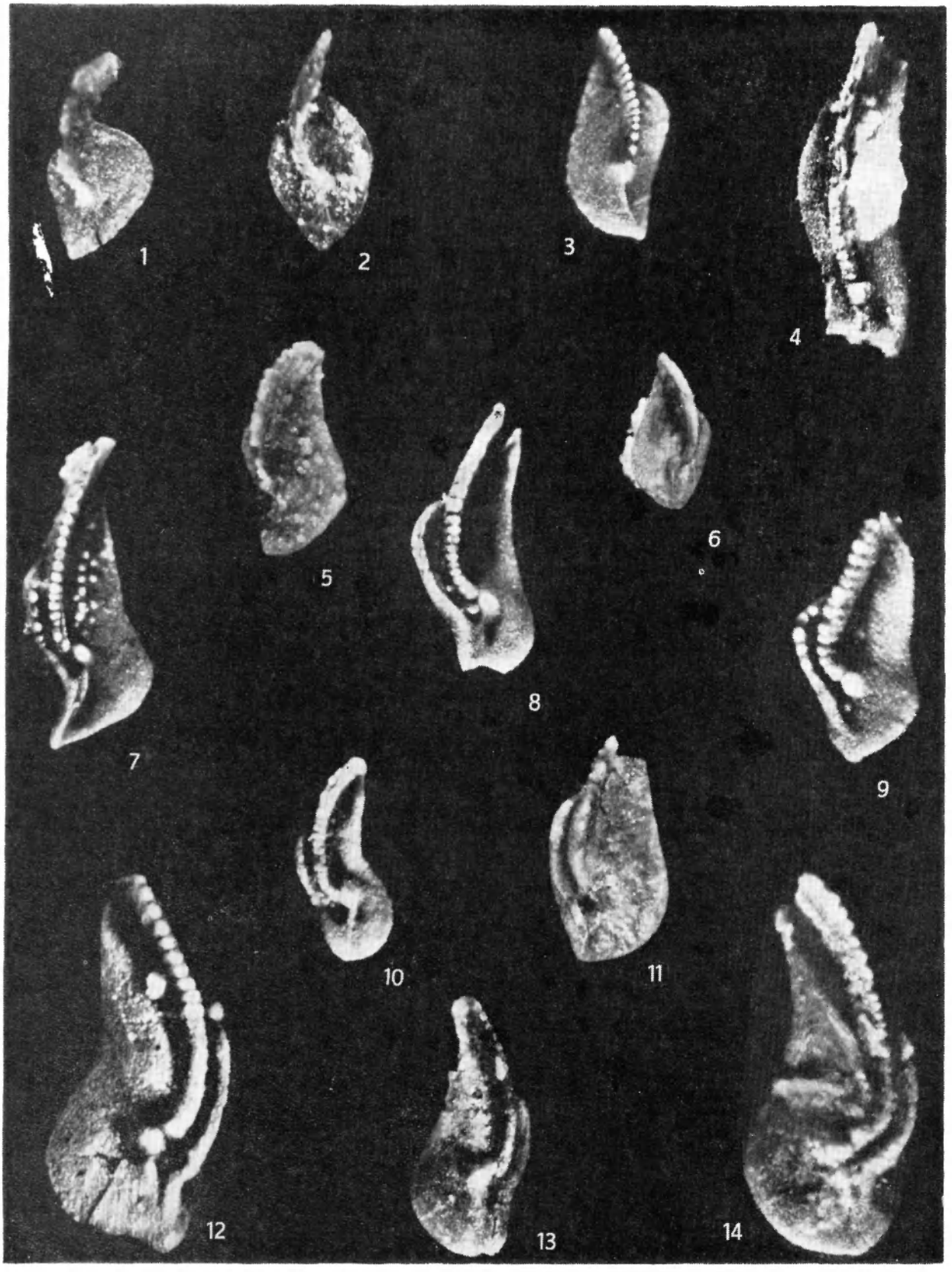
8—11. *Palmatolepis marginifera marginifera* Helms; upper views of four hypotypes; *8* — (ING/H.56) specimen with broken anterior and posterior platform from locality BoI (sample 3); *9* — (ING/H.58) from locality NWIV (sample 3); *10* — ING/H.57) juvenile specimen from locality BoI (sample 5); *11* — (ING/H.55) specimen with corroded platform from locality MIII (sample 12)

Palmatolepis marginifera marginifera Helms; z góry; *8* — (ING/H.56) okaz z pękniętą w przodzie platformą i odlamaną jej tylną częścią. Stanowisko BoI (próba 3); *9* — (ING/H.58) ze stanowiska NWIV (próba 3); *10* — (ING/H.57) młodociany okaz ze stanowiska BoI (próba 5); *11* — (ING/H.55) okaz ze skorodowaną platformą. Stanowisko MIII (próba 12)

12—14. *Palmatolepis marginifera duplicata* Sandberg & Ziegler; upper views of three hypotypes; *12* — (ING/H.61) from locality BoI (sample 5); *13* — (ING/H.60) juvenile specimen from locality BoI (sample 4); *14* — (ING/H.59) from locality MIII (sample 11)

Palmatolepis marginifera duplicata Sandberg & Ziegler; z góry; *12* — (ING/H.61) ze stanowiska BoI (próba 5); *13* — (ING/H.60) młodociany okaz ze stanowiska BoI (próba 4); *14* — (ING/H.59) ze stanowiska MIII (próba 11)

All photographs are ×70 enlarged, only 4 is ×35
Powiększenie 70×, tylko 4 pow. 35×



Joanna HAYDUKIEWICZ Stratigraphy of the Zdanów Series in the northern part of the Bardo Unit on the basis of conodonts
Stratygrafia serii zdanowskiej w północnej części struktury bardzkiej na podstawie konodontów

PLATE IV
PLANSZA IV

1a, b. *Polygnathus kockelianus* Bischoff & Ziegler; upper and lower views of hypotype (ING/H.13) from locality ZIII (sample 4); juvenile specimen with broken free blade

Polygnathus kockelianus Bischoff & Ziegler; z góry i od dołu; (ING/H.13) ze stanowiska ZIII (próba 4), młodociany okaz z odłamanym wolnym ostrzem

2a, b. *Polygnathus eiflius* Bischoff & Ziegler; upper and lower views of hypotype (ING/H.12) from locality ZII (scmple 5); specimen with longitudinal broken carina

Polygnathus eiflius Bischoff & Ziegler; z góry i od dołu; (ING/H.12) ze stanowiska ZII (próba 5); okaz z pękniętym podłużnie grzebieniem

3a, b. *Polygnathus* cf. *robusticostatus* Bischoff & Ziegler; upper and lower views of hypotype (ING/H.11) from locality ZII (sample 5); specimen with broken free blade

Polygnathus cf. *robusticostatus* Bischoff & Ziegler; z góry i od dołu; (ING/H.11) ze stanowiska ZII (próba 5); okaz z odłamanym wolnym ostrzem

4. *Ancyrodella gigas* Youngquist; upper view of hypotype (ING/H.14) from locality BI (sample 1)

Ancyrodella gigas Youngquist; z góry; (ING/H.14) ze stanowiska BI (próba 1)

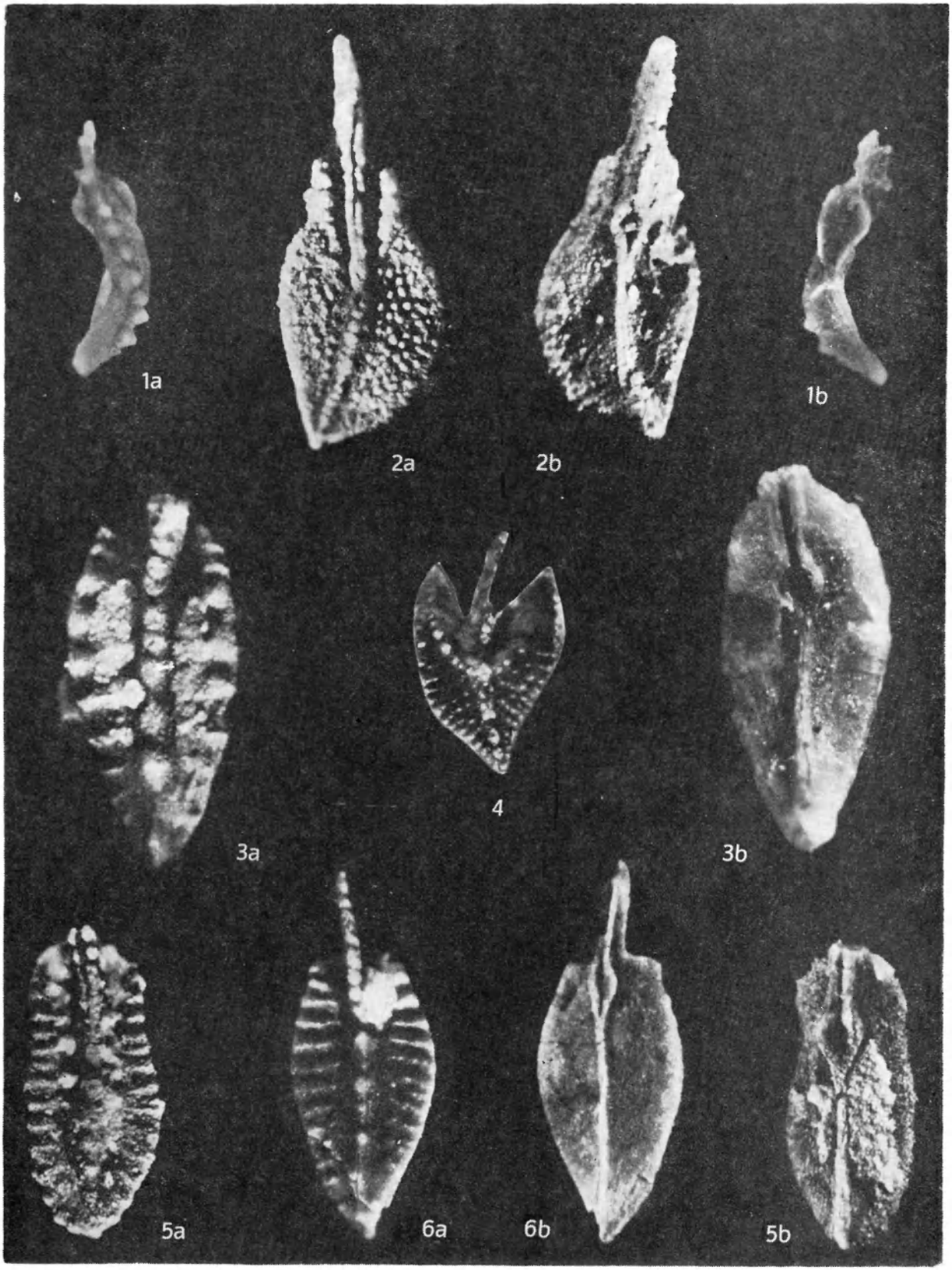
5a, b. *Polygnathus costatus costatus* Klapper; upper and lower views od hypotype (ING/H.9) from locality ZIII (sample 2); specimen with broken free blade

Polygnathus costatus costatus Klapper; z góry i od dołu; (ING/H.9) ze stanowiska ZIII (próba 2); okaz z odłamanym wolnym ostrzem

6a, b. *Polygnathus costatus* cf. *patulus* Klapper; upper and lower views of hypotype (ING/H.10) from locality WI (sample 43)

Polygnathus costatus cf. *patulus* Klapper; z góry i od dołu; (ING/H.10) ze stanowiska W (próba 43)

Photographs 2—4, 6 are ×35 enlarged, others are ×70
2—4, 6 powiększenie 35×, pozostałe pow. 70×



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Stratygrafia serii zdanowskiej w północnej części struktury bardzkiej na podstawie konodontów

PLATE V
PLANSZA V

1, 2a, b. *Polygnathus* n. sp. Ziegler & Leuteritz; upper and lower views of two hypotypes; *1* — (ING/H.75) from locality BoII (sample 4); *2* — (ING/H.76) from locality NWIV (sample 6)

Polygnathus n. sp. Ziegler & Leuteritz; z góry i od dołu; *1* — (ING/H.75) ze stanowiska BoII (próba 4); *2* — (ING/H.76) ze stanowiska NWIV (próba 6)

3. *Polygnathus obliquicostatus* Ziegler; upper view of hypotype (ING/H.72) from locality MIV (sample 6); specimen with broken anterior platform

Polygnathus obliquicostatus Ziegler; z góry; (ING/H.72) ze stanowiska MIV (próba 6); okaz z pękniętą przednią częścią platformy

4. *Polygnathus diversus* Helms; lateral view of hypotype (ING/H.69) from locality NWI (sample 3)

Polygnathus diversus Helms; z boku; (ING/H. 69) ze stanowiska NWI (próba 3)

5, 8a, b. *Pseudopolygnathus* cf. *micropunctatus* Bischoff & Ziegler; upper and lower views of two hypotypes (ING/H.77,65) from locality NWIV (sample 6); specimens with broken free blade and corroded platform

Pseudopolygnathus cf. *micropunctatus* Bischoff & Ziegler; z góry i od dołu ;(ING/H.77,65) ze stanowiska NWIV (próba 6); okazy z odłamanym wolnym ostrzem i skorodowaną platformą.

6, 7a, b. *Polygnathus glaber bilobatus* Ziegler; upper and lower views of two hypotypes; *6* — (ING/H.70) from locality NWIV (sample 3); specimen with broken free blade; *7* — (ING/H.71) juvenile specimen from locality BoI (sample 3)

Polygnathus glaber bilobatus Ziegler; z góry i od dołu; *6* — (ING/H.70) ze stanowiska NWIV (próba 3); *7* — (ING/H.71) młodociany okaz ze stanowiska BoI (próba 3)

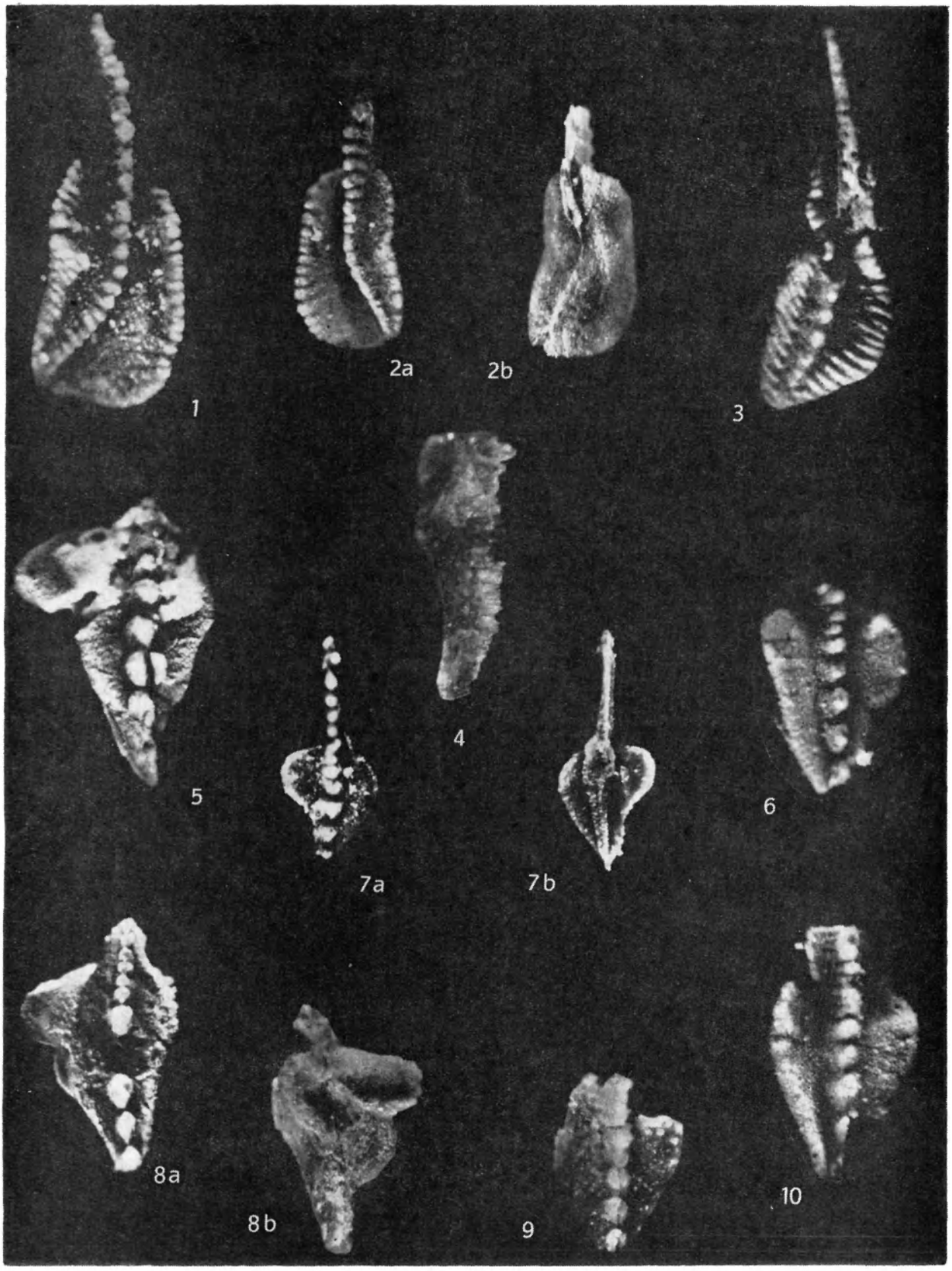
9. *Polygnathus* cf. *styriacus* Ziegler; upper view of hypotype (ING/H.73) from locality BII (sample 13); specimen broken after identification

Polygnathus cf. *styriacus* Ziegler; z góry; (ING/H.73) ze stanowiska BII (próba 13); okaz uszkodzony po oznaczeniu

10. *Polygnathus glaber glaber* Ulrich & Bassler; upper view of hypotype (ING/H.68) from locality NWI (sample 5); specimen with broken free blade and posterior platform

Polygnathus glaber glaber Ulrich & Bassler; z góry; (ING/H.68) ze stanowiska NWI (próba 5); okaz z odłamanym wolnym ostrzem i odłamaną tylną częścią platformy

All photographs are ×70 enlarged, only 3,5 are ×35
Powiększenie 70×, tylko 3,5 pow. 35×



Joanna HAYDUKIEWICZ — Stratigraphy of the Zdanów Series in the northern part of the Bardo Unit on the basis of conodonts
Stratygrafia serii zdanowskiej w północnej części struktury bardzkiej na podstawie konodontów

PLATE VI
PLANSZA VI

1. *Palmatolepis* cf. *regularis* Cooper; upper view of juvenile hypotype (ING/H.28) from locality MI (sample 7)

Palmatolepis cf. *regularis* Cooper; z góry; (ING/H.28) młodociany okaz ze stanowiska MI (próba 7)

2. *Palmatolepis minuta* cf. *loba* Helms; upper view of hypotype (ING/H.32) from locality NWIII (sample 3); specimen with broken free blade

Palmatolepis minuta cf. *loba* Helms; z góry; (ING/H.32) ze stanowiska NWIII (próba 3); okaz z odłamanym wolnym ostrzem

3, 4, 7. *Palmatolepis gracilis gracilis* Branson & Mehl; upper views of three hypotypes; *3* – (ING/H.33) from locality BoI (sample 3); *4* – (ING/H.34) from locality BoII (sample 4); *7* – (ING/H.35) from locality BII (sample 17)

Palmatolepis gracilis gracilis Branson & Mehl; z góry; *3* – (ING/H.33) ze stanowiska BoI (próba 3); *4* – (ING/H.34) ze stanowiska BoII (próba 4); *7* – (ING/H.35) ze stanowiska BII (próba 17)

5. *Bispathodus* sp. *indet*; upper view of specimen (ING/H.80) from locality MIV (sample 2)

Bispathodus sp. *indet*; z góry (ING/H.80) ze stanowiska MIV (próba 3)

6a–c. *Polygnathus communis communis* Branson & Mehl; upper, lower and lateral views of hypotype (ING/H.74) from locality MIV (sample 2)

Polygnathus communis communis Branson & Mehl; z góry, od dołu i z boku; (ING/H.74) ze stanowiska MIV (próba 2)

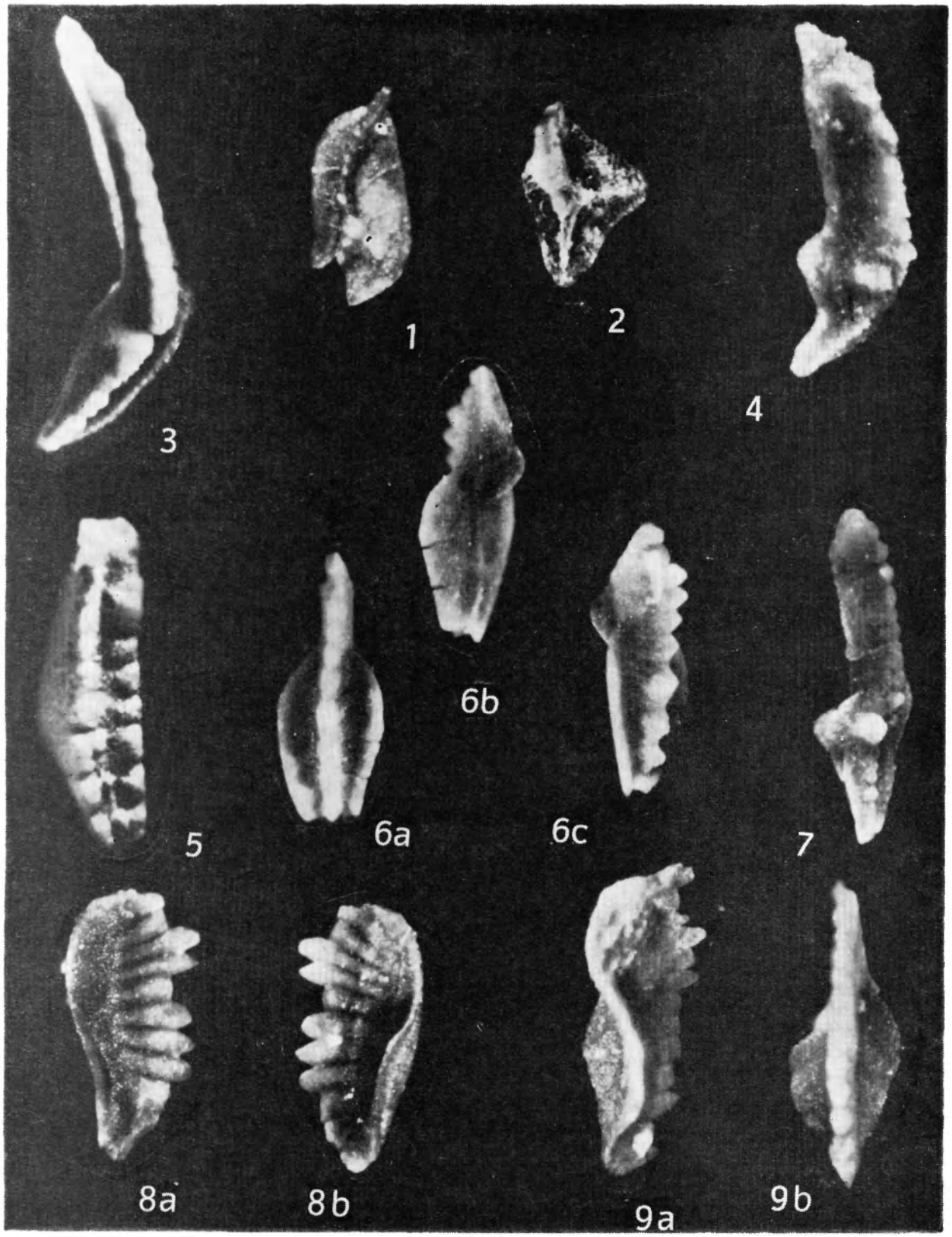
8a, b. *Spathognathodus werneri* Ziegler; left – lateral and right – lateral views of hypotype (ING/H.78) from locality BoI (sample 4)

Spathognathodus werneri Ziegler; z boku, z lewej i prawej strony; (ING/H.78) ze stanowiska BoI (próba 4)

9a, b. *Bispathodus stabilis* Branson & Mehl; left-lateral and upper views of hypotype (ING/H.79) from locality MIV (sample 2)

Bispathodus stabilis Branson & Mehl; z boku z lewej strony i z góry; (ING/H.77) ze stanowiska MIV (próba 2)

All photographs are ×110 enlarged
Powiększenie 110×

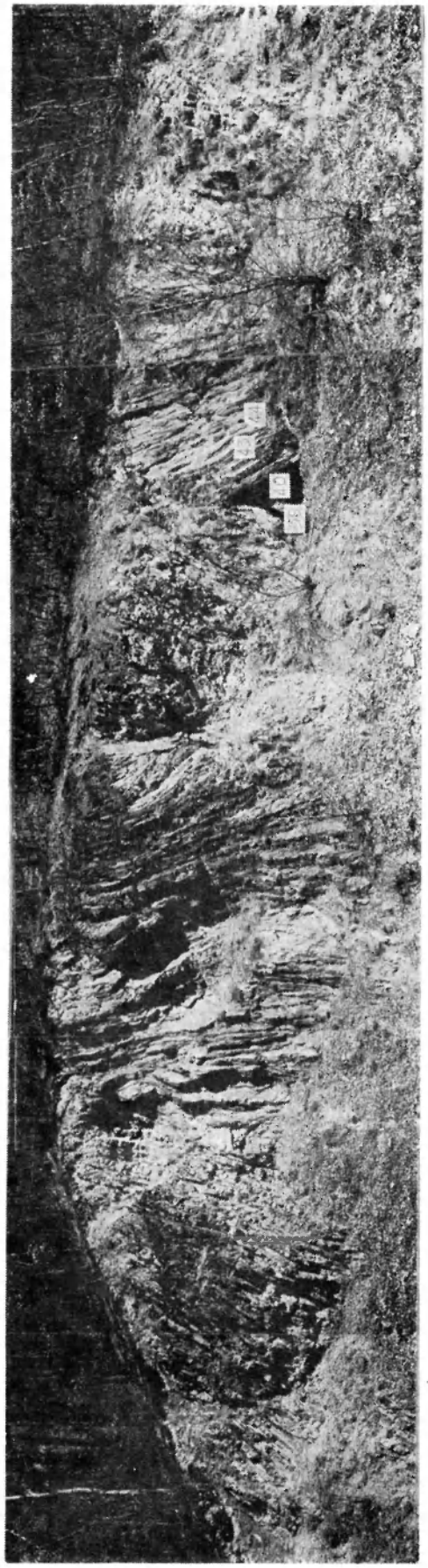


Joanna HAYDUKIEWICZ — Stratigraphy of the Zdanów Series in the northern part of the Bardo Unit on the basis of conodonts
Stratygrafia serii zdanowskiej w północnej części struktury bardzkiej na podstawie konodontów

PLATE VII
PLANSZA VII

The Wilcza beds in locality WI. Numbers denote sites of collecting of samples containing conodonts

Warstwy z Wilczy w stanowisku WI. Cyframi oznaczono miejsca pobrania prób, z których uzyskano konodonty



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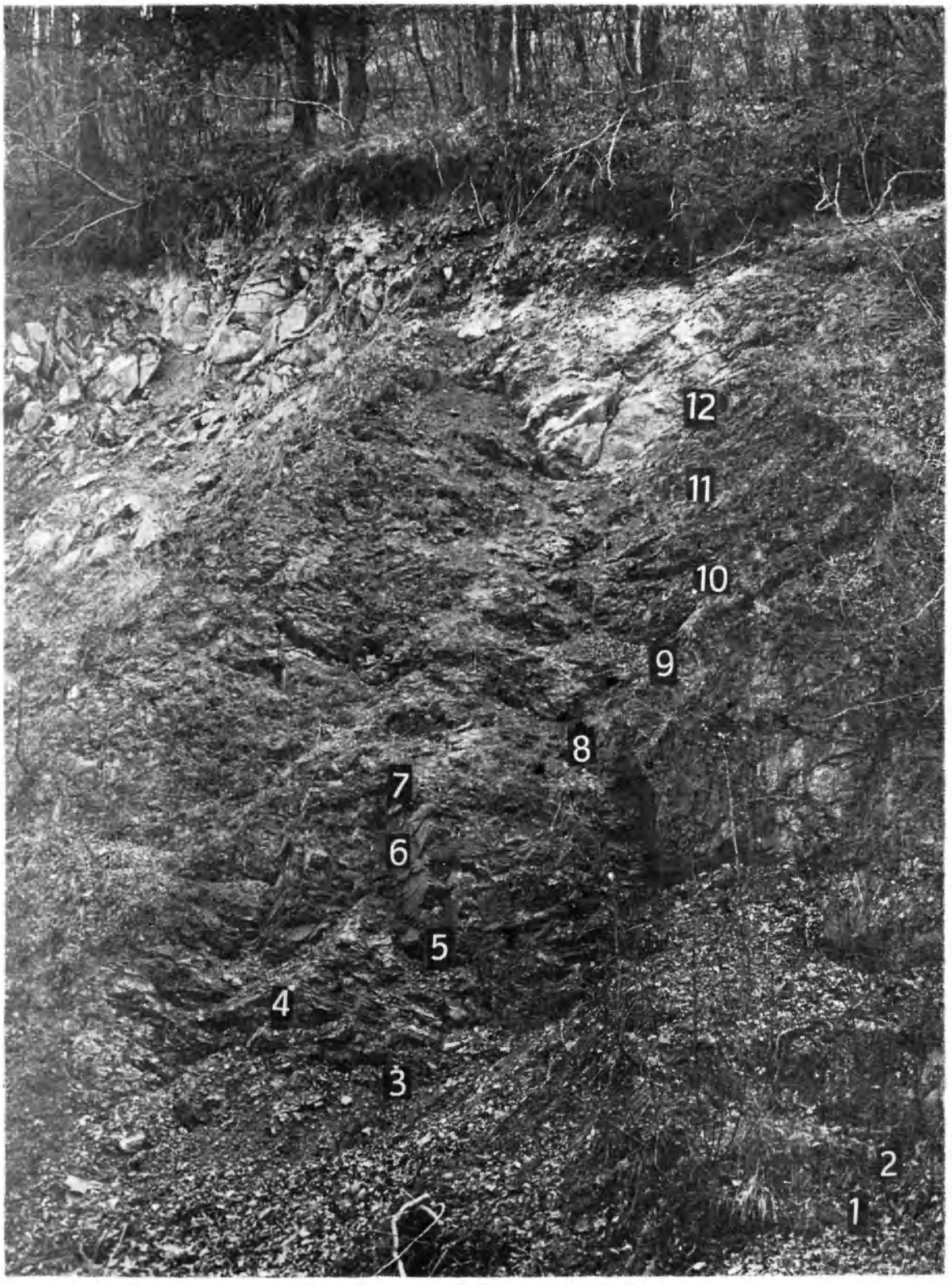
Stratygrafia serii zdanowskiej w północnej części struktury bardzkiej na podstawie konodontów

PLATE VIII
PLANSZA VIII

Beds of the Mikołajów shales in locality MI. Numbers denote sites of collecting of samples containing conodonts

Warstwy łupków mikołajowskich w stanowisku MI. Cyframi oznaczone są miejsca pobrania prób, z których uzyskano konodonty



Joanna HAYDUKIEWICZ — Stratigraphy of the Zdanów Series in the northern part of the Bardo Unit on the basis of conodonts
Stratygrafia serii zdanowskiej w północnej części struktury bardzkiej na podstawie konodontów

PLATE IX
PLANSZA IX

The Brzeźnica beds in locality BII. Numbers denote sites of collecting of samples containing conodonts

Warstwy brzeźnickie w stanowisku BII. Cyframi oznaczono miejsca pobrania prób, z których uzyskano konodonty

Joanna HAYDUKIEWICZ — Stratigraphy of the Zdanów Series in the northern part of the Bardo Unit on the basis of conodonts
Stratygrafia serii zdanowskiej w północnej części struktury bardzkiej na podstawie konodontów

Biostratigraphic and lithostratigraphic correlation of the Zdanów series
Korelacja biostratygrafii i litostratygrafii serii zdanowskiej

Stage – Piętro		Ammonoid Stufen „Poziomy" (Stufen) amonitowe	Condont Zones	Poziomy kondontowe
Famennian Famen	*Wocklum*	doVI	*Protognathodus*	
			costatus	upper
				middle
		doV/VI?		lower
	Gonioclym.	doV	styriacus	upper
				middle
				lower
	Platyclym.	doIV	*velifer*	upper
		doIIIβ		middle
				lower
		doIIIα	*marginifera*	upper
	Cheiloceras			lower
		doIIβ	*rhomboidea*	upper
				lower
		doIIα	*crepida*	upper
				middle
				lower
Frasnian Fran	*Manticoceras*	post-doIδ	*triangularis*	upper
				middle
				lower
		doIδ	*gigas*	uppermost
		doIγ/δ		upper
		doIγ		lower
		doIβ/γ	*triangularis*	
		doIα	*asymmetricus*	upper
				middle
				lower
				lowermost
			hermanni-cristatus	upper
				lower
Givetian Żywet			*varcus*	lat. horizon
			obliquimarginatus	upper
				lower
Eifelien Eifel			*kockelianus*	
			bidentatus	
			corniger	

Beds of Wilcza Warstwy z Wilczy				Mikołajów shales – Łupki mikołajowskie										Beds of Brzeźnica Warstwy brzeźnickie		
				Ma*					Mb**							
W I	Z I	Z II	Z III	M I	M II	B I	NW II	NWIII	M III	B III	Bo I	NW I	NW IV	B II	MIV	BoII
				1,3,12	4,5		1	1,2	11		1	3	1	5,9	6	4
				7			2		13	2,3		5	3	13,15,17		
					2,3		6	3			5		5			
													1	18		
													3			
													6			
						1	4									
43	1	5	6 2 4													

Minimum range of Wilcza beds, Mikołajów shales and Brzeźnica beds
Minimalny zasięg warstw z Wilczy, łupków mikołajowskich i warstw brzeźnickich

Beds of Brzeźnica
warstwy brzeźnickie

Mikołajów shales
łupki mikołajowskie

claystones and siltstones interbedded with claystones
iłowce z wkładkami mułowców

siliceous claystones and clayey-silica rocks
iłowce z krzemionką i skały ilasto-krzemionkowe

Beds of Wilcza
warstwy z Wilczy

* Claystones interbedded with siltstones, iłowce z wkładkami mułowców
** Siliceous claystones and clayey-silica roks, iłowce z krzemionką i skały ilasto-krzemionkowe