Geological Quarterly, Vol. 38, No. 2, 1994, p. 249–288

Maria CHOROWSKA, Krzysztof RADLICZ

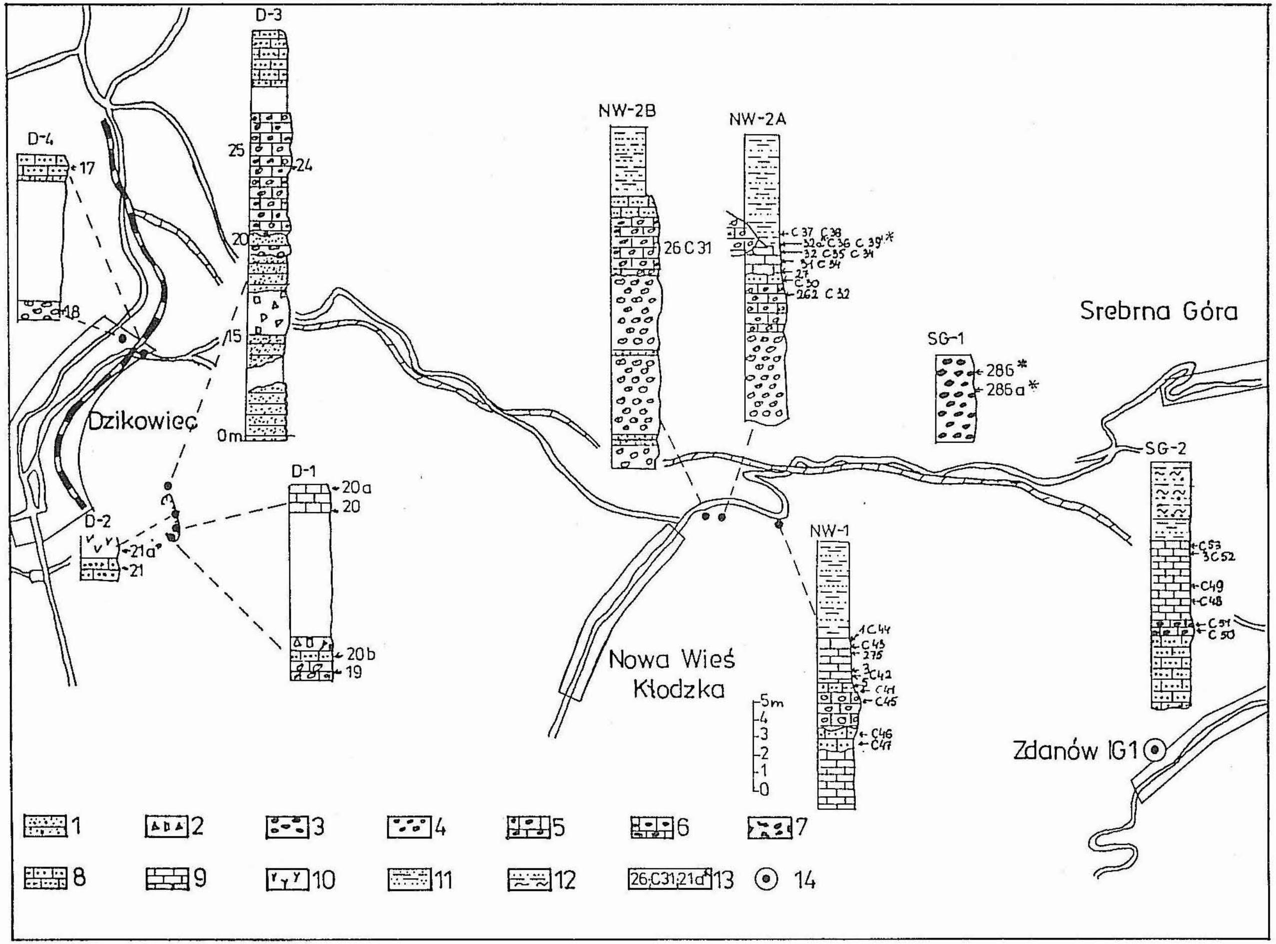
Revision of the age of the Lower Carboniferous deposits in the northern part of the Góry Bardzkie (Sudetes)

Deposits of the Nowa Wieś Formation were formed in the time interval from the Upper Tournaisian to the Lower Visean, while sedimentation of the flysch deposits of the Srebrna Góra Formation lasted, at maximum, until the upper part of the Middle Visean. Those facts are evidenced by conodonts and foraminifers from the carbonate deposits of the Nowa Wieś Formation exposed on the surface and from the upper part of that formation and of the flysch deposits of the Srebrna Góra Formation from borehole Zdanów IG 1. This age supports the conclusion of W. Paeckelmann (1930, 1931) and partly of T. Górecka, B. Mamet (1970), and M. Chorowska (1972, 1973). It is also concordant with the age proposed by A. Głuszek, A. Tomaś (1993) and contrary to the Upper Visean (M. Chorowska, K. Radlicz, 1984) or partly Lower Namurian ages (J. Haydukiewicz, 1986) of these deposits suggested in the literature.

INTRODUCTION

The Lower Carboniferous deposits from the Dzikowiec, Nowa Wieś, and Srebrna Góra regions and from borehole Zdanów IG 1 are discussed. The age of conglomerates, gneiss conglomerates, and gneiss-limestone conglomerates as well as of limestones is analysed, all the rocks belonging to the Nowa Wieś Formation (or sequence — B. Wajsprych, 1978, 1979, 1980, 1986). The age of the flysch part of the Srebrna Góra Formation (i.e., of the Srebrna Przełęcz Series, B. Wajsprych, 1986) in borehole Zdanów IG 1 has been analysed, too.

The carbonate deposits that belong to the sequences analysed in the present paper, were reported in the literature as the Lower Carboniferous Limestone. H. Żakowa (1963) called the series with the Lower Carboniferous Limestone that is exposed in the Nowa Wieś – Srebrna Góra belt the Ostróg Beds. J. Oberc (1987) distinguished two formations among the rocks under discussion, namely: the Góry Sowie gneiss conglomerates and the Bardo detritic limestones.


D-3
D-4
D-2
D-1
NW-2B
NW-2A
NW-1
SG-1
SG-2
Dzikowiec
Srebrna Góra
Nowa Wieś Kłodzka
Zdanów IG1
0m
5m
1
2
3
4
5
6
7
8
9
10
11
12
26 C31 21a 13
14

The authors of the present paper recognized that the conclusions on the Upper Visean (M. Chorowska, K. Radlicz, 1984) and partly may be on the Lower Namurian ages (J. Haydukiewicz, 1986) are incorrect based on revision of the studies of conodonts, foraminifers, and algae. These prove that the deposits of the Nowa Ruda Formation were formed in the time interval between the Upper Tournaisian and Lower Visean, while the deposition of the flysch deposits of the Srebrna Góra Formation lasted at maximum until the upper part of the Middle Visean. Biostratigraphic conclusions based on the macrofauna (W. Paeckelmann, 1930, 1931) and on foraminifers (T. Górecka, B. Mamet, 1970) are similar to those suggested by the present paper's authors. Also, the biostratigraphic conclusions of A. Głuszek and A. Tomaś (1992) based on the detailed analysis of the foraminifers are concordant with those presented here. Only in some cases do the conodont analyses more precisely limit the time of sedimentation of the rock series, within the Cf3 and Cf4 zones suggested by the authors quoted.

The revision of the conodont determinations was done by M. Chorowska following the suggestions of E. Groessens and Z. Bełka in relation to parts of specimens of *Mestognathus* and *Gnathodus*. The foraminifers were analysed by R. Conil and K. Radlicz, and conclusions from that analysis are drawn. The algae were repeatedly analysed by K. Radlicz with the help of S. Skompski. The corals were determined by J. Fedorowski, which led to determination of their time extent and to stratigraphic conclusions.

The authors of the present paper are greatly indebted to all the co-workers for their co-operation and helpful suggestions. We also thank A. Tomaś and A. Głuszek for a fruitful discussion of the problem. We are especially grateful to R. Conil for access of the foraminifer collection, which enabled the proper evaluation of the documenting material.

Fig. 1. Locations and sections from outcrops of the Lower Carboniferous deposits in the Dzikowiec (D), Nowa Wieś (NW), and Srebrna Góra (SG) regions

Nowa Wieś Formation: 1 — gneiss sandstones, 2 — gneiss breccias, 3 — gneiss conglomerates, 4 — conglomerates with gneiss and limestone clast material, 5 — limestone conglomerates, 6 — limestone breccias, 7 — gneiss-limestone breccia, 8 — detritic limestones, 9 — nodular limestones, 10 — rhyolite tuffs with interlayers of gneiss sandstones (with calcite cement and nodules of limestone), 11 — dark claystones and siltstones, at the bottom with lenses and nodules of limestones (tuffite interlayers); the Srebrna Góra Formation: 12 — lithic sandstones, siltstones, and claystones (flysch: the Srebrna Przełęcz Series); 13 — numbers of samples documented palaeontologically (* — samples from the limestone nodules); 14 — borehole

Lokalizacja i profile odsłonięć utworów karbonu dolnego w rejonie Dzikowica (D), Nowej Wsi (NW) i Srebrnej Góry (SG)

Formacja Nowej Wsi: 1 — piaskowce gnejsowe, 2 — brekcja gnejsowa, 3 — zlepieńce gnejsowe, 4 — zlepieńce gnejsowo-wapienne, 5 — zlepieńce wapienne, 6 — brekcja wapienna, 7 — brekcja gnejsowo-wapienna, 8 — wapienie detrytyczne, 9 — wapienie gruzłowe, 10 — tufy ryolitowe z wkładkami wapnistych piaskowców gnejsowych z bułami wapieni, 11 — ciemne iłowce i mułowce, w dole z soczewkami i bułami wapieni (wkładki tufitów); formacja Srebrnej Góry: 12 — piaskowce lityczne, mułowce i iłowce (flisz: seria Srebrnej Przełęczy); 13 — numery próbek udokumentowanych paleontologicznie (* — próbki pobrane z buł wapiennych); 14 — otwór wiertniczy

LOCALIZATION AND DESCRIPTION OF THE SECTIONS

Outcrops marked with a letter D in the Dzikowiec region (Fig. 1) occur on the southern and eastern slopes of Wapnica Hill (D-1, D-2, D-3), in the northern part of Dzikowiec (D-4) and near the top of Wapnica Hill (D-5). The outcrops marked with NW and SG symbols lie between Nowa Wieś and Srebrna Góra, south of the road from Srebrna Góra to Woliborz. Borehole Zdanów IG 1 lies in the village Zdanów, about 2 km towards SE from Srebrna Góra.

In **section D-1** carbonate conglomerates are exposed on the south-western wall of the old quarry, while on the south-eastern side, fine-grained detritic limestones and gneiss-limestone breccia overlie the conglomerates in a normal position. The upper part of the sequence (an interval over 7 m long) is covered. The top part corresponds to the nodular marly limestone exposed on the north-eastern wall.

Section D-2 is exposed on the eastern wall of the quarry placed on the eastern slope of Wapnica Hill. In the lower part there are fine-grained, detritic limestones, of small thickness, ovelain by rhyolitic tuffs with interlayers of sandy limestones displaying a thickness of 2 and 20 cm. Concretions of grey, micritic limestone were found in one such interlayer.

Section D-3 comprises deposits from the old mine and from the rock over this mine in the top part of the eastern slope of Wapnica Hill. They correspond to (from the bottom to the top): gneiss sandstones with mudstones and clayish gritstones interlayers; synsedimentary gneiss breccia with a calcite cement and some blocks of limestone, which in its bottom part contains black siltstone matrix and displays a transition to gneiss sandstones with crinoid bioclasts in its top part; gneiss sandstones with a calcite cement and crinoid bioclasts with an interlayer of gneiss-limestone conglomerate and with small interlayers (up to 5 cm in thickness) of grey detritic limestones; limestone conglomerates grading into detritic limestones towards the top of the section. Clasts and blocks of limestones, gneisses, pegmatites, gneiss sandstones, and many bioclasts, mainly of echinoderms, corals, and brachiopods occur in the conglomerates.

In **section D-4**, gneiss-limestone conglomerates occur in the bottom part (in the pit), and in the top part — there are fine-detritic limestones. The thickness of unrecognized deposits between the conglomerates and limestones equals to about 6–7 m.

Section NW-1 (old quarry with water) comprises (from the bottom to the top) the following rocks: greyish-beige nodular limestones; detritic limestones separated by a set of limestone conglomerate layers with gneiss detritus; greyish-beige nodular limestones; claystones and siltstones with tuffite interlayers and lenses, with nodules of marly limestones at the bottom.

In **section NW-2A** (east part of the old quarry) there occur (from the bottom to the top): conglomerates and breccias containing gneiss material together with clasts and blocks of limestones, pegmatites, gneiss conglomerates and sandstones, and infrequent fragments of crinoids; gneiss-limestone conglomerates with abundant bioclasts of crinoids, corals, and brachiopods; limestone conglomerate with interlayers of limestone breccia, with transition upwards to detritic limestone; greyish-blue and greyish-beige nodular marly limestones; dark claystones and siltstones with interlayers of tuffites. In claystones, nodules of marly limestones occur.

In **section NW-2B** (west part of the old quarry), there occur gneiss-limestone conglomerates with intercalations of gneiss sandstones with a calcite cement, overlain by limestone conglomerates with limestone nodules of a length up to some tens of centimetres and with numerous bioclasts of crinoids; thin (10–15 cm in thickness) detritic limestones with numerous bioclasts of echinoderms, corals, and brachiopods; dark claystones with detritic limestone intercalations, with bioclastic breccia, tuffites, sandstones, and siltstones with a calcite cement in the upper part.

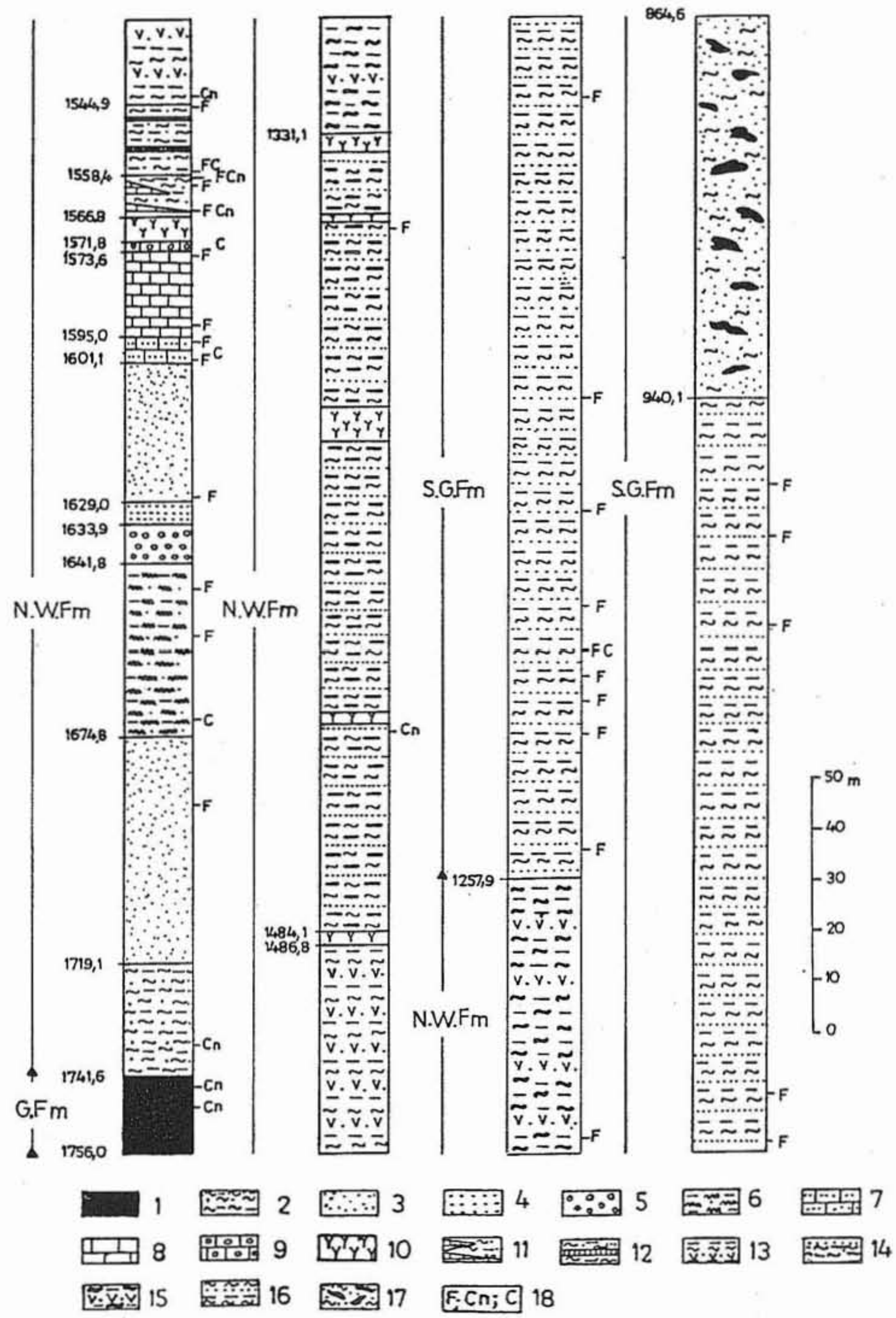
In **exposure SG-1**, there occur gneiss conglomerates with a few nodules of fine-detritic and conglomerate limestones and with discontinuous layers of greyish-beige micritic limestone.

In **section SG-2** the following deposits from the bottom to the top are present: black and brown crinoid limestones with intercalations of marly shales and siltstones with calcite cement; limestone breccia; greyish-beige nodular limestones with numerous sponge spicules; black siltstones with tuffite intercalations containing nodules of marls at their bottom.

The Lower Carboniferous sediments occur in the **Zdanów IG 1** borehole at a depth of 864.6 to 1756.0 m (Fig. 2). In the following description of the layers, we neglect the interval from 864.6 to 940.1 m built of olistostrome deposits from which we did not obtain biostratigraphic data.

The Lower Carboniferous deposits occur in the normal stratigraphic sequence and are as follows:

Depth in metres	Lithologic description
1756.0–1741.6	Black claystones with radiolarians and sandy siltstones. Intercalations of radiolarites, partly carbonatized. Layers and nodules of pyrite.
1741.6–1719.1	Dark deposits with a rhythmic stratification. Thin incomplete cycles built of black siltstone and claystone; complete cycles with fine- or medium-grained sandstone or rudite composed of clasts of clayey-siliceous and tuffogenic rocks at the base. Tuffite laminae and interlayers enriched in pyrogenic quartz and volcanic glass.
1719.1–1674.8	Coarse-, medium- and fine-grained sandstones, often of conglomerate character mainly with a calcisparite cement with a few crinoid bioclasts and the alga *Pseudosolenopora ovodenkoi* Chanton et Güren. In the main gneiss material, blocks of gneisses, migmatites, biomicritic limestones, and siltstones displaying a diameter of 5 to 10 cm locally occur. In inequigranular sandstones, graded bedding occurs with fine- or coarse-grained material and mica. In the siltstone laminae enriched in micas, an increased content of the coal matter and pyrite is observed.
1674.8–1641.8	Gneiss sandstones, of dominantly conglomeratic character, with generally poor graded bedding. In the lower and upper parts of the depth interval, distinct cycles displaying thickness of 7–15 cm built of coarse- and medium-grained sandstones; partly cycles of thickness of 80 cm — at their base there occurs inequigranular sandstone with gneiss clasts (also of augengneisses), sparry and micritic dolomites, black radiolarites and crinoids, corals, bryozoans, and the alga *Pseudosolenopora ovodenkoi* Chanton et Güren. The cement of that conglomerate, displaying a matrix character, is often metasomatically replaced by calcispar cement. Parts of the sequence between the sandstones described above are built of deposits with rhythmic layering. They comprise thin cycles of thickness ranging from some millimetres to 7 cm. Fine-grained gneiss sandstone occurs at the base and is overlain either with black siltstone or black siltstone and claystone with radiolarians.
1641.8–1633.9	Inequigranular, gneiss conglomerate with clasts and blocks (up to 25 cm in diameter) of: gneisses, granitoids, and less frequently, recrystallized limestones and dolomites with fine bioclasts of crinoids and algae. Sharp-edged, ellipsoidal and discoidal grains and clasts, with their longer axes towards one direction.


1544,9
1558,4
1566,8
1571,8
1573,6
1595,0
1601,1
1629,0
1633,9
1641,8
N.W.Fm
1674,8
1719,1
1741,6
G.Fm
1756,0
1331,1
N.W.Fm
1484,1
1486,8
S.G.Fm
1257,9
N.W.Fm
864,6
940,1
S.G.Fm
50 m
40
30
20
10
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
F.Cn; C 18

1633.9–1629.0 Gneiss sandstones, generally medium-grained with rhythmic bedding. Sedimentary cycles mostly incomplete. Complete cycles display a thickness reaching 40 cm. Their uppermost clayish members are weakly developed as black layers of thicknesses ranging from 3 mm to 2 cm. In the lower part of the depth interval the cycles are comprised of, at the base, conglomerate sandstones with gneiss and granite gravels with grain diameters to 10 cm.

1629.0–1601.1 Conglomerate sandstones built mainly of gneiss material with a clay cement of matrix character containing numerous micas, locally with a sparry cement. Occasional small clay layers discontinuous displaying synsedimentary deformation. At a depth of 1628.0–1629.0 m — calcilutite, discontinuous layers probably corresponding to neptunian veins. Sandstones contain discoidal clasts mainly of gneisses and crystalline schists, subordinate — quartzites, medium-grained sandstones, granitoids, biomicritic limestones, and laminar limestones. Clasts rounded to a different grade. Among the clasts of biomicrites there occur limestones of the foraminifer-algal microfacies and Upper Famennian limestones of the *Calcisphaera* microfacies with *Calcisphaera* sp., *Quasiendothyra* sp., *Issinella* sp., and *Girvanella* sp. In the upper part of the depth interval discussed, numerous bioclasts of crinoids, brachiopods, corals, bryozoans, molluscs, and foraminifers occur.

1601.1–1595.0 Grey sandy limestones, inequigranular, of the crinoid-coral microfacies with foraminifers and oncoids. In the upper part of the depth interval — coarses shingles of gneisses and unidentified rocks as well as interlayers of dark claystones of thickness reaching 2 cm. Quartz-feldspar material together with clasts makes up about 30 per cent of the rock composition. Terrigenous and allochemic material — densely packed. Squeezing deformation structures common. Calcispar cement. Locally — ?neptunian calcisparite veins and pyrite aggregates. At a depth of 1600.5–1600.7 m — sandy-oncoid limestone with a calcisparitic cement, cut with calcilutite

Fig. 2. Lithostratigraphic profile of the Lower Carboniferous sediments from borehole Zdanów IG 1
G. Fm — the Gołogłowy Formation: 1 — black schists; N.W.Fm — the Nowa Wieś Formation: 2 — black claystones and siltstones, subordinately sandstones, 3 — gneiss sandstones in majority with calcite cement, 4 — gneiss sandstones, siltstones, and black claystones with rhythmic layering, 5 — gneiss conglomerates, 6 — gneiss sandstones, mainly with calcite cement, and black siltstones and claystones, 7 — grey sandy and sandy-oncoidal limestones, 8 — bioclastic limestones, grey with interlayers of black and grey-greenish siltstones, 9 — limestone conglomerates, 10 — rhyolite tuffs, 11 — sandstones, siltstones, and claystones, dark grey and black, with interlayers of grey limestones, 12 — claystones, partly with radiolarians, and siltstones, dark grey and black, subordinate sandstones (interlayers of spongiolites), 13 — siltstones and black and dark grey claystones with small interlayers of limestones, marls, tuffs, and siliceous claystones (intercalations of sandstones without calcite cement), 14 — siltstones and black claystones, subordinately — sandstones without calcite cement (tuff intercalations), 15 — dark grey siltstones and light grey silty claystones (intercalations of tuffites and tuffs and sandstones with calcite cement); S. G. Fm — the Srebrna Góra Formation: 16 — dark siltstones and lithic sandstones with characteristic detritus of green siliceous schists, rhythmically layered, 17 — siltstones and sandstones with intercalations of olistostromes; 18 — biostratigraphic documentary recording: F — foraminifers, Cn — conodonts, C — corals
Profil litostratygraficzny osadów dolnokarbońskich z otworu wiertniczego Zdanów IG 1
G. Fm — formacja Gołogłów: 1 — czarne łupki; N.W.Fm — formacja Nowej Wsi: 2 — czarne iłowce i mułowce, podrzędnie piaskowce, 3 — piaskowce gnejsowe w większości wapniste, 4 — rytmicznie warstwowane piaskowce gnejsowe, mułowce i iłowce czarne, 5 — zlepieńce gnejsowe, 6 — piaskowce gnejsowe, przeważnie wapniste oraz czarne mułowce i iłowce, 7 — szary wapień piaszczysty i piaszczysto-onkoidowy, 8 — wapienie bioklastyczne, szare z warstewkami iłowców czarnych i szarozielonawych, 9 — zlepieniec wapienny, 10 — tufy ryolitowe, 11 — piaskowce, mułowce i iłowce ciemnoszare i czarne z wkładkami szarych wapieni, 12 — iłowce, częściowo z radiolariami i mułowce ciemnoszare i czarne, podrzędnie piaskowce (warstewki spongiolitów), 13 — mułowce oraz iłowce czarne i ciemnoszare z warstewkami wapieni, margli, tufów i iłowców krzemionkowych (wkładki piaskowców bezwapnistych), 14 — mułowce i iłowce czarne, podrzędnie piaskowce bezwapniste (wkładki tufów), 15 — mułowce ciemnoszare i iłowce pylaste jasnoszare (wkładki tufitów i tufów oraz piaskowców wapnistych); S. G. Fm — formacja Srebrnej Góry: 16 — mułowce ciemne i piaskowce lityczne z charakterystycznym detrytusem zielonych łupków krzemionkowych, rytmicznie warstwowane, 17 — mułowce i piaskowce z wkładkami olistostrom; 18 — dokumentacja biostratygraficzna: F — otwornice, Cn — konodonty, C — koralowce

	neptunian veins of several generations. Abundant bioclasts of crinoids, molluscs, and corals. Many terrigenous grains and bioclasts have micritic covers of different thickness and form superficial oncoids.
1595.0–1573.6	Grey bioclastic limestones, locally distinctly fractionally layered. Discontinuous layers or undulating layers of greyish-green tuffitic sandy claystones (in the upper part of the depth interval) and of black claystones (in the lower part). Limestones represented by biomicrites and biosparites and limestone breccias rich in bioclasts of crinoids, corals, bryozoans, molluscs, and foraminifers. Small admixture of gneissic terrigenous material, neogenic quartz, and albite grains. In the limestones and the breccia — calcilutite neptunian veins, some of them containing peloids, fine intraclasts of limestones, *Calcisphaera* limestones and neogenic quartz aggregates. Three generations of fissures with calcisparite.
1573.6–1571.8	Limestone conglomerate with a very small amount of fine-grained matrix with bioclasts, partly with the clasts in contact with each other; composed of limestone clasts of the microfacies of echinoderms, sponges, and bryozoans. In some intraclasts — pyroclastic material (quartz, plagioclase, muscovite) and laminae of crystalotuff.
1571.8–1566.8	Tuffs.
1566.8–1558.4	Deposits rhythmically layered, sandy-silty-clayey dark grey and black. Thin cycles with a dominance of fine-grained sandy members with calcite cement. Interlayers of fine-grained grey limestones, of conglomeratic character at the base or, sporadically, at the base and the top. Calcirudite layer with flat intraclasts displaying an imbricated distribution. Fine-grained limestones from individual interlayers consist of biomicrite or biooncomicrite, of clayey-silty shale and of biomicrite in the spicular-sponge microfacies or of bioclastic-oncoid and bioclastic layers. Among the limestones, there occur locally biomicritic veinlets with bioclasts (among the others — spicules of sponges) and oncoids, with irregular, discontinuous layers of calcilutite neptunian veins cut with fissures of several generations.
1558.4–1544.9	Deposits rhythmically layered, dark grey and black, mostly clayey. In the depth interval of 1550.4–1558.4 m, cycles reaching 5 cm in thickness, with the thickest member displaying a fine-sandy character with abundant bioclasts and a calcite cement. Higher — cycles of thickness up to 10 cm with a thin (reaching 5 cm) fine-sandy layer with calcite cement and the thickest claystone member. Among the fine-sandy members there occur laminae of spongiolites, black claystones with radiolarians, sponge limestones (calcitized spongiolites), and quartz-mica arenites. Among the members built of black claystones there are interlayers of greenish claystone with spicules of sponges and with radiolarians as well as with laminae of spongiolites.
1544.9–1486.8	Black claystones with discontinuous pyrite layers and aggregates, subordinate dark grey claystones. Thin layers or laminae of black siliceous-silty deposits, sandy claystones, dolomitic marls, sandy limestones, tuffs, and tuffites. At a depth of 1539.8–1543.0 m — also greyish-green claystones. In the laminae of the sandy claystone, dolomitic marl, and sandy limestone — numerous bioclasts, generally recrystallized. Among them — at a depth of 1506.3 m — remnants of brachiopods, bryozoans, echinoderms, and primitive foraminifers. Claystones separated with rhythmic layers of deposits, in thin and thick cycles. The thicker sedimentary cycles (ranging from 30 to 130 cm), composed at the base of sandstone with a cement without calcite, dominantly fine-grained with a significant percentage of mica; and higher, they are composed of siltstone and black claystone. Thin cycles (2–20 cm) built, in general, of siltstone and black claystone. Sandstones of some cycles contain clasts of black claystones with radiolarians, arenite quartzites, gneisses, spilites, and in one cycle — also greenish claystones. Rudite, present at the base of some cycles, contains flat clasts of greenish claystones of diameter reaching 2.5 cm.
1486.8–1484.1	Tuffs.
1484.1–1331.1	Mudstones and black claystones, partly dark grey, with discontinuous layers, bedded and with parallel lamination. Mostly built of pyrogenic material. Numerous laminae and layers of tuffs of thickness reaching 0.5 m and some thicker tuff interlayers (up to 5.6 m; selected in Fig. 3). Abundant irregular aggregates of organic matter and radiolarians in the accompanying claystones. The siltstone-claystone series is divided by several packages composed of thin sedimentary cycles. The sequence of sediments within these cycles is as follows: fine-grained, sporadically medium-grained sandstone with a calcite cement, siltstone, and black claystone.
1331.1–1257.9	Dark grey siltstones and light grey and greenish silty claystones with laminae, thin interlayers of tuffites and tuffs, and with interlayers of greenish siliceous claystones, partly with rare radiolarians. In the lower and upper parts of the depth interval — deposits with a rhythmic

layering composed of thin sedimentary cycles of thickness ranging from 1 to some centimetres as well as individual cycles 30–90 cm thick. At the base of those cycles — medium- or rarely fine-grained, exceptionally coarse-grained sandstones, in general with a calcite cement and with lithoclasts and bioclasts (lithoclasts: gneisses, blastomylonites, siltstones, siliceous-clayey rocks, spilites, micrites and biomicritic limestones; bioclasts: bryozoans, crinoids, brachiopods, trilobites, corals, algae, and foraminifers including *Calcisphaera*). The upper parts of the cycles built of dark or light grey siltstones, occasionally with a green shade and of dark grey or black claystones.

1257.9–940.1 Sandstone-siltstone-claystone deposits, grey or dark grey, subordinately black, with rhythmic layering, in the majority, with distinct graded bedding. Sedimentary cycles complete (e.g., rudite – arenite rudite – sandstone – siltstone – claystone) and incomplete.

At a depth of 957.9–1257.9 m there occur sets of thin cycles separated with the thick ones. Thin cycles are occasionally 1–6 m thick, sometimes 1–35 cm. They are, in general, built of siltstone and claystone, only sporadically of siltstone. Thick cycles display a thickness of 50–70 cm, but up to 110, 130 and 205 cm in three cases. At the base of the thick cycles, there occurs sandstone with a calcite cement, lithic, coarse- or medium-grained, rarely conglomeratic, with numerous clasts of green, and black claystones and bioclasts. Sometimes lithic arenite, rhyolite and tuff or tuffite wacke are at the base of the thick cycles. Exceptionally, in the case of a cycle displaying a thickness of 70 cm, it begins with sandy bioarenite followed by sandy bioclastic limestone followed by siltstone (depth of 1205.3–1206.0 m). Thick sedimentary cycles display the following features:

— in some of them siltstone-claystone parts are thicker than the sandstone ones;
— some contain coarse material of a thickness greater than that of the sandstones and claystones;
— laminae of sandstone and siltstone occur occasionally within the claystone part;
— layers of tuffs and claystones with abundant radiolarians occur in some siltstone-claystone parts.

Clasts of sedimentary, metamorphic and volcanic rocks occur in sandstones which begin the sedimentary cycles. They are as follows: claystones, clayey and clayey-siliceous slates, siliceous rocks, claystones with radiolarians, radiolarites, dusty-carbon-bearing claystones, limestones (biomicrite, biosparite, and micrite), wackes, gneisses (mostly muscovite gneisses), spilites, diorites, arenite tuffs with a calcite cement, and unidentified volcanites. Abundant bioclasts in the sandstones, include foraminifers, corals, crinoids, echinoids, moluscs, brachiopods, and trilobites.

At a depth of 1102.0–1104.2 m there occurs a rock with a siltstone-sandstone ground mass with crinoids and pyrite nests. It contains fragments of layered sandstones and siltstones, blocks and clasts of sandstones with calcite cement, as well as of green claystones.

At a depth of 940.1–957.9 m the cycles are not distinct. Thin layers of sandstones occur in the siltstones and black siltstone laminae are present in sandstones.

940.1–864.6 Olistostrome type deposits. Subordinately — layers of lithic, marly tuffitic, sandstones and of black siltstones with pyroclastic material.

In the stratigraphic column of the Zdanów IG 1 borehole discussed above, in the Carboniferous deposits from a depth of 1571.8 m upward there have been observed frequent tuff layers, the thicker ones being shown on the graph (Fig. 2). Tuffs are generally grey-greenish, rarely light grey, exceptionally black. They are sometimes layered. They display a porphyroblastic texture and belong to lithocrystalotuffs or rhyolitic crystalotuffs. Tuffs contain a ground mass built of albite microliths and chloritized glass. Crystaloclasts occur as tablets of albite and alkali feldspar, idiomorphic, sometimes bipiramidal or elongated grains of quartz biotite, and rare muscovite. Some feldspar tablets underwent calcite metasomatism. Relics of leucoxene and skeletal pseudomorphs, possibly after hornblende, are occasionally present. Tuffs are cut by fissures filled with calcispar, quartz, and albite. Organic matter occurs in some veinlets.

Biostratigraphy and distribution of main conodont species in the Lower Carboniferous from

Taxonomy	Tournaisian						
	conodont zone after Z. Bełka (1985)						
	cuneiformis		*anchoralis*				
	SG-1		D-2		D-3	D-1	
	286*	286a*	21	21a*	24	19	20b
Cavusgnathus sp.							
Dollymae bouckaerti Groessens, 1971	1						
Gnathodus cuneiformis Mehl et Thomas, 1947					1		
Gnathodus cuneiformis →*Gnathodus pseudosemiglaber*							
Gnathodus pseudosemiglaber Thompson et Fellows, 1970			9	1	8	1	1
Gnathodus semiglaber (Bischoff, 1957)					1		
Gnathodus semiglaber →*Gnathodus texanus*							
Gnathodus typicus M2 (Cooper, 1939)			1				
Gnathodus sp.							
Mestognathus beckmanni Bischoff, 1957			1				
Polygnathus bischoffi Rhodes, Austin et Druce, 1969							
Polygnathus aff. *bischoffi* Rhodes, Austin et Druce, 1969							
Polygnathus communis carinus Hass, 1959		1					
Polygnathus impar n. sp. Korn et Luppold, 1987							
Polygnathus triangulus triangulus (Voges, 1959)	2	1					
Protognathodus cordiformis Lane, Sandberg et Ziegler, 1980			1				
Pseudopolygnathus primus Branson et Mehl, 1934	1						
Scaliognathus anchoralis europensis Lane et Ziegler, 1983							1
Siphonodella var. sp.							

Outcrops: D-1, D-2, D-3, D-4 — Dzikowiec; NW-1, NW-2A, NW-2B — Nowa Wieś Kłodzka; SG-1, SG-2

Black, fine lenticular tuffogenic claystones with dispersed organic matter and radiolarians, sometimes individual sponge spicules and biotite flakes, are dominant adjacent to the tuffs.

BIOSTRATIGRAPHY

CONODONT AGE

Determinations of the conodonts from species of *Gnathodus, Mestognathus,* and *Cavusgnathus* were carried out in 1991. Those conodonts were quoted in earlier papers as

Table 1

the Dzikowiec, Nowa Wieś Kłodzka and Srebrna Góra area and the Zdanów IG 1 borehole

Tournaisian				Visean											Tournaisian	Visean	
conodont zone after Z. Bełka (1985)																	
anchoralis				*texanus*											*delicatus*	*texanus*	
D-1		D-4		NW-2B	NW-2A					NW-1				SG-2	Zdanów IG 1 borehole (depth in m)		
20	20a	17	18	26	262	27	31	32	32a*	5	3	275	1	3	1747.2	1565.8	1558.6
				1												1	
									4								
6	9			10	1	2	9		1	1	10	1	2			1	
			1	1			3	2	2				1	1		1	
				1													
							1		2								
																	1
	3			2		1	2			3				1		1	
			1														
	1						1						1				
		1	1														
															3		

— Srebrna Góra; * — samples from limestone bodies

indicators of the age of rock exposure from the Dzikowiec, Nowa Wieś, and Srebrna Góra regions as well as from borehole Zdanów IG 1 (M. Chorowska, 1972, 1973; M. Chorowska, K. Radlicz, 1984; M. Chorowska *et al.*, 1986). It follows from the conodont revision that the specimens assigned earlier to the species from the genus *Gnathodus girtyi* Hass mainly represent morphological varieties of the species *Gn. pseudosemiglaber* Thompson et Fellows, transition forms between *Gn. cuneiformis* Mehl et Thomas and *Gn. pseudosemiglaber* Thompson et Fellows, and atypical forms of *Gn. semiglaber* (Bischoff). Representatives of the species *Gn. pseudosemiglaber* Thompson et Fellows were also identified among the specimens not classified earlier to the species stage. Among the earlier unidentified conodonts from the *Gnathodus* species were the following: *Gn. cuneiformis* Mehl et Thomas, *Gn. typicus* (Cooper), *Prothognathodus cordiformis* Lane, Sandberg et Ziegler.

Biostratigraphy and distribution of foraminiferal and algal taxa in

Taxonomy		Siegle						
		Tn3a-b	V1a —V2a					
		foraminifera zone						
		Cf2	Cf4					
		SG-1	NW-2A, NW-2B					
		286a*	C32	C30	C31; 26	C34; 31	C35; 32	C36
1	2	3	4	5	6	7	8	9
Foraminifera	*Diplosphaerina inaequalis* (Derville, 1931)	x	x	x	x	x	x	x
	Pachysphaerina pachysphaerica (Pronina, 1963)		x	x	x	x	x	x
	Cytosphaera sp.							
	Bisphaera sp.	cf.						
	Parathurammina suleimanovi Lipina, 1949						x	
	Paracaligella sp.							
	Lituotubella glomospiroides Rauser-Chernousova, 1948							
	Earlandia elegans (Rauser et Reitlinger,1937)							
	Earlandia moderata (Malakhova, 1954)		x	x	x	x	x	x
	Earlandia minor (Rauser,1948)				x		x	x
	Earlandia vulgaris (Rauser et Reitlinger, 1937)							
	Lugtonia monilis (Malakhova, 1955)							
	Scalebrina sp.							
	Pseudolituotuba gravata (Conil et Lys, 1965)							
	Brunsia sp.		x		x	x		x
	Tournayella sp.		x	x		x	x	
	Septabrunsiina (Spinobrunsiina) implicata (Conil et Lys, 1968)							
	Septabrunsiina (Spinobrunsiina) sp.					cf.	x	
	Pseudolituotubella sp.				cf.			
	Eotextularia diversa (Tchernysheva, 1948)			cf.	x	x	cf.	
	Pseudotaxis sp.						x	
	Valvulinella sp.							x
	Tetrataxis sp.		x			x	x	x
	Endothyra laxa Conil et Lys, 1964		cf.					cf.
	Endothyra spira Conil et Lys, 1964							
	Endothyra sp.	x	x	x	x	x	x	x
	Spinoendothyra sp.							x
	Omphalotis sp.				x			
	Bessiella sp.							
	Florenella sp.		x	x	x	x		
	Globoendothyra sp.							
	Granuliferella sp.	x		x		x		
	Paraendothyra cummingsi (Conil et Lys, 1964)							
	Endospiroplectammina conili Lipina, 1970							
	Endospiroplectammina sp.			x		x		
	Mikhailovella sp.					x		
	Endothyranopsis sp.							
	Latiendothyranopsis sp.							

Table 2

the Lower Carboniferous from the Dzikowiec, Nowa Wieś and Srebrna Góra area

Siegle																	
V1a—V2a																	
foraminifera zone																	
Cf4																	
NW-2A, NW-2B			NW-1									SG-2					
C37	C38	C39*	C47	C46	C45; 7	C41; 6	5	C42; 4	3	C43; 2	C44; 1	C50	C51	C48	C49	C52; 3	C53
10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27
x	x	x		x	x	x	x	x	x	x	x	x	x	x	x	x	x
							x			x	x	x		x		x	x
cf.																	
																	x
								⊗			x						
								⊗									
								x						x	x		
x	x	x	x	x	x	x	x	x	x		x			x	x		x
				x	x	x	x	x						x			
								x									
								cf.	x			cf.					
			cf.														
			x	x	x	x											
		x	x	x	x	x		x	x								x
			x	x	x	x		x				x	x				
		x		⊗													
			⊗	x	x				x						⊗		
			cf.			x					x						
					x	x	x	x				cf.	cf.				
							cf.										
				x		x		x						x	x		
x	x		x	x	x	x		x	x		x	x	x			x	
		cf.				cf.											
											x						
x	x	x	x	⊗	x	x	x	x	x	x	x	x	x	x	x	x	x
			cf.	x													
								x									
			cf.	⊗	x			x	cf.		x						
x			⊗	⊗	x	x		x	cf.	x	x						
				⊗	cf.												
			x														
					⊗												
							x	x	x		x						
	x		x		x			x						x			
				⊗													
			⊗				x	cf.									

1	2	3	4	5	6	7	8	9
Foraminifera	*Dainella chomatica* (Dain, 1940)							
	Dainella sp.			⊗				
	Lysella sp.					⊗		
	Quasiendothyra sp.				x			
	Endostaffella parva (Moeller, 1880)							
	Endostaffella sp.							
	Eostaffella sp.							x
	Eoparastaffella sp.		cf.		x			x
Algae	*Girvanella problematica* Nicholson et Etheridge, 1880				x			x
	Girvanella sp.							
	Solenoporaceae	x	x	x	x			x
	Koninckopora sp.		x	x				
	Kamaena sp.				x			x
	Quasiumbella sp.							

* — samples from limestone bodies; C32, C35 — samples taken by R.Conil; ⊗—foraminifers photographed

Owing to redeterminations, the former *Gn. bilineatus* (Roundy) specimen displaying a damaged platform is reassigned to the species *Gn. semiglaber* (Bischoff). All the specimens from the genus *Mestognathus* represent the species *Mestognathus beckmanni* Bischoff. Among them there occur very early forms origining directly from *M. groessensi* Bełka and younger ones displaying a smaller basal cavity. It has been stated that the conodont from the genus *Cavusgnathus* cannot be determined to species level. It is very similar to *Cavusgnathus unicornis* Youngquist et Miller since it has a distinct posterior denticle of the anterior blade. Other features, however, show affinity to those of *C. convexus* Rexroad.

In some cases subspecies classification has been changed. It has been stated that the specimen earlier classified as *Scaliognathus anchoralis* Branson et Mehl represents the subspecies *S. anchoralis europensis* Lane et Ziegler. Terms of the conodonts have been actualized according to the present synonymy and systematic affiliation (e.g., *Dollymae bouckaerti* Groessens replacing *D. vogesi* Voges; *Polygnathus triangulus triangulus* (Voges) instead of *Pseudopolygnathus triangulus triangulus* Voges.

The stratigraphically important conodonts are presented in Table 1. The other conodonts in the deposits under research, mostly ramiform ones, belong to seventeen genera, some of them being determined to species. They are as follows: *Acodina* sp., *Angulodus* sp., *Bryantodus* cf. *scitulus* Branson et Mehl, *B.* sp., *Diplododella* sp., *Hibbardella cropa* Rhodes, Austin et Druce, *Hindeodella tenuis* Clarke, *H.* var. sp., *Ligonodina* cf. *bicincta* Huddle, *L.* cf. *levis* Branson et Mehl, *Lonchodina furnishi* Rexroad, *L.* cf. *paraclarki* Hass, *L.* sp., *Magnilaterella robusta* Rexroad et Collinson, *M.* sp., *Metalonchodina* cf. *bidentata* Günnel, *Neocordylodus* sp., *Neoprioniodus alatoidus* Cooper, *N. cassilaris* Branson et Mehl, *Ozarkodina delicatula* Stauffer et Plummer, *O. roundyi* Hass, *O.* sp., *Polygnathus* cf. *flabellus* Branson et Mehl, *Prioniodina stipans* Rexroad, *Spathognathodus campbelli*

Tab. 2 continued

10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27
				⊗													
				⊗				⊗			x						
	⊗		x							x	cf.						
								⊗									
			⊗														cf
x																	
x	x	x	cf.	cf.	x			cf.									
			x	x	x												
x												x		x			x
			x	x	x	x		x					x		x		
									x								
	x							x		x	x						
											x						

(Plate I, II); cf. — similar; cf. — similar, photographed; x — foraminifers present; other explanations as in Table 1

Rexroad, *Tripodellus* sp. These conodonts belong to the collection of the Lower Silesian Branch of the Polish Geological Institute in Wrocław.

The extent of the stratigraphically significant conodonts has been accepted after H. R. Lane *et al.* (1980), taking into account an occurrence of individual species in the Tournaisian and Visean of southern Poland (Z. Bełka, 1985).

It has been proved by the conodont studies that the gneiss conglomerates from **exposure SG-1** (Fig. 1) were formed not earlier than in the Upper Tournaisian — Tn3a–b. Conodonts typical for the Tournaisian (Tab. 1, samples nos. 286, 286a) were the only ones recorded in the grey micritic limestones which occur as nodules (lithoclasts) in the conglomerates discussed. Among those conodonts the species *Dollymae bouckaerti* Groessens (Pl. III, Figs. 2a, b) appears only in the *cuneiformis* Zone, not being followed by *Polygnathus communis carinus* Hass (Pl. V, Fig. 7a, b). The co-occurrence of *Dollymae bouckaerti* Groessens and *Polygnathus communis carinus* Hass indicates that the limestones, which form the nodules in the conglomerates, formed in the *cuneiformis* Zone. The species *P. triangulus triangulus* (Voges) and *Pseudopolygnathus primus* Branson et Mehl (Pl. V, Fig. 9), known only from older Tournaisian zones, presumably occur in the conodont assemblages in the limestones discussed as redeposited forms, i.e., admixed ones.

In the *anchoralis* Zone, most probably in its middle part, detritic, mostly conglomeratic, limestones were deposited; these are exposed in **section D-2.** In those limestones (sample no. 21) the following conodonts occur together: *Protognathodus cordiformis* Lane, Sandberg et Ziegler (a conodont not known from the upper part of the *anchoralis* Zone), *Gnathodus pseudosemiglaber* Thompson et Fellows (Pl. III, Fig. 7a, b) (which appears a little above the base of that zone), and *Mestognathus beckmanni* Bischoff with a big basal cavity (which, as the transition form from the *M. groessensi* Bełka (Z. Bełka, 1983), may be present in the suggested middle part of the *anchoralis* Zone).

It can be supposed that the tuffs with intercalations of the sandy limestones and concretional limestone nodules present over the detritic limestones in section D-2 originated in the upper part of the *anchoralis* Zone. The specimen of the species *Gn. pseudosemiglaber* Thompson et Fellows (sample no. 21) was extracted from the limestone from one such nodule.

The conglomerates with calcite cement in **section D-3** were formed in the middle part of the *anchoralis* Zone. This fact is evidenced by the co-occurrence of *Gnathodus cuneiformis* Mehl et Thomas (Pl. III, Fig. 3a, b) and *Gn. semiglaber* (Bischoff) (Pl. IV, Fig. 3a, b), determined in sample no. 24, and *Gn. pseudosemiglaber* Thompson et Fellows (Pl. III, Figs. 5a, b, 6a, b).

The deposits exposed in **section D-1** originated in the upper part of the *anchoralis* Zone. The index species (Pl. V, Fig. 10), described from the sandy limestone (Tab. 1, sample 20b), together with *Gnathodus pseudosemiglaber* Thompson et Fellows (Pl. III, Fig. 4) point to the *anchoralis* Zone. Specimens from the species *Mestognathus beckmanni* Bischoff, which occur in the nodular limestone (Tab. 1, sample 20a) together with *Gn. pseudosemiglaber* Thompson et Fellows and with a conodont similar to *Polygnathus bischoffi* Rhodes, Austin et Druce display the features characteristic for the transition forms from *M. groessensi* Bełka, which appear only in the upper part of the *anchoralis* Zone (Z. Bełka, 1983).

In **section D-4**, there occur limestones (sample no. 18) in the form of nodules (lithoclasts) in the gneiss and limestone conglomerates. They were most probably formed in the upper part of the *anchoralis* Zone. They contain *Gnathodus semiglaber* (Bischoff) (Pl. IV, Fig. 6a, b) together with *Polygnathus bischoffi* Rhodes, Austin et Druce, a conodont species known from the upper part of the *anchoralis* Zone in the area of southern Poland (Z. Bełka, 1985). It cannot be exclused, however, that they come from the lower part of the *texanus* Zone, according to the extent of *P. bischoffi* Rhodes, Austin et Druce presented by H. R. Lane *et al.* (1980). In sample no. 18 (Tab. 1), *Polygnathus impar* n. sp. Korn et Luppold occurs with the conodonts listed above.

The species *P. impar* n. sp. Korn et Luppold has been found in Upper Famennian deposits. It can be presumed, however, that its extent reaches at least the end of the Tournaisian. The species *P. impar* n. sp. Korn et Luppold (Pl. V, Fig. 8a–c) also occurs in the conglomerates with calcite cement (sample no. 17), which in the stratigraphic column lie some metres over the gneiss-limestone conglomerates.

The sandy limestones in **section NW-1** and the superimposed nodular limestones were deposited at the end of the *anchoralis* Zone or at the beginning of the *texanus* Zone. In the sandy limestone (sample no. 5), specimens from the species *Mestognathus beckmanni* Bischoff (Pl. V, Fig. 2a–c) with a relatively big basal cavity have been observed. They appear in the phylogenetic development from *M. groessensi* Bełka to *M. beckmanni* Bischoff at the end of the *anchoralis* Zone and do not occur in the upper part of the *texanus* Zone (Z. Bełka, 1983). From the top of the nodular limestone (sample no. 1), together with *Gnathodus pseudosemiglaber* Thompson et Fellows and *Gn. semiglaber* (Bischoff), a conodont form similar to *Polygnathus bischoffi* Rhodes, Austin et Druce has been separated. That conodont, according to its extent in the area of southern Poland, could limit the sedimentation time-span of the limestones analyzed to the *anchoralis* Zone. It should be taken into account, however, that the species *P. bischoffi* Rhodes, Austin et Druce is also known from the lower part of the *texanus* zone (H. R. Lane *et al.*, 1980).

It can be concluded that the nodular limestones from **section SG-2** come from the time interval from the uppermost *anchoralis* Zone to the base of the *texanus* Zone. This is suggested by *Mestognathus beckmanni* Bischoff with a relatively large basal cavity observed in sample no. 3.

The nodular limestones in **section NW-2A** were formed in the lower part of the *texanus* Zone. The conodont with an affinity to *Polygnathus* aff. *bischoffi* Rhodes, Austin et Druce (Pl. V, Fig. 6a, b) occurs in those limestones in sample no. 31 together with *Gnathodus typicus* M2 (Cooper) (Pl. V, Fig. 1a–c), *Gn. pseudosemiglaber* Thompson et Fellows (Pl. IV, Fig. 2a, b), *Gn. semiglaber* (Bischoff) and *Mestognathus beckmanni* Bischoff. Specimens from the species *M. beckmanni* Bischoff from samples nos. 26 and 27 (Pl. V, Fig. 3a, b) have a small basal cavity which points to their origin from deposits not older than the *texanus* Zone. The genera *Gn. typicus* M2 (Cooper) and *P. bischoffi* Rhodes, Austin et Druce limit the time of sedimentation of the limestones analyzed to the lower part of the *texanus* Zone.

Black claystones which overlie the nodular limestones in section NW-2a were also formed in the lower part of the *texanus* Zone. In the nodules within the black limestones at the base of the claystone (sample no. 32a) the following conodonts were found: *Gnathodus pseudosemiglaber* Thompson et Fellows, *Gn. semiglaber* (Bischoff) (Pl. IV, Fig. 6a, b), *Gn. cuneiformis* → *Gn. pseudosemiglaber*, and *Gn. typicus* M2 (Cooper).

The conglomerates with calcite cement from **section NW-2B** originated most probably during the middle of the *texanus* Zone. *Gnathodus semiglaber* → *Gn. texanus* (Pl. IV, Fig. 5a, b) found in sample no. 26 may indicate the lower part of the *texanus* Zone. Its co-existance with *Cavusgnathus* sp. (Pl. III, Fig. 1a–c), however, suggests the middle part of that zone. A representative of *Cavusgnathus* sp. is very similar to *C. convexus* Rexroad, which was discovered by Z. Bełka (1985) in the middle part of the *texanus* Zone. The specimen discussed differs from *C. convexus* Rexroad only with a distinctly bigger last denticle on the anterior part of the carina, the feature, which in turn, indicates the affinity of the form discussed to *C. unicornis* Youngquist et Miller. The conodonts of *Mestognathus beckmanni* Bischoff (Pl. V, Fig. 4a–c) from sample no. 26 display a small basal cavity. This means that even if they do not exclude, they also do not at least indicate the lowermost part of the *texanus* Zone. The species *Gnathodus pseudosemiglaber* Thompson et Fellows (Pl. III, Figs. 8a, b, 9a, b; Pl. IV, Fig. 1a, b), most abundant in the assemblage in sample no. 26, as well as *Gn. semiglaber* (Bischoff) (Pl. IV, Fig. 4a, b) have an extent above the *texanus* Zone, so they cannot increase precision of the above presented conclusion.

Conodonts of biostratigraphic significance have been observed in three cases in **Zdanów IG 1 borehole**.

Fragments of different, not classified into species, conodonts from the genus *Siphonodella* were found in a 2 cm thick radiolarite interlayer in the black claystones at a depth of 1747.2 m. Among the forms discussed, one displays three rostral ridges on the anterior part of the platform (presumably *S. quadruplicata* (Branson et Mehl). The genus *Siphonodella* disappears at the end of the *isostichia*-upper *crenulata* Zone (an equivalent of the *delicatus* Zone), which points to a formation age of the radiolarite not later than in the Middle Tournaisian — Tn2c.

The co-occurrence of the following species: *Cavusgnathus* sp., *Mestognathus beckmanni* Bischoff, *Gnathodus semiglaber* (Bischoff), and *Gn. pseudosemiglaber* Thompson et

Biostratigraphy and distribution of foraminiferal and algal taxa

Taxonomy		Siegle								
		Tn3a – Tn3c						V1a – V2a		
		foraminifera zone								
		Cf2 – Cf3						Cf4		
		depth in m								
		1688.2	1655.7	1647.3	1628.3	1601.3	1596.8	1591.0	1586.8	1572.8
1	2	3	4	5	6	7	8	9	10	11
Foraminifera	*Diplosphaerina inaequalis* (Derville, 1931)				x		x	x		x
	Pachysphaerina pachysphaerica (Pronina, 1963)									
	Bisphaera sp.									
	Parathurammina suleimanovi Lipina, 1949							x		
	Earlandia moderata (Malakhova, 1954)						x	x	x	
	Earlandia minor (Rauser, 1948)							x		
	Earlandia vulgaris (Rauser et Reitlinger, 1937)									
	Lugtonia monilis (Malakhova, 1955)						x	x	x	
	Palaeotextularia sp.							cf.		
	Cribostromum sp.									
	Scalebrina sp.									
	Pseudolituotuba gravata (Conil et Lys, 1965)						x	x	x	cf.
	Brunsia sp.						x	x		
	Archaediscus sp.									
	Tournayella sp.						⊗			
	Septabrunsiina (Spinobrunsiina) implicata (Conil et Lys, 1968)									
	Eotextularia diversa (Tchernysheva, 1948)							cf.	x	
	Pseudotaxis sp.						x	x		
	Tetrataxis sp.						x	x		
	Endothyra laxa Conil et Lys, 1964							cf.		
	Endothyra spira (Conil et Lys, 1964)									
	Endothyra sp.					x	x		x	x
	Endothyra (latiendothyra) sp.									
	Omphalotis minima (Rauser et Reitlinger, 1936)									
	Omphalotis sp.									
	Bessiella sp.							cf.		
	Florenella sp.									
	Granuliferella sp.									
	Endospiroplectammina conili Lipina, 1970							cf.		
	Endospiroplectammina sp.							x		
	Endothyranopsis crassus compressus Rauser et Reitlinger, 1936									
	Endothyranopsis sp.									
	Latiendothyranopsis sp.							x		
	Biseriella sp.							cf.		
	Dainella sp.						x			
	Mediocris mediocris (Vissarionova, 1948)									
	Planoendothyra sp.									

Table 3

in the Lower Carboniferous from the Zdanów IG 1 borehole

Siegle																					
V1a – V2a													V2b								
foraminifera zone																					
Cf4													Cf5								
depth in m																					
1565.8	1560.5	1558.6	1546.2	1350.5	1285.6	1284.8	1253.8	1230.5	1222.5	1219.0	1213.4	1205.8	1186.8	1164.0	1103.4	1085.6	1076.0	985.6	965.3	957.7	956.6
12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33
x	x	x	x		x		x		x		x										
x	cf.	x			x																
				x												x					
			x																		
x		x		x			x				x										
x	x			x	x						x	x									
x																					
						cf.					cf.										
											?										
											cf.										
				cf.			x	x	x		x								x		
x							x				x	x									
					cf.		x	?	x	x	x	x	x	cf.	x	cf.	x	cf.	x	x	cf.
											?										
⊗																					
x				cf.	cf.	x	x				x	x									
x					x																
x	x			x	x	x															
	⊗																				
											aff.										
x	x	x		cf.	x	x	x	x	x	x	x	x	x	cf.	cf.	x	x		x	x	x
	cf.	cf.				x															
x		cf.																			
		cf.				x			?		?										
												x									
	x				x																
x																					
		x																			
									aff.								cf.	aff.			
									x											cf.	cf.
																x					
x																					
cf.	cf.																				
								cf.		cf.			x								
				x		cf.															

1	2	3	4	5	6	7	8	9	10	11
Foraminifera	*Loeblichia* sp.									
	Eostaffella sp.									
	Eoparastaffella sp.									
Algae	*Girvanella problematica* Nicholson et Etheridge, 1880				x		x	x	x	
	Solenoporaceae	x	x	x			x			
	Kamaena sp.									
	Principia donbasica (Kosenko, 1972)									
	Quasiumbella sp.							x		
	Rodophyta							x		

⊗ — foraminifers photographed (Plate I); aff. — related; other explantations as in Table 1 and 2

Fellows, described from the grey bioclastic limestone at a depth of 1565.8 m, is the evidence for the formation of the rock in the *texanus* Zone. One specimen from the species *M. beckmanni* Bischoff has a basal cavity as small as that of the conodonts that only appear in the zone discussed (Z. Bełka, 1985). The form of *Cavusgnathus*, similar to *C. unicornis* Youngquist et Miller owing to its bigger tooth on the frontal part of the carina and identical to *C. convexus* Rexroad in the other structural details, may indicate that the limestones under discussion were deposited not earlier than in the middle of the *texanus* Zone. Z. Bełka (*op. cit.*) observed *C. convexus* Rexroad in this interval in the Moravian-Silesian Basin.

The bioclastic limestone, which forms an interlayer at a depth of 1558.6 m, contains a specimen from the genus *Gnathodus* unidentified to species. Based on that fact, it can only be concluded that the limestone formed not earlier than in the *delicatus* Zone, i.e., not earlier than in the Middle Tournaisian.

The conodonts of a very wide stratigraphic range or totally unsuitable for age determinations were found in some cases in borehole Zdanów IG 1. They correspond to specimens from the genera *Hindeodella* and *Polygnathus*, not identified to species, which come from the grey claystones at a depth of 1544.5 m. Also, the badly preserved, totally unidentified conodonts in the claystones at depths of 1441.0 and 1743.5 m as well as in the matrix of the tuffite breccia at a depth of 1735.2 m, belong to that group.

THE AGE BASED ON FORAMINIFERA

Foraminifers have been observed in thin sections of limestones and clastic deposits from the outcrops between Nowa Wieś and Srebrna Góra as well as from borehole Zdanów IG 1.

Table 2 presents foraminifers and algae identified in the deposits from outcrops NW-1, NW-2, SG-1, and SG-2 (Fig. 1) together with the limits of the zones based on the material analyzed. The limestones that occur as nodules (lithoclasts) in gneiss conglomerates from outcrop SG-1 are considered oldest. Those rocks were formed in the lower part of the Upper

Tab. 3 continued

12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33
						x		?													
				cf.	cf.	cf.					x			x							
					cf.																
											x	x							x		
x			cf.	x	x	x	x	x	x		x	x				x		x	x		x
		x		x			x			x	x										
	cf.																				
			cf.																		
x																					

Tournaisian (Cf2). Deposits of the Nowa Wieś Formation from outcrops NW-1, NW-2, and SG-2 originated during the time interval from the Lower to the Middle Visean (Cf4).

In Table 3, documentary material from borehole Zdanów IG 1 has been compiled. Data come from samples from a depth of 956.6 to 1688.2 m. Table 4 presents the biostratigraphic position of the deposits from different depth intervals. It has been found that the limestones from a depth of 1586.8–1596.8 m represent subzone *Lugtonia monilis* Cf4α1, which corresponds to the uppermost Tournaisian (R. Conil *et al.*, 1989). The species *Lugtonia monilis* (Malakhova), which has a narrow stratigraphic extent (R. Conil *et al.*, 1980, Fig. 4), occurs in those limestones together with *Pseudolituotuba gravata* (Conil et Lys), *Endospiroplectammina conili* Lipina, and with unidentified forms of Tournayellidae.

In the limestones sampled at a depth of 1558.6–1565.8 m, the following foraminifers have been identified: *Omphalotis minima* (Rauser et Reitlinger), *Granuliferella* sp., *Septabrunsiina* (*Spinobrunsiina*) *implicata* (Conil et Lys), *Endothyra laxa* Conil et Lys and *Dainella* sp., which document Cf4α_2, i.e., the lowermost Visean.

It can be concluded, based on the foraminifers identified in the clastic deposits, that the rock sequences from a depth interval of 1205.8–1546.2 m represent the Lower and Middle Visean, including Zone Cf4. The following foraminifers of peculiar biostratigraphic significance have been found in the deposits discussed: *Eotextularia diversa* (Tchernysheva), *Earlandia minor* (Rauser), *Endothyra spira* (Conil et Lys), *Bessiella* sp., *Eoparastaffella* sp., and unidentified specimens from the group of primitive Archaediscidae.

Deposits at a depth of 956.6–1186.8 m were formed in the lower part of Zone Cf5, i.e., in the Middle Visean. The species *Pseudolituotuba gravata* (Conil et Lys) and *Mediocris mediocris* (Vissarionova) are stratigraphically the most important. In the abundant Archaediscidae group, no specimens were found that are similar to the forms characteristic for the uppermost part of Zone Cf5. The total absence of specimens from the Neoarchaediscidae group excludes Upper Visean sedimentation of the deposits under discussion.

Table 4

Biostratigraphy on the base of foraminifers (the Zdanów IG 1 borehole)

Series	Siegle	Foraminifera zone		Depth in m			
				1596.8-1586.8	1565.8-1558.6	1546.2-1205.8	1186.8-956.6
VISEAN	V3a	Cf5					
	V2b						
	V2a	Cf4	δ				
	V1b		γ				
			β				
	V1a		α2				
TOURNA-ISIAN	Tn3c	Cf3	α1				
	Tn3b	Cf2					
	Tn3a						
	Tn2c		γ				

BIOSTRATIGRAPHIC CONCLUSIONS BASED ON THE ANALYSIS OF CORALS IN THE BOREHOLE ZDANÓW IG 1

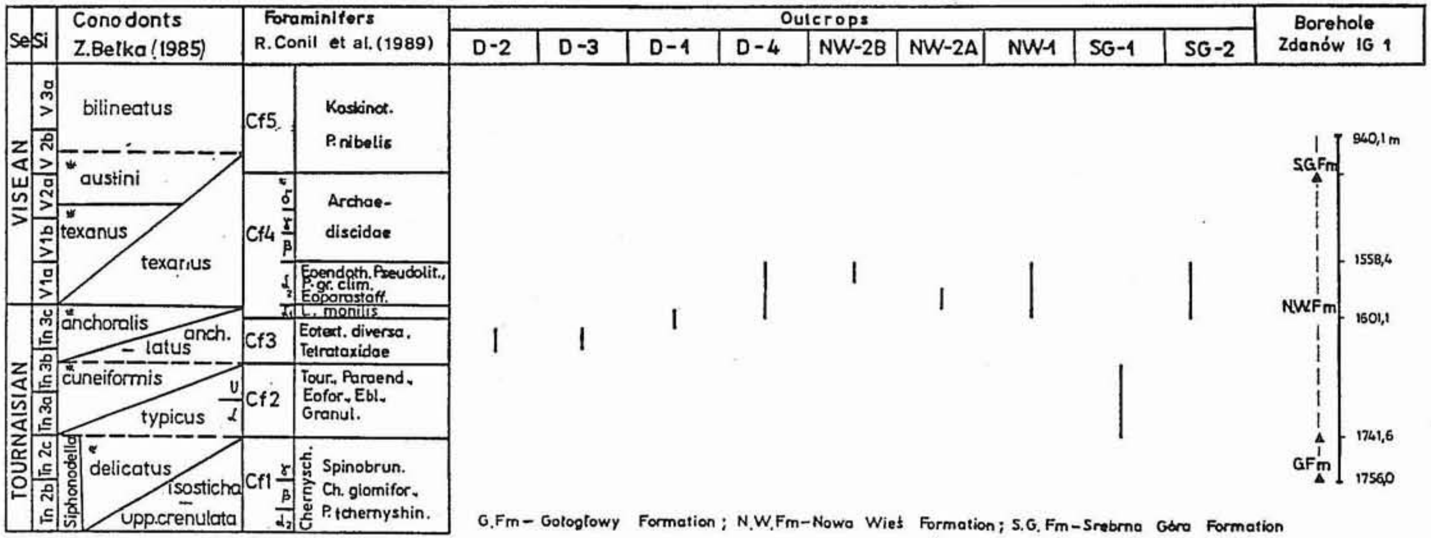
Individual corals were found in the limestone deposits and gneiss sandstones composing the series at a depth of 1544.9–1674.8 m and in lithic sandstones from a depth interval of 1213.4–1213.7 m (Fig. 2). The specimens collected lack many important details, so they cannot be identified to species. The specimens from the limestone conglomerate (Pl. VI, Fig. 4) and from the bioclastic limestone (Pl. VI, Fig. 5) from depths of 1572.9 and 1592.6 m were even not classified to genus. J. Fedorowski reports the names of the specimens as questionable. The extremely controversial cases should be treated very carefully (Pl. VI, Figs. 1, 8).

The analyzed corals, except for the specimen classified as *?Schindewolfia*, are of the Lower Carboniferous age.

Three specimens represent the genus *Rylstonia* (Pl. VI, Figs. 2, 3, 6) known from the Upper Tournaisian to the end of the Visean. These specimens are morphologically primitive — they possibly have not formed a dissepimentarium yet. They may be from, therefore, the

Table 5

Stratigraphic position of the Lover Carboniferous sediments of the Dzikowiec – Nowa Wieś – Srebrna Góra area and of the Zdanów IG 1 borehole



G.Fm – Gołogłowy Formation ; N.W.Fm – Nowa Wieś Formation ; S.G.Fm – Srebrna Góra Formation

Upper Tournaisian or the Lower Visean. It cannot be excluded that they are older than the Upper Tournaisian species *R. smythi* Weyer.

The genus *Cyathaxonia* has a stratigraphic extent from the Upper Famennian to the Permian. The specimen analyzed (Pl. VI, Fig. 7) displays a primitive character and can be classified as a Lower Carboniferous variety.

The genus *Rotiphyllum* is known from the Visean. The specimen classified to this genus (Pl. VI, Fig. 1), therefore, may indicate the Visean.

It can be concluded in a recapitulation of the biostratigraphic remarks that the deposits from a depth interval of 1558.6–1599.3 m, in which the primitive forms *Rylstonia* and *Cyathaxonia* were found, were formed in the time interval from the Upper Tournaisian to the Lower Visean (but not the Upper Visean). In the Visean, most probably the lower part, deposits formed which contain one specimen classified as the genus *Rotiphyllium* (?) (depth of 1213.7 m).

The coral determined as ?*Schindewolfia* may represent another genus. The genus *Schindewolfia* is known from the Upper Silurian to the Lower Devonian. At the present state of knowledge on the sedimentary sequences of the Góry Bardzkie Mts. there is no proof for the suggestion that the coral occurs in the Visean sandstones as a bioclast in a secondary deposit. We do not know, namely, the Upper Silurian-Lower Devonian deposits, which could have supplied these corals due to erosion.

BIOSTRATIGRAPHIC POSITION OF THE ROCK SERIES ANALYZED

The development of the rock series from the Nowa Wieś Formation and of the flysch from the Srebrna Góra Formation occurred in the time interval from the Upper Tournaisian to the Lower Visean. The biostratigraphic conclusions drawn based on the conodonts and the foraminifers are concordant and remain in agreement with those based on the analysis of corals.

The Nowa Wieś Formation has been recognized in total, in the section of borehole Zdanów IG 1 (Fig. 2, Tab. 5). Its formation began in the Upper Tournaisian since black schists from the Gołogłowy Formation occur at its base. In section Zdanów IG 1 (Fig. 2), the schists form the upper part of the *isosticha*-upper *crenulata* Zone (tn2c — M. Chorowska *et al.*, 1992). The conodonts, foraminifers, and corals found in the lower part of the Nowa Wieś Formation (depths from 1601.1 to 1741.6 m) do not allow determination of the biostratigraphic position in detail. The normal sequence of the layers, however, indicates that the deposits were formed in the Upper Tournaisian (from *cuneiformis* Zone to the lower part of *anchoralis* Zone). The carbonate deposits (the so-called Lower Carboniferous limestone), which occur in the borehole section at a depth interval of 1558.4–1601.1 m were formed from the end of the Upper Tournaisian (Tn3c, Cf4α_1, the upper part of the *anchoralis* Zone) through the lower part of the Lower Visean (V1a, Cf4α_2, the lower part of the *texanus* Zone in the classification of Z. Bełka). It can be presumed that the deposits from the depth of 1544.9–1558.4 m, with the characteristic interlayers of the radiolarian claystones and spongiolites, were formed in the upper part of the *texanus* Zone. Sedimentation of the rock series with abundant pyroclastic rocks, which represent the upper units of the Nowa Wieś Formation (depth of 1257.9–1544.9 m), most probably was completed in the lower part of the Middle Visean (V2a, Cf4δ). At the boundary of the V2a and V2b Zones, sedimentation of the flysch of the Srebrna Góra Formation began; it finished in the uppermost part of the Middle Visean (V2b, Cf5 — lower part).

From the outcrops in the Dzikowiec, Nowa Wieś, and Srebrna Góra regions we know only fragments of the Nowa Wieś Formation. The oldest deposits analyzed are the gneiss conglomerates from outcrop SG-1 (Tab. 5). They were deposited not earlier than in the *cuneiformis* Zone (Tn3a-Tn3b) since they contain lithoclasts of the limestones from that zone. The conglomerates are nearly contemporary with the limestones, which were transported as debris from the shallow zone to the deeper parts of the shelf during episodic gravity flows (A. Głuszek and A. Tomaś, 1992, pointed to repeated disturbances of the biogenic sedimentation and nearly simultaneous formation of the coarse-grained deposits in the deeper parts of the shelf). It cannot be excluded that these conglomerates are equivalent to the gneiss conglomerates, which occur in borehole Zdanów IG 1 at a depth of 1633.9–1641.8 m.

The carbonate deposits, present on the surface, were formed in the time interval from the upper part of the Upper Tournaisian (Tn3c, upper part of the *anchoralis* Zone) through the lower part of the Lower Visean (V1a, approximately the middle of the *texanus* Zone). It can be concluded, based on the conodonts, that the limestones exposed in Dzikowiec on the eastern slope of Wapnica Hill were the first deposits formed. The rocks come from the *anchoralis* Zone, from its middle part in outcrops D-2 and D-3 and from the uppermost part in exposure D-1. The limestones exposed north of Dzikowiec village (D-4) and in the Nowa Wieś and Srebrna Góra regions represent the interval that covers the uppermost Upper Tournaisian (tn3c — top part, upper part of the *anchoralis* Zone) and the lower part of the Lower Visean (V1a, approximately half of the *texanus* Zone). The biostratigraphic position of those deposits is identical with the position of the equivalent rocks from borehole Zdanów IG 1 from a depth of 1558.7–1601.1 m. The age of the rock series has been in most details determined from outcrops NW-2A and NW-2B, where subsequently there occur deposits of the lower part and approximately the middle of the *texanus* Zone. It is not excluded that formation of the deposits in outcrops D-4, NW-1, and SG-2 is also limited only to the *texanus* Zone.

GENERAL REMARKS

The Nowa Wieś and the Srebrna Góra Formations belong to the autochthonous unit of the Góry Bardzkie Mts. (B. Wajsprych, 1986). According to the material presented above, sedimentation of the flysch part of the Srebrna Góra Formation was finished in the Lower Visean. It can also be presumed that in that stratigraphic unit the olistostrome deposits of the formation discussed were formed. It can be further concluded that the Middle and Upper Visean sedimentation of the younger lithostratigraphic units of the Bardo autochton took place. B. Wajsprych (*op. cit.*) distinguished there: the Orzech sequence, the Paprotnia Series, the Wilcza Conglomerate Formation and the Włóczek Series (M. Chorowska, B. Wajsprych, *in press*). Deposits from the time interval from the uppermost Visean to the Early Namurian (A. Bossowski, S. Jachowicz, 1987) probably limit sedimentation in the marine basin of the Middle Sudetes, the Bardo structure being a part of the mountains.

Clastic and carbonate deposits of the Wapnica Formation begin development of the autochthonous unit of the Góry Bardzkie Mts., both in the section of borehole Zdanów IG 1 and in the Dzikowiec region. Black schists of the Gołogłowy Formation are overlain by deposits of the Nowa Wieś Formation. A conclusion on parautochthonous sliding in borehole Zdanów IG 1 (M. Chorowska *et. al.*, 1986) is, therefore, incorrect. That conclusion has already been shaken owing to a description of the Famennian and Tournaisian deposits from the same section (M. Chorowska *et al.*, 1992).

Translated by Katarzyna Jarmołowicz-Szulc

Oddział Dolnośląski
Państwowego Instytutu Geologicznego
Wrocław, al. Jaworowa 19
Zakład Petrografii i Geochemii
Państwowego Instytutu Geologicznego
Warszawa, ul. Rakowiecka 4
Received: 16.11.1993

REFERENCES

BEŁKA Z. (1983) — Evolution of the Lower Carboniferous conodont genus Mestognathus. Acta Geol. Pol., **33**, p. 73–84, no. 1–4.

BEŁKA Z. (1985) — Lower Carboniferous conodont biostratigraphy in the northeastern part of the Moravia–Silesia Basin. Acta Geol. Pol., **35**, p. 33–60, no. 1–2.

BOSSOWSKI A., JACHOWICZ S. (1987) — Granica namur/wizen w Dolnośląskim Zagłębiu Węglowym w świetle wyników wiercenia otworu Dzikowiec IG 1. Mat. X Symp. nt: "Geologia formacji węglonośnych Polski — formacja karbońska". Wyd. AGH. Kraków.

CHOROWSKA M. (1972) — Stratygrafia wapienia węglowego Gór Bardzkich na podstawie konodontów. Arch. Państw. Inst. Geol. Wrocław.

CHOROWSKA M. (1973) — Stratygrafia wapienia węglowego Gór Bardzkich na podstawie konodontów. Kwart. Geol., **17**, p. 917–918, no. 4.

CHOROWSKA M., RADLICZ K. (1984) — Carboniferous limestones and conglomerates in western part of Bardo structure (in Polish with English summary). Kwart. Geol., **28**, p. 251–290, no. 2.

CHOROWSKA M., WAJSPRYCH B. (*in press*) — Lower Carboniferous of the Bardo Mts. Unit.

CHOROWSKA M., FEDOROWSKI J., RADLICZ K. (1992) — Famennian and Tournaisian deposits from the Zdanów IG 1 borehole (Sudetes). Geol. Quart., **36**, p. 1–32, no. 1.

CHOROWSKA M., MILEWICZ J., RADLICZ K. (1986) — Preliminary results of borehole Zdanów IG 1 (in Polish with English summary). Prz. Geol., **34**, p. 596–597, no. 10.

CONIL R., GROESSENS E., LALOUX M., POTY E. (1989) — La limite tournaisian /visean dans la region — type. Ann. Soc. Geol. Belg., **112**, p. 177–189, no. 1.

CONIL R., GROESSENS E., LALOUX M., POTY E., TOURNEUR F. (1990) — Carboniferous guide Foraminifera, Corals and Conodonts in the Franco-Belgian and Campine Basins: their potential for widespread correlation. Courier Forsch.-Inst. Senckenberg, **130**, p. 15–30.

GŁUSZEK A., TOMAŚ A. (1992) — Age of the Nowa Wieś Formation (Bardzkie Mts., Middle Sudetes, SW Poland). Ann. Soc. Geol. Pol., **62**, p. 293–306, no. 3–4.

GÓRECKA T., MAMET B. (1970) — Sur quelques microfacies carbonates paleozoiques des Sudetes polonaises (Monts de Bardo). Rev. Micropaleont., **13**, p. 155–164, no. 3.

HAYDUKIEWICZ J. (1986) — Stratigraphy of the Carboniferous deposits in northern part of the Góry Bardzkie, Sudetes. Geol. Sudetica, **21**, p. 143–147, no. 2.

LANE H. R., SANDBERG Ch. A., ZIEGLER W. (1980) — Taxonomy and phylogeny of some Lower Carboniferous conodonts and preliminary standard post — Siphonodella zonation. Geol. Palaeont., **14**, p. 117–164.

OBERC J. (1987) — Struktura bardzka jako reper rozwoju waryscydów wschodniej części Sudetów Zachodnich i ich przedpola. In: Przew. 58 Zjazdu Pol. Tow. Geol. Wałbrzych 17–19 września 1987, p. 165–180. Wyd. AGH. Kraków.

PAECKELMANN W. (1930) — Die Fauna des deutschen Unterkarbons. Abh. Preuss. Geol. L.A.N.F., **122**, Teil 2.

PAECKELMANN W. (1931) — Die Fauna des deutschen Unterkarbons. Abh. Preuss. Geol. L.A.N.F., **136**, Teil 2.

WAJSPRYCH B. (1978) — Allochthonous Paleozoic rocks in the Visean of the Bardzkie Mts. (Sudetes) (in Polish with English summary). Rocz. Pol. Tow. Geol., **48**, p. 99–121, no. 1.

WAJSPRYCH B. (1979) — Sedymentacja osadów dolnego karbonu północnej części Gór Bardzkich i jej tektoniczna interpretacja. Arch. Inst. Nauk Geol. PAN. Warszawa.

WAJSPRYCH B. (1980) — Sedymentacja utworów dolnego karbonu w północnej części Gór Bardzkich a problem allochtonizmu. In: Rozwój struktury bardzkiej w świetle nowych badań stratygraficznych, sedymentologicznych i tektonicznych. Mat. Konf. Teren., Srebna Góra, 20–21 września 1980, p. 76–85; 129–134. Wyd. UWr. Wrocław.

WAJSPRYCH B. (1986) — Sedimentary record of tectonic activity on a Devonian-Carboniferous continental margin, Sudetes. In: IAS 7th European Regional Meeting; Excursion Guidebook, Kraków — Poland, p. 141–164. Ossolineum. Wrocław.

ŻAKOWA H. (1963) — Stratigraphy and facial extents of the Lower Carboniferous in Sudetes (in Polish with English summary). Kwart. Geol., **7**, p. 73–94, no. 1.

Maria CHOROWSKA, Krzysztof RADLICZ

REWIZJA WIEKU UTWORÓW KARBONU DOLNEGO W PÓŁNOCNEJ CZĘŚCI GÓR BARDZKICH (SUDETY)

Streszczenie

W artykule przeanalizowano wiek zlepieńców i piaskowców gnejsowych i gnejsowo-wapiennych oraz wapieni, wchodzących w skład formacji (bądź sekwencji) Nowej Wsi (fig. 1) — B. Wajsprych (1978, 1979, 1980, 1986). W profilu otworu Zdanów IG 1 (fig. 2) jest też rozpatrywany wiek wyższej części formacji Nowej Wsi (nie znanej z odsłonięć powierzchniowych w rejonie Dzikowca, Nowej Wsi i Srebrnej Góry) oraz fliszowej części formacji Srebrnej Góry (czyli serii Srebrnej Przełęczy — B. Wajsprych, 1986).

W wyniku rewizji oznaczeń i zasięgów stratygraficznych konodontów i otwornic wykazano, że utwory formacji Nowej Wsi powstawały od turneju górnego po wizen dolny, a sedymentacja fliszowych osadów formacji Srebrnej Góry trwała co najwyżej do wyższej części wizenu środkowego.

Ustalone datowanie utworów formacji Nowej Wsi potwierdza wniosek W. Paeckelmanna (1930, 1931), częściowo T. Góreckiej i B. Mameta (1970) oraz M. Chorowskiej (1972, 1973) i jest zgodne z datowaniem A. Głuszka i A. Tomaś (1993), natomiast przeczy wnioskom o górnowizeńskim (M. Chorowska, K. Radlicz, 1984), a częściowo i dolnonamurskim (J. Haydukiewicz, 1986) wieku omawianych utworów.

Konodonty i otwornice (tab. 1–3) stanowią podstawę zgodnych względem siebie wniosków biostratygraficznych, które są zbieżne z wnioskami z analizy koralowców opracowanych przez J. Fedorowskiego.

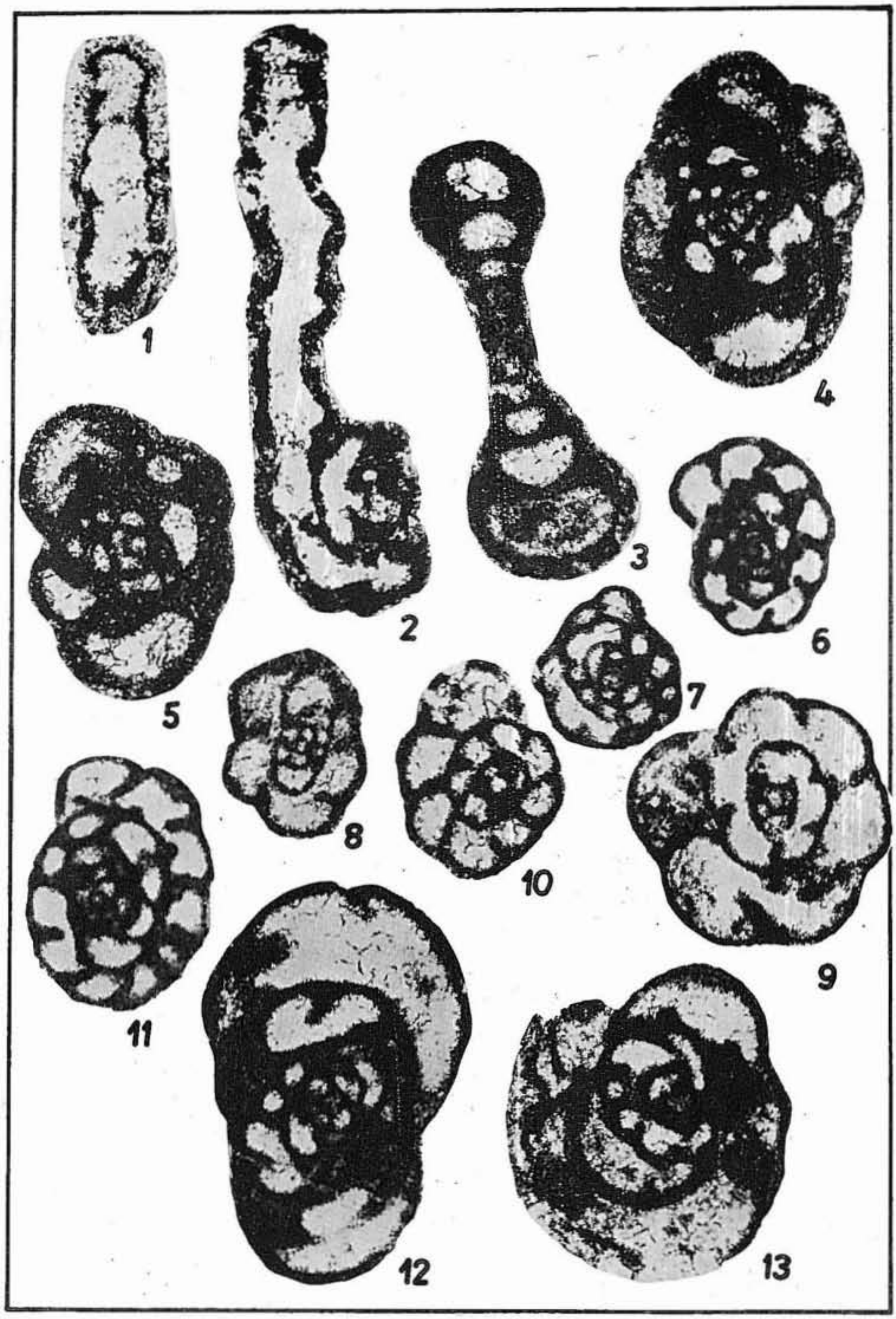
Biostratygrafię wyższej części formacji Nowej Wsi oraz fliszu formacji Srebrnej Góry ustalono głównie na podstawie otwornic (tab. 4).

Formacje Nowej Wsi i Srebrnej Góry wchodzą w skład jednostki autochtonicznej Gór Bardzkich (B. Wajsprych, 1986). W wizenie środkowym i górnym powstały młodsze jednostki litostratygraficzne autochtonu bardzkiego (M. Chorowska, B. Wajsprych, w druku).

W profilu otworu Zdanów IG 1, podobnie jak w innych częściach jednostki autochtonicznej Gór Bardzkich, obserwuje się od dołu ku górze kolejno utwory formacji Wapnicy, formacji Nowej Wsi i formacji Srebrnej Góry. Błędny jest zatem wniosek o występowaniu w profilu otworu Zdanów IG 1 pokryw ześlizgowych (M. Chorowska i in., 1986), co wykazała już dokumentacja utworów famenu i turneju z tego profilu (M. Chorowska i in., 1992).

PLATE I

Fig. 1. *Paracaligella* sp.
NW-1 outcrop, sample no. 4
Fig. 2. *Lituotubella glomospiroides* Rauser-Chernousova
NW-1 outcrop, sample no. 4
Fig. 3. *Tournayella* sp.
Zdanów IG 1 borehole, depth of 1596.8 m
Figs. 4, 5. *Septabrunsiina* (*Spinobrunsiina*) *implicata* (Conil et Lys)
Fig. 4 — NW-1 outcrop, sample no. C46; Fig. 5 — Zdanów IG 1 borehole, depth of 1565.8 m
Figs. 6, 7. *Septabrunsiina* (*Spinobrunsiina*) sp.
Fig. 6 — NW-1 outcrop, sample no. C47; Fig. 7 — SG-2 outcrop, sample no. C49
Fig. 8. cf. *Endothyra laxa* Conil et Lys
NW-2 outcrop, sample no. C36
Fig. 9. *Endothyra laxa* Conil et Lys
Zdanów IG 1 borehole, depth of 1560.5 m
Fig. 10. *Endothyra* sp.
NW-1 outcrop, sample no. C46
Fig. 11. *Spinoendothyra* sp.
NW-1 outcrop, sample no. C46
Figs. 12, 13. *Bessiella* sp.
NW-1 outcrop, sample no. C46; Fig. 12 — specimen no. 1; Fig. 13 — specimen no. 2

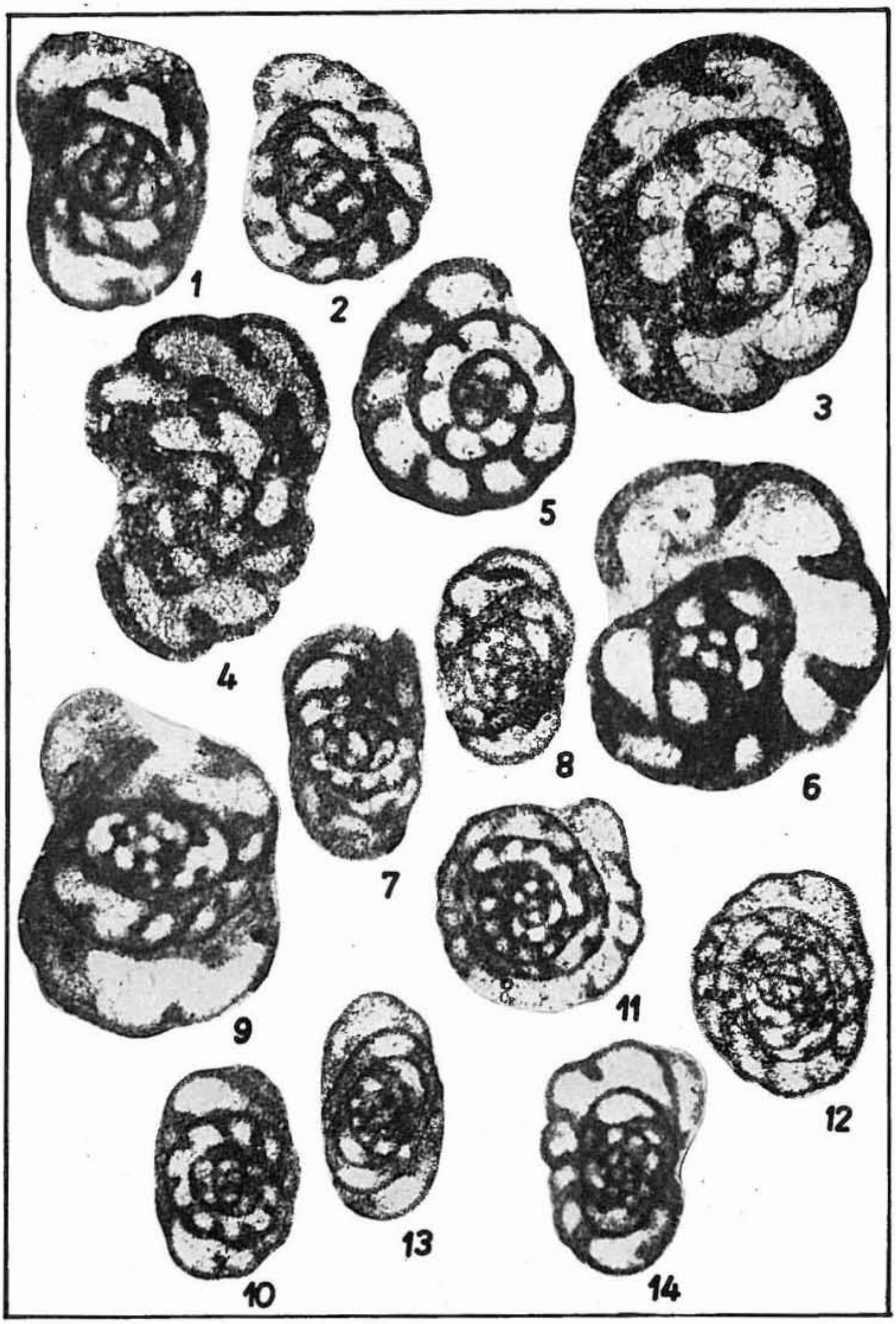


Krzysztof RADLICZ, Maria CHOROWSKA — Revision of the age of the Lower Carboniferous deposits in the northern part of the Góry Bardzkie (Sudetes)

PLATE II

Figs. 1, 2. *Florenella* sp.
Fig. 1 — sample no. C47; Fig. 2 — sample no. C46
Fig. 3. *Globoendothyra* sp.
Sample no. C46
Fig. 4. *Paraendothyra cummingsi* (Conil et Lys)
Sample no. C45
Fig. 5. *Endothyranopsis* sp.
Sample no. C46
Fig. 6. *Latiendothyranopsis* sp.
Sample no. C47
Fig. 7. *Dainella chomatica* (Dain)
Sample no. C46
Figs. 8–10. *Dainella* sp.
Fig. 8 — sample no. 4; Fig. 9 — sample no. C46; Fig. 10 — sample no. C30
Figs. 11, 12. *Lysella* sp.
Fig. 11 — sample no. C38; Fig. 12 — sample no. 31
Fig. 13. *Endostaffella parva* (Moeller)
Sample no. C42
Fig. 14. *Endostaffella* sp.
Sample no. C47

Figs. 1–9, 13, 14 — NW-1 outcrop, Figs. 10–12 — NW-2 outcrop



Krzysztof RADLICZ, Maria CHOROWSKA — Revision of the age of the Lower Carboniferous deposits in the northern part of the Góry Bardzkie (Sudetes)

PLATE III

Fig. 1. *Cavusgnathus* sp.

a — upper (góra), b — lower (dół), c — outer side (strona zewnętrzna); NW-2B outcrop, sample no. 26

Fig. 2. *Dollymae bouckaerti* Groessens

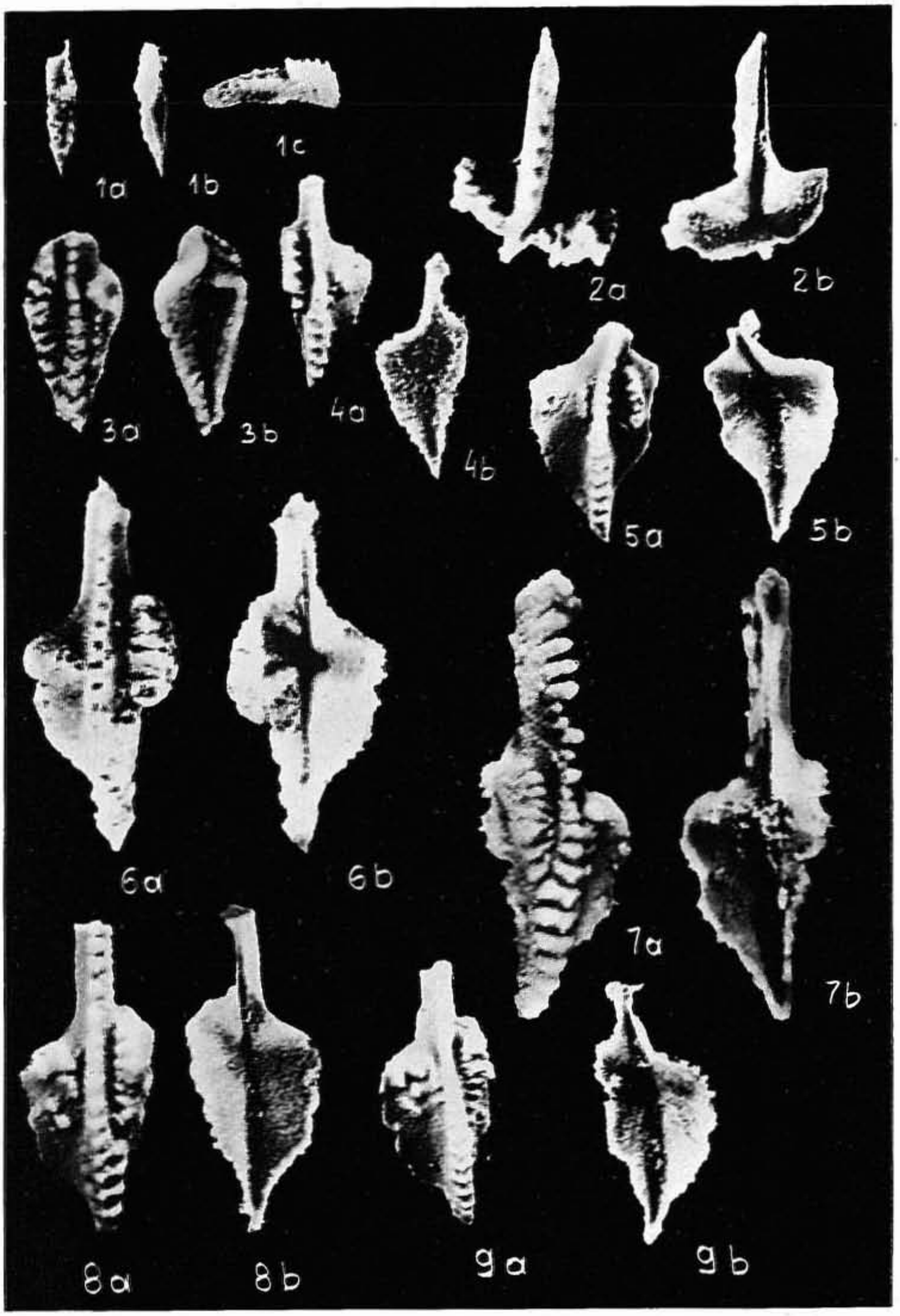
a — upper (góra), b — lower (dół); SG-1 outcrop, sample no. 286*

Fig. 3. *Gnathodus cuneiformis* Mehl et Thomas

a — upper (góra), b — lower (dół); D-3 outcrop, sample no. 24

Figs. 4–9. *Gnathodus pseudosemiglaber* Thompson et Fellows

a — upper (góra), b — lower (dół); Fig. 4 — D-1 outcrop, sample no. 20b; Fig. 5 — D-3 outcrop, sample no. 24, specimen no. 1; Fig. 6 — D-3 outcrop, sample no. 24, specimen no. 2; Fig. 7 — D-2 outcrop, sample no. 21; Fig. 8 — NW-2B outcrop, sample no. 26, specimen no. 2; Fig. 9 — NW-2B outcrop, sample no. 26, specimen no. 3

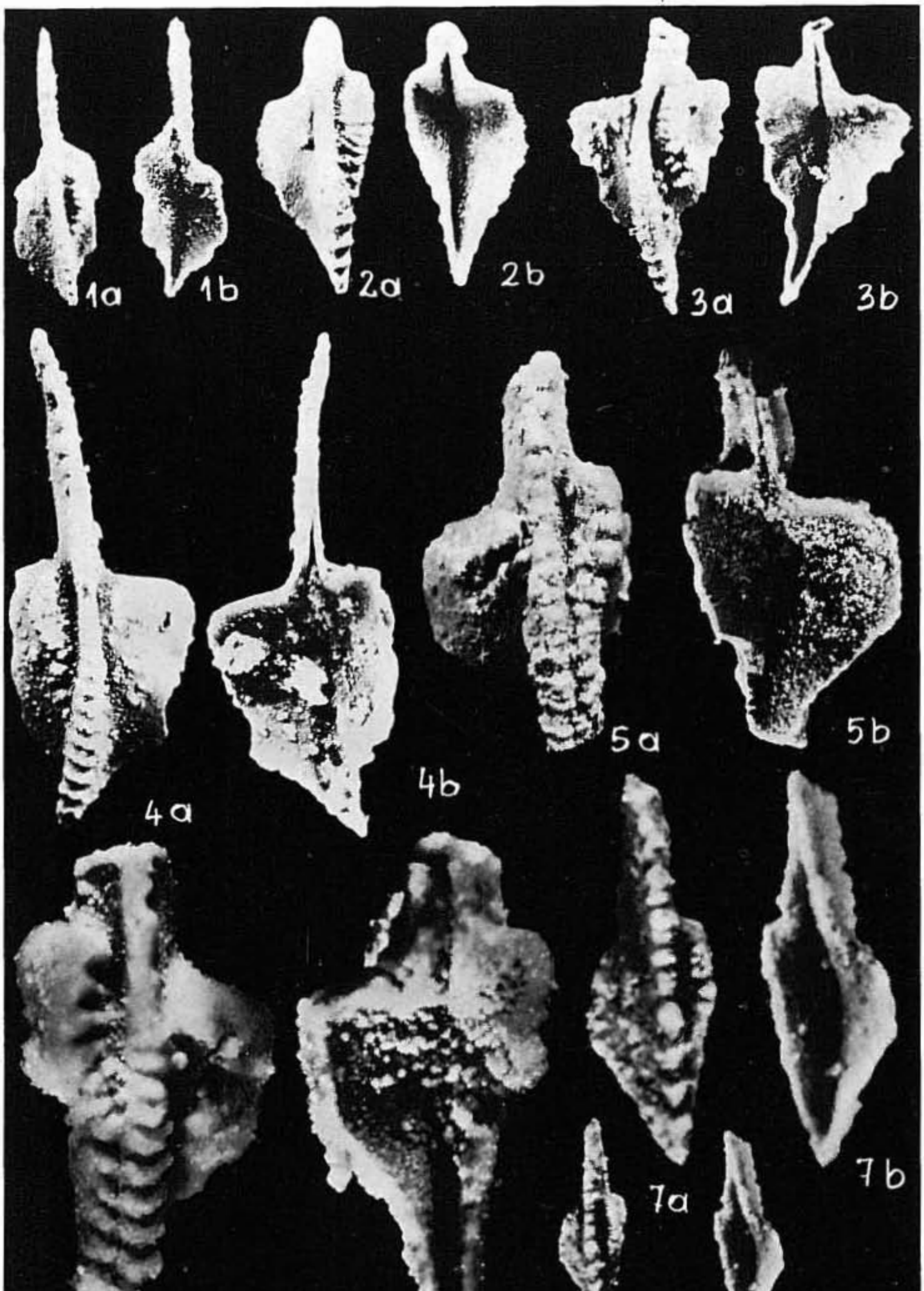


Krzysztof RADLICZ, Maria CHOROWSKA — Revision of the age of the Lower Carboniferous deposits in the northern part of the Góry Bardzkie (Sudetes)

PLATE IV

Figs. 1, 2. *Gnathodus pseudosemiglaber* Thompson et Fellows
Fig. 1 — NW-2B outcrop, sample no. 26, specimen no. 4; Fig. 2 — NW-2A outcrop, sample no. 31
Figs. 3, 4. *Gnathodus semiglaber* (Bischoff)
Fig. 3 — D-3 outcrop, sample no. 24; Fig. 4 — NW-2B outcrop, sample no. 26
Fig. 5. *Gnathodus semiglaber* → *Gnathodus texanus*
NW-2B outcrop, sample no. 26
Fig. 6. *Gnathodus semiglaber* (Bischoff)
NW-2A outcrop, sample no. 32a*
Fig. 7. *Gnathodus typicus* M2 (Cooper)
D-2 outcrop, sample no. 21
Fig. 8. *Gnathodus typicus* M2 (Cooper)
D-2 outcrop, sample no. 21

In all Figures: a — upper, b — lower
Na wszystkich figurach: a — góra, b — dół



Krzysztof RADLICZ, Maria CHOROWSKA — Revision of the age of the Lower Carboniferous deposits in the northern part of the Góry Bardzkie (Sudetes)

PLATE V

Fig. 1. *Gnathodus typicus* M2 (Cooper)

a — upper (góra), b — inner side (strona wewnętrzna), c — lower, oblique view from the outer side (dół, widok skośny od strony zewnętrznej); NW-2A outcrop, sample no. 31

Figs. 2–4. *Mestognathus beckmanni* Bischoff

Fig. 2 : a — upper (góra), b — lower (dół), c — inner side (strona wewnętrzna), NW-1 outcrop, sample no. 5; Fig. 3: a — upper (góra), b — inner side (strona wewnętrzna), NW-2A outcrop, sample no. 27; Fig. 4: a — upper (góra), b — lower (dół), c — inner side (strona wewnętrzna), NW-2B outcrop, sample no. 26

Fig. 5. *Polygnathus bischoffi* Rhodes, Austin et Druce

a — upper (góra), b — lower (dół); D-4 outcrop, sample no. 18

Fig. 6. *Polygnathus* aff. *bischoffi* Rhodes, Austin et Druce

a — upper (góra), b — lower (dół); NW-2A outcrop, sample no. 31

Fig. 7. *Polygnathus communis carinus* Hass

a — upper (góra), b — lower (dół); SG-1 outcrop, sample 286a*

Fig. 8. *Polygnathus impar* n. sp. Korn et Luppold

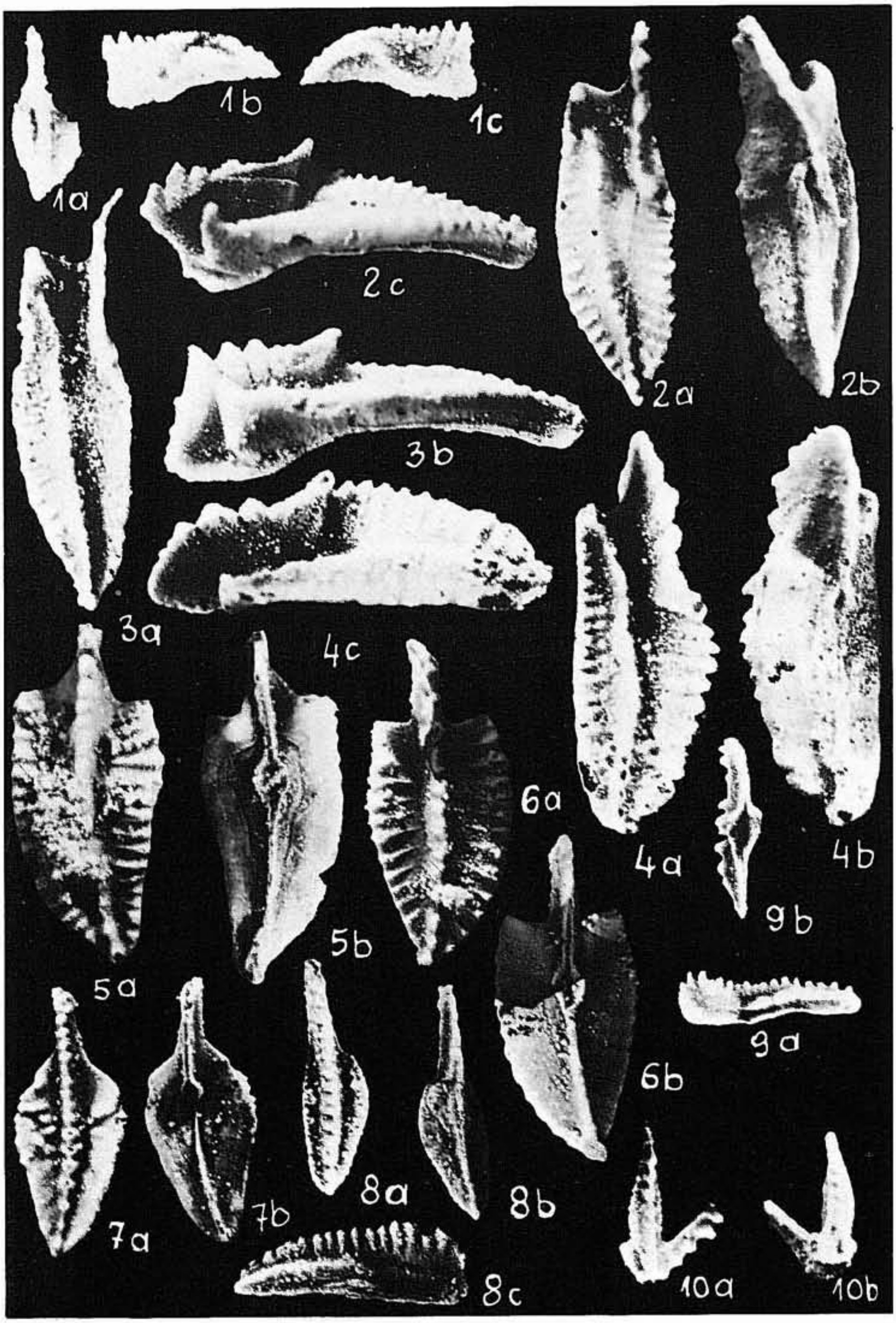
a — upper (góra), b — lower (dół), c — inner side (strona wewnętrzna); D-4 outcrop, sample no. 17

Fig. 9. *Pseudopolygnathus primus* Branson et Mehl

a — inner side (strona wewnętrzna), b — lower (dół); SG-1 outcrop, sample no. 286*

Fig. 10. *Scaliognathus anchoralis europensis* Lane et Ziegler

a — upper (góra), b — lower (dół); D-1 outcrop, sample no. 20b

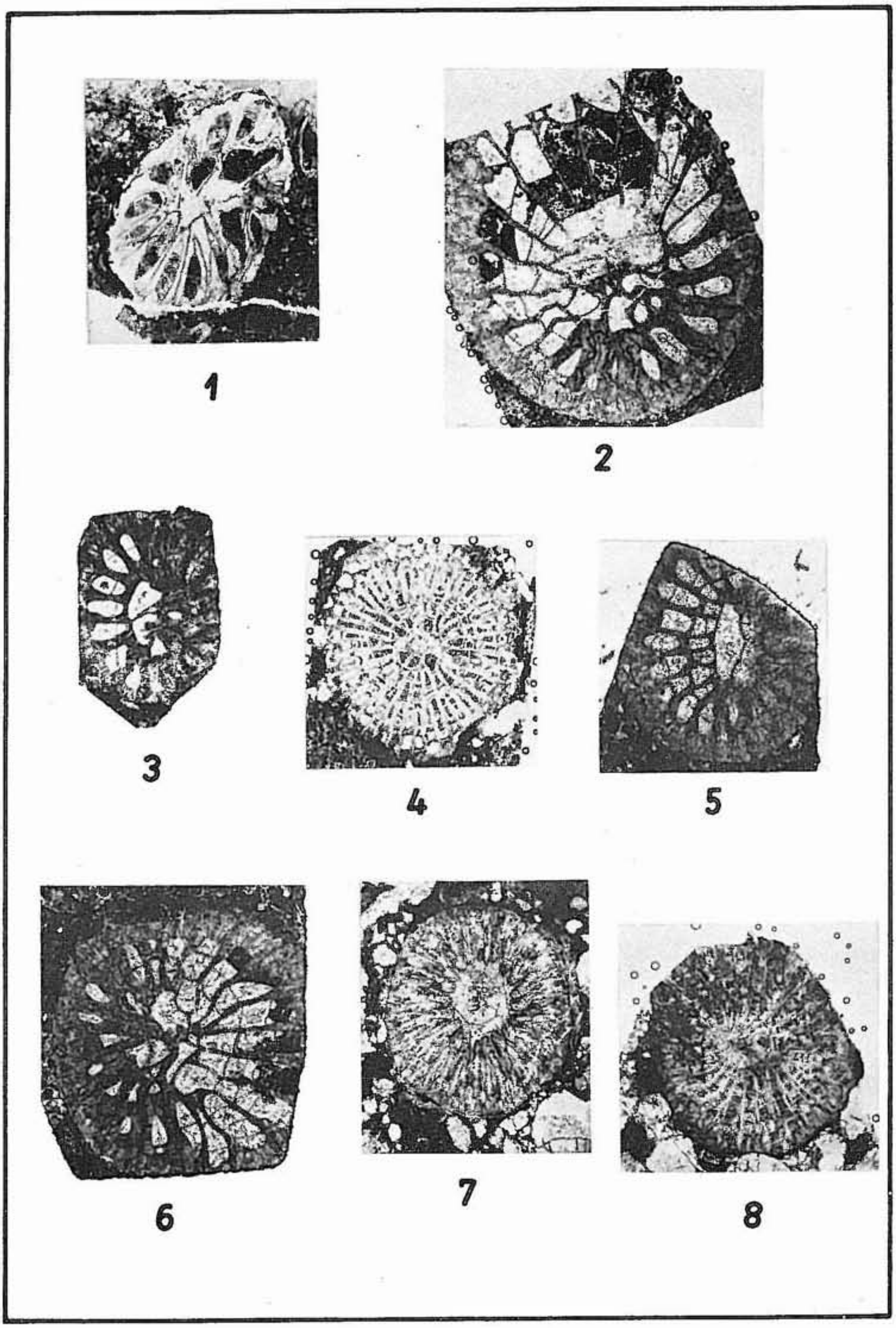


Krzysztof RADLICZ, Maria CHOROWSKA — Revision of the age of the Lower Carboniferous deposits in the northern part of the Góry Bardzkie (Sudetes)

PLATE VI

Fig. 1. *?Rotiphyllum*
Lithic sandstone with bioclasts, depth of 1213.7 m
Piaskowiec lityczny z bioklastami
Figs. 2, 3. *Rylstonia*
Bioclastic limestone, depth of 1558.6 m
Wapień bioklastyczny
Figs. 4–6. Coral, genus not determined: Fig. 4 — limestone conglomerates, depth of 1572.9 m, Figs. 5, 6 — bioclastic limestone, depth of 1592.6 m
Koralowiec nieoznaczony do szczebla rodzaju: fig. 4 — zlepieniec wapienny, fig. 5, 6 — wapień bioklastyczny
Fig. 7. *Cyathaxonia*
Gneiss sandstone, depth of 1599.3 m
Piaskowiec gnejsowy
Fig. 8. *?Schindewolfia*
Gneiss sandstone, depth of 1672.5 m
Piaskowiec gnejsowy

All samples come from the Zdanów IG 1 borehole
Wszystkie próbki pochodzą z otworu wiertniczego Zdanów IG 1



Krzysztof RADLICZ, Maria CHOROWSKA — Revision of the age of the Lower Carboniferous deposits in the northern part of the Góry Bardzkie (Sudetes)