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Conodont stratigraphy of the Uppermost Devonian and Lower Carboniferous rocks in the Racławka and Szklarka valleys west of Cracow

ABSTRACT: In the Uppermost Devonian and Lower Carboniferous Limestones in the Racławka and Szklarka Valleys west of Cracow the following conodont zones were found: Middle or Upper *costatus* Zone, *Protognathodus kockeli-Siphonodella sulcata* Zone, *Siphonodella-Pseudopolygnathus triangulus inaequalis* Zone, *Siphonodella-Pseudopolygnathus triangulus triangulus* Zone, *Siphonodella crenulata* Zone, *Polygnathus communis carinus* Zone, *Gnathodus semiglaber* Zone, *Cavusgnathus-Apatognathus* Zone.

INTRODUCTION

This is a preliminary report. A detailed paper on the conodont stratigraphy of the Lower Carboniferous west of Cracow will follow.

The Lower Carboniferous deposits developed as Carboniferous Limestone occur some 25 km west of Cracow over an area of about 20 km^2. They are unconformably overlain by the Jurassic deposits in the east, and by Triassic deposits in the west.

Outcrops are mainly in the valleys of the Szklarka, Racławka, Eliaszówka, and Czernka streams (Fig. 1). In the middle of the area, at Dębnik, there occur Devonian rocks, developed in a similar facies.

There are several papers on the stratigraphy of the Carboniferous Limestone west of Cracow (Alexandrowicz & Mamet 1973, Alexandrowicz & Siedlecka 1964, Jarosz 1909a,b, 1913, 1914, 1917, 1918, 1926, 1928, Limanowski 1903, Liszka 1962, Rutkowski 1926, 1928, Soboń-Podgórska 1972, 1975. Zajączkowski 1964, 1968, 1975, Zaręczny 1890, 1894). That most detailed is by Jarosz (1926). He distinguished six successive lithostratigraphic units correlated mainly on brachiopods with western Europe. When we compare the stratigraphy accomplished by Jarosz with that based on conodonts, it appears that almost all brachiopods age indications concerning the described outcrops in Szklarka and Racławka are incorrect. This may

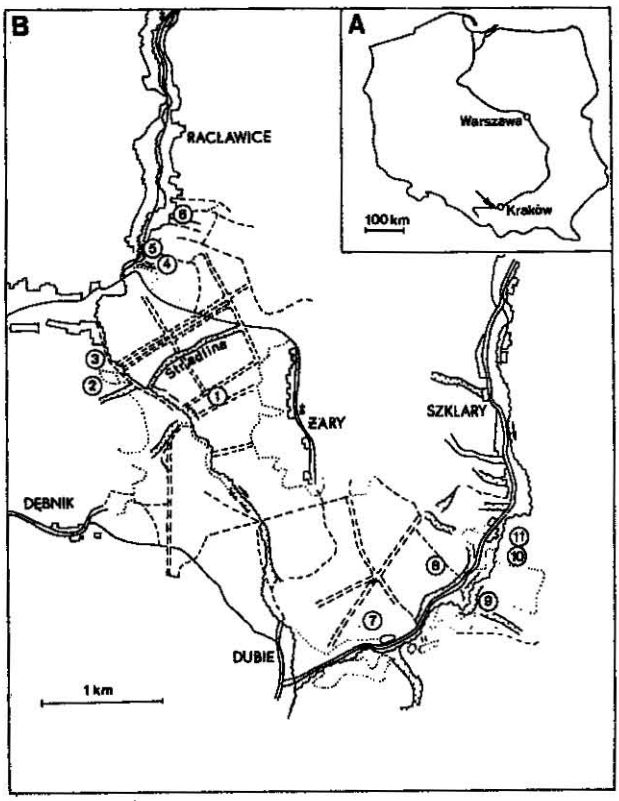

Fig. 1

A — General map of Poland (arrowed is the area presented in Fig. 1A); B — sketch map of the Szklarka and Racławka valleys
Members in circles indicating utocrops are described in the text

be due to very poor preservation of brachiopods occurring in the rocks under discussion.

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DISTRIBUTION AND AGE OF CONODONT ASSEMBLAGES

The condont assemblages dealt with here are fairly rich and allow precise dating. Location and age are resumed in Fig. 1 and 2.

The following profiles were studied:

(*1*) The outctop opposite Rokiczany Ravine (Rokiczany Dół) on the E slope of the Racławka Valley, about 750 m SE from the end of the Stradlina ravine. The Carboniferous Limestone is outcropped from the stream bed to the top of the hill.

These are brown limestones, somewhat bituminous, micritic, in the uppermost part of the profile alternating with beige limestones, non bituminous, otherwise similar.

The following conodonts have been found there:

Apatognathus varians varians Branson & Mehl
Apatognathus varians klapperi Druce

Apatognathus sp.
Bispathodus aculeatus aculeatus (Branson & Mehl)
Bispathodus aculeatus plumulus (Rhodes, Austin & Druce)
Bispathodus stabilis (Branson & Mehl)
Bispathodus sp.
Dinodus wilsonti Druce
Falcodus robertsi Druce
Falcodus tortus Huddle
Hibbardella (Hibbardella) sp.
Ligonodina sp.
Ozarkodina sp.
Patrognathus variabilis Rhodes, Austin & Druce
Prioniodina preloevipostica Rhodes, Austin & Druce
Pseudopolygnathus dentilineatus Branson
Pseudopolygnathus expansus Rhodes, Austin & Druce
Pseudopolygnathus sp.
Spathognathodus crassidentatus (Branson & Mehl)
Spathognathodus sp.

Bispathodus aculeatus plumulus appears in the upper part of the Lower *costatus* Zone, and ranges upwards into the top of *Siphonodella sulcata* Zone. This species occurs together with the Lower Carboniferous ones, i.e. *Patrognathus variabilis, Pseudopolygnathus expansus, Spathognathodus crassidentatus*. The coincidence of these species allows an exact dating of this assemblage as *Protognathodus kockeli-Siphonodellasulcata* Zone.

(*2*) Żarnówczany Ravine (Żarnówczany Dół), the outcrop on the W slope of the Racławka Valley some 60 m S from the end of the Stradlina Ravine. The Carboniferous Limestone is outcropped in a small ravine and N of it, from the stream bottom to the top of the hill.

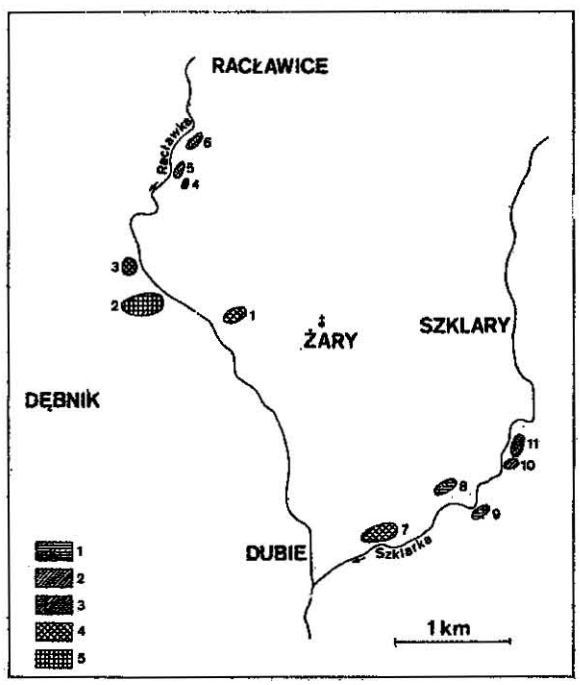

Fig. 2
Sketch map indicating age of exposures
1 — Viséan, *2* — Upper Tournaisian, *3* — Middle Tournaisian, *4* — Lower Tournaisian, *5* — Uppermost Famennian

These are mainly micritic limestones, grey, locally yellowish, becoming gradually lighter upwards with conodonts:

Bispathodus aculeatus plumulus (Rhodes, Austin & Druce)
Bispathodus stabilis (Branson & Mehl)
Hindeodella sp.
Ligonodina sp.
Pseudopolygnathus vogesi Rhodes, Austin & Druce
?Scaphignathus veliferus Helms
Spathognathodus sp.

This is an assemblage of the uppermost Famennian (*to VI*), Middle or Upper *costatus* Zone.

In the lowermost part of the profile there occurs *Bispathodus aculeatus plumulus*; in the middle part, *Bispathodus aculeatus plumulus* and *Pseudopolygnathus vogesi*; in the uppermost part *?Scaphignathus veliferus*. The middle part of the profile may correspond to the Lower Pilton Beds of North Devon, where occur together *Bispathodus aculeatus plumulus* and *Pseudopolygnathus vogesi*, while other forms are absent. According to Austin & al. (1970), this assemblage is younger than *to VI* as indicated by the absence of *Palmatolepis* and *Icriodus*, but older than the *Protognathodus kockeli-Siphonodella sulcata* Zone as indicated by the absence of the Lower Carboniferous genera. The range of *?Scaphignathus veliferus* which is present in the uppermost part of the profile of Żarnówczany Ravine, is different from that of *Scaphignathus veliferus*. Sandberg & Klapper (1967) described *?Scaphignathus veliferus* from the Cottonwood Canyon Member of the Madison Limestone in Wyoming which they considered to be of post Lower *costatus* Zone, possibly uppermost Devonian age. Glenister & Klapper (1967) described *Scaphignathus veliferus* from the Canning Basin of Western Australia, occurring together with *Bispathodus aculeatus*. They dated this assemblage as probably *costatus* Zone. In the area dealt with here *Scaphignathus veliferus*, besides Żarnówczany Ravine, occurs quite near in the Stradlina ravine together with *Bispathodus costatus* (Branson), thus indicating the Middle or Upper *costatus* Zone.

(*3*) The outcrop between Żarnówczany Ravine and Górecki Quarry (Łom Góreckiego), about 300 m from Żarnówczany Ravine in the W slope of the Racławka Valley.

They are dark beige micritic limestones.
The following conodonts have been ascertained:

Bispathodus aculeatus aculeatus (Branson & Mehl)
Lonchodina sp.
Polygnathus inornatus rostratus Rhodes, Austin & Druce
Siphonodella cf. *duplicata* (Branson & Mehl)
Siphonodella sp.

The age of this assemblage is *Gattendorfia* Stage, probably corresponding to the *Siphonodella-Pseudopolygnathus inaequalis* Zone of Germany.

Siphonodella cf. *duplicata* is restricted to *Siphonodella-Pseudopolygnathus triangulus inaequalis* and *Siphonodella-Pseudopolygnathus triangulus triangulus* zones of the Lower Tournaisian of Germany (Voges 1959, 1960). The absence in our assemblage of the species *Clydagnathus cavusformis* Rhodes, Austin & Druce, which abounds in the profile (*7*), corresponding to the *Siphonodella-Pseudopolygnathus triangulus triangulus* Zone, suggests a *Siphonodella-Pseudopolygnathus triangulus inaequalis* age.

(*4*) Roemer Quarry (Łom Roemera), in the E slope of the Racławka Valley, between the villages Paczółtowice and Racławice, about 60 m from the Racławka stream. The Lower Carboniferous is developed as dark marly limestones with cherts, becoming yellowish in the uppermost part of the profile.

The following species have been found there:

Apatognathus sp.
Bispathodus stabilis (Branson & Mehl)
Gnathodus delicatus Branson & Mehl
Gnathodus punctatus (Cooper)
Gnathodus semiglaber Bischoff
Gnathodus semiglaber Bischoff
Gnathodus simplicatus Rhodes, Austin & Druce
Hindeodella sp.
Polygnathus communis carinus Hass
Polygnathus communis communis Branson & Mehl
Scaphignathus sp.
Spathognathodus discretus Austin & Husri

This is the *Gnathodus semiglaber* Zone of the Upper Tournaisian, ranging from uppermost *Tn3a* to the top *Tn3b*.

The presence of *Gnathodus semiglaber* is particularly significant: in Belgium *Gnathodus semiglaber* appears in the uppermost part of *Tn3a* and continues in *Tn3b* (Groessens 1971). The beds from the Roemer Quarry may be correlated with the Avon Gorge beds in Great Britain posterior to Z_{2s}, where *Gnathodus semiglaber* appears (Rhodes & al. 1969). A similar conodont assemblage was found in the Cork Beds of SW Ireland (R_4) by Mattews & Naylor (1973), who compared it to the North American *Gnathodus semiglaber-Polygnathus communis carinus* Zone.

(5) Klippes on the ancient frontier of the town of Cracow (Skałki Przy Granicy). The Carboniferous Limestone is outcropped in the E slope of the Racławka Valley beginning about 60 m N of the road leading from the Racławka stream to the Roemer Quarry.

These are dark beige, micritic limestone with conodonts:

Bispathodus stabilis (Branson & Mehl)
Falcodus sp.
Hindeodella sp.
Polygnathus communis communis Branson & Mehl
Polygnathus lacinatus prelobatus Rhodes, Austin & Druce
Polygnathus vogesi Ziegler
Polygnathus znepolensis Spasov
Siphonodella crenulata (Cooper)
Siphonodella isosticha (Cooper).

This is the *Siphonodella crenulata* Zone, corresponding to *CuIIα* of Germany (Voges 1959).

(6) Quarry above Kozub's Mill (Odsłonięcie Nad Młynem Kozuba), in the E slope of the Racławka Valley.

These are micritic limestones, locally organodetritical, grey, yellowish grey, or dark with following conodonts:

Clydagnathus sp.
Polygnathus inornatus inornatus Branson & Mehl
Ozarkodina sp.
Siphonodella crenulata (Cooper)
Siphonodella isosticha (Cooper)

This is the *Siphonodella crenulata* Zone, corresponding to *CuIIα* of Germany (Voges 1959).

(7) Limestones above trout hatchery (Wapienie Nad Pstrągarnią), in the W slope of the Szklarka Valley, those limestones are discontinuosly outcropped.

Those are dark, beige, micritic limestones with conodonts:

Apatognathus sp.
Bispathodus stabilis (Branson & Mehl)
Clydagnathus cavusformis Rhodes, Austin & Druce
Lonchodina sp.
Siphonodella sandbergi Klapper
Spathognathodus cristatus Youngquist & Miller
Spathognathodus sp.

The conodonts from the profile (7) allow to assign it to the upper part of the *Gattendorfia* Stage, corresponding to *Siphonodella-Pseudopolygnathus triangulus triangulus* Zone of Germany. Two of the species are particularly significant for correlation. These are *Siphonodella sandbergi* and *Clydagnathus cavusformis*. *Siphonodella sandbergi* is restricted to *Siphonodella-Pseudopolygnathus triangulus triangulus* Zone of the Lower Tournaisian of Germany, and *Clydagnathus cavusformis* was not found outside the coral *K* Zone of Great Britain (Rhodes & al. 1969, Austin & Hill 1973).

(8) Quarry near the main road (Wapienie Przy Głównej Drodze), in the W slope of the Szklarka Valley about 1 km NE of the profile (7).

These are micritic limestones black to dark brown with conodonts:

Apatognathus chaullodus Varker
Apatognathus geminus (Hinde)
Apatognathus libratus Varker
Apatognathus scalenus Varker
Apatognathus sp.
Cavusgnathus charactus Rexroad
Cavusgnathus cristatus Branson & Mehl
Cavusgnathus naviculus (Hinde)
Hindeodella sp.
Polygnathus bischoffi Rhodes Austin & Druce
Spathognathodus cristulus Youngquist & Miller
Spathognathodus scitulus (Hinde)
Taphrognathus varians Branson & Mehl

The present assemblage of conodonts is very similar to the assemblage *Cavusgnathus-Apatognathus* Zone from the British Avonian, excepted the presence of *Polygnathus bischoffi* known from the somewhat older Laminosa Dolomite. The *Cavusgnathus-Apatognathus* Zone ranges from the upper part of C_2 to the base of D_2 (Austin 1973). The presence of *Polygnathus bischoffi* might suggest that the present assemblage represents the lower part of the *Cavusgnathus-Apatognathus* Zone, corresponding to C_2, correlated by Groessens (1974) with V_2a.

(9) Steep klippe over the stream (Stroma Skałka Nad Potokiem), in the E slope of the Szklarka Valley far from the road.

These are micritic limestones black to brown with conodonts:

Apatognathus geminus (Hinde)
Apatognathus libratus Varker
Ligonodina sp.

These forms have a wide range in the Viséan. However, in the profile (8) situated quite near there occur at the base some beds lithologically very similar, containing the same conodont species. Therefore, it may be supposed the present assemblage is coeval, i.e. represents the lower part of the *Cavusgnathus-Apatognathus* Zone.

(*10*) Quarry at the frontier (Łom Przy Granicy) where dark shales and limestones are exposed in the E slope of the Szklarka Valley, about 200 m from the profile (*11*).

These are dark grey limestones with black cherts, and thin intercalation of dark shales with conodonts:

Hindeodella sp.
Ligonodina sp.
Polygnathus communis carinus Hass
Polygnathus communis communis Branson & Mehl
Neoprioniodus sp.
Spathognathodus crassidentatus (Branson & Mehl)
Spathognathodus cf. *cristulus* Youngquist & Miller
Scaphignathus sp.
Ozarkodina sp.

This is the *Polygnathus communis carinus* Zone, *Tn3a*.
Austin & al. (1970) found a similar assemblage of conodonts in Yvoir, Belgium (Unit *10*).

(*11*) Slope over the stream opposite the houses (Zbocze Nad Potokiem Naprzeciw Domów) in the E slope of the Szklarka Valley.

These are micritic and organodetritical limestones, brown gradually greying upwards, generally rather dark with conodonts:

Bispathodus stabilis (Branson & Mehl)
Spathognathodus cristulus Youngquist & Miller
Siphonodella crenulata (Cooper)

This is the *Siphonodella crenulata* Zone, corresponding to *CuIIa* of Germany.

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A. GROMCZAKIEWICZ-ŁOMNICKA

STRATYGRAFIA GÓRNODEWOŃSKICH I DOLNOKARBOŃSKICH OSADÓW DOLINY SZKLARKI I RACŁAWKI NA ZACHÓD OD KRAKOWA NA PODSTAWIE KONODONTÓW

(Streszczenie)

W dolinie Szklarki i Racławki k. Krakowa występują liczne odsłonięcia dolnego karbonu, a w dolinie Racławki także odsłonięcia najwyższego famenu (fig. 1). Przedstawione wyniki badań nad górnodewońskimi i dolnokarbońskimi konodontami pochodzącymi z tych odsłonięć umożliwiły określenie wieku wszystkich utworów odsłaniających się w Szklarce i prawie wszystkich w Racławce. Na podstawie zespołów konodontów wydzielono tu w najwyższym dewonie i dolnym karbonie z wymienionego obszaru następujące poziomy konodontowe (fig. 2): środkowa lub górna część poziomu *costatus* (odsłonięcie *2* w Racławce), poziom *Protognathodus kockeli-Siphonodella sulcata* (odsłonięcie *1* w Racławce), poziom *Siphonodella-Pseudopolygnathus triangulus inaequalis* (odsłonięcie *3* w Racławce), poziom *Siphonodella-Pseudopolygnathus triangulus triangulus* (odsłonięcie *7* w Szklarce), *Polygnathus communis carinus* (odsłonięcie *10* w Szklarce), *Gnathodus semiglaber* (odsłonięcie *4* w Racławce) oraz dolna część poziomu *Cavusgnathus-Apatognathus* (odsłonięcie *8*, *9* w Szklarce).

W pracy przeprowadzono porównanie między poziomami konodontowymi wyróżnionymi przez autorkę i poziomami ramienionogowymi ustalonymi przez Jarosza (1926). Z porównania tego wynika, że prawie wszystkie odsłonięcia Szklarki i Racławki tu opisane są innego wieku niż podaje to Jarosz.

Wydzielone poziomy konodontowe pozwalają na dokładną korelację skał najwyższego famenu i dolnego karbonu okolic Krakowa z poziomami kondontowymi utworów Niemiec, Belgii i Wielkiej Brytanii.
