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Middle Triassic (Muschelkalk) conodonts from the SW margin of the Holy Cross Mts

ABSTRACT: Twenty two species and subspecies of the conodonts have been recognized in the Middle Triassic (Muschelkalk) of the SW margin of the Holy Cross Mts. Basing on the conodonts, the Upper Muschelkalk of the region has been correlated with the *Ceratites* Beds of Germany. In the Lower Muschelkalk of the region, the species *Paragondolella navicula* (Huckriede) and *P. excelsa* Mosher, characteristic of the Alpine province, have been stated.

During the stratigraphic investigations of the Röt and Muschelkalk of the SW margin of the Holy Cross Mts (Trammer 1970), the conodonts have appeared to be useful for local and regional correlation. The preliminary results, presented in this contribution, are based on the conodont material obtained from 49 samples collected in the profiles at Polichno, Stare Chęciny and Wolica (Fig. 1). A poor state of outcrops enabled to the sampling only in some intervals of the Röt-Muschelkalk sequence (cf. Fig. 2).

The conodonts have been found in 32 samples coming from the Lower and Upper Muschelkalk (Fig. 2). One of the samples (No. 9) from the *Pecten discites* Beds (lithostratigraphic schema according to Senkowiczowa 1957, 1959) has yielded as many as 200 conodonts in a 400 g rock sample, the number being the most extreme in the investigated profile. The other positive samples, taken from the Wellenkalk, Łukowa Beds, *Lima striata* Beds and *Pecten discites* Beds (cf. Fig. 2), contain the conodonts in range of 1 to 42 specimens in a similar rock volume. The full list of the conodont species or subspecies (including their number and samples) is as follows (cf. Pls 1 and 2):

Chirodella triquetra (Tatge 1956); 4 specimens (samples 48 and 49) — Pl. 2, Fig. 1.
Chirodella dinodoides (Tatge 1956); 26 specimens (samples 7, 11, 22, 31, 37, 39, 43, 49) — Pl. 2, Fig. 2a, b.

- Cornudina breviramulis breviramulis* (Tatge 1956); 5 specimens (samples 36, 37, 39) — Pl. 1, Fig. 3.
- Cornudina breviramulis minor* Kozur 1968; 10 specimens (samples 13, 33, 37, 43, 46, 48) — Pl. 1, Fig. 2.
- Cornudina* sp. A; 5 specimens (samples 21, 37, 44) — Pl. 1, Fig. 4.
- Cornudina* sp. B; 4 specimens (sample 43) — Pl. 1, Fig. 5.
- Enantiognathus ziegleri* (Diebel 1956); 26 specimens (samples 8, 9, 19, 37, 39, 43, 44, 45, 48) — Pl. 1, Fig. 1.
- Neospathodus kockeli* (Tatge 1956); 30 specimens (samples 14, 38, 46, 47) — Pl. 1, Figs 11—12.
- Hindeodella* (*Neohindeodella*) *triassica triassica* Müller 1956; 120 specimens (samples 16, 18, 21, 22, 24, 31, 32, 33, 34, 35, 36, 37, 39, 40, 43, 44, 48, 49) — Pl. 1, Fig. 15.
- Hindeodella* (*N.*) *triassica hirschmanni* Kozur 1968; 7 specimens (samples 33, 37, 43, 46, 48) — Pl. 1, Fig. 14.
- Hindeodella* (*Metapriioniodus*) *latidentata* (Tatge 1956); 7 specimens (samples 36, 37, 48) — Pl. 1, Fig. 13.
- Ozarkodina tortilis* Tatge 1956; 16 specimens (samples 9, 21, 37, 38, 44, 45, 48) — Pl. 2, Fig. 3.
- Parachirognathus?* *pandodentata* (Budurov 1962); 6 specimens (samples 7, 11, 31, 43, 48) — Pl. 1, Fig. 6.
- Prioniodella prioniodellides* (Tatge 1956); 3 specimens (sample 9) — Pl. 1, Fig. 9.
- Prioniodina muelleri* (Tatge 1956); 26 specimens (samples 9, 14, 19, 22, 34, 40, 43, 44, 47, 48, 49) — Pl. 1, Fig. 10.
- Roundya meissneri* Tatge 1956; 5 specimens (samples 6, 21, 33, 37) — Pl. 1, Fig. 7.
- Roundya magnidentata* Tatge 1956; 7 specimens (samples 38, 44, 48) — Pl. 1, Fig. 8.
- Gondolella* (*Gondolella*) *momburgensis momburgensis* Tatge 1956; 180 specimens (samples 5, 6, 7, 8, 9, 21, 37, 44, 45) — Pl. 2, Fig. 5a, b.

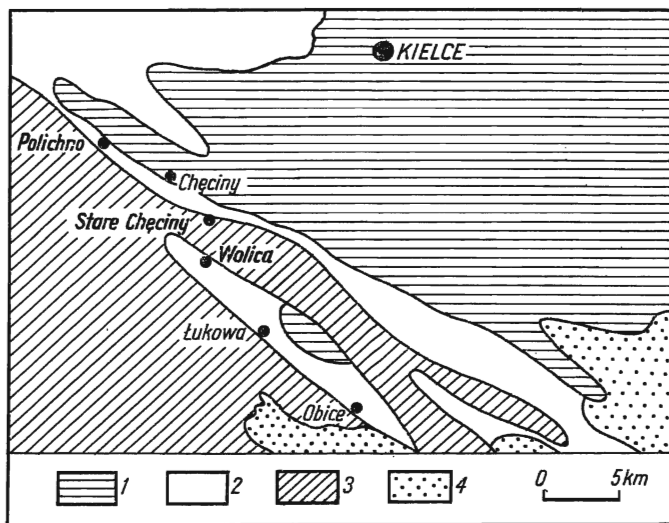
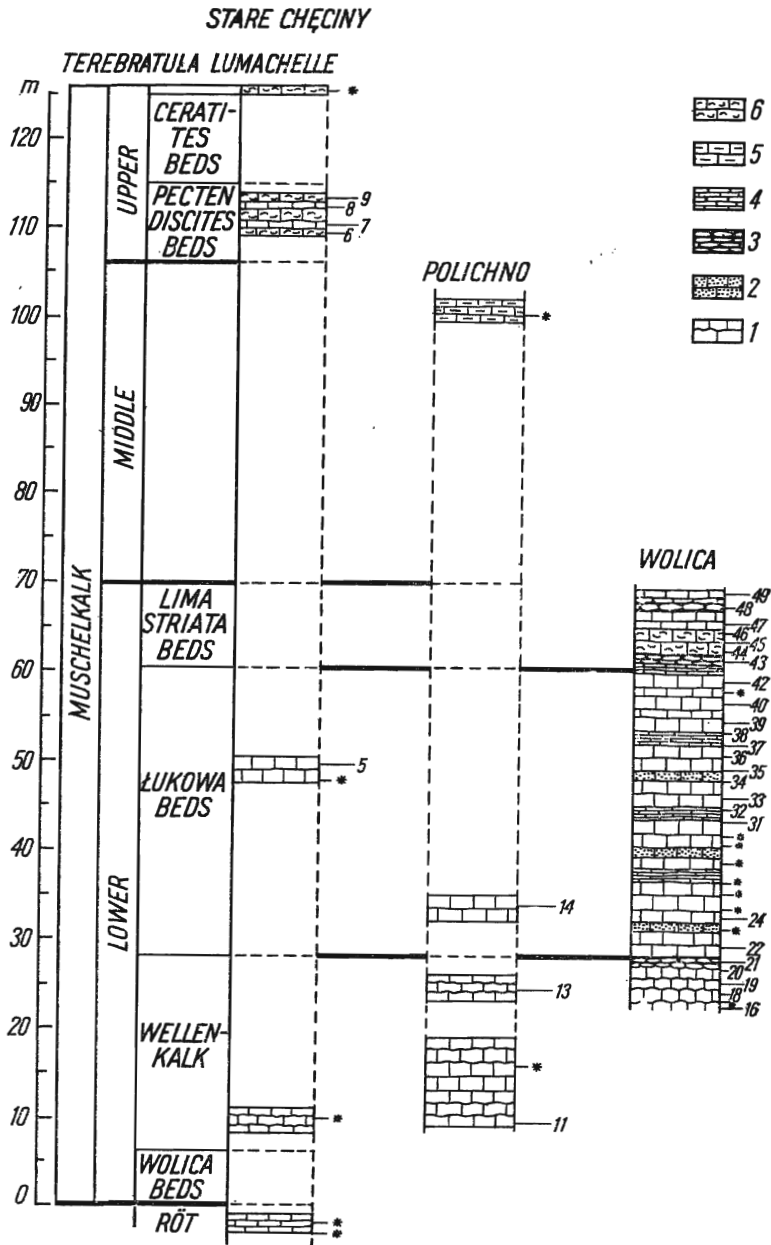


Fig. 1

Location map of the conodont bearing profiles (bold-faced) in the Muschelkalk of the SW margin of the Holy Cross Mts

1 Palaeozoic, 2 Triassic, 3 Jurassic and Cretaceous, 4 Miocene



Location of the conodont bearing samples in the Muschelkalk profiles

1 micritic limestones (locally with wavy surfaces), 2 detrital limestones, 3 crumpled limestones, 4 laminated limestones, 5 marly limestones, 6 lumachelles. Numbers denote the conodont bearing samples; asterisked are the samples lacking of conodonts. Lithostratigraphic schema according to Senkowiczowa (1957, 1959)

Gondolella (G.) *mombergensis media* Kozur 1968; 6 specimens (sample 9) — Pl. 2, Fig. 4.

Gondolella (G.) *mombergensis prava* Kozur 1968; 8 specimens (samples 8 and 9) — Pl. 2, Fig. 6.

Paragondolella navicula (Huckriede 1958); 54 specimens (samples 11, 14, 31, 32, 34, 37, 38, 39, 40, 42, 43, 44, 45, 46, 47, 48) — Pl. 2, Fig. 8a, b.

Paragondolella excelsa Mosher 1968; 5 specimens (samples 48 and 49) — Pl. 2, Fig. 7.

An attempt, based on the recorded conodonts, at correlating the Upper Muschelkalk of the Holy Cross Mts and of Germany, the latter being recently subdivided into 7 conodont zones by Kozur (1968), is presented.

The Upper Muschelkalk of the Holy Cross Mts is incomplete. The youngest biostratigraphic unit, according to Senkowiczowa (1957, 1959), is most probably the *Ceratites spinosus* Zone, so the Muschelkalk in the Holy Cross Mts ends with deposits corresponding to the Middle *Ceratites* Beds of Germany (Fig. 3).

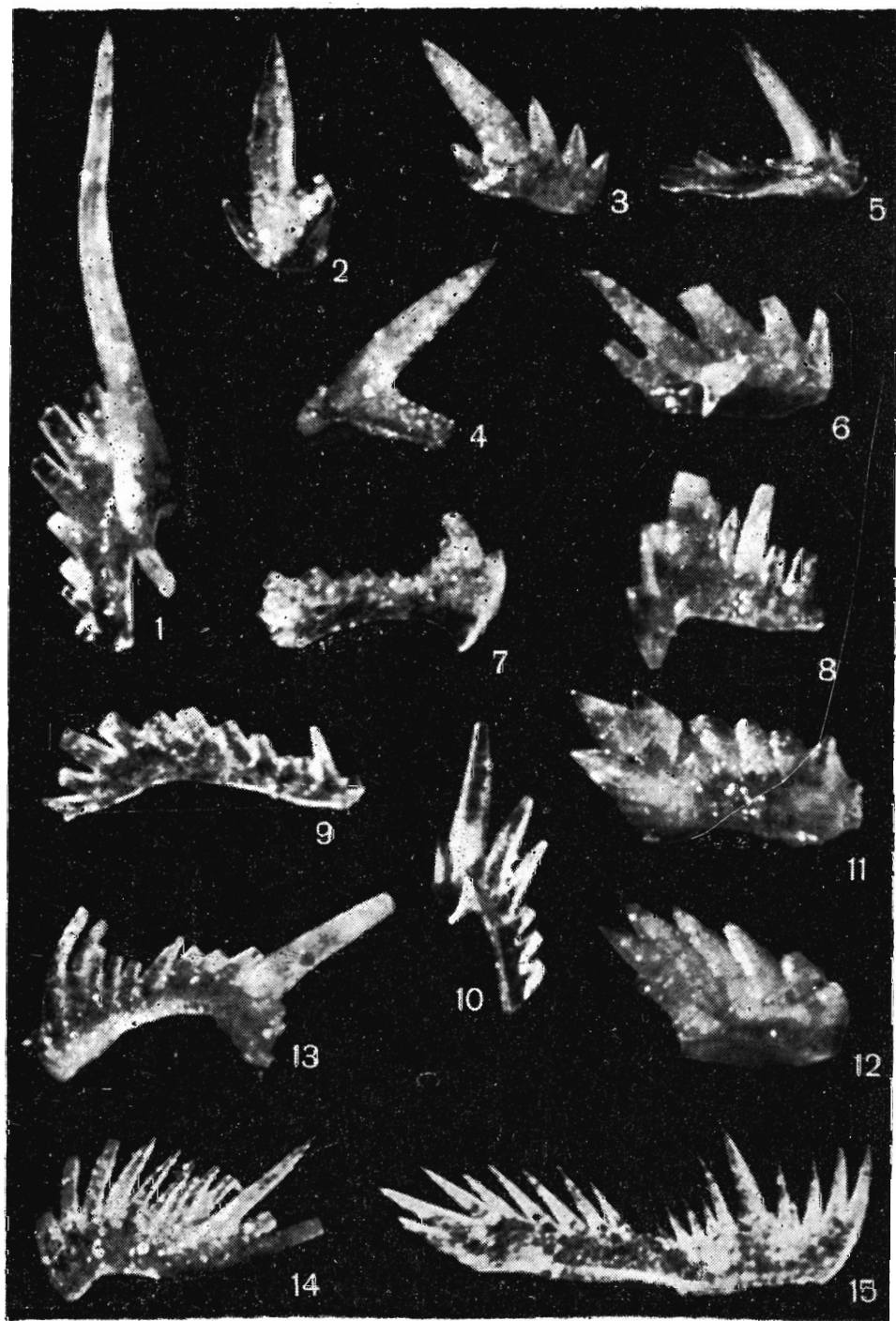
The part of the Upper Muschelkalk of Germany, corresponding to deposits occurring in the Holy Cross Mts, comprises 4 conodont zones (Fig. 3). However, in the Holy Cross Mts only the two lowest zones (cf. Kozur 1968) may be stated, and the boundary between the 1st and 2nd zone lies within the *Pecten discites* Beds (Fig. 3).

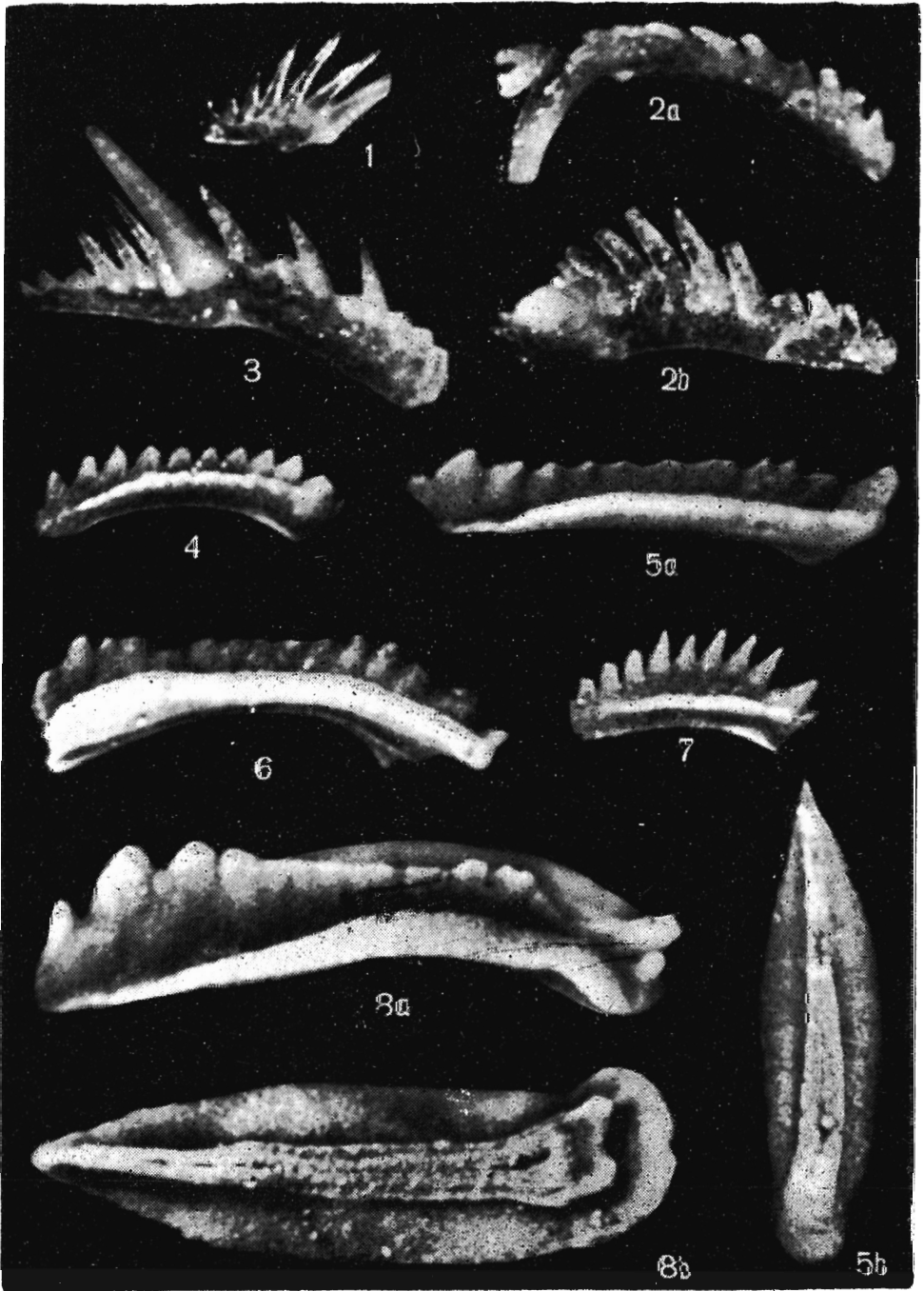
The 1st zone is documented with characteristic assemblage of conodonts (samples 6 and 7) which includes *Gondolella* (*Gondolella*) *mombergensis mombergensis* Tatge, *Chirodella dinodoides* (Tatge), *Parachirognathus?* *pandodentata* (Budurov) and *Roundya meissneri* Tatge, and it comprises the lower and middle parts of the *Pecten discites*

PL. 1

- 1 — *Enantiognathus zieglerei* (Diebel), Wolica (sample 44).
- 2 — *Cornudina breviramulis minor* Kozur, Wolica (48).
- 3 — *Cornudina breviramulis breviramulis* (Tatge), Wolica (39).
- 4 — *Cornudina* sp. A, Wolica (37).
- 5 — *Cornudina* sp. B, Wolica (43).
- 6 — *Parachirognathus?* *pandodentata* (Budurov), Wolica (31).
- 7 — *Roundya meissneri* Tatge, Wolica (33).
- 8 — *Roundya magnidentata* Tatge, Wolica (38).
- 9 — *Prioniodella prioniodellides* (Tatge), Stare Cęciny (9).
- 10 — *Prioniodina muelleri* (Tatge), Wolica (44).
- 11 — *Neospathodus kockeli* (Tatge), Wolica (38).
- 12 — *Neospathodus kockeli* (Tatge), Wolica (38).
- 13 — *Hindeodella* (*Metaproniodus*) *latidentata* (Tatge), Wolica (37).
- 14 — *Hindeodella* (*Neohindeodella*) *triassica hirschmanni* Kozur, Wolica (43).
- 15 — *Hindeodella* (*Neohindeodella*) *triassica triassica* Müller, Wolica (22).

All figures $\times 100$; taken by L. Łuszczewska, M. Sc.





Beds. The uppermost part of the *Pecten discites* Beds belongs to the 2nd zone, documented with conodont assemblage (samples 8 and 9) including *Gondolella (Gondolella) mombergensis mombergensis* Tatge, G. (G.) *mombergensis media* Kozur and G. (G.) *mombergensis prava* Kozur. The 2nd conodont zone of Germany comprises the Lower *Ceratites* Beds and the *Ceratites compressus* Zone of the Middle *Ceratites* Beds (Kozur 1968), so the uppermost *Pecten discites* Beds of the Holy Cross Mts, on the basis of conodont fauna, might have been correlated with the Lower *Ceratites* Beds and/or the *Ceratites compressus* Zone. However, the *Pecten discites* Beds are overlaid, according to Senkowiczowa (1957, 1959), by limestones of the *Ceratites robustus* Zone, so the uppermost part of these beds in the Holy Cross Mts has to correspond to the Lower *Ceratites* Beds of Germany (Fig. 3).

Upper links of the Muschelkalk (i.e. Middle *Ceratites* Beds) are not exposed in the area, and no conodonts were recorded in the sample from the *Terebratula lumachelle* (cf. Fig. 2) at the top of the Holy Cross Muschelkalk, and thus the younger conodont zones of Germany could not have been distinguished here.

Occurrence of the species *Paragondolella navicula* (Huckriede) and *P. excelsa* Mosher in the Lower Muschelkalk of the Holy Cross Mts is of some interest, as these species have not been recorded in the Muschelkalk of Germany, while they are known from the Upper Anisian through the Lower Norician of the Tethyan province (Huckriede 1958, Mosher 1968), and from the Lower Muschelkalk of Lower Silesia (Zawidzka 1970).

All other forms recorded in the Lower Muschelkalk of the Holy Cross Mts and Lower Silesia (cf. Zawidzka 1970), are known both from Germany and Tethyan province, which fact seems to support the previous assumption (Samsonowicz 1929) that the Polish province was more closely related to the Tethyan regions than the German one.

The subspecies *Gondolella (Gondolella) mombergensis mombergensis* Tatge was recorded not only in the Upper, but also in the Lower

PL. 2

- 1 — *Chirodella triquetra* (Tatge), Wolica (sample 48).
- 2 — *Chirodella dinodoides* (Tatge), Wolica (31); a upper view, b side view.
- 3 — *Ozarkodina tortilis* Tatge, Wolica (45).
- 4 — *Gondolella (Gondolella) mombergensis media* Kozur, Stare Chęciny (9).
- 5 — *Gondolella (Gondolella) mombergensis mombergensis* Tatge, Stare Chęciny (9); a side view, b lower view.
- 6 — *Gondolella (Gondolella) mombergensis prava* Kozur, Stare Chęciny (9).
- 7 — *Paragondolella excelsa* Mosher, Wolica (48).
- 8 — *Paragondolella navicula* (Huckriede), Wolica (37); a side view, b lower view.

All figures $\times 100$; taken by L. Łuszczewska, M. Sc.

HOLY CROSS MTS				GERMANY					
CONODONT ZONES		CERATITES ZONES (Senkowiczowa, 1957)		CERATITES ZONES (Riedel, 1916)		CONODONT ZONES (Kozur, 1968)			
/		/		Discoceratiten	7		UPPER		
				Nodusus	6				
				Engdis-laevigatus	5				
					4				
2		Spinus	Spinus	2		3		MIDDLE	
		Evolutus	Evolutus						
		Compressus	Compressus						
		Robustus	Robustus			2		LOWER	
		LACK OF CERATITES (PECTEN DISCITES BEDS)							Pulcher
									Atavus
									LACK OF CERATITES (TROCHITEN-KALK)
1									
		1		1		mo ₁			

Fig. 3

Correlation of the Upper Muschelkalk of the Holy Cross Mts and Germany

Muschelkalk of the Holy Cross Mts and of Lower Silesia (cf. Zawidzka 1970). This form is, according to Kozur (1968), a guide fossil for the 1th and 2nd zones of the Upper Muschelkalk; moreover, the conodont assemblage of the 1st zone of the Upper Muschelkalk in Germany differs from those from the Lower Muschelkalk in occurrence of this very subspecies (cf. Kozur 1968).

The subspecies *Cornudina breviramulis minor* Kozur, a guide fossil of the 2nd and 3rd zones of the German Upper Muschelkalk (Kozur 1968), was stated in the Holy Cross Mts only in the Lower Muschelkalk.

As a characteristic form for the Lower Muschelkalk, the species *Neospathodus kockeli* (Tatge) may be regarded, as it was recorded only in that substage, both in Germany (Tatge 1956, Wilczewski 1967) and in the area studied.

In one case, a widely accepted taxonomic concept was modified by including the species *kockeli*, established by Tatge (1956), to the genus *Neospathodus* Mosher, 1968, as appears from the structure of the base and of the basal cavity. Previously this species was included by Tatge

(1956), Budurov (1960) and Wilczewski (1967) to the genus *Ozarkodina* Branson & Mehl, 1933.

The preliminary statement of an abundant conodont fauna in the Upper Muschelkalk, and slightly scarcer in the Lower Muschelkalk of the Holy Cross Mts, shows further investigations to be necessary and may result in a more detailed biostratigraphic correlations with the classic profiles in Germany and in the Alps.

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**KONODONTY Z WAPIENIA MUSZLOWEGO
POŁUDNIOWO-ZACHODNIEGO OBRZEŻENIA MEZOZOICZNEGO
GÓR ŚWIĘTOKRZYSKICH**

(Streszczenie)

W profilach wapienia muszlowego z południowo-zachodniego obrzeżenia mezozoicznego Gór Świętokrzyskich (por. fig. 1 i 2) stwierdzono obecność 22 gatunków i podgatunków konodontów (*vide* lista w tekście angielskim pracy oraz pl. 1 i 2).

W oparciu o konodonty wykazano, że najwyższa część warstw z *Pecten discites* odpowiada dolnym warstwom ceratytowym Niemiec (fig. 3).

W dolnym wapieniu muszlowym Gór Świętokrzyskich znaleziono konodonty alpejskie *Paragondolella navicula* (Huckriede) i *P. excelsa* Mosher. Fakt ten potwierdza tezę J. Samsonowicza (1929) o silnych wpływach alpejskich w wapieniu muszlowym Polski.

Dla dwóch stratygraficznie ważnych podgatunków konodontów, *Gondolella* (*Gondolella*) *mombergensis mombergensis* Tatge oraz *Cornudina breviramulis minor* Kozur, stwierdzono w Górach Świętokrzyskich inne zasięgi stratygraficzne niż podawane dotychczas z wapienia muszlowego Niemiec (por. Kozur 1968).

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