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Cenomanian–turonian boundary event (CTBE) in the Pieniny Klippen Belt (Carpathians, Poland)

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Abstract. The Pieniny Klippen Belt (PKB) situated at the boundary between Inner and Outer Carpathians.The studied samples were collected from the Magierowa Marls Member (Mb) of the type locality (Magierowa klippe, Pieniny succesion) dated as Cenomanian-Turonian. The dark brown-black and green shales have been studied. The presence of organic matter and pyrite point to that mentioned above material was deposited under deficit oxygen conditions.

Key words: Pieniny Klippen Belt, Magierowa Marl Member, black and green shales.

Geological Setting

The Pieniny Klippen Belt situated between Inner and Outer Carpathians composed nearly 600 km in lenght and a few kilometres in width, arch-structure (fig. 1).

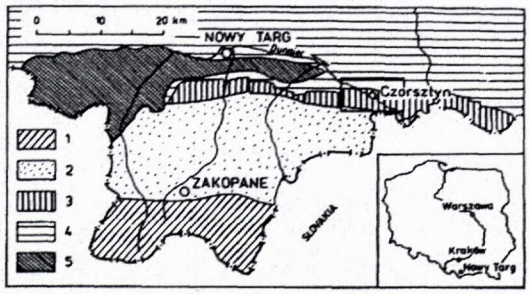

Figure 1 Sketch of part of the geological map of Poland c. 1:700 000 (after Ed. Wyd. Geol., 1977, compiled after Gasinski, 1988). 1 – Inner Carpathians, 2 – Podhale Flysch, 3 – Pieniny Klippen Belt, 4 – Flysch of Magura Unit, 5 – Outer Carpathians

Cretaceous sediments are dominated by marls, shales, limestones and turbidites. Biostratigraphy of these sediments have been established on the basis of foraminifera (Alexandrowicz et.al, 1968, Birkenmajer & Jednorowska, 1987, Gasinski, 1988, Bak, 1998, and others).

In the late Mesozoic time the Pieniny basin belonged to the Eastern branch of the Tethys. In the cross section of the belt several facial zones, coresponding to different conditions of deposition, have been distinguished (Birkenmajer, 1986; fig. 2).

The studied samples were collected from the Magierowa Marls Member (Mb) of the type locality (Magierowa klippe; Pieniny succession), preliminary dated on the basis of foraminifers and Radiolaria event as Cenomanian–Turonian (Bak, M. 1996 a, b).

This section is exposed on the household way from Sromowce Nizne *via* Magierowa Skalka to Nowa Góra. Along this way the mottled marls of the Macelowa Member and the thick-bedded sandstones of the Gróbka Member which contact with the strongly deformed thin-bedded flysch of the Snieznica Member can be observed. The Snieznica and Magierowa members are in tectonic contact. The Magierowa Mb consists of grey to green and black shales, marls and thin-bedded marly limestones, altogether 8–14 m thick.

The black and green shales part corresponds to the Upper Altana Shale Bed (Birkenmajer & Jednorowska, 1984) and corellates with mid-Cretaceous black shales facies in the South Alps and Apennines (especially to the „Bonarelli level", OAE 2; cf. Gasinski, 1988, 1997; fig 3).

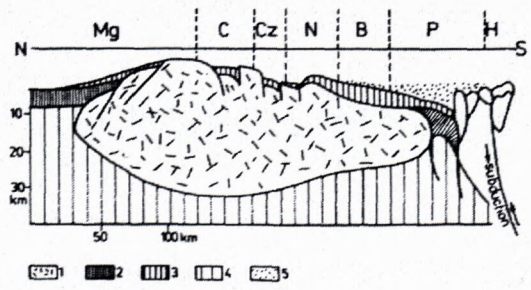

Figure 2. Palinspastic reconstruction of the sedimentarary basin of the Pieniny Klippen Belt during the Cenomanian (compiled after Birkenmajer, 1986). Mg. Magura basin. Succession of the PKB: C. Czorsztyn; Cz. Czertezik; N. Niedzica; B. Branisko; P. Pieniny; H. Haligowice. 1 – Continental crust, 2 – Oceanic crust, 3 – Carbonates and radiolarian cherts, 4 – Mantle, 5 – Flysch

To the North of the Magierowa Skalka, the Magierowa Mb. overlies the Snieznica Member. To the South the Magierowa Mb. disappears. It confirmed the palaeobathymetry of Pieniny Basin paleoslope during the mid –

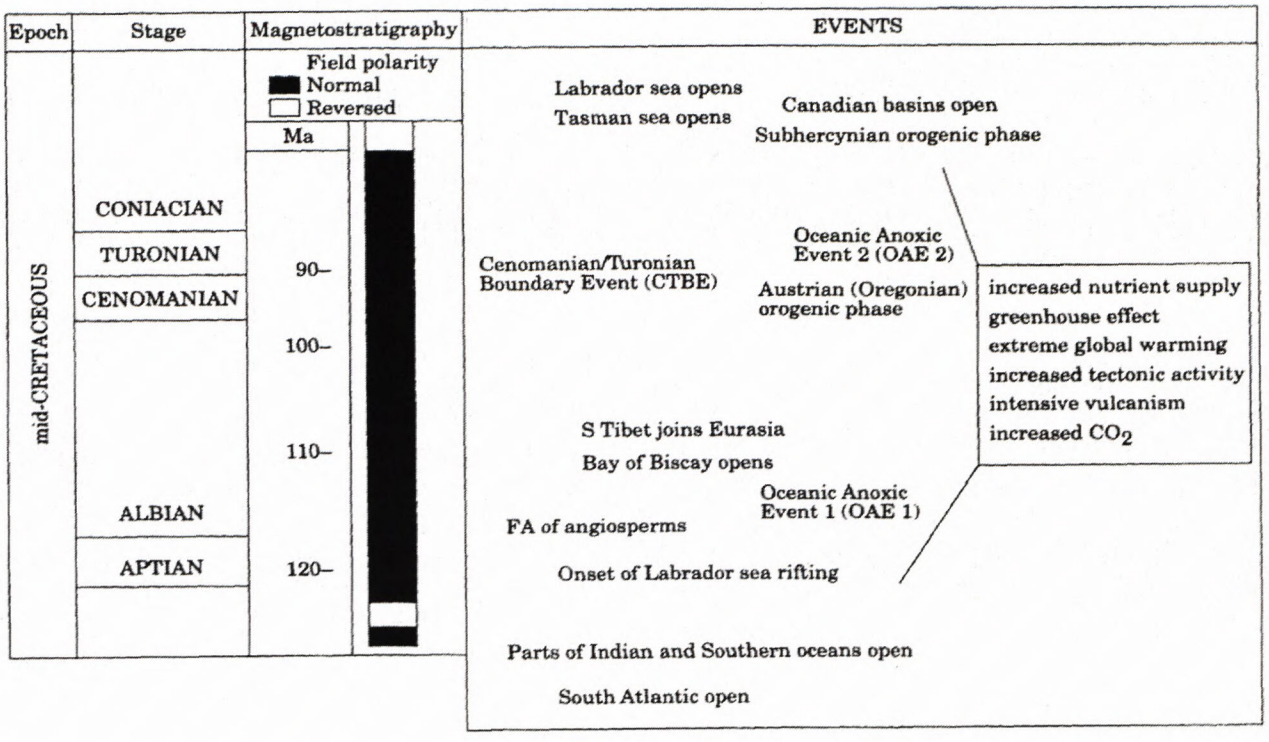

Figure 3 Mid-Cretaceous global events (mainly based on Harland et al., 1982, 1989, and Reyment & Bengston, 1986; compiled after Gasinski, 1988)

Cretaceous (deposition of shales and marls northward and the distal flysch southward; cf. Birkenmajer & Jednorowska, 1987; Birkenmajer & Gasinski, 1992).

Studied Samples

The studied samples represent dark brown and green shales. Laminated brown-black shales consist of small grains of quartz and clay minerals, which are parallely arranged. The dominating dark material is the wispy amorphous organic matter. Differential compaction and bending of laminae around piryte cubes and blebs were also noticed.

The green shales are not laminated but consist of pyrite blebs and numerous dark smudges and wisps which could be interpretated as burrow traces. In thin-sections single ghosts of unidentified tests were also found.

Conclusions

The presence of organic matter, the fine lamination in the sediment, the lack of burrowing and the apparent absence of benthic organisms suggest that anoxic conditions existed at or above the sea floor. Certainly anoxic conditions within sediment have been confirmed by the presence of pyrite.

The green mudstone beds were probably deposited under mildly oxygenated conditions because of occurence of bioturbation. However reducing conditions were established shortly after deposition as indicated by pyrite.

The further investigations will allow to explain origin of organic matter and will establish the deposition paleoenvironment of the mid-Cretaceous shales.

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