

CRETACEOUS BASIN EVOLUTION IN THE LUBLIN AREA ALONG THE TEISSEYRE–TORNQUIST ZONE (SE POLAND)

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Abstract: The Cretaceous basin of the Lublin area belongs to the SE part of the Mid-Polish Trough and its NE border extending on the East European Craton. Our study is based on isopach maps of seven time intervals, from Neocomian to Early Maastrichtian. Several main lithofacies have been distinguished whose areal extents were plotted on thickness pattern maps. The isopach and lithofacies maps helped to delimit the basin depocenter, providing information on vertical motions of the basin basement and synsedimentary reactivation of older fault zones. The areal extents of the siliceous and chalk lithofacies have been shown to be controlled by the positions of discontinuity zones in the crystalline basement.

Two stages of accelerated subsidence have been established: in Turonian and Early Maastrichtian times. Regional comparisons of accumulation rates and their accelerations during these time spans gave possibility to distinguish the roles of eustatic and tectonic factors in the process of augmenting the basin capacity. Some remarks concerning Early Maastrichtian timing of the inversion onset are also presented.

Key words: isopachs, lithofacies, subsidence, basin development, Cretaceous, Mid-Polish Trough, Teisseyre–Tornquist Zone.

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INTRODUCTION

This study covers the part of Poland comprised between the boundary with Ukraine in the east and southeast, the erosional limit of Jurassic and Cretaceous outcrops in the southwest, the meridian of Radom in the west and the parallel of Łuków in the north (Fig. 1). The Mid-Polish Trough formed along the Teisseyre–Tornquist Zone, above the contact of the West European Palaeozoic Platform with the Precambrian East European Craton.

The aim of this paper is to present sedimentary evolution of Cretaceous deposits in the basin of the southeast segment of the Mid-Polish Trough and its northeast margin, extending over the East European Craton. This analysis of the pattern of lithofacies and their thickness, and in consequence of subsidence, in the area adjacent from the northeast to the zone of the proper trough, which extended in the place of the present Lower San Anticlinorium in late Jurassic time (Niemczycka & Brochwicz, 1988; Kutek, 1994; Hakenberg & Świdrowska, 1997), may serve as a basis for further considerations on the Cretaceous palaeotectonic evolution of this area. The deposits of the opposite southwestern limb of the basin are partly buried beneath the overthrust units of the Outer Carpathians. Where these deposits were had been encountered by drilling, they were described in an earlier publication by the present authors (Hakenberg & Świdrowska, 1998). The purpose and the methods used in

this paper are similar to those used in that paper, dealing with the area of the Holy Cross Mountains (Góry Świętokrzyskie).

From the point of view of the deep geological structure, the area so defined lies within two major tectonic units (Fig. 1): the Precambrian East European Craton and the Palaeozoic West European Platform (Żelichowski, 1972, 1979; Książkiewicz *et al.*, 1977; Znosko, 1979, 1998). A fragment of the south eastern part of the East European Craton is distinguished as the Marginal Depression (Żelichowski, 1972). It is bounded on the northeast by the Kock Fault (see Fig. 10) that lowers the top of the Precambrian basement by 1–3 km (see Znosko, 1998). Farther to the east, within the Włodawa Graben, Kumów Elevation and Terebin Depression, the course of this fault in Precambrian rocks is less well known. The south western boundary of the Marginal Depression (see Fig. 10) is the Ursynów–Kazimierz Dolny–Wysokie–Rawa Ruska Fault (Żelichowski, 1972, 1974; Pożaryski & Dembowski, 1983; Znosko, 1998). The Marginal Depression is overlain by the Lublin Graben filled with Carboniferous and Devonian strata and underlain by older Palaeozoic rocks (Żelichowski, 1972, 1979). The north eastern boundary of the younger Palaeozoic graben is the Żelechów–Kock–Wasyłów Fault (Żelichowski, 1972). To the northeast of it lies the Łuków–Hrubieszów Eleva-

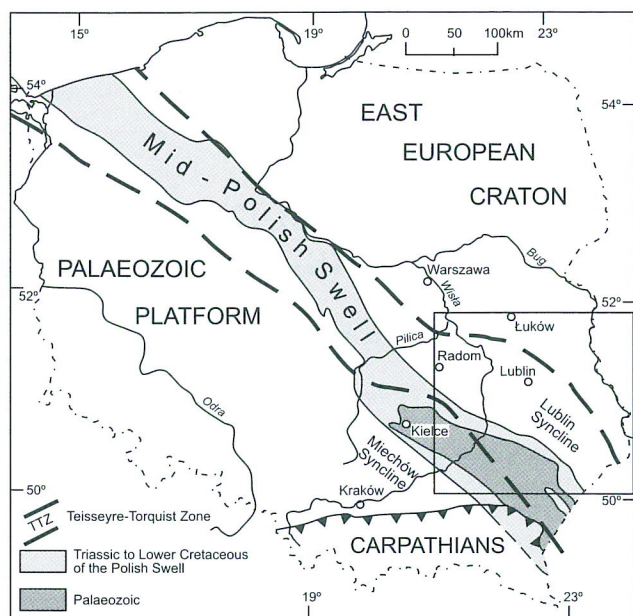


Fig. 1. Location of the study area relative to the major structural units of Poland. Line with solid triangles – frontal thrusts of the Carpathians

tion, which forms, together with the Lublin Graben, the Bug Trough (Porzycki, 1988).

The Jurassic and Cretaceous rocks build a gentle structure described as the Lublin Syncline, and farther southeast, in the Podolia area, as the Lwów Syncline (Żelichowski, 1972; Khizhnyakov & Żelichowski, 1974; Pożaryski, 1979). It was formed during the Laramian inversion, when its present south western limb formed by uplift of the Holy Cross part of the Mid-Polish Trough. The limbs of the Lublin Syncline extend beyond the young Palaeozoic Lublin Graben. In the south western part of the discussed area the Jurassic and Cretaceous sediments cover the Radom–Kraśnik Uplift, attributed to the Caledonian tectonic storey (Żelichowski, 1972, 1979), and in the north eastern part overlie the margin of the East European Craton.

Biostratigraphical zonation of the Cretaceous sediments of the Lublin area, based on ammonites, belemnites, inoceramids and foraminifers, was established mainly by: Samsonowicz (1925), Pożaryski (1938, 1948, 1956, 1960), Pożaryska (1956), Cieśliński (1959a, 1960, 1965), Witwicka (1976), Błaszkiwicz (1980), Peryt (1983), Pożaryska & Witwicka (1983), Walaszczyk (1987, 1992), Gawor-Biedowa (1992).

The lithology and stratigraphy was the subject of papers by Krassowska (1976, 1977, 1981b, 1982, 1986, 1989), Wyrwicka (1980) and Marek (1983). Petrography of the Cretaceous rocks of the Lublin area was studied by Sujkowski (1931), Uberta (1967), Harapińska-Depciuch (1972), Harasimiuk (1975) and Wyrwicka (1977, 1980).

The evolution of sedimentation and palaeogeography in Cretaceous time were analysed mainly in papers by Cieśliński (1959b, 1976), Marcinowski & Radwański (1983), Marcinowski & Walaszczyk (1985), Machalski & Walaszczyk (1987), Kutek *et al.* (1989), Marcinowski & Wiedmann (1990), Walaszczyk (1987, 1992).

Comprehensive analyses of the Cretaceous deposits outside the Carpathian part of Poland, including the Lublin area, are present in the papers by Pożaryski (1962), Jaskowiak-Schoeneichowa & Krassowska (1988), Marek (1988, 1997) and Krassowska (1997). Reviews of earlier works were presented by Pożaryski (1956) and Cieśliński & Pożaryski (1970).

Geological structure of the Precambrian and Palaeozoic basement in the Lublin area was the subject of studies by Pożaryski (1957), Żelichowski (1972, 1974, 1979, 1984), Żelichowski & Kozłowski (1983), Khizhnyakov & Żelichowski (1974), Porzycki (1988) and Znosko (1979, 1984, 1998). Tectonics of Mesozoic strata was studied mainly by Pożaryski (1948, 1956, 1957, 1997) and Pawłowski (1961); many observations on this topic are also included in the papers by Żelichowski quoted above.

The basic analytical material (logs of exposures and boreholes) on stratigraphy and lithology of the Cretaceous strata of the Lublin Syncline, used in this paper, was taken mainly from studies by Krassowska (1965, 1976, 1977, 1981a, b, 1982, 1986, 1989), and also by Cieśliński (1959a), Lendzion (1960, 1969), Moryc & Waśniowska (1965), Cieśliński & Pożaryski (1970), Geroch *et al.* (1972), Krassowska & Witwicka (1983), Kijakowa & Moryc (1991), Moryc (1996, 1997), Olszewska (1999) and from logs of deep boreholes drilled by Polish Geological Institute (Profile ..., 1973–1989). Archived descriptions of PIG boreholes were also used to a large extent. Many of these papers, especially those by A. Krassowska and S. Cieśliński, include many valuable data on conditions of sedimentation and palaeogeography.

The length of time corresponding to the stratigraphical hiatus at the base of the Cretaceous varies largely over the area, in consequence of differentiated evolution of individual pre-Cretaceous tectonic units. The gap is greatest – ca. 230 My – near Hrubieszów, where Cenomanian strata directly overlie the Upper Carboniferous (Żelichowski, 1972; Krassowska, 1976). Over the East European Craton, where Cretaceous strata directly overlie the Jurassic ones, the gap corresponds to ca. 54 My (Cenomanian overlying Middle Oxfordian – Krassowska, 1976; Niemczycka, 1976). In the area of Dębica (Fig. 2), close to the axis of subsidence, the hiatus disappears, as a continuous transition was observed there between the Tithonian and Berriasian strata (Olszewska, 1999).

LITHOLOGY AND STRATIGRAPHY

Neocomian strata occur in a narrow belt near the erosional boundary with the Upper Jurassic in the south western limb of the Lublin Syncline and are known only from a few boreholes: Szelina, Potok IG-1, Ruda Janowska, Dyle IG-1, Józefów, Narol IG-1, Narol PIG-2, Babczyn 2 and Basznia 1 (Fig. 2).

The Neocomian strata are proven by microfauna in three boreholes: Szelina (Cieśliński & Pożaryski, 1970), Basznia 1 (Moryc & Waśniowska, 1965) and Narol PIG 2 (Marek & Leszczyński, 1992). Upper Valanginian age was determined at Narol, Valanginian–Hauterivian at Basznia

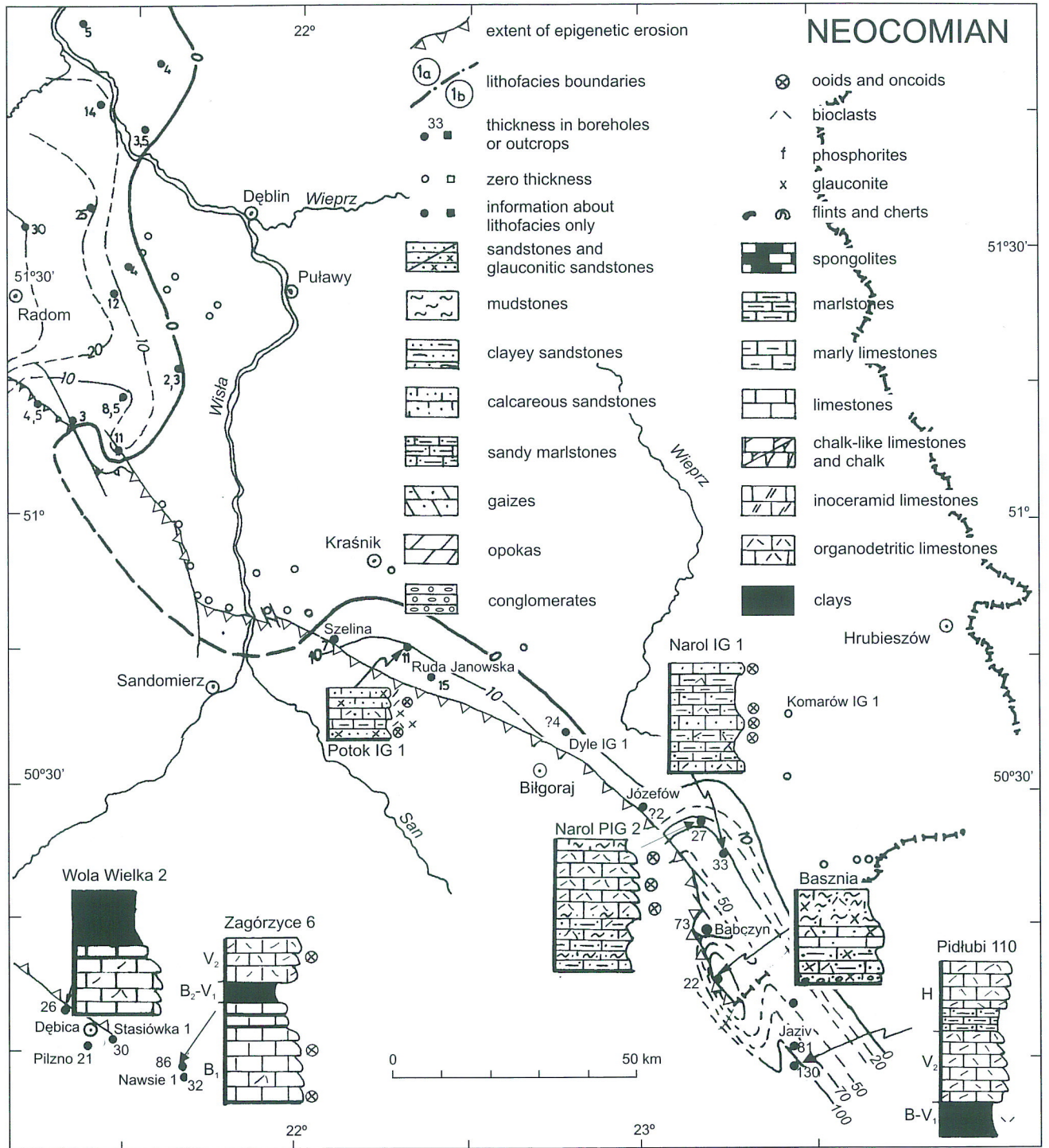


Fig. 2. Thickness pattern and characteristic lithological sequences of Neocomian deposits. Schematic, characteristic profiles not to vertical scale. B₁ – Lower Berriasian, B₂–V₁ – Lower Valanginian – Upper Berriasian, V₂ – Upper Valanginian, H – Hauterivian

and Neocomian at Szelina. In the other boreholes the Neocomian age was attributed on the grounds of the position in the sequence and lithological analogies to the stratigraphically documented boreholes. The Neocomian sediments are sandy-muddy-calcareous with oolites, bioclastic material and locally glauconite. The north western part of the studied area, represented by boreholes Szelina and Potok IG 1, clearly stands out with its higher content of terrigenous ma-

terial. The sections of Neocomian deposits from the area near Dębica, on the south western side of the Lower San Anticlinorium, have been also taken into account, as the results of their stratigraphical studies have been recently published (Moryc, 1997; Olszewska, 1999). These include: Wola Wielka 2, Pilzno 21, Stasiówka 1, Nawisie 1, Zagórzycze 6 (Fig. 2). The sequence of Lower Cretaceous strata is there tripartite (Fig. 3): the lower and upper units of