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SEDIMENTARY FEATURES OF TYLAWA LIMESTONES (LOWER OLIGOCENE) IN THE POLISH FLYSCH CARPATHIANS

The article presents preliminary observations on development and sedimentary features of the Tylawa limestones, which are the oldest coccolith limestone horizon in the Oligocene of the Carpathians. Tylawa limestones occur as thin intercalations in Menilitic Beds. A characteristic feature of these limestones is their specific type of lamination. The thin laminae are arranged in distinctive successions. These successions are suitable for long-distance correlation of laminae in the Tylawa limestones in different tectonic units of the Carpathians. Present features as erosional gaps, plastically deformed laminae, dissolution structures, as well as sediments between laminae e.g., thin layers of mud, clay or non-laminated limestones, may preclude detailed correlation of laminae sequences. Observations of distribution and development of the Tylawa limestones seem to confirm the presence of an early Oligocene event in Carpathian basin, which favored deposition of the Tylawa limestones over the vast area.

Представлены предварительные результаты исследования эволюции и особенностей процесса образования тылавских известняков, являющихся старейшим горизонтом известняковых кокколитов олигоцена Карпатских гор. Тылавские известняки встречаются в виде тонких переслаиваний в пределах менилитских пластов. Отличительной чертой этих известняков является специфический характер напластования. Прослеживается особая закономерность в последовательности расположения тонких слоев, позволяющей проводить корреляцию слоев тылавских известняков, находящихся на значительном расстоянии и в различных тектонических образованиях Карпатских гор. Современные характеристики, такие как эрозионные перерывы, пластически деформированные слои, структуры растворения, а также осадочные отложения между слоями, например тонкие слои грязи, глины или нерасслоенных известняков, могут препятствовать точной корреляции расслоенных последовательностей. Изучение распространения и эволюции тылавских известняков подтверждает наличие значительного геологического явления в Карпатском бассейне в раннем олигоцене, которое способствовало образованию тылавских известняков на большой территории.

Tylawa limestones are the oldest coccolith limestone horizon in the Oligocene of the Carpathians. They occur as thin intercalations in the Lower Oligocene Menilite Beds in different tectonic-facies units: Silesian and Dukla [10; 5], Skole [4; 3; 6; 7] and Subsilesian [3].

All coccolith limestone horizons in the Carpathian Oligocene are thought to be a product of sedimentation of coccolith ooze over a vast area in a short time [1]. The Tylawa limestones occur over a much greater area then the younger limestones. Palaeoceanographic conditions during the Tylawa limestones deposition are still controversial [e.g. 2; 1] and require detailed study.

In this work I present preliminary results of a project aimed at describing the nature and paleoceanographic environment of the Tylawa limestones. I present preliminary observations on the development and sedimentary features of the Tylawa limestones. The study has been carried out in eight outcrops in the Polish

Flysch Carpathians, from three tectonic units: Dukla, Silesian, Skole units. I made detailed lithological logs and collected samples of the Tylawa limestones. The samples were studied using mezoscopic, microscopic and cathodoluminescent methods. Host sediments of the limestones have also been studied.

The Tylawa limestones occur just above cherts of the Lower Menilite Shales as intercalations from a millimeter and often up to 10 cm thick, and the total thickness may reach 25 cm. There are from one to nearly ten intercalations in individual sections. These intercalations are separated by various deposits: shales, mudstones, sandstones, cherts, non-laminated limestones, dark non-laminated bituminous shales, marly shales, and marls. The vertical distance between the most distant intercalations can be from 10 m up to 100 m and depends on the type of the host deposits.

A characteristic feature of these limestones is their specific type of lamination. When viewed with the naked eye the laminations are composed of light and dark wavy laminae, more or less distinct and continuous. Approximately, 6 to 10 laminae can be present in 1 mm of the limestone thickness.

The laminae visible as the dark and light ones can be subdivided into several microlaminae in microscopic normal or cathodoluminescent view. They are very thin, wavy, undulated, partly discontinuous, and sometimes difficult to trace laterally. Those laminations are composed of micrite, with a nodular structure [1]. The light laminae are built of more or less regular nodular micrite with very rare thin dark streaks, and dispersed small pyrite fromboids. They are approximately from 0,05 to 0,5 mm thick. The dark laminae are composed of smaller nodules with many thin dark streaks. There are many pyrite fromboids. These dark laminae are often thinner than the light laminae. The amount of the dark streaks seems to have an effect on the presence of light and dark laminae in mezoscopic view.

Densely spaced dissolution structures are present in the dark laminae. These resemble stylolites developed at small distances or often surrounding irregular, flattened nodule.

The nodules present in these deposits are interpreted as zooplankton (copepod) fecal pellets made up of coccolith debris [1]. These point to massive coccolithoporid blooms during the time interval corresponding to the zone NP 23. The assemblage of coccolithoporids is of low diversity, with predominance of one species – *Reticulofenestra ornata* Müller – [1; 9].

There are abundant well preserved fossil fishes, belonging to an assemblage which appears only in this part of the Oligocene section [8].

Poorly preserved rare diatoms [1] may indicate the source of silica for selective silicification of some laminae or sometimes of the whole limestone layers.

Additional characteristic features of the Tylawa Limestones lamination include: erosional gaps, deformed laminae, plastically deformed laminae, non-laminated limestones clay, or mud layers, and silicification. Some of them appear in all the studied outcrops, but in variable form. In some sections they occur in various positions, and sometimes their occurrence is limited to one section.

The thin laminae are arranged in distinctive successions that can be traced in equivalent limestones in different outcrops. These successions are suitable for long-distance correlation of laminae in the Tylawa limestones in different tectonic units of the Carpathians. So far, successful correlation has been obtained over small distances or with some discrepancies [1]. Often those features mentioned above preclude detailed correlation of laminae sequences.

Observations of the distribution and development of the Tylawa limestones seem to confirm the presence of an early Oligocene event in the Carpathian basin, which favored the deposition of Tylawa limestones over a vast area. Even if the coccolith limestones are very thin in profile, separated by different deposits, they are not representing a background sediments in the Carpathians basin. They were delivered from surface waters to the basin floor in the form of zooplankton fecal pellets. The pellets are preserved and form limestones under anoxic bottom waters. Sediments between laminae e.g., thin layers of mud or clay or non-laminated limestones, as well as structures in the host sediments mentioned in this paper, show that there were events that disturbed the limestone deposition. Dissolution structures

(styloliths) point to post depositional effects, which may have had influence on the original thickness of those deposits.

Further sedimentological data from Tylawa limestones are still being collected, in order to obtain a more detailed view on the nature of the event (events).

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