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Diversification of Productivity of the Oxfordian Subtidal Carbonate Factory in the Holy Cross Mountains

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Abstract : The aim of the research was to verify lateral extent and thickness variability of individual limestone layers within early-Jurassic medium- and thick-bedded limestone interbedded with marlstones. Location: The main research area is located in the south-central part of Poland in the south-western part of Permo-Mesozoic margin of the Holy Cross Mountains. It includes outcroppings located on the line between Mieczyn and Wola Morawicka. The analyses were carried out on six profiles (Mieczyn, Gniezdziska, Tokarnia, Wola Morawicka, Morawica and Wolica) representing three early-Jurassic links: Jasna Gora layers, grey limestone, Morawica limestone. Additionally, an attempt was made to correlate the thickness sequence from the Holy Cross Mountains to the profile from the quarry in Zawodzie located 3 km east of Czestochowa. The distance between the outermost profiles is 122 km in a straight line. Methodology of research: The Callovian-Oxfordian border was taken as the reference point during the correlation. At the same time, ammonite-based stratigraphic studies were carried out, which allowed to identify individual packages in the remote outcroppings. The analysis of data collected during fieldwork was mainly devoted to the correlation of thickness sequences of limestone layers in subsequent profiles. In order to check the objectivity of the subsequent outcroppings, the profiles have been presented in the form of the thickness functions of the subsequent layers. The generated functions were auto-correlated, and the Pearson correlation coefficient was calculated. The next step in the research was to statistically determine the percentage increment of the individual layers thickness in the subsequent profiles, and on this basis to plot the function of relative carbonate productivity. Results: The result of the above-mentioned procedures consists in illustrating the extent of 34 rock layers across the examined area in demonstrating the repeatability of their success in subsequent outcroppings. It can also be observed that the thickness of individual layers in the Holy Cross Mountains is increasing from north-west towards south-east. Despite changes in the thickness of the layers in the profiles, their relations within the sequence remain constant. The lowest matching ratio of thickness sequence calculated using the Pearson correlation coefficient formula is 0.67, while the highest is 0.84. The thickness of individual layers changes between 4% and 230% over the examined area. Interpretation: Layers in the outcroppings covered by the research show continuity throughout the examined area and it is possible to precisely correlate them, which means that the process determining the formation of the layers was regional and probably included both the fringe of the Holy Cross Mountains and the north-eastern part of the Krakow-Czestochowa Jura Upland. Local changes in the sedimentation environment affecting the productivity of the subtidal carbonate factory only cause the thickness of the layers to change without altering the thickness proportions of the profiles. Based on the percentage of changes in the thickness of individual layers in the subsequent profiles, it can be concluded that the local productivity of the subtidal carbonate factory is increasing logarithmically.

Keywords : Oxfordian, Holy Cross Mountains, carbonate factory, Limestone
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