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Seismic characterization of the Upper Jurassic organic buildups in the Miechów Trough (S Poland)

Łukasz Słonka and Piotr Krzywiec
Institute of Geological Sciences, Polish Academy of Sciences, Warsaw, Poland (lukasz.slonka@twarda.pan.pl)

The study area is located within the Miechów Trough, which forms SE part of the Szczecin– Łódź–Miechów Synclinorium that was formed during the Late Cretaceous – Paleogene inversion of the Permian–Mesozoic Polish Basin. In Jurassic times Miechów Trough was located within the transition zone between the epicontinental Polish Basin and the Tethyan basins. During the Late Jurassic both the transition zone and the northern Tethyan shelf were areas of a widespread carbonate sedimentation with diversity of depositional systems including microbial-sponge facies associated with organic buildup deposits. In the Oxfordian, the Miechów Trough was situated mainly within the carbonate open shelf and, progressively from NE, towards the end of the Oxfordian and the beginning of the Early Kimmeridgian, partly within the shallow-water carbonate platform.

The reinterpretation of relatively dense coverage of 2D seismic profiles from the SE part of the Miechów Trough proved presence of a system of carbonate buildups in this part of the basin. One of the large carbonate buildup complexes has been recently drilled and the well data proved presence of the massive (sponge) limestones within the Oxfordian interval. The aim of this study was to identify the seismic signatures and analyze reflection configuration patterns in order to describe the internal structure and development of the given organic buildups. Seismic interpretation was preceded by detailed well-to-seismic correlation based on high-resolution synthetic seismograms calculated for key calibration wells.

Seismic stratigraphic analysis revealed distinctive depositional architecture, i.e. the existence of the biohermal complexes separated by intra-biohermal basinal facies. An effect of differential compaction between the carbonate sediments can be clearly observed on seismic data too. It is expressed by: (1) significant draping above the buildups – an evidence of lesser compaction within the carbonate buildups, typical for more resistant bioherms, and (2) compaction sag between the buildups – result of more significant compaction of intra-biohermal fine-grained carbonates. Differential compaction also led to formation of normal faults along the edges of organic buildups. Lateral extent of particular buildup complexes is in range of 400–1000 meters and total height is around 100–200 meters. Results of seismic data interpretation show evidences of generally aggradational growth of the buildups, sometimes with possible periods of lateral growth. The entire system of the Upper Jurassic carbonate buildups in the Miechów Trough formed due to combined effect of at least partly tectonically controlled Late Jurassic (Oxfordian) paleorelief of sea bottom and of regional (eustatic) sea-level changes. The interpreted depositional architecture of the Oxfordian carbonate succession in the Miechów Trough resembles the well-recognized Oxfordian system in the neighbouring Kraków-Częstochowa Upland, characterized by large organic buildup complexes surrounded by basinal (bedded) facies.

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