Łukasz Grzybowski

Analysis of the evolution of the Goleniów structure in the Mesozoic based on an integrated interpretation of geological and geophysical data

PhD thesis

/Abstract/

The Goleniów structure is located in the NW part of the Polish Basin which belongs to a system of Permian-Mesozoic epicontinental sedimentary basins of the Western and Central Europe. Its axial part (so called Mid-Polish Trough – MPT) was filled with several kilometers of sediments, mainly siliciclastic and carbonates and with Zechstein (Upper Permian) evaporites at its base. The Polish Basin was fully inverted in Late Cretaceous-Paleogene. The presence of thick layer of evaporites led to formation of diverse salt structures. The study area is located within the NW flank of the MPT (Pomeranian region), characterized by presence of numerous salt and salt-related structures. One of them, the NNW-SSE oriented Goleniów structure, extends for over 25 km. Interpretation of dense array of 2D seismic reflection profiles allowed for the assessment its spatial variability and main evolutional stages.

NNW part of the Goleniów structure is formed by a well-developed salt diapir (salt wall). Its evolution started in Late Triassic when regional extension triggered formation of the asymmetric reactive diapir. After Late Triassic-Early Jurassic active growth, diapir continued its development as a passive diapir due to a regional extensional tectonic regime. In Middle and Late Jurassic, insufficient amount of salt in the source layer led to diapir burial. Further extension caused diapir to fall. This resulted in Early Cretaceous localized extension and formation of a half-graben alongstrike the salt structure filled with Lower Cretaceous sediments of locally increased thickness. The Goleniów structure was significantly re-shaped during the Late Cretaceous inversion of the Polish Basin. It was rejuvenated and started to grow which led to roof uplift followed by its partial erosion. This progressive compression-related Late Cretaceous growth is very well documented by growth strata preserved above the diapir. Finally, after completion of inversion of the Polish Basin, salt crest reached the Cenozoic groundwater active circulation zone which caused its dissolution and, eventually, development of the dissolution-collapse trough filled with Cenozoic sediments with increased thickness. The style of the deformation changes alongstrike toward the SSE where, due to smaller amount of evaporites, salt diapir did not form and was replaced by a complex zone of thin-skinned deformation detached within the Zechstein evaporites. First, series of half-grabens was formed during Late Triassic-Jurassic extensional phase. It was then compressionally deformed during basin inversion and this led to complex thin-skinned folding and thrusting within the Mesozoic section.