Late Jurassic to Miocene dynamics of the Polish part of Outer Carpathian Basins and its regional implications

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The Late Jurassic to Early Neogene tectonic evolution of the Polish part of Outer Carpathian fold-and-thrust flysch belt was a subject of the research. The flysch sequences in Poland are divided into several tectonic and facial units related to primal basins/sub-basins; Magura, Dukla, Fore-Dukla, Silesian, Subsilesian and Skole units were analysed here. Outwards of flysch belt basin the European platform Peri-Tethyan basins developed, including Polish Trough and its southern prolongation, of which tectonic relations with northern Tethyan realm are in question.

Synthetic 1-D sections of the basin-fill for individual zones of flysch belt sub-basins were reconstructed and backstripped in order to calculate tectonic component of the basement vertical movements. The results are highly dependent on palaeobathymetry estimations. For the Polish Trough maps of subsidence rates were constructed, and correlation of the main tectonic events between Outer Carpathians and European plate (Polish Trough) were analysed. Subsidence pattern is consistent the across analysed part of Outer Carpathians (less certain for Magura basin) suggesting common mechanisms controlling subsidence and uplift of basins/sub-basins. For the Late Jurassic to Maastrichtian main tectonic events of the northen Tethyan realm (Outer Carpathians) and southern Peri–Tethyan realm (Polish Trough) correlate in time, while for the Neogene only very limited correlation is observed. During Oxfordian time, the major tectonic event took place across the southern prolongation of the Polish Trough, which significantly increased in rate towards the Outer Carpathian basins. Together with extensional/transtensional major tectonic event in the Inner Carpathians it allows to suggest that the Outer Carpatian basins were afected by extensional tectonic regime at that time.

For the Tithonian to beginning of Early Cretaceous, an extensional event is recorded for Silesian (and possibly Dukla) units, followed by thermal cooling subsidence pattern throughout the remaining part of the Early Cretaceous. Decreasing deposition rates convince regional thermal sag mechanism, affecting source area aswell. Since the Turonian–Coniacian until Maastrichtian–Paleocene, an uplift of basins took place (not certain for Magura basin), which was coeval in time with the Inner Carpathian collision and folding. The uplift is interpreted as being a result of change in tectonic regime into compressional one. This is also coeval with suggested here beginning of inversion processes of the Polish Trough, recorded by very minor subsidence and/or uplift of former main depocentre, as well as development of marginal depocentres on both flanks of the Polish Trough. Therefore, it is suggested that dynamic processes taking place in the Tethyan realm (the northern Inner and Outer Carpathians) and in the southern Peri–Tethyan realm (Polish Trough) at that time were part of common geodynamic frame controlled by transmission of compressional stresses from the collision zone of the Inner Carpathians. Renovation of subsidence since the Paleocene and lasting until Middle–Late Eocene times, could be related to an isostatic rebound after previous uplift, although thermal cooling after the Late Jurassic/Early Cretaceous extension might be of some contribution as well. During Late Eocene to Early Oligocene times prominent uplift took place, followed by minor subsidence. This uplift, having the general plate convergence background, is interpretated here to be a reaction to compressional stress develoment and a shift of locus of shortening to the north. Its final relocation and creation of main detachment surfaces resulted in stress relaxation and limited subsidence, therefore, the Late Oligocene–Early Miocene basin would developed on top of undergoing initial thrusting flysch sequences. Further continuation of shortening introduced orogenic processes into the Outer Carpathians.