The Late Alpine Kleszczów Graben (south-central Poland): the role of the reactivation faults in its origin and structural evolution

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Structural relationship between the Permian–Mesozoic fault sets and fabric of Cenozoic Kleszczów Graben (south-central Poland) is presented.Tectonic analysis of deep wells data revealed the occurence of the two main fault sets in the Permian-Mesozoic sequence: 1) NE–SW to ENE–WSW, 2) NW–SE to WNW–ESE. These faults are generated mainly in Kimmerian and Alpine tectonics and some of these are older and continue down to the Moho boundary (Holy Cross Fault).

Sedimentation and deformation pattern of the Permian–Mesozoic sequence was controlled by these regional faults. Structural analysis of the Cenozoic Kleszczów Graben infilling was made on the basis of the two data groups: results of the shallow drilling of brown coal and the detailed field investigations in the open cast brown coal mine "Bełchatów" (eastern part). The reconstruction of the main deformations in the Kleszczów Graben was made: 1) reactivation of WSW–ENE and NW–SE faults in transtension regime in Late Oligocene–Early Miocene (WNW–ESE the maximum stress axis) and opening pull-apart basins along WSW–ENE faults; 2) reactivation of NE–SW faults in extensional regime in the Late Sarmatian–Early Panonian (high angle plunge maximum stress axis) and vertical displacement of Cenozoic series; 3) reactivation of NW–SE inversion faults with strike-slip movements in transpresional regime in the Late-Middle Pleistocene (with NE–SW shortening direction). Analysis of the youngest deformations in the Kleszczów Graben and recent seismic activities in the region indicate the relationship with older faults.

The Alpine collision seen from Paris Basin and southern North Sea

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The Paris Basin and the Southern North Sea basins (Broad Fourteen Basin, Sole Pit Basin, Dutch Central Graben, Central and West Netherlands Basins) have recorded compressional deformations related to the alpine collision from Upper Cretaceous to present-day. Deformation events in both basin domains are of similar age. Compression started during Upper Turonian with a paroxysm at the end of Cretaceous times (Maastrichtian). Eocene deformations (so-called "pyrenean") are well recorded in both domains. Another event occured during the Oligocene, but preferentially in the Paris Basin.

Although both domains have very similar tectonic timing, they significantly differ in tectonic style and structure size. The Paris Basin exibits a regional scale folding with a 200–300 km wavelength. On the contrary the Southern North Sea Domain is characterised by narrow spaced faulting (few tens kms) with associated folding. The Paris Basin mainly records lithosphere buckling from Upper Cretaceous to present-day with slight changes of the compression direction (N–S during Upper Cretaceous to NW–SE during Upper Miocene) with some NE–SW trending folds of Upper Cretaceous age (Bray anticline). The Southern North Sea Domain is characterised by spectacular inversion of mesozoic grabens, through reactivation of normal faults into strike-slip reverse faults. The amount of uplit associated with strong erosion and related to fault reactivation is higher in the Southern North Sea Domain than in the Paris Basin.

This twofold style of alpine age compressional tectonics in the West European Platform is discussed in mechanical terms.