TECTONIC EVOLUTION OF THE SOUTHERN PART OF THE CENTRAL–CARPATHIAN PALEOGENE BASIN IN THE EASTERN SLOVAKIA

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Abstract: Synsedimentary evolution of the southern part of the Central – Carpathian Paleogene Basin has been determined by tilting of its basement blocks towards NW and associated subsidence of the basin in this direction. Post – Paleogene tectonics of the basin associates with at least three successive tectonic events: the Oligocene – Miocene one having NW – SE orientation of paleocompressional field, the Middle Miocene NW – SE oriented extensional event and presumably Sarmatian ENE – WSW oriented compressional event.

Key words: Western Carpathians, Central – Carpathian Paleogene Basin, tectonic events

Central-Carpathian Paleogene Basin (CCPB), located S of the Pieniny Klippen Belt (PKB) is the largest Paleogene basin in the Central Western Carpathians (CWC). The opening of the basin in the Paleocene commenced S of the Outer Carpathian accretionary prism and was driven by collision between the North-European Platform and Western Carpathians, pull of the subducting slab and isostatic load (Bezák et al, 2000). The basin is filled by sediments of the Subtatric Group, which are up to 4 000 m thick (Gross et al., 1984) and overlap a substantial part of the pre-Gossau nappe units of the CWC. According to the recent data (Janočko et al, 1998, Soták & Starek, 1999) sedimentation within the basin continued up to the Neogene.

Generally, the sedimentary fill of the E part of the CCPB is flatly inclined to the centre of the basin and is mainly segmented by NE-SW and NW-SE fault sets. However, the NE part of the basin belonging to the Šambron – Kamenica zone (ŠKZ) has more complicated structure recording major compression during its evolution.

The SE part of the CCPB is nearly exclusively deformed by faulting. Only at the northern edge of the pre-Tertiary block of Branisko Mts. in muddy shales of Huty Formation

Marko (1999) has recorded S verging, tight, disharmonic flexural-slipe folds of ENE – WSW direction.

The SE flank of the CCPB is deformed by NW-SE, SW-NE, N-S and E-W, obviously steeply dipping faults. All of them have vertical and at least partly strike-slip kinematics. Their neo-activity has been confirmed by various methods (e.g. Jacko, 1997). Regionally, the most important post-Paleogene faulting of the discussed part of the CCPB has accurred along NW-SE and SW-NE dislocations (cf. Polák & Jacko et al., 1997). However, many individual dislocations represent older, pre-Paleogene reactivated faults.

The aim of the paper is to contribute to kinematic mechanism of the mentioned faults in the SE part of the CCPB and also to discuss some wider interrelations between the basal Paleogene deposits in the area and type of CCPB basement on which they were deposited.

Geological setting

The SE, marginal part of the CCPB is composed of four Paleogene formations assigned to the Subtatric Group (Gross et al., 1984). The lowermost, Borové Fm. consists of Paleocene to Oligocene continental, deltaic and shallow-marine deposits. It is overlain by Huty Fm. (Eocene – Oligocene) composed of prevailing mudstones and minor sandstones and conglomerates. The Huty formation gradually passes into Early and Late Oligocene Zuberec Fm. consisting of alternating mudstone and sandstone beds. The succession of the basin fill is capped by prevailingly coarse-grained Biely Potok Fm (Oligocene – Early Miocene).

In studied area mostly sediments of Borové Fm. occur. They crop out on the uplifted blocks of the basin margin formed by Mesozoic rocks underlain by pre-Mesozoic basement of the Gemericum and Veporicum units. Facial analyses provided basis for division of the formation into four lithofacial units representing terrestrial (fluvial, alluvial fan and slope) and shallow-marine deposits of Paleocene to Early Oligocene age (e.g. Filo & Siráňová, 1996, 1998).

Tectonic evolution

The origin of the CCCB basin was initiated by both pre-Gossau nappe pile overloading the northern edge of the CWC and continuous subduction of the North European plate below the CWC. The basin started to develop as in-wake basin (e.g. Janočko in Bezák et al., 2000). Its present structure is a result of interference of synsedimentary and Neogene /Quarternary tectonics.

Both structure and clastic composition of the southern margin of the basin are highly influenced by pre-Tertiary tectonics of its basement. Nearly all regional post-Paleogene fault sets within the realm reveal very close directional relations to Cretaceous tectonics of the area. At the western part of the area mainly E-W faults occur. The eastern part is predominantly controlled by originally shear structures of Cretaceous NW-SE trending transpressional Margecany shear zone (Jacko et al. in Polák et al., 1997). However kinematic character of the structures has been repeatedly changed during Tertiary/ Quarternary evolution of the basin (cf. Jacko, 1997).

The beginning of Paleogene sedimentation of the area was significantly affected by Late Cretaceous unroofing of the basement and following – spatially different pre-Eocene exhumation of the basement blocks according to NW-SE and SW-NE faults, respectively. Due to these processes the base of CCPB overlap a very wide scale of the pre-Gossau units of the CWC starting with Silica nappe formations and finishing by deeply eroded – the Variscan, Middle lithotectonic unit of the Veporicum basement (e.g. eastward from Kluknava village).

For the synsedimentary tectonic evolution of the southern margin of the CCPB continuous uplifting of the basement unit is typical. A gradual deepening of the CCPB to its centre has been already in Late Eocene accompanied by directionally analogous tilting of its basement block followed by at least local formation of tight disharmonic slump folds probably developed at the edges of tilting blocks (Marko, l.c.). Our research reveals subsidence of the CCPB from SE to NW at that time connected with redeposition underlying sequences material. The filling of the CCPB has been terminated by the Oligocene – Early Miocene sedimentation of Biely Potok Fm. The low-angle SW -NE inclination of the basin fill is related to the post Paleogene tectonics.

The post – Paleogene tectonics of the region principally associates with at least three successive tectonic events. The oldest, Oligocene – Early Miocene one, originated by the NW – SE oriented paleocompressional field (Nemčok, 1993) is related to dextral shearing of the CCPB along master fault at the southern margin of the PKB. Besides fold structures at the mentioned part of the CCPB it caused a partial southvergent thrusthing of the Biely Potok Fm. (Plašienka et al., 1998) and desintegration of the basin by NE – SW fault sets.

According to structural relations at the Branisko horst both its marginal reverse faults i.e. western – Poľanovce fault (PF) of N – S direction and NE – SW the Šindliar one (ŠF) limiting the horst from the East belong to R' structures of the event. On these faults pre – Tertiary sequences of the Branisko Mts. are moderatly to steeply thrusted onto the Eocene – Oligocene formations of the CCPB. Moreover, CCPB formations in the ŠF zone is deformed

into drag folds and splitted by penetrative cleavege sets. Also NE – SW Klenov fault limiting the Čierna hora Mts. cover succesions against the CCPB fill was likely initiated at this event.

The second – NW – SE extensional event probably of the Middle Miocene age resulted to activity of NE – SW normal faults with horst and graben activity. The process resulted into sliding along bedding planes of CCPB sequences into the basin centre. At the western part of the Branisko horst dextral N – S strike slips have been created. For the subsequent NWN – SES compressional event a development of both NW – SE reverse thrust and steeply dipping E – W strike slips is symptomatic. Structures of this local event are nearly exclusively related to the Branisko horst incl. its E – W tectonic limitation against CCPB formations.

The third, a compressional (ENE – WSW), presumably Sarmatian event (Kováč et al., 1998) has notably caused a regional reactivation of older structures. SW dipping mainly basement faults reveal sinistral strike – slip and prevailingly slight normal component as well (eg. Jacko et al., 1996). SE – NW oriented R' shear faults regularly disrupted the study area of the CCPB and the previous fault set which is in the Veporicum basement, accompanied by expressive negative duplexes.

Neo – activity (incl. Quarternary movements) of E – W, NW – SE, NE – SW and N – S faults is confirmed by geological, geodetical evidences and by technical works data as well (Jacko, 1997). The main depocentres of the Hornád river terraces originated during the Middle and Late Quaternary are located at the intersections of NW-SE and NE-SW faults of the Veporic unit. Similarly, many NW – SE faults or their intersection areas with N – S or NE – SW faults are accompanied by travertines or calcareous tufas. A beginning of N – S fault set activity is placed by Kováč et al. (l.c.) into Pannonian. These faults deeply deformed the Veporic basement of the region at its eastern part and their joints cut deluvial sediments cemented by calcareous tufas at some places.

Consequently we conclude that tectonic development of the CCPB has clearly polystage character and it was mainly developed in noncoaxial shear regime of the tectonic events.

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