IMPLYING ON TECTONICS OF BOROD BASIN (NW PART OF APUSENI MOUNTAINS, ROMANIA)

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ABSTRACT: Exploration with geological drill holes of Sarmatian coals from Borod Basin, situated in north-western part of Apuseni Mountains, gave us the necessary information in order to build up some morpho structural models for the pre-Neogene basement as well as for the previously identified lithostratigraphic units. Thus it is confirmed the previous hypotheses regarding the opening of the basins from western part of Apuseni Mountains, along of normal listric faults.

KEYWORDS: Borod Basin, tectonics, digital elevation model.

Introduction

The Neogene Borod Basin is located in NW part of the Apuseni Mountains, bounded by the Plopis Mountains in the North and Padurea Craiului in the South. The basin represent one of the eastern prolongation of the Pannonian Basin, being oriented WNW-ESE (Fig. 1)

TISZA-DACIA block it is found in the basement of the Pannonian Basin and the Apuseni Mountains as well. Along of Central-Hungarian translithospheric faults alignment, the ALCAPA block positioned northwesterly, contacting the TISZA-DACIA block situated southeasterly. During the lower Miocene the ALCAPA block suffered a northeastward displacement along the mentioned alignment, combined with a counterclockwise rotation. In the mean time the TISZA-DACIA block has rotated clockwise and translated towards east (e.g. Csontos, 1995). In a different opinion (Kováč & Márton, 1998), during the early Miocene time, the ALCAPA block suffered a counterclockwise rotation combined with lateral towards right displacement along the northern margin of the TISZA-DACIA micro-plate, without a clockwise rotation of the later one. The rotation of ALCAPA continued during the Badenian synchronous with a slight clockwise rotation of the TISZA-DACIA microplate.

Connected with these major events that took place in the Carpatho-Pannonian area, in the Apuseni Mountains were separated three tectonic events that produced normal faults systems predominantly oriented NW-SE (lower Miocene), NE-SW (middle Miocene) and NW-SE (upper Miocene-Pliocene). In the pre-Badenian event, characterized by the NW-SE

compressions and NE-SW extensions, were formed the Neogene western basins (Zarand, Beius, Borod), along of some normal faults oriented NW-SE, alike the basins from the basement of the Great Hungarian Plain (Gyorfi & Csontos, 1994).

Lithostratigraphy

The Neogene deposits representing the filling of the Borod Basin consists predominantly of pelites rocks and subordinate of micro-conglomerate sequences, sandstones, sands, silts rocks, tuffs and coals. In the eastern part of the basin, were separated three lithostratigraphic units: the Borod Formation, the Cornitel Formation and the Beznea Formation (Popa, 2000).

The Borod Formation (Eggenburgian-Badenian), contains clays and siltic fine micaceous blackish marls with interlayers consisting of silts, sands, sandstones and fine coal levels. These sediments contain the richest fauna from whole Neogene column. Deposits of this formation outcrop only in the northeastern part of the basin and cover the northern third of its eastern part. Their thickness ranges between 100-240m.

The Cornitel Formation (Volhynian), consists predominantly of grayish compact marls, laminated on top, with sandstones and greenish micro-conglomerates at the lower part followed by two coal beds separated by a tuffaceous interlayer (Borozel Member). The thicknesses vary from few tens of meters (Cornitel) to 250-300m, generally in the east part of the basin. Towards west the thickness grows to 600 m (Grosi), on the northern side of the basin. In the west side, where the basin have its largest opening, the Sarmatian deposits thickness vary in the range of 100-300 m (in the south), grows to 500 m (central), and misses on the north side.

The Beznea Formation (Pannonian), consists of hard compact marls, whitish, with tuffitic interlayers at the lower part and covers large areas within the basin. In the southeastern part contacts directly Mesozoic deposits which outcrops in Padurea Craiului Mountains, and in the northwestern part lays directly on the Plopis Mountains' metamorphics. In the eastern part of the basin it can be found thickness of 500-600 m (SW of Borod), and in the western part thickness of 600-700 m, maybe more.

In the western part of basin, starting from Urvind, were signalized Pontian deposits of up to 350 m in thickness. The thickness grows from the central part of the basin (50-100 m) towards its northern border (Burzuc).

Morfostructural map of Borod basin

A large number of geologic drill holes were done in the Borod Basin, in order to explore the Sarmatian coals. The information gathered from drill cores and geophysical investigations was used for creating the contour maps both of the pre-Neogene basement (Fig. 2) and of the surface of the separated lithostratigraphic formations. In the same time

were made up digital elevation models (DEM) both for the basement and for the other lithostratigraphic formations. These models were realized using the SURFER® software for Microsoft® Windows®, using the Kriger interpolation method. We chose this method for highlighting the morpho-structural features, given the working scale

The 3D depiction of the pre-Neogene basement (Fig. 3) highlights the existence of a major fault on the northern border of the basin, along of probably the basin has opened. The cross sections aligned longitudinally and transversally through the basin, made up based on the drill holes, shows some fault systems trending NW-SE (parallel with the main fault), and NE-SW. The marginal fault on the northern border of the basin separate the Neogene deposits by the metamorphics from the Plopis Mountains. Givulescu (1969) noticed the presence of a fault trending NE-SW, at the contact between the Neogene and Mesozoic deposits from Padurea Craiului Mountains.

At the basement level, there is some lifted tectonic blocks praised by the electrometric investigations (Bădică & Dumitrescu, 1988). These blocks are generally stepping down towards of the west of the basin, precisely towards NW. Westward of Vadu Crisului and southward of Crisul Repede River (this river cuts the basin approximately on the middle), the paleo-landform is represented by the lower Cretaceous deposits. On the surfaces of these limestones has formed large ellipsoidal sinks with the long axis on the E-W direction (Petrescu et al., 1986).

Generally, on the northern margin of the basin, eastwardly, the oldest and the thickest sediments come out. The drills from Grosi have met only the Sarmatian deposits with 600 m in thick without intercepting the basement (Nicorici et al., 1983).

Probably the tectonic events that affected the northern part of the Apuseni, leads to a sequential forming of faults, but in the same time to the reactivation of those already opened, acting progressively on the Neogene cover. It formed thus a series of tectonic blocks with different elevation levels.

As a concluding remark, we may say that the Borod Basin has opened along of a normal fault, probably listric (depicted by Kováč & Márton, 1998-fig. 4), positioned on the northern border of the basin. The enlargement of the basin took place progressively, as it is suggested by the presence of the oldest deposits only in the northern half of the basin. The Sarmatian and Pannonian deposits covers areas more and more larger towards the south and the west of the basin. Tectonic blocks from the western part of the basin are in the deeper position. Whole Neogene suite was affected by the fault systems mentioned before, fact that confirms the continuation in the Apuseni Mountains of the extensional events connected to TISZA-DACIA evolution in the regional geotectonic context.

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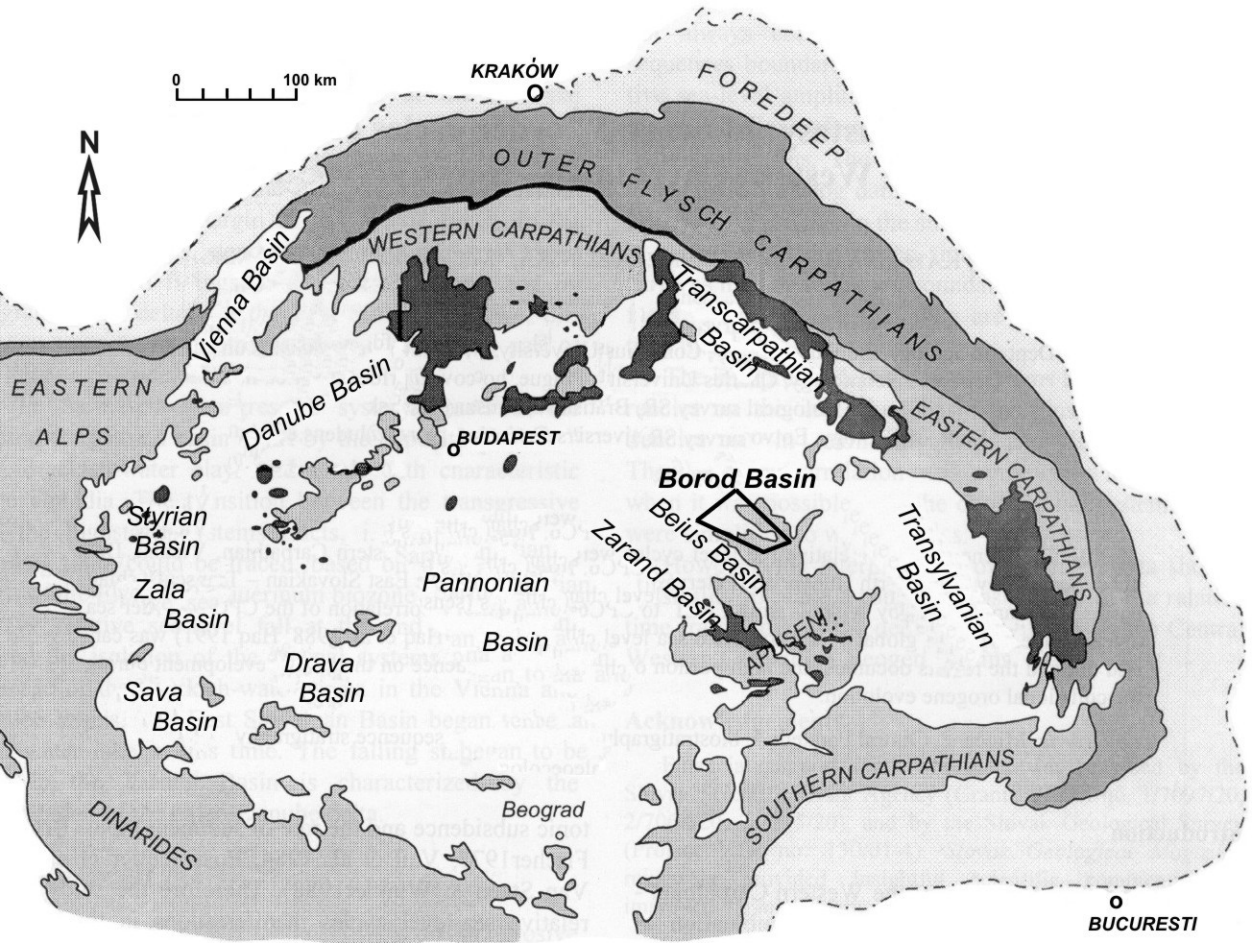
Fig. 1 Location of Borod Basin within Carpatho-Pannonian area.

Fig. 2 The pre-Neogene basement contour map.

Fig. 3 Digital elevation model (3D block diagram) of the pre-Neogene basement.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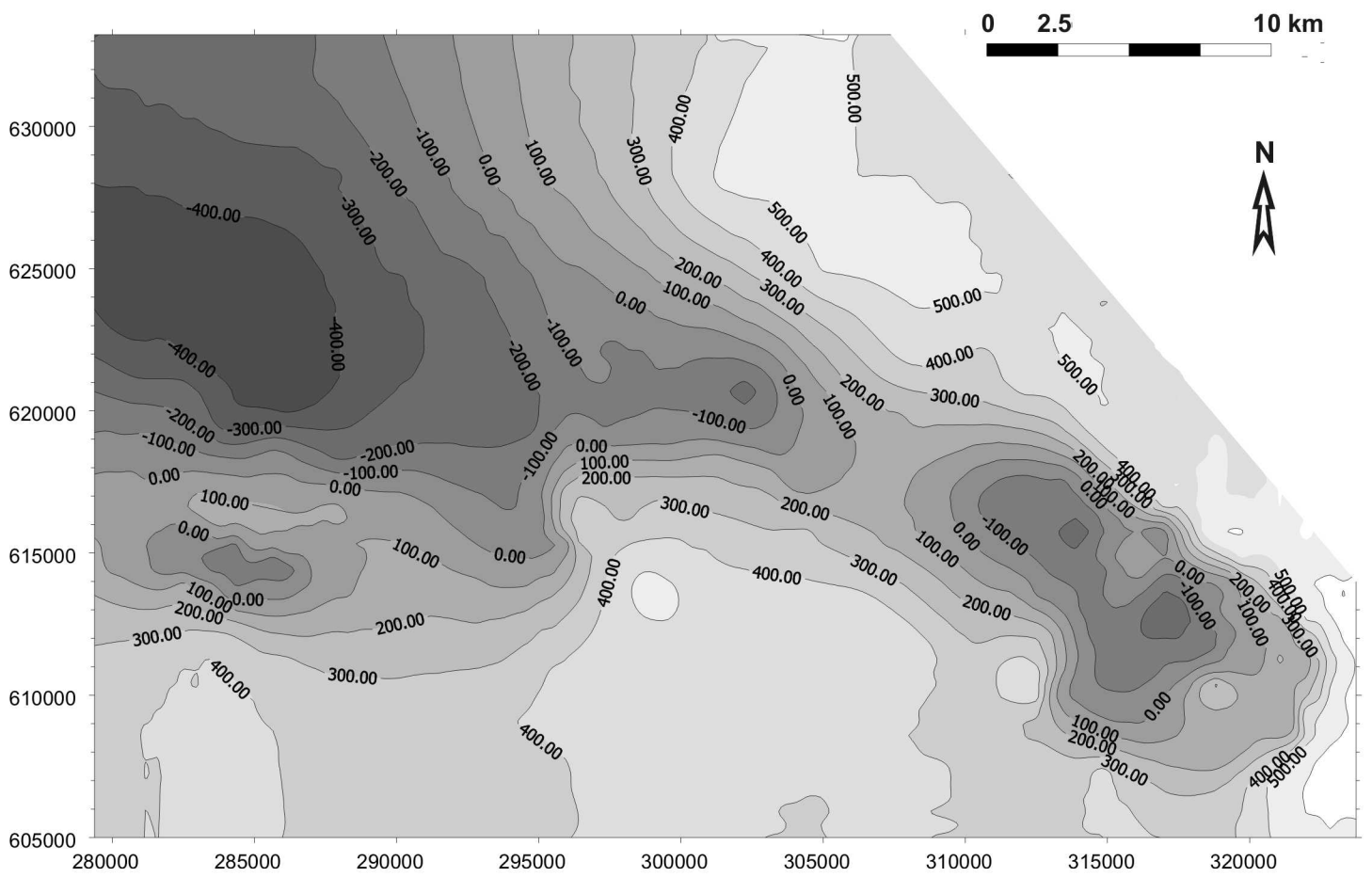
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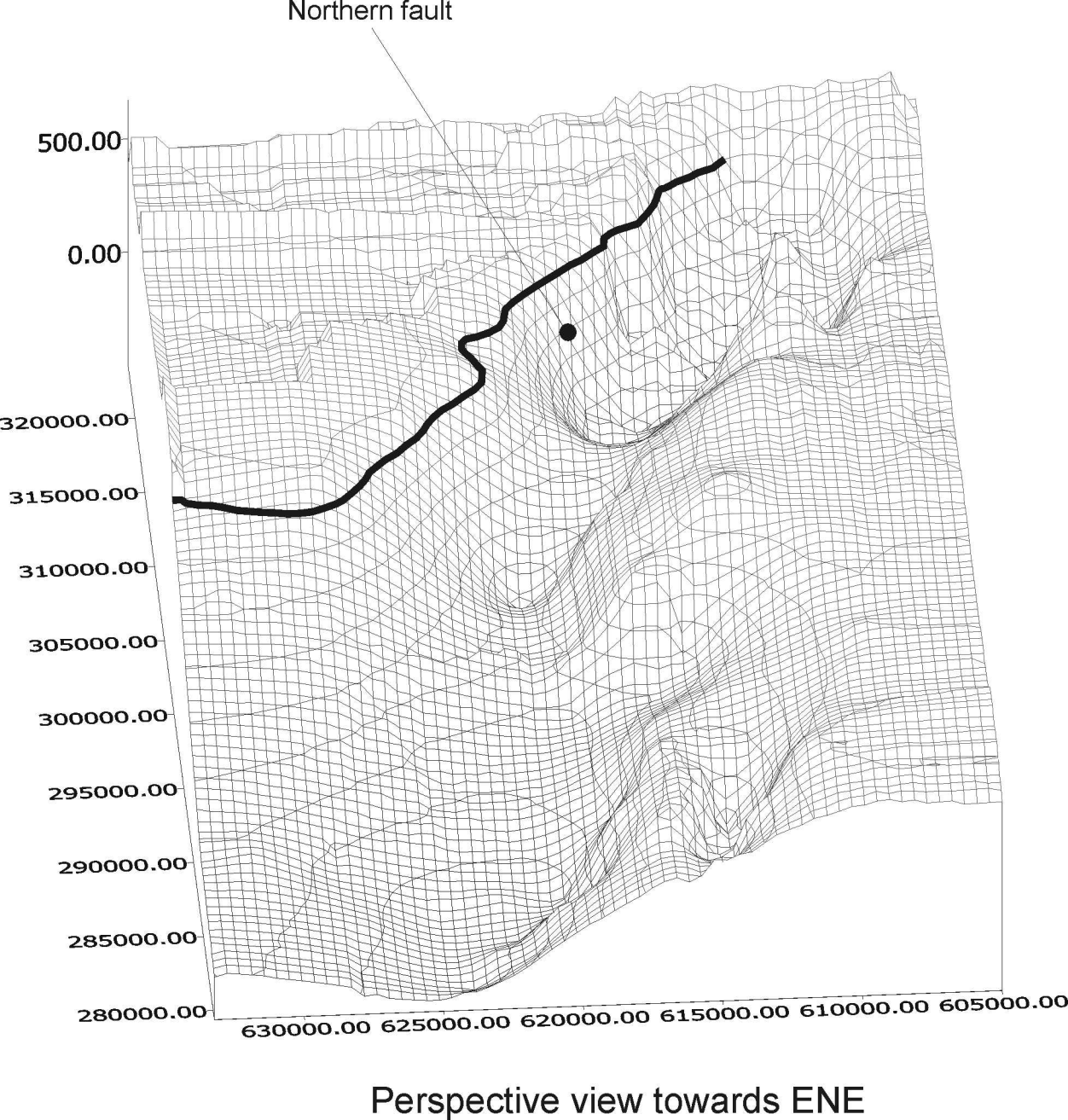

Perspective view towards ENE