

# Structural evolution of Northern Bakony Mts.

Thesis

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## **INTRODUCTION**

The study area is situated in the northern Bakony Mountains (Transdanubian Range, western Hungary) between Ugod and Bakonyháza. It is involved the Telegdi Roth fault, Porva-basin, Hódos, Aranyos and Kökényes basin and the Castle Hill of Csesznek. The aim of the thesis was to describe the tectonic elements of the northern Bakony Mountains related to Alp-Carpathian structural evolution. The Bakony Mts., as a part of the Transdanubian Range (TR) is interpreted as the uppermost situated Cretaceous thrust sheet within the Alpine nappe pile. Former thrust-planes were reactivated as detachment faults, and the Transdanubian Range forms the hanging wall of a Miocene detachment fault system running down from the Kőszeg-Rechnitz window. The description of fault pattern, its kinematics and the structural evolution can be used as analogy in other area. Some of the new data can have implications for the structure of the whole Pannonian Basin.

## **METHODS**

For the structural analysis, microtectonic data like brittle faults, joints and stylolites were used. Based on the kinematic compatibility faults belonging to the same tectonic phase were selected to the same fault set. Stress axes were defined by the palaeostress-analyses. After the paleostress tensor calculation, data with similar paleostress axes were grouped into separate phases.

I completed the microtectonic measurements with structural mapping of the area. Particularly, we modified the fault pattern of earlier maps. Outcrop-scale observations, the determined stress axes, apparent map displacements and cross sections were used to determine the fault kinematics; this was not completed on earlier maps.

## **THESIS AND RESULTS**

1. At least 10 tectonic phases took part in the structural evolution of the northern Bakony Mts. As follows in chronological order: (1) Jurassic NNE-SSW tension, (2) early Cretaceous (Barremian? – Aptian?) – early-Albian) NW–SE compression (3) middle Albian W(NW) – E(SE), and W(SW) – E(NE) extension, (4) Cenomanian - Turonian compression, (5) Campanian – Maastrichtian NE – SW extension, (6) late Senonian – Paleocene strike-slip and/or compressional deformation with WSW-ENE max. horizontal stress, (7) middle Eocene – early Miocene strike-slip stress field with WNW-ESE max. horizontal stress, (8) Karpatian – Badenian NE-SW extension, (9) Sarmatian transpressional stress field, (10) late Miocene (?) – Pliocene-Quaternary (?) extension.

2. Bakonybél fault (Tari 1995), as a prominent, several km long fault of the northern Bakony Mts., was generated in the early Cretaceous (Barremian?-Aptian? – early Albian) NW-SE compressional stress field. Kinematics of this fault, just like its subparallel one (Cuha thrust, Taeger 1935) was sinistral thrusting, thus it can be interpreted as oblique thrust fault. South of the study area thrust fault appearing within the Csollános valley section (Fodor 1998), which is related to the middle Albian deformation, I interpreted as the southern continuation of Bakonybél fault. Generation of the oblique thrust fault can be connected with the formation of the syncline, and so with the first phase of the Albian thrust system evolution.

3. Middle Albian structural history of the northern Bakony Mts. is indicated by previously not documented WSW-ENE oriented extensional stress field. Extensional phase resulted in forming of synsediment normal faults and also rollover anticline (Pintér Hill and Biancone quarry, Zirc). The middle Albian extension is a newly recognized episode within the structural evolution of the Transdanubian Range.

4. The middle Eocene – early Miocene phase can be described with WNW-ESE maximum horizontal stress. The PhD thesis provide several new evaluated microtectonic data to the statement that the maximum horizontal stress has similar importance as the  $\sigma_3$  has within this tectonic phase, in some cases it played more significant role in the deformation. Consequently the stress field has changed between the strike-slip – transpressional and the compressional type. This conclusion is also suggested by the geographic occurrence of Eocene formations. The Eocene accommodation space was separated by NE-SW directed highlands, ridges. This paleogeographic situation induces considering that strong tectonic control influenced the Eocene depositional system.

5. Generation of Porva Half-graben occurred in the Karpatian – Badenian extensional stress field, when NE-SW striking normal faults were formed. Half-graben tectonics suggested by microtectonic data, rollover anticlines and reactivation of Bakonybél thrust fault with normal sense, proves the extensional character of the first period of the synrift phase in Bakony Mts., which was responsible for the generation of the Pannonian Basin.

6. Sarmatian stress field shows transpressional sense with NNW-SSE maximum horizontal stress based on the microtectonic data recorded in the northern Bakony Mts.. The main deformation of the dextral transpressional Csesznek Zone including an echelon thrust faults and folds took part in this tectonic phase. Marks of transpression were also observed along the Telegdi Roth fault, which is parallel to the Csesznek Trend. It indicates that while extensional deformation related to Alp-Carpathians subduction continued in the Eastern part of the Pannonian Basin in Sarmatian, the stress field of Northern Bakony Mts. shows tectonic pattern similar to the Alp-Dinarian region.

7. Normal faults corresponding to Late Miocene (?) – Pliocene – Quaternary (?) NNW-SSE oriented extension appear in the northern Bakony Mts. N-S striking faults segmented the Csesznek Ridge. In that phase, fault running on the eastern side of Kőrös-Hill generated some proven half-grabens. Hódos-Graben, which can be modelled as a rifted graben opened in this phase. This deformation can be connected to the thermal subsidence of the Pannonian Basin.

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