The different faces of supposedly single thrust: a reevaluation of the Vezhen thrust, Central Balkanides

Различните лица на предполагаемо единична навлачна повърхнина: преоценка на Веженския навлак, Централни Балканиди

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Deciphering the character and timing of nappe emplacement is of prime importance for tectonic syntheses. Here we present new data on the thrust tectonics in Tetevenska Stara Planina (so-called Vezhen massif) that are leading to completely new tectonic model and evolutionary scheme.

First data on the thrust tectonics for this area were presented by Mandev (1941) who described the emplacement of gneissic basement over low-grade metamorphic rocks along the southern slope of the mountain. He suggested that this nappe is part of the Tertiary thrust system, documented in the Kaloferska Stara Planina. These ideas were further elaborated by Boncev and Karagjuleva (1961) with the hypothesis that along the southern slopes of Stara Planina the Tertiary thrust is crustal-scale feature reaching length of more than 150 km. The first detailed geological mapping confirmed the existence of the thrust and its trace was precisely drawn (Kuikin et al., 1971). To this moment, the existence of brittle, Tertiary in age thrust in the area of the Vezhen massif is widely accepted and this tectonic zone is regarded as one of the most important structural boundaries within the frames of the Balkanides.

We mapped in some detail the proposed trace of the "Vezhen thrust" (as defined by Kuikin et al., 1971). Our data are inconsistent with the existence of single, brittle thrust zone, and in this short report a distinctly different geometry and nature of the tectonic boundaries is described. In the western and central part of the Vezhen massif we can distinguish two major tectonic zones:

(1) Stargel-Boluvanya tectonic zone (SBTZ). With this name is designated the contact zone between Central Srednogorie High-Grade Metamorphic Complex (CSHGMC) and Diabase-Phyllitoid Complex (DFC). The 40 km long SBTZ has been traced from the village of Stargel to the area of peak Boluvania. The synmetamorphic character of this zone was documented for the first time by Belev (1967) and presence of high-strain fabric along SBTZ is already described for the area west of the village of Anton (Antonov et al., 2003). The movements along SBTZ resulted in the emplacement of CSHGMC on DFC and the associated fabric is spread in a fairly thick rock volume. On the basis of lithology, peak and synshearing temperatures four domains can be distinguished within SBTZ (from the bottom to top): very low-grade metasedimentary domain, low-grade metabasite domain, high-grade orthometamorphic domain and reworked in low-grade conditions gneissic domain. The same tectonic stratification is observed in the area of this study, but here orthometamorphic and metabasite domains are very thin (up to several meters). Except for a limited area situated close to the neotectonic mountain-bounding normal fault, along the trace of the zone there are no indications for brittle reactivation and overprint. East of the Boluvanya peak the fabric related to the SBTZ is sealed by Anton and Vezhen plutons.

Synmetamorphic fabric within SBTZ shows significant variations. The dominant fabric is S-type, with pronounced, often mylonitic foliation and no clear stretching or mineral lineation. In some places (at the village of Stargel, east of the village of Anton) the foliation is deformed by upright folds with axes trending approximately E-W. Within reworked gneissic domain all rocks show signs of very high strain: primary gneissic and migmatitic layering is destroyed and rocks are transformed into augen gneisses with abundant boudinaged veins. Despite this, in this domain the lineation is poorly developed. Related to

the foliation lineation is well-defined only in the orthometamorphic domain. The orientation is down-dip (aprox. N-S) at the outcrops north of the Tsarkvishte village, where sigma-type porphyroclasts in deformed pegmatitic veins indicate top-to-the N shear sense. At other places (locality Kaleto; east of the Anton village) the lineation is consistently oblique, plunging shallowly to the SW or SE, and this probably indicate significant strike-slip component.

The penetrative synmetamorphic fabric in the rocks of DFC displays spatial, geometrical and metamorphic continuity with the rocks of SBTZ. In fact it is impossible to trace in the field the lower boundary of the SBTZ. All this leads us to propose that the formation of the synmetamorphic fabric within DFC is related to the emplacement of CSHGMC.

(2) Bratanitsa shear zone (BSZ). This is a subequatorial high-strain zone that is traced for more than 10 km along the crest and in the southern slopes of Vezhen massif. The foliation in the BSZ dips shallowly to the south and bear pronounced down-dip lineation. The zone is well outcropped along the crest line of Stara Planina in the area of the peak Bratanitsa, where emplaces leucocratic, pinkish granitoids on more mesocratic, biotite granites (Anton pluton). Southeast of the Vezhen peak the zone is traced along the contact between the same pinkish granitoids and the hornblende-bearing granodiorites of the Vezhen pluton. Except the spatial continuity, the other argument for the proposed trace of BSZ is the consistent orientation of the penetrative solid-state fabric in the sheared rocks. Kinematic indicators as shear bands and asymmetric porphyroclast systems are abundant and indicate that the zone is North-directed thrust.

Other important arguments in our model are the intrusive relations between the granitoids of supposedly different affinity and the lack of fault rocks along the supposed trace of the Vezhen thrust. An essential, but overlooked fact known from the work of Kuikin et al. (1974) was confirmed - the existence of intrusive relations between the so-called Anton granite with the rocks of DFC. In the area of the river Zavodna, within the biotite-bearing Anton granite decimeter-scale xenoliths from DFC were found, and also meter-scale granitic dykes are crosscutting the foliation of DFC. According to the model of Kuikin et al. (1971, 1974) the Anton granite is building up the hanging wall of the Vezhen thust, but our observations make this supposition groundless. It is important to note, that all along the northern contact of the Anton granite (e.g. supposed trace of the Vezhen thrust) there are no occurrences of foliated granitoids or fault-related rocks. Due to the limited outcrops and to the similarities of the constituent rock varieties, it is impossible to decipher the relations between the Vezhen pluton and Anton granites. We are favoring the hypothesis that they are spatially and temporally related granitoids emplaced almost simultaneously toward the end of the Variscan tectono-metamorphic stage. This assumption is supported by the recent geochronological data of Carrigan et al. (2005) which demonstrated overlapping in time emplacement of Variscan plutons in Central Sredna Gora and Stara Planina. It is important to note that the occurrences of Variscan granitoids crosscutting supposed "Alpine" thrusts is not limited to the Vezhen massif. We are presenting similar results for the Kaloferska Stara Planina (Balkanska et al., this vol.).

Except regional tectonic implications, our results have bearing mainly on ductile tectonics. Based on the field relations and available geochronological data we can constrain the timing of the shearing within SBTZ. It was recently obtained the Variscan age of the high-grade metamorphic overprint in CSHGMC (336.5±5.4 Ma — Carrigan et al., 2006). Migmatitic layering of CSHGMC gneisses is severely deformed within SBTZ and on the other hand SBTZ and related fabric in DFC are sealed by the Vezhen pluton (314±4.8 Ma (Kamenov et al., 2002). These data imply that the emplacement of CSHGMC on DFC occurred shortly after the peak of the metamorphism in CSHGMC, but before the emplacement of the Vezhen pluton. The timing of the shearing in BSZ is not well constrained. The movements along BSZ are clearly post-Carboniferous: the granodiorites as well as porphyry dykes of the Vezhen pluton are intensively deformed. Based on some similarities with Anton shear zone (Antonov, Jelev, 2002; Lazarova et al., 2006) as intensive S/L fabric, almost penetrative shear bands and very low-grade nature of the shearing we can tentatively assume Early Alpine age of the BSZ. This assumption has to be confirmed by geochrolonogical data.

Two important questions are provoked by our study: does Vezhen thrust really exist and is there a northern boundary of the Srednogorie zone in the studied area? The negative answer to both of them is obvious and this conclusion has far-reaching consequences.

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