Structural and tectonic geomorphological studies in Zlatitsa graben, Central Bulgaria

Структурен анализ и оценка на тектонската геоморфология за района на Златишкия грабен, Централна България

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Zlatitsa graben is part of the system of half-grabens situated along the southern margin of Stara Planina Mountain (e.g. Tzankov et al., 1996). Almost everywhere the southern foot is marked by a prominent mountain front (mean slope angles 18–34°) – an unequivocal indication for at least Quaternary activity of the controlling master normal fault. On the basis of the trajectory of the fault trace in map view three geometrical segments can be defined – western (~11 km), central (14.5 km) and eastern (12.5 km). The field work followed an in-depth study of digital elevation model (DEM), satellite imagery and maps. Despite this the only outcrops of the fault zone were found along the eastern segment. The most complete section was found in the cuts of road E-871, east of the village of Anton (E 24.358520°, N 42.718300°). Very weakly foliated to unfoliated granites constitute the footwall. The fault zone is about 20–30 m thick and consists of five domains, distinguished on the basis of strain intensity and tectonite types (Fig. 1). Within the damage zone (domain 1) the granites are strongly fractured and dissected by discrete south-dipping faults. Unlike domain 1 where the granitic protolith is easily recognizable, in domain 2 the initial fabric is almost completely obliterated and rocks are strongly silicified. Domain 3 consists of comparatively incohesive grey-greenish microbreccias with coarse cataclastic foliation that is co-planar with weak layering. Matrix-supported breccias and ultrabreccias containing mainly rounded clasts are building up domain 4. There are no clasts in the ultracataclasites from domain 5 that build up the uppermost outcropped level of the fault zone. Domains 3–5 represent the core of the fault and contain two sets of penetrative or semi-penetrative structures: cataclastic foliation and Riedel shears. The foliation dips shallowly (~35°) to the S, SW, whereas the Riedel shears (R′) are steeper (40–50°) and in some cases displace the faint layering within breccias. Because we were unable to observe any marks on the fault/shear surfaces, the Riedel shears are the only kinematic indicator that confirms extensional character of shearing. Meso-scale corrugation of the fault is also missing.

To further gain insights into the contemporary activity of the normal fault system we studied the geomorphology of the area, using as a base the detailed work of Mishev et al. (1962). The generated DEM (cell size 30 m for the whole graben, 15 for the area of the eastern segment) was used to calculate basic morphometric indicies used in tectonic geomorphology (S/L index, Hypsometric integral, Drainage basin shape parameters, Valley cross section parameters, etc.). In general the quantitative data point to moderate to high tectonic activity. Taking into account other geomorphological criteria we also apply the classification of the Mountain fronts (Bull, 2007). Features like: 1) the existence of comparatively straight fault-predestined segments; 2) V-shape of the valleys in the footwall and the morphometry of the watersheds; 3) the existence of degraded facets; 4) dissected alluvial cones; are consistent with interpretation of the master normal fault as an active structure of class either 2 (rapid) or 3 (slow).

It is important to note that the hanging wall of the graben has a rather complex relief in the easternmost (the uplifted block in the area of Taushantepe peak) and the westernmost parts (west of Veselomogilsko-Gusnets step of Mishev et al., 1962). Poor outcrop condition and highly cultivated environment prevent proper documentation of fault zones, but it can be speculated that the hanging wall of the graben contains 3–4 prominent fault systems. Their recent activity is well expressed in the contemporary relief and move-

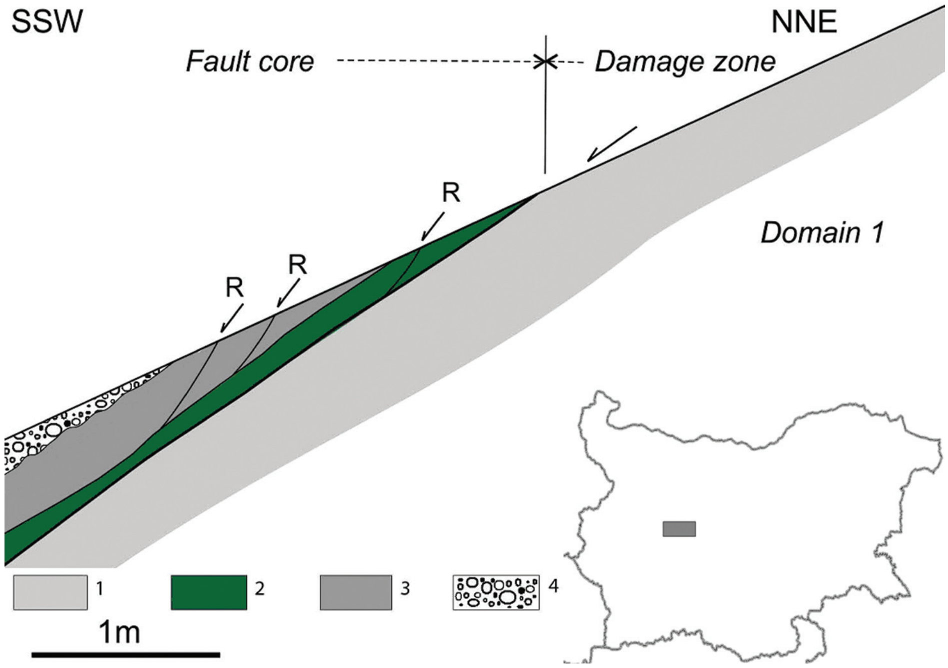

Fig. 1. Structure of the normal fault zone: *1,* domain 2; *2,* domain 3; *3,* domains 4–5; *4,* colluvium

ment along them unambiguously led to modification of landforms created by the master normal fault. As a conclusion, the results from morphometric analysis should be analyzed with caution.

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