Lithotectonic subdivision of the Western Rhodopes and parts of Eastern Pirin

Литотектонска подялба на Западните Родопи и части от Източен Пирин

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Based on field and microstructural observations as well as on preliminary petrological and geochronological data we motivate a subdivision of lithotectonic units formed during a syn-compressional shearing and attending high-grade regional metamorphism. Rely on the criteria for similar regional subdivisions (Ivanov, 1988, 1989, 2000; Burg et al., 1990, 1996; Ricou et al, 1998; Sarov, Gerdjikov, 2002; Sarov et al., 2004), for the area of the Western Rhodopes and the eastern slopes of Pirin Mountain we were able to recognize four lithotectonic units – Mesta, Slashten, Sarnitsa and Obidim. These units are bounded by amphibolite to upper greenschist facies Mesta, Dolen and Breznitsa-Kremen shear zones.

Mesta lithotectonic unit comprises the lowermost part of the metamorphic section in the studied area. It crops out as a tectonic windows to the south of Satovtcha and along the Bulgaria-Greece state border, between the villages of Slashten, Beslen and Teplen. Mesta unit consists of strongly sheared even-grained to porphyroclastic biotite to two-mica orthogneisses or aplitic orthogneisses. North of Kochan and around Valkosel and Fargovo villages the interfingering between orthogneisses and marbles hints for their previous intrusive relationships. Everywhere in the field the rocks are mylonitized. The intensity of deformation increases to the upper part of the unit near the boundary with the Slashten lithotectonic unit. The very contact between these two units is marked by Mesta shear zone (MSZ). The foliation of the footwall is parallel to the foliation of the shear zone. The foliation dips in general 10–30° to the NNE or SSW, but also forms big open folds. At many localities the dip direction varies from almost horizontal to gently dipping to the W or E. The direction of the fold axes is mainly N-S to NNE-SSW and rarely WNW-ESE. The mineral lineation plunges 5 to 30° from NNW-NNE to SSW-SSE. In some localities within MSZ the orthogneisses are transformed into L-tectonites. Reliable criteria within Mesta unit consistently show top-to-the SSW to SSE shear sense. The microstructural investigations show upper greenschist to lower amphibolite facies deformation conditions of the rocks from this unit. The deformed Dolno Drianovo biotite to two-mica granite forms sill-like bodies within the Mesta unit. The foliation and stretching lineation within the granite are parallel to the regional metamorphic foliation and lineation of the orthogneisses. Both the orthogneisses and the granite are deformed in the same style and conditions. A preliminary U/Pb zircon ages from the orthogneisses show Jurassic (146.67±0.25 Ma and 153±7.4 Ma) age of the protholites (von Quadt et al., this volume).

Slashten lithotectonic unit consists mainly of amphibolite facies parametamorphic rocks (schists, marbles, calcschists, paragneisses) including also abundant meter to decameter scale mafic to ultramafic bodies. Scarce orthogneisses crop out as separate foliated sill-like bodies. As a rule the lenses of amphibolites and ultramafic rocks are common near and along the contact between Slashten unit and lower Mesta unit. Kilometers in size mafic to ultramafic bodies are situated exactly at the very contact in the area of villages Pletena, Slashten, Teplen and Lialevo. Everywhere in the field the mafic bodies associate with garnet- and kyanite-bearing schists. In few places eclogite-looking garnet-bearing mafic rocks are found. Slashten unit is strongly folded in meter to hundreds of meters scale isoclinal folds that are traced by the more competent marble levels. In general the fold axes strike to N-S or NNE-SSW. The regional metamorphic foliation and associated mineral lineation are parallel to those from the Mesta unit. In the vicinity of MSZ the rocks from Slashten

unit are strongly sheared. The marbles are banded, almost fine grained and isoclinally folded. The fold axes are parallel to the regional stretching lineation. The reliable kinematics criteria show top-to-the SSW to SSE shear sense. Away from the MSZ the deformation intensity decreases. In the central parts of the unit well preserved slightly migmatized (metatexite) paragneisses and schists can be observed. In some more sheared localities dismembered and boudinaged leucosomes are also preserved. A U/Pb dating of zircons from a leucosome west of Kochan village show Jurassic (147–165 Ma) age of the migmatization (von Quadt et al., this volume). The upper contact of the unit corresponds to the Dolen shear zone (DSZ) that separates Slashten unit from the upper Sarnitsa lithotectonic unit.

Sarnitsa lithotectonic unit consists of migmatized (metatexite) parametamorfic rocks (schists, marbles, calcschists, and gneisses), amphibolites, ultramafics and Jurassic in age (145.67±0.83, von Quadt et al., this volume) biotite to two-mica orthogneisses. The Sarnitsa unit is also strongly folded and sheared. The foliation and lineation are roughly concordant to those from the lower situated units. There are some deviations in the lineation pattern (to WSW and ESE) near the contact of the unit with the Rila-Rhodope Batholith. The reliable syn-kinematic criteria show stable top-to-the SW to WSW shear sense. The upper boundary of the unit is Breznitza-Kremen shear zone (BKSZ) that separates Sarnitsa unit from uppermost Obidim lithotectonic unit. This boundary is reactivated during the Late Eocene and overprinted by the brittle-ductile to brittle Ribnovo detachment fault. The very contact between Sarnitsa and Obidim units is partly preserved in the areas of Breznitza and Kremen villages or as separate outcrops along Mesta River. A typical feature of the Sarnitsa unit affected by BKSZ are macroscopically appearing mylonitic rocks, which show no mylonite structures on a micro level due to processes of static recrystallization or eventually annealing process due to emplacement of Rila-Rhodope batholith and Bezbog pluton.

There are two main differences between these two units: Sarnitsa is migmatized; within Sarnitsa unit the orthogneisses are widespread and show former intrusive relationships with the parametamorphic host; we were not able to find eclogite-looking rocks in this unit. It seems that both Slashten and Sarnitsa units might be part of one and the same lithotectonic unit, but the presence of 100 to 200 m thick mylonites of DSZ north of the villages of Pletena and Dolen indicates for the present tectonic contact between these two units.

Obidim lithotectonic unit is the uppermost part of the metamorphic section in the studied area. The unit consists of migmatitic para- and orthogneisses, garnet-bearing two-mica schists (metapelites), amphibolites and eclogite-looking garnet-bearing mafic rocks. Typical for this unit are porphyroclastic metagranites with 4×8 cm K-feldspar megacrysts (named "Ciclope augen gneisses", by K. Naydenov). The migmatization within the unit looks rather diatexitic than metatexitic. The boundary between Obidim and Sarnitsa units is the BKSZ. This shear zone has affected mainly the rocks from the lower laying Sarnitsa unit but not the gneisses and schists of Obidim lithotectonic unit. The preliminary microstructural investigation point to the lack of dynamic recrystallization of the rocks from this unit. Our field observations prompt to some similarities with the Variscan migmatites from the Ograzden complex.

Discussion and conclusions

Our subdivision relies on criteria as: lithological and structural similarities and differences; age of the protholites; time and conditions of metamorphism; presence of bounding shear zones separating different parts of the metamorphic section. In general the described above lithotectonic units show a clear inverted metamorphic zonation. This zonation combined with top-to-south sense of shear point to regionally revealed thrust tectonics thus forming the West Rhodopean south-vergent nappe pile. Despite lack of shear zone dating the time of thrusting could be constrained after the migmatization of Slashten and Sarnitsa units and before the emplacement of Rila-Rhodope batholith at ~40 Ma.

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