



## Lithotectonic units in the metamorphic basement of NW Rila, Bulgaria

### Литотектонски единици в метаморфния фундамент на СЗ Рила, България

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Despite its location and touristic popularity, Rila Mountain remains among the geologically most poorly studied areas of the Rhodope Metamorphic Complex. However, from a structural and regional geology point of view Rila Mountain and especially its northwestern part is of particular interest. The area is located at the boundary between several larger scale tectonic units (zones) that form together the edifice of the Alpine Orogen in the region. Thus, enclosed between Sredna Gora Zone to the north and Kraishte Zone to the west, the geology of Northwest Rila plays a key role for deciphering the tectono-metamorphic history of the Alpine Orogen on the Balkan Peninsula Rhodope Metamorphic Complex.

In this abstract we present a lithotectonic subdivision of the metamorphic rocks that form the crystalline basement of Northwest Rila Mountain. This subdivision is based on structural, petrological and geochronological studies and represents a part of a larger project dealing with the tectono-metamorphic history of the western parts of the Rhodope Metamorphic Complex.

The metamorphic basement of Northwest Rila Mountain consists of several lithotectonic units which are in a tectonic superposition. Their boundaries represent regional scale faults with either compressional or extensional nature. They were formed in the course of a complex tectono-metamorphic history, mostly during the Alpine orogeny. However, some contacts represent shear zones of an older (Variscan) origin that were reactivated during Alpine time.

*Malyovitsa Unit (MU)* is structurally the lowermost unit within the metamorphic basement of NW Rila Mountain. MU consists of orthogneisses that comprise the lower structural levels of the unit and a variegated section of paragneisses, schists, amphibolites, marbles, metaultramafites and smaller orthogneiss bodies that comprise the higher structural levels of the unit. The orthogneisses show lithology and age (150–155 Ma) similarities (see also Sarov et al., 2011). Metamorphic rims of dated zircons from the

orthogneisses show that the rocks of the unit suffered a high-grade metamorphic overprint during the Late Cretaceous (Gorinova et al., 2015). The lower boundary of the unit does not expose in the study area but is sealed by Upper Cretaceous granitoids (Von Quadt, Peytcheva, 2005) of the Rila-Rhodopian Batholith. The penetrative foliation dips with shallow angles to W or SW. The related stretching lineation plunges with small angles towards NW or SE. Reliable kinematic criteria show consistent top-to-the SE sense of shear. The upper boundary of the unit represents a regional scale Dodov Vrah Shear Zone (DSZ), an amphibolite facies Late Cretaceous top-to-the SE thrust at the contact with the overlying Kabul Lithotectonic Unit (Gorinova et al., 2015).

Our new data show that *Kabul Unit (KU)* consists of migmatized variegated section of garnet bearing amphibolites with 537 Ma protholith age, orthogneisses, small grain amphibolites with 265 Ma protholith age and schists. The unit also contains rare relics of Triassic (~235 Ma) eclogites (Miladinova et al., 2013). Along its boundaries the unit is intensely sheared. Despite the intensive folding, at a distance from the shear zones, the unit has preserved its earlier penetrative high-grade foliation and stretching lineation and related top-to-the north-northwest tectonic transport. In several newly dated samples, the metamorphic rims of the zircons show ages between 115 and 98 Ma and thus pointing to an amphibolite facies metamorphism that affected Kabul Unit in the latest Early Cretaceous time. However, some of the zircon rims we studied give also ages between 90 and 81 Ma thus, pointing to a possible Late Cretaceous metamorphic event what would fit to the Late Cretaceous age of the main metamorphic fabric in MU as well as the age of DSZ. The upper boundary of the unit has a complex character. To the west KU is tectonically bounded from Polich Unit by a regional-scale amphibolite facies top-to-the NNW Bistritsa Shear Zone (see also Sarov et al., 2011). In some places the upper

boundary of the unit represents top-to-the N North Rila Detachment Fault (NRDF).

*Polich Unit (PU)* was affiliated previously as a part of Ograzhden Unit (Sarov et al., 2010). Despite similarities in the lithology and their metamorphic grade, these two units share only a common pre-Alpine history but significantly differ in their Alpine evolution. The facies and senses of shear within the shear zone as well as in both Polich and Kabul units are identical. Thus, we interpret the general penetrative structure of PU as contemporary formed with the main penetrative structure of KU so possibly being early Alpine in age. The upper boundary of the unit is presented by different in age extensional faults. In the area of Rilska River valley a segment of the Late Eocene–Early Oligocene NRDF separates Polich Unit from the above lying Lakatishka and Verila units as well as from the Paleogene sediments of Padala Formation. Along the western and northwestern slopes of Rila Mountain as an upper boundary of the unit are several neotectonic failures that separate the metamorphic basement from the Neogene–Quaternary sediments of Dupnitsa and Blagoevgrad basins.

*Lakatishka Unit (LU)* forms the high-grade basement of Lakatishka Rila Mountain to the north of Northwest Rila and a small extensional klippe in the lower part of Rilska River valley. The unit is composed of gneisses, amphibolites, garnet-mica schists and pegmatite veins and show lithology similarities with PU. The age of the high-grade metamorphism is unknown but Boyadjiev and Lilov (1976) dated an undeformed pegmatite vein at ca. 63 Ma. In the field, the rocks of the unit show a strong retrogression which is rather pronounced close to the contact with the overlying greenschist facies Verila Unit. The contact between the two units represents a greenschist facies shear zone with top-to-the NW kinematics known as Gabrov Dol Fault (Bonev et al., 1995).

*Verila Unit (VU)* is also referred to as Struma Diorite Formation or Frolosh Unit by different authors is the uppermost unit of the metamorphic basement of NW Rila Mountains. VU consists of lower-grade metamorphosed gabbros, gabbrodiorites, diorites and granodiorites of Late Precambrian to Cambrian ages. The unit is sheared and folded and shows a multiphase deformation pattern.

In a larger scale view the metamorphic pile of NW Rila Mountain must be assumed as a coherent part of the Rhodope Metamorphic Complex and thus, representing particular parts of the Rhodope nappe edifice.

Comparing structures, kinematics, lithologies and age determinations, as well as following the general tectonic subdivision proposed by Janák et al. (2011) we can affiliate the lithotectonic units from the metamorphic basement of NW Rila Mountains as follows: 1) Malyovitsa Unit show lithology, metamorphic grade and protholith similarities with the upper units of the Middle Allochthon. However, the stretching lineation pattern and the kinematics of the unit is rather unique for the Rhodopes; 2) Kabul, Polich, Lakatishka Rila and Verila Units, from their lithology, metamorphic grade and protholith ages are similar to the units of the Upper Allochthon.

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