



## Mélanges or layered lithostratigraphic units in the Rhodopes?

### Меланжи или слоести литостратиграфски единици в Родопите?

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Since the studies of Strashimir Dimitrov in the 40ies and 50ies of the 20th century, the parametamorphic rocks of the Rhodopes Massif have been regarded as forming layered lithostratigraphic units. Formal lithostratigraphic grouping has been introduced later (Ivanov et al., 1984; Kozhoukharov, 1984). One of these units (Chepelare Varied Formation) is situated at the base of the Rhodopian Supergroup (Kozhoukharov, 1984) and represents “a comparatively consistent level built of biotite paragneisses, two-mica schists with garnet and kyanite, marbles and amphibolites, amongst the latter with occurrences of lenses of amphibolitized eclogites and ultrabasites. They are all intensely intruded by pegmatite veins....” This level has the features of a mixed complex of para- and orthometamorphics described by Sarov et al. (2005 – unpublished report, remark by I. Z.) as “Chepelare mélange” (Sarov et al., 2007a, p. 16–17). This notion has been adopted in a number of later publications by several Bulgarian and foreign authors.

Turpaud (2006) noted that “dating of orthogneiss protoliths define two groups of intrusion-ages: Permo-Carboniferous and Late Jurassic–Early Cretaceous. Structurally, these two groups correspond to distinct units: the Late Jurassic gneissic complex overthrusts the one bearing Permo-Carboniferous orthogneisses. Mylonites, eclogites, amphibolites of oceanic affinities, and UHP micaschists, mark a “mélange” zone, intensively sheared towards the SW, which separates the two units. Thus, we interpret them as two distinct terranes, the Rhodope and Thracia terranes, separated by the Nestos shear zone.” A similar explanation is adopted in a dozen of publications which consider the layered parametamorphics (metapelites, marbles and paraamphibolites) with lenses of eclogites, orthoamphibolites (metabasites) and metaultrabasites as “mélanges” within vast shear zones that mark sutures (e.g., Chepelare shear zone = Chepelare suture, Ardino mélange, Nestos shear zone) between orthogneissic terranes. Collings et al. (2016) noted that this (Chepelare) “metaigneous and meta-sedimentary

*mélange* (is) hosted by Variscan (Hercynian) orthogneiss.” Obviously, this new interpretation of the term “*mélange*” covers all formations of varied composition within the Rhodopian Supergroup (supercomplex), i.e., the so-called varied (or variegated) formations, and namely, the Chepelare, Lyaskovo (Vacha) and Yavrovo (Lukovitsa) Formations (Ivanov et al., 1984; Kozhoukharov, 1984) all over the Rhodopes Massif.

Since the introduction of the term *mélange* by E. Greenly in 1919, all definitions of this phenomenon are considering a chaotic accumulation of rock fragments within a serpentinite, cataclastic (tectonite) or sedimentary matrix. A modern definition describes *mélange* as “a body of mixed rocks, containing blocks (exotics and native) that are derived from different stratigraphic units or sequences, different tectonic units, various paleogeographic domains, and/or dissimilar metamorphic zones.” (Festa et al., 2012). The major groups of *mélanges* may be defined as sedimentary (often also described as olistostromes, wildflysch or megabreccia), tectonic (with transitions to tectonites or broken formations), serpentinite (with serpentinite matrix) and mixed (transitional). Descriptive classifications are based also on the composition of the matrix and of the rock fragments. Genetic classifications (Festa et al., 2012) rely on the proven or supposed geodynamic environment of *mélange* formation.

The detailed information (e.g., Ivanov et al., 1984; Kozhoukharov, 1984; Sarov et al., 2007a, b) about the varied formations within the Rhodopes Massif shows a considerable persistence of the occurrence both of the individual layers of para- and orthometamorphics, and of the major lithostratigraphic units formed from them (i.e., the mentioned three formations) across the massif. Single amphibolite and marble layers are usually traced at considerable distances within the varied formations, and are considered as markers for the deciphering of the fold structure. Lenses built of metaultrabasic and metabasic rocks are irregularly dis-

tributed, and usually are hosted by orthoamphibolite layers. Intensive internal deformations (folding, boudinage, shear and interformational shear along major lithologic boundaries) are observed, being a natural consequence of the character of these units – multilayers built of rocks with contrasting rheological behavior. No units of premetamorphic olistostromic character, and no angular exotic fragments have been observed, and/or reported. The cases of metagranitoid rock bodies incorporated in the varied sequences and reworked together with them during later tectonic and metamorphic events fall into the categories of tectonometamorphic amalgamations (Zagorchev, 2003).

The ideas about the “mélange” character of the varied formations (Turpaud, 2006; Sarov et al., 2007a, b) are not consistent from the viewpoint of the “classical” definitions of the term, and represent an attempt for its enlargement, a practice that is often observed in the Earth sciences. These ideas are aligned with the theoretical model for the shear phenomena within a subduction channel (Shreve, Cloos, 1986; Zheng et al., 2015), and would explain the presence of ultrabasic and basic lensoid bodies within the orthoamphibolite (metabasaltic) layers in the varied formations. However, the position of the continuous layers of parasediments exclude such an interpretation for the Rhodopian varied formations.

The existing information shows that the layered varied formations within the Rhodopian supercomplex (Supergroup) should be regarded as formal (Formations) or informal (formations and complexes) lithostratigraphic units.

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