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Polyphase tectonometamorphism in Bulgaria: Some alternative interpretations and ideas

Многофазов тектонометаморфизъм в България: алтернативни интерпретации и идеи

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The present report aims to draw attention towards some major but controversial problems of our metamorphic complexes, and to suggest some unfamiliar approaches and ideas. The problems discussed are: (1) possible protoliths and their correlations; (2) polymetamorphism and repeated anatexis and tectonism in the amphibolite-facies basement; (3) the "Diabase-phyllitoid formation": origin, polymetamorphism, and boundary with the ultrametamorphic Ograzhdenian and Ograzhdenian-type complex(es); (4) origin of the Rhodope massif, and its place in the tectonic structure of the Balkan Peninsula.

The analysis of a huge amount of published and unpublished evidence gives grounds to suggest some basic ideas about the onset and evolution of the basement complexes through repeated polyphase tectonometamorphism. Some of these facts and ideas have been already published during the last quarter of the last century (e.g., Kozhoukharov, 1986; Aleksić et al., 1988), and elaborated and supported by new evidence (Antić et al., 2015; Burg, 2012; Kounov et al., 2012; Zagorchev, 2014; Zagorchev et al., 2011, 2015, and references therein).

(1) The metamorphic complexes of Bulgaria derived mostly from Cadomian and pre-Cadomian protoliths.

(2) The Rhodopian supercomplex in the Rhodope massif consists of two different protolithic complexes possibly separated by a regional uncoformity. The protolith of the lower, Rupchos complex represented a volcano-sedimentary association formed in volcanic arc conditions. The upper (Bachkovo + Asenovgrad) complex began over a primary unconformity(?) with mature metapsammites and metapelites followed by a transitional (Lukovitsa) volcano-sedimentary association, and ending with the carbonate platform (Dobrostan + Belashtitsa). The upper complex may be a correlate of the Ediacaran–Cambrian? Frolosh complex from the NW periphery of the Thracian terrain.

(3) The metamorphic complexes underwent a complex, multistage Phanerozoic tectonometamorphic development. Deformations and metamorphism have been irregularly partitioned throughout different basement zones.

(4) Lower- and middle-crust anatexis was an important process that triggered crustal flow of different character and dimensions, and produced considerable volumes of migmatites and of granitoids of diatexitic origin. Anatexis and channelized crustal flow mobilized mostly either lithostratigraphic units with predominant quartz-feldspathic composition or rock units that were influenced by penetrating fluids rich in silica and alkalis. In the cases of less massive and oriented flow, and due to melting heterogeneities, domal structures with migmatitic cores, and cores built by intruded granitoid plutons have been formed.

(5) Synmetamorphic thrusts and nappes fundamentally differ from the "epidermal", "shallow" or "thin-skinned" thrusts in the Balkanides and the Struma zone. Thrust surfaces in the "epidermal" zones are "razor-blade" surfaces that separate different upper (nappe) and lower (sole) blocks, each of them having preserved its pre-thrusting structure and fabric. Synmetamorphic thrust surfaces are not well-defined, and the whole rock volume of the nappe has lost its primary features being deeply recrystallized and obtaining penetrative new foliation and lineations.

(6) The contact between the greenschist facies Frolosh diabase-phyllitoid complex and the underlying Ograzhdenian supercomplex (s. discussion in Antonov et al., 2001) is a thick complex zone of multistage tectonometamorphic development rather than a "razor-blade" surface of one-stage origin. As a boundary between suprastructure and infrastructure, it played an important role throughout the Phanerozoic, and acted

as a screen with a steep thermal gradient during the Ordovician anatexis in the Ograzhdenian.

(7) The Rhodope "protomassif" originated with the Proterozoic formation of the Prerhodopian supercomplex, the consecutive pre-Cadomian formation of the Rupchos complex, its (Late?) Ediacaran covering by the upper (Bachkovo + Asenovgrad) complex, and the Cadomian orogenesis and crustal thickening. These processes led to the establishment of a thickened crustal core that later suffered deformations during inclusion into the Hercynian and Alpine orogens. In the same time, heating (radiogenic included) and anatexis within the thickened crust (also influenced by subductions, fluxes of asthenospheric provenance, and orogenic movements) periodically transformed the Rhodope region into a "fireball", and recycled through anatexis considerable volumes of its complexes, with predominance of those with acidic, eutectoid composition. Thus, the Rhodope massif possessed during some Phanerozoic stages (Hercynian – around 310–290 Ma; Jurassic – ca. 160–145 Ma; Palaeogene – at 61–55 Ma, ca. 44 Ma; 34–30 Ma) features of a hot orogen.

References

Aleksić, V., S. Dimitriadis, M. Kalenić, R. Stojanov, I. Zagorčev. 1988. Serbo-Macedonian Massif. – In: Zoubek, V., J. Cogné, D. Kozhoukharov, H. Krautner (Eds.). *Precambrian in Younger Fold Belts*. Wiley & Sons, 779–820.

Antić, M., I. Peytcheva, A. von Quadt, A. Kounov, B. Trivić, T. Serafimovski, G. Tasev, I. Gerdjikov, A. Wetzel. 2015. Pre-Alpine evolution of a segment of the North-Gondwanan margin: Geochronological and geochemical evidence from the central Serbo-Macedonian Massif. – *Gondwana Res.*; DOI: 10.1016/j.gr.2015.07.020.

Antonov, M., V. Zhelev, S. Pristavova, K. Shipkova. 2001. The boundary between the high-grade and the low-grade rocks in a part of SW Bulgaria: review of the ideas and preliminary results. – *Rev. Bulg. Geol. Soc.*, *62*, 1–3, 77–86 (in Bulgarian with an English abstract).

Burg, J.-P. 2012. Rhodope: From Mesozoic convergence to Cenozoic extension. Review of petro-structural data in the geochronological frame. – In: Skourtsos, E., G. Lister (Eds.). *The Geology of Greece. J. Virtual Explorer*. Electronic ed., ISSN 1441-8142, 42, 1.

Kounov, A., J. Graf, A. von Quadt, D. Bernoulli, J.-P. Burg, D. Seward, Z. Ivanov, M. Fanning. 2012. Evidence for a "Cadomian" ophiolite and magmatic-arc complex in SW Bulgaria. – *Precambrian Research*, *212–213*, 275–295.

Kozhoukharov, D. 1986. Interregional correlations of the Precambrian in the southern parts of the Balkan Peninsula. – *Geologica Carpathica*, *37*, 3, 317–333.

Zagorchev, I. 2014. Rhodope evolution in the heart of Balkan geology. – In: *Proceedings of the XVI Serbian Geological Congress*. 22–25.05.2014, Donji Milanovac, 43–48.

Zagorchev, I., C. Balica, I. Balintoni. 2015. Repeated crustal melting and ductile flow: Possible major mechanisms of Rhodope evolution. – *Compt. rend. Acad. bulg. Sci.*, *68* (in press).

Zagorchev, I., C. Balica, I. Balintoni, E. Kozhoukharova, R. Dumitrescu, G. Săbău, E. Negulescu. 2011. New isotopic data on the metamorphic rocks in SW Bulgaria. – In: *3rd International Symposium on the Geology of the Black Sea Region*. Bucharest, 223–225.