



The Vlahina-Maleshevo Detachment Fault in Southwest Bulgaria – combined structural and zircon LA-ICPMS U-Pb study

Влахинско-Малешевският разлом на отделяне в Югозападна България – комбинирани структурни и геохронологички LA-ICPMS U-Pb изследвания

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Introduction

The Late Alpine syn- to post collisional extension and attendant tectonic denudation in the inner parts of the Alpine Orogen on the Balkan Peninsula is a well-documented fact. In contrast to the Central and Eastern Rhodopes, where the exhumation of the lowermost high grade units occurred in the Paleogene, the western parts of the Rhodopean Zone were affected by two separate extensional tectonic events, during Paleogene and Neogene (Georgiev et al., 2010 and references therein). At the northern end of the Struma (Strymon) Basin (SB) where the present study is located, two systems of faults related to the Paleogene and Neogene extensional tectonics are present. Distinguishing between the latter is a difficult task due to their similar deformation style and kinematics. This study is focused on the kinematics and age of origin of the Paleogene Vlahina-Maleshevo Detachment Fault, the exhumation of the middle units of the Rhodope Zone and formation of the Eocene-Oligocene Padesh Basin (PB) in SW Bulgaria.

Geological setting

The crystalline basement of Maleshevska and Vlahina Mountains in Southwest Bulgaria consists of four tectono-metamorphic units which from bottom to top are: amphibolite facies variegated Predel Unit (PU); the lower-amphibolite facies Troskovo Unit (TU); the migmatized Ograzhden Unit (OU) and the greenschist facies Frolosh Unit (Predel Metamorphic Complex in Milovanov et al., 2009; Troskovo Group, Maleshska Group and Frolosh Formation in Zagorchev, 2001). East of the Struma River the contact between TU and OU is a synmetamorphic shear zone with a possible Alpine age. To the West of Struma River the contact

between PU and OU or TU and OU is the West or SW dipping Vlahina Detachment. The OU contacts with the overlying FU along the top-NW Gabrov Dol Detachment Fault, interpreted as Cretaceous western boundary of the Rhodope Massif (Bonev et al., 1995). The FU is covered by Lower Mesozoic sediments and altogether they were involved in NE-vergent thrusting during Early Alpine time (Zagorchev, 2001). The mentioned above units are covered by Paleogene and Neogene sediments which deposition is related to the Late Alpine extensional tectonics.

Results and Discussion

Two parts of a supposed single detachment fault were investigated: the Troskovo Fault (TF) along the eastern boundary of the PB and the Alikochov Fault (AF) along the S-SW boundary of the Krupnik Pluton (KP).

The Troskovo Fault is a West or SW dipping low-angle shear zone that has affected the upper part of the TU at the contact with OU or with the Komatinci and Logodash Formations of the PB. The shear zone consists of a greenschist facies and a cataclastic domain. The foliation in the greenschist domain dips gently to SW or West. The foliation contains a West or SW shallow dipping stretching lineation. The synkinematic criteria show top-to-the-SW sense of shear. The cataclastic domain is oblique and dips steeper with respect to the foliation of the mylonitic domain. The cataclastites do not show clear kinematics but on single fault surfaces slicken-slides and steps point to top-to-the-SW sense of shear. Both domains are transgressively covered by the Early Oligocene sediments of the Padesh Formation (Černjavská, 1977). The Troskovo Fault is also cut by a 33.73 ± 0.36 Ma dacite dykes (Georgiev et al., 2012). On the other hand the oldest syn-tectonic

unit of the PB – the Suhostrel Formation is dated as old as Early Priabonian (Černjavská, 1977). Thus the time of activity along TF can be fixed between ~38 Ma and ~34 Ma. Some authors (Vatsev et al., 2011) reported Lutetian ages for the sediments of the lowermost Suhostrel Formation that would bring the onset of the extension tectonic activity and attendant sedimentation in PB down to ~45 Ma.

The *Alikochov Fault* separates a variegated high-grade metamorphic section of PU and the deformed part of the KP in the footwall from OU in the hanging wall. The fault zone consists of a greenschist facies and a cataclastic domain. The AF has been already interpreted as top-SW extensional failure related to the Struma Detachment Fault (Machev, Klain, 2000). The greenschist facies mylonitization affected the rim of the KP and its high-grade metamorphic host – PU. The mylonitic foliation dips 20–30° to the SW and bears stretching lineation that plunges towards WSW or SW. The syn-kinematic criteria show top-to-the-SW sense of shear. Same kinematics are obtained from the cataclastic domain located immediately beneath the AF plane. In the vicinity of the AF three structurally different types of igneous rocks appear. The first two are newly dated mylonitized 35.36±0.21 Ma rim of the KP and late- to post tectonic 33.93±0.28 Ma dyke-sill body intruded along and cutting through the mylonitic foliation of the AF. The third type is the post-tectonic 34.07±0.19 Ma KP (Georgiev et al., 2012) that seals the AF. The deformed part of the KP contains superimposed structures developed in a decreasing temperature from amphibolite to greenschist facies and we interpreted that part of the pluton as syntectonic with respect to the AF. In this sense the AF was active already before and also during the emplacement of this phase of KP. The fault was active until ca. 34 Ma when the emplacement of the post-tectonic part of the KP occurred.

Due to the similar deformation style and kinematics, as well as due to the continuity between the TF and the AF, we collectively address these two faults to a single regional scale structure namely Vlahina-Maleshevo Detachment Fault. The time of activity of the latter must be fixed between the Lutetian and the end of the Priabonian (45–34 Ma).

Conclusions

The regional extension and tectonically induced exhumation of high-grade rocks in the westernmost parts of the Rhodope Zone started in the Priabonian (Lutetian?). The main regional-scale structure which accommodated the exhumation of amphibolite fa-

cies rocks of the Middle Rhodope metamorphic section (Predel and Troskovo Units) and formation of the Padesh Basin is the Vlahina-Maleshevo Detachment Fault. The activity of the detachment lasted from (?) Middle Lutetian to very Late Priabonian–Early Rupelian. In the beginning of Rupelian steeper normal faults reshaped the geometry of the detachment and thus led to the final opening of the Padesh Basin. The latter was accompanied by volcanic activity and deposition of the volcano-sedimentary section of the Padesh Formation. Since the Vlahina-Maleshevo Detachment was inactive already in the Oligocene it is impossible to correlate this structure with the Neogene Struma (Strymon) Detachment. In this sense the Paleogene extension in the area must be assumed as a separate extensional event.

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