New data about the age of granitoid magmatism in the Strandzha Mt. (SE Bulgaria)

Нови данни за възрастта на гранитния магматизъм в Странджа планина (ЮИ България)

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Key words: Strandzha, Variscan, granitoid magmatism.

Introduction

The pre-Cretaceous metamorphic basement in SE Bulgaria and NW Turkey forms part of a major early Alpine orogen known as the Strandzha Zone or Strandzha Massif (Okay et al., 2001; Natal’in et al., 2012, etc). According to the tectonic subdivision of Bulgaria the Sakar-Strandzha Zone is part of the Internal Balkanides (Ivanov, 1998). The Strandzha massif on Bulgarian territory consists of late Variscan crystalline basement of metagranites and gneisses covered by Lower Mesozoic metasedimentary sequenses. This relative autochthone is tectonically overlain by allochthonous Triassic sequences – Strandzha type of Triassic (Chatalov, 1988, 1990; Gochev, 1991). The late Variscan metamorphism affected only the basement, whereas the mid-Mesozoic regional metamorphism affected both the basement and cover rocks. The grade of Variscan metamorphism reaches low-grade amphibolite facies but rare manifestations of anatexis and migmatization of the rocks on Turkish territory were observed, too (Okay et al., 2001). The Variscan granites in the Strandzha massif are of two ages – “older” 308–315 Ma (Carboniferous) and “younger” 309–257 Ma (Okay et al., 2001; Natal’in et al., 2012). The aim of this paper is to provide new data about the petrology and age of two granitic bodies cropping out in the Bulgarian part of Strandzha massif close to the border with Turkey and to highlight the problem of Variscan magmatism in this part of SE Bulgaria.

Petrology

Our field investigations were focused on the high-grade metamorphic rocks (Locality 1) and the adjacent Variscan granites (Locality 2). They show that in this part of Strandzha Mountain the metamorphic rocks from Locality 1 (L1) are dominated by deformed metagranites. They crop out mainly in the Fakiyska river valley between the villages of Fakiya and Gorno Yabalkovo. They represent irregularly deformed and foliated rocks composed of plagioclase, biotite, quartz, rare potassium feldspar and accessories. The L1 granites show evidence for continuous deformation from magmatic to solid stage.

The granites from this locality contain SiO_2 in a narrow range (66–67%) and by normative composition they correspond to monzogranites. The REE distribution pattern is characteristic for acid magmatic rocks with LREE enrichment and La_N/Lu_N ratio 16.47–30.84. A specific feature of the rocks from this locality is the positive Eu anomaly which is probably due to the high CaO content. The distribution of HREE is peculiar. After Eu their concentrations decrease down to Er and then the amount of Tm and Yb increases. The crystallization temperatures of the metagranites calculated by Ti-in-zircon thermometry 656–750 °C (Watson et al., 2006) are lower than those obtained by the zircon saturation method (730–745 °C).

The granites from Locality 2 (L2) are coarse-grained to porphyritic having massive structure. They are grey in color (with pinkish potassium feldspar) being commonly crosscut by melanocratic dykes of Late Cretaceous age. They consist of plagioclase, microcline, biotite, hornblende and quartz showing poor indications only for plastic deformation. The rocks are calc-alkaline, peraluminous with ACNK>1.0 and they have higher concentrations of some rare elements compared to the L1 granites. The REE distribution shows LREE enrichment and $(La/Lu)_N$ ratio 17.85–30.86. The L2 granites have shallow negative Eu anomaly and flat distribution of the HREE. The crystallization temperatures of the L2 granites calculated by Ti-in-zircon thermometry (662–688 °C) are lower

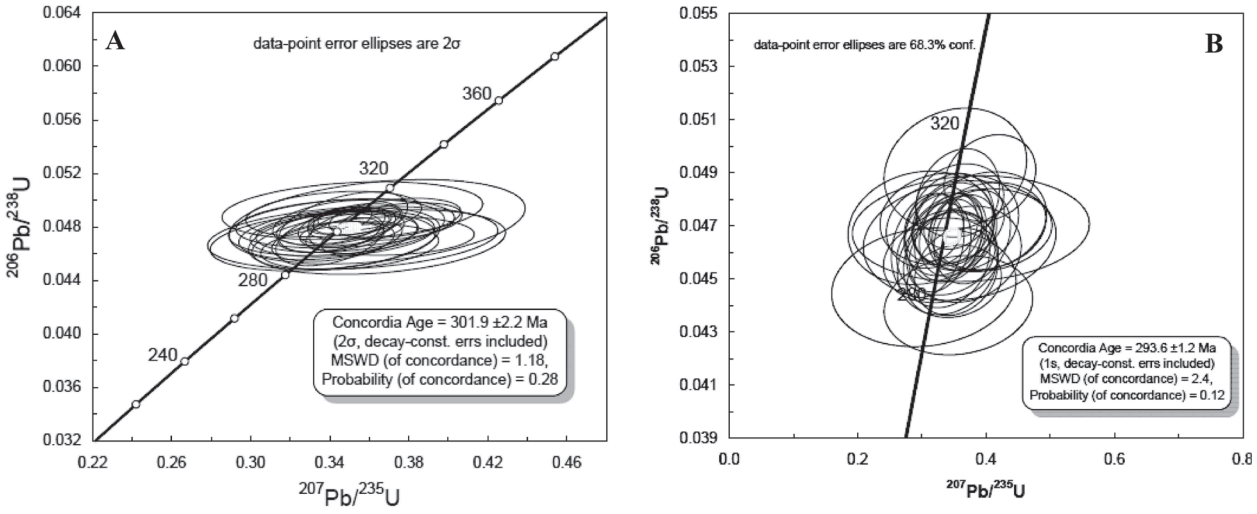

Fig. 1. Concordia diagram for zircons from: *A,* L1 granite and *B*, L2 granite

than those obtained by the zircon saturation method (788–811 °C), e.g. like the L1 granites.

Zircons in one sample from L1 and L2 granites were dated by means of LA-ICP-MS. They are pinkish-brown in color and display zoning which is typical for igneous zircons. Twenty five grains from the L1 granite were analyzed (core and rim) and they yield a precise concordia age of 301.9±2.2 Ma (Fig. 1A). The L2 granite (34 zircon grains) shows slightly younger age – 293.6±1.2 Ma (Fig. 1B).

Conclusions

Our investigations do not confirm the presence of Precambrian rocks in the investigated area as shown by Chatalov et al. (1995). The macro- and microtextural features of the L1 granites as well as their age demonstrate that they were formed during a post-Variscan metamorphic event. The crystallization was accompanied by high-temperature liquid-state deformation followed by low-temperature solid state deformation. The melting, magma generation and granite emplacement continued after the peak of metamorphism and deformation resulting in the formation of L2 granites.

Acknowledgments: This study was financially supported by the Scientific Fund of "St. Kliment Ohridski" Sofia University, Grants 155/2012, 97/2013 and Synthesys Program – Project DE-TAF-763.

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