U-Pb zircon geochronology of Central Pirin batholith

U-Pb геохронология на циркони от Централнопиринския батолит

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Introduction

The Central Pirin batholith consists of several phases intruded successively in time. Their time relationships, however, are subject of discussion. Here we provide new U-Pb zircon ages of the batholith in order to constrain the timing of their intrusion.

Geological setting

Three granite bodies (phases) comprise the Central Pirin batholith: porphyritic (Bezbog type), equigranular (Pirin type) and coarse-grained granite (Demianitza type). Contacts between the porphyritic and equigranular granites are characterized by both gradual (inner parts of the batholith mainly) and sharp (southern parts of Central Pirin batholith) transitions. Based on the field relations and their mineralogical and geochemical similarities Dimitrova and Sarafova (1968), and Machev (1993) interpreted both granite types as facial varieties within the Central Pirin batholith. According to other researchers, Bezbog- and Pirin-type granites are not coeval, since few dykes of equigranular Pirin granite are intruded into the porphyritic Bezbog granite north of Pirin village, picking up xenoliths of it (Zagorchev et al., 1971; Slavov et al., 1975; Boyadjiev, 1989).

Demianitza granite has been considered as a part of the porphyritic Bezbog pluton, with gradual transition between them (Slavov et al., 1975; Zagorchev et al., 1987; Boyadjiev, 1989). However, based on structural dissimilarities and geochemical differences with the other two granite types of the batholith, Machev (1993) described the coarse-grained Demianitza pluton as a separate body.

Analytical techniques

Zircon samples of the three granite types were separated and dated by U-Pb method. Zircon datings were carried out with LA-ICP-MS at the Geological Institute of BAS using New Wave excimer laser coupled to ELAN DRC-e ICP-MS. Samples were ablated with 35 micron diameter laser crater and 8 Hz frequency. Calibration was performed using GJ-1 zircon standard. Analytical 1σ error ranges from 1% to 3%, statistical uncertainty varies within 0.3–1%. Cathode luminescence (CL) and backscattered photographs were taken at the University of Belgrade on JEOL JSM-6610 LV SEM-EDS.

Results and discussion

Zircon crystals extracted from the coarse-grained Demianitza granite sample are mostly long prismatic. The CL images reveal tiny fragments of corroded inherited cores which comprise up to 30% of all analyzed grains. The inherited cores show very heterogeneous age distribution ranging from 48 Ma to 551.6 Ma. Magmatic zircons comprise two major populations. The older population gave ages varying from 35.5 Ma to 36.8 Ma. The younger population yielded a concordia age of 34.06 ± 0.11 Ma, which we consider to represent the emplacement age of the Demianitza granite.

Zircons from the porphyritic Bezbog granite have short prismatic to rounded-ovoid shapes with common resorption textures. Inherited cores and xenocrysts are abundant forming more than 30% of the total number of analyzed crystals. Inherited zircon ages range from 117 Ma to 275 Ma. The most typical feature of the magmatic zircons is development of a thin oscillatory rim around inherited cores. Several zircon grains yielded a range from 33.9 to 34.9 Ma, indistinguishable from the age of the Demianitza granite, implying either a common deep chamber or contamination during emplacement. A population of younger zircons yielded concordia age of 33.14 ± 0.21 Ma, which we consider as the emplacement age of the Bezbog granite.

Zircons from the equigranular Pirin-type granite have short prismatic, pyramidal to ovoid shapes. Inherited cores and xenocrysts prevail over the mag-

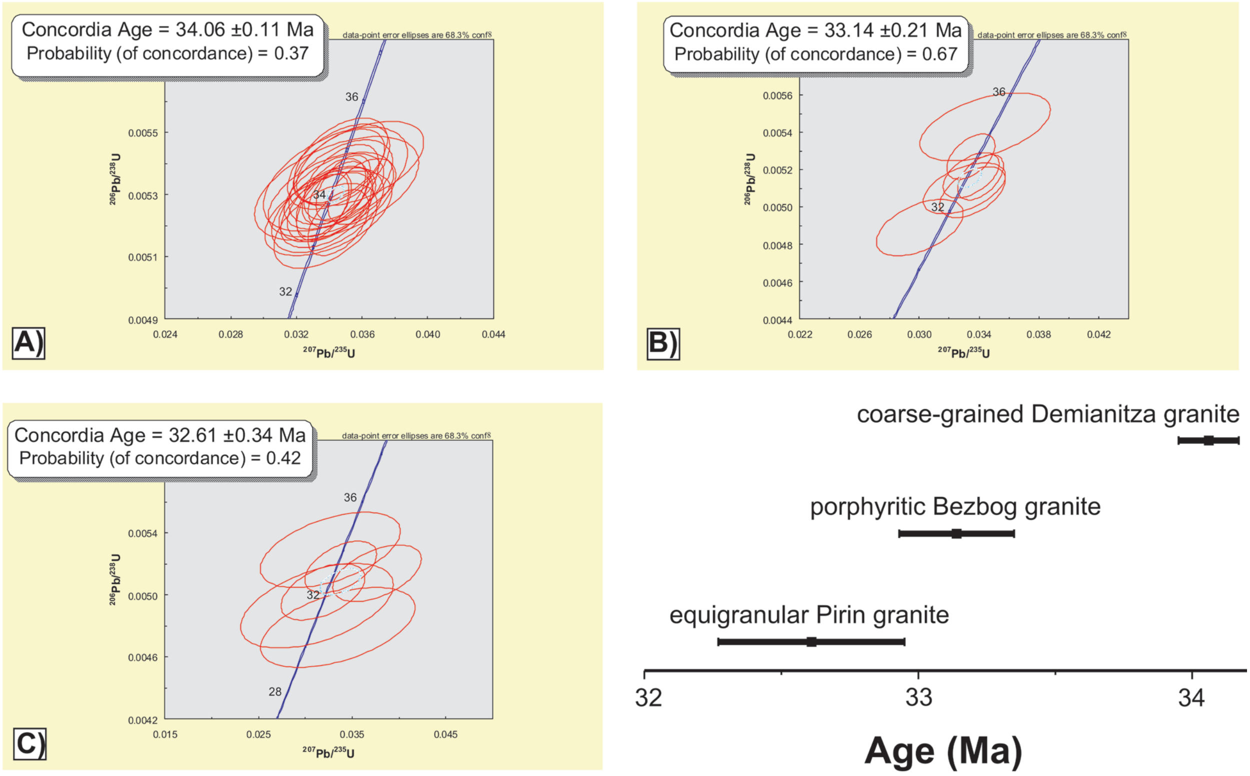

Fig. 1. Concordia diagram for zircons from: *A,* coarse-grained Demianitza granite; *B,* porphyritic Bezbog granite; *C,* equigranular Pirin granite

matic zircons, comprising up to 60% of all analyzed grains. The ages of these zircons range from 170.8 to 718.6 Ma. The concordia age of the magmatic zircons from the Pirin-type granite was calculated at 32.61 ± 0.34 Ma. It is noteworthy that zircons aged 33 to 34 Ma are typical for both the Pirin and Bezbog granites (Fig. 1).

Conclusion

Newly obtained U-Pb zircon ages provide a better time constrain for the magmatic evolution of the Central Pirin batholith. In general, the obtained ages are consistent with the field relations of the three granite varieties of the batholith. The coarse-grained granite of Demianitza is the oldest phase of Central Pirin batolith emplaced at ~34 Ma. It was followed by the intrusion of the porphyritic Bezbog granite at 33.1 Ma. It seems that at this time, Demianitza granite was not completely crystallized, which may explain the gradual transition between the coarse-grained and porphyritic varieties. Its prolonged stay in a crystal mush state is supported by the strong resorption of inherited zircon crystals. The latest equigranular Pirin phase was intruded at ~32.6 Ma, i.e 0.5 Ma after the porphyritic granite. The sharp contacts between the Pirin and Damianitza granites suggest that at that time Demianitza granite was completely solidified.

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