



Onset of the Late Cretaceous magmatism in the Eastern Balkan, Bulgaria: results from $^{40}\text{Ar}/^{39}\text{Ar}$ dating of amphibole from volcanic rocks

Начало на къснокредният магматизъм: резултати от $^{40}\text{Ar}/^{39}\text{Ar}$ датиране на амфибол от вулкански скали от Източния Балкан

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Introduction

Precise radiometric ages define a north to south age progression for the Late Cretaceous magmatism in Bulgaria, thought to reflect a southward-retreating role-back subduction of the Neotethyan Ocean beneath the European continental margin (Von Quadt et al., 2005; Georgiev et al., 2012). The oldest magmatic activity is recorded in the Central Balkan part of the Upper Cretaceous Magmatic Belt, where U–Pb single zircon ages $\sim 92.10 \pm 0.3$ Ma mark the initiation of the magmatism. Here we provide new precise $^{40}\text{Ar}/^{39}\text{Ar}$ ages from the Eastern Balkan zone of the belt, demonstrating that the volcanism started at ~ 94.6 Ma, ~ 2.5 Ma earlier than in Central Srednogie.

Geological setting

Late Cretaceous magmatism in the Eastern Balkan region is characterized by minor volcanic activity, represented by small remnants of lava flows to the east and dikes and subvolcanic bodies intruded into the Triassic and Jurassic metamorphosed sediments to the west. The magmatic rocks are high-K calc-alkaline basaltic to dacitic lava flows and subvolcanic porphyry stocks and dikes. Compared to the other main regions in the eastern part of the magmatic belt (i.e. Strandzha and Yambol–Burgas), the rocks from the Eastern Balkan are volumetrically smaller and show much narrower compositional variations (Georgiev et al., 2009).

Samples, methods and results

Two samples with unaltered appearance in the field and under the microscope were selected for geochronological studies. The rocks are from two lava flows

located in the vicinity of the village of Zaimchevo. Stratigraphically the samples come from the base (sample SG104) and top of the sequence (sample SG093). According to the TAS classification diagram (Le Bas et al., 1986) they are classified as andesite and dacite, respectively. Although different in bulk rock chemical composition, the rocks have identical phenocryst mineralogy, consisting of plagioclase, clinopyroxene, amphibole and magnetite set in microlitic groundmass.

Amphibole crystals were extracted from the two rock samples using standard mineral separation techniques. Amphibole grains were irradiated along with the 28.201 Ma Fish Canyon sanidine fluence monitor (Kuiper et al., 2008) at the Oregon State University TRIGA reactor and analyzed at the University of Wisconsin–Madison Rare Gas Geochronology Laboratory, using a 25 W CO_2 laser. The decay constants used for calculations are those of Min et al. (2000).

The results are presented in Fig. 1. Laser incremental heating experiments of the two amphibole separates yielded indistinguishable within analytical precision ages. Andesite SG104 yielded a weighted mean plateau age of 94.67 ± 0.40 Ma and dacite SG93 yielded a weighted mean plateau age of 94.56 ± 0.40 Ma.

Conclusions

The newly obtained ages of the volcanic rocks from the Eastern Balkan zone of the Upper Cretaceous Magmatic Belt in Bulgaria show that the magmatic activity started at 94.5 Ma, i.e., in the middle of Cenomanian. This age is ~ 2.5 Ma older than the oldest published age for this magmatism in the central part of the Belt.

The two $^{40}\text{Ar}/^{39}\text{Ar}$ ages, taken from the base and top of the volcanic stratigraphy, are indistinguishable

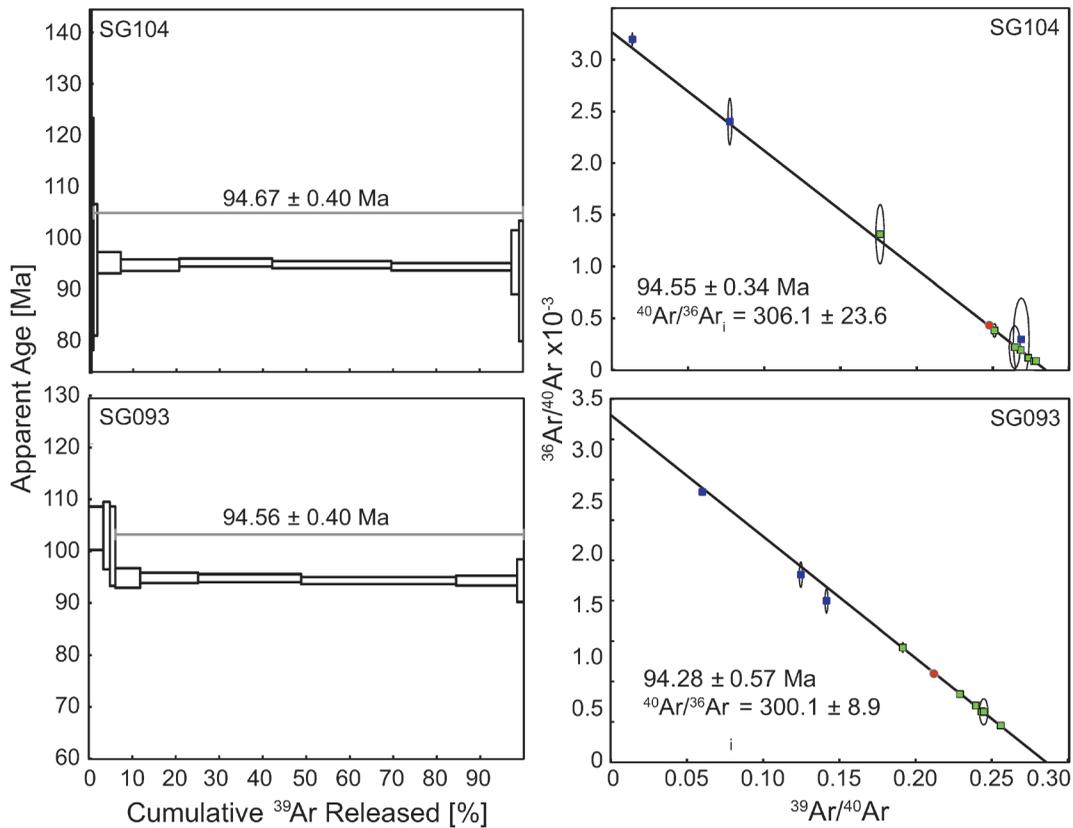


Fig. 1. Plateau and inverse isochron diagrams for andesite (SG104) and dacite (SG093) from Eastern Balkan obtained from $^{40}\text{Ar}/^{39}\text{Ar}$ incremental heating experiments. Ages calibrated to 28.201 Ma Fish Canyon sanidine with 2σ analytical uncertainties.

within the analytical error, suggesting that this earliest volcanic activity in the Eastern Balkan was relatively short-lived.

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