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# GEOCHRONOLOGICAL AND GEOCHEMICAL STUDIES ON CRYSTALLINE ROCKS FROM THE CENTRAL SERBO-MACEDONIAN MASSIF WITH IMPLICATIONS ON ITS PRE-ALPINE EVOLUTION

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## Abstract

The Serbo-Macedonian Massif (SMM) represents a composite crystalline terrane situated between the two diverging branches of the Eastern Mediterranean Alpine orogenic system, the northeast-vergent Carpatho-Balkanides and the southwest-vergent Dinarides and the Hellenides. It is outcropping from the Pannonian basin in the north, to the Aegean Sea in the south, along the central and southeastern Serbia, southwestern Bulgaria, eastern Macedonia and central Greece. Its affiliation to European and/or African plate basement is still questionable due to the lack of reliable geochronological data and a detailed structural investigations. The SMM is the key area for understanding the bipolarity of the Alpine orogenic system, as well as the interaction of the Pannonian and Aegean back-arc extension during the Cenozoic time.

The SMM is traditionally considered to comprise an Upper (low-grade) and a Lower (medium to high-grade) unit. The protoliths of both units are reported as volcano-sedimentary successions, which have been intruded by magmatic rocks during several pulses. Here we present the results of our four-year project aimed at discerning the main magmatic episodes and the geodynamic evolution of the SMM and its environs. In order to obtain the protolith ages, LA-ICP-MS analyses were carried out on zircon grains from 24 ortho-and para-metamorphics as well as undeformed igneous rocks. Additionally, we were able to constrain the geotectonic settings of formation for the total of 30 whole-rock samples by obtaining the main oxide and trace element measurements.

The new geochronological constraints coupled with the field evidence, allowed us to conclude: a) The Lower complex of the SMM consists of Cadomian (569-558 Ma) volcano-sedimentary sequences and magmatics, which were consequently intruded by igneous rocks from late Cambrian to Early Silurian (528-439 Ma); b) The Upper SMM (i.e. Vlasina or Morava unit) represents a volcano-sedimentary sequence, which is intruded by the Cadomian (562-550 Ma) and Cambrian (521 ± 4 Ma) magmatic rocks; c) No evidence of Ordovician and Silurian magmatism in the Upper complex were revealed by our research; d) The Upper complex is structurally overlain by a deformed Silurian-Devonian sedimentary sequence; e) Additional pulses of magmatism, represented by Carboniferous (328-304 Ma), and late Permian (255-253 Ma) weakly deformed rocks constrain the lowest age for the penetrative high-strain ductile deformation. This conclusion is in accord with the reports from the Lower complex in Bulgaria (i.e. the Ograzhden block); and f) The youngest magmatic event in the SMM recorded by our study took place in the late Eocene (35-32 Ma) related to the intrusion of Surdulica granodiorite and associated latitic volcanism. However, even younger (Oligocene to Quarternary) volcanic activity is known at periphery of the SMM.