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U–Pb ion-microprobe zircon dating of subduction-related magmatism from northern Greece: The ages of the Guevgueli, Thessaloniki and Chalkidiki igneous complexes

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The Guevgueli, Thessaloniki and Chalkidiki igneous complexes are located in northern Greece forming a NW-SE trending belt along the eastern boundary of the Vardar zone and bordering the Serbo-Macedonian Zone at its western margin. They represent relics of different evolutionary stages of subduction-triggered magmatism developed at an intricately-structured continental margin. Although there are data from indirect dating methods (e.g. radiolarian sediments, stratigraphic correlations) suggesting a Middle- to Late-Jurassic age for these igneous rock associations, there is a conspicuous lack of radiometric age data. The only reliable radiometric age determinations published so far are those of Spray et al. (1984) on the Guevgueli complex and suggest a formation age between 149$\pm$3 and 163$\pm$3 Ma, obtained by applying the $^{40}Ar/^{39}K$ method on biotite and kaersutite separates from gabbros and diorites of the complex. In this study, we report preliminary radiometric geochronological data for the igneous complexes of Guevgueli, Thessaloniki and Chalkidiki. The ages were mostly obtained using an ion microprobe (SHRIMP II) to measure the U–Pb isotopic characteristics of magmatic domains of zircons from high-level intrusives within these complexes.

For the purpose of the age determination of the Guevgueli complex a plagiogranite (trondhjemite) pond within high-level gabbros was sampled. The measured zircons

yield a mean weighted $^{238}U/^{206}Pb$ average age of 167±2 Ma, interpreted here as the intrusion age of the Guevgueli complex. With regard to the Thessaloniki complex, a plagiogranite sample situated among high-level intrusives was selected for the geochronological investigation. These zircons analyzed yielded a concordia age of 169±1 Ma which is interpreted as the crystallization age of the plagiogranite. Going further to the southeast, the collected samples were from the Metamorphosis area and the Sithonia peninsula, both belonging to the greater Chalkidiki peninsula. A very coarse-grained diorite (pegmatitic hornblende-gabbro) from the top part of the magma chamber and a medium-grained quartz-diorite (described as plagiogranite dyke by Gauthier, 1982) from the high-level gabbroic section were sampled respectively. The zircons from the Metamorphosis diorite were dated using the $^{207}Pb/^{206}Pb$ single-zircon evaporation method. The age obtained from the zircon separates of this rock is 160±4 Ma. The zircons from the Sithonia diorite yielded a mean weighted $^{238}U/^{206}Pb$ average age of 160±10 Ma obtained by SHRIMP II. Both ages from the Chalkidiki bodies are considered virtually identical within analytical error. To summarize, the subduction zone-related magmatism observed in the Guevgueli, Thessaloniki and Chalkidiki areas has evidently taken place during the Middle-Late Jurassic between 169-160 Ma.

It has recently been proposed that exhumation of the Rhodope Metamorphic Core Complex was achieved through a clockwise rotation of the Vardar+Serbo-Macedonian Massif block by approximately 30˚ (Brun and Sokoutis, 2004). Interestingly, restoration of this block to its original position before rotation brings in line the complexes studied here with the Samothraki marginal-basin ophiolite further south, for which available radiometric K/Ar data on hornblende separates from a high-level diorite suggest a mean formation age of 155±7 Ma (Tsikouras and Hatzipanagiotou, 1990). This age is in the same range of ages with the igneous complexes of Guevgueli, Thessaloniki and Chalkidiki.

Taking collectively the data presented herein, we propose that the subduction-related magmatism as exposed in the Guevgueli, Thessaloniki and Chalkidiki complexes and probably the Samothraki ophiolite is synchronous and took place during the Middle-Late Jurassic between 169-155 Ma.

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