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Interactions between extensional shear zones and syn-tectonic granitic intrusions: the example of Ikaria Island (Cyclades, Greece)

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The Aegean domain is an ideal place to investigate the development of Metamorphic Core Complex (MCC) and to study the role of syn-tectonic granites on their development. MCCs of the Aegean domain are dynamically associated with a few major detachments, especially the North Cycladic Detachment System (NCDS) and the West Cycladic Detachment System (WCDS), which have accommodated a large part of the crustal thinning during the Oligocene and Miocene. The NCDS extends toward the East within the Simav Detachment that has exhumed the northern high-temperature part of the Menderes massif. The transition between the NCDS and the Simav Detachments is located above a major tear in the Aegean slab whose effects on lithospheric deformation are far from understood. The Aegean granitoids were emplaced during the Middle Miocene within a zone of high-temperature during the episode of slab tearing and recorded increments of extensional tectonics within this complex zone. Ikaria Island (Cyclades, Greece) is a metamorphic dome intruded by three Miocene granitoid plutons (one I-type intrusion, two S-type ones) including the largest pluton of the Aegean domain. However, geometry, structures and kinematics are still debated with several recent yet conflicting studies. We have reconsidered the geology of Ikaria to settle the geological and structural context of these plutons. The intrusion depth of the Raches granite has been estimated at 10-15 km by the Al-in-hornblende barometer. Our field study has led to the identification of two major structures: the Gialiskari and Kalamos detachments, which we interpret as belonging to the NCDS. A study of deformation in the granites has highlighted a continuum during cooling that can be described in three stages: i) magmatic deformation, ii) high-temperature ductile deformation from late magmatic stage until complete crystallization of the granite, iii) low-temperature brittle deformation. Throughout this evolution, the same top-to-the-NE shearing deformation was active below the Gialiskari and Kalamos detachments with a progressive localization of strain. A scenario of this deformation continuum below the Gialiskari-Kalamos detachments through the ductile-brittle transition is proposed. The granites were emplaced while the exhumation of the Ikaria high-temperature metamorphic dome was already underway. We conclude that the crustal-scale detachment has controlled the localization of the intrusion and not the opposite.