Geodynamic constraints deciphered from the petrology and geochemistry of the Late Cretaceous granitoids from Anafi island (Cyclades - Greece)

Petros Koutsovitis¹, Konstantinos Soukis², Panagiotis Voudouris², Stylianos Lozios², Theodoros Ntaflos³, Christina Stouraiti², and Nikolaos Koukouzas⁴

¹University of Patras, Department of Geology, Section of Earth Materials, Greece (pkoutsovitis@upatras.gr)
²National and Kapodistrian University of Athens, Faculty of Geology and Geoenvironment, Greece
³University of Vienna, Department of Lithospheric Research, Austria
⁴Centre for Research and Technology-Hellas (CERTH), Greece

In the Aegean region (Cyclades - Greece), the island of Anafi island comprises Late Cretaceous intermediate and felsic granitoids that intruded within exhumed HT/LP metamorphic sequences that include amphibolites, serpentinites and metasediments. The granitoids correspond to I-type arc-related rocks with calc-alkaline geochemical affinities. Variations in their petrography mineral chemistry and geochemical features are attributed to magma differentiation with removal of plagioclase and/or K-feldspar, but also amphibole and biotite. Differentiation processes of the upwelling granitoid magma included fractional crystallization accompanied with crustal assimilation, pointing to interaction with the overriding continental crust. Mineral chemistry and geochemical results display that the Anafi granitoids are highly comparable with the Late Cretaceous granitoids of East Crete and Donousa island suggesting that this magmatic activity was not a local event. Geothermometric results show relatively moderate temperature crystallization conditions (~790 °C) for the compositionally intermediate granitoids, which are and lower for the felsic granitoids (~630 °C). Geobarometric calculations suggest shallow intrusion conditions (~2.0-6.5 kbar), which corresponds to a depth of crystallization of ~12 ± 4 km.

The thrust sheets that overly the flysch constitute a subducted and metamorphosed oceanic sequence, that after the intrusion of the granitoids was exhumed from the Late Cretaceous to the Late Oligocene. These metamorphic units likely represent a part of the Pindos - CBU domain that was subducted at an earlier pre-Campanian stage. In the hydrated mantle wedge, incorporation of shallow level granitoids within metamorphic units was likely facilitated via corner flow intrusion mechanisms. Ongoing underplating of subducted material gradually brought the granitoids along with the host units to shallow structural levels and on top of the parautochthonous flysch.