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Geochemical characterization of zircons in the Aegean Arc

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Zircon is an invaluable archive in igneous petrology, offering the ability to track the geochemical evolution of magmatic systems through trace element incorporation. This study investigates the rare earth element (REE) signatures of zircons from the volcanic centers of the Methana Peninsula and Poros Island, part of the Aegean Arc. The arc is dominated by calc-alkaline basaltic andesites, andesites, and dacites [1]. Whole-rock models suggest that eruptive events were generated during upper plate extension during subduction at the Aegean margin [2].

We analyzed zircons from andesitic samples (SiO_2 : 58.0-62.7 wt.%) exhibiting typical subduction-related signatures, including LREE enrichment, HREE depletion, and minor negative Eu anomalies. Zircon cathodoluminescence imaging reveals normal growth and sector zoning with no inherited cores, indicating crystallization from recent magmatic pulses. Although zircon populations can be considered homogeneous across samples, individual grains display variability in trace-element composition, allowing for a mineral scale investigation of petrogenetic events not fully captured by the whole-rock geochemistry.

Using trace-element ratios we can discriminate between different fractionation assemblages. For example, the high HREEs values observed in our zircon dataset together with the low Dy/Yb ratio, are indicative of a low-pressure fractionation assemblage dominated by amphibole with little to no garnet signature. This is in agreement with the low crustal thickness measured using geophysical methods [3].

By integrating zircon geochemistry with already established whole-rock chemical mohometers, we aim to calibrate zircon as a high-resolution tool for reconstructing crustal thickness in palaeo-orogenic systems where the original whole rockcontext is no longer available.

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