

EXTENSION AND EXHUMATION OF THE HELLENIC FOREARC
AND
RADIATION DAMAGE IN ZIRCON

by

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Abstract

Mapping and new structural observations on Kythera demonstrate the presence of a major detachment fault, which borders the domed structure of a metamorphic core complex. A three stage extensional context accompanied the exhumation of HP-rocks in Kythera. Early ductile structures near the mapped detachment fault indicate its initiation under NE-trending extension. Later ductile, ductile-brittle and some brittle structures, in the metamorphic unit near the detachment, indicate a significant NW-SE extension along-the-arc. The youngest brittle structures indicate return to NE-SW extension.

Thermochronological and structural data show the intensive extension along-the-arc in the Kythera area fades out in both directions along the Cretan-Peloponnese ridge. The exhumation of HP-rocks in the Hellenic forearc ridge and arc-parallel extension in the Hellenic forearc ridge are tectonic episodes resulting from simultaneously high rates of trench rollback and slab retreat and consequent expansion of the arc of the overriding Aegean plate and simultaneously, the bending of the arc from a more rectilinear shape. Local arc-parallel extension occurred where stretching was a maximum, and occurred in a position of oblique late convergence along the arc.

Determination of radiation damage (RD) in zircon using Raman spectroscopy and annealing experiments shows wavenumber shifts to correlate strongly with uranium concentration of zircon (U_z). Consequently, Raman spectroscopy of $\nu_3[\text{SiO}_4]$ can potentially determine the U_z . There is a progressively increasing range of wavenumber shift due to U_z increase, which reflects the ratio of intact versus distorted crystallinity. The time since crystallization or last annealing of the zircon will control the amount of radiation damage and the Raman wavenumber shift for zircons with a given U_z . A longer time is required for

a low-uranium zircon to reach the same amount of alpha and fission damage events of a high-uranium zircon, in order for both to show equal wavenumber shift. Time distinguishes zircons of same U_z , which show differences in the Raman wavenumber. The correlation of the Raman wavenumber range and U_z may permit the development of a new chronometer using Raman measurements only for determining U concentration.

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