

Evidence for large-scale imbrication during Eocene syn-orogenic exhumation of the Hellenic subduction channel (Cyclades, Greece)

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In the Cyclades, Miocene post-orogenic back-arc extension overprinted the exhumed syn-orogenic Eocene subduction channel. Whereas the exact geometry and kinematics of the syn-orogenic exhumation are still controversial, but must have involved a floor thrust and an apparent normal fault at the roof, the post-orogenic extension, leading to the exhumation of Cordilleran-type metamorphic core complexes, is well constrained by several major detachment systems.

On the island of Milos, which is part of the South Aegean Volcanic Arc, minor outcrops of schist occur. New data indicate that these witnessed Eocene blueschist facies metamorphism at ~ 8.5 kbar and $\sim 400^\circ\text{C}$, but escaped the Miocene extensional overprint, as they lie in the hanging wall of the West Cycladic Detachment System. In contrast, eclogite pebbles in "Green Lahars" on Milos yield metamorphic conditions of ~ 19.5 kbar at $\sim 550^\circ\text{C}$. Both high-pressure units belong to the Cycladic Blueschist Unit and can only have been juxtaposed by thrusting. This indicates that two nappes, the newly defined Cycladic Blueschist Nappe and the overlying Cycladic Eclogite Nappe, both comprising rocks of the Cycladic Blueschist Unit, exist on Milos. These nappes probably also form the other Cycladic islands, separated by a syn-orogenic thrust, which we name the Trans Cycladic Thrust.

The Trans Cycladic Thrust, which traces the orientation of the syn-orogenic exhumation channel, is partly offset by the post-orogenic Miocene extensional detachment systems. As a result of the Mid- to Late Miocene clockwise crustal block rotation, the syn-orogenic channel, and hence the Trans Cycladic Thrust, bends through 90° at Milos, changing from a W-E trending to a N-S trending extrusion-related stretching lineation. Restoration of the Miocene block-rotation and extension results in syn-orogenic thrusting kinematics (top-SSW) in the Cycladic Blueschist Nappe and along the Trans Cycladic Thrust and syn-orogenic apparent normal faulting kinematics (top-NNE) at the roof of the Cycladic Eclogite Nappe, consistent with the Eocene extrusion of the high-pressure rocks in the Cyclades.