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Implications of structural analysis, P-T pseudosection modelling and white mica 40Ar/39Ar age distributions for the interpretation of the tectonometamorphic history of Syros (Cyclades, Greece)

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The island of Syros, in the Cycladic region of Greece, remains a key location for investigations aiming to understand tectonic and metamorphic subduction processes of fluid-rock interaction and metasomatism, channel flow, extrusion wedges and back-arc extension in syn-collisional environments.
The present ongoing research is based on newly obtained 40Ar/39Ar phengite ages, P-T modelling of eclogite, blueschist and greenschist facies samples, and structural analysis and mapping. It provides new insights in order to unravel the complex Eocene-Miocene history of the Cycladic Blueschist Unit (CBU) in Syros. Numerous previous contributions provide a wide variety of interpretations for similar observations. An agreement on a basic input such as the peak metamorphic conditions achieved by the different identified units within the island, needed for the proposition of geological sound models, is still lacking despite considerable efforts. This research aims to estimate peak metamorphic conditions for several of them. Preliminary data suggests that they experienced peak metamorphic conditions varying between 20-25kbar and temperatures ranging 500-600ºC: this supports a recent trend in literature towards higher peak pressure conditions for eclogite metamorphism. Moreover, it suggests that the different units reached similar metamorphic conditions.
Structural observations on the island scale support previous research with respect to the preservation of at least two ductile deformation events. The first, mostly recorded in the northern part of the island associated to preserved lawsonite pseudomorphs, is interpreted to record prograde burial and top-to-the-S thrusting in blueschist facies. The second, pervasively found across the island, is associated to a continuum of top-to-the-E extensional shearing that started in eclogite facies, being the blueschist structures the dominant ones. Continued greenschist overprint is found as both static and deformation-driven. It is interpreted to record syn-collisional exhumation and top-to-the-E extension: transport direction is narrowly clustered around 90º in the proximities of shear zones, and more distributed within the wall rocks. The pervasiveness of lineation development indicates a deviation from simple shear strain in the shear zones. Therefore, shear sense analysis is not as straightforward as previously assumed in the island. The occurrence of both top-to-the-E and top-to-the-W shear sense indicators has previously been interpreted as a consequence of vertical thinning and coaxial stretching. Alternatively, it can be explained in terms of flow partitioning resulting in the generation of coaxially stretched domains, or as a consequence of slip along the penetrative foliation planes, as has been previously shown theoretically and experimentally. The clear dominance of top-to-the-E shear sense is interpreted as an indication of the bulk kinematics during syn-collisional extension.
Considering opposite rotations of the western and eastern Cycladic regions, the apparently orthogonal angle between transport estimates for coeval thrusting (S, in Ios) and extension (E, in Syros) decreases considerably. This supports the interpretation of the exhumation of the CBU as taking place within an extrusion wedge during a syn-collisional stage. The different shear zones identified in the island are the result of flow partitioning during the extrusion-related retrograde deformation, so that they accommodated most of the extension that led to the early exhumation.