



The Western Cycladic Detachment System on Makronisos, Greece

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Makronisos, which lies 3 km east of the Attica port of Lavrion, is the northwesternmost part of the Western Cycladic archipelago. The Cyclades and adjacent part of Attica are dominated by Miocene low-angle detachments that developed during top-to-SSW crustal extension, forming the West Cycladic Detachment System. Although extension is well documented on the other Western Cycladic islands and in Attica, the geology of Makronisos is poorly known. The aim of this study is to provide data on the structural, microstructural and metamorphic evolution of Makronisos to resolve its tectonostratigraphic position and its relationships within the Cycladic realm.

Most of Makronisos consists of grey, locally graphitic, pelitic schists and yellowish impure marbles, interlayered with blue-grey mylonitic marbles and quartzites, forming large-scale pinch-and-swell structures. Metabasites are present as small bodies along the east side of the island but are thicker and more continuous in the southeast. Petrography shows that metabasites usually contain blue amphiboles, although generally only as relicts after greenschist facies retrogression. Serpentinite has been found at two localities. The structurally highest level of the island consists of white-grey to pale-red ultramylonites up to 40 m thick. These mainly lie on the central ridge of the island, but, due to large-scale upright folding, also crop out along the east and west coasts. In several places, the ultramylonites overlie 1-2 m of foliated ultracataclasites derived from the footwall pelitic schists.

Stretching lineations and macroscopic shear-criteria indicate a top-to-SSW shear-sense. Microstructural analyses consistently show the same shear-sense, indicated by shape and crystal preferred orientations, σ - and δ -clasts, mica-fish, rotated veins and SCC' structures. Deformation mechanisms observed in quartz (LT-bulging) and calcite (recrystallization) are evidence for deformation temperatures of c. 300°C. Albite porphyroclasts may preserve an older foliation and layering, exhibiting features of an earlier, higher grade metamorphism and deformation phase. This evolution is consistent with progressive cooling during top-to-SSW deformation.

The relict HP-mineral assemblages indicate a correlation with the Cycladic Blueschist Unit and hence the white-grey to pale-red ultramylonites forming the structurally uppermost part of the island can be interpreted as a part of the footwall of the Western Cycladic Detachment System. $^{40}\text{Ar}/^{39}\text{Ar}$ analyses on metamorphic white mica from pelitic schists, quartzites and marble mylonites/ultramylonites yield ages between 15 and 22 Ma, with a positive correlation between young ages and higher strain. These results are younger than $^{40}\text{Ar}/^{39}\text{Ar}$ ages in the Cycladic Blueschist Unit on Evvia (55-45 Ma and 35-30 Ma) but are similar to white mica ages on nearby Kea. In combination with the given tectonometamorphic data, this suggests that Makronisos underwent a similar geological history as other Western Cycladic islands.