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Exhumation of metamorphic core complexes is accompanied by progressive strain localization within large-scale shear zones, which may evolve into long-lived bounding detachments affected by ductile to brittle deformation. Despite the well-studied P-T-t patterns of individual nappes, their relative timing, mode and kinematics of exhumation are debated. In this study, in the frame of the Mediterranean syn- and post-orogenic deformation, examples of shear zone hierarchization and strain localization from Sifnos and Syros islands (Cyclades, Greece) are documented in detail in order to explain 3D-geometries and regional kinematics and are here tentatively related to the Ar/Ar ages available in literature. During the Eocene syn-orogenic uplift, the degree of strain localization increases progressively from blue- to green-schists deformation. Some of these shear zones where then reworked during the Oligo-Miocene post-orogenic deformation in different, usually warmer P-T conditions and a new episode of strain localisation, and an evolution toward brittle faulting, either along the main detachments or along newly created faults (as in Sifnos). Such shear zones demonstrate long-lived efficiency, especially where fluid circulation enhance retrograde metamorphic reactions. During Neogene, the final shape and exhumation of domes is the result of crustal thinning and brittle-ductile deformation in the whole Cycladic region. Although stretching directions along individual kilometric scale shear zones may be complex in the details, a simple general picture is shown for the Oligo-Miocene episode, less so for the Eocene one. Most Cycladic islands show a top-to-the-North sense of ductile shear from the syn-orogenic to the post-orogenic stage, this is the case of Sifnos for instance. The syn-orogenic stretching is however often more E-W trending, as exemplified by Syros and Tinos. The top-North or Top-East sense of shear is attributed to the NCDS for the post-orogenic stage and to a syn-orogenic detachment (Vari D.) for the syn-orogenic stage. However the southwestern Cyclades show clear top-South post-orogenic kinematic indicators related to the WCDS, with a complete ductile to brittle evolution. As for the NCDS the WCDS leads to intense ductile deformation in its footwall. To the east of Serifos this ductile top-South sense of shear is lost. Only top-South brittle faults are found in Folegandros and Sifnos where they cut across the older foliation. The complexity of the distribution of shear sense on Syros and Sifnos, both in the ductile and brittle regimes, during the post- and syn-orogenic stages, is discussed in the framework of the transition in time from syn-orogenic exhumation faults to post-orogenic detachments and of the interactions between different sets of detachments, such as the NCDS and the WCDS.