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Thrusting and extensional exhumation in an Accretionary Wedge: The Paleogene evolution of the Northern Sporades (Greece)

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Abstract
We present a study on the latest Cretaceous - Paleogene tectonic evolution of the Northern Sporades islands (Greece) using multi-scale structural analysis and white mica Ar/Ar dating. We show new geological maps, cross sections, and kinematic datasets from the islands of Skiathos, Skopelos, and Alonnissos. Structural observations are supplemented by the Ar/Ar dating of mylonitic sericite foliations.
The Northern Sporades are part of the Pelagonian zone that experienced burial and exhumation related to the Aegean subduction system in Late Cretaceous-Paleogene times. The islands largely consists of metasediments that belong to 1) a Paleozoic to Jurassic passive margin succession (Pelagonian and Eohellenic units), and 2) an Albian to Paleocene succession that transgresses the older formations (Mesoautochtonous and Palouki units).
Tectonic burial by top-SW thrusting initiated in the latest Cretaceous – Early Paleocene, and resulted in the stacking of the outcropping geological units of the islands. All the formations were buried to greenschist facies conditions, where shortening was largely accommodated by the formation of reverse-sense shear zones. These shear zones localized along pre-existing weak zones such as marble layers in the Cretaceous strata and resulted in the formation of thin thrust slices. Between the shear zones, distributed top-SW to top-S shearing is observed which is especially pronounced on Skiathos. Mylonitic sericite foliations of Skopelos which are most likely related to top-SW burial yield Ar/Ar ages between 75 and 54 Ma.
Top-SW thrusting was followed by top-NE shearing related to the extensional exhumation of the formations. Top-NE shear zones localized at pre-existing stratigraphical and tectonic contacts, and are subparallel with the main foliation. These shear zones may have a minor to medium (few 100 or 1000 m) displacement and consequently do not cut out major parts of the stratigraphy. However, they triggered distributed top-NE shearing between the shear zones that is especially characteristic on Skopelos. Ductile top-NE shearing was gradually replaced by normal faulting which was driven by both NE-SW and NW-SE extensional directions. Normal faults are characteristic features of the whole Northern Sporades and are linked to the formation and evolution of the North Aegean Trough.
Our kinematic dataset (stretching lineations and shear sense indicators) shows that Skiathos and Skopelos shares the characteristic directions of top-SW burial and top-NE exhumation which is in good agreement with regional constraints. However, the same dataset on Alonnissos deviates from that by $\sim 90^{\circ}$, possibly implying extreme post-Eocene vertical axis rotation of the island.