Hiding beneath a volcano: the Santorini Detachment System (Cyclades, Greece)

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The cores of most Cycladic Islands are formed as consequences of early Paleogene high-pressure subduction processes of the African plate beneath Europe, and Miocene extensional exhumation of the subduction channel. The island of Thera (Santorini) resides in the Hellenic Volcanic Arc, and is dominated by Quaternary eruptive volcanic material atop pre-volcanic basement. Composed primarily of crenulated pelitic schists, meta-conglomerates, and calcitic marbles, the basement is present at two main localities. Within the caldera walls, the area near the port of Athiniós exposes Ms(Phg)-Chl-Ab-Bt schists and metabasites with marble interlayers, which possess relict glaucophane and crossite indicating blueschist facies metamorphism. Detrital zircon U-Pb geochronology from this package of rocks yields a dominant ca. 650 Ma Pan-African signature, and very few zircon dates <500 Ma. Foliation-defining white mica bundles give 40Ar/39Ar dates of 25-19 Ma and zircon (U-Th)/He (ZHe) dates are 11-8 Ma. A cross-cutting dacitic dike is 8.5 ± 0.2 Ma based on zircon U-Pb dating. The petrologic and geochronologic characteristics of the metamorphic rocks of Athiniós are traits of the Cycladic Blueschist Unit (CBU) found as footwall rocks on other Cycladic islands. Another outcrop of the CBU below the volcanic rocks is located north of Emporió that contains pelitic schists and conglomerates with an interbedded meta-rhyolite that displays clear eutaxitic microstructures and porphyritic quartz and feldspar phenocrysts with zircon dated at 235.0 ± 1.4 Ma. White mica ages give 40Ar/39Ar dates of 26-23 Ma, and ZHe dates are ca. 12 Ma. Separated by a major detachment system, the newly discovered Santorini Detachment with top-to-SE shear sense, the highest mountains of the island (Profítis Ilías and Mésa Vounó) are composed of metamorphosed "Pantokrator" facies carbonates containing large, well-preserved Upper Triassic Megalodon fossils. Between these two mountains, low-grade meta-conglomerates occur in a complex refolded syncline, which has been also reworked by SE-directed shear. White mica from this package of rocks occurs as thin ribbons aligned with the dominant foliation and as isolated, slightly corroded grains, apparently detrital that yield Jurassic to early Paleogene single grain 40Ar/39Ar dates, with a dominant Paleocene signature. Zircon He-dating similarly reveals dispersed ages between 36-15 Ma suggesting Miocene temperatures were not high enough (<200°C) to completely reset all of zircon cooling ages. The rocks of the hanging wall above the newly discovered detachment most likely belong to the Pelagonian zone with a Triassic carbonate platform discordantly transgressed by an Eocene flysch deposit. These new results require re-evaluation of the southern limit of Miocene extensional systems in the Cyclades realm.