Geophysical Research Abstracts
Vol. 17, EGU2015-8409, 2015
EGU General Assembly 2015

Variscan tectonics in Dodecanese, Kalymnos island, Greece

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Kalymnos island is located in the Dodecanese, southeastern Aegean Sea, and geologically appears to be part of the external Hellenides. Pre-Alpidic basement rocks on the Dodecanese islands have been suggested to record compelling similarities with the basement rocks in Eastern Crete with respect to their lithologies and pre-Alpidic metamorphic evolution. The lithotectonic units experienced greenschist to amphibolite facies conditions during the Variscan orogeny. Whereas the rocks in Eastern Crete reveal Alpine high-pressure overprint, the Variscan basement units in the Dodecanese record no or low-grade Alpine metamorphism.

A field study of basement rocks below Mesozoic limestones and dolomites in the NW part of Kalymnos near Emporios uncovered a complex history of metamorphism, folding and faulting. Three different tectonic units can be discriminated from top to bottom: a) a quartz-mica schist, b) a white-grey, fossiliferous coarse grained marble and c) a fine-grained fossiliferous blue-grey marble. In the marbles macrofossils such as brachiopods, ammonoid cephalopods (Goniatids?) and crinoids suggest a Middle-Upper Devonian deposition age (Givetian-Frasnian).

Structural mapping the area resolved a dominant W-E shortening event, resulting in an overall inverted metamorphic gradient. The lowermost blue-grey marble unit is folded into large-scale upright folds, which are truncated by top-to-east overthrusting of the white-grey marble unit. Whereas deformation mechanisms in the blue-grey marble unit are dominated by dissolution-precipitation creep, the white-grey marble suffered intense crystal plastic deformation with localized high-strain mylonitic shear zones. The uppermost quartz-mica schist unit is separated from the lower units by a cataclastic phyllonitic shear zone. 40Ar/39Ar geochronological dating on white micas from the quartz-mica schists yielded cooling ages between 240 and 334 Ma indicative of Variscan cooling. Our data suggest that this part of the Dodecanese experienced intense Variscan deformation with no high-temperature Alpine overprint.