Geophysical Research Abstracts
Vol. 12, EGU2010-9975, 2010
EGU General Assembly 2010

A brittle-ductile high- and low-angle fault related to the Kea extensional detachment (W Cyclades., Greece)

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Roll-back of the African Plate within the Eurasian-African collision zone since the Oligocene/Miocene led to extension in the Cyclades along low-angle normal fault zones and exhumation of rocks from near the brittle-ductile transition zone. On the island of Kea (W Cyclades), which represents such a crustal scale low-angle fault zone with top-to-SSW kinematics, remote sensing analysis of brittle fault lineaments in the Pissis area (W Kea) demonstrates two dominant strike directions: ca. NE-SW and NW-SE. From the north of Pisses southwards, the angle between the two main fault directions changes gradually from a rhombohedral geometry (ca. 50°/130° angle between faults, with the acute angle facing westwards) to an orthogonal geometry. The aim of this study is the development of this fault system. We investigate, if this fault system is related to the Miocene extension or if it is related to a later overprinting event (e.g. the opening of the Corinth)

Field observations revealed that the investigated lineaments are high-angle (50-90° dip) brittle/ductile conjugate, faults. Due to the lack of marker layers offsets could only rarely be estimated. Locally centimetre thick marble layers in the greenschists suggest a displacement gradient along the faults with a maximum offset of less than 60 cm. Large displacement gradients are associated with a pronounced ductile fault drag in the host rocks. In some instances, high-angle normal faults were observed to link kinematically with low-angle, top-to-SSW brittle/ductile shear bands. Both the high- and the low-angle faults have a component of ductile shear, which is overprinted by brittle deformation mechanisms. In thin-section, polyphase mode-2 cracks are filled mainly with calcite and quartz (ultra)cataclasites, sometimes followed by further opening with fluid-related iron-rich carbonate (ankeritic) precipitation. CL analysis reveals several generations of cements, indicating multiple phases of cataclastic deformation and fluid infiltration. Ar/Ar white mica data from Pisses constrain ductile deformation to ca. 20 Ma. Since the high-angle faults show a continuum from ductile to brittle deformation, the Ar/Ar cooling ages suggest that faulting must have occurred in the Miocene. Consequently the high-angle faulting was genetically related to the SSW-directed low-angle extensional event and does not represent a later overprint related to a different kinematic event.