Geophysical Research Abstracts, Vol. 8, 04990, 2006
SRef-ID: 1607-7962/gra/EGU06-A-04990
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Crustal scale detachment fault system on Kea (Western Cyclades, Greece)

K. Voit (1), B. Grasemann (1), K. Petrakakis (2), E. Draganits (3),

M.A. Edwards (1), M. Müller (1), Ch. Iglseder (1), U. Exner (1), A. Zamolyi (1)

(1) Department of Geodynamics and Sedimentology, Structural Processes Group, University of Vienna, A-1090 Vienna, Austria

(2) Department of Geodynamics and Sedimentology, University of Vienna, A-1090 Vienna, Austria

(3) Institute for Engineering Geology, Vienna University of Technology, A-1040 Vienna, Austria

(klaus_voit@gmx.at)

It is generally accepted that post orogenic extension in the late Oligocene to early Miocene is responsible for the exhumation of metamorphic rocks in the Aegean. This extension is principally largely accommodated by low angle crustal detachment faulting frequently resulting in the formation of metamorphic core complexes (MCC). Classic examples include Naxos, Paros, & Ios and recently Serifos.

Here, we present data from recent structural investigations on the island of Kea in the W. Cyclades, Greece. In the north of the island, where our work focussed, the entire section of rocks are highly strained, first under ductile, later under brittle conditions.

Lineations (mineral, stretching) show a NNE-SSW-direction on mostly NE dipping foliation planes (with an average dip of 30˚) and has the orientation of a thrust fault in its present position. Of the ca. 270 m total structural thickness that was mapped, regional characteristics vary depending on the protolith and the intensity of strain. The uppermost portion comprises very coherent km-long blocks of 10's m thick marble-ultramylonite with dolomite lenses at its base. The central portions are a fine-grained greenschist comprising a series of interlayered cm- to m-scale marbles and compositionally varying schist layers. These host structural features such as macroscopic s-c

fabric, lensoidal to angular boudins. The lower portions comprise albite blast-bearing greenschist gneiss. All sections are overprinted by polyphase brittle/ductile to brittle deformation.

The competence contrast between the marble-ultramylonite layer and the underlying fine-grained greenschists is frequently a metre-scale zone of very high strain as indicated by the presence of sheath folds. Within the marble-ultramylonite, a-type flanking folds represent the last stage of deformation.

The fine grained greenschist overprints a higher temperature fabric as evidenced by internal gneiss lamella. A high density of syn- to post-mylonitic quartz veins are present as well as distinctive ultramylonite (graphitic) shear zones implying mass transfer and solution/precipitation mechanisms during deformation. Late stage fluid-related activity resulted in alterations and mineralizations including a conspicuous ankeritization of dolomitic megaboudins.

Exhumation during progressive deformation is recorded by the transition from ductile to brittle conditions. Brittle fault zones are concentrated on rheologically distinct weak layers. These layers often contain serpentinite lenses and talc. Additionally cataclasites with slickensides and Riedel-fractures are present in these zones.

Shear sense indicators include ductile (SC´ or SCC´, clasts with monoclinic symmetry, shear bands, SPO and LPO in quartz mylonites), brittle/ductile (rotated veins, flanking structures, asymmetric boudinage), and brittle (Riedel fractures, slickensides) all of which consistently show top to SSW direction. Although the low-angle fault system in the northern part of Kea has the current orientation of a thrust, we speculate that, in analogy to other metamorphic core complexes (e.g. Serifos), the fault zone is part of an up-warped extensional crustal scale detachment.

The low-angle extensional faulting related structures are overprinted by younger (and probably still active) steeply dipping conjugate fault zones that strike NNE-SSW and NW-SE respectively. A possible regional genetic link with the actively widening Gulf of Corinth is subject of further investigations.