Geophysical Research Abstracts
Vol. 14, EGU2012-3897, 2012
EGU General Assembly 2012

The brittle stage of the exhumation of a metamorphic core complex: Naxos, Cyclades, Greece and some general rules

F. Neubauer (1) and S. Cao ()

(1) University of Salzburg, Dept. Geography and Geology, Salzburg, Austria (franz.neubauer@sbg.ac.at, +43-662-8044-621),
(2) University of Salzburg, Dept. Geography and Geology, salzburg, Austria

Structures of hangingwall units of major detachment systems in extensional settings leading to metamorphic core complexes are equally important to the generally well-studied footwall rocks. Here, we describe hanging-wall structures of the North-Cycladic Detachment System on Naxos Island of the Aegean Sea and found that they well monitor the structural evolution of hanging blocks complementary to the footwall structures, vertical fluid flow as well as late-stage inversion of the whole extensional system. On Naxos, Upper Oligocene-Miocene and Pliocene sedimentary successions are deposited on the hangingwall unit, which is largely an ophiolite. The Upper Oligocene-Miocene and Pliocene sedimentary successions are separated by a hiatus arguing for a two-step evolution. Whereas the first step, Miocene, indicate moderate subsidence and relief, and only denudation of the hangingwall unit, the Pliocene conglomerates indicate a sharply increasing relief and an over-steepened topography. Hydrothermal systems developed in hangingwall rock succession (e.g. Miocene at Steladia) play an important role and resulted in large-scale silica precipitation and associated alteration similar as these found in subvolcanic epithermal systems. This constrains a close link between footwall granodiorite intrusion and near-surface processes. The Pliocene coarse boulder conglomerate with its abundant first appearance of granite/granodiorite, and subsequent marble-rich debris on distant places like Palatia indicate a sudden erosion and high-gradient relief leading to erosion of the mantle of the migmatite dome during Pliocene. On Naxos, we recognize, therefore, a three-stage tectonic evolution in the hangingwall unit: (i) moderate subsidence of an Upper Oligocene-Miocene basin, in part below sea level; (2) a second stage with deposition of Pliocene coarse conglomerates, and (iii) post-Pliocene faulting affecting the conglomerates. During the second stage, surface exposure of the metamorphic core complex was reached resulting in catastrophic alluvial fans.

Structural data from the Upper Oligocene-Miocene rocks indicate that NNE-SSW extension still prevailed up to the Miocene/Pliocene boundary. Together with structural data from Pliocene conglomerates, we can distinguish between three major events: The first stage is characterized by mostly NNE-dipping and subordinate SSW-dipping normal faults indicating together ca. NNE-SSW extension. A second palaeostress tensor group (B) mainly comprises ca. NW-trending dextral and WSW-trending sinistral strike-slip faults indicating together ca. E-W strike-slip compression and monitor, therefore, inversion and compression perpendicular to the previous extension direction. The third palaeostress tensor group (C) is characterized by dominating mostly NE-trending subvertical sinistral strike-slip faults and steep NNW-trending dextral strike-slip faults constituting together ca. N-S strike-slip compression. In a few cases, S- to SW-dipping reverse faults also occur.

On a general level, our study allows for the following major conclusions:

(1) Structures of hangingwall units of major detachments above metamorphic core complexes are equally important compared to the generally well-studied footwall rocks. They allow date several tectonic events not necessarily found in footwall rocks.

(2) On Naxos, we can distinguish between three major tectonic events, which are in accordance with large-scale tectonic processes in the Aegean Sea: (a) ca. NNE-SSW extension; (b) ca. E-W strike-slip compression and monitor therefore inversion and compression perpendicular to the previous extension direction, and (c) N-S strike-slip compression.