Geophysical Research Abstracts, Vol. 9, 01425, 2007
SRef-ID: 1607-7962/gra/EGU2007-A-01425

Early Pliocene onset of left-lateral strike-slip tectonics, rotations and uplift in the southern Aegean region related to STEP faulting

D.J.J. van Hinsbergen (1), W.J. Zachariasse (2), W. Krijgsman (1), C.G. Langereis (1), R. Govers (3), M.J.R. Wortel (3), A.R. Fortuin (4)

(1) Paleomagnetic Laboratory 'Fort Hoofddijk', Utrecht University, the Netherlands, (2) Stratigraphy and Paleontology Group, Utrecht University, the Netherlands, (3) Tectonophysics Group, Utrecht University, the Netherlands, (4) Department of Earth and Life Sciences, Free University of Amsterdam

Late Neogene genesis of the south Aegean strike-slip system – including the Pliny and Strabo trenches– forms a late stage in the formation of the Aegean arc. Southward roll-back created a back- arc with metamorphic core complexes since the Oligocene, and led to large-scale rotations of opposite sense on both sides of the arc since the middle Miocene and led to arc-parallel extension on Crete and opening of the Cretan basin in the late Miocene. The significant late Neogene contribution of strike-slip tectonics in the Aegean region, a right-lateral in the north (NASSS) since $\sim$5 Ma (including the Marmara pull-apart basin and the Kefalonia Fault Zone) and left-lateral in the south Aegean strike-slip system (SASSS) has long been recognised. The SASSS alledgedly formed due to e.g. curvature of the Aegean arc in combination with ongoing northward motion of the African plate, the westward extrusion of Anatolia into the Aegean region or southwestward retreat of the African subducted slab along a STEP fault. Within any of these scenarios, it is essential to assess the exact timing of the onset of activity of this fault system.

We have carried out detailed stratigraphic, sedimentologic, paleomagnetic and vertical motion analyses in the upper Miocene and Pliocene of Rhodos, Karpathos and Crete.

On Rhodos, we reconstructed four distinct phases of motion: 1) 3.8-3.6 Ma: a 10˚ccw rotation phase; 2) 2.5-1.8 Ma, SE-ward tilting, drowning the SE coast to 500-600 m; 3) 1.5-1.1 Ma, NW-ward tilt, re-emerging the drowned relief; 4) post-0.8 Ma, 17˚ccw

rotation. It is unlikely that these rotations are regional, including SW Turkey, as it the amount of Pliocene extension required to accommodate the rotation north of Rhodos would be much larger than observed. We relate the rotations of Rhodos activity of the SASSS. Previously published absence of Messinian evaporates in the deep-marine Rhodos basin and the post-3.8 Ma ccw rotation of Rhodos shows an onset of SASSS activity between 5.3 and 3.8 Ma.

Crete and Karpathos shows the following history: 1) Ongoing subsidence until the terminal Messinian; 2) Transition to regional uplift in the earliest Pliocene coinciding with widespread massflow emplacement; 3) Ongoing uplift of $\sim$1 km between 5 and 3 Ma over an E-W area of $\sim$400 km and only some hundreds of metres after 3 Ma; 5) varying ccw rotations after the early Messinian, explained by left-lateral strike-slip tectonics.

We conclude that the onset of formation of the SASSS occurred around 5 Ma. The NASSS and SASSS at present translate westward Anatolian motion towards the Hellenic Trench. Superimposed on this motion, the Aegean region itself spreads outward orthogonal to the arc. Westward extrusion of Anatolia probably already started in the middle Miocene, around 13 Ma, i.e. much earlier than NASSS and SASSS formation. The formation of the NASSS was explained by the blocking of further westward motion due to the collision of northern Greece and Albania with Apulia.

The uplift of Crete may within its geological setting could be explained by the friction of the southern Aegean region with the African promontory. However, the driving source of the Aegean velocity field is still located to the south. Moreover, uplift of Crete has not significantly continued after the Pliocene. The south Aegean region has thus not collided (yet) with the African promontory in a way comparable to the northwestern Aegean region. Recently, the SASSS was explained as a STEP fault, accommodating SW-ward roll back of the African slab. This scenario predicts uplifted bulges at the leading edge of the STEP fault. The size, amount and rate of uplift of these bulges is dependent on the model parameters but are of the same order of magnitude and relative dimensions as those we reconstructed and this scenario is in line with a driving source south of the Hellenic arc for the Aegean crustal velocity structure. The STEP-scenario thus provides an explanation for the formation of the south Aegean strike-slip system that is in line with the available kinematic reconstructions.