A Geophysical Study of the Aegean Sea

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The Aegean Sea was resurveyed with gravity, magnetic and seismic methods. The gravity and magnetic profiles, spaced at between 1.5 to 6 n.m., covered the entire area and yielded extremely precise data. These confirm to a large extent the existing models and provide new information which can be used to refine the geological concepts for the development of the Aegean Sea.

In the past the evolution of this area has been explained using the back-arc spreading model. Our interpretation however suggests that the deformation is a consequence of the large-scale shearing associated with the East Anatolian Fault System, and of the way that continental crust and lithosphere react under shearing forces. The Aegean microplate responds to the kinematic pattern in the east with extension and partial strike-slip, and in the west with compression and the building-up of a thrust belt and nap systems. The factor controlling the tectonic development of this area is the shear movement and not the subduction. Seen under this aspect, the Aegean Sea can be understood as a "pull-apart" basin.

The crustal profiling across the Aegean Sea revealed a stretched thinned continental crust, resting on a "soft" upper mantle characterized by low Pn velocity, high heat-flow and low density distribution. Mapping of the sedimentary record of recent and subrecent subsidence events and the major tectonic lineaments confirmed the continuing stretching and subsidence of the Cretan Trough. The newly compiled gravity and magnetic anomaly maps of the Aegean Sea show a strong correlation with the tectonic elements of delineation and weakness.

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Neotectonic and Recent Deformation of Crete

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In Crete, the Quaternary shorelines constitute good vertical deformation indicators. The stratigraphical age of the shorelines and their todays elevation, show that they 've been under strong deformation associated with the block-faulting that affected Crete.

Radiometric dating of the shorelines, made from various researchers, show that the average speed of some uplifts from Tyrrhenian up to the last thousand years ranges between 5 to 6 cm/100 years.

The speed of differential deformation for the entire Neotectonic period (approximately 13 M.years) is estimated to be similar with the speed of the fossilized Pleistocenic shorelines.

The analysis of the Neotectonic period faults shows that they are associated with a strong extentional status, in a perpedicular direction to the longer dimention of Crete (and in general to the Aegean arc). In the internal of this status, small events of ephemeral compression have been observed, that are different in width and in direction.

This extention that has been expressed with normal faults, has caused a gravitationnally spreading of Aegean towards the Ionian sea on an extremely large scale in Crete. This phenomenon is associated with the subduction of the African plate under the Aegean plate.

Shorelines of the last 1500 years "record" revolving upward movements in West Crete with maximum rising approximately 10m.

Gravimetric measurements of the last 7 years in Crete show that the upward and downward movements in the horsts and grabens respectively, are still continuing in an increasing speed. This phenomenon is probably related to the particular stage of continental collision between Africa and Europe.