A REVIEW ON MEDITERRANEAN BACK - ARC BASINS (AEGEAN AND TYRRHENIAN SEA)

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A synopsis on the structure and evolution of the Aegean and Tyrrhenian Sea area is given. Similarity and dissimilarity with Pacific-type island arcs are discussed. Fixistic and mobilistic evolutionary hypotheses are reviewed and checked against the observations. Subduction induced mantle convection with crustal stretching explains most satisfactorily the expanding back arc basins.

Geological and geophysical information on the Aegean and Tyrrhenian region, largely obtained during the International Geodynamics Project, are presented in form of structural maps and typical cross sections through the island arc - back arc regime. The intimate relation of island arc evolution and post Mesozoic orogenic fold belts is emphazized. Crustal shortening during orogeny requires subduction of the lower lithosphere. Tensional tectonics is prevailing in the back arc basins. Expansion began some 5 m.y. ago in both areas. In the early phase extension seems to be more pronounced in the volcanic arc-trench gap. In a later stage extension reaches far back behind the volcanic arc. From petrological point of view no true oceanic crust exists in both back arc basins. The center of back arc seas was or is still rising. The upper mantel is hot and the heat flow high. Benioff zones are strongly disturbed in the Aegean and interrupted in the Tyrrhenian. Compression of the thick sedimentary cover of the subducted lithosphere with the island arc or collision with epicontinental crust (Calabria) limits subduction.

The following fixistic and mobilistic hypotheses for the evolution of arc- back arc basin systems are critically reviewed: Thermal expansion by radiogenic heat production and thermal blanketing. Mantle diapir model. Gravitational instability at young continental borders. Lithosphere subduction and its thermal and mechanical consequences such as friction heating, viscous drag, thermal bouyancy effects, induced mantle convection below the back arc region. Lithosphere stretching and its thermal consequences in the back arc basin. Lithosphere cracking and dike intrusion in the back arc basin.

It seems that subduction induced mantle convection with crustal stretching in the back arc region provides the most satisfactory explanation for the observations. Gravitational instability in a laterally inhomgenions lithosphere might have initiated subduction.