GEOLOGICAL HISTORY OF THE EASTERN MEDITERRANEAN SINCE LATE MIOCENE

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Abstract. The paleogeography of the Eastern Mediterranean was reconstructed using a new "Dynamic Model" : In late Miocene the Mediterranean most likely has been a shallow sea with subsiding basins filled with evaporites, while in Pliocene-Quaternary time the subsidence became more conspicuous because of slow rate of sedimentation. The present day configuration, probably, is not older than Quaternary.

Since the leg 13 findings of Late Miocene evaporites below the Mediterranean basins several attempts were made to combine deep sea drilling results (1 ; 2 ; 3) with land geology. One of the models proposed by Hsü and Ryan (1), known as the "Deep Basin Dessication Model", postulates Late Miocene basins of a bathymetric setting comparable with the present day morphology. This model excludes important Post-Messinian basinal foundering, while the evaporites of the present land sections are thought to be uplifted. In contrast, Nesteroff's "Shallow Basin Dessication Model" (4) combines temporary total dessication with basins of only 400 to 600 m depth below world sea level, thus avoiding the tectonical premisses of the first model.

Recent investigations proved continuous marine sedimentation at least for parts of the Western Mediterranean (5 ; 6). Facies analyses in the circum-Ionian region also suggest a relative stability of the Mediterranean sea level and an almost continuous supply of oceanic sea water (7). All this contradicts the hypothesis of the existence of a huge waterfall (1) of which, up to now, no vestiges were found. These evidences are the base of a "Dynamic Model" of the Mediterranean salinity crisis during Messinian time (8).

In this model the evaporites are thought to have formed in a very shallow sea. In basinal areas where thick chlorides were deposited (e.g. the central Ionian and the Balearic basins), the waterdepth may have reached only a few hundred maters ; on the other hand, the sulphats facies was formed in very shallow waters as well as in subaerial settings. In areas exposed to continuous or predominant influx of normal marine water "hemipelagic" marls and shallow water carbonates with reefs formed contemporaneously.

In central areas the thick deposits of evaporites, sometimes exceeding a thickness of 1000 m, are indicative for synsedimentary subsidence of the basins in the order of magnitude of about 1 m per thousand years. This rate of subsidence has not changed drastically till present time.

In many Mediterranean cores and land sections, the Miocena/Pliocene boundary is a zone of transition : Messinian evaporites are topped by ("hemipelagic") dolomitic marls of still Miocene age, followed by ("hemipelagic") calcareous marls and/or limestones (Trubi) of Early Pliocene time. The Trubi-facies is frequently intercalated with or grades laterally into typical shallow water sediments, indicating a still not very deep setting. During Pliocene time, the Mediterranean basins continued subsiding, but, because of the lack of important sedimentary infill ("starving basins", in contrast to Messinian time), the subsidence is more obvious.

During Quaternary time turbidites became very important in the central Ionian area (9), indicating that the morphological situation (deep basins with abyssal plains surrounded by steep "continental" slopes) has reached a configuration comparable to the now existing one.

Sapropels and sapropelic layers, frequently intercalated in normal marine Plio-Quaternary sediments, are indicative for events of long lasting (10^2 to 10^3 years) stagnations of the Eastern Mediterranean deep water body (10). The lack of sapropels in the Western Mediterranean basins underlines the importance of the Atlantic water influx and the existence of a treshold between the western and the eastern basins since Pliocene time. Hence, an uplift of Sicily from a deep basinal setting in Messinian time to its present situation (advocated by the Deep Basin Model) can be excluded. In the contrary, the Sicily-Tunisian platform is regarded as a relict of a Miocene shallow water "Mediterranean Sea".

There are important differences in time for the beginning of subsidence of the different Mediterranean basins, e.g. Late Miocene : Balearic, Ionian and (probably) N.-Aegean basins ; Pliocene : Alboran and Tyrrhenian basins ; Quaternary : S.-Aegean area.