

## TWO DECADES OF DEEP-SEA DRILLING IN THE MEDITERRANEAN : PAST, PRESENT AND FUTURE

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The geological history of the Mediterranean region is very complex and articulated. The Mediterranean sea, as we know it now, consists of two major parts : the western Mediterranean which was formed in post-alpine orogeny time and the eastern Mediterranean which is much older and is considered a remnant of Mesozoic Tethys.

Deep Sea Drilling had a fundamental impact in the scientific exploration of the Mediterranean, with special reference to its evolution in the Neogene (last 24Ma).

### The past.

**1970.** The first drilling campaigns (leg 13 of the Deep Sea Drilling Project) was extremely successful. Even though in the early days of the project core recovery was not comparable to the present one, and site survey was primitive in many occasions, fourteen drillsites were successfully drilled and cored to a subbottom penetration up to 800 m. The most exciting result was the discovery that in all the major basins explored (Alboran, Balearic, Tyrrhenian, Ionian and Levantine), under a one to several hundred meters thick sedimentary cover consisting of ooze, marls and turbidites of Plio-Pleistocene age, Messinian evaporites were present, indicating subtidal, intertidal and even supratidal conditions. This discovery leads to develop the concept of Mediterranean salinity crisis, and to the formulation of the so-called "deep basin desiccation model".

**1975.** The second drilling campaign (leg 42A of DSDP) provided additional evidence for the desiccation model by (a) recovering pre-Messinian sediments indicative of open marine deep water conditions both in the western Mediterranean (DSDP site 372, Balearic Basin) and in the eastern Mediterranean (DSDP site 375, Levantine Basin), (b) documenting intertidal to supratidal facies in the Messinian evaporites recovered from the deepest basin of the Mediterranean (i.e. Messina A.P. - 4200 m) and (c) recovering Messinian evaporites in the Aegean sea, north of Crete. Among the most interesting results is the first recovery of basement rocks from the Tyrrhenian sea (DSDP site 373, flank of seamount).

**1986.** The third Mediterranean drilling campaign (leg 107 of the Ocean Drilling Project) was centered on the Tyrrhenian sea. A transect of seven holes aligned NW-SE across the back arc-basin proved beyond any doubt that its evolution was quite recent and fast, as fast as that of recently explored back-arc basins of the West-Pacific. The main results include : recovery of basement rocks at four drillsites, one with peridotites; first good paleomagnetic calibration of the Plio-Pleistocene succession, discovery of a 500 m thick pile of subaqueous, but non marine (lacustrine) Messinian sediments in the western Vavilov basin; demonstration that the age of marine sediments overlying basement is progressively younger from the western end of the transect (passive margin of Sardinia) to the eastern end (Marsili basin).

### Present and future.

A new phase of exploration will start soon and has three major objectives; two of them essentially dealing with the tectonic evolution of the Mediterranean, the third one with paleoceanographic circulation and evolutionary patterns. One of the tectonic themes deals with the Alboran basin. By drilling a series of holes it is hoped to decipher the extensional history of this basin which is entirely surrounded by orogenic chains. Another tectonic theme is concerned with the Mediterranean Ridge, an accretionary complex in collisional context. The subducting sediment pile is anomalously thick and contains at shallow subbottom depth the Messinian evaporites. As a result of the combination of all these factors, mud diapirism is highly developed.

The 1995 drilling plan includes a transect of (shallow) holes across an active mud volcano, an experiment never undertaken so far. This tectonic objective will be combined with a transect of holes across the Eratosthenes Seamount south of Cyprus, of great geodynamic interest.

The third theme is focused on "Mediterranean sapropels". Sapropels are pelagic, organic-rich sediment layers well known from the late Quaternary of the eastern Mediterranean, poorly known elsewhere. Their origin is controversial with basically two alternative models : one relating them to the vertical stratification of the water column, the other one oriented to changes in productivity. The experiment consists in continuous coring (twice or three times, in order to guarantee a complete recovery) 7 drillsites along an E-W transect crossing the entire Mediterranean, where temperature and salinity gradients are known.

The three scientific themes have been combined in two drilling legs (ODP 160+161) for logistic reasons, dealing respectively with the western Mediterranean (the latter) and the eastern Mediterranean (the former). Never before four consecutive months of shiptime were dedicated to the Mediterranean !

We look forward seeing the new results and we do hope they will bring the same scientific excitement that the previous Mediterranean drilling campaigns brought about. But this will by no means be the end of the scientific exploration of the Mediterranean by deep drilling. Indeed, the present step of exploration only comprises shallow targets. Deep targets are not obtainable with the present technology which prevents the penetration of the Messinian evaporites without a riser. If such technology will be made available in the future, a brand new scenario for deep drilling will open ahead of us.