THE DEEP MEDITERRANEAN SEA: THE LESSONS FROM SYSTEMATIC AND DETAILED SWATH BATHYMETRIC MAPPING

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Abstract
Detailed morphology of the Mediterranean deep basin, based on swath bathymetric data, directly show the consequences of various active geological processes which shape the present sea floor, including the results of geological hazards. They also provide opportunities to study the impacts of such processes on the deep environments (sediment, biology, microbiology, etc..) and at some stage in the water column. A synthesis of the most recent data is presented and briefly discussed.
Keywords : Swath Mapping, Western Mediterranean, Eastern Mediterranean.

For a decade systematic swath bathymetric mapping of the deep Mediterranean Sea has been progressively conducted by several European oceanographic and hydrographic Institutions, mainly from France, Italy, Spain, Greece, the Netherlands, Israel and Germany.
Geosciences-Azur laboratory (Villefranche sur Mer) and Ifremer Geoscience mapping office (Brest) have jointly conducted a project to compile syntheses of all swath data made available in a cooperative framework comprising most of the national Institutions involved.
This resulted first in the publication in 2000, under the sponsorship of CIESM and Ifremer, of a Morpho-bathymetric Map (DTM at 500 m) and of an acoustic Image of the Mediterranean Ridge and surrounding areas [1], and, in 2005, of two new Morpho-bathymetric Maps (DTM at 500 m) of the Mediterranean Sea western and eastern basins, respectively [2] (Figures 1 and 2). Detailed maps of the morphology of the Mediterranean Egyptian Margin (DTM at 100 m), and of its acoustic signature, were produced by Géosciences-Azur and CIESM in 2003 [3]. The same group is now working on the most recent swath bathymetry synthesis of the Mediterranean Sea (at a 4.000.000 scale, DTM 500 m), which will incorporate the most recent results made available (south of Spain, Balearic plain, Calabrian ridge, Algerian margin and several areas from the Aegean and Eastern Mediterranean seas).

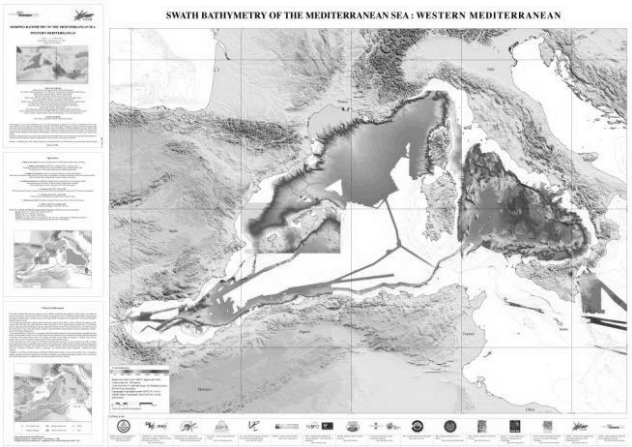

Fig. 1. Morpho-bathymetry of the Western Mediterranean Sea as in 2005, from [2].

Based on 100 m (Nile Margin) or 500 m DTM, these various maps have already revealed the importance of distinct active geological processes, which are directly imprinted on the seafloor in absence of important erosion. They also stress the drastic contrasts between the Neogene Western Mediterranean Basin, which results from successive back arcs opening, and the much older, Mesozoic, Eastern Mediterranean Sea, where subduction and collision processes, and huge sedimentary loading contribute to generate widespread compressive tectonics and lead to massive mud and fluid expulsions directly on the sea floor.

Beside their obvious geological values, the availability of these syntheses appears quite significant with respect to most other oceanographic fields of study in the Mediterranean Sea. For example a precise knowledge of deep circulations cannot now be assessed without detailed bottom topography as extracted from swath mapping data. Recently the discovery of numerous brines, fluid vents and mud volcanoes on several areas of the deep Eastern Mediterranean basin has strongly modified our understanding of geochemical and biological processes operating in the water column and on the sea floor. Gas plumes, delivering large quantities of gas in the sea water, widespread bacterial mats growing nearby fluid vents, associated worms, lamellibranchia, sea urchins, etc., are now frequently observed and sampled on the basis of detailed bathymetric maps. More recently scientists had even access to swath bathymetric data recorded using an AUV equipped with swath system (Bionil expedition of the ESF Mediflux.program).

Fig. 2. Morpho-bathymetry of the Eastern Mediterranean Sea as in 2005 from [2].

This provides the possibility to obtain, for seafloor areas up to several km^2 wide, DTM at 1 meter precision (and even 50 cm in some case!) and thus to fill the gap in scales between direct in situ observation (from towed cameras, submersibles or ROV) and geophysical data. Near bottom swath bathymetry is opening a new era for the study of seabed processes whether they are geological, geochemical or biological, and for the management of seagoing operations.

References

1 - Loubrieu B. Satra, C., Mascle J., 2000, Cartography by multibeam echo-sounder of the Mediterranean Ridge and surrounding areas, CIESM/Ifremer special publication, Atlases and Maps, two maps at 1/2000 000.
2 - Medimap group, Loubrieu B., Mascle J., et al., 2005, Morpho-bathymetry of the Mediterranean Sea, CIESM/Ifremer special publication, Atlases and Maps, two maps at 1/2000 000.
3 - Sardou O., Macle J., 2003, Cartography by mutibeam echo-sounder of the Nile deep sea fan, CIESM/ Geoazur special publication, cartes et atlas, two maps at 1/600 000.