ODP Targets on sediment deformation and post-Messinian depositional patterns of the outer deformation front of the Mediterranean Ridge accretionary complex

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A re-examination of the multichannel seismic coverage of the Mediterranean Ridge (Eastern Mediterranean) has been done motivated by growing attention to the evolution of accretionary wedges.

Although preliminary results of the extensive geophysical investigations conducted by OGS in the whole Mediterranean Sea from 1969 to 1982 have been published by the principal investigators (FINETTI and MORELLI, 1972 and 1973), most of the MCS lines of the Eastern Mediterranean (FINETTI, 1976 and 1982) are still unpublished and no definitive interpretation has been proposed in the frame of the recent identification of the Mediterranean Ridge as an accretionary prism in a collisional setting.

MCS lines crossing the outer deformation front of the ridge that extends from west to east from the Messina and Sirte abyssal plains (Ionian Sea) to the Herodotus abyssal plain (Levantine Sea) reveal two different styles of initial deformation of the sedimentary sequence entering the subduction zone: 1) to the Southwest, where the deformation front is orthogonal to the direction of plate convergence, a thin post-Messinian sedimentary sequence (up to 450 ms TWT) only slightly disturbed by initial salt-diapirism is coherently and abruptly uplifted. A re-processed version of line MS-33, which includes migration, shows evidence of seaward vergent thrusting and back-thrusting. 2) to the Southeast, where the ridge is oriented at a small angle with the direction of plate convergence and left lateral strike-slip movement occurs in the Pliny and Strabo branches of the Hellenic Trench, a thick post-Messinian sedimentary sequence (over 1800 ms TWT) is gently deformed by seaward vergent folding and reverse faulting with formation of piggyback sedimentary basins (over 2400 ms TWT). Salt deformation and initial salt diapirism in the core of anticlines of the SE margin of the Mediterranean Ridge show typical characteristics of other salt-bearing fold and thrust belts.

In the Levantine portion of the Mediterranean Ridge, the following depositional patterns can be identified in the post-Messinian sequence:

1) The overall Plio-Quaternary sediment thickness decreases from north to south across the deformation front.

2) The internal pattern of the uppermost Messinian and/or lowermost PlioQuaternary units (i.e. post evaporites) indicates a southward sediment progradation directly overlying the top-of-the-evaporites Messinian horizon. Northward sediment progradation occurs in the overlying remaining Plio-Quaternary sequence.

3) The sediment thickness of the Plio-Quaternary sequence does not increase significantly as the Nile Cone is approached from the Herodotus abyssal plain.

Drilling targets:

On the Sirte deformation front: A transect of at least three shallow holes in the post-Messinian sequence across the deformation front would allow the estimation of rates of uplift and outward growth of the outer edge of the western Mediterranean Ridge. Timing of the change of sedimentation pattern (from basinal to hemipelagic) will be provided by the well tested high resolution litho- and bio-stratigraphy of the Pleistocene of the Eastern Mediterranean. Pliocene high resolution stratigraphy is to be refined through drilling a reference site on a all-pelagic Plio-Quaternary site.

On the Herodotus deformation front: A single hole located on a buried anticline crest through a condensed Post-Messinian section would allow to tie the main unconformities, time the rate of folding, and investigate the nature of the northward versus southward sediment progradation. A working hypothesis is that the southward propagating unit overlying the evaporitic sequence may represent a sediment provenance from Paratethys (i.e. Black Sea "Lago Mare") in latest Messinian (post evaporites) time soon replaced by a Nile derived northward prograding sediment provenance.

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