The Mediterranean and Atlantic connection: Seismic Clues from the Alboran Sea

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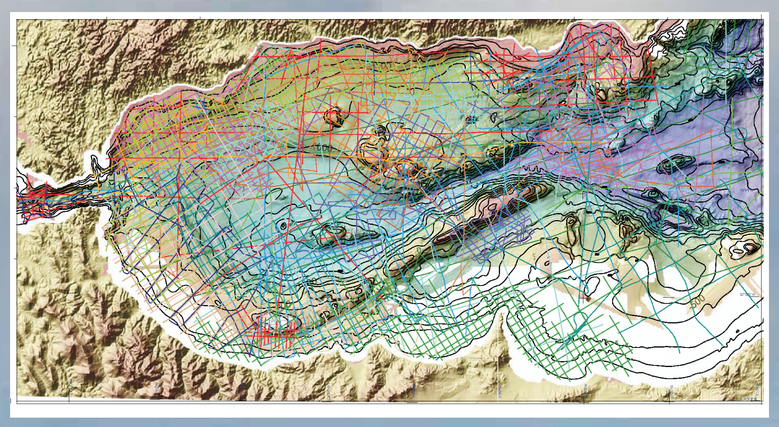
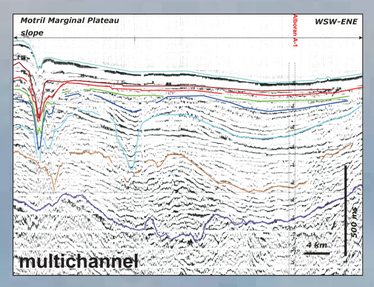
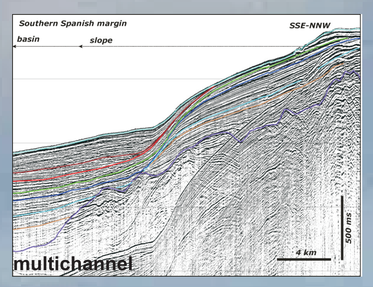
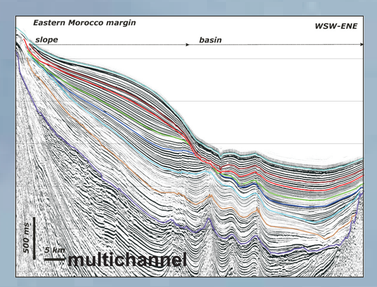
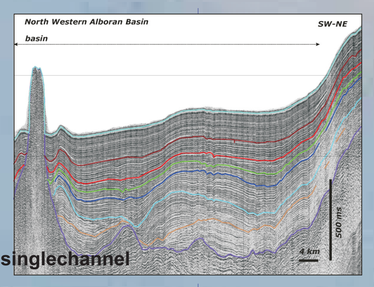
DATABASE & QUALITY: multi and single channel, very high to low resolution seismic profiles

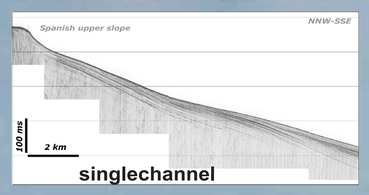






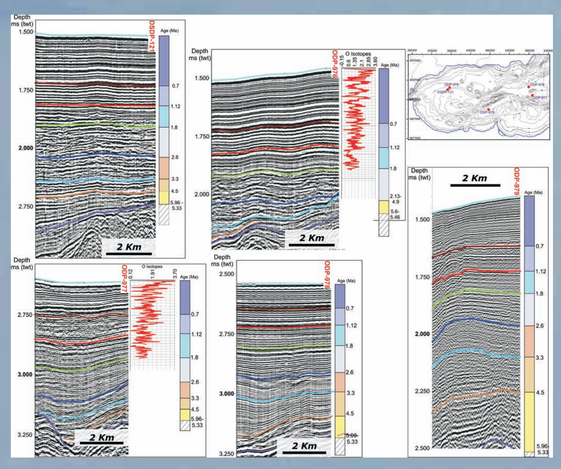


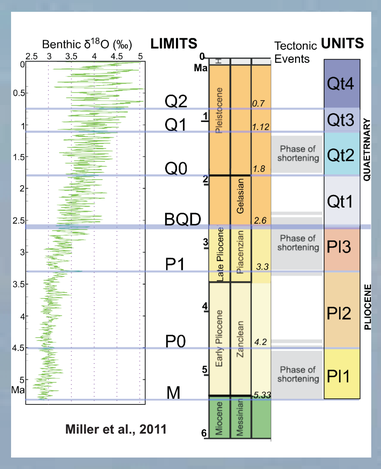




About 2000 seismic profiles comprising single and multi-channel seismic records with different resolutions, coming from national and international research projects and from hydrocarbon commercial entities are available at the Action Marges Group (http: //www.icm.csic.es/geo/gma/SurveyMaps/). To facilitate their correlation and interpretation, all seismic profiles were integrated in a Kingdom Suite project (IHS Kingdom).

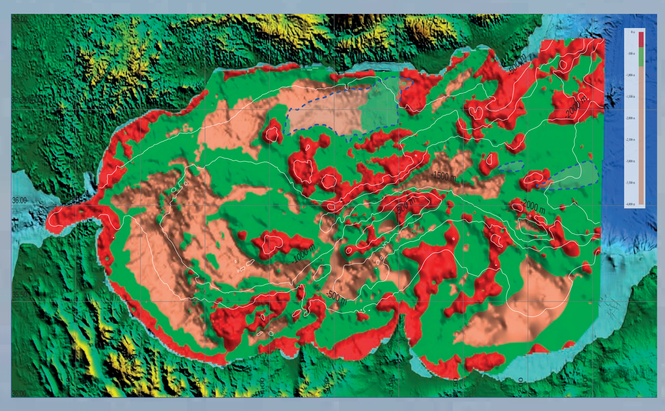
SEISMIC STRATIGRAPHYAGE & CONTROL : Messinian, Pliocene and Quaternary througouht the Alboran Sea



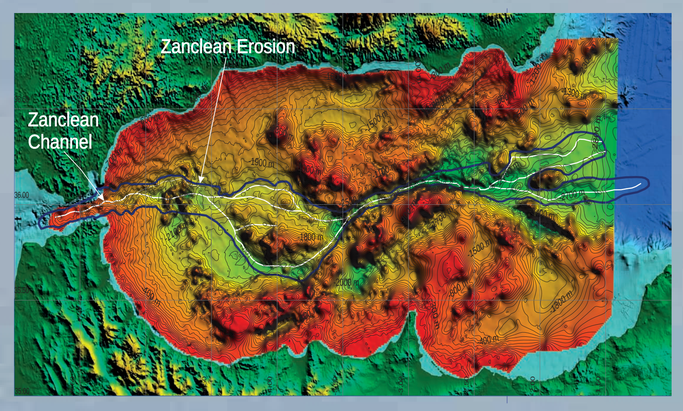


In order to define a time-stratigraphic framework for the Pliocene and Quaternary sedimentary registers, an age calibration for the seismic boundaries has been done based on the scientific wells DSDP 121 and ODP 976, 977, 978 and 979 located in the Alboran Sea.The Plio-Quaternary sedimentary register is divided by seven stratigraphic boundaries or reflectors, M, P0, P1, BQD, Q0, Q1 and Q2, that represent discontinuities in the margins and/or basins that laterally evolve to continuity surfaces.

Surface of the top Messinian

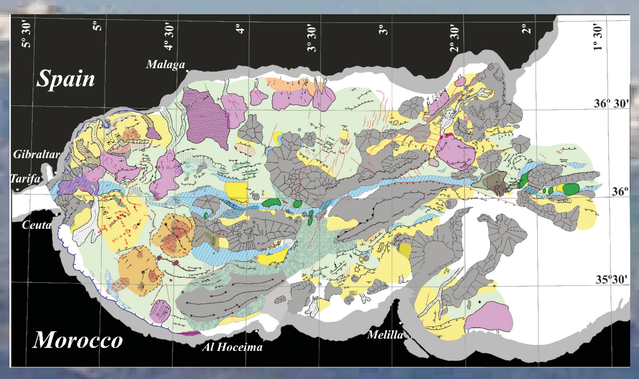


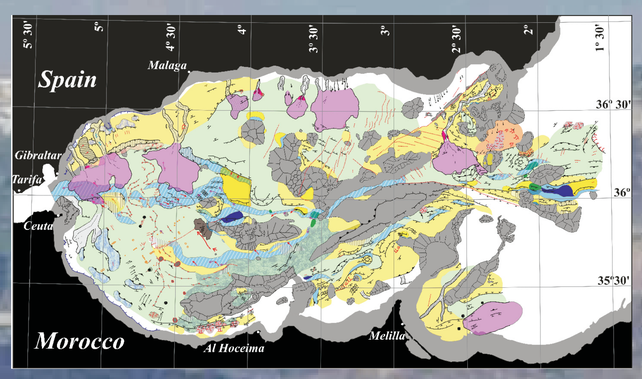
M reflector surface in meters, discriminating between 0-350m (red), 350-800m (green) and >800m (brown). White isobaths represent present day sea floor surface. Areas with blue dashed line indicate well preserved upper Miocene deposits.

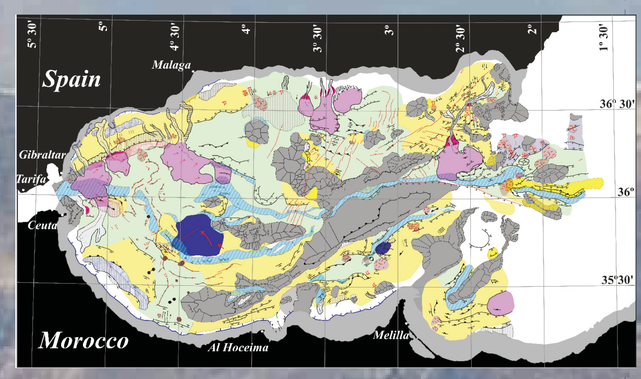


M reflector surface in meters, showing the Zanclean flooding erosion (area with blue line) and the main flooding paths (white lines). This erosion crosses the entire central Alboran basin and its entrenchment has been associated with the opening of the Strait of Gibraltar and subsequent inflow of Atlantic waters.

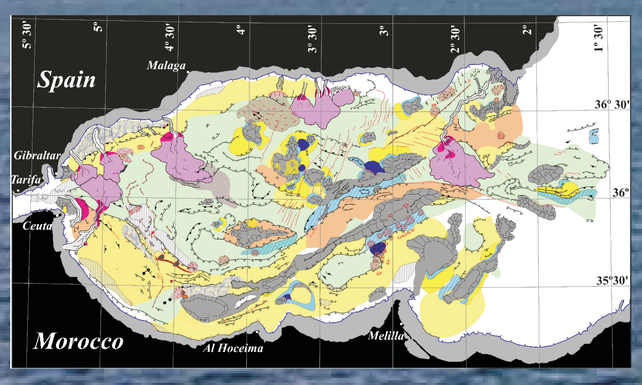
PLIOCENE AND QUATERNAY SEDIMENTATION: alongslope and downslope sedimentary systems

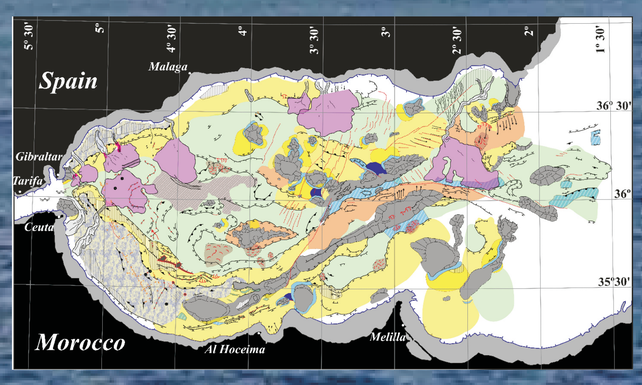


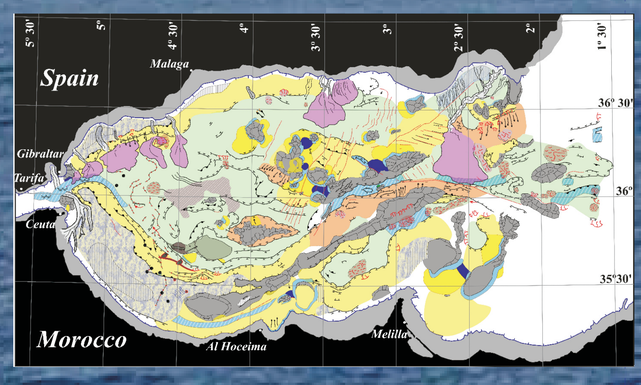




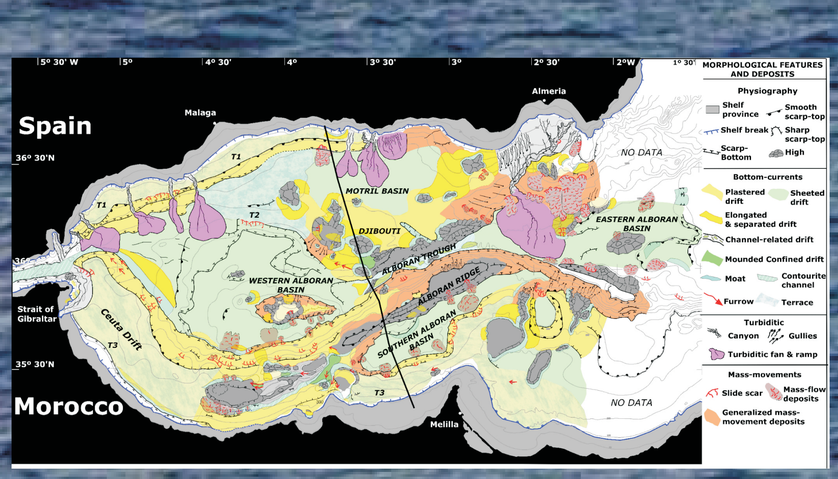
The seismic facies making up margins and subbains reveal that Messinian erosive surface was infilled and smoothed by contourites deposits. Plastered and sheeted drifts are the dominant facies during the Pliocene and Quaternary, being locally associated or affected by similar or different types of small-scale drifts as well as erosive contouritic features. The lateral continuity of the contourites is interrupted by the development of turbiditic features and local mass-movement deposits. Pliocene and Quaternary seismic units have a recurrent similar sedimentary pattern, defining a stratigraphic architecture mostly made up by vertically stacked contourite facies, divided by stratigraphic boundaries whose formation have been governed by climatically controlled bottom currents. The contourite stacking have contributed to the outbuilding of the margins and to the infilling with an aggrading pattern of the subbasins. The stracking pattern shows differences between the margins, the outbuilding being major for the Morocco margin, and also between basins, with a relative major aggradation for the Western Alboran Basin.

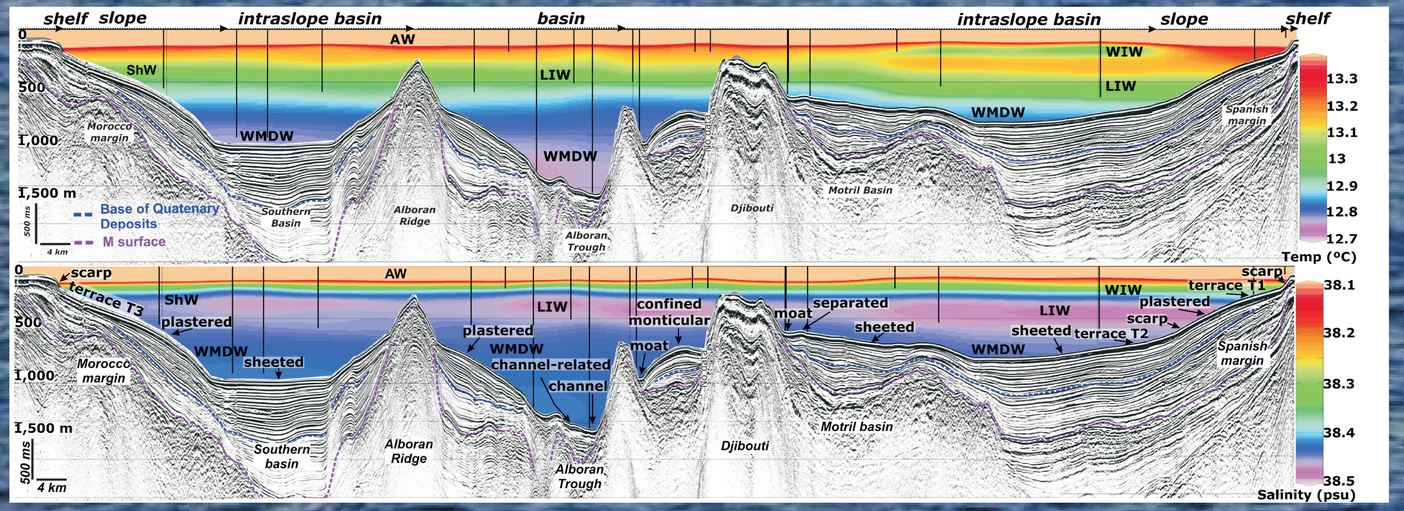




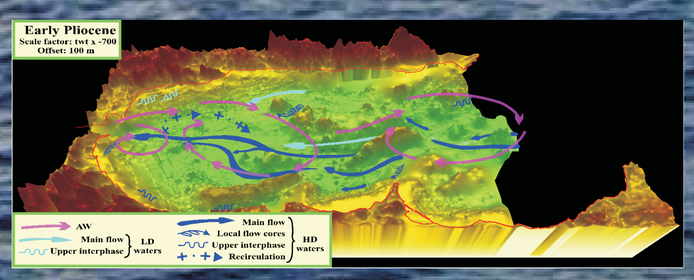


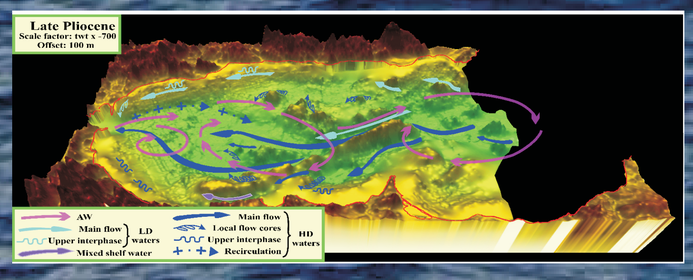
PALEOCEANOGRAPHIC IMPLICATIONS: first paleoreconstructions

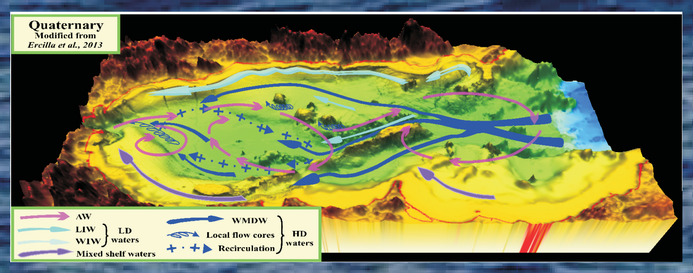




The spatial and temporal evolution of contouritic features as well as changes in their morphology and type suggest: i) their formation roughly agrees with the present-day Mediterranean water masses distribution, i.e., the Low Dense Mediterranean Water-LMW (Winter Intermediate Water + Levantine Intermediate Water) in the Spanish margin, and the High Dense Mediterranean Water –DMW(Deep Mediterranean Water) in the subbsains and Moroccan margin; ii) the important role played by the changing landscape during the Pliocene and Quaternary, with important consequences for the water masses circulation, especially for the DMW. Point and linear barriers, and troughs and elongated subbasins, condition a complex current distribution, especially for the Quaternary; iii) a higher energetic recirculation of the DMW in the Western Alboran Basin; iv) a more an enhanced density contrast between the LMW and DMW during the Quaternary; and v) larger vertical and horizontal displacements of the water mass interfaces during the Quaternary related to 4th-order glacioeustatic change.
These frist paleoceanographic reconstructions have implication for the ventilation of Mediterranean waters trough the Strait of Gibraltar, Mediterranean Outflow Water formation, Altantic-Mediterranean interchange and then for the AMOC and climatic changes in the past.







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