Contourite deposits in the El Arraiche area, southern Gulf of Cadiz

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Abstract

The El Arraiche area is situated in the southern part of the Gulf of Cadiz, between 35° and 35°45' north and 6°30' and 7°15' west. This area contains nine mud volcanoes, thousands small cold-water coral (CWC) mounds, several small contourite drifts and two tectonic ridges. CWC mounds are present both on top and at the foot of the Pen Duick Escarpment, but recent multibeam and seismic data indicate the ubiquitous presence of small mounds both beneath and on top of the seafloor.

All of the topographic obstacles in this region interfere with the contourite deposits, e.g. the Quaternary Pen Duick drift displays pinch-out due to uplift of the Pen Duick Escarpment, a Christmas-tree structure due to the outflow of mud from the nearby Gemini Mud Volcano and CWC mounds deflect the pathway of the moat [1]. The Renard South drift is much smaller (a moat of 2 km long) and surrounded by uplifted sediments, while the Renard North drift has a deeply incised moat. The location of the different drift deposits can be explained by the steepness of the slope along which they are deposited: slopes >12° are associated to drift deposits, while smaller slopes are bordered by uplifted hemi-pelagic deposits. These steeper slopes may cause increased bottom currents, which in turn enhance basal erosion deposition on the side, creating the contourite deposits.

Nutrient data from the bottom water masses indicate that the region is located at the boundary between (modified) Antarctic Intermediate Water and North Atlantic Central Water. Both water masses flow from south to north and are deflected by the topographic obstacles. Coriolis deflection ensures that the bottom currents remain at the base of the topographies. The boundary between the two water masses also creates internal tides, which are east-west aligned. These semi-diurnal tidal currents can be responsible for the contourite deposits along the mud volcanoes, as west-to-east currents are inferred from the orientation of their moats [2].

References:

[1] Vandorpe et al. (2014) Marine Geology 349: 136-151
[2] Vandorpe et al. (In Press.) Marine Geology