Appendix A. Supplementary materials

Figure DR1. Study area with the data sets (a and b) used in this work and the regional water-mass circulation sketched. The data that we used in this study were acquired mainly during the CONTOURIBER-1 Cruise (2010) onboard RV “Sarmiento de Gamboa” and include: I) swath bathymetry (showed in a); II) very high-resolution (Parasound) and mid-resolution (airgun) seismsics; III) superficial sediment samples; and IV) Acoustic Doppler Current Profiler (ADCP) data. Published bathymetric data sets (showed in b) from the SWIM Project (Zitellini et al., 2009) were also utilized, including higher-resolution data from TV-GIB (Gutscher, 2005), the CADISAR-1 (Mulder et al., 2003) and Sonar-91 (IFREMER, 1991, SECEG/SNED) cruises, in addition to a regional geophysical compilation. Industry borehole MPC-1 (1982) provided details on margin evolution and age constraints. Finally, a very detailed hydrographic analysis was performed, based on: I) the ADCP data; II) an extensive Conductivity, Temperature and Depth (CTD) dataset collected by the Universities of Lisbon and Cádiz since 1970; III) an integrated acoustic analysis of the water column, conducted at the University of Bremen, for detection of water-mass interfaces, nepheloid layers and internal waves; and IV) numerical simulations of bottom temperature, salinity and currents, performed at the University of Hamburg.
Figure DR2. Golfo de Cadiz, Mar Profundo C-1 (MPC-1, 1982) Borehole data showing the main lithologic and logging characteristics and the ages of the Miocene, Pliocene and Quaternary sedimentary records. The main discontinuities and stratigraphic horizons are included: Top of the Miocene (M); Lower Pliocene Reflection (LPR); Upper Pliocene Discontinuity (UPD); Base of the Quaternary (BQD); Mid Pleistocene Discontinuity (MPD). The chronology of the sediments was established based on the combination of planktonic foraminifera biostratigraphy performed in the sidewall samples taken along the borehole, and the cyclostratigraphic patterns defined in the well logs. The ages (in Ma) for the first occurrence (FO) and last occurrence (LO) of species are based on Lourens et al. (2004). Additionally, patterns in the Gamma Ray (GR), Sonic (DT) and Spontaneous Potential (SP) were correlated with those previously defined by Sierro et al. (2000). A sandy/clayey interval is identified between 917 and 1722 m depth, with a porosity of 34 to 38% and the following main characteristics: sand-clay thickness of 815 m; net sand thickness of 600 m; net/total percentage of 74%; 80 reservoirs of sandy layers; average thickness of the frequent layer of 12 to 15 m; minimum layer thickness of 1.5 m; maximum layer thickness of 40 m; and net in layers of thickness higher than 10 m of 168 m (Buitrago et al., 2001).
Figure DR3. Vertical sections of ocean velocity measured at the eastern area close to the exit of the Strait of Gibraltar (a) and further west (b and c). See Figure 1 for section locations. The water color code displays the Acoustic Doppler Current Profiler (ADCP) velocity components. Water-mass interpretations are shown on the left sections and major contourite features, on the right sections. The ocean velocities were measured by a 75 KHz hull-mounted ADCP. The panels on the left correspond to the velocity component in the east-west direction (positive values indicate currents towards the east), and the panels on the right correspond to the velocity component in the north-south direction (positive values indicate current towards the north). The dashed black lines indicate where the current velocity is zero.
Figure DR4. Average (left) and standard deviation (right) of simulated bottom salinity (a,b), temperature (c,d) and speed (e,f) adjacent to the Strait of Gibraltar. Major erosional features (terraces and channels) are indicated. White dots represent the 200-m isobath. We used output of the MIT general circulation model (Marshall et al., 1997), configured to the Northeast Atlantic and Western Mediterranean regions from 9°E to 24°W and 30°N to 48°N with a horizontal resolution of about 2.8 km (Serra et al., 2010a). The vertical resolution varies from 5 m in the upper ocean to 100 m in the deep ocean (140 levels). The bottom topography was extracted from ETOPO2 and the initial temperature and salinity from the World Ocean Atlas 2005 (Boyer et al., 2005). The model was run for the period 1990 to 2009 forced at the surface by fluxes of momentum, heat and freshwater computed with bulk formulae and the NCEP reanalysis 6-hourly atmospheric state (Kalnay et al., 1996) and laterally by the output of a 16-km Atlantic solution of the MITgcm forced by the same NCEP dataset (Serra et al., 2010b). Vertical mixing uses the KPP formulation of Large et al. (1994) and Laplacian vertical diffusion and viscosity have coefficients of $1\times10^{-4} \text{m}^2/\text{s}$. A quadratic bottom drag coefficient of 0.002 and biharmonic coefficients of
horizontal diffusion and viscosity of $1 \times 10^3$ m$^3$/s and $5 \times 10^8$ m$^3$/s were employed. The simulation realism concerning the MOW circulation is discussed in Serra et al. (2010a). All analyses presented here were based on daily model output and corroborated our conclusion that, presently, the MOW flows mainly along the upper slope and the upper terrace (UT) in the middle slope, without any permanent circulation over the lower terrace (LT).

Table DR1. Regional characteristic values of potential temperature ($\theta$), salinity ($S$), dissolved oxygen ($O_2$) and neutral density ($\gamma$) for the main water masses in the sector of the Gulf of Cadiz close to the Strait of Gibraltar.

<table>
<thead>
<tr>
<th>Water Masses</th>
<th>Temperature (T)</th>
<th>Salinity (S)</th>
<th>Dissolved oxygen ($O_2$)</th>
<th>Neutral density ($\gamma$)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Surface Atlantic Water (SAW)</td>
<td>18-20</td>
<td>~36.4</td>
<td>4.6</td>
<td>1025.8-1026.3</td>
</tr>
<tr>
<td>East North Atlantic Central Water (ENACW)</td>
<td>10.6-16.5</td>
<td>35.6-36.3</td>
<td>5.06</td>
<td>1026.4-1027.6</td>
</tr>
<tr>
<td>Mediterranean Outflow Water (MOW)</td>
<td>13.1-14</td>
<td>~38.5</td>
<td>4.15</td>
<td>1029.1</td>
</tr>
<tr>
<td>Modified Antarctic Intermediate Water (AAIW)</td>
<td>~10°</td>
<td>~35.62</td>
<td>~4.16</td>
<td>1027.5</td>
</tr>
<tr>
<td>(North) Atlantic Deep Water (NADW)</td>
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<td>34.8-35.2</td>
<td>5.52</td>
<td>1027.3-1027.9</td>
</tr>
</tbody>
</table>

REFERENCES


