Figure F1. A. Bathymetry location map, Site U1609 with nearby sites from Expeditions 339 and 397. Box = location of B. B. Zoomed-in bathymetric map, Site U1609.

Figure F2. Present-day water mass circulation patterns on either side of Gibraltar Strait in relation to main topographic features and Expedition 401 sites. AMW = Atlantic Mediterranean Water.

Figure F3. Seismic Profile IL1774 with location and approximate penetration of Hole U1609A and Expedition 339 Hole U1391C. SP = shotpoint, TWT = two-way traveltime.

Figure F4. Lithologic synthesis, Site U1609. See SYNTHLOGS in Supplementary material for editable version of this figure. V.f. = very fine.

Figure F5. Lithologic summary, Site U1609. Curve variation in sedimentary log indicates relative long-term variations of coarser versus finer grained sediments. Black dashed lines = unit boundaries (these are transitional, not abrupt), gray dashed lines with T = interval succession transitions from one unit to another.

Figure F6. Composition of lithologies per core and core and bed thickness by lithology, Site U1609. Black dashed lines = unit boundaries.

Figure F7. Example facies description for each unit, Site U1609. Linescan image and RGB color are from Section Half Imaging Logger (SHIL), X-ray image is from X-Ray Linescan Logger (XSCAN). Reflectance (L*a*b*) and MS are from Section Half Multisensor Logger (SHMSL). A. Calcareous mud and calcareous silty mud are dominant, Unit I. Vfs = very fine sand, fs = fine sand, Ms = medium sand, Cs = coarse sand, vcs = very coarse sand. Ch = *Chondrites*, Pl = *Planolites*, Te = *Teichichnus*, Th = *Thalassinoides*, Zo = *Zoophycos*. cps = counts per second. (Continued on next three pages.)

Figure F7 (continued). B. Calcareous mud and clayey calcareous ooze are dominant, Unit II. (Continued on next page.)

Figure F7 (continued). C. Two different calcareous muds (dark and brown) and clayey calcareous ooze are dominant, Unit III. (Continued on next page.)

Figure F7 (continued). D. Two different calcareous muds (dark and brown) and clayey calcareous ooze are dominant, Unit IV.

Figure F8. Powder XRD patterns of 22 squeeze cake residues, Hole U1609A. Samples are arranged from shallowest (top; 1H-1; 1.45 m CSF-A) to deepest (bottom; 73X-2; 603.14 m CSF-A). Patterns are plotted with intensity on logarithmic scale to highlight presence and nature of smaller peaks. Although bulk mineral assemblage is nearly constant downhole, relative intensities of various peaks change with depth.

Figure F9. Representative XRD patterns of <2 µm fractions for samples from each unit, Hole U1609A.

Figure F10. Mineral composition and percentage (excluding mixed-layer I/S) from bulk XRD patterns using Rietveld refinements method, Hole U1609A. Samples are from either squeeze cake residues or spot samples (*). Kao = kaolinite.

Figure F11. Variation in carbonate composition based on coulometry (see Geochemistry) and XRD data, Hole U1609A.

Figure F12. Fine-grained contourites from Unit I, Site U1609. Left: typical expression of subtle lithologic change observed at this site (401-U1609A-24H-1; linescan). Right: rare example showing trace fossil distribution, primary sedimentary structures, and subdivision intervals (C1–C5) according to contourite facies model for bigradational sequences (Stow and Faugères, 2008) (401-U1609B-44X-3I X-ray). Ch = *Chondrites*, Pl = *Planolites*, Pa = *Palaeophycus*, Th = *Thalassinoides*. Yellow circles = occurrence of discrete traces on central interval of bigradational sequence.

Figure F13. Major lithologies for Units I–IV, Site U1609. Dominant siliciclastic and biogenic components are annotated. Bs = biosiliceous fragment, Cl = clay, Cn = calcareous nannofossils, Dol = dolomite, Fd = feldspar, Fm = foraminifer, Gl = glauconite, Hm = heavy mineral, Lith = lithic fragment, Py = pyrite, Qz = quartz, Sp = sponge spicule.

Figure F14. Texture (grain size) and mineralogical composition in main lithologies in Units I–IV based on averaged data from smear slide analysis, Site U1609.

Figure F15. Trace fossil assemblages in Unit I for calcareous silty mud and calcareous mud, Hole U1609B. Note change in BI from 2–3 to 1. Ch = *Chondrites*, Pl = *Planolites*, Zo = *Zoophycos*.

Figure F16. Linkage between lithologic names and mineral compositions from XRD analysis, Hole U1609A. White bars = intervals XRD samples were taken from. Albite = plagioclase.

Figure F17. Turbidite beds (Tu) in clayey calcareous oozes from (left) Units II and (right) III showing some sedimentary characteristics, trace fossil distribution, and infilling material of traces in relation to different parts of turbidite beds, Site U1609. Ch = *Chondrites*, Pl = *Planolites*, Zo = *Zoophycos*.

Figure F18. Turbidite composition of correlated and uncorrelated turbidite layers, Site U1609. Left: linescan images showing full turbidite layer. Smear slide photomicrographs depict major siliciclastic and biogenic components of sediments within turbidite (middle: plane-polarized light; right: cross-polarized light). Bottom centered: pyrite and pyritized biogenic fragments (reflected light). Fd = feldspar, Gl = glauconite, Hm = heavy mineral, Lith = lithic fragment, Mc = microcline, Qz = quartz, Qz ov = quartz overgrowth, Py = pyrite, Sp = sponge spicule, Py sp = pyritized sponge spicule.

Figure F19. Preliminary age model based on depths of calcareous nannofossil and foraminifer bioevents, Site U1609. S/D = sinistral/dextral.

Figure F20. Paleomagnetic results, Hole U1609A. Red vertical line = GAD inclination at site latitude in normal polarity. Smoothed inclination used 1 m moving window. Orange band = standard deviation of smoothing results. ChRM inclination of discrete samples have α_{95} uncertainties. Blue triangles = discrete sample positions. Chron column: black = normal polarity, white = reversed polarity, gray = zones of uncertain normal polarity. Lines and numbers along interpreted chron column = tie points between hole and GPTS. Dashed lines between hole and GPTS = best-fit correlation of well-recognized polarity boundaries.

Figure F21. Paleomagnetic results, Hole U1609B. Red vertical line = GAD inclination at site latitude in normal polarity. Smoothed inclination used 1 m moving window. Orange band = standard deviation of smoothing results. ChRM inclination of discrete samples have α_{95} uncertainties. Chron column: black = normal polarity, white = reversed polarity, gray = zones of uncertain normal polarity. Lines and numbers along interpreted chron column = tie points between hole and GPTS. Dashed lines between hole and GPTS = best-fit correlation of well-recognized polarity boundaries.

Figure F22. AF demagnetization results, Hole U1609A. Left: vector endpoints of paleomagnetic directions measured after each demagnetization treatment on orthogonal projection (Zijderveld) plot. Examples of normal (positive inclinations) and reversed (negative inclinations) polarity are shown in left and right panels, respectively. Squares = horizontal projections, circles = vertical projections. Right: intensity variation with progressive demagnetization.

Figure F23. Detailed paleomagnetic results, upper Tortonian–lowermost Messinian part of Hole U1609B (400–510 mbsf). Complex interval comprises multiple short polarity chrons. Lines = best-fit correlations between inclination record after 20 mT AF demagnetization and GPTS. Age: black = normal polarity, white = reversed polarity, gray = uncertain polarity.

Figure F24. Correlation of magnetostratigraphy, Site U1609. Red vertical line = GAD inclination at site latitude in normal polarity. Smoothed inclination used 1 m moving window. Orange band = standard deviation of smoothing results.