

**Figure F1.** Location of Site U1609 (red star) in the southwest Portuguese margin, one of the four sites drilled during Expedition 401 around the Mediterranean–Atlantic gateway. AM = Alentejo margin, GC = Gulf of Cádiz, SCD = Sines contourite drift. Map is modified from GEBCO and SRTM.

**Figure F2.** Crossplots, kernel density estimation plots of data distribution for each element, and Spearman's rank correlation coefficient between elements ranging +1 to −1, colored by degree and direction of correlation for the selected element raw counts from XRF scanning, Holes U1609A and U1609B ( $n = 14727$  measurements). Terrigenous correlations: Al vs. Si, Ti, Mn, and Ba; biogenic correlation: Ca vs. Sr (both biogenic); biogenic anticorrelations: Ca and Sr vs. Al, Si, Ti, Mn, and Ba. Correlations ( $r$  values) are displayed in red for positive correlations and blue for anticorrelations. Heatmap colors: bluish ranges −1 to 0, red-dish ranges 0 to 1.

**Figure F3.** MS, NGR, and XRF from selected elements (Al, Si, Ti, Fe, Rb, Zr, Ca, Sr, Mn, and Ba), Hole U1609A. cps = counts per second. Timescale is based on the shipboard age model. Gaps in data correspond either to gaps in recovery or when scanning on splice. Red rectangle = interval with low terrigenous and high biogenic elemental abundance during the MSC, blue dots = element counts, black line = 3-point moving average of those counts.

**Figure F4.** MS, NGR, and XRF from selected elements (Al, Si, Ti, Fe, Rb, Zr, Ca, Sr, Mn, and Ba), Hole U1609B. cps = counts per second. Timescale is based on the shipboard age model. Gaps in data correspond to gaps in recovery. Blue dots = element counts, black line = 3-point moving average of those counts.