

Supplementary Materials

The study well was drilled by BP in the distal section of the Congo Fan (Block 31, ~200 km offshore Angola) at ~2000 m water depth. The Oligocene section consists of predominantly non-calcareous silts and clays (Kender et al., 2008). Lower-Middle Miocene sediments consist of fine grained silt and clay distal turbidites with sand content <3% (Kender et al., 2009). Drill cuttings were collected at 10 m intervals from 2750–3400 m (below rotary table). Although no large-scale caving (younger material from higher in the hole becoming amalgamated with older material) has been reported in this well (Kender et al., 2009), interpretations from this study are based on large-scale trends and not individual data. From each ~100 g sample, all foraminifera >125 µm were identified and counted (smaller fractions were not included due to the bias associated with low fossilisation potential of smaller delicate specimens). Fisher's Alpha diversity was calculated using software of Hammer et al. (2001). Changes in benthic oxygen levels were estimated using a modern calcareous benthic foraminiferal assemblage analogue technique (Corliss, 1991; Kaiho, 1994), species in this study being assigned to groups based on their morphological similarity to the modern forms where the species is extinct. The Kaiho (1994) benthic foraminiferal oxygen index (BFOI) was used to estimate the level of dissolved oxygen in the sediment at low values based on the relative proportions of three groups of calcareous benthic foraminifera associated with oxic, suboxic and dysoxic conditions (see Kaiho, 1994 for detailed methodology). Samples analysed contained between 40-600 specimens. Stable isotopes were obtained from *Cibicidoides*

spp. (*C. mundulus* and *C. pachyderma* were preferentially used where available), 2-5 specimens >250 µm taken where possible. Crushed specimens were then immersed in 3% hydrogen peroxide for 30min, ultrasonicated in methanol for 15s, excess residue and liquid removed, and dried at 45 °C. Stable isotope analysis was conducted using a ThermoFinnigan MAT 252 and coupled carbonate preparation device at Cardiff University, with an external reproducibility of ≤ 0.08 ‰ for $\delta^{18}\text{O}$ and reported on the VPDB scale. Values of $\delta^{18}\text{O}$ recorded from *Cibicidoides* spp. have been adjusted by +0.64 ‰ to align them with equilibrium calcification at given temperature and $\delta^{18}\text{O}_{\text{sw}}$ (Shackleton and Opdyke, 1973). Bulk rock total organic carbon (TOC) determined with an Elementar VarioMax C, N analyser via high temperature combustion at BGS. Age model follows that of Kender et al. (2009) based on 9 foraminiferal, nannofossil and isotope markers. Data from this well is plotted against Lourens et al. (2004) timescale.

Supplementary References

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