

Cenozoic Variations in the South Atlantic Carbonate Saturation Profile: Insights from the Walvis Ridge Depth- Transect of ODP Leg 208

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Carbonate saturation profiles are a complex and dynamic product of processes operating on scales from the "short-term local" (e.g., carbonate export production) to the "long-term global" (e.g., Ca weathering flux, shelf: basin carbonate partitioning, and thermohaline circulation). Established, if admittedly crude, proxies for reconstructing carbonate saturation from sediment records include weight percent (wt%) carbonate, where values of 0-20% are typically attributed to deposition below the carbonate compensation depth (CCD), and planktonic foraminifer fragmentation, where enhanced fragmentation is typically attributed to deposition below the lysocline.

Ocean Drilling Program Leg 208 successfully drilled a sixsite Walvis Ridge depth-transect spanning modern water depths from 2717 to 4755 m. Exceptional core recovery, well-constrained biomagnetostratigraphy, and standard crustal subsidence corrections provide an age-depth framework for contouring ship-board wt% carbonate determinations and identifying the following first-order features of the regional CCD: 1) >3.5-km-position from 60 to 48 Ma punctuated by a major transient shoaling to <2 km during the Paleocene- Eocene Thermal Maximum at ~55 Ma; 2) shoaling to ~2.75 km from 48 to 44 Ma; 3) subsequent deepening to >4.25 km from 37 to 28 Ma; 4) marked high-amplitude fluctuations from 28 to 20 Ma followed by deepening to >4.75 km; and 5) transient shoaling to ~4 km around 15 Ma followed by deepening to >4.75 km by ~12 Ma. These first-order contouring features are broadly congruent with classic Atlantic CCD reconstructions by van Andel (1975) and Berger and Roth (1975).

A wealth of higher-frequency variation in carbonate saturation is clearly preserved within the Leg 208 depth-transect materials. Ongoing, shore-based analyses aim to synthesize cm-scale variations in core physical properties (i.e., magnetic susceptibility and color reflectance) into high-resolution records of wt% carbonate and mass accumulation rates, and should provide valuable constraints on cyclic and secular fluctuations in the Cenozoic history of the South Atlantic carbonate saturation profile.