Long-term Stability of the Carbonate Compensation Depth Across the Late Paleocene-Early Eocene Warming Trend

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The carbonate compensation depth (CCD) is the sedimentary expression of the balance between the rate of biogenic carbonate deposition and carbonate dissolution in the ocean. As such, the CCD is used as a powerful paleoenvironmental constraint for past global carbon cycle reconstructions. Using weight percent carbonate data from nearly 80 DSDP/ODP/IODP drilling sites, we reconstruct the behavior of the CCD for three snapshots spanning a pronounced, long-term late Paleocene through early Eocene warming trend (~59 Ma to ~49 Ma). Across this interval, the CCD is relatively deep (≥~3500m), and indistinguishable between the three investigated snapshots once the errors associated with paleodepth reconstruction are taken into account. Assuming the long-term late Paleocene – early Eocene warming trend was accompanied by an increase in atmospheric CO_2 concentration and increased global weathering rate, the observed CCD stability refutes the popular notion that the position of the CCD is responsive to weathering and closely tied to deep sea carbonate burial rates. Indeed, modelling results using the Earth system model GENIE indicate that high atmospheric CO_2 concentrations coupled with high weathering rates, as expected, yields higher overall deep sea carbonate burial rates. However, the 'action' occurs at the lysocline, the distance of which from the CCD fluctuates freely as a function of weathering rate and hypsometry.