

## ***Interactive comment on “Latitudinal differences in the amplitude of the OAE-2 carbon isotopic excursion: $p\text{CO}_2$ and paleoproductivity” by E. C. van Bentum et al.***

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General Comments - van Bentum and colleagues present an impressive reconstruction of the inferred  $p\text{CO}_2$  change across the CTBE using new, high resolution measurements of the stable carbon isotopic composition of sulfide-bound phytane at ODP Site 1260 to verify that similar changes in bulk organic carbon isotopic compositions are proxies for marine productivity. They then compare the isotopic excursions at Site 1260 to lower resolution CTBE sulfide-bound phytane records from DSDP sites 367 and 603 and with the Tarfaya sequence to identify a latitudinal gradient that they relate to differences in sea-surface paleotemperatures and the magnitude of the increases in

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paleoproductivity at the different locations. The authors calculate from considerations of how temperatures affect  $\text{CO}_2$  solubility in sea water that global  $p\text{CO}_2$  dropped from about 1750 to 900 ppm across the CTBE as a result of the amplified paleoproductivity, showing an interesting and significant interlink between the global carbon cycle and Cretaceous climate. The study is elegant and novel, and its conclusions are likely to stimulate further studies of this important and unusual event in Earth history.

Specific Comments – Although the authors mention something at least twice about “increased continental weathering, they do not directly explore the possible significance to weathering of the higher  $p\text{CO}_2$  levels and particularly the amplified hydrological cycle that likely existed in the mid-Cretaceous. One likely by-product of greater weathering would be greater delivery of trace metals like Os and Zn to the oceans. Another consequence would be greater delivery of continental runoff to the coastal ocean, which would dilute the surface ocean and augment the impact of warmer global temperatures on its stratification. Both of these factors would be especially important in the relatively narrow proto-Atlantic of the mid-Cretaceous. This narrow ocean would behave differently than the one we know now. A portion of the apparently greater discrimination against  $^{13}\text{C}$  observed in the  $\delta^{13}\text{C}$  records may derive from greater stratification and more recycling of isotopically light marine organic matter in the surface ocean, and the extent of this stratification could well be different at different latitudes.

The authors also fail to mention the important high-resolution bulk organic carbon excursions at sites 1258, 1260, and 1261 shown in Erbacher et al., G3,v6, n6 (2005) in which the duration of the OAE2 was estimated to be 400 kyr. The discussion presented in this paper includes isotopic information from other CTBE locations that could help to broaden and might bolster the interpretations and conclusions of van Bentum and colleagues.

Technical Comments – Referee #1 has already listed a number of stylistic corrections that need to be made. I concur with all of them, and I had two more: Page 6204, line 25 – change “exist” to “exists” Page 6205, line 9 – delete the comma after “which shows”

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