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Climate of the Past Discussions

Interactive comment on "Element/Calcium ratios in middle Eocene samples of Oridorsalis umbonatus from Ocean Drilling Program Site 1209" *by* C. F. Dawber and A. K. Tripati

Anonymous Referee #1

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In this study, Dawber and Tripati present records of elemental ratios in benthic foraminifera at ODP site 1209 in the subtropical Pacific Ocean for the middle Eocene, a time characterized by large and dynamic shifts in the global carbon cycle. Using X/Ca (i.e. B/Ca, Li/Ca, and Sr/Ca) - carbonate saturation calibration from Dawber and Tripati 2011 (in review at Biogeosciences), these authors apply their calibration and attempt to interpret the middle Eocene X/Ca variations observed in context of shifts in the carbon cycle. However as the authors themselves state the records are complicated and do not consistently show any similar trends either between the X/Ca records or with the carbon cycle proxies. This leaves the reader feeling dissatisfied. Additionally, their interpretation of the X/Ca records depends on the suitability of their calibration, which

is currently in review. Therefore we recommend that this version of the manuscript in its current form is not publishable. Below we highlight the major issues with the paper and provide some suggestions for revising.

X/Ca-DCO3 calibration

Dawber and Tripati cite their paper, currently in review, for the calibration equations to convert X/Ca into DCO3. The paper in review needs to be accepted or critically peer reviewed prior to the submission of this paper as the whole interpretation hinges on the calibration. Also the authors summarize available publications for O. umbonatus but fail to mention the work of Brown et al., 2011 (EPSL). Brown et al., 2011 thoroughly assesses the potential of B/Ca as a DCO3 proxy in similar a BWT and DCO3 range and determine that B/Ca in 0. umbonatus is insensitive to DCO3 changes. The authors need to address this in the manuscript.

X/Ca Records and synthesis

The authors fail to examine the X/Ca records in light of other published X/Ca records across the Cenozoic. This is essential to provide context for their interpretations and might help in examining their offsets in X/Ca records.

See records below:

Lear & Rosenthal 2006: Benthic Li/Ca record from ODP 1218 (19-35 Ma) Benthic Li/Ca records from ODP 806 (0-12 Ma)

Delaney & Boyle 1986: Planktonic Li/Ca record from DSDP 305 (0-65 Ma)

Brown et al., 2011: Benthic B/Ca record from ODP 689 and ODP 1262 (32-46 Ma)

Lear et al., 2003 Benthic Sr/Ca record (0-65 Ma)

Peck et al, 2010: Benthic Sr/Ca, Li/Ca, and Mg/Ca from ODP 1263 (32.8-33.8 Ma)

Lingering questions?

How do the uncertainties in the age model affect the interpretation? Potential uncertainties in the ODP site 1209.

Missing data before 41 Ma – Li and B – yet biggest shift in Eocene (CAE-3) – why focus on CAE-4?? The best test of CO3 vs X/Ca is a longer-term record across the CAEs to evaluate the correspondence with the magnitude of X/Ca and events themselves – CAE-3 biggest!

Dissolution – Site 1209 is clearly situated close to the long-term lysocline as evidenced by the multiple clay rich horizons visible in core photos. Is there a dissolution effect on X/Ca – is this assessed in the calibration? Primary versus secondary carbonate ion controls.

Discussion – to re-iterate the authors really must provide some firmer conclusions at the moment the reader is left feeling uncertain about the impact and contribution that the dataset represents to the field. (e.g., lines 12-14)

Minor comments

Figures 1 and 2 could be condensed into a single figure to prevent repetition of information.

In figure 3 a pCO2 record is presented yet there is seemingly no reference to this in the main text.

Title – more informative about implications or conclusions of study

Redundant' use of Mg/Ca. . .. To make correlations or lack of more readily digestible the authors would benefit from correlation coefficients between the different element ratios.

Typo fig caption 1 – O. umbonatus

Specify which ocean basin the CCD reconstruction is from in Fig. 2

Typos Lyle et al., (2005) not 2006

CAE-5 not labeled on figure 3

In abstract – mention that umbonatus is a benthic foram in the abstract

Edgar et al., 2007 references but not in list

Authors need to add a,b or c to their 2011 reference list.

Sentence starting on line 19 completely throw away move to methods.

Line 23 – poor English please rephrase – "the site was above the CCD for much of the Eocene"

Foram preservation – authors state 'non-chalky' as opposed to what? I don't think the samples are glassy. Please be more specific.

Consistency with number of decimal places that ages reported to e.g., line 9 on p3802.

Interactive comment on Clim. Past Discuss., 7, 3795, 2011.