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Climate of the Past Discussions

Interactive comment on "Climate variability and relationship with ocean fertility during the Aptian Stage" *by* C. Bottini et al.

C. Bottini et al.

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Dear Fabienne Giraud, Thank you for your critical comments on the paper, please find our reply to the general comments below and the point by point reply in the pdf.

Kind regards

Cinzia Bottini

REPLY TO COMMENTS

COMMENT N.1 Data concerning OAE 1a for the different settings considered in this work have been already published. The authors present new data, but it is really difficult to know what is new with respect to preceeding works. It needs to be clarify.

REPLY The Reviewer is correct in pointing out that the three sections have already been studied. The new data comprise a: A) Quantitative analyses of the entire nannofossil assemblages in smear slides (relative abundances) of the latest Barremian-Aptian interval. B) For the early Aptian previously published data (Erba 1994; Premoli Silva et al., 1999; Erba and Tremolada 2004; Erba et al., 2010) regard relative abundances of nannoconids, nannoliths and selected coccolith taxa. Here, for the first time, a high resolution study of all taxa is performed through the OAE 1a. C) Ultra thin sections were used to quantify absolute abundances of nannoconids through the Aptian. The upper Aptian dataset is new, while the uppermost Barremian-lower Aptian dataset derives from higher resolution sampling, significantly increasing the results of previous investigations.

We have revised the description in chapter 2.2, clarifying as follows: Calcareous nannofossil assemblages were quantitatively investigated under polarizing light microscope at 1250X magnification in smear slides prepared using standard techniques, without centrifuging or cleaning in order to retain the original sedimentary composition. A small quantity of rock was powdered in a mortar with bi-distillate water and mounted on a glass slide with Norland Optical Adhesive. A total of 285 smear slides for the Cismon core, 179 smear slides for the Piobbico core and 281 smear slides for DSDP Site 463 were investigated. At least 300 nannofossil specimens were counted in each sample and percentages of single taxa were calculated relative to the total nannoflora. Previous investigations of Aptian nannofossil assemblages in the Piobbico core, Cismon core and DSDP Site 463 focused on relative abundances of nannoconids, nannoliths and a few selected coccolith taxa (Erba 1994; Premoli Silva et al., 1999; Erba and Tremolada 2004; Erba et al., 2010) across OAE 1a. Here, we extend quantitative investigation of nannofossil assemblages in smear slides to all taxa in the latest Barremian-Aptian time interval. Quantitative investigation of nannoconid abundance was performed on a total of 161 thin-sections for the Cismon Core (85 new thin sections integrating the dataset of Erba and Tremolada, 2004 and Erba et al., 2010), 221 for DSDP Site 463 (101 new thin sections integrating the dataset of Erba et al., 2010),

and 179 for Piobbico. Thin-sections were polished to an average thickness of 7μm for optimal view of nannofossils. Absolute abundances were obtained by counting all nannoconids in 1 mm2 of the thin-section.

COMMENT N.2 The methodology used in this work is the major problem . The authors present first raw data (stratigraphic curves of different proxies, and in particular, nannofossils). In order to better see the trends, the authors used statistical analysis, which is not well constrained ! (see my detailed comments directly written on the manuscript). From the results of this factorial analysis, they construct nannofossil temperature and fertility indices. And from these indices, they construct two other synthetic curves. So there are not less than 4 transformations from raw data ! it is not serious ! and the statistical analysis is really not rigourous.

REPLY In chapter 4.1, we first illustrate, describe and discuss the raw nannofossil data for individual sections, then we describe and discuss the results of Factor Analyses and in the final part we describe and discuss the results of the PCCA on nannofossil and stable oxygen isotopes. We stress the fact that we did not apply statistical analyses (FA and PCCA) "to better see the nannofossil trends". Indeed FA is a consolidated methodology in nannofossil paleoceanography/paleoecology for the early to mid Cretaceous since the pioneristic work of Roth and Krumbach (1986) who used the results of factor analyses for various time slices to identify taxa related to paleofertility and paleotemperature in mid-Cretaceous oceans. Since then other Researchers applied FA to various sections obtaining comparable results (see Mutterlose et al. 2005 for a synthesis), thus confirming the reliability of some nannofossil species as proxies of paleotemperature and paleofertility. We performed statistical analyses to verify the occurrence, in the selected sections, of factors identifying the same nannofossil taxa (FA) as in previous papers. Moreover, PCCA was used to substantiate with oxygen isotope data the temperature significance of the nannofossil-derived factor interpreted as warm/cool surface waters. The nannofossil temperature and nutrient indices are independent from FA. Here we applied the NI and TI of Herrle et al. (2003) who used

the available literature on paleoecological affinity of calcareous nannoplankton during the Cretaceous. The "synthetic" curves presented in Fig 7 are the composites of the NI and TI curves reconstructed for the three studied sites.

COMMENT N.3 3a) The interpretations are based on the preceeding step and seem highly speculative to me in this form. The stratigraphic curves presented by the authors present clear trends and are not sufficiently used by the authors. The raw data must be taken into consideration first for the interpretations. 3b) Some parts of the discussion need to be clarified and developped. 3c) For me, the new part do not concern the OAE 1a, already studied by the authors in the same and other settings, but the late Aptian and the earliest Albian and the interpretations concerning the late Aptian and the earliest Albian are not sufficiently documented and developped.

REPLY 3a) The stratigraphic curves of nannofossil fluctuations in relative abundances are described (for each studied section) and interpreted in chapter 4.1. In our opinion this part of the manuscript does not require any extension. 3b) It is not clear to which clear to which part of the discussion the Reviewer is referring to. 3c) The Reviewer is partly correct. As explained under criticism N.1 the uppermost Barremian-lower Aptian dataset derives from higher resolution sampling, significantly increasing the results of previous investigations on the Piobbico, Cismon cores and DSDP Site 463. The upper Aptian dataset is new. New data and reconstructions, therefore, indeed regard OAE 1a that for the first time is characterized in the selected sections in extremely high resolution using nannofossils, oxygen isotopes and TEX86. Consequently, here we identified and correlated brief cooling interludes across OAE 1a. The fluctuations of nannofossil and oxygen isotopes in late Aptian time interval are documented in high resolution, interpreted in terms of both paleoclimate and paleofertility and compared to previous reconstructions provided by McAnena et al. (2013). The earliest Albian is not a topic of this manuscript. As detailed in the introduction, our investigation covers the Aptian Stage up to the Aptian/Albian boundary.

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Please also note the supplement to this comment:
http://www.clim-past-discuss.net/10/C629/2014/cpd-10-C629-2014-supplement.pdf

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Interactive comment on Clim. Past Discuss., 10, 689, 2014.