

Review of 'Major perturbations in the global carbon cycle and photosymbiont-bearing planktic foraminifera during the early Eocene' by Luciani et al. (2nd version)

First, I must congratulate the authors with their great effort to improve the quality of the paper. In my view, the shift in focus, the structure, the extensive considerations of concerns expressed earlier and the addition of data from other localities have strongly enhanced the value of this paper.

The planktic foraminifera of Possagno are now described as being recrystallized and infilled with calcite – a feature that is very common in foraminifera from many early Paleogene (and older) outcrops. Although this is unfortunate as it will not allow geochemical analysis of the foraminifera, the good news is that the infillings make the planktic foraminifera much more robust to various ways of processing so that for instance %F will not be significantly affected through this and may thus only reflect settling and/or early diagenetic processes. With this new information one concern is tackled.

The authors now provide a generally well-balanced discussion on diagenesis and dissolution influencing the faunal and isotopic patterns. However, I'm still missing consideration of a few issues:

A short discussion to the (potential) effects on the isotopic records of meteoric water penetrating (as groundwater) the rocks in the subsurface. This also may or may not have played a role in the red coloration of the Scaglia Rossa (refs?).

In connection with the previous: as mentioned in the first review, I'd like to see the author's viewpoint to the often observed positive correlation between $\delta^{13}\text{C}$ and $\delta^{18}\text{O}$ records in outcrop sequences like the Scaglia rossa in the Gubbio area, that were largely or in part interpreted as resulting from diagenetic overprint (e.g. Corfield et al. 1991 –Terra Nova). Obviously, this correlation is also expected for hyperthermals, so a short discussion of how the two causes can be distinguished would be very useful.

512-513 This holds only true in organic-lean rocks. If originally there were levels with increased Corg content in this sequence this ^{12}C -enriched material may also have decomposed and be incorporated during the recrystallization process, leading to negative excursions. Please provide some reflection on this.

538-541 Show this in a detailed correlation graph, even if the details of correlation are still ambiguous, it would be more convincing if this is shown in a graph and that further research can focus on evaluating the patterns and correlations proposed here.

756-758, 766-769, 816-817 Assemblages may contain large numbers of Acarinina for ecologic reasons and without taphonomic overprint. This is also well documented for the PETM in Spain and the Middle East. The Acarinina dominance over Morozovella and the link to eutrophication of marginal basins during the PETM has also been documented for the southern Tethyan basins either through upwelling or through enhanced discharge (e.g. Schulte et al. 2011 – Chemical Geology and references therein). It occurs to me as if only in open ocean settings Morozovella may be doing well during the PETM. Along most(?) continental margins Acarinina seems to flourish, notably at the expense of Morozovella, that nearly disappears from the record at least in the Middle East (Guasti & Speijer, 2007 – GSA SP) and southern Spain (papers by Molina & Arenillas).

Minor issues (queries, typo's, style, formalities, additions..)

53 an archetypical..

55 two other significant Eocene warming...

59 the term ELMO should be reserved only for the ETM-2 clay bed at Walvis Ridge

60 why not stick to 'K' in the remainder of the text (connecting the terminology to the use of J)?

85-88 and turnovers in nannos, ostracods, platform organisms (larger foraminifera, corals,..), ..

105 Fraass

107 morozovellids and acarininids are informal terms for the two genera. I see no advantage for using these terms over *Morozovella* and *Acarinina*. Why not just call it the *Morozovella* crisis further in the text?

111 delete 'and'

111 leave out reference to fig. 1 here, as it rather would suggest that the decrease in *Morozovella* takes place near the top of the EECO.

115-116 "These foraminiferal assemblages presumably reflect relationships between climate and carbon cycling across the EECO." Rather cryptic phrasing. Intended are the overall patterns of abundance changes.

136 Why circa?

143 Important issue! perhaps give some examples of the overall range in previous estimates.

189 Why not add a standard biozonation (NP or CNE)? If not, please briefly explain why this is not done. Biostratigraphic inconsistencies?

203-204 Confusing: "an important decrease in sedimentation rate (up to ca. 1.4 m/Myr)". The maximum was 1.4 and then it goes down?

272 a total is collected?

273 various spacing of 20 and 50 cm?

286-287 Unclear: "We collected new samples spanning their effort for stable isotopes"

304 Mass percent? (unusual in geosciences, but perhaps some geophysicists can be made happy)

325 and onwards the delta notation varies

402 Fig. 8!

416 show or occur?

464 unclear: is the increase on average 7% or is this a typo?

519: lower and higher temperature instead of colder and warmer T?

610-612: the same observations were already made and briefly discussed some 20 years ago for the PETM (e.g. Schmitz et al. 1996 – Geology)

677 'Morozovella crisis'?

678 also at 577?

686 this correlation should be highlighted with some colored bands like for ETM2 etc. Otherwise it is not really clear.

689-690 'nearby' instead of 'proximal'

732 it is more likely that variations of the depth of the lysocline, rather than the CCD, played a direct role in the taphonomy of foraminifera in bathyal to upper abyssal sequences.

750-751 note that in Petrizzo et al. 2008 the dissolution susceptibility planktic genera includes Eocene records up to zone E8. The results are in line with the experimental results of Nguyen et al.

824-825 show this more clearly in the figures (as for 686)

1420 The captions are very long and can to some extent be shortened

1491 typo *A. cuneicamerata*

1508 hexagons?

1552-1553 information is not quite clear in figure

1556 in what way is 'slightly modified' meant? Do you mean as indicated in the next sentence?

1559 what is exactly meant with 'this group'?

1595 Coxall not in italics

1599 Gümbel

1600 Gohrbandt not in italics

1612 why refer to Grassé and not Deflandre (note spelling of Deflandre)

1614 what is meant with (Stradner 1958) Bukry 1972? In Bukry 1972?

1615 idem for (Bramlette and Riedel 1954) Shamrai 1963

Robert Speijer

10/01/2016