

## ***Interactive comment on “Decline of coral reefs during late Paleocene to early Eocene globalwarming” by C. Scheibner and R. P. Speijer***

**Anonymous Referee #2**

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The paper by C. Scheibner and R. Speijer deals with a topic that may be of great interest to researchers working on processes and evolutionary trends during the early Paleogene. From this viewpoint, the paper has an intrinsic value, as represents one of the few attempts considering this interval from the perspective of the shallow marine record.

As a whole, the main text is well organized, of appropriate length and written with fluent English, and these qualities must be acknowledged as they facilitates comprehension and made easier the process of review. After careful reading, only very minor grammatical mistakes or confusing terms were detected, and a single discrepancy between the list of references and quotations in the main text was noted (see section minor points of the review).

## Main substantive/discursive points

The paper focus on the evolution of coral reefs across the late Paleocene and early Eocene, an interval of about 6 My that is known to have recorded a general warming trend, punctuated by a short-lived climatic deterioration, the PETM, at the Paleocene-Eocene boundary. In the whole paper, the authors look at the studied topic from the perspective of the present climate warming and the high incidence in the form of bleaching and increasing mortality that the associated rise in sea surface temperature (SST) is causing in coral communities. In following sections and based on different paleotemperature estimates, the authors assume a similar scenario to that of the present for the coral decline across the studied interval.

I sincerely think the use of such 'actualistic' approach is not appropriate for the case study, given the disparity in global environmental conditions at the beginning of Paleocene-Eocene and the present climate warmings, their different temporal scale and, also, the great differences between early Paleogene and modern shallow benthic communities. These topics should be introduced and discussed in the text, may be even briefly, to offer the most suitable criteria for comparison. In this regard, it is not clear if in the analysis the authors are considering the whole coral community or exclusively corals belonging to the group of colonial, zooxanthellate-like corals that characterize shallow photic reef habitats. A similar doubt arises when speaking about larger foraminifers, a 'large family' in which are differentiated groups according to the supposed presence/absence of symbionts, depth/light dependence, and type of substrate or feeding habits.

On the other hand, I think rather hazardous the interpretation of the studied coral decline only bearing in mind a single controlling factor (SST). In section 6 of the paper (Capacity of coral reefs.....) the authors stress the idea of other factors assisting the process but surprisingly they are not introduced/mentioned in the text. In this regard, I think that to make the argument more convincing to skeptics the authors should discuss about other important processes affecting to modern and ancient coral reefs (e.g.

changes in nutrient levels, terrigenous supply, salinity, sea level...), and subsequently argue why the geologic evidence allows considering temperature the main cause of the observed trend. Something like that was already made in a previous paper (Scheibner et al., 2005) and I wonder why in this they do not rely of their previous interpretations.

Leaving aside the comments above, my main concerns about this manuscript come from the way in which is used the database supporting the interpretations. As illustrated in Figure 2 and discussed in several sections of the text, the long-term coral decline across the Paleocene-Eocene transition would be clearly recorded in many tethyan localities, in the form of three successive platform growth stages that can be constrained and correlated accurately using the shallow benthic foraminifer biozonation of Serra-Kiel et al. (1998). After revision of most of the literature cited by the authors I found that such platform stages, particularly stages 1 and 2, can not be differentiated so clearly nor dated in detail with the information provided by several reference papers. That is the case, for example, in the Paleocene-Eocene succession of the Ionian Islands (data from Accordi et al., 1998), Northern Somalia (Carbone et al., 1993), Oman (Racz, 1979), Tibet (Willens, 1993) and the Maiella (Moussavian and Vecsei, 1995). Similarly, I also noted that some of the referred papers are specifically focussed on Paleocene platform sediments or fossils, and do not provide data about the overlying lower Eocene (e.g. Moussavian and Vecsei, 1995, and Turnsek and Drobne, 1998; about the Maiella and the Northern Adriatic platform, respectively). In fact, only 3-4 areas, and particularly the Pyrenees and the Galala mountains, allow the identification of the three growth stages within the Paleocene-lower Eocene platform succession, and provide enough biostratigraphic data from shallow benthic foraminifers and calcareous plankton to build a detailed correlation and evaluate the evolutionary trends properly. But even in this specific case I found discrepancies, such as the position of the biozone SBZ4 relative to calcareous plankton biostratigraphies and thus of the interpreted limit between platform stages 1 and 2. According to Scheibner et al. (2003) in the Galala mountains the base of the SBZ4 is situated just above the NP6-NP7 boundary, whereas in the Pyrenees the same level is usually constrained within the uppermost NP8 (see

Serra-Kiel et al., 1998 and references therein). That means a temporal difference of about 1 My for the boundary between platform stages 1 and 2.

Bearing in mind all these problems, I would recommend a complete re-elaboration of Figure 2 and the corresponding discussion in the text, leaving out the subdivision in platform stages. Instead, I think more appropriate to analyse the information about evolution of coral/coral reefs and larger foraminifers using some kind of chronostratigraphic chart based on the SBZ or any other standard biozonation.

#### Minor points

Introduction. The correct reference is Hallock (2005), not Hallock et al. (2005).

Bio- and chemostratigraphy. 1) The first works revealing the correspondence between the LFT event recorded in shallow marine environments and the carbon isotopic excursion and the benthic extinction event that labelled the Paleocene-Eocene boundary and the PETM in open marine successions are those developed in the Pyrenees by Orue-Etxebarria et al. (2002) and Pujalte et al. (2003). To be fair, this should be addressed in the text together with the author's works. 2) Question: do the small benthic foraminifers provide precise correlation between shallow and deep sections?

Material and methods. In the last paragraph, some references from the huge pile of works developed by other authors in the Spanish sections should be added.

Early Paleogene decline of coral reefs. 1) The work by Schuster ((1996), or any other, should be also included together with that from Schroeder (1986) when doing reference to Paleocene reefs in Egypt. 2) Add upper Paleocene reefs instead of late Paleocene reefs. Please, check this and similar uses in the whole text. 3) Comment: the knowledge about Paleocene corals and coral reefs has been improved significantly during last years: see, for example, the general works by Perrin (2002) or Kiessling and Baron-Szabo (2005), or other in specific zones such as those by Tragelehn (1996) or Baceta et al. (2005). 4) In the sentence -Particularly the lower Eocene is well known for THE

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dominance of larger foraminifera...-, and add some representative reference papers. 5) Solenomeris reefs are quoted firstly as -reef-like- structures but in a later sentence are considered -kilometre-sized reefs- (contradiction?). Please, add remark about the equivalence between Solenomeris and Acervulina. 6) Comment: please, the notion of significant growth of coralgal reefs during the early Paleocene comes from the literature not from the author's papers! 7) Comment: the sentence -Coralgal build-ups are absent within platform stage...- is at odds with that shown in Figure 2.

List of references. Add paper by Schroeder (1986)

Additional point: In different paragraphs of the text it is not clear if the authors refer to Paleocene or to Paleogene. Please check this issue carefully.

### Figures

Figure 1: Please add age and location of the bioconstruction, and some info about composition of the overlying bedded limestones (foram-dominated?).

Figure 4. Add in the diagram or caption the meaning of LF I and LF II.

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