

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

Anonymous Referee #1

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GENERAL COMMENTS

The paper by Scheibner and Speijer deals with global warming, currently one of the most preoccupying issue in science and policy. The authors aim at evaluating the effects of global warming on low-latitude carbonate platforms using the distribution and evolution of the early Paleogene reef record. The study is thus timely and potentially of general interest. Overall, the text is well organized, well written and the arguments are logical. I have marked only minor mistakes in spelling and a few points that need rewording. However, the main scientific message requires substantial revision prior to consideration of the manuscript for publication. These points are addressed below.

SPECIFIC COMMENTS

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1. Introduction:

The decline of modern reef ecosystems is multifactorial, although SST and the solar irradiance, on which the authors focused, are among the most important issues. I suggest at least the addition of a few key papers that review the multiple factors (e.g., nutrients, sea level, ocean composition, CO₂) triggering the demise of modern coral reefs. This is fundamental for the discussion of the fossil rock record, where the various factors generally can barely be discriminated.

4. Early Paleogene decline of coral reefs:

Clearly, the Paleogene reefs under study do not compare to modern coral reefs. Also, the abundance of larger foraminifera in the lower Eocene cannot be compared to the situation today.

5. Early Paleogene temperature gradient + 6. Capacity of coral reefs to withstand the warming:

The interpretation and discussion in these sections concentrate exclusively on SST, whereas in the last sentence, it is stated "Other factors probably assisted in the initiation of the coralgal reefs decline and hampered a subsequent rise of coralgal reefs after the PETM". As known from modern reef ecosystem, SST is one the multiple factors that potentially can lead to reef decline. The authors should thus enlarge the discussion. Also, the abundance of larger foraminifers should be addressed. Although all specialists agree that the PETM was a period of extreme global warming, there are controversies on the factors that ultimately led to biotic crisis (including reef demise). This discussion appears crucial because multiple scenarios are in debate, including temperature increase, salinity changes, sea-level fluctuations (Speijer and Morsi, 2002!!), methane release, increase runoff, etc. (Tripathi and Elderfield, 2004; Zachos et al., 2005; Gibbs et al., 2006a, b; Sluijs et al., 2006; Cohen et al., 2007; Schmitz and Pujalte, 2007; among many others). No proof is provided "from the data presented" that SST was the most important factor, considering the multiple scenarios suggested by

other scientists (and by the second author in previous papers).

OTHER COMMENTS

Following previous arguments of the authors, larger foraminifers may take over as the coral reefs decline. This is not granted for the modern situation, where larger foraminifers are equally affected by increasing solar irradiance (Hallock, 2006, Proceedings 10th ICRS Okinawa, Japan, p. 729-737). A fundamental question arises from the actualistic model that the authors used: Did Paleogene larger foraminifera host symbionts, as do modern counterparts? Is the dominance of larger foraminifera related to increase in nutrients? The abundance of larger foraminifera in strata covering coral reefs needs further consideration and may potentially give indirect hints to explain the coral reef demise.

The stratigraphic constraint using benthic foraminifers can be questioned. Although I am not a specialist of Tertiary benthic foraminifera, I doubt the biozonation can allow for resolution at that level (stages I, II, III). A correlation of shallow-water and deep-water sections (if feasible), eventually adding chemostratigraphy, would be needed to claim accurate dating. Furthermore, I suggest to consider data and discussion by El-Nady (2005), who studied planktonic foraminifera (*Revue de Paléobiologie*, v. 24, p. 1-16).

TECHNICAL CORRECTIONS

P. 134, line 20: add "Modern" (Modern reef-building corals)

P. 136, line 4/5: less precise (to replace "more imprecise")

P. 136, line 16: field-based data (to replace field based study, add -)

P. 136, line 19/20: Reformulate, starting with "The Galala Mountains were located at low latitude during..."

P. 138, line 17: outcropping shallow-water deposits (to replace "shallow-water outcrops")

P. 139, line 13: Coral buildups are absent ... stage III, except for the Pyrenees (to match your Fig. 2)

P. 147: Fig. 1 needs further details (setting, age, etc).

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