

Interactive comment on “Ammonoid multi-extinction crises during the Late Pliensbachian – Toarcian and carbon cycle instabilities” by J. Guex et al.

Anonymous Referee #1

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Review of Guex et al. Ammonoid multi-extinction crises during the Late Pliensbachian – Toarcian and carbon cycle instabilities

This manuscript presents some new bulk carbonate carbon-isotope data from a Late Pliensbachian to Late Toarcian section in Peru. The paper then discusses the new data in the light of ammonite discoveries from the same section and a reconsideration of global ammonite evolutionary patterns and radiometric age dating. This paper will certainly stimulate discussion, but does require some further thought and restructuring of the arguments.

Some specific issues are as follows:

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1) It is stated in several places (e.g. page 1207, line 6, and page 1212, line 25) that the Pliensbachian-Toarcian ammonite crisis and negative carbon isotope excursion occur during a period of regression and cooling. Whilst this statement may be true of the ammonite extinction pattern (perhaps not yet documented with sufficient precision to be sure) it is demonstrably the case that the negative excursion occurs in a transgressive or deepening context, at least where this can be determined with some confidence in the European area (e.g. in the Lusitanian Basin (Hesselbo et al. 2007) or the Cleveland Basin (Littler et al. 2010) – both papers cited in the ms). Recently the negative excursion has also been reported and discussed for Morocco (Bodin et al., 2011, *Journal of Petroleum Geology*, Vol. 34(4), October 2011, pp 345 - 364), where the context again seems to be transgressive, and the environmental change in the North African region are also discussed in Reolid et al., 2012, *Geological Society of America Bulletin*, published online on 10 August 2012 as doi:10.1130/B30585.1. This is important because the authors draw conclusions about the relationship of evolutionary events to global sea-level and temperature change that may not therefore be correct.

2) Whilst it is useful to have a new isotope stratigraphy from Peru, the limitations of a bulk carbonate curve need to be recognized. In this ms there is no discussion of possible diagenetic alteration of the isotope data. This is a significant omission that does need to be addressed, perhaps by a consideration of accompanying trace element data and/or thin section of SEM analysis of the sediment textures. Some other fairly recent papers that document the carbon-isotope (and oxygen-isotope) data for some of this interval, including consideration of diagenesis, are not cited (e.g. Korte and Hesselbo, 2011, *Shallow-marine carbon- and oxygen-isotope and elemental records indicate icehouse-greenhouse cycles during the Early Jurassic*. *Paleoceanography* 26, PA4219, doi:10.1029/2011PA002160). It would be by no means surprising to find that the upper part of the isotope curve presented for Peru has been strongly affected by diagenesis, which would be expected to lead to the more negative values observed.

3) Although the authors acknowledge the possibility of a stratigraphic hiatus in Peru

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at the level of the T-OAE, their preferred explanation for the reduced amplitude of the Peru negative excursion is in terms of paleoceanography. However, it is noteworthy that large-amplitude excursions have also been recorded in terrestrial materials at multiple locations worldwide (several papers cited in ms), which precludes explanations of excursion amplitude that rely on mechanisms such as local upwelling. This issue ought to be addressed.

4) The structure of the paper is confusing with results, discussion, and conclusions all being seemingly mixed together. This is particularly the case for the conclusions section which introduces a lot of new discussion of the causes of the Toarcian OAE and dating of the Karoo-Ferrar large igneous province. There are also further speculations made in this section with regard to environmentally effective volatiles, recapitulating arguments of e.g. Svensen et al., 2009, Siberian gas venting and the end-Permian environmental crisis. *Earth and Planetary Science Letters*, Volume 277, Issues 3-4, Pages 490-500, but without specific reference to this paper.

5) It is not clear that there is adequate referencing of previous work. As well as papers mentioned above as not cited, the work of Cecca is missing too (e.g. Cecca and Macchioni, 2004, The two Early Toarcian (Early Jurassic) extinction events in ammonoids, *Lethaia* v.37, p. 35–56, DOI: 10.1080/00241160310008257).

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