

**The habitat of the nascent Chicxulub crater**

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## **Peer Review Comments on 2020AV000208**

### **Reviewer #1**

#### General Comments:

The Bralower et al revised manuscript on a new Chicxulub crater drill core presents a variety of new information to reconstruct the paleoenvironment of the Chicxulub crater in the subsequent months to years to tens of thousands of years after the crater was formed. Overall I believe this to be a much improved version of the original submission that the multiple lines of evidence about the habitat of this impact crater in the aftermath of its formation is much more connected together. Specifically I appreciated the expansions of sections 3.3, 3.4, and 3.5 which go a long way in connecting more of the huge variety of details in this manuscript. Additionally, the new figures made and new versions of the original figures are clearer and more understandable, in the context of internal consistency with the manuscript text but more easy to follow from one figure to the next. I only have a couple minor comments worth considering.

#### Specific Comments

(line numbers refer to clean version of resubmission)

Abstract (Line 73): I suppose you are referring to the tsunami deposits themselves here in the 'hours' end of the spectrum, as the rest of the manuscript and figures refers to the seiche deposits being formed within days to years.

Introduction (Line 119): how can the authors claim that LIP volcanism played no part, 'unrelated' in the K-Pg mass extinction? Many other LIP eruptions in the Phanerozoic have been linked to mass extinctions, most famously is the Siberian Traps and the EPME...why does Deccan have no relationship? These are geologically unique phenomenon just as large bolide impacts, and I just don't see how any geoscientist can simply state that either of them would have no impact on the existing biosphere at the time as there is a whole host of biogeochemical-Earth System feedbacks well established with these types of explosive volcanism.

-Seems more appropriate, less conjectural, to say that the volcanism is unrelated to the Chicxulub impact event. There are a whole host of papers that have drawn links to the Deccan Traps and this mass extinction... seems unnecessarily dismissive of this hypothesis even though it has no bearing on your data and story presented here.

## **Reviewer #2**

Reviewed by R. Mark Leckie, Univ. of Massachusetts Amherst

This is a well-written, thoroughly documented analysis of the biosphere response to the K-Pg impact as recorded in a remarkable succession of sedimentary deposits from the peak ring of the crater. The new stable isotope and clumped isotope paleotemperature data nicely track the biotic succession recovered in the core; the interpretation that the cooler, elevated peak ring was inhabited by survivor nannoplankton and a monospecific dinocyst assemblage illustrates how much fine detail is preserved in this record.

Calcareous dinocysts in association with charcoal and the Ir-anomaly, a widely observed association, provides strong support for the hypothesis of darkness (and cooling) in the immediate aftermath of the impact. The likely implication of very rapid evolution of the earliest Paleocene planktic forams, consistent with the  $^3\text{He}$  data, is very compelling and significant.

The paper is ready for publication, but I have a couple of minor questions, a suggestion, and a typo.

Line 62: First key point: How can tsunami and seiche waves last months to years?: Hours to days seems more likely; how/why would such waves last any longer? Can you provide support/documentation for such protracted activity following a singular abrupt event?

Line 81: Were the seiche triggered by the impact-generated tsunami, or by winds? I think it would be helpful for the reader to understand how you are differentiating between the tsunami deposit and seiche deposits. The duration of a tsunami would have been hours to days, right? Is an extreme perturbed climate, like the modeled super cooling that may have lasted for decades (Brugger et al. 2016) responsible for winds to drive a seiche during the years post-tsunami?

Line 110: 'In one of the most rapid geomorphic events in Earth history...' Perhaps of of the most rapid geomorphic, biotic and environmental events in Earth history.

Line 446: The Ir anomaly generally signifies fallout within years of the impact (Not with years of the impact).

## **Reviewer #3**

This paper presents an impressive amount of new data on the Chicxulub crater IODP core. It is well written and the interpretations are well supported by the data. The sedimentological and clumped isotope data are novel and provide important constraints on the conditions after the impact. The authors have carefully taken in consideration the reviewer comments and modified the manuscript accordingly.

The manuscript provides a compelling story which is well supported by the data, even if in parts its speculative. It will definitely stimulate the discussion on the aftermath of the Chicxulub impact in the literature and can be published basically as is.

I only have a few minor comments

Line 551 : should be "per meg" not " per mg"

Supplementary. Information:

A table with the carbon, oxygen and clumped isotopes should be added to the supplement.

The authors should cite Bernasconi et al. 2018 as source information for the ETH standards, for which they report different values than the "accepted" values used by other laboratories. These standards have been used in producing different temperature calibrations from those used in this paper and their values may change. It is important to report the original publication with the current accepted values if other workers wish to recalculate the temperatures with a different  $\Delta 47$ -Temperature equations and recalculate the data according to different equations in the future.

Bernasconi S.M., Müller I. A., Bergmann K.D., Breitenbach S. F. M., Fernandez, A., Hodell D. A., Jaggi M., Meckler A.N. Millan I., and Ziegler M. (2018). Reducing uncertainties in carbonate clumped isotope analysis through consistent carbonate-based standardization. *Geochemistry, Geophysics, Geosystems*, 1-20.