

## ***Interactive comment on “Oxygenation variability off Northern Chile during the last two centuries” by J. A. Díaz-Ochoa et al.***

**Anonymous Referee #2**

Received and published: 20 August 2010

Dear Antje,

Please see below my review of the manuscript bg-2010-166 by Díaz-Ochoa et al. “Oxygenation variability off Northern Chile during the last two centuries”. Before starting to comment on the manuscript, please take into consideration that I am not a specialist in the Peru-Chile upwelling system and ENSO events. Therefore, my comments and suggestions originate from a ‘regional outsider’.

The title and abstract of the manuscript promises to provide information on the oxygen variability and shifts in the coastal marine ecosystem off Northern Chile as a whole during the past couple of centuries. It came a bit as a surprise that the study is based on two sediment cores from a rather small bay compared to the long Northern Chilean coast. The authors use the bay as an example and try to extrapolate their findings

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to the Chilean coast. Caution should be taken in doing so. In bays, the circulation and related conditions are usually different than along a strait coastline. Looking at Figure 1, I would suspect calmer waters in the bay protected by Angamos point, which would support higher productivity in the bay and less mixing, hence, less ventilation and higher oxygen consumption in the bottom water. I would suspect much lower oxygenation inside the bay than outside. Hence, the productivity and bottom water oxygenation deduced from the core proxies might not represent the conditions outside the bay. My suggestion is to change title and abstract to better represent the content of their study.

The authors use a good suite of sediment proxies to reconstruct past productivity and bottom water oxygenation to analyze ecosystem changes in relation to climate changes. It appears that the authors often seem to either get lost in between those multiple proxies themselves or fail to clearly structure the description and interpretation. As a result, the reader has difficulties to follow the reasoning of the authors.

In summary, despite my criticism, I recommend publication of this interesting study in Biogeosciences after major changes to the manuscript. The manuscript requires reorganization and a clear description of the links between the proxies and reconstructed environmental conditions.

Review of the manuscript bg-2010-166 by Díaz-Ochoa et al. “Oxygenation variability off Northern Chile during the last two centuries” submitted to Biogeosciences

General comments

The title and abstract of the manuscript promises to provide information on the oxygen variability and shifts in the coastal marine ecosystem off Northern Chile as a whole during the past couple of centuries. It came a bit as a surprise that the study is based on two sediment cores from a rather small bay compared to the long Northern Chilean coast. The authors use the bay as an example and try to extrapolate their findings to the Chilean coast. Caution should be taken in doing so. In bays, the circulation and

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related conditions are usually different than along a strait coastline. My suggestion to the authors is to change title, abstract to better represent the content of their study, or to provide a more detailed comparison of their findings to other studies to justify an extrapolation to the Chilean coast. Looking at Figure 1, I would suspect calmer waters in the bay protected by Angamos point, which would support higher productivity in the bay and less mixing, hence, less ventilation and higher oxygen consumption in the bottom water. I would suspect much lower oxygenation inside the bay than outside. Hence, the productivity and bottom water oxygenation deduced from the core proxies might not represent the conditions outside the bay.

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Specific comments

Abstract

-See general comments

1 Introduction

-Line 5 on page 4989: -What are the oxygen levels in that OMZ?

- Describe the link between higher  $\delta^{15}\text{N}$  and less oxygenation promoting denitrification or leave  $\delta^{15}\text{N}$  out.

2 Study area

-Upper paragraph on page 4990: What are the oxygen levels in the bottom water? Is

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there any seasonality? What is the circulation in the bay compared to the outside?

3 Material and Methods

-This part contains results that should be moved to the results section. On the other hand, some crucial information on sediment dating is missing from Material and Methods.

-Upper paragraph on page 4991: "This core was subsampled..." Not clear. Do the authors mean that it was divided into four aliquots?

-Line 5 & 10 on page 4991: The authors refer to results of  $^{210}\text{Pb}$  dating and dating using magnetic susceptibility to an article by Caniupan 2009. Unfortunately, this article is written in Spanish and not readily available online. As the dating is crucial for the conclusion drawn in the manuscript, more details should be provided by the authors.

-Line 15 on page 4991 to line 5 on page 4992: These are results and should be transferred to the results part of the manuscript.

4 Results

4.1 Chronology

-This chapter needs re-arrangement. The description jumps back and forth within the cores and back and forth in between proxies and is rather confusing. A Subchapter dealing with the sediment dating should be included as good sediment ages are crucial for the conclusions drawn in the manuscript.

-Line 5 on page 4994: The paragraph on ENSO events needs to be better put into context. It appears somewhat isolated.

4.2 Sediment characteristics

-Should become 4.1 as it describes the general sediment conditions. The sediment characteristics need to be taken into account when developing an age model. Since

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the authors stress earlier that the sediments in the bay are laminated, it is surprising that the lamination is not further described here.

#### 4.3 Paleoproductivity proxies

-Biogenic opal: Reorganize paragraph. Currently it reads as if decreasing trend refers to the whole core, not just to the 19th century.

-Line 5 on page 4995: The name of the diatom species as such does not add more information. Omit or provide more information.

-Line 10-20 on page 4995: Needs reorganization. Omit explanations given in the Material and Methods.

#### 5 Discussion

-The introduction to the discussion reads like a summary and can be omitted.

##### 5.1 Oxygenation and productivity proxies

-This subchapter needs re-writing. Often, the authors relate peaks in the proxies to trends in climate, productivity and oxygenation, but do not explain the link behind driver and signal. As a result, the authors' reasoning remains unclear.

-When looking at the trends in the proxies in figure 3, I really find it difficult to follow the interpretation of the authors. No explanation is provided why in the spongy layer, despite high Mo/Al and V/Al ratios S is at an absolute minimum and how this could be related to any upwelling/climate events.

-Line 10 on page 4997: The description is missing how the peaks and troughs of the proxies are related to ENSO events.

5.1.1 Preservation issues -I disagree with the authors findings in S trends. I observe in figure 4 fairly constant S values from 1870 to 1930, followed by a drop in S until 1950. Only after 1950, S shows an increasing trend. After 1990, S reaches values as high as

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before 1930, followed by a rapid increase in the recent past.

##### Tables

-Table 2 should become table 1 and vice versa.

-Table 2: In the text, not all periods of time listed in the table are discussed. Perhaps the authors may want to focus on periods of time discussed in the study.

##### Figures

###### Figure 2

-a & d) Please provide both total  $^{210}\text{Pb}$  and  $^{210}\text{Pb}_{\text{ex}}$ , and the age model.

-f) The unit for  $^{210}\text{Pb}_{\text{ex}}$  is missing.

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Interactive comment on Biogeosciences Discuss., 7, 4987, 2010.

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