

Brest, 22th of July 2016

Dear editor and reviewer,

We wrote the response and we corrected the manuscript at the same time.

For the moment, you will find below our detailed responses to each of the reviewer comments. For the reader convenience, all our responses are in red in the following text.

We hope to have satisfied / clarified all remarks.

Sincerely yours,

Aurélie Penaud and co-authors

F. Marret-Davies (Referee)

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This paper presents a new high resolution dinoflagellate cyst record from the bay of Cadiz, covering the last 50 ka, with an emphasis on the Marine Isotopic Stage 3 and interstadials. The variations in dinocyst assemblages are explained as a complex interaction between orbital forcing (precession and obliquity) as well as land-ocean interactions. Overall, this study should be published as it highlights the complex answer of the ocean to environmental changes but the text would need some moderate revisions as it is not always well expressed or structured. Given that Reviewer#1 has highlighted mistakes that I have seen, my review is focused on some other aspects.

Lines 47-51: This introductory sentence gives the wrong information as it leads the reader to assume that this paper is about CO2 sequestration, but that is not the case. You may want to start to talk about marine regions in the world where productivity is at its highest (shelves, upwelling cells, river mouths, etc) and how they play an important role as a carbon sink. Restructure your introduction to be clearer where you are going.

Response: The introduction has been re-structured. We suggest the following beginning:

“Marginal and semi-enclosed seas, continental shelves and especially upwelling cells, or river mouths, are marine regions characterized by high primary productivity conditions. They play an important role as a carbon sink and then significantly contribute to CO2 storage. In this context, the North Atlantic is the major contributor to atmospheric CO2 sequestration (Sabine et al., 2004; Takahashi et al., 2009), especially in high latitudes, even if uncertainties remain on the calculated amount stored by coastal regions (e.g. Flecha et al., 2012). Disregarding abiotic processes, CO2 storage evolution is itself substantially governed by continental and marine primary producers through carbon biological fixing, export and fossilization. The majority of ocean primary (...)”

Line 64: include sea-ice cover duration

Response: done

Line 70: This sentence could be better structured, please rephrase such as: “The central Gulf of Cadiz is a place of low present-day marine productivity, with a moderate responsibility for CO2 storage (REF). However, it may not have been the case in the past with the potential migration of proximal productive centers (e.g. Portugal and Moroccan upwellings) through time : : . In fact, it was demonstrated that productivity changes in this region involve: : : Our study aims to explore how these changes may have impacted dinoflagellates, here viewed as an: : :”

Response: done

Line 93: replace focused with located

Response: done

Lines 109-110. Give values of Chlor. and PP if possible.

Response: done

Line 143: Start with: “Core MD99-2339 (35.89_N; 7.53_W; 1170m water depth; 18.54m length; Figure 1), was recovered from a contouritic field (Habgood et al., 2003) by the R/V Marion Dufresne during the 1999 International Marine Global Change Studies V 146 (IMAGES V-GINNA) cruise (Labeyrie et al, 2003).

Response: done

Either Ky or Ka but not both

Response : both are used in the manuscript following Aubry et al. 2009 “the distinction between **geohistorical date**, in years before present expressed in ‘annus’, symbol ‘a’, with the multiples ‘ka’, ‘Ma’, and ‘Ga’ for thousands, millions and billions of years ago, according to a convention that has been very widely adopted during the last 30 years, and **geohistorical duration**, expressed in ‘year’, symbol ‘yr’, with multiples ‘kyr’, ‘Myr’ and ‘Gyr’, respectively” (*Terminology of geological time: Establishment of a community standard*; Stratigraphy vol. 6(2), pp.100-105)

Line 156: six instead of 6

Response: done

Line 167: delete dinocyst, as already mentioned earlier in the text

Response: done

Lines: 169-171. Rephrase as suggested: 161 samples were analyzed for their dinocyst content (every 10 cm in average, representing a sample resolution of around 300 years [± 210]) for the whole MD99-2339 core, using an Olympus BX50 microscope at 400X magnification (75 slides from 0 to 740 cm / 0 to 27 ka BP: Penaud et al., 2011a; 86 slides from 750 to 1844 cm / 27 to 49 ka BP: this study).

Line 176: cold HCl (10%) and cold HF (??%)

Line 180: following the taxonomy in Fensome and Williams (2004) and Fensome et al. (2008). Percentages were calculated based on a total dinocyst sum that excludes reworked : : :

Response: done

Lines 206-209: rephrase as suggested: A qualitative thermic index “Warm/Cold” (W/C) that has previously been used (Turon and Londeix, 1988; Versteegh, 1994; Combourieu-Nebout et al., 1999; Eynaud et al., 2016) to qualitatively address SST change issues, was calculated for core MD99-2339 (cf. Table 1).

Response: done

Line 218: Protoperidinium in italics

Response: done

Lines 221-22: correct Heterotrophics/Autotrophics

Response: done

Line 226: Suggested rephrasing: Quantifying taxonomical diversity in study samples was carried out through a variety of statistical analyses using “Past version 1.75b” software (Hammer et al., 2001); most of these indices being explained in : : :

Response: done

Line 241: replace 5 with five. You may want to explain this number, rather than 10 or less.

Response: we refer the reader, in the text, to Guiot and de Vernal (2007) for the complete methodology about the transfer function used in this study

Line 244. Give a source for the modern-day sea-surface conditions.

Response: done

Lines 250-251: Consider rephrasing: A total of 40 taxa was identified, with an average diversity of 20 main species. Your diversity does not decrease; in fact, there is a slight increase from bottom to top.

Response: done

Line 256: suggestion: «thus probably indicating enhanced fluvial inflows»

Response: done

Lines 261-265: I sort of understand what you mean but it is not well expressed. Suggestion: "Large increase of monospecific assemblages (when dominance is close to 1) will: : :"

Response: done

Lines 266-273: suggestion: Concentrations are generally low, with the exception of two large maxima, one centered around GIS 12 (: : :) and another one around GIS8.

Response: done

Line 280: L. machaerophorum is considered as mixotrophic, can you please explore this a bit further?

Response: This apparent conflict is discussed in our recent paper on the same margin but on longer time scales: see Eynaud et al., 2016

We suggest adding in the revised text: **"Previous studies have revealed contrasted patterns between brown heterotrophic and L. machaerophorum cysts. Their apparent conflict is discussed at long time scales on the southern Iberian margin area in Eynaud et al. (1999; 2006)."**

Line 364: Not sure that you can cite a paper in preparation. May be Pers. Comm. Would be more suitable.

Response: reference deleted and replaced by Pers. Comm.

Correct spelling of Sanchez-Goni

Response: corrected throughout the text

Line 449: replace "deduced" with "suggested"

Response: done

Line 450: replace "and" with "as well as"

Response: done

Line 451: occurrences of the thermophilic: : :

Response: done

Line 452: replace "attest of" with "indicate". Suggestion: warmer surface conditions at a time when bottom MOW velocity was reduced.

Response: done

Line 455: suggestion: peculiar and unique when comparing to other GIs in the core. These two intervals

Response: done

Line 460: you mean figure 8? Line 471: replace "attest" with "suggest extremely"

Response: done

Line 482: replace "are obviously related" with "seem to be related"

Response: done

Line 503: At the onset of the Holocene,

Response: done

Line 532: correct "contributes"

Response: done

Conclusion: It is a bit weak. Your first sentence should refocus on the hypothesis from the introduction, i.e. change of primary productivity recorded by the dinocysts. The rest is a bit weak, more like a summary than a conclusion.

Response: conclusion re-written

Line 955: add a after 2009

Response: not done. Mertens et al., 2009b was a mistake in the reference list since it was not cited in the manuscript. There is only one reference of Mertens et al., 2009 in the text now and the « a » is then no longer useful.

Some references in the list are not in the right chronological order (Ambar and Howe, 1979; Bar-Matthews et al., 2000

Response: corrected

Give all authors' names for Barker et al. 2009; Magny et al., 2013; Rogerson et al, 2010

Response: corrected

Some references in the list are not in the text (Dale and Fjellsa, 1994, Dale et al 1999, Daniaux et al 2007; de Vernal et al 1994 ; Devillers and de vernal 2000 ; Ellegaard, 2000 ; Eynaud, 1999 ; Eynaud et al 2004 ; Fiuza et al 1998 ; Harland, 1983 ; McMinn, 1991; Mertens et al., 2009b ; Morzadec-Kerfourn et al., 1990 ; Nehring, 1994 ; Persson et al 2000 ; Sanchez-Goni et al., 2008 , 2009 ; Sprangers et al 2004 ; Vink et al 2000 ; Waelbroeck et al 2002 ; Wall and Dale 1973

Response: corrected

References not in the list:

Fatela and Taborda, 2002 Gasse, 2000 Guiot and de Vernal, 2007 Radi and de Vernal, 2008

Réponse : corrected