

Cover Letter

Dear Editor,

First of all on behalf of all co-authors, I would like to thank the reviewers and the editor for their helpful comments and suggestions. I believe that we have successfully integrated all the reviewers' comments and requests, and that these changes have greatly improved the manuscript. Please find the revised version of our manuscript CP-2016-40 entitled: **“Extreme floods events reconstruction spanning the last century in the El Bibane lagoon (Southeast of Tunisia): A Multi-proxy Approach”** by **A. Affouri, L. Dezileau and N. Kallel.**

In this revised MS the text has been modified taking into account the reviewers and the editor comments. Please find in this MS three text colors as follows: The **pine text color** reflects the modifications as suggested in the first revised version (RC1, RC2, RC3 and RC4); the **blue text color** reflects the second revisions to the reviewers (RC1, RC2 and RC3) and finally the **red text color** reproduces the MS modifications as suggested by the editor comments. In addition, figures qualities had been enhanced and some figures were modified as recommended by the reviewers.

I look forward to hearing from you and please do not hesitate to contact me for any further requests.

Sincerely yours,

Aida Affouri

Response to the Editor comments

We thank the Editor for his thoughtful comments and suggestions. We have included almost all of the raised suggestions and below we present a point-by-point response to the comments.

1- The reviewers underlined problems in the structure of your paper. They asked you to modify the organization by moving some paragraphs. Corrections are not only remove and added some rare sentences or correct some typographic or language errors. Especially as pointed by the reviewers, some paragraphs are not related to the discussion but to the results. So please, move all descriptions of data in results. For example, paragraphs 6.1, 6.2 and probably part of 6.3 are related to results and not to discussion. This will helps to clarify your manuscript.

We thank the reviewer for his comment and we take into account his suggestion. The structure of the manuscript is changed.

5. Results

5.1. Surface sediments

5.1.1. Sediment description: grain size and morphology

5.1.2. Distribution of major and trace elements

5.1.3. Principal component analysis (PCA)

5.1.4. El Bibane lagoon: Main sediment sources

5.2 Core BL12-10

5.2.1. ²¹⁰Pb and ¹³⁷Cs dating

5.2.2 Sedimentary and geochemistry

6. Discussion

6.1 Paleoflood reconstructions

6.2. The El Bibane lagoon: A key region for paleohydrological reconstructions

2- As underlined by report 1, you have to present in the methods all types of data you use on the core and do not present data that will not be described in the results and used in the discussion. Ex: XRF data.

We agree with the report 1. A paragraph was added in the text with corresponding data reported on figure 11:

“Down-core profiles of heavy and light elements through the depth also delineate the different units distinguished by sedimentological analysis. Based on their profiles, the first group composed by Fe, Ti, K and Al exhibit similar variations, concentration values are mainly high in fine-grained intervals and are low in coarse-grained intervals. These high values are probably due to high inputs from the Fessi River. The Si and Zr which characterized the second group display a different behaviour than the first group. These two elements are high in the fine sandy intervals. This probably suggests that their highest values are related either to aeolian inputs in the lagoon. The Ca and Sr characterised the third group show a reverse distribution pattern by comparison to the first group with higher values in the coarse grained intervals and lower values in the fine grained intervals. (Fig.11). In order to obtain the best resolution in the geochemical analysis, a similar elemental ratios used in the surface sediments were applied on the core to identify the geochemical signatures of the different sedimentological events. Our data displays that the elemental ratios Fe/Ca and Ti/Ca show the most down core significant variations and that the three mud layers (high content of clay+silt) preserved in the core are characterized by high Fe/Ca and Ti/Ca ratios (Fig.12a)”.

3- In the response to reviewer 3 you add some information on the core but you did not write anything in the text. For example, explanations on the upper centimetres or on the grain size may be helpful. Why didn't you add that in the text?

We thank the editor for his remark and **requested** information was added in the text:

“The S6 representing the first three centimeters of a lagoon sediment core BL12-10 was used to characterize the surface sediments samples”.

Moreover, to reconstruct recent flood events occurred in the studied area, a short sediment core (BL12-10, 40 cm length; Latitude: 33°14'58.7"; Longitude: 11°10'3.7" Fig.3) was recovered from the El Bibane Lagoon (EBL) by a hand corer 75mm diameter PVC tube in the southern part of the lagoon, at 35 km from the Fessi River delta and 14 Km for the connection with the sea (Please see: 4. **Materials and Methods; 4.1 Materials**).

The whole BL12-10 core length is 90 cm but in this study we used only the first 30 cm (Please see **5.2.2 Sedimentary and geochemistry**).

4- The true discussion is definitively too short and still more after moving what is relevant to results. This has been underlined by reviewers in the two rounds of reviews and I agree with that. You have to develop and debate on what your work is interesting and brings concerning the flood reconstructions comparing to previous works and not only in the studied area but in a larger context in Tunisia and in Mediterranean. In addition, it will be useful and

essential to develop in the discussion how your work helps to understand local and regional climate changes, especially on what concerns extreme events, through such floods analyses. We thank the editor for comment and we take into account his suggestion. A paragraph is added in the text:

“6.2. The El Bibane lagoon: A key region for paleohydrological reconstructions

According to many studies on lagoons, these environments are good study areas to record past climatic and environmental changes, and extreme sea events. These fields of research were successfully applied in the western North Atlantic (Donnelly and Woodruff, 2007), Northwest Florida (Liu and Fearn, 2000; Lane et al., 2011; Das et al., 2013), the Northeastern United States (Parris et al., 2010), the Central Pacific (Toomey et al., 2013), Southern Japan (Woodruff et al., 2009), Western Australia (Nott, 2011), Northeastern New Zealand (Page et al., 2010), Northern Europe (Sorrel et al., 2012), or the Western Mediterranean (Dezileau et al., 2011, 2016; Sabatier et al., 2012; Raji et al., 2015; Degeai et al., 2015). Despite, the importance of these topics, such studies are still scarce in southern Tunisia. The El Bibane lagoon is different from the other studied lagoons because it cannot record coastal overwash events. Such particularity is linked to the morphology of barriers that separate this lagoon from the open sea. These barriers consist of two narrow fossil carbonate consolidated peninsula formed during the last interglacial period and reaching 10 m elevation (Medhioub et al; 1997 and Jedoui; 2000). Thus they are not recent sand bars or spits as the geographical map could suggest and they cannot not be over-washed during extreme sea events. However, we have demonstrated from this study that this lagoon could record past flood events during exceptional heavy precipitation episodes that punctuated the recent meteorological and climatic history of Tunisia and North Africa. Trambly et al., (2013) have analysed the influence of large-scale atmospheric circulation, including the North Atlantic Oscillation (NAO), Mediterranean Oscillation (MO), El Nino-Southern Oscillation (ENSO) and Western Mediterranean Oscillation (WEMO) on precipitations and extreme events in 22 stations located in Algeria, Morocco and Tunisia for the last 50 years. Although some spatial patterns for the different precipitation indices have been identified over Maghreb countries the southern part of Tunisia was only represented by one meteorological station (Gabes). This clearly avoid to identify an homogeneous climatic region, there is a need to include more stations with longer record length. El Bibane lagoon paleoflood record can be of great importance to better understand the physical mechanism responsible for the changes in the frequency and/or the intensity of extreme events in the southern part of Tunisia. It will be

interesting to study the natural variability of past flood events in this semi-arid environment through contrasting climatic periods (cold and warm periods). Further coming investigations on long core sediments could clarify the relationship between large-scale atmospheric circulation reconstructions and the major flood periods (Affouri et al., in prep). Additionally, such studies could be a crucial tool to evaluate the role of Mediterranean paleo-climate on the development and growth of human society”.

5- One of the reviewers ask you to gather the figures 9 and 12. I agree with that. Why did not you do that? You write you agree and you did not change that!!!

These two figures were combined as one. (Please see Figure 12)

6- It is not acceptable to produce figures with a so bad resolution as what is offered in the corrected manuscript. Please take care about what you sent. Furthermore, the characters in many of them are too little and often unreadable. Some figures are blurred with unreadable legends. Please enlarge the characters in the maps and correct the readability and sharpness of all figures.

We thank the editor for his remark. All the figures had been improved with high resolution.