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Climate of the Past Discussions

Interactive comment on "Mid-Late Holocene event registered in organo-siliciclastic-sediments of Lagoa Salgada carbonate system, Southeast Brazil" *by* Anna Paula Soares Cruz et al.

Anonymous Referee #1

Received and published: 20 April 2019

General comments

The manuscript by Soares Cruz et alii presents new interesting data on environmental changes, influenced by sea level fluctuations, occurred during the middle and late Holocene in a coastal area of Southern Brazil. The aims of the study are to evaluate both the depositional processes related to sea level changes during the marine and lacustrine stage of Lagoa Salgada site and the Holocene climatic changes occurred in this area during the last 5.8 ka BP.

The work is well structured and easy to read. The methodological approach based on the analysis of lithological features, organic matter geochemistry and δ13C and

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δ15N composition performed on a sedimentary core collected from Lagoa Salgada is sound and useful to achieve the aims. The authors show care in the presentation of the results, although some figures need an accurate revision. The discussion presents valid interpretations, but these are not always supported by references to the up-to-date literature dealing with global paleoclimate processes, especially those related to the 4.2 ka event.

My main criticism concerns the interpretation of the stable isotope composition in terms of vegetation dynamics influenced by climate. The climate-vegetation-isotope relationship is hard to understand since this study lacks any local proxy of past vegetation changes.

Overall, the research is well managed, and it has the potential to contribute to the growing literature on the regional specificity of the Holocene climate variability and environmental processes in South America. Before the acceptance, I would recommend an accurate revision of the manuscript according to the following suggestions.

Specific comments

The authors interpret the fluctuations in the δ13C and δ15N composition as the main consequence of change in both vegetation structures and C3/C4 photosynthetic organisms due to climate dynamics (e.g. page 2, lines 9-12; page 4, lines 27-28; page 7, lines 5-9). This is substantially based on the assumption that terrestrial plants are dominated by two distinct vegetation groups employing different photosynthetic pathways (C3 and C4 plants) that determine different δ13C; generally, C3 plants grow under humid conditions while C4 plants under relatively arid conditions. Furthermore, a combination of stable carbon and nitrogen and the C/N ratio of organic matter is used to discriminate the different source of organic matter. The vegetation changes discussed in the manuscript, however, are quite difficult to understand due to the lack of adequate direct proxies (e.g. pollen, plant macro-remains, phytoliths).

In the transitional environments represented by coastal wetlands several factors dif-

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ferent from climate changes, such as salinity, light level into the water, and impact of human activities, among others, can shape the communities of primary producers, influencing the stable isotopic composition of the organic matter into the sediments. Sea level fluctuations also produce major geomorphic and ecological changes in coastal areas, which have the potential to modify the sedimentological processes and affects the communities of primary producers, even without a direct influence of climate. For example, input of saltwater into a coastal wetland may determine the development of communities of halophilic plants and aquatic algae, featured by photosynthetic species that may present a wide range of δ13C and δ15N values (see Duarte et al. 2018, Frontiers in Marine Sciences, doi: 10.3389/fmars.2018.00298). The formation of coastal dunes may trigger the development of plant communities dominated by C4 species of Poaceae in a context not influenced by climate changes. In the hydrosere, often occurring in coastal wetlands without a direct relationship with climate, there is the succession of different environmental stages characterized by peculiar sedimentological processes and photosynthetic organisms (C3 and C4 species), which have the potential to produce major changes in the stable isotopes composition of the organic matter. The authors do not seem to adequately consider the high variety of ecological situations that can influence the isotopic composition in coastal sites. Therefore, I would like to suggest them to comment in the text on the possible uncertainties of the applied methodology in the study of coastal sites and to discuss occurrence / exclusion of other possible factors that influence the composition of δ13C and δ15N and the C/N ratio in their study area.

Paragraph 4.2 must be integrated by references to recent research dealing with the 4.2 ka event. I would suggest the authors to look for recent literature focussed on this climate change characterized by a high regional specificity. To this purpose there is a special issue of Climate of the Past devoted to 4.2 ka event with contributions from various regions of the world.

Figures 2-6 of the pdf version of the manuscript I downloaded shows a low quality in

terms of image resolution. Besides, the Figures 3 and 6 show curves too close to each other with overlapped scales that limit the readability of the data. I would suggest the authors to check this graphic material and improve its quality.

Technical corrections

Page (P) 2, Line (L) 28: check the correct version of the Bacon program

P 4, L 7: include space between '3.7' and 'ka'

P 4, L 10: add 'ka' after '3.2'

P 4, L 21: include space between '3' and 'm'

P 6, L 1: change 'estromatolites' to 'stromatolites'

P 6, L 14: write '2200±80 BP'

P 6, L 16: include space between '0.05' and 'mm/year'

P 6, L 14: write '2800±8 BP'

P 6, L 23: include space between '4.2' and 'ka'

P 6, L 31: change 'Monson' to 'Monsoon'

P 7, L 6: include space between '4.2' and 'ka'

P 7, L 24: include space between '3.7' and 'ka'

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