

Interactive comment on “Volcanism and climate change as drivers in Holocene depositional dynamic of Laguna del Maule (Andes of central Chile – 36° S)” by Matías Frugone-Álvarez et al.

Anonymous Referee #1

Received and published: 16 February 2020

General Comments: Frugone-Álvarez et al. provide a highly detailed, multi-proxy study of a volcanic lake in the central Andes, with emphasis on geochemical analysis of downcore lake sediment. The clear organization of scientific methods and assumptions as well as the use and integration of diverse disciplines (e.g., stratigraphy, seismic surveys, geochemistry, statistics, tephra, volcanism, climate) to reconstruct a paleoclimate story make this a valuable contribution to Climate of the Past. The well-characterized framework that this paper provides for the complex LdM site sets the stage, for what I imagine, is a lot more interesting work planned by this group. I support acceptance of the manuscript upon some minor revisions outlined below.

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Specific Comments: I noticed in the abstract, and at times throughout the text and tables, the nomenclature for describing ages varied. I'd suggest choosing one and sticking with it, such as cal a BP (and cal ka BP), which indicates that the ages discussed are calibrated and provides an appropriate reference point (i.e. BP).

Early, Middle and Late Holocene should all be capitalized as they have recently been formalized subdivisions for the Holocene (Walker et al., 2019).

How certain are the authors that the ash layer suggested to be the Quizapú tephra is indeed so? Are there other possible eruptions that could be correlated with this layer as well, especially since major (or trace) elemental analysis was not performed? I know from personal experience that assuming a tephra as a key marker without geochemical data to support it can sometimes be incorrect, and instead, turn out to be another layer all together. This seems especially important considering that one goal of this work is to lay a tephra stratigraphy framework for this region.

Can the authors place an estimated uncertainty on the reservoir effect that results in offsets of the age model? In other words, the authors assume a constant offset of 4.7 ka, and rightfully acknowledge a level of uncertainty inherent to this, however, to what extent? Could DOC in the lake ever be in equilibrium with the atmosphere during the Holocene such that there is periodically no offset, or somewhere in between? Given that the age model is used to compare against regional climate records, being clearer about this uncertainty is extremely important.

What is the threshold %TOC value for laminated organic-rich silts (L166)?

In the paleoclimate section, what ages are used to define the Medieval Climate Anomaly and the Little Ice Age? I know these events mostly as Northern Hemisphere climate anomalies. How are they expressed in the Southern Hemisphere in terms of temperature and precipitation?

L601-602: How are these rhyodacite eruptions linked to your L2 and L1 lapilli deposits?

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L616-620: Why is the two-phased structure of the LIA not discussed in the main text if it is in the conclusions? Similarly, solar irradiance is brought up directly afterwards as a centennial-scale climate forcing but not discussed in the main text. Expanding on these points in the discussion would be important if they are to remain as conclusions.

Technical Corrections: L6: remove “is” and make date plural (i.e. “dates”) L7: add “the” before “Early Holocene”, change “were” to “was” L8: reverse order of major hydroclimate transitions (i.e. oldest to youngest) L21: add “in” before “terrestrial ecosystems” and “as well as” before “atmospheric and ocean circulation” L33: It seems like a word is missing – a hazard to regional xxx in central Chile. Add “the” before “last deglaciation”. L170-172: These are not complete sentences and need some rewriting. L173: Delete “they” L175: I think it should read “Well-defined troughs in BioSi values occur at...”. There are extra words here that make the meaning of the sentence unclear. L282: change “dominant” to “dominate” L282: change “occurred” to “occurs” L299: Capitalize “unit” as it is the first word of the sentence L305: remove “a” after “Establishing” L307: add “to” before “degassed” L335: add “age” after “pre-Holocene” L336: change “as” to “to” L337: change “forming” to “formed” L352: seems like a word is missing. Maybe add “although” before “. . .if this emplacement would have been related. . .” L395: add “and” before “reflect” L397-399: I think the final sentence of the paragraph should be two and read as the following “The decrease in TOC and the less abundant calcite occurrences indicate a less productive environment towards the end of this phase. Simultaneous decreases in Ephedral/Poaceae values indicate increased aridity.” L519: change “shown” to “show” L542: remove “also” L546: remove the second “in” L555: add either “in/of” after “fluctuations” L564: change “concomitant to” to “concomitant with” L565: Spell out LIA here since it’s the first time it is mentioned L569: This sentence is long and needs rephrasing in the beginning. L599: add “the” before “Holocene Phase”

Sources: Walker, M., Head, M.J., Lowe, J., Berkelhammer, M., Björck, S., Cheng, H., Cwynar, L.C., Fisher, D., Gkinis, V., Long, A., Newnham, R., Rasmussen, S.O., Weiss,

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H., 2019. Subdividing the Holocene Series/Epoch: formalization of stages/ages and subseries/subepochs, and designation of GSSPs and auxiliary stratotypes. *Journal of Quaternary Science* 34, 173-186.

Interactive comment on *Clim. Past Discuss.*, <https://doi.org/10.5194/cp-2019-147>, 2020.

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