Response to anonymous Referee #2 comments:

We are very grateful to Referee #2 for the constructive suggestions and comments that significantly improve our manuscript. Here, we provide detailed responses to each individual comment. All comments have been considered and will be included in a revised version of this manuscript.

Page 1

Line 22: Please check if it would make more sense to use here the term "younger" instead of "lower".

Thanks for your suggestion. We have changed "lower" to "younger".

Line 28: The introduction is very well written and the problem investigated and the aim of the study are clearly described. However, I think the manuscript might benefit from a few sentences about reservoir effects in general and/or definitions like the terms "C14-free", "C14-depleted",…. . Please consider adding some sentences.

Thanks for your suggestion. We have now included a few sentences in the introduction.

Line 36 now reads "Our understanding of the regional and temporal hydroclimatic dynamics in the Altiplano-Puna Plateau is hampered by the difficulty in obtaining accurate chronologies from lacustrine sediments due to the scarcity of terrestrial organic matter and the anomalously old apparent ^{14}C age of waters and hence aquatic samples, known as "reservoir effect" (Grosjean et al., 1995, 1997, 2001; Geyh et al., 1998; Valero-Garcés et al., 2000; Yu et al., 2007)".

We have also modified line 42 and now reads "Therefore, obtaining reliable chronological models using lake sediments from this region is critical and requires an understanding of the ^{14}C reservoir effect variability in each particular lake system as it depends on the CO_2 exchange rate between the water and the atmosphere, the internal system mixing dynamics, and the input of ^{14}C-dead (i.e. derived from carbonates), ^{14}C-depleted (i.e. dilution of the initial ^{14}C content), or ^{14}C-free carbon (e.g. volcanic CO_2; Macdonald et al., 1991; Ascough et al., 2010; Keaveney and Reimer, 2012; Jull et al., 2013; Lockot et al., 2015)".

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Line 80: I am not familiar with the study area, but as it is written "currently" I asked myself if information is available about the frequency of lake level changes and/or the history of earlier connections of both lake systems. In both cases the authors should add information here.

Unfortunately, there is no information on the frequency of lake level changes in these lakes. The only information on the history of past connections between both lakes comes from recent satellite images showing a connection until ca. 2005 (Villafañe et al., 2021).

We have added a comment on this in line 80: "Both lakes were connected until ca. 2005 according to satellite images (Villafañe et al., 2021)", and line 250: "…probably related to a lake level lowering of at least 0.6 m with the consequent disconnection between Laguna del Peinado and Laguna Turquesa (Villafañe et al., 2021)".

Lines 85 – 98: The climate patterns are well described, but to follow this paragraph even better, the manuscript would benefit from an addition of the climate patterns to Fig. 1.

Thanks for your suggestion. We have modified Fig. 1 to include the climate patterns.

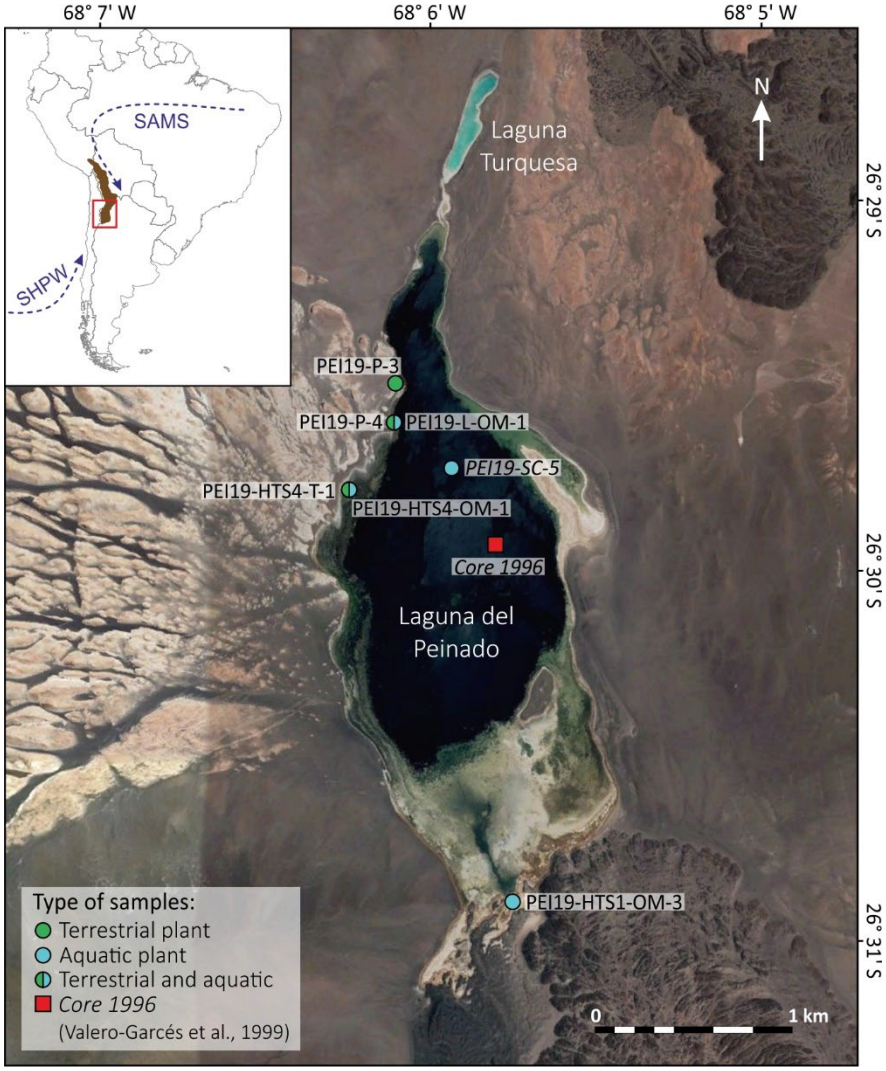

Figure 1: Location and and type of samples collected in the El Peinado basin during 2019 (© Google Earth 2020, Maxar Technologies, CNES/Airbus). Sediment core samples are indicated in italics. Left top corner: map of South America with the Altiplano-Puna Plateau highlighted in brown and the climatic moisture sources (SAMS-South American Monsoon System and

SHPW-Southern Hemisphere Pacific Westerlies). The red square marks the approximate location of the El Peinado basin in the Puna Plateau of NW Argentina.

Page 6:

Line 139: I have three questions/comments to Table 1:

- I count six questions marks in the table, e.g. “Hot spring 4?”. These uncertainties are not mentioned in the text or the Table caption. Question marks should be explained to avoid confusion.

Thanks for your comment. We have now added an explanation of the question marks in the Table caption “Question marks (?) denote samples where water influence, water mixing, and plants genus and/or species could not be determined with certainty”. The question mark in “Hot spring 4 (shallow, mix with lake water?)” is indeed discussed in the text in line 180-181: “The difference of ca. 8,000 ^{14}C years between both hot springs (Table 1, Fig. 1 and 4) could result either from some influence (i.e. mixing) of lake water with higher ^{14}C concentrations in the western shore hot spring (Fig. 1), or from the existence of separate hydrothermal systems bounded by the Peinado lineament with distinct ^{14}C content in the DIC”. For the question mark in “Hot spring 4?” we have added a brief discussion in line 239: “This might explain the old age of the terrestrial plant sample since it grew at a distance of only ~15 cm from the local hot spring. Potential uptake of soil DIC through the roots might additionally contribute but only to a very minor degree since it usually represents less than 1% of the total CO_2 fixed by the plant and may be a more relevant source of carbon for the underground tissues (Loczy et al., 1983; Brix, 1990; Enoch and Olesen, 1993; Ford et al., 2007)”.

- The first two samples result in two calibrated ages each. It should be explained why this is the case.

In order to report ages in a consistent way, we resign from calibrating the modern ages. A calibration of only these two ages further distracts from the main focus of the study (see also comment to reviewer 1)

- Please explain why not all radiocarbon ages have been calibrated.

Thank you for pointing this out. It does not make sense to calibrate only two ages since calibrating the other data is not useful without known reservoir ages. Therefore, we resign from calibrating only the two modern samples (see comment above and to reviewer 1).

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Line 172, 174, 180: The authors refer to Figure 4 only. Its orientation becomes clear only in comparison to Figure 1. However, I wish either an indication of e.g. “western hot spring”, a north arrow or maybe a numeration of the hot springs as indicated in Fig. 1 with sample names added to

Fig. 4. Otherwise, this paragraph might not be understandable without comparison to Fig. 1. Moreover, Fig. 1 should be referred in addition to Fig. 4.

Thank you for your suggestion. We have modified Fig. 4 and included the names of the samples as well as an arrow indicating north. We now also refer to Fig. 1.

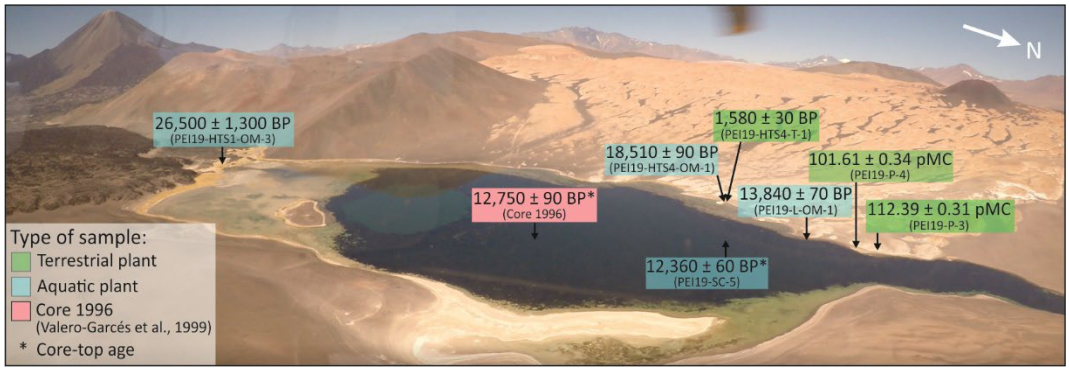

Figure 4: Aerial view of Laguna del Peinado from the northeast and all radiocarbon dates obtained from modern surface samples. For a top view, please refer to Figure 1.

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Line 257: How do the authors proceed with the sediment core and develop the chronology? I would suggest to implement this information here or somewhere later in the manuscript.

We have now included in the conclusions of the manuscript (line 289) information on how we will proceed with the chronology of the sediment cores: “In contrast to proving spatial variability of reservoir ages, it remains challenging to determine temporal changes in reservoir effects in absence of robust independent dating methods. One potential option would be radiocarbon dating on pollen which, however, failed due to the scarcity of vegetation in the region. Another option is U/Th dating which is currently evaluated. However, the sedimentary environment of the Peinado lake is challenging for this method as well. Therefore, the potential of radiocarbon dating of lake sediment cores from the Central Andes is limited and remains a major challenge.”

Line 263: Are there lithological indications that would support the hypothesis of a hiatus in the sediment core?

We have added the following information in line 263: “We do not observe lithological indications in the sediment core neither for a substantial sedimentation rate change nor for a hiatus in the record. However, since detection of a hiatus is not always straightforward, we cannot fully exclude the existence of one”. Please see also the comment to reviewer 1 regarding line 31.

Page 16:

Line 380-381: Please check if the published year should be changed to 2022, as indicated on the journal's homepage

Correct, we have changed the publication year to 2022.

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