Last interglacial (MIS 5e) sea-level proxies in southeastern South America – response to comments by Dr. Alejandra Rojas

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1 Overview

First off, we would like to thank Dr. Rojas for reviewing our paper. Here, we summarize the main steps we have taken to address the comments. The original comments from the reviewers are in italics, our response is in standard font, and changes to the text in the manuscript are shown in blue.

2 Main comments

The present manuscript represents a valuable attempt to summarise the data on the sea-level proxies available for southeastern South America during the Last Interglacial. The overall quality of the preprint is correct as it contains all the expected items, and provides comments on all the localities considered. Figures are fair although some of them are too small (e.g. figure 10).

Response: We thank Dr. Rojas for the review. We will expand the size of figure 10 from a single column (8.3 cm) to double column (12 cm).

Some general comments follow: -I found some inconsistencies regarding the consideration of previous publications that should be revised by the authors. Some information is added for certain localities (for example publications dealing with the study of molluscan assemblages), while for others this information is not included even if available. This should be standardised. In addition, in many publications, the taphonomic and palaeoecological analysis of the molluscan assemblages support a MIS 5 assignment for the sites. Moreover, in some of them the molluscan content provides evidence for a particular substage within the MIS 5. I included some references in the comments on the pdf file.

Response: We will go through in detail to ensure the descriptions are consistent. In the revised document (details specified in Section 3 this response), we note where we made changes to the manuscript to ensure conformity. As for molluscan assemblages, we only listed species that were used for dating (lines 124-125 in the original submission).

The deposits noted in the comments, specifically related to northern Argentina and Uruguay, compliment our database, but are regarded as being marine limiting and having only limited information on Last Interglacial sea level position in MIS 5e. There are several reasons to be cautious about interpreting these deposits, including the following reasons:

1) There are large uncertainties on the applied dating methods, 2) the depositional environment of nearshore deposits means that the deposits can be heterogeneous (*i.e.* ages will never have the precision of deep ocean sediments), 3) some dating methods (*e.g.* AAR) will give different results depending on the species dated, and 4) through comparison of other areas dealt with in our review, where continuous, spatially correlatable terraces that can be linked to a sea level position exist. In this regard, local information from isolated sites in Uruguay and northern Argentina cannot be easily compared with the better geomorphologically and taphonomically constrained sites further south (more detailed information was provided in previous studies, for example, Aguirre et al. (2011)).

In terms of taphonomy, we are cautious in using it as a technique to support an age assignment in the absence of other numerical dating techniques. As an example, the Uruguayan coast is influenced by its proximity to Río de La Plata and to the Mirim Lagoon (close itself to the Lagoa dos Patos in southern Brazil). This fact has two consequences: 1) the Uruguayan coastal palaeoenvironment is mainly marginal marine (not fully marine nearshore conditions), so taxonomic variations are linked to salinity gradients, and taphonomical aspects are different and not comparable with most of the nearshore deposits we reviewed; 2) Río de La Plata behaves as a biogeographical barrier and molluscan species present or absent northwards or southwards of the Uruguayan coast did not necessarily respond to MIS 5e palaeotemperature changes, but to the magnitude of salinity across this barrier through time. Only species which can be recognized as true climatic markers for our area – after a taxonomic review – can be used for meaningful comparisons, such as *Noetia bisulcata*, *Anomalocardia brasiliana*, *Triphora spp.*, *Anachis spp.*, *Tegula atra*, etc. These issues have been published elsewhere (*e.g.* Aguirre, 1992, 1993; Aguirre et al., 2011, 2013, 2017).

Taphonomy does not have the precision to pinpoint the substage within a sea-level highstand, only some general palaeoenvironmental conditions of the deposits. Once dated, it could be placed within a certain sea-level highstand or substage within a highstand. In our opinion, along the whole area reviewed, differences in taxonomic molluscan composition is not a valid tool to discriminate between substages, only - and with caution- between different palaeoenvironmental conditions of different highstands in a broad sense, *e.g.* between Last Interglacial and Holocene.

We have added the following text to a new subsection in Section 6, entitled "Faunal content".

However, in the absence of precise numerical dating, faunal surveys can only be used to evaluate the paleoenvironmental conditions. Species distribution may be influenced by salinity and geological influences as well as temperature (Aguirre et al., 2011). Only after through careful evaluation over a region with correlatable deposits do we regard it as a method to distinguish between deposits of different ages. Further details on this topic can be found in Aguirre (1992, 1993) and Aguirre et al. (2011, 2013, 2017).

We have made notes in the paper where the original study used taphonomy to distiguish the age of a deposit. Though in our database, we have not used it as a basis for discriminating between deposits in the absense of other numerical dating techniques.

> *Also regarding information from previous publications I found some examples of missing data worth including in the manuscript, and the incorrect communication or superficial interpretation of the original results and discussion on those results. See specific comments in the pdf file but please consider this through the entire manuscript.*

Response: In the subsequent section, we provide a summary of corrections and additions to the descriptions of sites. Please note that more detailed information on the sites exists in the WALIS database, so anyone interested can find it there.

> *An important concern is the use of mollusc shells for ESR and U/Th dating. Despite the authors provide some comments regarding the ages, I would expect a more detailed review on literature on this issue, and an explicit discussion on how much uncertainty ESR and U/Th ages represent for the main objective of this work.*

Response: We have added extra discussion on the uncertainties of ESR, the revised paragraph is below:

The details of ESR dating can be found in Rutter et al. (1990) and Schellmann and Radtke (1997, 1999). The main issue with ESR is that mollusc shells are not a closed system to uranium, so therefore it cannot be assumed that the uranium concentration was constant since deposition (Radtke et al., 1985; Schellmann and Radtke, 1999). As a result of this problem, Schellmann and Radtke (1997) recommended using the "early uptake" model for determining the age. Under this hypothesis, most of the uranium was taken up in the shell within the first 10 000 years of deposition. Although this approach will give younger ages than the commonly used "linear uptake" model, Schellmann and Radtke (1997) regarded it as being more accurate. All of the ages in this database use the early uptake model. The early ESR dates (Radtke, 1989; Rutter et al., 1990) are not reported with an uncertainty, so we use a value of 15% of the age, as recommended in those studies. Schellmann and Radtke (1999) tested their methods on a number of articulated shells from a deposit in Camarones, and showed a large spread in ages (between 92–171 ka), which demonstrated the care that must be taken in interpreting the results of ESR dating. Due to the uncertainty on the uranium uptake history of shells, it is not possible to use this method to distinguish between substages in MIS 5, even if the reported ages indicate ages that are younger than MIS 5e.

And also for U/Th:

The U/Th dating done by Radtke (1989) was accomplished using mass spectrometry. The measurements were done at three laboratories, University of Cologne, University of Heidelberg and McMaster University. The University of Cologne laboratory corrected for excess thorium using the formula $-(^{232}\text{Th} \times (3\text{ppm U}/12\text{ppm Th}) \times 0.378)$ if the thorium was in excess of 0.3 ppm. This corrected value was preferred by Radtke (1989). Rostami et al. (2000) reported U/Th analysis on shells using alpha spectrometry. The ages were generally consistent with ESR dates from the same deposits. Pappalardo et al. (2015) also used this method for dating shells, using mass spectrometry and also returned dates that were consistent with ESR dating. As with ESR dating, the reliablity U/Th ages of mollusc shells are questionable since they are not closed systems for uranium (Radtke et al., 1985). When Radtke et al. (1985) compared ESR and U/Th ages of the same shells, they found that the similarity between the two methods was species dependent, and for some the measured ages could be very different from independently derived ages of deposits. Deriving accurate ages from mollusc shells using this method requires careful analysis of the uranium uptake history of the shell (*i.e.* using the ICPMS method), and precise and accurate dates may not be possible without it (Eggins et al., 2005). As a result, shells dated using the U/Th method in the study area provide can only provide a general assignment to MIS 5, and are not precise enough to determine a specific substage.

> *Also regarding the ages based on molluscan shells, in the database, column O or Material type should include the species name and not "mollusc shell", "mollusc or algae", "sea snail" or others. If this information is available in the original source it is important to include it on the database.*

Response: The descriptions in the "Summary RSL from stratigraphy" tab in the WALIS database is just a generalized reference to the material dated. In the tabs with the details on the dated material, there are columns for specifically what was dated. The species are listed in column AJ in the U/Th tab, column K in the AAR tab, and column CO in the ESR tab.

I find that the authors must explain the presence of figure 11 (and related text), and why is it relevant to include a sea level plot at two points in the Holocene that was not contrasted with the corresponding sea level proxies.

Response: We have included this as part of the discussion on the debate on whether the relatively high elevation sea level indicators could be explained by GIA alone. We have added two sentences to the third paragraph of section 6.4.2 to elaborate. Doing a full comparison of Holocene sea level indicators is a massive project that is beyond the scope of our database description paper.

A publicly available ice sheet reconstruction that spans from the penultimate glaciation to present (which includes the Last Interglacial) does not currently exist. However, it is possible to make inferences on the magnitude of GIA-induced variations on the southeastern South American sea level after the ice sheets reached their present extent in the mid-Holocene.

Finally, I included many other detailed comments regarding the text, figures and tables in the pdf file of the preprint.

Response: Response to these comments are in the following section.

3 Comments from the Paper

In this section, we specifically reply to comments in the text of the paper. The line numbers refer to the line number in the original submitted document.

Title: *capital letter*

Response: "Last Interglacial" has been capitalized here and elsewhere in the document.

Line 8: *14C should be included here at least providing minimum ages.*

Response: We have modified the sentence to read:

Many coastal deposits are correlated to MIS 5e solely because they form the next highest terrace level above the Holocene highstand; however, dating control exists for some landforms from amino acid racemization, U/Th (on molluscs), electron spin resonance (ESR), optically stimulated luminescence (OSL), and radiocarbon dating (which provides minimum ages).

Line 15–16: *add some more references*

Response: We added additional references to Kopp et al. (2009) and Rovere et al. (2016).

Line 16–18: *Either two more interstadials (MIS 5c and MIS 5a) or four more substages (adding MIS 5d and MIS 5b). Please correct.*

Response: We have sought to clarify the definitions of the substages by rewriting the two sentences as follows.

MIS 5e represents one substage within MIS 5 (about 130-71 ka), which is defined by relative peaks and troughs of deep sea bethic δ^{18}O proxy records (Emiliani, 1955; Shackleton, 1969) (Fig. 1). Within MIS 5, there are two stadial events when relative sea level reached a relative highstand, MIS 5c and MIS 5a, but have lower sea-level peaks (-24 to +1 m and -22 to +1 m, respectively) than MIS 5e (Creveling et al., 2017).

Line 27–29: *How much bias does this incorporates to the database? Is other evidence considered (such as the warmer appearance of fossil taxa) to support or discard a MIS 5e assignment?*

Response: We only included sites when there was at least some numerical dating control (even minimum ages). We have added the following to this paragraph:

Many of the studies on shoreline deposits described in this database gave support of MIS 5 substage assignment based on comparing the abundance species of molluscs to infer paleo-water temperatures (*e.g.* Aguirre et al., 2006; Martínez et al., 2016). We have decided in our database to only include deposits that have numeric age control and assigned a MIS 5 (or MIS 3, see Section 4.5) age by the original authors and only use faunal evidence if used by the original authors. We acknowledge that due to the imprecision of the dating methods that the deposits may represent a MIS 5a or MIS 5c highstand, or even the Holocene or pre-MIS 5 highstands.

Line 67: *fig. and Fig. is found in the text. Use one format.*

Response: The "Fig" has been capitalized throughout the document.

Line 103: *Why is 20% uncertainty choosed?, and not 15% or 25%? Please explain.*

Response: The 20% value is what is suggested in Rovere et al. (2016), so this is the value that we used. A reference to Rovere et al. (2016).

An additional 20% uncertainty (a value recommended by Rovere et al. (2016)) was added to altimetric measurements since this method is less reliable than levelling or differential GPS, and results can vary depending on atmospheric conditions.

Line 121–123: *Excellent preservation in this case is referred to the articulation of the valves? Be careful as for the confident application of dating techniques the shells selected should have no signs of chemical alteration. This is misleading.*

These methods have been questioned for molluscan shells despite "excellent preservation"

Response: We have changed the text here to be more conservative.

Marine shell fossils (Fig. **??**), often still articulated, are abundant in many shoreline deposits. AAR, ESR and U/Th techniques can provide a confident MIS 5 age assignment provided there has been limited chemical alteration.

Line 180: *Also Rojas and MartÃnez (2016).*

Response: The reference has been added.

Line 201: *Add previous references too.*

Response: References have been added, including Aguirre and Whatley (1995), Martínez et al. (2016) and Rojas and Martínez (2016).

Line 215: *There is another publication containing depositional information that the authors may find useful in Rojas, A., Demicheli, M. & Martinez, S. 2018. Taphonomy of the Late Pleistocene marine molluscan assemblages from Uruguay. Neues Jahrbuch fur Geologie und Palaontologie - Abhandlungen 289 (2): 217-235.*

Response: A reference to Rojas et al. (2018a) has been added to the La Coronilla and Zagarzazú sections. See below for modifications. We have also updated the information in the database.

> Line 215: *There is another publication containing depositional information that the authors may find useful in Rojas, A., Demicheli, M. & Martinez, S. 2018. Taphonomy of the Late Pleistocene marine molluscan assemblages from Uruguay. Neues Jahrbuch fur Geologie und Palaontologie - Abhandlungen 289 (2): 217-235.*

Response: A reference to Rojas et al. (2018a) has been added to the Uruguay subsections. See below for modifications. The reference has also been added to the database.

> Line 223–224 (Zagarzazú): *This work also refers to a 14C dating result obtained from bivalves in life position for this locality. Add the information.*
>
> *In fact OSL supports a MIS 5a deposit. Please consider carefully the information discussed in the cited publication that also takes into account the presence of warm water taxa as mentioned in line 220 for La Coronilla.*

Response: This information has been added, and this paragraph now reads:

Rojas and Martínez (2016) and Rojas et al. (2018a) described a thin (0.5 m) exposure of marine sediments at the modern coast containing shells in living position. A radiocarbon date from this site yielded a minimum limiting date, while an OSL date supports a MIS 5a age assignment. The marine limiting elevation is 0.50±0.53 m. An analysis of the fossil shell species indicated that conditions were more saline than present, but since there were fewer warm water species than the La Coronilla section, they concluded MIS 5a age was more likely (Rojas and Martínez, 2016).

> Line 226–231 (Puerto de Nueva Palmira): *No thickness is mentioned as for the above deposits, despite present in the cited research.*

Response: This information has been added, and this paragraph now reads:

Marine deposits, interpreted as having been deposited in a proximal, wave dominated environment, at Puerto de Nueva Palmira were described by Martínez et al. (2001), Rojas and Martínez (2016) and Rojas et al. (2018a). The deposit (about 1.5 m thick) contained disarticulated, randomly oriented shell fossils. Martínez et al. (2001) collected two minimum age radiocarbon dates from this deposit, but interpreted the deposit as being from the Last Interglacial on the basis of marine fauna indicating a relatively warm environment. Rojas and Martínez (2016) reported an OSL date of 80.7±5.5 ka, which suggests an MIS 5a assignment, but they were cautious on assigning a specific substage of MIS 5 for the deposit. From the species present, they suggested that the environment was not necessarily warmer than present, and an MIS 5a assignment is plausible. This deposit gives a marine limiting elevation of 12.5±2.8 m.

> Line 255 (Ezeiza): *MartÃnez et al. (2016) concluded that the deposit belongs to MIS 5e. Please cite previous works correctly.*

Response: Changed it to say "MIS 5e".

> Line 307 (Colorado River Delta): *Charo et al. (2015) assigned to MIS 5e several localities with molluscan assemblages.*
>
> *Charo, M. P., Fucks, E. E. & Gordillo, S. 2015. Late Pleistocenee-Recent marine malacological assemblages of the Colorado River delta (south of Buenos Aires Province): Paleoecology and paleoclimatology. Quaternary International, 377: 52-70.*

Response: We have added the following to this section:

Charó et al. (2015) investigated the faunal composition at sites they interpreted to be MIS 5e, and found the faunal content was similar to Holocene deposits. Since they did not present any numerical dating, there is not enough information to include these sites in the database.

> Line 315 (Bahía Anegada): *As mentioned for other localities, molluscan assemblages assigned to MIS5e were studied by Charo, M. P., Fucks, E. E. & Gordillo, S. 2013. Moluscos marinos bentonicos del Cuaternario de BahÃa Anegada (sur de Buenos Aires, Argentina): variaciones faunÃsticas en el Pleistoceno tardÃo y Holoceno. Revista Mexicana de Ciencias Geologicas, 30 (2): 404-416.*

Response: We have added the following to this section:

Charó et al. (2013a) furthern analyzed the faunal content and found a higher abundance of species in the deposits attributed to MIS 5e, which they interpreted to indicate warmer water conditions.

> Line 330 (San Blas): *Also Charo et al. (2013) reported on molluscan taxa from several localities which they considered MIS 5e. Charo, M. P., Gordillo, S. & Fucks, E. E. 2013. Paleoecological significance of Late Quaternary molluscan faunas of the Bahia San Blas area, Argentina. Quaternary International, 301: 135-149.*

Response: We have added the following to this section:

Charó et al. (2013b) compared the faunal content of shoreline deposits attributed to MIS 5e and the Holocene in the San Blas area. Due to the presence of *C. rhizophorae*, they interpreted the conditions to be warmer in the MIS 5e deposits, although overall the species content was simliar. Since these deposits do not have numerical ages, we do not include them in the database.

> Line 347 (San Antonio Oeste): *Which reference corresponds to this locality?*

Response: We have added references (Rutter et al. (1989) and Radtke (1989)).

> Line 365 (Puerto Lobos): *In other previous work (e.g. Pastorino 2000; Aguirre et al. 2008) interesting comments on the presence of molluscan species relevant to the paleotemperature reconstruction are provided.*

Response: We have added these two references and elaborated:

Pastorino (2000), Aguirre et al. (2008) and Boretto et al. (2013) provided additional information on the mollusc fossils from these deposits. Notably, the deposits attributed to MIS 5e in Puerto Lobos provide the most robust evidence of warmer ocean conditions of any site in Patagonia (Aguirre et al., 2008).

> Line 412 (Camarones): *Aguirre et al. (2006) studied the molluscan fauna of several marine terraces from this locality. Please add some comment on this.*

Response: We have added a paragraph:

Aguirre et al. (2006) investigated the fauna composition of the shoreline deposits in Camarones. They did not find any significant difference in the fauna content between the deposits attributed to MIS 5 and the Holocene. The interpretation they gave was that there was not a significant difference in the environmental conditions.

Line 429 (Bahía Bustamante): *Aguirre et al. (2005) studied the molluscan assemblages from this site. Please add a comment.*

Response: We have added a paragraph:

Aguirre et al. (2005b) investigated the faunal content of deposits in the Bahía Bustamante area. They found that there was not a significant difference in species found in deposits attributed to MIS 5 compared to the modern species. Therefore, they concluded that there was likely similar environmental conditions.

Line 470 (San Julián): *?*

Response: We fixed the grammatical error here.

Line 482 (San Julián): *The molluscan species dated were not mentioned in the majority of the sites compiled. Make this uniform. Also I noted this Mytilus sp. dated by U/Th is missing from Table 5.*

Response: We have removed the reference to the shell species here to be uniform with the other sections. We have added U/Th to the entry to *Mytilus Sp.* to Table 5.

Line 509 (Further details)*: In fact, there are other surveys on the fauna of the northern provinces as well, but they are not mentioned either in the corresponding sections or here. This should be fixed.*

Response: We have gone through the literature of faunal surveys more thoroughly and added them to the paragraph:

There are extensive surveys of fauna diversity at many MIS 5 sites, including in Uruguay (Martínez et al., 2001; Rojas and Martínez, 2016; Rojas and Urteaga, 2011; Rojas et al., 2018b,a), Pilar (Fucks et al., 2005), Ezeiza (Martínez et al., 2016), Magdalena (Aguirre and Whatley, 1995), Colorado River Delta (Charó et al., 2015), Southern Buenos Aires Province (Fucks et al., 2012), Bahía Blanca (Aliotta et al., 2001), Bahía Anegada (Charó et al., 2013a), San Blas (Charó et al., 2013b, 2018), San Antonio Oeste (Bayer et al., 2016b,a), R'io Negro and Chubut provinces (Pastorino, 2000), Santa Cruz Province (Aguirre et al., 2009), Camarones area (Aguirre et al., 2006), Bahía Bustamante (Aguirre et al., 2005b), Caleta Olivia (Aguirre, 2003), Puerto Lobos (Aguirre et al., 2005a; Boretto et al., 2013), Tierra del Fuego (Gordillo and Isla, 2011; Gordillo et al., 2010, 2013), Patagonia and Tierra del Fuego (Aguirre et al., 2008), and southeastern South America (Aguirre et al., 2011).

Section 6 (Further details)*, noted on lines 515–521: These seem to be out of the scope of the present manuscript. I suggest deleting them.*

Response: The reviewer has questioned why these sections are in the paper. These sections were requested by the architects of the WALIS database to give a brief overview of other paleo sea level topics in the study area, and to document any research questions and debates with regards to Last Interglacial. This is not articulated in the original paper, so we have changed the title to "Further details on paleo sea level", and added a new paragraph to introduce it.

In this section, we highlight some details on topics of interest to those investigating Last Interglacial sea level in southeastern South America. Of particular note are the extensive surveys of the faunal content the shoreline deposits, the existence of Holocene and pre-MIS 5 shoreline deposits that are elevated

compared to present sea level, and the debate on why Last Interglacial sea level indicators in the study area are elevated compared to low latitude areas.

We have also added some additional references to the Other interglacials and Holocene sections. The other interglacials section now reads:

Many of the studies that investigated and dated MIS 5 shorelines also reported older deposits at higher elevations. Some of these have been correlated to MIS 7, 9 and 11 on the basis of ESR and U/Th dates (Schellmann, 1998; Rostami et al., 2000; Schellmann and Radtke, 2000; Pappalardo et al., 2015). Pre-Quaternary raised shoreline deposits have been confidently dated in the study area via strontium dating methods, including early Pliocene (del Río et al., 2013; Rovere et al., 2020), late Miocene (del Río et al., 2013; del Río et al., 2018), and Miocene/Oligocene (Parras et al., 2008, 2012; Cuitiño et al., 2015b,a).

And the Holocene section now reads:

No standardized compilation of Holocene sea level indicators has been completed. However, one is in development (T. Shaw, *pers. comms*). Previous papers that have comprehensively reviewed Holocene sea level for southeastern South America include Rostami et al. (2000) and Schellmann and Radtke (2010).

> Line 511 (Further details)*: References for Uruguay are missing.*

Response: We added a reference to Martínez et al. (2016) here.

> Line 513 (Last Interglacial sea level fluctuations)*: Then, why they are still used to assign to the MIS 5e several records presented here? Please explain.*

Response: This section was part of the template for the WALIS database paper. We have added an uncertainty range (1000s to 10000s of years) to the sentence, and added some details for clarity. The section now reads:

The Last Interglacial lasted approximately 15 000 years. The analytical precision of the ESR and U/Th methods on mollusc shells from deposits attributed to the Last Interglacial in the study region is 1000s to 10 000s of years. This limits the applicability of these methods for discerning sea-level oscillations within the Last Interglacial.

> Line 525 (Controversies)*: The limitation of the method is an explanation that can be found in many publications, especially for some of the standard radiocarbon datings available in the literature. However, it is not true for the cited research. Please read carefully the discussion provided in the paper by Martinez et al. (2016).*
>
> *In addition, 14C datings have been considered minimum ages because of other evidence. The elevation of the deposits and the paleoenvironments inferred by means of the fossil assemblages do not fit with the MIS 3 scenario.*

Response: The sentence in question has been deleted.

> Line 535 (Tectonic uplift or glacial-isostatic adjustment of Argentinian shorelines)*: Uruguayan shorelines are not mentioned here although they are part of the manuscript.*

Response: This section was completed before we decided to include Uruguayan shoreline deposits (since another member of our team is working on Brazil, so we did not want a gap in the WALIS database). Unfortunately we neglected to update the section prior to submission. We now refer to the section as "southeastern South America".

Line 550 (Tectonic uplift or glacial-isostatic adjustment of Argentinian shorelines)*: Why is this included in the present manuscript?*

Response: This section shows a demonstration that GIA is a likely cause of higher than average sea level within the Holocene, and therefore is a plausible cause of higher than average sea level in the Last Interglacial. Therefore, we wish to include this section in the paper.

Line 550 (Tectonic uplift or glacial-isostatic adjustment of Argentinian shorelines)*: This was at least considered in several previous publications.*

Response: When a shoreline deposit has been correlated to other points in MIS 5 rather than MIS 5e by the original authors, it has been noted the database and the descriptions in Section 5.

Line 572–573 (Future research directions)*: Explain better.*

Response: We have added a sentence here:

Specifically, these deposits have been described as estuary deposits, with no indication of the relative water depth the deposits form, making them marine limiting indicators.

Figure 7*: Magdalena and Puente de Pascua are far from their black circles*

Response: The figure will be edited in the revised paper.

Figure 8*: Provide names for all of them.*

Response: Some locations have multple sites within the vicinity of the named town or geographical feature.

Figure 10*: I suggest a larger figure.*

Response: The figure is now set to be 12 cm (the maximum width of figures in this journal).

Figure 10*: and Uruguay?*

Response: This has been changed to read "southeastern South America".

Figure 10*: why is the map distorted?*
Does this figure include only Argentinean data points?

Response: The map was squished to save space, but now it has been adjusted to be less distorted. It has also been expanded so that it includes Uruguay.

Figure 10*: Why are this Holocene curves included?*

Response: There are no publicly available ice sheet reconstructions that span MIS 6 to present. This figure is a schematic to demonstrate the variability of the elevation and timing of the Holocene high stand due to GIA, as described in Section 6.4.2.

Table 3*: How is the age quality assigned? Especially, for example a 3 is given to U/Th datings although this method has limitations when applied to mollusc shells. Please explain.*

Response: The quality score information is available in the documentation of WALIS. However, we now include these tables into the papes (see below).

Table 1: Quality scores for RSL, from the WALIS documentation

Description	Quality rating
Elevation precisely measured, referred to a clear datum and RSL indicator with a very narrow indicative range. Final RSL uncertainty is submetric.	5 (excellent)
Elevation precisely measured, referred to a clear datum and RSL indicator with a narrow indicative range. Final RSL uncertainty is between one and two meters.	4 (good)
Uncertainties in elevation, datum or indicative range sum up to a value between two and three meters.	3 (average)
Final paleo RSL uncertainty is higher than three meters	2 (poor)
Elevation and / or indicative range must be regarded as very uncertain due to poor measurement / description / RSL indicator quality	1 (very poor)
There is not enough information to accept the record as a valid RSL indicator (e.g. marine or terrestial limiting)	0 (rejected)

Table 2: Quality scores for Age, from the WALIS documentation

Description	Quality rating
Very narrow age range, e.g. few ka, that allow the attribution to a specific timing within a substage of MIS 5 (e.g. 117±2 ka)	5 (excellent)
Narrow age range, allowing the attribution to a specific substage of MIS 5 (e.g., MIS 5e)	4 (good)
The RSL data point can be attributed only to a generic interglacial (e.g. MIS 5)	3 (average)
Only partial information or minimum age constraints are available	2 (poor)
Different age constraints point to different interglacials	1 (very poor)
Not enough information to attribute the RSL data point to any pleistocene interglacial.	0 (rejected)

Table 5*: Be careful with this. For example, in the first record, A. brasiliana clearly corresponds to Anomalocardia brasiliana, as the genus was already mentioned earlier in the original paper. Not considering this, adds an unnecesary uncertainty that the authors should avoid. Probably for T. plebeius occurs the same. Please correct.*

Response: We have added the full species name, *i.e. Anomalocardia brasiliana* and *Tagelus plebeius.*

Table 5*: This table should include the original publications from which the ages were obtained.*

Response: All of the references can be found in the WALIS database, as well as the associated descriptions in Section 5.

Best Regards,
Evan J. Gowan (on behalf of the authors)

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