

Comment on:

G. WENZENS 2005: Glacier advances east of the Southern Andes between the Last Glacial Maximum and 5,000 BP compared with lake terraces of the endorrheic Lago Cardiel (49 S, Patagonia, Argentina). Z. Geomorph. N. F. 49: 433–454.

by

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Introduction

The article by Wenzens describes in great detail the geomorphic features in Southern Patagonia between latitudes 46°S and 50°S, focusing on radiocarbon dating moraine sequences. The information he provides is impressive, especially knowing how difficult fieldwork can be in this region. The presented results will help to clarify the glacial-climatic history in southernmost South America especially during early Holocene times when the occurrence of glacial advances is still controversially debated (see DOUGLASS et al. 2005).

Based on the mapping of the outwash plains of the Belgrano Glacier and Sierra de Sangra lobe as well as the fluvial terraces in the Río Chico valley, Wenzens claims a meltwater input into the Cardiel basin through the Tres Lagunas dry valley during the last glacial maximum (LGM). He further links the radiocarbon ages of the six glacier advances with the set of shorelines that encircle the modern Cardiel basin. In this comparison, Wenzens unfortunately ignores and re-interprets critical information about Lago Cardiel's past lake level, accumulated by thorough analysis of shoreline data (STINE & STINE 1990), seismic data and multi-proxy sediment core analysis published in detail by GILLI et al. 2001, 2005 A and MARKGRAF et al. 2003.

Lake level lowstand of Lago Cardiel during the last glacial maximum

WENZENS (2005) claims a high lake level of +175 m in the Cardiel basin during the LGM. According to Wenzens' view the lake level subsequently dropped reaching the modern shoreline around ~7,000 ¹⁴C yr BP. The intermediate shore terraces are linked to five dated glacier advances. This proposed lake evolution of Lago Cardiel is in contradiction with the results of 3 independent studies reconstructing the past lake level fluctuations. All three studies document a general pattern with a low lake level during the LGM followed by a short desiccation interval around 11,000 ¹⁴C BP and a large transgression in the early Holocene.

1. Seismic imaging of the subsurface of Lago Cardiel (GILLI et al. 2005A) mapped a full glacial to late glacial sediment package (Sequence IV) that was only deposited in the deepest part of the basin below a water depth of 76 m. This Sequence IV consists of a 20 m-thick internally conformable sedimentary succession that is horizontally layered onlapping laterally the substratum. By applying the concepts of seismic sequence stratigraphy, Sequence IV represents undoubtedly a lake level lowstand. Furthermore, no erosional unconformity occurs within this unit as would be expected if drastic lake level changes would have occurred during that period. Recovered sediments from the top of Sequence IV consist of coarse sandy layers intercalated with layered clays, woody debris and plant fragments, indicating a desiccation interval. A radiocarbon date on a piece of wood from this core section dates the end of the low lake level to around 11,220 ^{14}C yr BP. Extrapolating the existing age model (GILLI et al. 2005B) for the entire Sequence IV, the lake level of Lago Cardiel likely stayed low at least back to 35,000 cal yr BP. Furthermore, the lakewide erosional unconformity that underlies Sequence IV clearly documents that Lago Cardiel completely dried out prior to deposition of Sequence IV.
2. Sediment and paleoenvironmental characteristics in cores retrieved close to the modern shoreline indicate – independently from the first study – a low lake level during the late Pleistocene. (MARKGRAF et al. 2003). The multiproxy analyses of these cores clearly document that the rising lake level reached the modern shore only shortly after 10,000 ^{14}C yr BP and stayed high during the early Holocene.
3. The early Holocene lake level highstand is best documented by STINE & STINE (1990). They also proposed two older highstand shorelines, but both are incompatible with Wenzens' interpretation of the evolution of Lago Cardiel. Stine and Stine's +75 m shoreline of subdued morphology was dated to be older than 30,000 ^{14}C yr BP and hence cannot correspond to the second late glacial glacier advance around 11,800 ^{14}C yr BP as suggested by WENZENS (2005). A ~20,000 ^{14}C yr BP age transgression phase reaching neither the +30 m nor the +55 m shoreline (STINE & STINE, 1990) is also conflicting with Wenzens' interpretation of a high lake level during full or late glacial times.

All these evidences are in contradiction with Wenzens' view of a high lake level exceeding an elevation of +55 m between ~18,000 and 9,500 ^{14}C yr BP (WENZENS 2005; Fig. 11). Unfortunately, Wenzens does not provide any direct dating of these older shorelines and therefore the linkage between the observed glacier advances and the Cardiel' shoreline terraces remains speculative.

The fluvial character of the Tres Lagunas valley is indeed striking and a possible inflow and/or drainage between the Lago Cardiel basin and the Río Chico valley could have occurred in the distant past. But more research is needed to constrain the timing of this possible drainage path. For the understanding of a possible inflow through the Tres Lagunas valley the geomorphological evolution of the Río Chico valley has to be further explored. This ultimately determines whether meltwater could drain through the Tres Lagunas valley into Lago Cardiel rather than a change in the amount of meltwater by moving the continental divide in the Sierra de Sangra area.

The observed initial Holocene increase in precipitation is – in contrast to WENZENS (2005) claims – seen in many vegetation records from southern South America and Tierra del Fuego (e. g. ASHWORTH et al. 1991, MARKGRAF 1993, BRADBURY et al. 2001, PENDALL et al. 2001, HUBER et al. 2004).

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