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# THE SEDIMENTARY RECORD OF LAGUNA MAR CHIQUITA, CENTRAL ARGENTINA, AS AN ARCHIVE OF RECENT FLUCTUATIONS IN THE HYDROLOGICAL CYCLE

E. Piovano<sup>1-2</sup>, S.D. Moreira<sup>3</sup>, J.A. Morales<sup>4</sup> and D. Ariztegui<sup>1</sup>.

<sup>1</sup>Geologisches Institute, ETH-Zentrum, 8092 Zürich, Switzerland. <sup>2</sup>CIGES, Universidad Nacional de Córdoba, 5000 Córdoba, Argentina. <sup>3</sup>Radioprotection Department - IPEN, 05422-970, São Paulo, Brasil. <sup>4</sup>Universidad de Huelva, 2189 Huelva, España

Laguna Mar Chiquita is a closed, saline lacustrine basin located in the Pampean plain of central Argentina (30°54'S – 62°51'W). Today this shallow lake (maximum 9 m) has a well-mixed water column with permanent anoxic bottom waters (Martinez et al., 1994). It occupies a tectonic depression of Middle Pleistocene age (Kröling and Iriondo, 1999) and, therefore, it

provides an ideal setting to obtain long climatic records for this region of South America.

Dramatic water-level-fluctuations characterize the recent lake history defining conspicuous low and high stands (Fig. 1). Within a six years interval both maximum depth and lake surface increased from 4.0 m and 1,980 km<sup>2</sup> in 1977, to 9.0 and 5,800 km<sup>2</sup>, respectively, whereas the salinity changed from 77 to 30 g L<sup>-1</sup> during the same period (Martinez et al., 1994). Moreover, high salinity values have been reported throughout almost the entire XX century: 360, 291 and 270 g L<sup>-1</sup> for the years 1911, 1953 and 1970, respectively. The last quarter of the century was characterized by substantially lower salinity values in coincidence with comparatively higher lake water stands.

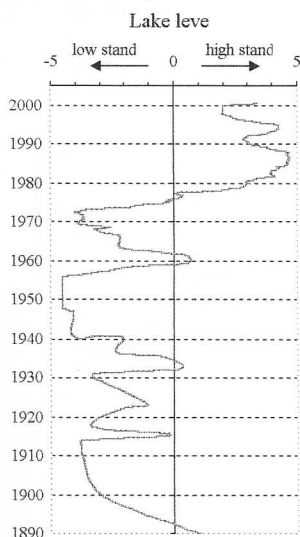


Fig 1. Lake-level fluctuations.

Three sedimentary cores were retrieved in 1997 using a Beeker-type sediment sampler in order to first evaluate the sedimentological record and determine the most recent rates of sediment accumulation. Two cores (TMC-5 and TMC-14) were collected at 7 m depth in the main water body. An additional core (TMC-3) was retrieved from a small satellite lake. Concentration of radionuclides <sup>226</sup>Ra and <sup>210</sup>Pb were measured and further used to establish a robust chronology that in turn allowed the accurate calculation of sedimentation rates.

Pb-210 ages profiles (Fig. 2) remark that sedimentation rates varied according to the stage of the lake. The last high stand (i.e., 1976-1997) yields lower sedimentation rates ranging from 0.6 to 1.1 cm yr<sup>-1</sup>, whereas low stand intervals (e.g., 1973-1964) exhibits rates varying from 0.8 to 2.2 cm yr<sup>-1</sup>. However, long-term average sedimentation rates (ASR in Fig. 2) are lower when compared to recent rates. This could be attributed to diminishing or interruptions in the sedimentation during extreme low stands. Core TMC-3 shows a strong Pb-210 anomaly below the 36-38 cm interval and coincides with remarkably low stand years. The observed Pb enrichment could be attributed to a long sub aerial exposure of the lake floor.

Laminated muds dominate the lithology of the three cores. X-ray radiographies have revealed intervals of well-developed lamination with alternating light and dark colored laminae. This millimetric-scale feature is most probably produced by variations in the organic matter content as a result of seasonal changes in the productivity cycle of the lake. The lamination is further preserved due to the permanent water bottom anoxia. Some intervals of

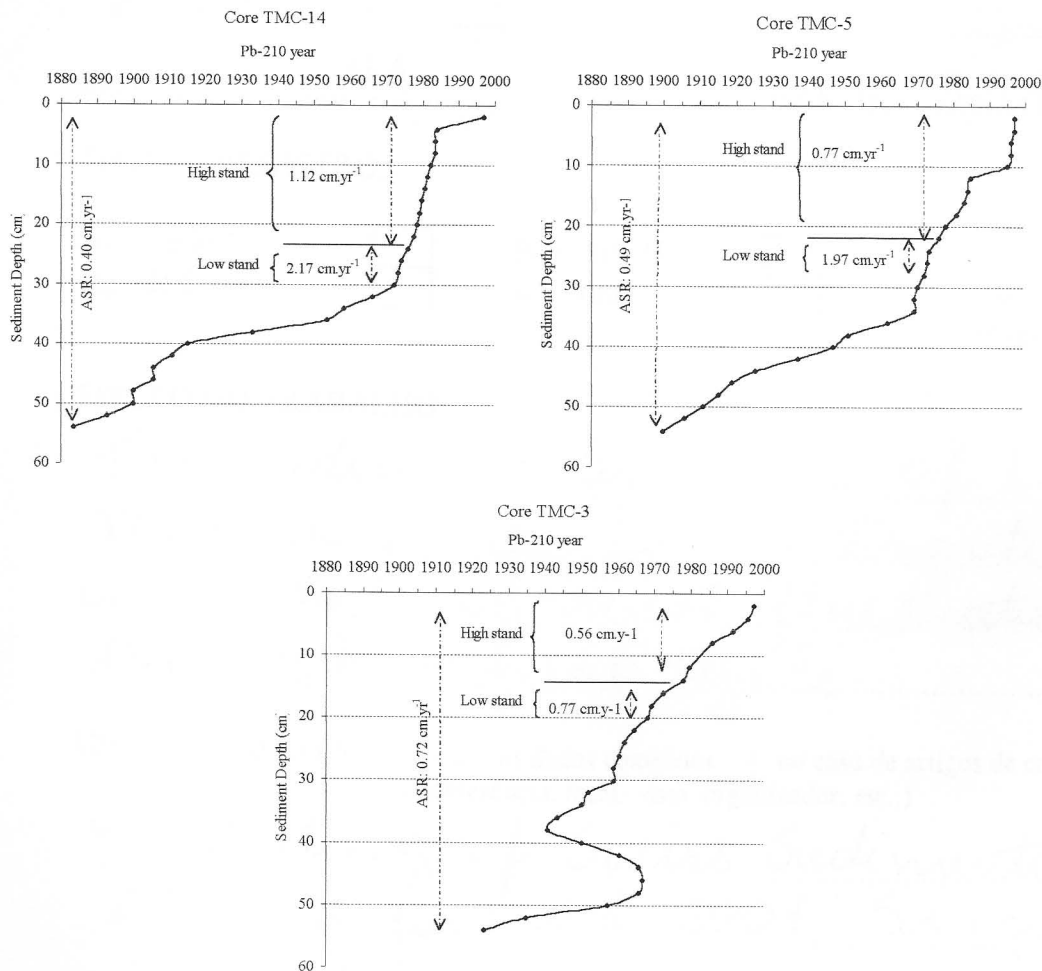
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the cores are, however, dominated by mostly light or dark laminae. Clustering of laminae is a response to changes in the organic matter production that are most probably related to long-term fluctuations in lake level.

The sedimentary cores taken in the main water body contain evaporites including gypsum, carbonates and halite. These evaporitic facies can be dispersed in the sediments or forming layers of up to 4 cm thick. Historical lake level data indicates that the age of evaporite-rich sediments correspond to years of low lake levels. Thus, the observed sedimentological and mineralogical changes combined with a reliable chronology provide a unique archive of recent changes in the Evaporation/Precipitation ratio at this latitude in the Southern Hemisphere. Ongoing research using a multiproxy approach will provide a more quantitative reconstruction and probably a solid base to obtain long cores.

Fig. 2. Pb-210 profiles.



#### References:

- Kröling and Iriondo, 1999. Upper Quaternary palaeoclimates of the Mar Chiquita area, North Pampa, Argentina. *Quaternary International* 57/58:149-163.
- Martinez, D., Gómez Peral M and Maggi, J., 1994. Caracterización geoquímica y sedimentológica de los fangos de la laguna Mar Chiquita, Provincia de Córdoba: aplicación del análisis multivariante. *Revista de la Asociación Geológica Argentina*, 49(1-2):26-38.