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Deciphering climate variability over the last 3 kyr in the geochemical record of Lake Jeinimini, Northern Chilean Patagonia

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XRF core scanner geochemical profile of a lacustrine sediment core was used to evaluate the climate variability of Northern Chilean Patagonia over the Last 3 Millennia. The lake Jeinimini (46°50'S, 72°00'W) is located in the region of Chile Chico in NW Patagonia. The core (161 cm long) was collected in 2014 at a water depth of 61 m. The sediment is mainly terrigenous, with a few diatoms and a low organic matter content (mean 2.5%, C/N ratio 16.7) of allochtonous origin. Visual descriptions and Scopix radiographies show that the sediment is finely laminated, made by light brown clayey silts and fine sands with a few centimetric coarser layers. Magnetic susceptibility highlights the presence of one 5 mm-tick tephra layer in the upper part of the core. The age model, based on 210Pb data, 137Cs and 4 radiocarbon ages measured on bulk sediments demonstrate that the core covers the last 2800 years with an average sedimentation rate of 0.7 mm/an. A multivariate statistical analysis of the raw XRF core-scaner data (performed at 2 mm resolution) allows to define 4 principal components. The first component represents 40% of the total variance. In this group, Al, Si, Ti, K, Fe are clustered and vary in an opposite way to S. We use the ratio between the detrital elements (Al, Si, Ti, K, Fe) to S to represent variations between detrital inputs and lake productivity. The average (Al, Si, Ti, K, Fe)/S ratio displays a high variability over the last Holocene, in agreement with general climate trend as reported by Markgraf et al. (2003) in lacustrine pollen record for this zone. In particular the changes are more rapid in two intervals, i.e. between 2800 and 2000 BP and between 600 and 150 BP. The intermediate interval is consistent with a dry and warm period evidenced in North Patagonia for instance in fjord sediments (1800-900 BP, Sepulveda et al., 2009). Likely Villalba (1994) evidenced a warmer interval ca.1000 BP from Andean tree-rings at 41°S. The upper interval is coincident with colder and moister conditions according to the same authors. At Northern latitude (33°S), an episode of very intense flood events was observed between 600 and 300 BP and interpreted by strong precipitation in relation with Westerlies winds (Jenny et al., 2002). The laminations reflect changes in the allochtonous sedimentary inputs, with high terrestrial inputs during wetter conditions in relation with the Westerlies. The geochemical record of Lago Jeinimini is consistent with regional climate changes. The evolution of average (Al, Si, Ti, K, Fe)/S ratio probably record flood-like events, bringing to the lake variable detrital supplies according to the precipitation rate. Our interpretation will be further constrained by a calibration of the uppermost sedimentary record with instrumental data from close meteorological stations and climate reconstruction for the last century.

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References

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