Interactions between precipitation and sea surface temperature in Northern Chilean Patagonia during the Late Holocene

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The climate of Chilean Patagonia is highly influenced by the Southern Westerlies, which control the intensity and latitudinal distribution of precipitation in the Southern Andes. In austral summer, the Westerly Wind Belt (WWB) is restricted to the high latitudes (> 47°S). It expands northward in winter, which results in a strong seasonal signal in precipitation between ~47 and ~30°S. In addition, the area is characterized by a steep latitudinal Sea Surface Temperature (SST) gradient, which reflects the regional influence of the Antarctic Circumpolar Current (ACC). Here, we present a new precipitation proxy record from the Chilean fjords at 45°S, and we compare our results with regional SST records to assess the ocean-continent interactions in Chilean Patagonia during the last 2 millennia. Our precipitation record is based on a high-resolution inorganic geochemical analysis of a 2m long sediment core from Quitralco fjord (45°S), using ICP-AES and XRF core scanning techniques. Since our coring site is located in front of a small river that drains the Patagonian Andes (Rio Pelu), it is particularly sensitive to changes in river discharge, and therefore precipitation. Our data demonstrates a significant increase in Fe/Al and Ti/Al between ~700 and ~50 cal. yr BP, which corresponds to a decrease in mean sediment grain-size from ~30 to ~20 μm. This shift is interpreted as a decrease in the energy of river sediment discharge, which most likely reflects a decrease in seasonal floods. The comparison of our precipitation record with published SST records from the region demonstrates that lower (higher) SSTs are systematically coeval with a decrease (increase) in seasonal floods in the Patagonian Andes. The decrease in seasonal floods at 700-50 cal. yr. BP corresponds to a SST decrease of ~1°C. We argue that the synchronicity of changes in precipitation and SST during the last two millennia likely reflects concomitant migration of the zonal systems, i.e., the WWB and the ACC.

Evolution of the macromolecular structure of biopolymers during pyrolysis: A C-XANES study

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Identifying traces of life in ancient rocks can be challenging as they may have experienced significant structural and chemical transformations during diagenesis and metamorphism. Natural organic matter may indeed evolve during fossilization processes and hence lose all chemical and textural information relative to its original precursor. Recently, advanced spectromicroscopy techniques have allowed evidencing that morphological, textural and chemical bio-signatures might be preserved in some contexts despite intense metamorphism [1,2], notably depending on the chemical nature of the organic precursor [3]. Synchrotron-based techniques are thus increasingly used to *in situ* characterize natural kerogens and study fossilization processes although standard data sets are still only scarcely available [4,5]. Therefore, information obtained from these recently developed techniques remains barely exploited.

Here, we have investigated the evolution of reference organic biocompounds more or less resistant to biodegradation (e.g. sporopollenin, lignin and cellulose) heat-treated at different temperatures up to 1000°C at ambient pressure using X-ray absorption near edge structure (XANES) spectroscopy at the Carbon K-edge. In addition to evidencing the differential evolutions of these precursors during carbonification and early steps of graphitization, quantitative information extracted from our results provide a calibration for the spectroscopic evolution of reference biocompounds with increasing temperatures. By providing new insights into the thermal evolution of the macromolecular structure of reference biopolymers, the present results constitute a new step towards better constraining the fate of natural organic matter during burial.

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