Paleoclimate variability of Southern Chile during the last 17,900 years reconstructed by organic geochemical properties (C/N, d13C) of Lago Puyehue sediments (40°S)

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Lago Puyehue is an oligotrophic moraine-dammed lake situated at the foothills of the Chilean Andes (40°S). Because of its location at the northern boundary of the southern westerly wind belt, this lake bears the potential to reveal important information about the past latitudinal migration of the westerlies. The sedimentary infill of the lake is characterized by volcaniclastic terrigenous particles mixed with important amounts of organic matter and biogenic silica. Sedimentological and paleoecological studies of Lago Puyehue sediments have previously demonstrated that the PU-II long core (11.22 m long), collected on a sublacustrine moraine ridge at 48 m depth, yields a continuous record of paleoclimate changes during the last 17,900 years. However, interpretations of paleoproductivity and organic matter concentrations were biased by the lack of data about the origin of the organic matter and the factors influencing the paleoproductivity of the lake. In this work, we present new elemental and isotopic geochemical data obtained every 10 cm on PU-II long core sediments using an elemental analyser coupled with an IR-MS. In order to characterize the sources of organic matter, samples of present-day terrestrial vegetation and lake plankton were also analysed. The results demonstrate that proportions of autochthonous and allochthonous organic matter in Lago Puyehue can easily be estimated using C/N ratios. For the last

17,900 years, the downcore record indicates that the sedimentary organic matter of Lago Puyehue is characterized by low C/N ratios, evidencing that it mainly originates from algal production. Carbon stable isotopes data show less negative values during the last deglaciation (17,000 - 13,500 cal. yr. BP) and during the mid-Holocene (7500 - 4500 cal. yr. BP). This could reflect periods of enhanced algal productivity due to high nutrient supplies related to (1) the melting of the north Patagonian ice cap during the last deglaciation and (2) a period of high precipitation during the mid-Holocene. Results are compared with previously published sedimentogical (inorganic geochemistry, grain size, biogenic silica concentration, varve thickness) and paleoecological (diatoms, pollens) data and they are used to improve the understanding of paleoclimate changes in South America since the Last Glacial Maximum.