



ORGANIC CARBON SOURCES ACROSS SALINITY GRADIENTS IN CHILEAN FJORDS: RELONCAVÍ FJORD (~41°S) AND SOUTHERN PATAGONIAN ICE FIELDS AREA (~48°S)

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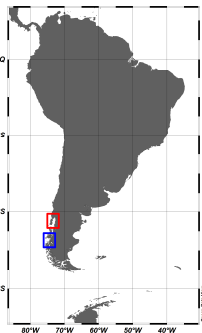
ABSTRACT

The organic matter preserved in marine sediments contains contributions of allochthonous and autochthonous and variable source inputs. Allochthonous sources are terrestrial erosion (including anthropogenic material) of relatively labile and refractory material, while autochthonous sources are mainly marine phytoplankton. This study intend to establish the sources of the organic matter (allochthonous/autochthonous) and how organic carbon is distributed along salinity gradients. We examined organic carbon/nitrogen molar ratio (C/N ratio), organic carbon isotopic composition ($\delta^{13}C$) and leaf waxes (long chain n-alkanes from $n-C_{24}$ to $n-C_{34}$) in surface sediments from two continuous systems: river-fjord-ocean in Northern Patagonia (41°S-43°S), and glacier-fjord-ocean in central Patagonia (47°S-50°S). The continental inner fjord areas are characterized with sediment enriched in allochthonous organic carbon characterized by high C/N ratio (8-12) and low $\delta^{13}C$ values (-23‰ to -26‰). Towards the Pacific Ocean (open sea), low C/N ratio (6-7) and high $\delta^{13}C$ values (-20‰ to -22‰) are interpreted as a prevalent autochthonous marine source. Estuarine waters with salinity between 2 psu and 30 psu were associated with high C/N ratio and low $\delta^{13}C$ values together with odd over even long-chain n-alkane predominance ($n-C_{31}$, $n-C_{29}$ and $n-C_{27}$) in surface sediments. All geochemical proxies suggest a great contribution of terrigenous organic carbon of glacier origin delivered by rivers. Our study provides a framework to guide future research on environmental and climate change on these still pristine ecosystems.

STUDY AREA

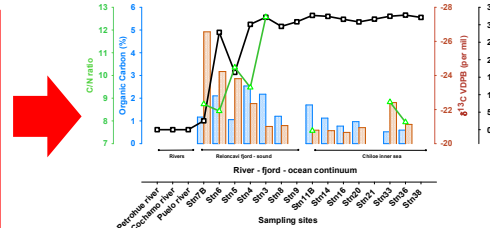
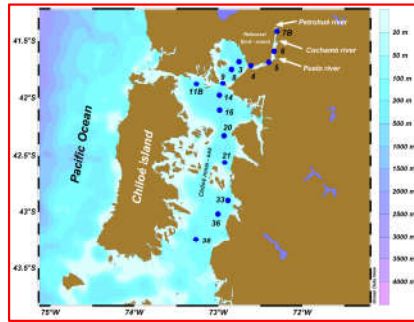
Northern Patagonia (~41°S)

Ice fields of Patagonia (~48°S)

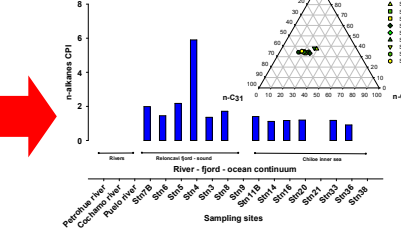


2- MAIN RESULTS

Northern Patagonia (~41°S)



Distribution of C/N ratio, organic carbon, and isotopic composition of organic carbon ($\delta^{13}C$), in surface sediments of Northern Patagonia (up) and Ice fields of Patagonia (down). Black lines represent the surface water salinity.



Distribution of the odd/even carbon number preference index (CPI) of long-chain n-alkanes in surface sediments of Northern Patagonia (up) and Ice fields of Patagonia (down). Ternary plots represent the abundance of predominant n-alkanes ($n-C_{31}$, $n-C_{29}$ and $n-C_{27}$) in surface sediments of study area.

The C/N ratio and $\delta^{13}C$ in surface sediments evidence clear differences between Reloncaví fjord - sound (influenced by freshwaters) and the Chilóe area more exposed to the influence of the ocean.

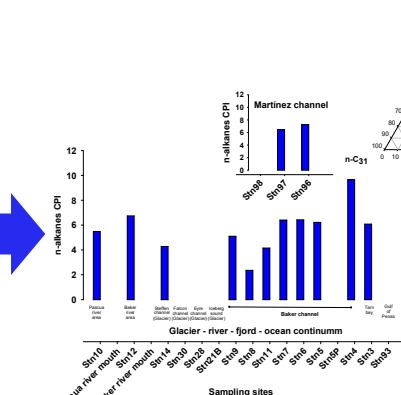
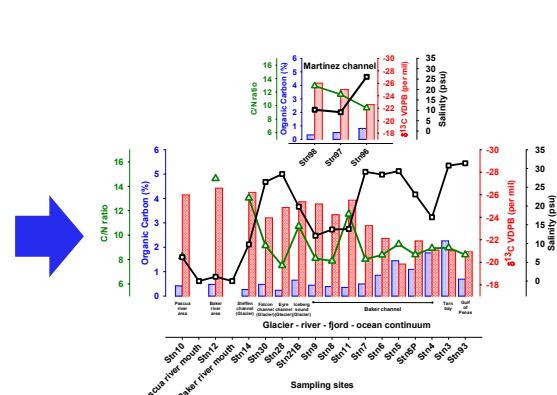
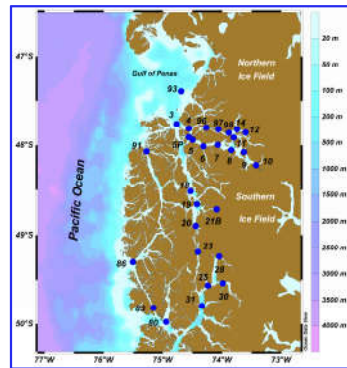
The C/N ratios in Reloncaví fjord - sound area ranged between 8.4 and 12.5, consistent with depleted values of $\delta^{13}C$, which varied between -26.5‰ and -21.0‰. In contrast, C/N ratio and $\delta^{13}C$ values in Chilóe inner-sea area were <9 and with enriched 13-carbon >-22 ‰, respectively.

The C/N ratio and $\delta^{13}C$ values in surface sediments are consistent with Silva et al. (2011) and the suspended particulate matter results found on this area (not shown here).

The CPI values (1.3 - 5.9) indicated odd over even predominance of long-chain n-alkanes in Reloncaví fjord - sound sediments, suggesting terrestrial input mainly from soils and vascular plants (Douglas and Eglinton, 1966). On the other hand, the lowest CPI values (<1.0) in surface sediments of Chilóe inner-sea suggest input of degraded material and/or anthropogenic sources (Bugge et al., 2010).

The relative abundance of long-chain n-alkanes in surface sediments were: 41.0% - 49.9% ($n-C_{31}$), 33.3% - 38.1% ($n-C_{29}$) and 15.9% - 29.3% ($n-C_{27}$), indicating woody plant sources along the study area (Bush and McInerney 2013).

Ice fields of Patagonia (~48°S)



The C/N ratio and $\delta^{13}C$ in surface sediments exhibited differences between glacier-river influence area, fjord-channel and marine areas, consistent with the suspended particulate matter information in the study area (not shown here).

The C/N ratios ranged between 8.2 and 14.5 in glacier-river influence area, coherent with depleted values of $\delta^{13}C$ (between -26.5‰ and -24.0‰). Fjords, channels and marine areas show C/N ratios around 9.0, and $\delta^{13}C$ with enriched values between -25 ‰ and -20‰.

The CPI values (2.3 - 9.6) indicated odd over even predominance of long-chain n-alkanes in surface sediments along the ice fields of Patagonia, suggesting terrestrial inputs mainly transported by precipitation and meltwater from the icefields.

The abundance of long-chain n-alkanes in surface sediments along the study area, i.e., 31.5% - 45.5% ($n-C_{31}$), 32.5% - 39.9% ($n-C_{29}$) and 21.1% - 30.4% ($n-C_{27}$), suggest woody plant sources (Bush and McInerney 2013), such as *Nothofagus* sp. described by Sepulveda et al. (2011)

MAIN QUESTION:
What are the main sources of organic material to the Chilean Patagonia?

CONCLUSIONS

- An important gradient of C/N ratio and $\delta^{13}C$ values were found in surface sediments between river outlets, fjord/channels and oceanic areas. Terrestrial inputs dominate inside the fjord, whereas marine area is predominantly dominated by marine autochthonous organic matter. This gradient was not consistent with the long-chain n-alkane information CPI in northern Patagonia, which decreased towards the fjord and inner-sea until values < 1.0, suggesting potential input of degraded material, in contrast to the ice fields system where CPIs was > 2.0. The predominance of long-chain n-alkanes $n-C_{31}$, $n-C_{29}$ and $n-C_{27}$ in both areas suggest that woody plants may be the main source of long-chain n-alkanes in the northern Patagonia and ice fields.
- The gradient of organic carbon sources shown here is agree with the strong salinity gradient. In fact, we consider to do future studies in suspended particulate matter (SPM) in the study area.
- This study provide valuable information about the main sources and distribution of organic material to the sediments in two important continuum system of the Chilean Patagonia.

Acknowledgements
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