The influence of glacier cover on trace metal input and cycling in Patagonian fjords

J. HAWKINGS[1,2]*, R. M. SHERRELL[3], T. CONWAY[4], J. WADHAM[5], K. HENDRY[6], H. PRYER[5], G. DANERI[7], R. TORRES[7], S. BERTRAND[8], A. KELLERMAN[1], M. MARSHALL[5], A. BEATON[9], HC. NG[6], V. ROCCANOVA[3], K. BU[3], B. SUMMERS[4], L.G. BENNING[2], R. SPENCER[1]

[1]Earth, Ocean and Atmospheric Science, FSU, FL, USA, *jhawkings@fsu.edu
[2]Interface Geochemistry, GFZ Potsdam, Germany
[3]Departments of Marine and Coastal Sci. and Earth and Planetary Sci., Rutgers University, NJ, USA
[4]College of Marine Science, USF, FL, USA
[5]School of Geographical Sciences, University of Bristol, UK
[6] School of Earth Sciences, University of Bristol, UK
[7]CIEP, Coyhaique, Chile
[8]Department of Geology, Ghent University, Belgium
[9]National Oceanography Centre, Southampton, UK

Fjords are dynamic critical interface zones between fresh and marine waters, and are hypothesised to be hotspots of carbon burial. Their importance as biogeochemical reactors remains uncertain and few fjords have been studied in the context of trace element cycling. Trace elements (e.g. iron, manganese, copper, zinc) play an important role in the carbon cycle due to their importance as micronutrients to marine biota, complexation with macronutrients (C, P), and carbon burial in sediments (e.g. the “Rusty Carbon Sink”). Glaciers are major contributors to fjord freshwater budgets. Turbid glacial meltwaters carry elevated concentrations of labile particulate and dissolved trace elements that may be directly or indirectly available to biota, and tidewater glaciers drive a “meltwater pump” upwelling fjord bottom waters to the surface. However, the downstream impact of these meltwater inputs is debated.

Fjords dominate the coastline of Chilean Patagonia, spanning over 14 degrees of latitude, and include freshwater inputs from pristine rivers draining regions of variable glacial cover, providing an ideal natural laboratory to test hypotheses. Here we combine a suite of surface and benthic measurements (including size fractionated elemental concentration, reactive particulate phase concentration, Fe isotope measurements and organic carbon molecular composition) from 4 Patagonian fjords and 33 rivers to elucidate the importance of glacial inputs in fjord trace element cycling. In glacier fed fjords we highlight the importance of particulate and organic carbon complexed trace elements in sustaining high water concentrations and large benthic fluxes with a distinctive Fe isotopic signature.