Unravelling the responses of shallow soft sediment assemblages to rapid glacier retreat in an Antarctic fjord: Carbon and nitrogen cycling

Braeckman Ulrike[1,2], Francesca Pasotti[1], Ralf Hoffmann[2,3], Susana Vázquez[4], Anders Torstensson[5], Frank Wenzhöfer[2,3] and Ann Vanreusel[1]

[1] Marine Biology Research Group, Ghent University, Krijgslaan 281/S8, 9000 Ghent, Belgium
E-mail: ulrike.braeckman@ugent.be
[2] HGF MPG Joint Research Group for Deep-Sea Ecology and Technology, Max Planck Institute for Marine Microbiology, Celsiusstraße 1, 28359 Bremen, Germany
[3] HGF MPG Joint Research Group for Deep-Sea Ecology and Technology, Alfred Wegener Institute, Helmholtz Centrum for Polar and Marine Research, Am Handelshafen 12, 27569 Bremerhaven, Germany
[4] Facultad de Farmacia y Bioquímica, Universidad de Buenos Aires, Argentina
[5] Young and Deming Laboratory, University of Washington, Seattle

At the northern tip of the Western Antarctic Peninsula lies Potter Cove (PC), a fjord-like small embayment (about 3 km^2), influenced by the dynamics of the Fourcade Glacier. Since the 1950s, this glacier has been actively retreating, releasing the underlying soft sediments from the ice, exposing them to glacier calving disturbances (e.g. brash ice and ice scouring), increasing discharge of sediment-laden melt waters and to wave action. Several contrasting shallow (<20m) benthic habitat types are present within the bay. Although bathymetric and granulometric characteristics are relatively similar within the cove, the sediment-inhabiting fauna community composition is very patchy and variable, ranging from colonist to medium-developed benthic assemblages as a result of the locally altered conditions.

Efficient carbon cycling is especially crucial in this very productive bay. The large annual primary producer biomass (mainly benthic microalgae and large macroalgae) needs to be recycled to the basic nutrients. Since benthic communities are - through their feeding and burrowing activities - strongly involved in the degradation of organic matter, it can be expected that the gradient in development of benthic communities in Potter Cove will be somehow reflected in the local patterns in carbon and nitrogen cycling.

In 2015-2016, we had the unique opportunity to measure carbon and nitrogen cycling *in situ* over a seasonal cycle (summer, winter *under ice* measurements, and spring). To this aim, skilled divers deployed a set of benthic chambers on the sediment and measured fluxes of oxygen, inorganic carbon and dissolved inorganic nitrogen species at the sediment-water interface. At the same time, the sediment was sampled to assess environmental variables and benthic assemblage structure. Preliminary results show that despite the low water temperatures (0-2°C), benthic carbon and nitrogen cycling rates were similar to those of temperate regions, which highlights the productivity of the area. Carbon cycling in winter was remarkably lower than in spring and summer, which probably relates to a lower activity and/or biomass of the benthos. The most recent ice-free site, also most frequently disturbed by the glacier calving, was characterized by the least developed communities and lowest carbon cycling rates.

This seasonal set of carbon and nitrogen cycling measurements along a gradient of benthic assemblage statuses in Potter Cove will provide an example dataset for direct and indirect effects of glacier retreat on benthic ecosystem functioning, representing a unique study in the Western Antarctic Peninsula region.