Carbon cycling in Antarctic benthic communities subject to glacier retreat

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

[1] Marine Biology Research Group, Ghent University, Krijgslaan 281 - S8, 9000 Gent, Belgium
E-mail: ulrike.braeckman@ugent.be

[2] HGF MPG Joint Research Group for Deep-Sea Ecology and Technology, Alfred Wegener Institute, Am Handelshafen 12, 27569 Bremerhaven, Germany

[3] Nanobiotec, Facultad de Farmacia y Bioquímica, Universidad de Buenos Aires – CONICET, Junin 954, Ciudad Autonoma de Buenos Aires, Argentina

[4] Department of Biological and Environmental Sciences, University of Gothenburg, Box 100, SE-405 30 Gohtenborg, Sweden

The western Antarctic peninsula (WAP) is one of the fastest warming regions on Earth. At the northern tip of the WAP, on the southern coast of King George Island, lies Potter Cove, a fjord-like small embayment (about 3 km^2), influenced by the dynamics of the Fourcade Glacier. This glacier has been actively retreating since the 1950s and completely lost its water tongue in the past decade and now lays completely on land. The retreat released huge portions of the underlying soft sediments from the ice, exposing them to glacier calving disturbances (e.g. brash ice and ice scouring), the increased discharge of sediment-laden melt waters and to wave action. Several contrasting shallow 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 cycling.

In 2015-2016, we had the unique opportunity to measure carbon 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 over the sediment and measured fluxes of oxygen, inorganic carbon and nutrients 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 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 glacier calving, was characterized by the least developed communities and lowest carbon cycling.

This seasonal set of carbon 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.

Keywords: Antarctica; benthos; carbon cycling; glacier retreat