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Carbon cycling in shallow Antarctic benthic communities subject to glacier retreat

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The western Antarctic peninsula (WAP) is one of the fastest warming regions on Earth. Potter Cove is a small fjord on King George Island (northern tip of the WAP), strongly influenced by the Fourcade Glacier. This glacier has been actively retreating since the 1950s, exposing the underlying soft sediments to glacier calving disturbances, increased discharge of sediment-laden melt waters and to wave action. As a result of these locally altered conditions, benthic communities range from colonist to medium-developed assemblages. Benthic microalgae and large macroalgae are the main primary producers in this area. Their biomass eventually ends up in the sediment, where it is recycled to the basic nutrients. 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 performed a seasonal cycle of in situ carbon and nutrient cycling measurements (summer, winter under ice measurements, and spring) in this area. Divers deployed benthic chambers over the sediment and measured fluxes of oxygen (Total Oxygen Uptake, TOU), DIC and nutrients at the sediment-water interface. A profiler was deployed in summer and spring, measuring vertical oxygen profiles in the sediment, from which diffusive oxygen uptake (DOU, representing microbial and chemical oxygen consumption) was calculated. The sediment was further sampled to assess environmental variables and benthic assemblage structure. Preliminary results show that DOU rates only contribute $\sim$10% to the TOU, which points at a major role for macrobenthic communities, as compared to microbial communities. Carbon cycling in winter was remarkably lower than in spring and summer, which probably relates to a lower benthic activity and/or biomass. Sites most frequently disturbed by the glacier calving were 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 represents a unique study of direct and indirect effects of glacier retreat on benthic ecosystem functioning in the Western Antarctic Peninsula region. Finally, it contributes to the currently limited knowledge on the role of macrobenthos (bioturbation) in carbon cycling in fjord systems in the Southern Ocean.