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Sedimentary organic matter sources, benthic consumption and burial in west Spitsbergen fjords – signs of maturing of Arctic fjordic systems?

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Abstract

Mature ecosystems sequester little organic carbon (C_{org}) in sediments, as the complex and effective food webs consume most available organic matter within the water column and sediment, in contrast to young systems, where a large proportion of C_{org} is buried in deeper sediment layers. In this paper we hypothesize that "warmer" Atlantic water influenced fjord exhibits the 'mature' system features as compared to "cooler" Arctic water influenced fjord . C_{org} concentrations, sources and burial rates, as well as macrobenthic community standing stocks, taxonomic and functional composition and carbon demand, were compared in two west Spitsbergen fjords that are to different extents influenced by Atlantic water and can be treated as representing a cold one (Hornsund) and a warm one (Kongsfjorden). Water, sediments and macrofauna were collected at three stations in the central basin of each fjord. C_{org}, N_{tot}, $\delta^{13}C_{org}$ and $\delta^{15}N$ were measured in suspended matter, sediment cores and possible organic matter sources. The composition of sources of sedimentary organic matter was modeled by Mix-SIAR Bayesian stable isotope mixing models. The ^{210}Pb method was used to calculate sediment accumulation rates, C_{org} accumulation and burial rates. The sedimentary C_{org} concentration and accumulation rate were larger in Hornsund than in Kongsfjorden. The contributions of pelagic sources to the C_{org} in sediments were similar in both fjords, macroalgal detritus had a higher importance in Kongsfjorden, while terrestrial sources were more important in Hornsund. Similar density and species richness were noted in both fjords, but higher biomass, individual biomass, production and carbon demand of benthic communities were noted in Kongsfjorden despite the lower amounts of C_{org} in sediments, indicating that macrobenthos responds to quality rather than quantity of available food. Subsurface tube-building conveyer belt detritus feeders (maldanids and oweniids) were