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Sedimentary regimes at Potter Cove, King George Island, maritime Antarctica – from source to sink

Donata Monien, Patrick Monien, Robert M. Brünjes, Tatjana Widmer, Bernhard Schnetger, and Hans-Jürgen Brumsack

Institute for Chemistry and Biology of the Marine Environment (ICBM), carl-von-Ossietzky University, Oldenburg, Germany (donata.monien@icbm.de)

Increased particle run-off due to recently retreated ice masses along the Antarctic margins may play an important role in fertilizing the high-nutrient-low-chlorophyll regions of the Southern Ocean. At Potter Cove, King George Island, maritime Antarctica, small melt water streams at the south-eastern shoreline (Potter Peninsula) discharge up to 1,500 mg L^{-1} (av. 110 mg L^{-1}) of suspended particle matter (SPM) per day into the coastal water body during the summer seasons. Apart from potential light limitation of plankton growth by the suspension load, the particle run-off affects benthic feeders, possibly changes the depositional regime and the preservation of chemical proxies in the outlet zones, and exports trace elements offshore. In Potter Cove's water column, the average particle size is low, and extreme turbidity events are restricted to the upper five to seven meters. High particle loads are often associated with low salinities, most probably induced by increased onshore precipitation. Sediment traps installed in the inner and outer cove at 5 and 20 m water depth suggest mass accumulation rates of 0.83 and 0.58 g cm^{-2} yr^{-1}, and 0.13 and 0.11 g cm^{-2} yr^{-1} (considering 183 days of sedimentation), respectively. ^{210}Pb measurements of short sediment cores reveal recent sediment accumulation rates of approximately 0.1 to 0.6 g cm^{-2} yr^{-1}. The SPM sampled in the melt water streams and plumes is chemically different to surface sediments deposited in Potter Cove. Chemical characteristics suggest a significant impact of particle sorting: SPM and outer cove sediments are more clayey, whereas inner cove sediments contain more heavy minerals. Generally, sediment deposits in Potter Cove exhibit coarser grain sizes and are mainly derived from Barton Peninsula (northern shoreline), whereas the SPM consists of more fine-grained material originating from Potter Peninsula eluviations. Sequential leaching of the SPM by ascorbic acid showed that approximately 0.5 to 2% of the total iron (5.9 wt.% Fe) is easily dissolvable, which in turn can be translated into an additional load of approximately 5 to 21 mmol L^{-1} dissolved Fe^{2+}. In consequence, the results of our three-summer study highlight that the major part of the particle load from the melt water streams are exported to the Southern Ocean rather than being deposited near shore in Potter Cove. These exported particles are rich in easily leachable Fe acting as a natural fertilization to the Fe-limited Southern Ocean.