

Particulate organic carbon production and preservation on the Amundsen Shelf, Antarctic

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We have examined the flux, biogenic composition, and isotopic values of sinking particles collected by a time-series sediment trap deployed in the sea ice zone (SIZ) of the Amundsen Sea from January 2011 for 1 year. The major portion of the particle flux, dominated by opal, occurred during the austral summer. The dominant source of sinking particles shifted from diatoms to soft-tissued organisms, evidenced by high particulate organic carbon (POC) content (>30 %) and a low bio-Si/POC ratio (<0.5) during the austral winter. CaCO₃ content and its contribution to total particle flux was low (~6 %) throughout the study period. When compared with POC flux inside the Amundsen Sea polynya obtained by the US Amundsen Sea Polynya International Research Expedition (ASPIRE), the POC flux integrated over the austral summer in the SIZ was virtually identical, although the maximum POC flux was approximately half that inside the Amundsen Sea polynya. We have also examined recent history of sedimentary organic carbon (SOC) accumulation on the western Amundsen shelf. Vertical profiles of SOC content, radio- and stable-carbon isotopes in the upper 21-cm sediment horizons were obtained at four locations in the western Amundsen Sea representing various summertime sea ice conditions, bottom depths, and distance from the coast (near the shelf break, at the periphery and at the center of the Amundsen Sea polynya, and inside the polynya near the Dotson Ice Shelf). SOC content, radiocarbon content, and average SOC accumulation rate were all slightly higher at the periphery than at the center of the polynya, in contrast to the present-day primary production in the corresponding surface waters. If our estimation of SOC accumulation is extrapolated to the western Amundsen shelf between 110 °W and 120 °W, approximately 4×10^{10} gCyr⁻¹ is buried on the shelf, with ~90 % of SOC accumulation occurring in the Amundsen Sea polynya.