

Algal concentration and composition in newly formed/young sea ice in Antarctic

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In the seasonal sea-ice zone, ice melting during spring to summer releases ice algae, which are consumed by zooplankton or seed in the water column and trigger ice-edge bloom. Ice algal biomass is higher (up to 2 orders of magnitude) than phytoplankton biomass in adjacent seawater. Such a high biomass can be derived from phytoplankton accumulation to sea ice during its formation as well as in situ growth of ice algae in spring–summer. To elucidate how sea ice with high ice-algal concentration forms by accumulating phytoplankton efficiently is important to understand the regional variability of ice-algal biomass. Laboratory-based studies found freezing in turbulent conditions forms higher phytoplankton accumulation in young ice, however, they have yet to explain the high variability of ice-algal concentrations observed in fields (Garrison et al. 1989). We collected various types of sea ice (nilas/young grey ice/grease ice) to understand the factors to determine the algal concentration of newly formed sea ice.

Sea ice was collected at 5 stations off the Totten Glacier using a basket from the ice breaker *Shirase* during the JARE61 cruise (Figure). Simultaneously surface seawater (0 m or 9 m) was sampled and chlorophyll *a* concentration, salinity and temperature were measured. Visual observations of ice condition followed by Worby et al. (1999) were conducted immediately before or after the sampling. All sea ice was melted in filtered seawater (pore size 0.2 μm) and the same parameters as surface seawater were obtained. Subsamples were fixed by lugol-solution for cell enumeration by a microscope. Accumulation of chl *a* or cells of phytoplankton on sea ice was quantified by enrichment index (EI) according to Gradinger and Ikävalko (1998).

Sampled ice was as follows; nilas (Stn. A, E), nilas/young grey ice (Stns. B, D), and grease ice (Stn. C). St. A was covered with first year ice mainly, and nilas was formed by refreezing at the openings between the ice floes indicated by low surface seawater salinity (17.9‰). Thickness of sampled ice ranged from 2.0 to 15.2 cm and bulk salinity of them ranged from 5.0 to 26.4‰. The mean Enrichment Index (EI) of chl *a* was highest at nilas/young grey ice at Stn. B (12.4 ± 12.4) followed by grease ice at Stn. C (5.4 ± 5.4). In this study, grease ice formation was accompanied by moderate (5.4 ± 5.4) enrichment of phytoplankton. Enrichment in relation with species composition and meteorological conditions will be discussed.

References

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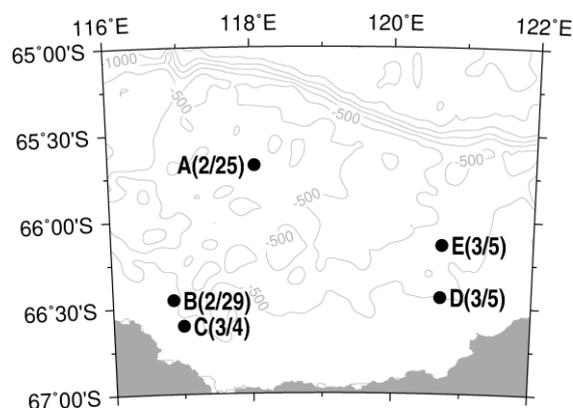


Figure. The locations and the dates of sampling sites.