The 21st International Symposium on Polar Sciences (ISPS), Korea Polar Research Institute, Incheon, Republic of Korea, May 19-20, 2015

Biogeochemical characteristics of nutrients, dissolved and particulate organic matters in the Amundsen Sea

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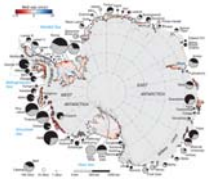
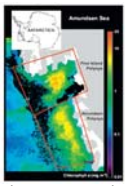
1. Introduction

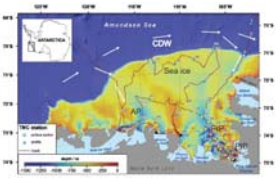
• The Amundsen Sea is one of the regions where ice sheet thinning is the fastest in Antarctica, which is mainly attributed to the intrusion of Circumpolar Deep Water (CDW) through deep troughs onto the Antarctic continental shelf. In addition, the Amundsen polynya is the most productive among those identified along the Antarctic coast. These features make the Amundsen Sea an ideal location to monitor the influence of environmental changes on marine biogeochemical cycles.



(Rignot et al., 2013)



(Arrigo et al., 2012)

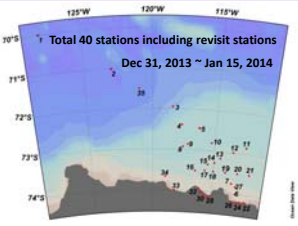


(Alderkamp et al., 2012)

• Nevertheless, no study has been carried out over this region to investigate carbon and nitrogen biogeochemical cycles, simultaneously..

• Here, we report that biogeochemical characteristics of nutrients (NH_4, NO_2+NO_3, PO_4 and SiO_2) and organic carbon and nitrogen in the Amundsen Sea, Antarctica.

2. Sampling and chemical analysis



Seawater sampling stations during ANA04B cruise

Korean icebreaker *Araon*

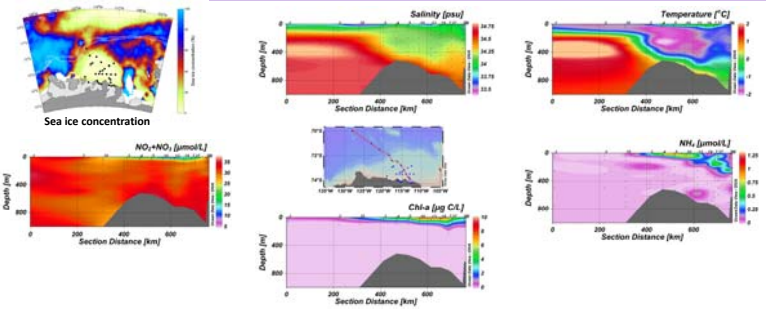
Auto-analyzer

Filtering system for DOM

TOC-TN analyzer

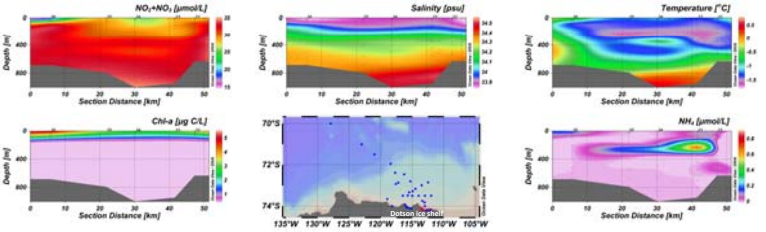
POM collecting system

3. Hydrographic characteristics in the Amundsen Sea

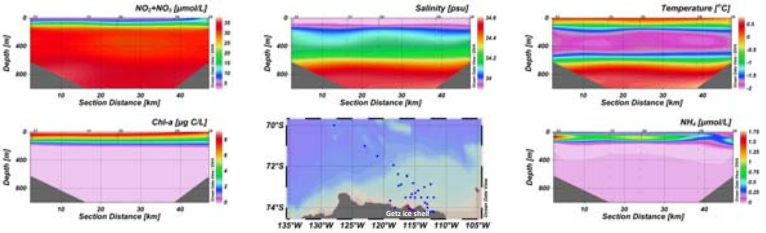


• Surface NO_2+NO_3 and PO_4 concentrations in the open ocean station (i.e., station 1 and 2) were higher than those observed in the Amundsen polynya owing to low biological activity in these two stations. The surface NO_2+NO_3 and PO_4 concentrations gradually decreased with increasing chlorophyll a, indicating that NO_2+NO_3 and PO_4 were utilized by phytoplankton.

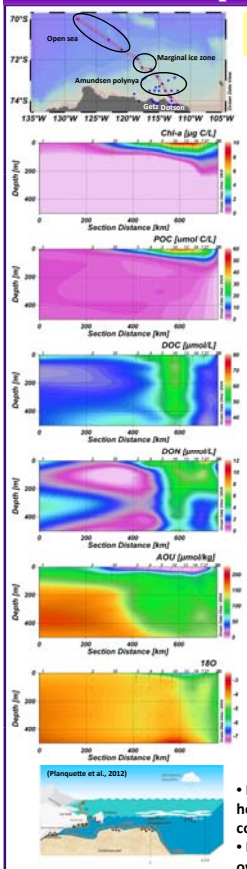
• NH_4 occurs generally in the euphotic zone, where organic matter is rapidly remineralized. The results for NH_4 therefore suggest that organic matters are actively remineralized in the Amundsen polynya.



• Despite the exceedingly high biological production in the Amundsen polynya, NO_2+NO_3 and PO_4 in surface water were not totally depleted, suggesting that remineralization is fast enough to maintain their concentrations, and/or that biological production is limited by other factors such as iron.

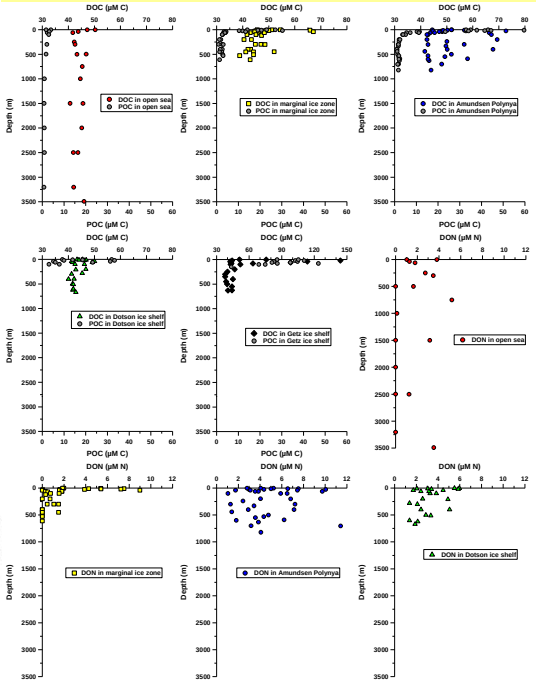


4. Dissolved and particulate organic matters



(Planquette et al., 2012)

• Samples were grouped into five major regions: open sea, marginal ice zone, the Amundsen polynya, the Dotson ice shelf and the Getz ice shelf.

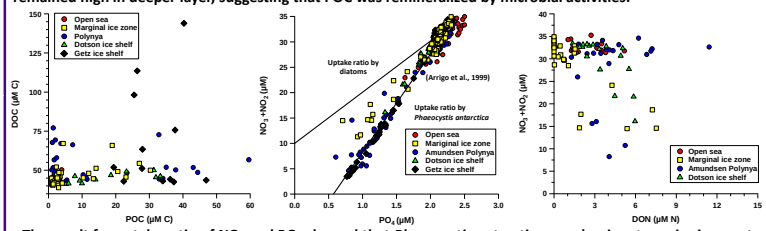


Depth profiles of dissolved organic carbon (DOC), particulate organic carbon (POC) and dissolved organic nitrogen (DON) in major five regions of the Amundsen Sea.

• DOC and POC concentrations observed in the open sea were distributed homogeneously over the entire water column, and were considered background concentrations of DOC and POC.

• In the Amundsen polynya, DOC and POC concentrations sharply increased owing to high marine biological activity.

• While POC concentration in the Amundsen polynya sharply decreased with increasing depth, DOC concentration remained high in deeper layer, suggesting that POC was remineralized by microbial activities.



• The result for uptake ratio of NO_3 and PO_4 showed that *Phaeocystis antarctica* was dominant species in our study area. *Phaeocystis antarctica* has been reported to allocate a significant but variable amount of phtosynthetically fixed carbon to colony formation. *Phaeocystis antarctica* also release large amounts of DOC, and DOC is released from deteriorating colonies.