Preliminary study on the effect of low-salinity ice melting water on biomass and composition of ice algae

*Keigo Takahashi[1], Ryosuke Makabe[2,3], Shintaro Takao[2,3], Tsuneo Odate[2,3], Masato Moteki[1,2]

1. Tokyo University of Marine Science and Technology, 2. National Institute of Polar Research, 3. The Graduate University for Advanced Studies (SOKENDAI)

Upon sea ice melting ice algae are subject to low salinity water, sometimes nearly freshwater, while sea ice produces a brine (high salinity). Certain taxa of ice algae, primarily diatom, increase in cell number after released in water column (seeding). Since lower salinity water deteriorates photosynthetic efficiency of ice algae, such a variability of salinity is likely to influence seeding of ice algae during melting season. However, it is not clear how biomass, abundance, composition and mortality of ice-algal community changes under different salinity conditions. To further understand the mechanism for seeding of ice algae, we conducted a shipboard experiment in the Indian Sector of the Southern Ocean during austral summer.

We collected pack ice and surface seawater in the ice edge (65º17.9’ S, 109º40.9’ E) on January 16th, 2019 during the 22nd Antarctic voyage by the training vessel *Umitaka-maru*. Sea ice was melted with different volume of filtered seawater (moderate salinity: 10.0 kg ice+90 L filtered sea water, FSW, low salinity: 8.6 kg ice+10 L FSW) to simulate different final salinity (moderate: 30.05, low: 18.00). We incubated the algal communities in seawater and two types of sea-ice melting water (moderate and low salinity conditions) under a natural light condition for 24 hours, with temperature maintained by a circulating surface seawater. Before and after the incubation, we obtained chlorophyll *a* concentration (bulk and size-fraction), Lugol-fixed samples for microscopic analysis and cell viability (live or dead).

After 24 hours, <10 μm size class of ice-algal communities in both moderate and low salinity conditions showed a significant difference in the ratio of chlorophyll *a* concentration (chl *a* fin. /chl *a* ini.) relative to the bulk and >10 μm size class (Tukey-Kramer test, Fig.). The ratio of chl *a* (mean±SD, *n*=3) in this size class was highest (moderate: 2.1±0.1, low: 1.8±0.2) among the samples. This suggests that algal community of <10 μm have an ability to acclimate to low salinity water. This study discussed the changes in species composition and abundance of the algal communities as well.

Keywords: The Southern Ocean, Ice algae, Sea ice

©2019. Japan Geoscience Union. All Right Reserved.

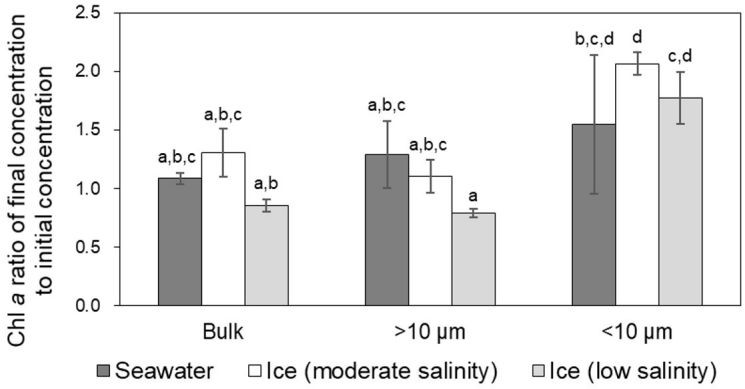

Fig. The final chlorophyll *a* concentration of bulk and size-fractionated samples relative to the initial concentration of seawater and two types of ice (moderate and low salinity). The same letters indicate no significant difference at the p=0.05 level (Tukey-Kramer test).

©2019. Japan Geoscience Union. All Right Reserved.