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Early Career Scientist Session

My experience in the Arctic and expectations for the new Japanese icebreaker

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My research interest is the biogeochemical cycles related to microalgal dynamics in the Arctic. Microalgae is a leading primary producer in the ocean, including the Arctic. In the Pacific Arctic Ocean, a seasonal sea ice area with a large shallow shelf, microalgae in sediments and sea ice, as well as in the water column, are highly related to the biogeochemical cycles there. Because the microalgal community is vulnerable to environmental changes, we should understand how the role of microalgae in the biogeochemical cycles has been changing in the Arctic. For instance, my previous studies revealed a high abundance of viable diatom cells in sediments on the Pacific Arctic shelf, and they have high photophysiological plasticity to resume proliferating after taking sufficient light. Because of the significant environmental changes in the Pacific Arctic related to sea ice, microalgae in sediments would play essential roles in the shallow Arctic.

Such research interests have been growing due to field observations in the Arctic. My experience of Arctic observation is mainly based on cruises by non-icebreaker vessels, such as T/S *Oshoro-Maru* (Hokkaido University) and R/V *Mirai* (JAMSTEC) during summer and autumn. Especially, R/V *Mirai* has many well-equipped laboratories and ample space for on-deck incubation experiments, which allow us to understand microalgal dynamics in summer and autumn using many methodological ways. In addition, the crews in R/V *Mirai* always give us kind help and support from professional points of view regarding sampling and establishing equipment for experiments. Thanks to them, we obtained many samples safely and did experiments even in the Arctic. On the other hand, I have also experienced field observation on sea ice via land in spring. Sampling and planning the experiments using sea ice is attractive to me because sea ice is one of the critical factors in the Arctic biogeochemical cycles related to microalgae, and there are unraveled processes. Access to sea ice using snow machines allowed us to get the sampling sites non-destructively and obtain sea ice samples close to the natural state. However, in field observation via land, it takes a long time before we further treat samples using laboratory equipment, and we have to bring all equipment used on the field by snow machines, which means certain limitations of experiments and sampling parameters.

Research icebreakers would be one of the solutions for these limitations. We can more easily access both sea ice and the well-equipped laboratory. Using the new Japanese icebreaker, I would like to study to understand microalgal and primary production dynamics related to sea ice at a shorter spatial-temporal scale, which the modeling and satellite cannot detect. For example, I wish to join observations to hold the icebreaker at one ice-edge station from existing to retreating sea ice, which would help us to know how the composition and primary productivity of microalgae respond during spring (“polar morning”) and how it differs between regions and melting timing. I believe that piling up detailed knowledge about the dynamics of microalgae and primary production related to sea ice would help predict its future dynamics more accurately and contribute to understanding the changing biogeochemical cycles in the Arctic.