G6–O1

Cancelled

PHYTOPLANKTON PIGMENTS IN CHUKCHI SEA DURING AUG. TO SEP. 2010

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The Chukchi Sea shelf is one of the highest productive area in the the world due to inflow of nutrient-rich Pacific water. The structure of phytoplankton communities would be changed at the beginning of ice melting and in the open ocean. During the Third ChineseArctic Research Expedition, from Aug. to Sep., 2008, phytoplankton pigments were studied in Aug.(ince covered) and in Sep(open ocean) in Chukchi Sea. And the structure of phytoplankton communities were discussed under these two time periods with different nutrients conditions . The results showed nutrients conditions were much different not only affected by different characteristics of Bering Strait inflow currents, but also affected by phytoplankton depletion. Pigments and phytoplankton communities in the Chukchi showed spatial and temporal variation during Aug. to Sep. Along 168oW. From Bering Strait to north in Chukchi sea, diatoms dominated over the shelf where controlling by high nutrients inflow water in the upper layer in early Aug.with high Fuco concentrations. With the ice cover decreasing in Sep., nutrients depleted, the structure of phytoplankton communities changed to smaller ones with dinoflagelates and prasinophytes increasing indicated by the increasing contents of the peridinin and prasinoxanthin. The stations influenced by Alaska coastal current with low salinity and low nutrients, small size phytoplankton such as prasinophytes, chlorophytes and cryptophytes were dominated. 19-HEX, the pigmentsof prymnesiophytes were found at the area higher than 74 oN with low nutrients conditions. The results showed phyotoplankton communities were changed with ice cover decreasing in different time periods in Chukchi Sea.

G6–O2

Satellite remote sensing of primary productivity in the Bering and Chukchi Seas using an absorption-based approach

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Ocean colour remote sensing has been utilized for studies on primary productivity in the Arctic Ocean. However, phytoplankton chlorophyll *a* is not accurately predicted in the estimation model, because of the interference of coloured dissolved organic matter (CDOM) and non-algal particles (NAP). To enhance estimation accuracy, a phytoplankton absorption-based primary productivity model (ABPM) was applied to the Bering and Chukchi Seas.

The phytoplankton absorption coefficient was correctly retrieved from sea surface remote sensing reflectance (R_{rs}) and reduced the effect of CDOM and NAP in primary productivity (PP_{eu}) estimation. PP_{eu} retrieved from *in situ* R_{rs} using the ABPM satisfied a factor of 2 of measured values. PP_{eu} estimated from MODIS R_{rs} data were within the range of historical values. These estimated PP_{eu} was less than half of the chlorophyll *a* based model, and the difference between the two models reflected the influence of CDOM and NAP absorptions. Inter-annual variation in August and September for the period 2002–2010 showed an increase in primary productivity. The increase in 2007 was especially large, by a factor of 1.51–2.71, compared with 2006. The significant temporal increase in productivity detected here differs from earlier studies that detected little, if any, change in the region.

Keywords: Arctic Ocean, Chukchi Sea, Bering Sea, primary productivity, absorption coefficient, coloured dissolved organic matter (CDOM), ocean colour remote sensing

G6–O3

Macromolecular production of phytoplankton in the Northern Bering Sea, 2007

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Macromolecular production of phytoplankton was investigated in the northern Bering Sea in 2007, and the relationships between the production and environmental factors (nutrients, salinity, light, temperature, Chlorophyll-a) were examined. The productivity experiments for photosynthetic carbon allocations were conducted at three light depths (100%, 30%, and 1%) for nine different stations, using ^{13}C isotope tracer technique. The photosynthetic carbon allocations into different macromolecular classes (proteins, lipids, polysaccharides, and low-molecular-weight metabolites (LMWM)) of primary producers were determined based on the productivity experiments. The overall average allocations were 37.9% (S.D. = ± 18.8%), 26.6% (S.D. = ± 17.4%), 9.1% (S.D. = ± 7.8%), and 26.5% (S.D. = ± 20.7%), respectively, for LMWM, lipids, polysaccharides, and proteins. LMWM and polysaccharides had similar vertical patterns whereas lipids and proteins had reverse vertical patterns at all the stations. In our study, low incorporation into proteins and relatively high incorporation into lipids at 100% light depth would suggest that the phytoplankton had nitrogen limitation in the northern Bering Sea. In contrast, high incorporation into proteins and relatively low incorporation into lipids at 1% light depth suggest that phytoplankton had no nitrogen limitation during our study period. Based on a general pattern of macromolecular production in the northern Bering Sea, phytoplankton was a physiologically transitional phase from a unlimited status during our cruise period, 2007.

G6–O4

ISOLATION OF NEW STRAINS OF COCCOLITHOPHORE, *EMILIANIA HUXLEYI* FROM ARCTIC SEA AND THEIR CHARACTERIZATION

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The cosmopolitan coccolithophore *Emiliania huxleyi* widely is known as the most abundant bloom-forming coccolithophore. It becomes more prominent since the late 1970s in Eastern Bering Sea (Harada et al. 2012) as one of examples of changing ecosystem caused by global warming. In this study, we isolated Coccolithophore *Emiliania huxleyi* from Arctic sea and Bering Sea in order to characterize their growth to study on the effect of climatic change on phytoplankton community.

First, we collected seawater sample during the MR10-05 cruise of the R/V *MIRAI* and cultivated them after mixing with sterilized seawater enriched with the microelements of Erd–Schreiber's medium. After incubation for 5 months at 4°C, coccolithophores were found at 5 sampling sites from arctic sea to Bering Sea and isolated to establish clones. All these strains were identified to be *E. huxleyi*. We incubated *E. huxleyi* strains at 25, 20, 17, 10 and 4°C. All the 5 strains showed similar response to temperature. Interestingly, they could not survive at 25°C and it is very different from *E. huxleyi* strains isolated from warm region. Growth rates of subarctic strains at 4°C were not strongly diminished but maintained to a greater extent, namely ca. 1/3 of the maximum rate. The Arctic strains showed clear cold-tolerance. The optimum growth temperature of most of the *E. huxleyi* strains were around 20°C, irrespective of place where it was isolated. The mechanism how to keep cold tolerance is interesting to be elucidated. As arctic *E. huxleyi* strains can keep its growth even at higher temperature, raising of oceanic temperature by the global warming will not give serious damage on coccolithophore and associated with ecosystems in Arctic sea.

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G6–O5

FAUNAL TURNOVER AND SHELL DENSITY CHANGE IN THE ARCTIC SEA: RESPONSES UNDER OCEAN ACIDIFICATION

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It is deeply concerning about biological and geochemical influences of ocean acidification due to carbon emission by human activity. The reaction of atmospheric CO2 with seawater reduces pH and carbonate ions that are necessary for phyto- and zooplankton which produce CaCO3 skeletons. In the Arctic Ocean, it is considered that sea ice melting by global warming may change saturation states of calcium carbonate and production rates of marine calcifires (e.g. Coccolithophores, Planktic foraminifers, Pteropods, and Ostracods), therefore composition of Arctic ecosystem would be drastically changed in near future. Here we reported the results of sediment trap experiment to understand biogeochemical responses and effects of ocean acidification in the western Arctic Sea. We deployed two sediment traps in the Northwind Abyssal Plain (Stn. NAP10t, 75° N, 162° W, water depth: 1.975m) in the Arctic Sea from October 2010 to September 2011. The sediment trap had been deployed about 180 m (shallow) and 1,300 m (deep) water depths, respectively. In this study, we analyzed total mass flux (TMF) and assemblages of carbonate-shelled zooplankton. As the results, remarkable seasonal changes of TMF and carbonate-shelled zooplankton community had identified. It seems that carbonate-shelled zooplankton in the Arctic Ocean is close related with sea ice distributions. Furthermore, we developed a novel method to know shell density of carbonate-shelled zooplankton quantitatively by using micro-focus X-ray Computing Tomography technique. According to this, severe dissolution of aragonitic shells had been occurred at the shallow water depth. It suggests that freshwater that has lower Ω for aragonite affects shell density of marine calcifier.

G6–O6

YEAR-LONG MONITORING OF UNDER-ICE PHYTOPLANKTON ASSEMBLAGES IN THE ARCTIC BY ICE-TETHERED PROFILERS

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In September 2012 an Ice-Tethered Profiler (ITP) completed the first-ever year-long daily assessment of phytoplankton abundance in the water column under ice-covered Arctic Ocean waters. This new ability to observe seasonal trends in under-ice phytoplankton populations with such high temporal and spatial resolution provides critical data for understanding how climate-driven changes in the Arctic Ocean will affect these organisms, which are the foundation for primary production and biogeochemistry in these ocean ecosystems. A special bio-optical sensor suite was developed for this research, which represents the first sensor system for ITP platforms designed specifically to measure biological processes. This sensor suite uses optical approaches to measure properties related to phytoplankton biomass (chlorophyll fluorescence), the presence of other particles (optical scattering), and the concentration of colored dissolved organic material (UV excitation of fluorescence). Of particular interest in these data is the timing and duration of the increase in phytoplankton biomass in the spring, and the rapidity with which phytoplankton abundance decreases in the fall at the end of the growing season. Three more bio-optically equipped ITPs were added to the Arctic Observing Network in summer 2012, in the Canada Basin and in the Eurasian Basin, providing a substantial improvement in our ability to monitor under-ice phytoplankton in the Arctic, year-round on daily timescales. Preliminary data from these additional sites will be presented.

G6–O7

SINKING FLUXES OF DIATOM AND SILICEOUS FLAGELLATES IN THE NORTHWIND ABYSSAL PLAIN

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In order to understand time-series sinking fluxes of siliceous microplankton (diatoms, silicoflagellates, chrysophyte cyst, endoskeletal dinoflagellate *Actiniscus*, and ebridian) in seasonal sea-ice environment, sediment trap experiment was conducted at Station NAPt in the Northwind Abyssal Plain (75N 162W, 1975 m water depth) from 4 Oct. 2010 throughout 28 Sep. 2011. Two time-series sediment traps with 26 collecting cups were deployed at 180 m and 1300 m water depths. Total mass fluxes at both depths were relatively high in Nov.-Dec. 2010 and July-Aug. 2011. Chemical component analysis of sinking particles showed high dominance of lithogenic materials rather than biogenic components throughout the studied period. However, the relative increases of biogenic opal were observed in Nov.-Dec. 2010 and Apr.-Aug. 2011. Just after the initial decrease of summer sea-ice concentration at Station NAPt in late June, the sinking flux of silicoflagellate *Distephanus speculum* (= *Dictyocha speculum*) reached up to 2.3 $\times 10^4$ skeletons m^{-2} d^{-1}. The sinking diatom fluxes, which are mainly composed of *Fragilariopsis* spp., increased after the silicoflagellate flux peak. The highest diatom flux in summer was 5.5 $\times 10^6$ skeletons m^{-2} d^{-1}. During the high diatom flux period in July-August, abundant gelatinous materials such as house of *Appendicularia* were also contained in >1mm size fraction. The high total mass flux in summer is essentially explained by increased primary production under the sea-surface environment with seasonal sea-ice reduction and increased insolation. On the other hand, the high biogenic flux in Nov.-Dec. 2010 does not reflect the high primary production at Station NAPt due to limited light condition during polar night. The sinking flux of ebridian *Ebria tripartita*, which is mainly observed in the shelf of Chukchi Sea, increased in Nov. 2010. The large portion of high total mass flux in Oct.-Dec. 2010 is probably explained by lateral particle input into the Northwind Abyssal Plain from the Chukchi Sea shelf by the northward flow of North Pacific waters.