

THE SEDIMENTARY RECORD OF ORGANIC-WALLED DINOFLAGELLATE CYSTS AS INDICATORS OF PALAEOCEANOGRAPHIC CHANGES ACROSS THE CHUKCHI BORDERLAND AND SOUTHERN MENDELEEV RIDGE IN THE WESTERN ARCTIC OCEAN

So-Young Kim, Seung-Il Nam, Young-Ju Son, Hyo-Seon Ji

Division of Polar Climate Research, Korea Polar Research Institute

Abstract Palynological analysis of box- and multi-core sediment samples from the Chukchi Borderland and southern Mendeleev Ridge in the western Arctic Ocean were performed in order to document the distribution of dinoflagellate cyst assemblages and their relationship to palaeoceanographic conditions. A total of 9 genera and 23 dinoflagellate cysts were identified, mainly consisting of *O. centrocarpum*, *Brigantedinium* spp. and *Spiniferites elongatus*. The surface distribution of dinoflagellate cysts shows a sharp decrease from the inner (St. 01A) to the outer shelf areas. The vertical variations of dinoflagellate cyst concentrations in a multi-core sample from site 01A show a gradual increase from the bottom to the top of the core. In the lower part of the core, lower values of total organic carbon and nitrogen contents correspond to lower concentrations of dinoflagellate cysts. Emphasis has been placed on a prominent increase in dinoflagellate cyst concentrations accompanied by total organic carbon and nitrogen contents in the upper part of the core, probably suggesting increased nutrient inputs and marine productivity in the study area.

Research Background

- The Arctic Ocean is a key component of the global climate system characterized by the perennial ice cover, the relative importance of the continental shelves and shelf processes, and the complex interaction of water masses of the Atlantic, Pacific, and riverine sources.

- The sedimentary records in continental shelves and slopes of the Arctic Ocean show generally higher sedimentation rates and thus provide detailed sedimentary archives.

- Dinoflagellate cysts are significant primary producers, and have an excellent fossil record. Researches on distributions of dinoflagellate cyst assemblages in recent sediments and their correlation with sea-surface parameters (e.g. temperature, salinity and nutrients) have demonstrated that dinoflagellate cysts can be utilized as a useful tracer for palaeoceanographic studies.

- In this study, we present preliminary results of organic dinoflagellate cyst analysis on marine sediments from the Chukchi Borderland and the southern Mendeleev Ridge of the western Arctic Ocean.

Study Area

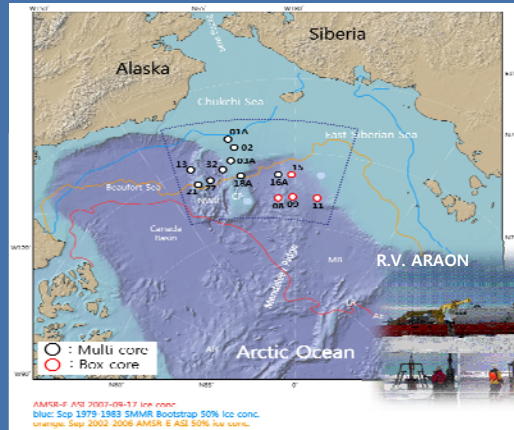
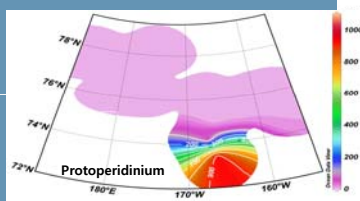
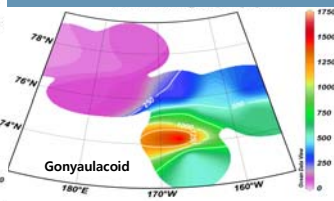
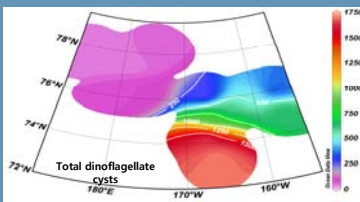


Figure 1. Locations of 13 geological stations at the Chukchi Borderland and the southern Mendeleev Ridge in the western Arctic Ocean.

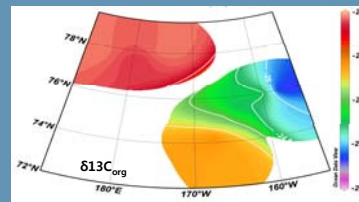
Results and Discussion

❖ surface sediments

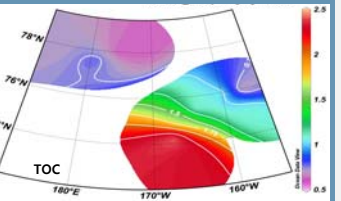
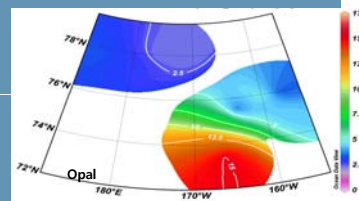
- A total of 9 genera and 14 dinoflagellate cyst taxa identified. Dominant species include *O. centrocarpum*, *Brigantedinium* spp. and *Spiniferites elongatus*.
- Dinoflagellate cyst and pollen concentrations sharply decrease from the inner to the outer shelf areas.



- Protoperidinioid group (e.g. *Brigantedinium* spp. and *Polykrikos swartzii*) pre-dominates at station 01A near the coast.
- Gonyaulacoid group (e.g. *Operculodinium centrocarpum* and *Spiniferites elongatus*) pre-dominates at station 02.



- TOC, opal and $\delta^{13}C_{org}$ contents show a decrease from inner to the outer shelf areas



- In general, total dinoflagellate cysts and protoperidinioid cysts in the Arctic are in proportion to TOC, opal and $\delta^{13}C_{org}$.

Figure 2. Distributions of major microfossil concentrations in the Chukchi Borderland and the southern Mendeleev Ridge, the western Arctic Ocean.

❖ 01A multi-core

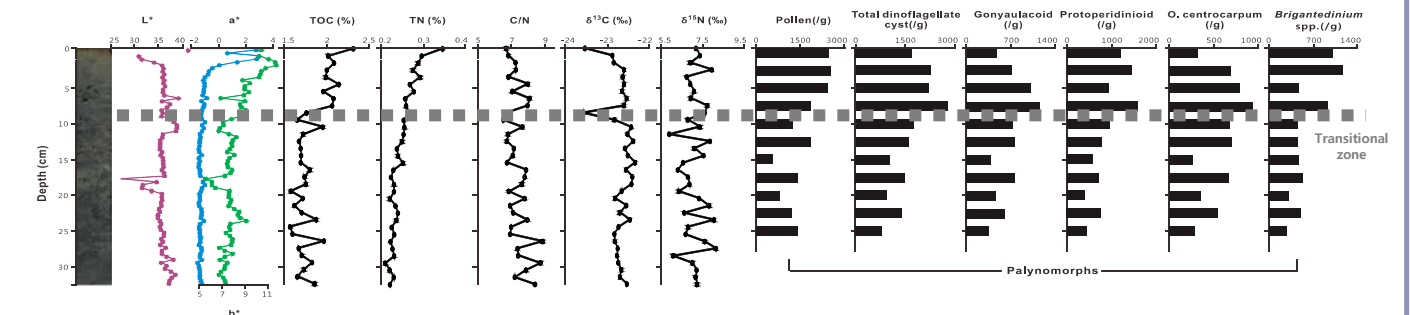


Figure 4. Vertical variations of sediment color parameters (L^* , a^* , b^*), total organic carbon and nitrogen contents, C/N ratios, isotope ratios ($\delta^{13}C_{org}$ and $\delta^{15}N$) and organic microfossil records in core 01A.

- A total of 14 genera and 23 dinoflagellate cyst taxa identified. Dominant species are *O. centrocarpum* and *Brigantedinium* spp.
- Dinoflagellate cyst and pollen concentrations show a gradual increase from the bottom to the top of the core.
- In the lower part of the core (from the bottom to 15cm), lower values of total organic carbon and nitrogen contents correspond to lower concentrations of dinoflagellate cyst and pollen. A prominent increase in dinoflagellate cyst and pollen concentrations accompanied by total organic carbon and nitrogen contents in the upper part of the core (from 15cm to the top) suggest increased nutrient inputs and marine productivity in the study area.
- The C/N ratios (<10) represent marine organic matter. Comparison of TOC and C/N ratios indicates that the increase in organic matter deposition in the upper section of the core is due to increased accumulation of marine organic matter, as supported by $\delta^{13}C_{org}$ and $\delta^{15}N$ values.

Acknowledgement

This research was funded by KOPRI research program (PP12030).



