Ice-breaker R.V. ARAON Expedition: Unveiling hidden history of the western Arctic Ocean

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Abstract Research expeditions to the western Arctic Ocean have been carried out by the Korean Icebreaker 「ARAON」 in 2010 and 2011. The main goal of this marine geological research is to reconstruct glacial history and palaeoceanographic changes (sea-ice coverage, brine formation, palaeoproductivity, origin of organic matters) in the western Arctic Ocean during the late Quaternary glacial-interglacial cycles. One focus was to gather sedimentary materials and therefore establish chronostratigraphy of the sediments across the Chukchi shelf and the southern Mendeleev Ridge. The shipboard echosounder systems (Multi-beam Bathymetry and Sub-bottom Profiling) were continuously operated during the entire expedition to decide suitable coring sites based on a high-resolution seismic profiles for the uppermost sediment sections. Box, multiple and gravity cores were retrieved with the ARAON coring system. Directly after retrieval, the cores were divided into 150cm sections and brought to the sedimentology lab onboard for core curation (e.g. photography, description, photospectrometry, subsampling). Here we present preliminary results obtained from multi-proxy analyses of onshore laboratory as well as the onboard analyses conducted on the sediment core samples retrieved during the ARAON expeditions.

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.
- In 2010 and 2011, research expeditions to the western Arctic Ocean have been carried out by the Korean Icebreaker 「ARAON」 to take new and undisturbed sediment cores from the selected research target areas including the Chukchi shelf cross the Chukchi Plateau, and two E-W transects from the CP cross the southern Mendeleev Ridge to the eastern Makarov Basin.
- Main purpose of marine geological research is to establish a precise chronostratigraphy of the recovered sediment cores for reconstructing glacial history and paleoceanographic changes (sea-ice coverage, brine formation, paleoproductivity, origin of organic matters, etc.) in the western Arctic Ocean during late Quaternary glacial-interglacial cycles.

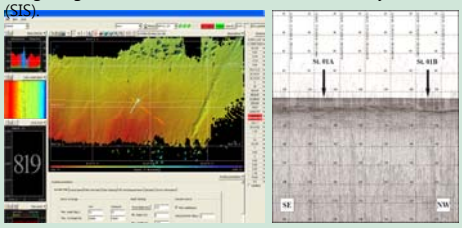
Study Area

Sediment corking

Locations of 21 geological stations at the Chukchi Borderland and the southern Mendeleev Ridge in the western Arctic Ocean.

❖ On-board analysis

Survey data were acquired and visualized in real time using Kongsberg's MBES software Seafloor Information System (SIS).



Examples of SBP sub-bottom records (coring sites 01A and 01B). These two sites are selected to recover sediment cores for understanding multi-directional pattern of iceberg gouges, top gouges are leveled by 8m to 15m thick stratified mud.

Sediment taken from the box core are sieved for collecting iceberg-rafted detritus which were transported with icebergs and then deposited during melting of icebergs at the geological stations. Dolomite with about 9 cm in diameter occurred in box core (18A-Box 03) probably originated from Canadian Arctic Archipelago.

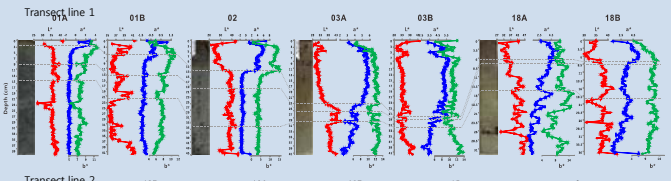
Split parts (archive and working halves) of sediment core sample (ARA02B/01A-BOX) recovered with box corer.

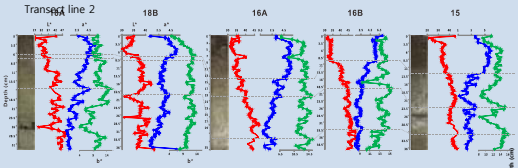
Surface sediment from box corer with large size dropstones and pyrited-worm tubes

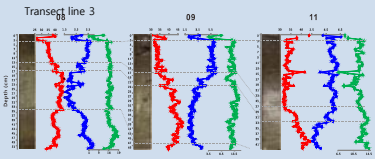
❖ Preliminary results

2011 multi-cores

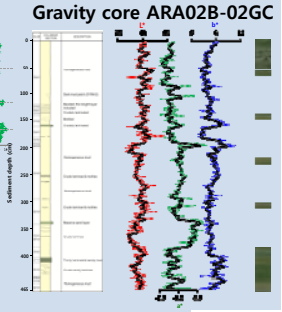
Color reflectance measurement

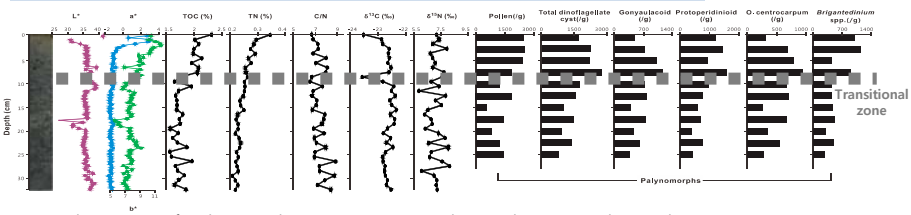




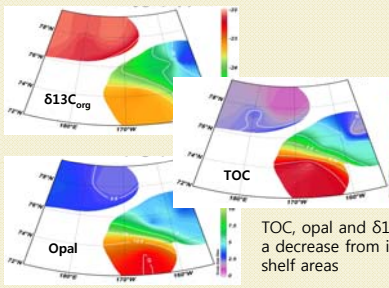


Gravity core ARA02B-02GC

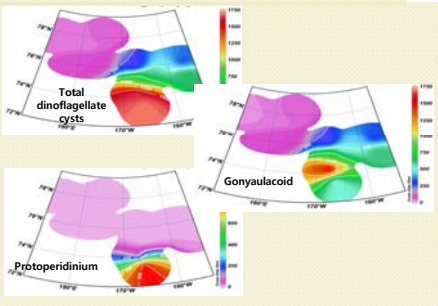




Vertical variations of sediment color parameters (L*, a*, b*), total organic carbon and nitrogen contents, C/N ratios, isotope ratios ($\delta^{13}C_{org}$ and $\delta^{15}N$) and organic microfossil records in core 01A.



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



Dinoflagellate cyst and pollen concentrations sharply decrease from the inner to the outer shelf areas.

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