北極海における海洋酸性化:GRENE と JOIS の結果から

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Arctic Ocean Acidification: Results from GRENE and JOIS

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The Arctic Ocean is known to be especially vulnerable to the ocean acidification. However, the progress of acidification is not uniform across the Arctic Ocean, because different processes dominate in different regions and the warming of Arctic waters alters these processes to enhance or mitigate acidification. Therefore, ocean acidification must be assessed in the context of regional changes happening within the Arctic Ocean [AMAP, 2013]. In this study, as part of Japanese GRENE-Arctic project and international JOIS (Joint Ocean Ice Studies) project, we analyze temporal changes of aragonite saturation state (Ω) in the Chukchi Sea and Canada Basin and estimate contributions from anthropogenic CO_2 and physical and biological processes.

In the Chukchi Sea, Ω in shelf bottom water exhibits large regional and interannual variability, but good correlation between Ω and AOU indicates that remineralization of organic matter is the major controlling factor. Estimations show that bottom water in some regions of this productive sea could be undersaturated with respect to aragonite even without the influence of anthropogenic CO_2. Furthermore, Ω reconstructed from mooring observations suggests that in 2012 bottom water was undersaturated with respect to aragonite not only in the stratified period of summer and autumn but also in the cold winter period. This means the bottom waters of the Chukchi shelf could be undersaturated for over half the year.

In the Canada Basin, surface Ω had largely decreased from 1997 to 2008 due to melting of sea ice [Yamamoto-Kawai et al., 2009]. However, observations since then show a gradual increase of Ω. A comparison with changes in temperature, freshwater content and pCO_2 indicate that this increase in Ω is due to warming, freshwater export and a decrease in pCO_2 that was potentially caused by enhanced biological productivity.

References

AMAP, Arctic Ocean Acidification, AMAP, 2013.
Yamamoto-Kawai et al., Aragonite Undersaturation in the Arctic Ocean: Effects of Ocean Acidification and Sea Ice Melt, Science, 326, 1098-1100, 2009.