

Hypoxia events in Cheonsu Bay, West coast of Korea, triggered by discharge of eutrophicated water from artificial lakes

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Frequent outbreaks of hypoxic water masses have been reported in Cheonsu Bay, west coast of Korea, due to the influx of eutrophicated waters heavily loaded with oxygen demanding material from artificial lakes formed by large-scale land reclamation and subsequent industrial development and rapid urbanization since early 1980s. The hypoxia events would give deteriorative impact on fisheries and aquaculture industry around the bay.

In summer 2010, we measured the concentration of dissolved oxygen (DO) and nutrients in bottom waters collected from 14 stations. We also measured the nutrient fluxes across the sediment-water interface in 3 stations by deploying a fully automated benthic lander, which collects time-series water samples inside a benthic chamber, on the seafloor for a couple of days.

We confirmed the on-going hypoxia in the northern parts of the bay into where the lakes discharged. DO content of the bottom water was below 2 mg/l, compared to that of 5 mg/l at the mouth of the bay. Organic carbon oxidation rate was estimated to be 55 mmol C m⁻² d⁻¹ and the oxygen consumption rates to be 50.4 mmol O₂ m⁻² d⁻¹. These rates were about twice as fast as those at the bay mouth. Benthic fluxes of nutrients at the northern part of the bay were 4 to 6 times higher than those at the bay mouth.

Our results imply that it is necessary to keep keen eyes on hypoxia events since they would give severe damages to fisheries and aquaculture industry.

Oxygen isotope fractionation between calcium carbonate and water: Influence of ionic strength

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The conventional carbonate-water thermometer is one of the most successful paleotemperature proxies in the Earth sciences and it was developed on the theoretical basis of oxygen isotope fractionation between CaCO₃ and H₂O. As a result, numerous scientists have extensively studied the oxygen isotope systematics in the CaCO₃-H₂O system over the past several decades in order to establish a more reliable carbonate-water paleothermometer. Whereas the majority of natural calcium carbonate samples, such as corals and foraminifera, that are frequently used to reconstruct Earth's past climate changes on the basis of the conventional carbonate-water thermometer, are of oceanic origin, most of the experimental studies, that provide a baseline for the calibration of many of the species-specific carbonate-water paleotemperature proxies [1, 2], used calcium carbonates precipitated from parent solutions of low ionic strength (e.g. freshwater) rather than those precipitated from parent solutions of seawater salinity or ionic strength (e.g. ocean water).

In order to investigate the effect of a parent solution's ionic strength on the oxygen isotope fractionation between CaCO₃ and H₂O, calcium carbonates were synthesized in the laboratory from Na-Ca-(Mg)-Cl-HCO₃ solutions of seawater ionic strength (I = ~ 0.7). Subsequently, the oxygen isotope composition of the calcium carbonate precipitates and that of the parent solutions were determined. In particular, the passive CO₂ degassing and the constant addition methods, which are described in Kim *et al.* [3], were employed in this study. Our preliminary experimental results suggest that the oxygen isotope fractionation factors determined from calcium carbonates that were formed from high ionic strength solutions may not be always the same as those determined from low ionic strength solutions.

[1] Bemis *et al.* (1998) *Paleoceanography* **13**, 150–160.
[2] Grossman & Ku (1986) *Chem. Geol.* **59**, 59–74. [3] Kim *et al.* (2007) *GCA* **71**, 4704–4715.