Preliminary observation on the acidification of seasonally hypoxic bottom water of an enclosed bay (Omura bay, Nagasaki, Japan)

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Abstract

In enclosed coastal bays, not only deoxygenation but also acidification would easily proceed due to carbon mineralization through microbial respiration. Aerobic respiration by heterotrophic bacteria is responsible for most of the consumption of dissolved oxygen (DO), and the production of carbon dioxide (CO_2), which will lead to the formation of acidified hypoxic water mass at the bottom. However, little attention has been paid to the actual status of acidification during the bottom hypoxia of coastal areas. Considering the growing concerns on the negative impacts of ocean acidification and deoxygenation, quantitative information on the extent of acidification in conjunction with coastal hypoxia is urgently needed. In this study, we focused on Omura bay, as it is one of the enclosed bays that experience severe hypoxia every summer. We measured seasonal variations of DO and pH in Omura bay from June to October 2017 and April to October 2018. The pH in Omura bay ranged between 7.59 and 8.33 during the observation. The values of pH at the surface water were higher than those at the bottom water. Temporal variation of pH was very similar to that of DO at the bottom as well as the water just above the sediment surface. There was a highly positive correlation between pH and DO ($r = 0.796$, $p<0.01$). These findings clearly demonstrate that extent of acidification in the seasonally hypoxic water mass of Omura bay was comparable with that projected by the end of this century, and consistently support the idea that microbial respiration is responsible for the acidification.