Variation in hypoxic water mass in Ariake Sea -what consumed the dissolved oxygen?-

*Yuichi Hayami[1], Naoki Fujii[1], Hiroyuki Takasu[2], Yu Umezawa[3], Minoru Wada[2]

1. Saga University, 2. Nagasaki University, 3. Tokyo University of Agriculture and Technology

In the inner most area of Ariake Sea, the estuarine circulation is dominated in summer. Therefore, the suspended material is transported toward offshore in the surface layer and toward inward and accumulated in the bottom layer. Simultaneously, there is a conspicuous spring-neap variation where stratification is enhanced and bottom water hypoxia develops in neap tide and stratification is reduced and hypoxia is moderated in spring tide. However, it was not clarified that such variation in hypoxia was driven only by the physical process or affected by some biological process such as biological oxygen demand. In order to clarify the variation in mass transport and ecosystem, we made surveys in the inner most area of Ariake Sea in the summer of 2018. We made 6 transect surveys with a boat during a spring-neap cycle during continuous measurements of temperature, salinity, currents, DO and turbidity with moorings.

During the mooring observation period, as a typhoon attacked Ariake Sea on 27 July, most of the mooring instruments were once recovered. The surface mooring instruments was set again on 30 July, and other ones were set again on 1 August. Another typhoon attacked on 14 August but the mooring observation was continued. Between these 2 typhoons, transect surveys were conducted on 1, 5, 8 and 12 August during low tide. It was in neap tide on 5 August and in spring tide on 12 August. The water column was well mixed in the morning of 1 August at the mooring station (Stn. 3) due to strong tidal mixing in spring tide and wind induced mixing by the typhoon. The temperature decreased and salinity increased in the bottom layer toward neap tide. Stratification was strongest on 8 August. Then the stratification became weaker and the water column was entirely mixed again on 11 August. The bottom water DO decreased from 1 August and became lower than 3 mg/L on 4 August. The bottom DO was kept lower than 3 mg/L until 10 August. In the surface layer, the bloom of *Chattonella* sp. occurred from late July. It continued at least until 13 August. The results of the transect survey indicated that the cold and saline water intruded from offshore to enhance the stratification and formed hypoxic water mass. On 12 August, stratification weakened and the hypoxic water mass was disappeared in the coastal area. But, in the offshore area, weak hypoxic water mass was formed. High turbidity layer was formed over the bottom in the coastal area on 1 August. But the turbidity decreased on 5 and 8 August. The turbidity increased again and became highest on 12 August. The experiment to estimate the oxygen demand of the bottom water was conducted on the each survey day. The oxygen demand decreased from 1 to 5 August then increased and became maximum on 12 August. In order to estimate the contribution of bacterial respiration and chemical oxygen consumption to the total oxygen demand in water, we made incubation experiment with Chloramphenicol and formalin. Chloramphenicol was added to stop the bacterial respiration. Formalin was added to measure the chemical oxygen consumption. The bacterial respiration occupied about 80 % of the total oxygen demand on 6 August. However, almost all the oxygen demand was occupied by the respiration except for the bacterial respiration on 13 August. There was almost no chemical oxygen demand on each date. There was a high correlation between chlorophyll a concentration and oxygen demand (R=0.90). There was a correlation between turbidity and oxygen demand. But it was weaker than chlorophyll a (R=0.61).

The hypoxic water mass was generated by the cold and saline water intrusion occurred between spring

tide and neap tide. However, the oxygen demand in the bottom water decreased in this period. It indicated that the formation of hypoxia was generated by the physical process and the change in oxygen demand did not affected. The oxygen demand in spring tide was larger than in neap tide. It would be due to the active resuspension of organic matter by the strong tidal mixing. There was a high correlation between chlorophyll a and oxygen demand of water. But most of the oxygen demand when the hypoxic water mass was formed was bacterial respiration. The contribution of the phytoplankton respiration was small. They suggested the oxygen demand was mainly generated by the decomposition of organic matter derived from phytoplankton by bacteria. The red tide of *Chattonella* sp occurred continuously during the observation period. The maximum chlorophyll a concentration reached 72.3 ug/L. The organic matter supply from the red tide would fuel the oxygen consumption in the bottom layer.

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