Reconstruction of historical trends via preserved sedimentary pigments from sediment cores sampled from the Changjiang Estuary

Futao Fang[1], Zhuoyi Zhu[1*], Jinzhou Du[1], Bing Deng[1], Yueying Liu[1]
1. State Key Laboratory of Estuary and Coastal Research, East China Normal University, Shanghai, China.
Corresponding author: zyzhu@sklec.ecnu.edu.cn

From the early 1960s to the present, the content of dissolved inorganic nitrogen, phosphate, silicate and other nutrients in the Yangtze River dilute water continued to rise, and the input of a large amount of nutrients led to severe eutrophication in the Yangtze River estuary and its adjacent waters. The regional ecosystem has also undergone tremendous changes [1]. From the Figure 1[2]. we can see that the content of DIN and DIP has increased significantly. As shown in Figure 2[3], the number of occurrences of red tides in the Yangtze River estuary and adjacent sea areas has increased significantly.[3]

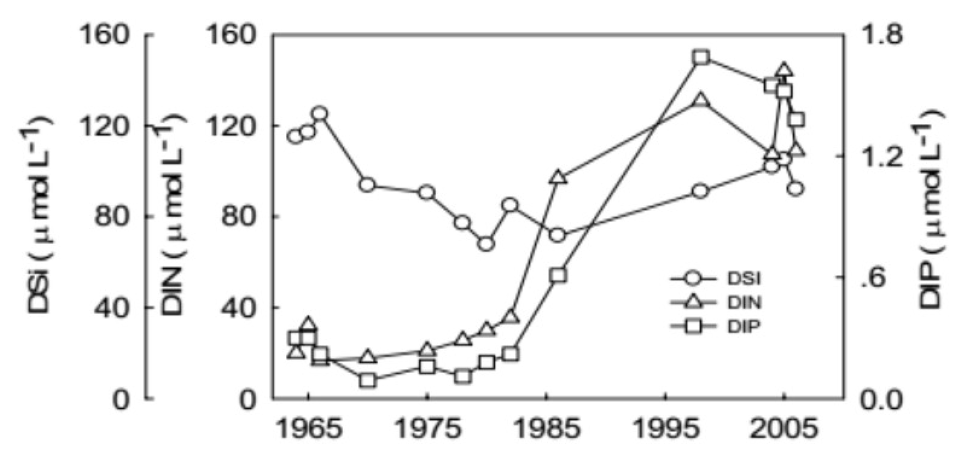


Figure.1 Changes in nutrient salt concentration in the Changjiang Estuary in the past 50 years （ Source: Yingying Zhang . Study on the controlling of nutrient phase transformation by adsorption –desorption in Changjiang Estuary[D]. East China Normal University, 2007.)

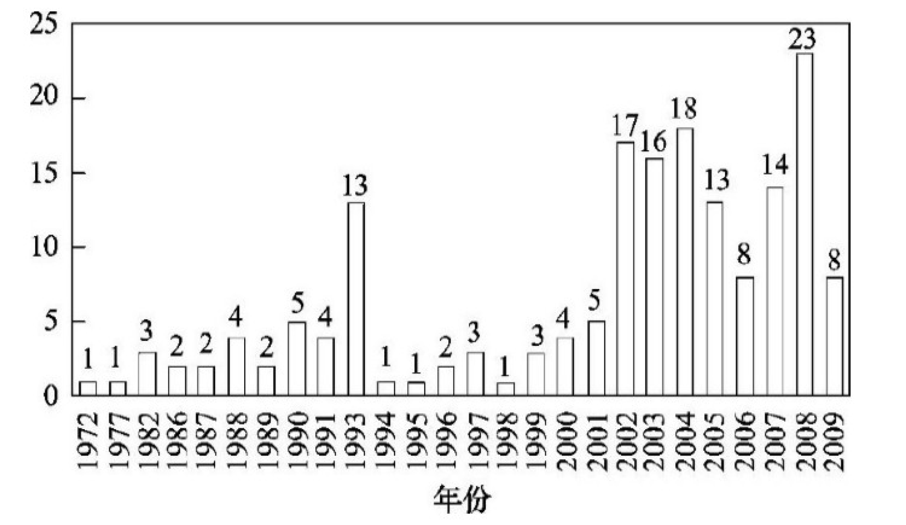
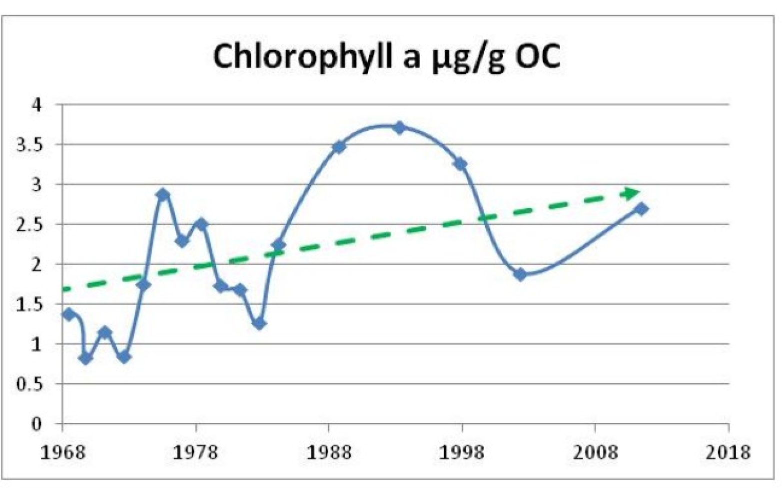


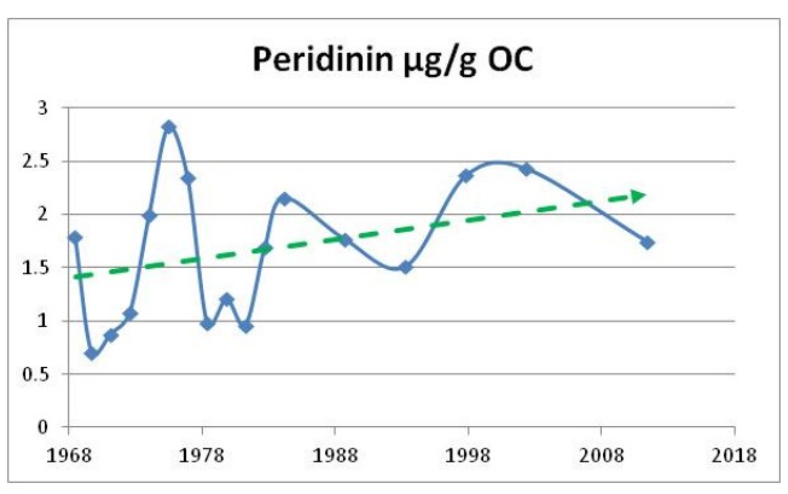
Fig.2 Number of red tide occurence in Yangtze River Estuary and adjacent waters . Source: Lusan Liu, Zicheng Li, Juan Zhou, Binghui Zheng, Jingliang Tang. Temporal and Spatial Distribution of Red Tide in Yangtze River Estuary and Adjacent Waters
[J]. Environmental science,2011,32(09):2497-2504.

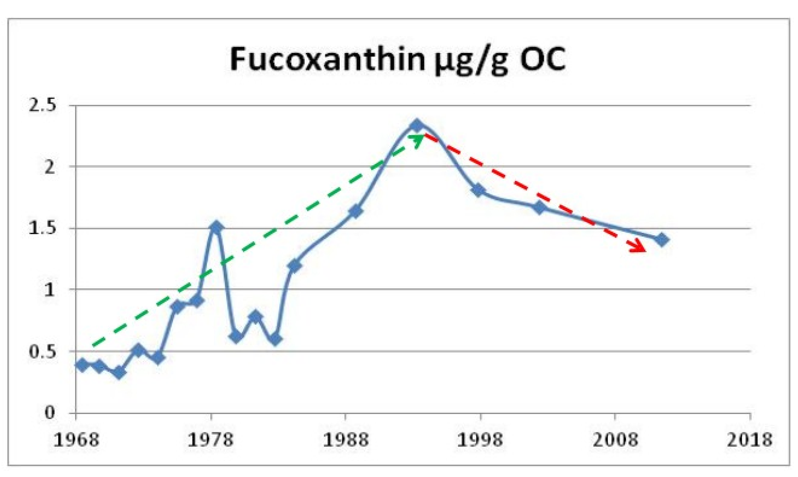
Research area and method

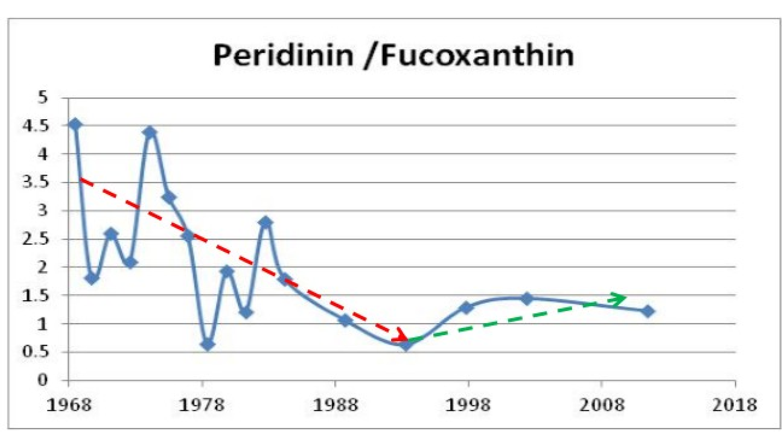
In this experiment, the pigmentation of the sediments in the A5-4 station of the Yangtze River Estuary in July 2016 voyage was determined by high performance liquid chromatography of phytoplankton photosynthetic pigments.

Discussion





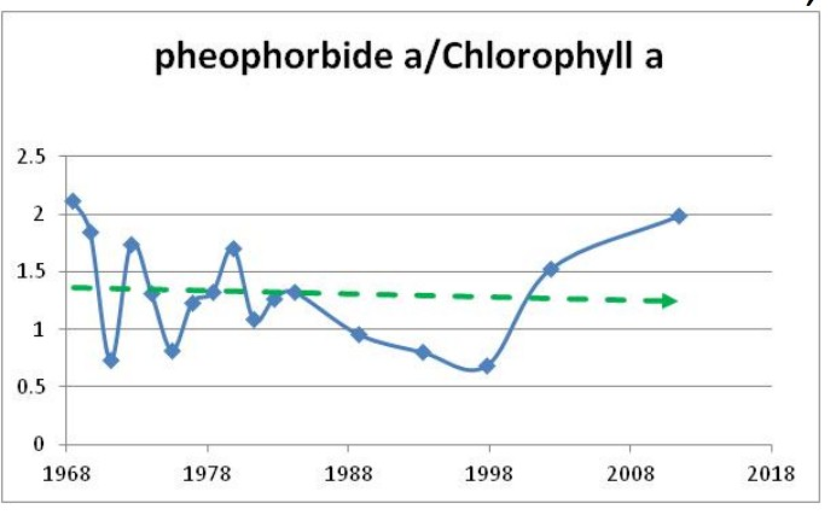




Chlorophyll a has generally increased in the past 40 years. After reaching a high value in 1975, the content of chlorophyll a decreased rapidly until it reached a minimum in 1983 and began to increase significantly in the next 10 years. This corresponds to the decline in sediment transport and the increase in nutrient flux in the Yangtze River in 1985. However, from 1993 to 2002, the chlorophyll a content decreased significantly. The reasons for this change need further study. Over the past 40 years, the increase in chlorophyll a has reflected that the phytoplankton biomass in the Yangtze River estuary has generally increased over the past 40 years, which corresponds to the trend of increasing nutrient content in the Yangtze River Basin in the past 50 years.

Peridinin has shown fluctuating changes over the past 40 years and is generally on the rise. This trend indicates that in the Yangtze River estuary, the biomass of dinoflagellates has been on the rise since the 1970s. This is in line with the increasing nutrient content of the Yangtze River estuary in the past 50 years and the corresponding increase in phytoplankton biomass.

Similarly, Fucoxanthin also fluctuated and rose from 1968 to 1993. This indicates that the biomass of diatoms is also showing an increasing trend. However, since 19993, the content of diatoms has a relatively obvious downward trend. We can see that from 1968 to 1993, both dinoflagellates and diatoms have a tendency to increase, but diatoms have seen a significant decline since 1993, while dinoflagellates are fluctuating, rising from 1993 to 1998.And from 2002 to 2011, it was down. We can see from the map of Peridinin/Fucoxanthin that from 1968 to 1993, the biomass of dinoflagellates and diatoms increased, and diatoms dominated. However, since 1993, the population dominance of diatoms has declined.



The stability of Chlorophyll a is different from that of pheophorbide a. We can use the ratio between the more stable Pheo-a and the easily degradable Chl-a content (Pheo-a / Chl-a) to indicate the preservation of chlorophyll in the sediment.In the graph of Pheo-a / Chl-a of the A5-4 column, we can see that its Pheo-a / Chl-a value has a small change trend, which indicates that the sediment pigment retention level in the column is stable[4]. In the whole trend, the change of 20 after 1984 is greater than that of the previous 20 years. The possible reason is that the sedimentation rate of the Yangtze River has decreased, which has affected the preservation stability of the pigment.

Acknowledgement

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