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# Block diagram model for high sedimentation process of Cu in Jiaozhou Bay

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**Key words:** Cu; High sedimentation; Block diagram model; Distribution trend; Jiaozhou Bay.

**Abstract.** This paper analyzed the horizontal distributions and the trends of Cu contents in surface and bottom waters in Jiaozhou Bay during 1982-1985 in Shandong Province of China. Based on this analysis, this paper established block diagram models for high sedimentation process. The distribution trends of Cu contents in surface and bottom waters could be determined, and the high sedimentation locations could be defined. In according to the block diagram models, the transport path and the remaining trace of the substance contents could be defined, and the horizontal distribution trends of the substance contents could be predicted.

## Introduction

Jiaozhou Bay is located in Shandong Province, China, and is surrounding by cities of Jiaonan, Qingdao and Jiaozhou, respectively. This bay has been polluted by various pollutants along with the rapid development of industrialization and urbanization after reform and opening-up [1-6]. Hence, understanding the horizontal distributions and the trends of pollutants in marine bay is essential to marine environment protection [7-16]. This paper analyzed the horizontal distributions and the trends of Cu contents in surface and bottom waters in Jiaozhou Bay based on investigation data on Cu during 1982-1985. Furthermore, this paper established block diagram models for high sedimentation process.The aim of this paper was to provide information for scientific research.

## Study area and data collection

Jiaozhou Bay is located in the south of Shandong Province, eastern China (35°55′-36°18′ N, 120°04′-120°23′ E). The total area, average water depth and bay mouth width are 446 $km^2$, 7 m and 3 km, respectively. This bay is a typical of semi-closed bay which is connected to the Yellow Sea in the south. There are a dozen of rivers, and the majors are Dagu River, Haibo Rriver, Licun Rriver, and Loushan Rriver etc., all of which are seasonal rivers [17-18]. The investigation on Cd in surface waters in Jiaozhou Bay was carried on in July and October 1982, May, September and October 1983, July and October 1984, and April, July and October 1985, respectively [13-16] (Fig. 1). Cu in waters was sampled and monitored follow by National Specification for Marine Monitoring [19].

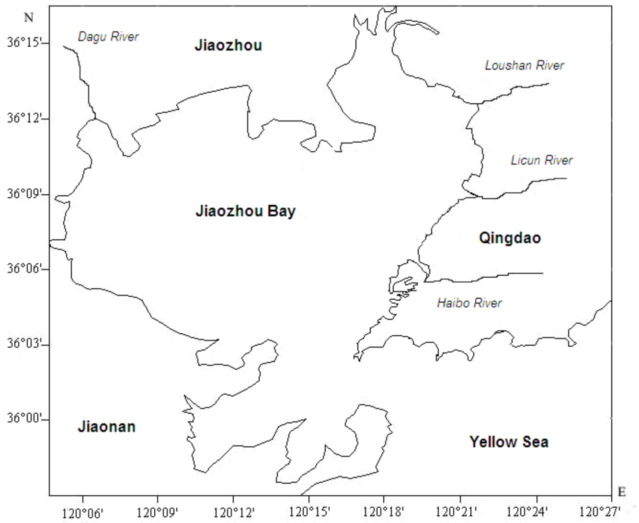


Fig. 1 Geographic location of Jiaozhou Bay

## Results and discussion

In Jiaozhou Bay waters, Cu contents were transporting along with the variations of source input and the changing of distance, and the horizontal distribution trends of Cu contents in surface and bottom waters were changing by means of water's effect [ 20-22]. It could be defined that Cu contents were settling rapidly, and there was accumulation process in bottom waters, resulting in high sedimentation locations in bottom waters. Four block diagram models were provided to identify these high sedimentation processes in different cases.

1) block diagram model for high sedimentation process in case of one major source. This scene was that there was only one major Cu source to the bay. In this case, the horizontal distribution of substance contents in surface and bottom waters was determined by direction of source input, and the substance contents in surface waters were decreasing along with the direction of the source, so do the substance contents in bottom waters. Supposed that the major source was from locations of A, the high sedimentation location was in A (Fig. 2).

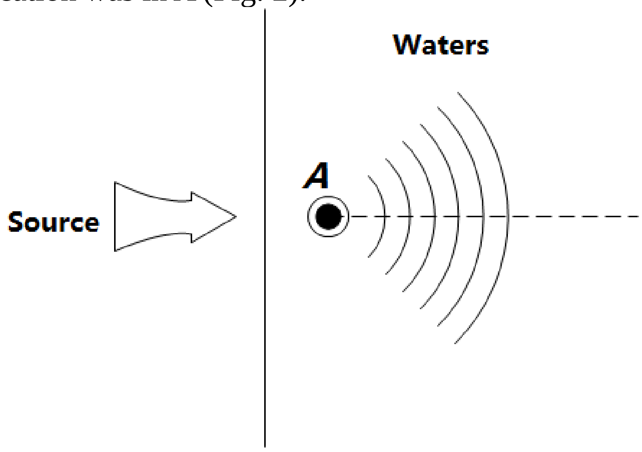


Fig.2 Block diagram model for high sedimentation process in case of one major source

2) block diagram model for high sedimentation process in case of two major sources. This scene was that there were two major Cu sources to the bay. In this case, the substance contents in surface waters were decreasing, as well as in bottom waters, and the substance contents were settling rapidly. Hence, the high sedimentation was in place where the directions of the two sources were intersecting and the sedimentation was overlaying (Fig. 3). Supposed that the two major sources were from locations of A and B, the high sedimentation location would be in the line segment AB. The strongest overlaying of the sedimentation was O, which was the center of line segment AB, in

where the substance contents were highest in bottom waters (Fig. 3).

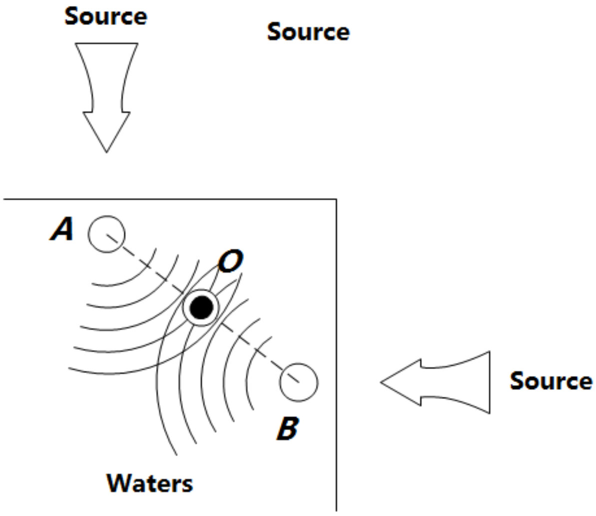


Fig.3 Block diagram model for high sedimentation process in case of two major sources

3) block diagram model for high sedimentation process in case of three major source. This scene was that there were three major Cu sources to the bay. In this case, the substance contents in surface waters were decreasing, as well as in bottom waters, and the substance contents were settling rapidly. Hence, the high sedimentation was in place where the directions of the three sources were intersecting and the sedimentation was overlaying (Fig. 4). Supposed that the three major sources were from locations of A, B and C, which were forming a triangle △ABC. The strongest overlaying of the sedimentation was O, which was the barycenter of triangle △ABC, in where the substance contents were highest in bottom waters (Fig. 4).

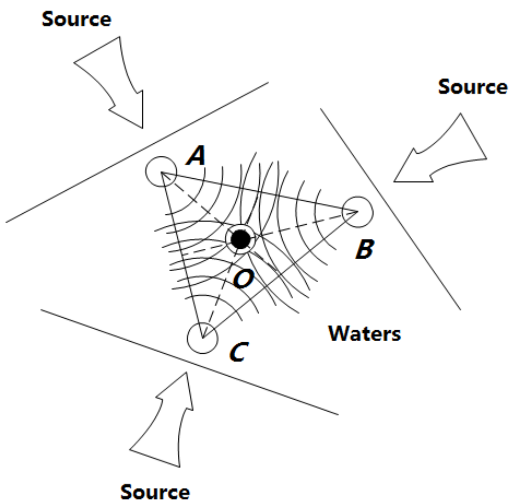


Fig.4 Block diagram model for high process location in case of three major sources

4) block diagram model for high sedimentation process in case of *n (n*>3*)* major source. This scene was that there were *n* major Cu sources to the bay. In this case, the substance contents in surface waters were decreasing, as well as in bottom waters, and the substance contents were settling rapidly. Hence, the high sedimentation was in place where the directions of the *n* sources were intersecting and the sedimentation was overlaying (Fig. 5). Supposed that the three major sources were from locations of A, B, C, …, N, which were forming a polygon. The strongest overlaying of the sedimentation was O, which was the barycenter of polygon, in where the substance contents were highest in bottom waters (Fig. 5).

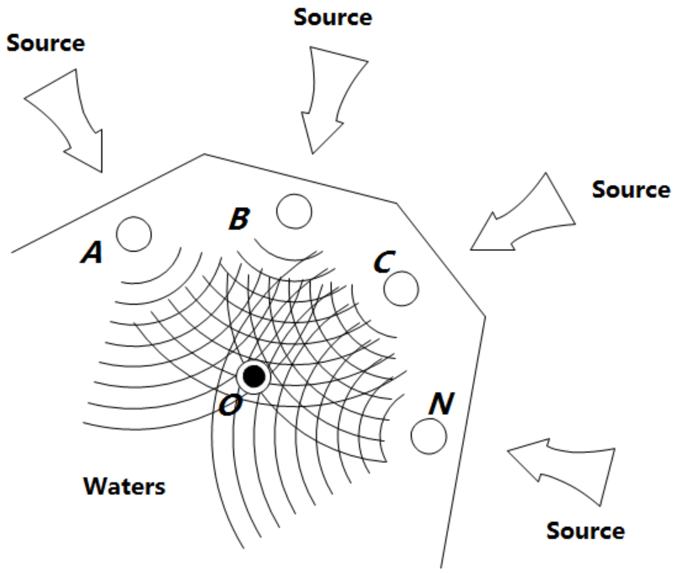


Fig.5 Block diagram model for high sedimentation process in case of *n* major sources

## Conclusions

This paper established block diagram models for high sedimentation process. By means of these block diagram models, the distribution trends of substance contents in surface and bottom waters could be determined, and the high sedimentation locations could be defined. Furthermore, in according to the block diagram models, the transport path and the remaining trace of the substance contents could be defined, and the horizontal distribution trends of the substance contents could be predicted.

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