Different sources and high sedimentation rate regions of Cu in Jiaozhou Bay

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Keywords: Cu; Bottom water; Distribution; Source; High sedimentation rate region; Jiaozhou Bay.

Abstract. Based on investigation data on Cu in bottom waters in Jiaozhou Bay in July and October 1984, we analyzed the content, pollution source and sedimentation process of Cu. Results showed that Cu contents in bottom waters were in July and October 1984 were 0.13-2.97 μg L^{-1} and 0.40-0.61 μg L^{-1}, respectively, and were meeting Grade I in National Sea Water Quality Standard (GB 3097-1997). There were high sedimentation regions in different positions due to different pollution sources. The major Cu source was stream flow in July, and the high sedimentation rate region was in the bay mouth; while marine current was the major Cu source in October, and the high sedimentation rate region was in the outside of the bay mouth. In generally, due to the different Cu sources and by means of vertical water's effect, there were different high sedimentation rate regions of Cu in Jiaozhou Bay.

Introduction

Cu has been widely used in industry and agriculture, especially in metal processing and electroplating. The excessive discharge of Cu-containing waste water and Cu contents in the environment had caused many environmental issues in both terrestrial and marine ecosystems [1-2]. The Cu pollution in the marine environment could be harmful to human via food chain, and the research on the contents, pollution levels and migration process of Cu in marine bay was essential to reveal the exist and transfer of Cu in marine bay. This paper he contents, pollution levels and migration process of Cu in Jiaozhou Bay, a semi-closed bay in Shandong Province, China, and provide basis remediation of the environment.

Material and method

Jiaozhou Bay (35°55′-36°18′ N, 120°04′-120°23′ E) is a semi-closed bay located in the south of Shandong Province, eastern China (Fig. 1). The total area, average water depth and bay mouth depth 446 km^2, 7 m and 3 km, respectively. This bay was surrounded by Qingdao City, Jiaozhou City and Jiaonan City in the east, north and west, respecitively, and was connecting to Yellow Sea in the south. The bay has more than ten inflow rivers, including Haibo Rriver, Licun Rriver and Loushan Rriver etc., all of which have seasonal features [3-4].

The data was provided by North China Sea Environmental Monitoring Center. The survey was conducted in July and October 1984. Cu in bottom waters in three sampling sties (2031, 2032 and 2033) (Fig. 1) were sampled and monitored follow by National Specification for Marine Monitoring [5].

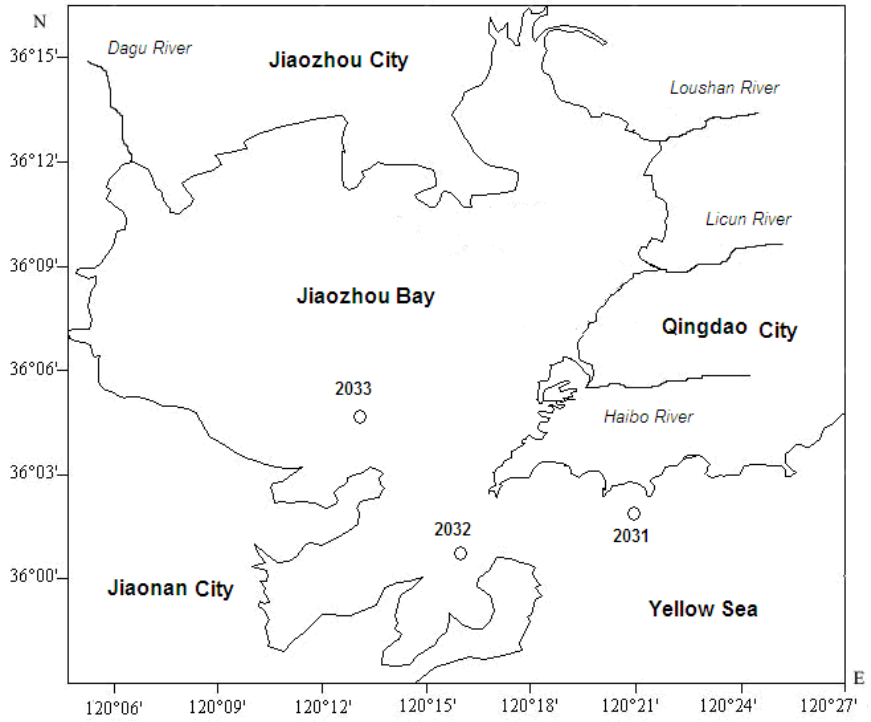

Fig.1 Investigation sites in Jiaozhou Bay

Results and discussion

Contents of Cu. Cu contents in bottom waters in July and October 1984 in Jiaozhou Bay were 0.13-2.97 μg L^{-1} and 0.40-0.61 μg L^{-1}, respectively (Table 1), and were meeting Grade I in National Sea Water Quality Standard (GB 3097-1997) (Table 1). Once Cu was inputted to the bay, it was firstly arrived at the surface waters, and was transported through the water body by means of vertical water's effect [6]. In generally, Cu contents in bottom waters in July and October 1984 in Jiaozhou Bay were very low, particularly in October, and this bay could be considered as unpolluted by Cu in 1984.

Table1 Pollution level of Pb in bottom waters in Jiaozhou Bay in July and October 1984

Month	July	October
Content/μg L^{-1}	0.13-2.97	0.40-0.61
Water quality grade	I	I

Horizontal distributions of Cu in bottom waters. As showed in Fig. 1, Site 2033, Site 2023 and Site 2031 were located in the inside of the bay mouth, the middle of the bay mouth and the outside of the bay mouth, respectively. In July, there was a high value (2.97 μg L^{-1}) in Site 2032 and a high value region in the bay mouth, and there were a series of parallel lines, which were decreasing from the bay mouth to the open waters (0.13 μg L^{-1}) (Fig. 2). In October, there was a high value (0.61 μg L^{-1}) in Site 2031 in the inside of the bay mouth, and there were a series of parallel lines, which were decreasing from the inside of the bay mouth to the bay mouth (0.40 μg L^{-1}). The distributions of Cu in bottom waters indicated that there were different sources.

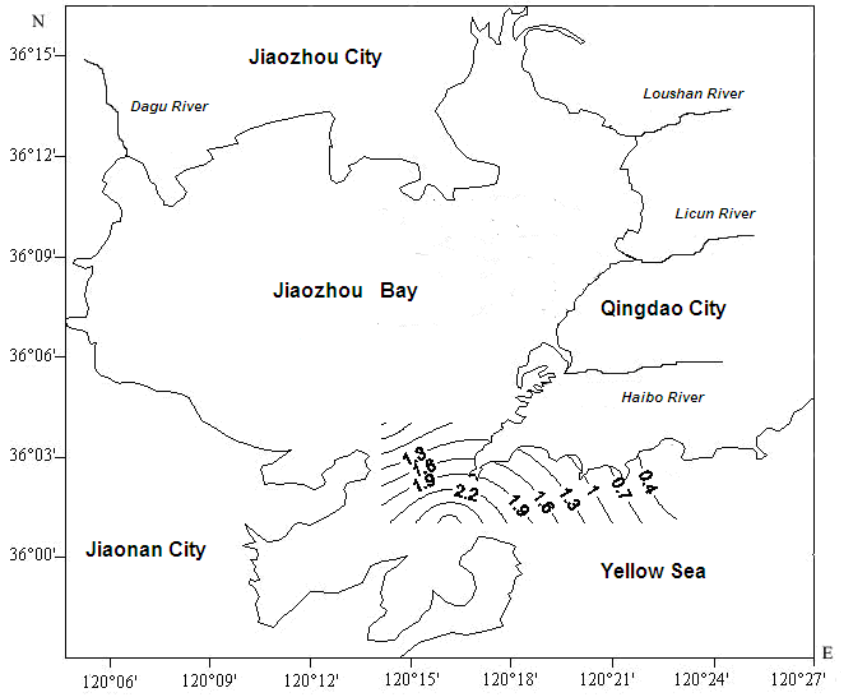

Fig. 2 Horizontal distributions of Cu in bottom waters of Jiaozhou Bay in July 1984/μg L^{-1}

Migration processes and high sedimentation regions of Pb. The contents of the substances in marine bay were continuously decreasing along with the water exchange of the bay and the open sea [7]. Cu contents in July were 0.13-2.97 μg L^{-1}, which were more high than in October, and were decreasing from the bay mouth to the open waters, indicating that there were high sedimentation rate region in the bay mouth and low sedimentation rate region outside the bay mouth. Cu contents in July were 0.40-0.61 μg L^{-1}, which were more low than in July, and were increasing from the bay mouth to the open waters, indicating that there were low sedimentation rate region in the bay mouth and high sedimentation rate region outside the bay mouth. In generally, due to the different Cu sources and by means of vertical water's effect [6], there were different high sedimentation rate regions of Cu in Jiaozhou Bay.

Acknowledgment

This research was sponsored by Doctoral Degree Construction Library of Guizhou Nationalities University, Education Ministry's New Century Excellent Talents Supporting Plan (NCET-12-0659), the China National Natural Science Foundation (31560107) and Research Projects of Guizhou Nationalities University ([2014]02), Research Projects of Guizhou Province Ministry of Education (KY [2014] 266), Research Projects of Guizhou Province Ministry of Science and Technology (LH [2014] 7376).

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