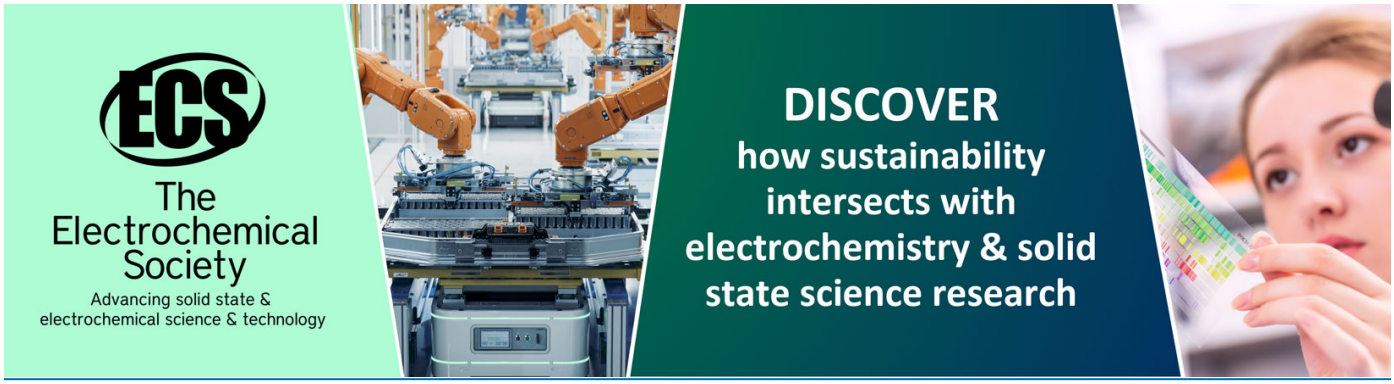
Terrestrial and oceanic transport processes of Cu in Jiaozhou Bay



Terrestrial and oceanic transport processes of Cu in Jiaozhou Bay

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Abstract. This paper analyzed the terrestrial and oceanic transport processes of Cu in Jiaozhou Bay. Results showed that the terrestrial transport processes included three stages of 1) the existence of Cu in the nature, 2) the leaching of Cu from soil and land surface, and 3) the transport of Cu to ocean by stream flow and overland runoff. The oceanic transport processes included three stages of 1) Cu was input to the bay by marine current, 2) Cu was input to the bay by island top directly, and 3) Cu was input to the bay by marine traffic directly. The existence of Cu in marine bay were determined bay both human activity and natural factor. The seasonal variation of Cu contents were determined by the terrestrial and oceanic transport processes jointly.

1. Introduction

Cu is one of the precious metal widely existing in the whole world. Cu has been exploited for thousands of years and widely used in industry and everyday life. The exploitation and utilization of Cu were increasing rapidly along with the rapid development of industrialization and urbanization, and a large amount of Cu-containing wastes were generated and discharged to the environment. As a result, many marine bays have been polluted by Cu since ocean is the sink of pollutant [1-8]. Hence, understanding the terrestrial and oceanic transport processes of Cu in marine bay is helpful to decision-making of pollution control practice.

Jiaozhou Bay is a semi-closed marine bay in Shandong Province China. This bay had been polluted by various pollutants after the reform and opening-up [9-16]. This paper analyzed the terrestrial and oceanic transport processes of Cu in Jiaozhou Bay based on investigation data during 1982－1986. The aim of this paper was to provide information for scientific research and pollution control and environmental remediation.

2. 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, August and October 1984, April, July and October 1985, and April 1986, respectively (Fig. 1). Cu in waters was sampled and monitored follow by National Specification for Marine Monitoring [19]. For seasonal division in study area, April, May and July are spring, July, August and September are summer, October, November and December are autumn, respectively.

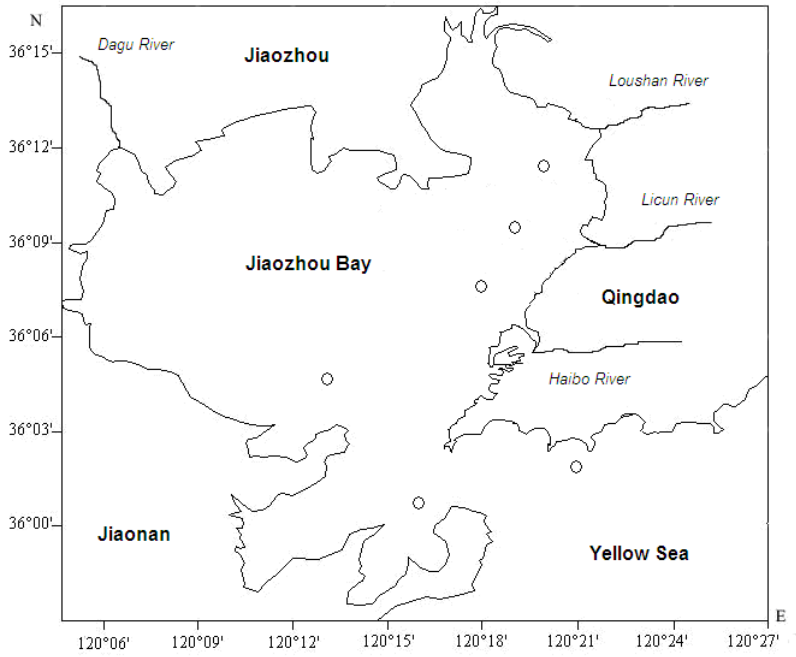

Fig. 1 Geographic location and sampling sites in Jiaozhou Bay

3. Results and discussion

Sources of Cu in Jiaozhou Bay. Cu contents in surface waters and the seasonal variations in Jiaozhou Bay were mainly determined by the seasonal variations of the source strengths of the major Cu sources, as well as the transport processes of Cu from land to ocean. During 1982-1986, the major Cu sources in Jiaozhou Bay were marine current, stream flow, island top, overland runoff and marine traffic, respectively, whose source strengths were varying from 0.39—20.60 μg L^{-1}, 0.37—10.57 μg L^{-1}, 0.77—4.86 μg L^{-1}, 2.28—3.56 μg L^{-1}, 9.48 μg L^{-1}, respectively (Fig. 1). The seasonal variations of Cu contents in surface waters in Jiaozhou Bay were significant since the sources and their source strengths were changing within year and with years. By means of vertical water's effect [6], the seasonal variations of Cu contents in surface waters in Jiaozhou Bay were objective existing.

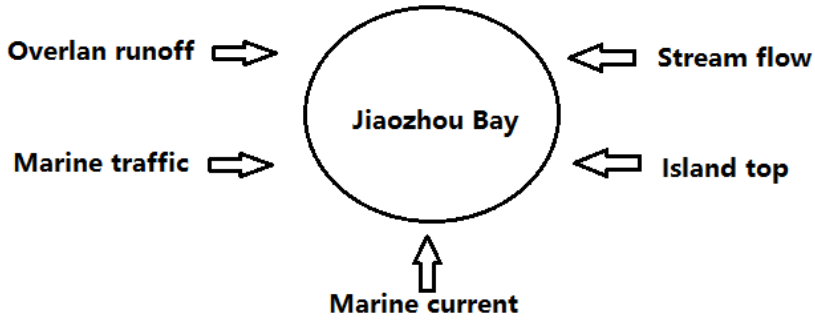

Fig. 2 The major sources of Cu in Jiaozhou Bay 1982-1986

Terrestrial transport processes of Cu in Jiaozhou Bay. The terrestrial transport processes of Cu in Jiaozhou Bay were mainly including stream flow input process and overland input process. The seasonal variation of Cu contents in surface waters in Jiaozhou Bay were strongly impacted by these terrestrial transport processes. In general, the terrestrial transport processes included three stages of 1) the existence of Cu in the nature, 2) the leaching of Cu from soil and land surface, and 3) the transport of Cu to ocean by stream flow and overland runoff. The terrestrial transport processes could be described in a block diagram model (Fig. 3) The human activity enhance the leaching of Cu from soil and land surface, and Cu was transported to the ocean via stream flow and overland runoff. In general, the generated and the transport of Cu to stream flow and overland runoff were determined by human activity and and natural factor jointly.

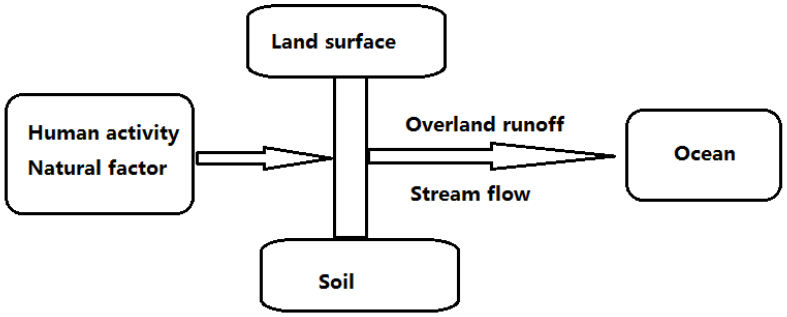

Fig. 3 The block diagram model of terrestrial transport processes of Cu

Oceanic transport processes of Cu in Jiaozhou Bay. The oceanic transport processes of Cu in Jiaozhou Bay were mainly including marine current input process, island top input process and marine traffic input process. The seasonal variation of Cu contents in surface waters in Jiaozhou Bay were also strongly impacted by these oceanic transport processes. In general, the oceanic transport processes included three stages of 1) Cu was input to the bay by marine current, 2) Cu was input to the bay by island top directly, and 3) Cu was input to the bay by marine traffic directly. The oceanic transport processes could be described in a block diagram model (Fig. 4). In according to the oceanic block diagram model (Fig. 4), the transport path and the remaining trace of Cu could be defined. As a whole, the Cu contents in marine bay were determined by human activity and natural factor jointly.

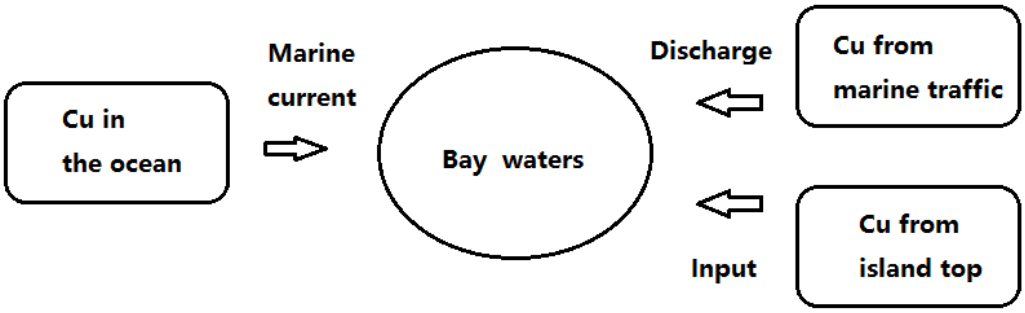

Fig. 4 The block diagram model of oceanic transport processes of Cu

4. Conclusions

The terrestrial and oceanic transport processes of Cu in Jiaozhou Bay major were analyzed, and the block diagram models were provided. The terrestrial transport processes included three stages of 1) the existence of Cu in the nature, 2) the leaching of Cu from soil and land surface, and 3) the transport of Cu to ocean by stream flow and overland runoff. The oceanic transport processes included three stages of 1) Cu was input to the bay by marine current, 2) Cu was input to the bay by island top directly, and 3) Cu was input to the bay by marine traffic directly. The seasonal variation of Cu contents were determined by the terrestrial and oceanic transport processes jointly. In according to the terrestrial block diagram models, the transport path and the remaining trace of Cu could be defined.

Acknowledgment

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