Ocean acidification causes element release from the sediments of Changjiang (Yangtze River) estuary

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The Changjiang (Yangtze River) is the largest river in China, which plays a critical role in terrestrial material cycle and ecosystem health of the East China Sea. In recent years, the Changjiang delivered a huge amount of nutrients into the estuarine and coastal areas, resulting in the deterioration of marine environment such as the occurrences of red tide and hypoxia off the estuary. How the estuarine and shelf sediments that are originally weathered from the land respond to the rapid changes of oceanic environment may significantly influence the material cycle and biogeochemical process in the East China Sea and the West Pacific.

In this contribution, an experimental study was carried out to examine the release rates of major elements (Ca, K, Mg, Mn and Fe) from the surface sediments in the Changjiang Estuary, aiming to explore the element release behavior and mechanism in terms of ocean acidification. Under the wide pH ranges of simulated seawater from 4.0 to 8.0, the release fluxes of Ca, K, Mg, Mn and Fe from four sediment samples increase rapidly while the sediments reacting with the solution, and then show different variations. The dissolution rates of the elements decrease with the simulated seawater pH increasing from 4.0 to 7.0, but increase while the pH increasing from 7.0 to 8.0. Furthermore, Ca, K and Mg have relatively higher dissolution rates than Mn and Fe. The different release rates of these elements are closely related to the original mineral composition of the studied sediments and the reaction kinetics. Overall, although the release rates of the elements are relatively slow, the enhancing ocean acidification could cause significant release of major elements from naturally-weathered terrigenous sediments into the ambient marine environment, which has to be considered carefully in the future studies on global environmental change and ocean chemistry.

Acknowledgements: This work was supported by NSFC research fund (Grant No: 41225020, 41376049).