

## Supplementary Information

### 1. The in-situ parameters of Cr, Ni, Cu, Pb and Zn concentrations were measured by instrument

The five elements were tested using the XFS method based on DZ/T0279.1,10-2016 and DB34/T 2127.2-2014. The instrument was ZSX PrimusII, the sample quality was 5.00 g, the determination atmosphere was vacuum, the ambient temperature was set at 24 °C, the ambient humidity was 42%, the carrier gas was argon methane, the voltage was 55 kV, the current was 60 mA, the carrier gas flow was 6.7 mL/min.

### 2. The in-situ parameters of Cd concentrations were measured by instrument

This element was tested using ICP-MS according to based on DZ/T0279.5.7-2016. The instrument was XSERIES2, the mass of sample was 0.0500 g, the volume was 35 mL, the ambient temperature was set at 23 °C, the ambient humidity was 50%, the high frequency power was 1.25 kW, the atomization gas flow was 0.80 L/min, the peristaltic pump rotate speed was 30 rpm.

### 3. The in-situ parameters of As and Hg concentrations were measured by instrument

The sediment samples were digested in water bath with HCl-HNO<sub>3</sub> mixture, then pretreated with thiourea (CH<sub>4</sub>N<sub>2</sub>S), ascorbic acid (C<sub>6</sub>H<sub>8</sub>O<sub>6</sub>) and tartaric acid (C<sub>4</sub>H<sub>6</sub>O<sub>6</sub>), and then the total As concentration was determined. Besides, the sediment samples were digested with aqua regia in a water bath, pretreated with potassium dichromate (K<sub>2</sub>CrO<sub>4</sub>), and then the total Hg concentration was determined. These two elements were tested using AFS based on DZ/T0279.13-2016 and DZ/T0279.17-2016. The instrument was AFS-3100, the sample mass was 0.5000 g/50 mL, the ambient temperature was set at 21 °C, the ambient humidity was 55% , the negative high pressure was 250 V, the lamp current was 28 mA, the carrier gas flow was 400 mL/min.