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Geochemical transfer of thallium in a sediment profile from the Pearl River, China and its source apportionment by lead isotope

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Thallium (Tl) is a highly toxic heavy metal, with higher toxicity than Hg, Cd and Pb for organisms. Serious Tl pollution incidents successively occurred in the Pearl River, China, as a result of longtime mining and smelting of Tl-bearing sulfide minerals (such as pyrite, chalcopyrite and sphalerite) without proper environmental management. The Pearl River, is the third-longest river in China (2,400 km) and acts as the main drinking water sources for nearly 50 million people. However, it remains largely unknown of the geochemical fate of Tl in sediments from the Pearl River. In addition, the ambiguity of source apportionment of Tl pollution set a giant obstacle for pollution treatment of Tl.

The aims of this study are to (i) to investigate the contents and geochemical speciations of Tl in one representative sediment profile from North section of the Pearl River; (ii) to quantitatively apportionment of Tl pollution source in the sediments with the aid of Pb isotope tracing technique. The results showed that (1) Tl contents ranged 4.81 to 13.50 mg/kg with a mean of 2.73 mg/kg, which is about five times Tl content in background sediment (0.55 mg/kg); (2) the EF_{Al} (enrichment factor normalized to Al) values of Tl were in the range of 8.3 to 23.9 and averaged 14.4; (3) the contents of Tl has a significantly positively relationship with those of Pb, Cu, Zn and Cd; and (4) approximately 67.3%, 11.2%, 12.4% and 9.1% of Tl in the sediments were derived from Pb-Zn smelting activities, automobile exhausts, coal burning activities from local power plants and natural weathering of granitic parental bedrock, respectively.

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