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# Deciphering anthropogenic trace metal sources and physicochemical processes affecting the Urban Area of Taipei on the Danshui System (NE Taiwan)

Antoine Lerat<sup>\*†1</sup>, Alexandra Coynel<sup>‡1</sup>, Rita Yam<sup>2</sup>, Fi-John Chang<sup>2</sup>, Alexia Legeay<sup>1</sup>, Magalie Baudrimont<sup>1</sup>, Agnès Feurtet-Mazel<sup>1</sup>, Laureline Gorse<sup>1</sup>, Lionel Dutruch<sup>1</sup>, Cécile Bossy<sup>1</sup>, Gérard Blanc<sup>1</sup>, and Georges Vachaud<sup>3</sup>

<sup>1</sup>Université de Bordeaux, UMR EPOC 5805 – Metropolitan France

<sup>2</sup>National Taiwan University, Department of Bioenvironmental Systems Engineering – Taiwan

<sup>3</sup>Université Joseph Fourier, UMR LTHE 5564 – Metropolitan France

## Abstract

Estuaries are important interfaces between continent and ocean and deliver invaluable ecosystem services. The identification of urban pollutant sources, especially for trace metals, is a major issue to provide a sustainable management and restore estuarine and coastal water quality. Moreover, it is a useful tool to minimize future contamination as worldwide urban populations are projected to increase from ~3.1 to 6.7 billion in 2050, particularly in East Asian countries with high economic development. The Danshui River (L=159 km and S=2,726 km<sup>2</sup>) is the major system in North Taiwan. It has three major tributaries (Xindian, Dahan and Keelung). It shows a quite undisturbed section in upstream and it drains the Taipei-Keelung-Taoyuan Metropolitan area (9.1 million inhabitants) in downstream. A snapshot sampling campaign was performed in March 2015 for characterizing the spatial distribution of trace metal concentrations in water (i.e. unfiltered, < 0.2 μm and < 0.02 μm fractions) and in river sediments. Additionally, road dusts were also collected in the Taipei conurbation. This study aims at establishing local geochemical background (LGB), localizing and explaining geochemical anomalies. Trace metal concentrations in water increase from upstream (mainly on dissolved fractions) to downstream (mainly on unfiltered fractions) attributed to geochemical (desorption/adsorption) or physical (resuspension) processes and/or anthropogenic sources. Enrichment Factors (EF) are calculated using LGB and display a high spatial variability depending on the studied element. The highest EF are obtained for Sn (EF<sub>max</sub>=28), Cu (EF<sub>max</sub>=9) and Ag (EF<sub>max</sub>=7) in river sediments and for Sn (EF<sub>max</sub>=104), Cu (EF<sub>max</sub>=78) and Ag (EF<sub>max</sub>=10) in road dusts. Our results suggest that these 3 elements are good tracers for urban sources. However, the impact on the Danshui sediments is limited compared with other systems due to the high mechanical erosion and sediment supply entering in the estuary, leading to a high dilution during extreme rainy events (e.g. typhoons).

**Keywords:** Copper, Silver, Tin, Trace metals, Urban area, Taiwan, Taipei, Danshui River, Estuary

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\*Speaker

†Corresponding author: antoine.lerat@etu.u-bordeaux.fr

‡Corresponding author: alexandra.coynel@u-bordeaux.fr