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Coastal Research: Estuarine Processes and Submarine Ground Water Discharge

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Editorial

The estuarine and coastal environments of Mauritius are suffering ever-increasing impact from anthropogenic activities and Submarine Groundwater Discharge (SGD) is now recognized as an important pathway between land and sea. As such, this flow may contribute to the biogeochemical and other marine budgets of nutrients in near-shore waters. The stable isotopic composition of submarine waters is also characterized by significant variability and heavy isotope enrichment and used to predict the contribution of fresh terrestrially derived groundwater to SGD (range from a few % to almost 100%) in Flic en Flac lagoon, Mauritius. Sources of input of trace metals (in particular, Pb, Cu and Zn) in Mauritius in recent years include industrial effluents, urban and road runoff, sewage sludge, landfill leachates including scrap metal and solid waste leachates [1-5]. The potential sources of Pb in sediments from upstream to the estuary were from the adjacent motorway and road runoff causing significant quantities to be trapped within the St. Louis River in the Grand River North West catchment area. Pb and Zn were significantly positively correlated in the sediments along St. Louis River indicating a common source for Pb and Zn. Significant negative correlations were also found for both Pb and Zn with dissolved oxygen in summer along St. Louis River which indicated that the presence of anoxic waters influenced the trapping of Zn and Pb in the sediment phase. A phasedown of Pb in petrol was necessary and with the introduction of unleaded petrol and vehicles equipped with catalytic converters, studies on levels of Pd and Pt to provide baseline data need to be done in the near future and integrated in environmental development schemes and effective coastal zone management of small island states [6-9]. The common influential cycling of Pb and Zn was further reinforced as both dissolved Pb and Zn were significantly positively correlated to dissolved phosphate, which suggested a biological role in the cycling of Zn and Pb. The mean concentrations of Zn (204.0 ± 92.3 mg kg^{-1}) and Pb (44.5 ± 16.4 mg kg^{-1}) in sediments at Sable Noir, an urban estuary, can be considered below those from contaminated estuarine sediments in industrialized countries. Pb significantly decreased from two consecutive winters 2004/2005 to summer 2005/2006 at Sable Noir at 5% significance level due to flash floods in summer and dilution with cleaner background sediments. Pb was however significantly higher at Sable Noir in winter 2004 compared to winter 2005 and significantly increased from summer 2005 to summer 2006 due to a minor diesel spill in the estuary. Both Pb and Zn were significantly higher at Sable Noir in winter 2004 compared to Flic en Flac in winter 2008. Pb and Zn were also significantly higher at Sable Noir in summer 2005 compared to Flic en Flac in summer 2009. The presence of Cu at Sable Noir can be attributed to road run off, brake linings and urban activity prevailing in the area. The contamination of sediments with Cu in downstream and estuarine sediments was significant showing an increasing trend following flash floods in March 2013 sediments and values indicated that the sources of Cu are traffic and urban related and potentially constitutes a health hazard [10-13].

In contrast to the strong temporal and spatial variability in the aqueous concentrations of contaminants, sediments integrate contaminant concentrations over time. Protecting estuarine and coastal resources from continued trace metal contamination and eutrophication particularly requires the ability to predict responses to potential increases in pollution loading resulting from changing land-use patterns and urbanization in line with environmental sustainability.

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