Data Article

# Sedimentological and geochemical data in bed sediments from a tropical river-estuary system impacted by a developing megacity, Ho Chi Minh City - Vietnam

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## ARTICLE INFO

## ABSTRACT

Sedimentological and geochemical data were obtained for bed sediments from a tropical estuary environment in Vietnam in October 2014, January 2016, and November 2016. The data include grain-size distribution, percentage of clay, silt and sand, percentage of organic matter, concentration of total particulate phosphorus (TPP), concentration of particulate

inorganic phosphorus (PIP), concentration of particulate organic phosphorus (POP), percentage of total nitrogen (TN), percentage of total carbon (TC), trace metals concentrations (V, Cr, Co, Ni, Cu, Zn, As, Mo, Cd, Pb) and major elements (Al, Fe, Mn). Geochemical indexes (Enrichment factor EF and Geo-accumulation Index I-geo) and sediment quality guideline (mean Effect Range Median quotients) were calculated.

## Specifications table

| | |
|---|---|
| Subject | Environmental Science |
| Specific subject area | Environmental Chemistry; Pollution |
| Type of data | Figures |
| How data were acquired | Sampling: Eckman sediment grab, plastic spatula |
| | Analysis: aqua regia digestion; High-temperature/HCl extraction for particulate Phosphorus |
| | Measurements: Thermo Scientific iCAPQ ICP-MS; laser diffraction sizer Malvern; muffle furnace, colorimetry for P, Thermoflash CHN analyser for C and N |
| Data format | Raw and analysed |
| Parameters for data collection | Sites were chosen according to their environmental characteristics such as salinity gradient and the anthropogenic activities and pressure nearby the zones: industrial zone, urban zone, remote zone, aquaculture zone. |
| Description of data collection | Surface intertidal sediments (layer: 0–1 cm) were collected in October 2014, November 2016 and January 2016. In October 2014 and November 2016 they were sampled at low tide in intertidal mudflats. In January 2016 they (layer: 0–5 cm) were sampled with an Eckman grab operated from a boat for the river sites, and from the shore for canal sites. In all cases, sediments were collected using a plastic spatula. |
| Data source location | City/Town/Region: Ho Chi Minh City, Can Gio district |
| | Country: Vietnam |
| | Latitude and longitude (and GPS coordinates) for collected samples/data: in published public repository data |
| Data accessibility | |
| | In a public repository |
| | Repository name: dataSuds |
| | Data identification number: doi.org/10.23708/3KJR0C; doi.org/10.23708/IXK6MQ, |
| | Direct URL to data: https://doi.org/10.23708/3KJR0C; https://doi.org/10.23708/IXK6MQ, |
| | Full reference |
| | STRADY, Emilie; NEMERY, Julien; NGUYEN, Thanh-Nho; DENIS, Hervé, 2020, "Sedimentological and biogeochemical data of bed sediments from the Can Gio Mangrove, Vietnam, 2014″, https://doi.org/10.23708/IXK6MQ, DataSuds, V1, UNF:6:cRrCuB2zubHIRLw00uGCog== [fileUNF] |
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| Related research article | Babut M., Mourier B., Desmet M., Simonnet-Laprade C., Labadie P., Budzinski H., De Alencastro L.F., Tu A.T., Strady E., Gratiot N., 2019. Where has the pollution gone? A survey of organic contaminants in Ho-Chi-Minh City / Saigon River (Vietnam) bed sediments. Chemosphere, 217, 261–269. https://doi.org/10.1016/j.chemosphere.2018.11.008 |

**Value of the data**

- Provide baseline concentrations of carbon, nitrogen, phosphorus, and trace metals as well as geochemical indexes in sediment upstream to downstream the developing megacity of Ho Chi Minh City.
- Can benefit to environmental protection and management agencies and researchers.
- Can be useful for long-term observation of the level of contamination and remediation programs.
- Concern both geochemical and sedimentological characteristics of surface sediments.

## 1. Data description

Data presented in this article are related to a pluri-annual and multi-proxy study of pollution in the sediments of the Saigon River Estuary crossing the megacity of Ho Chi Minh City and the Can Gio Mangrove estuary located downstream the city [1; 2]. The present dataset focuses on destructive analyses used to acquire sedimentological and geochemical data including grain-size distribution, percentage of clay, silt and sand, percentage of organic matter, concentration of total particulate phosphorus (TPP), concentration of particulate inorganic phosphorus (PIP), concentration of particulate organic phosphorus (POP), percentage of nitrogen in the sediment, percentage of total carbon (TC) and trace metals and metalloid concentrations for vanadium (V), chromium (Cr), cobalt (Co), nickel (Ni), copper (Cu), zinc (Zn), arsenic (As), molybdenum (Mo), cadmium (Cd), lead (Pb), and major elements for aluminium (Al), iron (Fe), manganese (Mn) [3; 4]. A total of 66 samples is presented, 14 samples taken in October 2014 in the Can Gio Mangrove estuary, 17 samples in January 2016 in the Saigon River and its main urban canal tributaries, 17 samples in November 2016 in the Saigon River Estuary and the Can Gio Mangrove Estuary [3; 4]. Two pollution indexes were also calculated: enrichment factors (EF) (Fig. 1) and geoaccumulation indexes (I-geo) (Fig. 2) using upstream local sediment as natural background and the mean Effect Range Median quotients for all samples (Fig. 3).
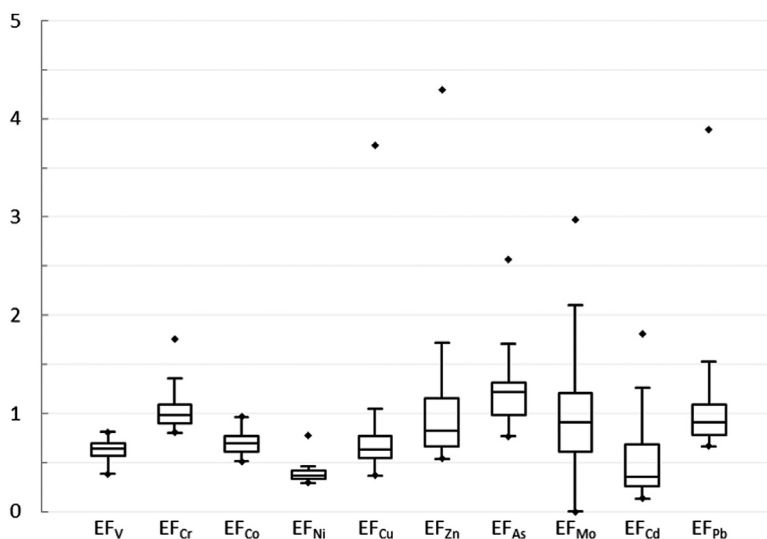


**Fig. 1.** Box plot of V, Cr, Co, Ni, Cu, Zn, As, Cd and Pb enrichment factor considering all sites.
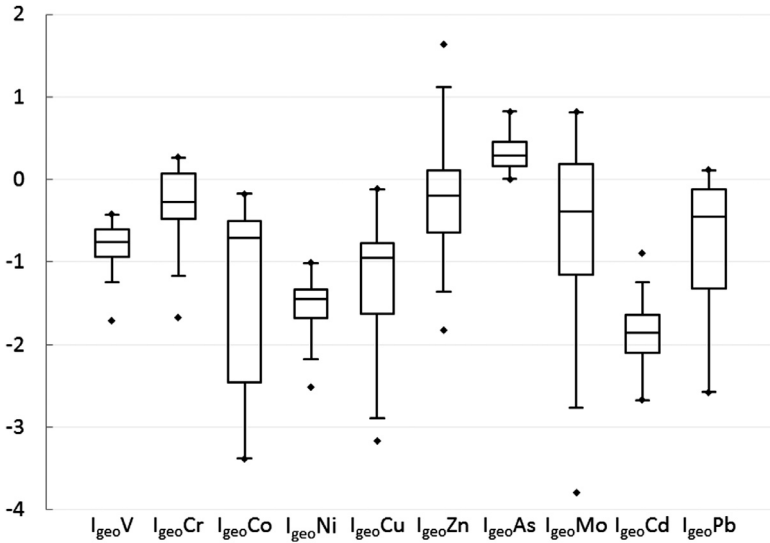
**Fig. 2.** Box plot of V, Cr, Co, Ni, Cu, Zn, As, Cd and Pb Igeo considering all sites.
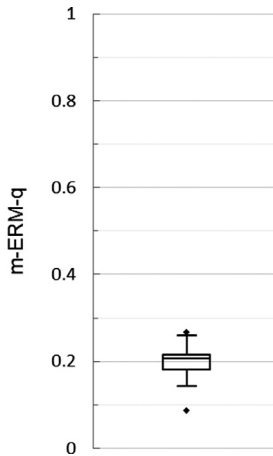


**Fig. 3.** Box plot of m-ERM-q values considering all sites.

## 2. Materials and methods

### 2.1. Sampling and handling

Surface intertidal sediments (0–1 cm) collected in October 2014, November 2016 and January 2016 were sampled at low tide in intertidal mudflats of urban, industrial and in the Can Gio Mangrove Forest reserve areas while surface bottom sediment (0–5 cm) were sampled with an Eckman grab operated from a boat for the river sites, and from the shore for canal sites. In all cases, sediments were collected using a plastic spatula and immediately introduced into a polyethylene bag, stored in a cool box after handling until being returned to the laboratory at

the end of the sampling day. The GPS location were recorded for each sample. A first aliquot of each sediment sample was kept in the fridge at 4 °C for particle size analyses. A second aliquot of each sediment sample was immediately stored in a freezer at −18 °C, then was freeze-dried and kept at room temperature for organic matter, carbon, nitrogen, phosphorus and trace metals analyses.

### 2.2. Laboratory analyses

#### 2.2.1. Grain size analysis

Grain size distribution was measured after a 3 min ultrasonic agitation by a laser diffraction sizer (Malvern, Mastersizer 2000 IGE-OSUG Laboratory, Grenoble, France), with a reproducibility better than 5%.

#### 2.2.2. Organic matter content

Organic matter in sediments was measured directly by calcination [5]. Aliquots of 1 g of dried, powdered and homogenized sediment samples were placed in aluminium pupils (weighed beforehand) in a muffle furnace at 550 °C for 16 h. Calcined sediments were then cooled and weighed again. The organic matter content was then calculated based on the weight loss after calcination.

$$\%OM = (dry\,weight(g) - weight\,incinerated(g))/(dry\,weight(g)) \times 100$$

#### 2.2.3. C, N and P analysis

Dried sediment was crushed into powder and sieved at 200 µm. To determine total carbon and total nitrogen, 10–30 mg sub-sample was weight, put in aluminium cup, and kept in a desiccator until the analysis using an elementary CN-analyser FlashEA 1112 (Thermo Fisher Sci., MA, USA, geochemistry platform OSUG-LECA, University Grenoble Alpes). Total particulate P content of suspended sediment was determined using a high-temperature/HCl extraction technique [6]; organic P was mineralized into inorganic forms at 550 °C during 16 h as for organic matter determination. Both inorganic and mineralized organic forms of 0.5–1 g of sediment were extracted by using 1 N HCl for 15–20 h and analysed for phosphate using the colorimetric method [7]. To estimate particulate inorganic P, the analysis was similar to that for TPP, except that the high temperature organic P mineralization was omitted. Particulate organic phosphorus was determined by subtracting the PIP concentration from the TPP concentration ($[POP]=[TPP]-[PIP]$, in gP kg$^{-1}$). Reproducibility for replicate measurement was better than 5% for TC, TN, TPP, and PIP.

#### 2.2.4. Trace metals analyses

Dried representative sub-samples of surface sediments were ground into a powder with agate pestles and mortars. A 30 mg sub-sample of powdered and homogenized sediment was digested into acid pre-cleaned 30 mL Savilex vessel using aqua regia (2 mL of $HNO_3$ 14 M, Suprapur® and 4 mL of HCl 12 M Suprapur®) and placed on a heating plate at 120 °C for 4 h. After cooling, the digested solution was evaporated until dryness, and the digestate was diluted to 10 mL using 0.5 mL $HNO_3$ (14 M, Suprapur®) and ultrapure water (Elga®) for 30 min at 65 °C. After cooling and decantation, 3.5 mL of supernatant and 6.5 mL of ultrapure water (Elga®) were poured into 15 mL acid pre-cleaned PP tube. Trace metal concentrations were measured by Thermo Scientific iCAPQ ICP-MS using internal standard calibration (AETE-ISO platform, OSU-OREME/Université de Montpellier). The quality of analysis and measurements were controlled using certified riverine sediments for aqua regia digestion LGC 6187 (recoveries: 86% for Cr, 103% for Mn, 93% for Ni, 94% for Cu, 94% for Zn, 99% for As, 101% for Cd, 101% for Pb) and certified marine sediments for total extractable digestion MESS-3 (recoveries 28% for Cr, 86% for Mn, 79% for Co, 70% for Ni, 78% for Cu, 72% for Zn, 82% for As, 83% for Cd, 81% for Pb).

## 2.3. Geochemical and ecotoxicological indexes

The degree of metal enrichment in the sediments was assessed through the following numerical methods: Enrichment Factor (EF) and Geo-accumulation Index (I-geo).

### 2.3.1. Enrichment factor (EF)

The enrichment factor (EF) is an index that allows differentiating natural geochemical background to anthropogenic inputs [8;9]. The EF is defined as the ratio of Al normalized metal concentrations in sediments over Al normalized ratio in a geochemical background reference [1]. We used as a background reference a local sediment sampled in the upstream Saigon River, few kilometers downstream the Dau Tieng Reservoir, previously defined as a background reference. An EF value between 0.5 and 1.5 suggests natural weathering processes, while a value of EF > 1.5 suggests trace metals release from noncrustal materials which correspond to enrichment from anthropogenic sources [8]. More precisely, Birth [10] defined minor enrichment for 1.5 < EF < 3, moderate enrichment for 3 < EF < 5, and moderately severe enrichment for 5 < EF < 10.

### 2.3.2. Geo-accumulation index (I-geo)

The degree of metal enrichment was also assessed using the I-geo [11] using the background value Bn as a 'pre-civilisation' value for the study area, defined by:

$$I - geo = \log_2 (C_n / 1.5 * B_n)$$

where Cn is the measured concentration in the sediment for metal n, Bn is the background value for the metal n, and factor 1.5 is used because of possible variations in background data due to lithological variations. A local sediment sampled in the upstream Saigon River was used as a background reference [1]. The Geoaccumulation Index includes seven grades: I-geo < 0 uncontaminated; $0 < I$-geo $< 1$ uncontaminated to moderately contaminated; $1 < I$-geo $< 2$ moderately contaminated; $2 < I$-geo $< 3$ moderately to strongly contaminated; and so on until extremely contaminated.

### 2.3.3. Sediment quality guideline

The mean Effect Range Median quotients (m-ERM-q) is a sediment quality guideline that has been developed for marine ecosystems; it provides a management tool for assessing sediment quality in terms of adverse biological effects. This pollutant-specific index (e.g. mixtures of contaminants, including trace metals present in sediment samples) was obtained in laboratory experiments using amphipod organisms [12].

The m-ERM-q calculation is based on:

$$m - ERM - s = \frac{\sum_{i=1}^{n} C_i / ERM_i}{n}$$

where Ci is the concentration of the pollutant i in the sample, ERMi is the experimentally defined effect concentration for the pollutant i and n is the number of studied pollutants i. Four classes of toxicity probability for biota are then defined: low (m-ERM-$q$ < 0.1), low-medium (m-ERM-q: 0.11–0.5), medium-high (m-ERM-q: 0.51–1.5) and high priority sites (m-ERM-$q$ > 1.5) [10]. The m-ERM-q index is derived from the concept of effect range-low (ERL i.e.10th percentile of the effect dataset) and effect range median (ERM, i.e., 50th percentile of the effect dataset) defined by [13] respectively as the concentration below which adverse effects are not expected to occur, and above which adverse effects are expected to occur.

## Declaration of Competing Interest

The authors declare that they have no known competing 1financial interests or personal relationships which have, or could be perceived to have, influenced the work reported in this article.

## Supplementary materials

Supplementary material associated with this article can be found, in the online version, at doi:10.1016/j.dib.2020.105938.

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