



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

David Noncent, Emilie Strady, Julien Némery, Nguyen Thành-Nho, Denis Hervé, Brice Mourier, Marc Babut, Truong An Nguyen, Thi Ngoc Tuyet Nguyen, Cyril Marchand, et al.

### **► To cite this version:**

David Noncent, Emilie Strady, Julien Némery, Nguyen Thành-Nho, Denis Hervé, et al.. Sedimentological and geochemical data in bed sediments from a tropical river-estuary system impacted by a developing megacity, Ho Chi Minh City - Vietnam. Data in Brief, 2020, 31, pp.261-269. 10.1016/j.dib.2020.105938 . hal-02889560

**HAL Id: hal-02889560**

**<https://hal.science/hal-02889560>**

Submitted on 4 Jul 2020

**HAL** is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

L'archive ouverte pluridisciplinaire **HAL**, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d'enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.



## 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



David Noncent<sup>a,b</sup>, Emilie Strady<sup>a,c,e,\*</sup>, Julien Némery<sup>a,d</sup>,  
 Nguyen Thanh-Nho<sup>f</sup>, Hervé Denis<sup>d</sup>, Brice Mourier<sup>g</sup>, Marc Babut<sup>h</sup>,  
 Truong An Nguyen<sup>a,d</sup>, Thi Ngoc Tuyet Nguyen<sup>a,d</sup>, Cyril Marchand<sup>i</sup>,  
 Marc Desmet<sup>j</sup>, Anh Tu Tran<sup>k</sup>, Joanne Aimé<sup>a</sup>, Nicolas Gratiot<sup>a,d</sup>,  
 Quoc Tuc Dinh<sup>a</sup>, Phuoc Dan Nguyen<sup>a</sup>

<sup>a</sup> CARE, Ho Chi Minh City University of Technology, VNU-HCM, Viet Nam

<sup>b</sup> Laboratoire de Qualité de l'Eau et de l'Environnement, Université Quisqueya, Port-au-Prince, Haiti

<sup>c</sup> Aix-Marseille Univ., Mediterranean Institute of Oceanography (M I O), Marseille, Université de Toulon, CNRS/IRD, France

<sup>d</sup> Université Grenoble Alpes, CNRS, IRD, Grenoble INP<sup>a</sup>, IGE, F-38000 Grenoble, France

<sup>e</sup> Institute of Engineering, Université Grenoble Alpes, France

<sup>f</sup> Faculty of Environmental and Food Engineering, Nguyen Tat Thanh University, Viet Nam

<sup>g</sup> UMR5023 Laboratoire d'Ecologie des Hydrosystèmes Naturels et Anthropisés, Université de Lyon, Université Lyon 1, ENTPE, CNRS, 3, rue Maurice Audin, F-69518 Vaulx-en-Velin, France

<sup>h</sup> Irstea, RIVERLY Research Unit, Lyon-Villeurbanne Center, 5 rue de la Doua CS 20244, F-69625, Villeurbanne, France

<sup>i</sup> ISEA, University of New Caledonia, Nouméa, New Caledonia

<sup>j</sup> GêHCO, Université de Tours, Faculté des Sciences Parc de Grandmont Avenue Monge, F- 37200 Tours, France

<sup>k</sup> Faculty of Geology and Petroleum Engineering, Ho Chi Minh City University of Technology, VNU-HCM, Viet Nam

## ARTICLE INFO

## Article history:

Received 1 June 2020

Revised 22 June 2020

Accepted 23 June 2020

Available online 27 June 2020

## 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

DOI of original article: [10.1016/j.chemosphere.2018.11.008](https://doi.org/10.1016/j.chemosphere.2018.11.008)

\* Corresponding author at: Aix-Marseille Univ., Mediterranean Institute of Oceanography (M I O), Marseille, Université de Toulon, CNRS/IRD, France.

E-mail address: [Emilie.strady@ird.fr](mailto:Emilie.strady@ird.fr) (E. Strady).

<https://doi.org/10.1016/j.dib.2020.105938>

2352-3409/© 2020 The Author(s). Published by Elsevier Inc. This is an open access article under the CC BY-NC-ND license. (<http://creativecommons.org/licenses/by-nc-nd/4.0/>)

**Keywords:** 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.

Grain size distribution  
Trace metal  
Carbon  
Nitrogen  
Phosphorus  
Enrichment factor  
I-geo

© 2020 The Author(s). Published by Elsevier Inc.  
This is an open access article under the CC BY-NC-ND license. (<http://creativecommons.org/licenses/by-nc-nd/4.0/>)

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: <a href="https://doi.org/10.23708/3KJR0C">https://doi.org/10.23708/3KJR0C</a> ; <a href="https://doi.org/10.23708/IXK6MQ">https://doi.org/10.23708/IXK6MQ</a> , 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", <a href="https://doi.org/10.23708/IXK6MQ">https://doi.org/10.23708/IXK6MQ</a> , DataSuds, V1, UNF:6:cRrCuB2zubHIRLw00uGCog== [fileUNF] STRADY, Emilie; BABUT, Marc; NEMERY, Julien; MOURIER, Brice; NONCENT, David; DESMET, Marc; NGUYEN, T.N. Tuyet; TRAN, Anh Tu; NGUYEN, Truong An; AIME, Joanne; GRATIOT, Nicolas; DENIS, Hervé, 2020, "Sedimentological, biogeochemical and chemical data in bed sediments from the Saigon River and Can Gio Mangrove, Vietnam, 2016", <a href="https://doi.org/10.23708/3KJR0C">https://doi.org/10.23708/3KJR0C</a> , DataSuds, V1, UNF:6:raRlRAKhW3HhUIRD09oyA== [fileUNF]
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. <a href="https://doi.org/10.1016/j.chemosphere.2018.11.008">https://doi.org/10.1016/j.chemosphere.2018.11.008</a>

## 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).

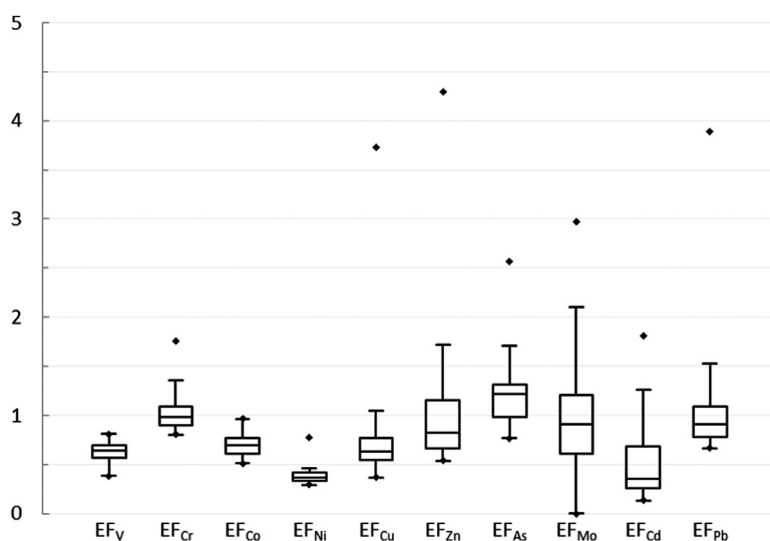
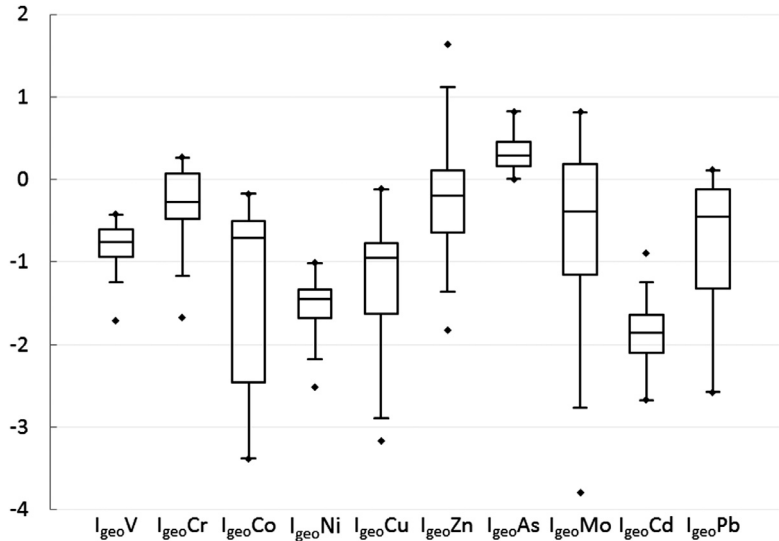
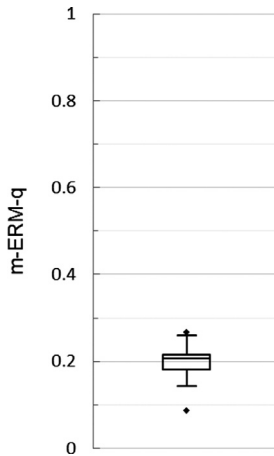


Fig. 1. Box plot of V, Cr, Co, Ni, Cu, Zn, As, Cd and Pb enrichment factor considering all sites.



**Fig. 2.** Box plot of V, Cr, Co, Ni, Cu, Zn, As, Cd and Pb  $I_{geo}$  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.

$$\%OM = (\text{dry weight(g)} - \text{weight incinerated(g)}) / (\text{dry weight(g)}) \times 100$$

### 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<sup>−1</sup>). 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<sub>3</sub> 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<sub>3</sub> (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  $B_n$  as a 'pre-civilisation' value for the study area, defined by:

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

where  $C_n$  is the measured concentration in the sediment for metal  $n$ ,  $B_n$  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:

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

where  $C_i$  is the concentration of the pollutant  $i$  in the sample,  $ERM_i$  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 financial interests or personal relationships which have, or could be perceived to have, influenced the work reported in this article.

## Acknowledgments

This study has been conducted under the framework of CARE-RESCIF initiative. The data acquisition was funded by VNU under grant number B2016–20–05, by the Auvergne-Rhône-Alpes Region, through the CMIRA-Coopera program, “Saigon River: la ville et le fleuve, 2015–2017” and by incentive grants from the French Research Institute for Sustainable Development IRD.

## Supplementary materials

Supplementary material associated with this article can be found, in the online version, at doi:[10.1016/j.dib.2020.105938](https://doi.org/10.1016/j.dib.2020.105938).

## References

- [1] E. Strady, V.B.H. Dang, J. Némery, S. Guédron, Q.T. Dinh, H. Denis, P.D. Nguyen, Baseline seasonal investigation of nutrients and trace metals in surface waters and sediments along the Saigon River basin impacted by the megacity of Ho Chi Minh (Vietnam), *Environ. Sci. Pollut. Res.* 24 (2017) 3226–3243.
- [2] M. Babut, B. Mourier, M. Desmet, C. Simonnet-Laprade, P. Labadie, H. Budzinski, L.F. De Alencastro, A.T. Tu, E. Strady, N. Gratiot, Where has the pollution gone? A survey of organic contaminants in Ho-Chi-Minh City / Saigon River (Vietnam) bed sediments, *Chemosphere* 217 (2019) 261–269.
- [3] STRADY, Emilie; NEMERY, Julien; NGUYEN, Thanh Nho; DENIS, Hervé, 2020. Sedimentological and Biogeochemical Data of Bed Sediments from the Can Gio Mangrove, Vietnam, 2014, DataSuds, V1, 10.23708/IXK6MQ
- [4] STRADY, Emilie; BABUT, Marc; NEMERY, Julien; MOURIER, Brice; NONCENT, David; DESMET, Marc; NGUYEN, T.N. Tuyet; T.R.A.N., Anh Tu; NGUYEN, Truong An; A.I.M.E., Joanne; GRATIOT, Nicolas; D.E.N.I.S., Hervé, 2020. Sedimentological, biogeochemical and chemical data in bed sediments from the Saigon River and Can Gio Mangrove, Vietnam, 2016, DataSuds, V1, <https://doi.org/10.23708/3KJROC>
- [5] S.C. Byers, E.L. Mills, P.L. Stewart, A comparison of methods of determining organic carbon in marine sediments, with suggestions for a standard method, *Hydrobiologia* 58 (1978) 43–47.
- [6] K.I. Aspila, H. Aghemian, A.S.Y. Chau, A semi-automated method for the determination of inorganic, organic and total phosphate in sediments, *Analyst* 101 (1976) 187–197.
- [7] J. Murphy, J.P. Riley, A modified single solution method for the determination of phosphate in natural waters, *Anal. Chim. Acta* 27 (1962) 31–36.
- [8] J. Zhang, C.L. Liu, Riverine composition and estuarine geochemistry of particulate metals in China-weathering features, anthropogenic impact and chemical fluxes, *Estuar. Coastal Shelf Sci.* 54 (6) (2002) 1051–1070.
- [9] E. Strady, Q.T. Dinh, J. Némery, T.N. Nguyen, S. Guédron, S.N. Nguyen, H. Denis, P.D. Nguyen, Spatial variation and risk assessment of trace metals in water and sediment of the Mekong Delta, *Chemosphere* 179 (2017) 367–378.
- [10] G. Birth, et al., A scheme for assessing human impacts on coastal aquatic environments using sediments, in: C.D. Woodcoffe, et al. (Eds.), *Coastal GIS, Wollongong University Papers in Center for Maritime Policy*, Australia, 2003, p. 14.
- [11] G. Müller, in: *Schadstoffe in Sedimenten—Sedimente als Schadstoffe*, Mitt. 79, Österreichische Geologische Gesellschaft, 1986, pp. 107–126.
- [12] E.R. Long, L.J. Field, D.D. MacDonald, Predicting toxicity in marine sediments with numerical sediment quality guidelines, *Environ. Toxicol. Chem.* 17 (1998) 714–727.
- [13] E.R. Long, D.D. MacDonald, S.L. Smith, F.D. Calder, Incidence of adverse biological effects within ranges of chemical concentrations in marine and estuarine sediments, *Environ. Manag.* 19 (1995) 81–97.