HAL
open science

Long-term records of trace metal elements in core sediments: anthropogenic impacts in the Eure river watershed

Thomas Gardes, Maxime Debret, Yoann Copard, Edouard Patault, Julien Deloffre, Stéphane Marcotte, Anne-Lise Develle, Pierre Sabatier, Eric Chaumillon, Thibault Coulombier, et al.

To cite this version:

Thomas Gardes, Maxime Debret, Yoann Copard, Edouard Patault, Julien Deloffre, et al.. Long-term records of trace metal elements in core sediments: anthropogenic impacts in the Eure river watershed. American Geophysical Union (AGU) Fall Meeting, Dec 2017, Nouvelle-Orléans (LA), United States. . hal-01855428

HAL Id: hal-01855428

https://hal.science/hal-01855428v1

Submitted on 7 Aug 2018

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.

LONG-TERM RECORDS OF TRACE METAL ELEMENTS IN CORE SEDIMENTS: ANTHROPOGENIC IMPACTS IN THE EURE RIVER WATERSHED

Thomas Gardes[1,2,*]

Maxime Debret[1], Yoann Copard[1], Edouard Patault[1], Julien Deloffre[1], Stéphane Marcotte[3], Anne-Lise Develle[4], Pierre Sabatier[4], Eric Chaumillon[5], Thibault Coulombier[5], Sidonie Revillon[6], Jean Nizou[6], Yan Laberdesque[1,2], Florence Portet-Koltalo[2]

[1]Normandie Univ, Rouen, UNIROUEN, UNICAEN, CNRS, M2C, FED-SCALE, Rouen, France.
[2] Normandie Univ, Rouen, UMR CNRS 6014 COBRA, Evreux, France.
[3]INSA of Rouen, Normandie Univ, UMR CNRS 6014 COBRA, Saint-Etienne-du-Rouvray, France.

*Corresponding author: thomas.gardes2@univ-rouen.fr

[4]University of Savoie Mont Blanc, UMR CNRS 5204 EDYTEM, Le Bourget du Lac, France.
[5]University of La Rochelle, UMR CNRS 7266 LIENSs, La Rochelle, France.
[6]IFREMER, IUEM, Brest, France.

INTRODUCTION

❑ General context

The Seine River watershed is historically known for important Trace Metal Elements (T.M.E) anthropogenic contaminations, from various human pressures except mining activities. The Eure River watershed was poorly studied in the past, although there is one of main tributary of the Seine River. Recently, it was highlighted that lead contamination recorded in Seine River partially came from the Eure River.

❑ The OSS 276 Project: Observatory of the Seine Sediments in the Eure River and the Seine River

The main aim of the OSS 276 project is to fill the gap of knowledge concerning the Eure River watershed.
This part of the study is focused on the potential anthropogenic impacts suffered by the Eure River.

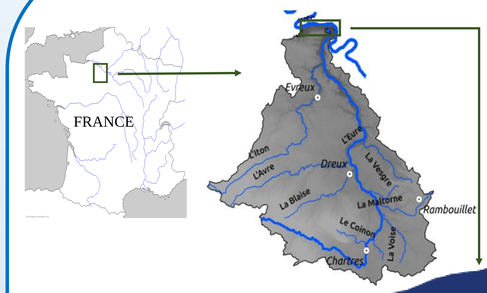
❑ Uniqueness of the OSS 276 Project

The hydro-sedimentary inputs from the Eure River watershed were blocked ~ 300 m upstream of the confluence with the Seine River by a small obstacle called the Dam of Martot. Built during the last century, this dam was removed recently. Observing and understanding the impact of the dam removal on hydro-sedimentary transfers, re-suspension and transfers of contaminated sediments is one of the aim part of this project.

❑ Trace Metal Elements (T.M.E)

In fluvial systems, T.M.E are majority linked to the Suspended Particulate Matter (S.P.M), especially the < 63 µm fraction. Their potential toxicity is well established and for this project it was decided in this project to work with metals (Cadmium : Cd, Chrome: Cr, Copper: Cu, Mercury: Hg, Nickel: Ni, Lead: Pb), and metalloid (Arsenic: As) elements listed 'priority substances" by the European Water Framework Directive.

STUDY AREA: THE EURE RIVER WATERSHED



❑ Eure River:

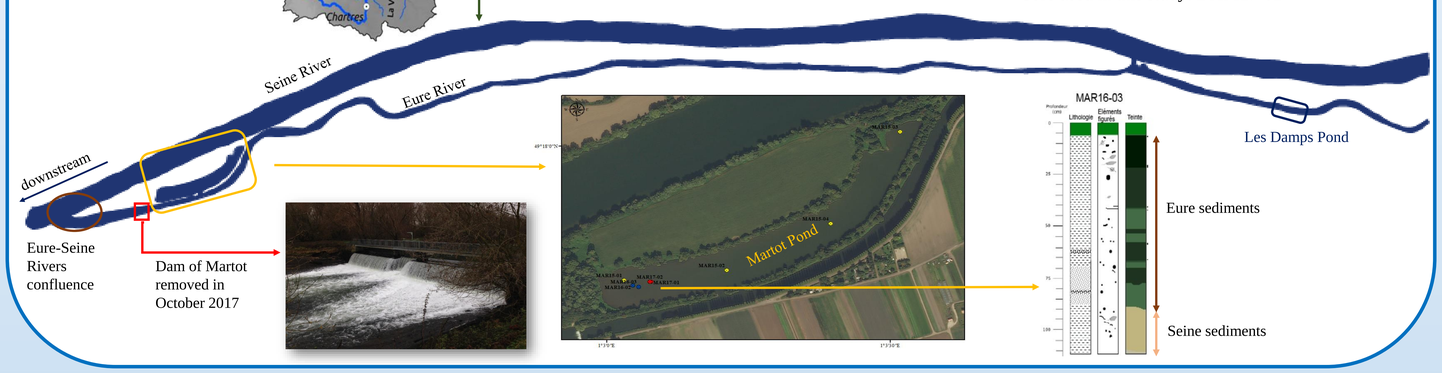
- Main tributary of the Seine River downstream
- 228.7 km long

❑ Eure Watershed:

- 6,017 km²
- ~ 70 % agricultural land

❑ Study Area: Eure River downstream

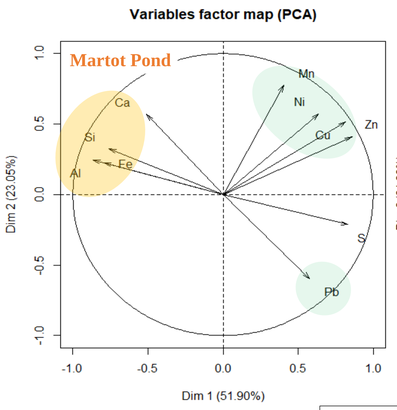
- ~ 10 km long upstream Eure-Seine Rivers confluence
- Two ponds cored:
  - Martot pond:
    - Filled by Seine until ~ 1940 then Eure River inputs
    - Cores used in this study: MAR15-01, MAR16-02 and MAR16-03
  - Les Damps pond:
    - Filled by Eure River inputs
    - Core used in this study: DAM17-02

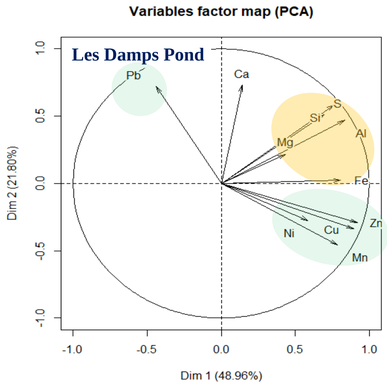


T.M.E IN SEDIMENTARY CORES: HIGHLIGHT THE INDUSTRIAL PAST OF THE EURE RIVER WATERSHED

❑ Principal Component Analysis (PCA):

- XRF Core Scanner data
- Sedimentary cores used:
  - Martot Pond: MAR15-01
  - Les Damps Pond: DAM17-02





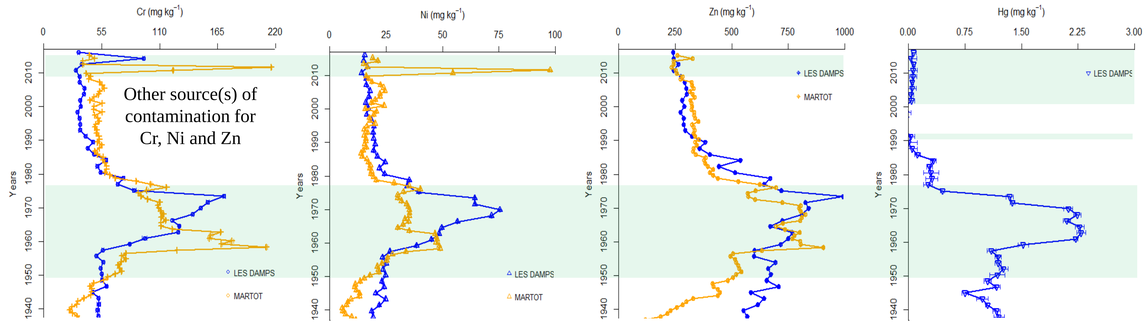
- *Legend:*
  - *Sedimentary inputs*
  - *Anthropogenic inputs*

❑ For Martot and Les Damps Ponds:

- T.M.E came from non-natural sources
  - Common origins for Ni, Cu, Zn.
  - Pb: one anthropogenic sources.

❑ T.M.E analysis:

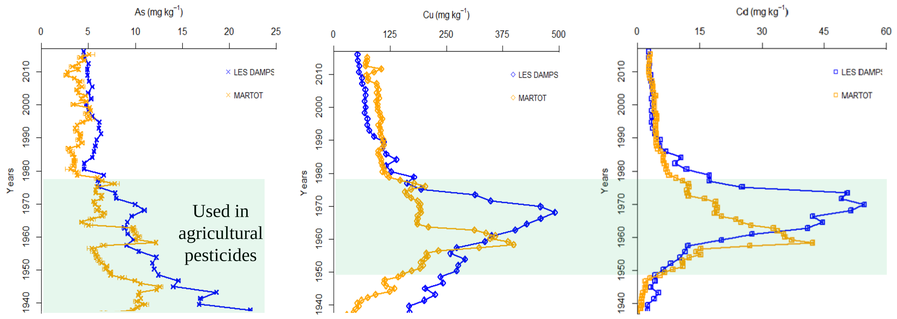
- ICP-AES (external calibration)
- C.R.M: Trace elements on fresh water sediment CNS301-04-050



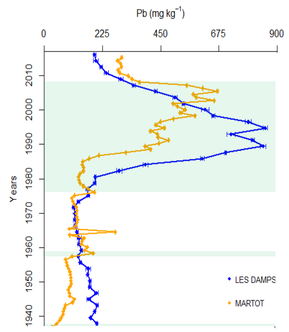
Top: 0,05 ± 0,04 mg kg^{-1} ≈ Seine River watershed geochemical background (0,03 mg kg^{-1})

1991 : Batteries with Hg banned (91/157/ECC)

Saline batteries production on the Eure River watershed



Similar behaviour between Cu and Cd but origin still unknown



2006: site closure

1990-2000: important production

1974: Opening of a 2nd factory on the Eure River watershed

1956: Opening of a cathode-ray tube factory on the Eure River watershed

Close to the Seine River geochemical background (20 mg kg^{-1})

CONCLUSION & PROSPECTS

❑ Sedimentary cores from Eure River ponds showed **several decades of metallic contamination from multiple anthropogenic origins.**

❑ The origins of contamination (Pb, Hg, etc.) are determined, nevertheless there is still other past and recent contaminations sources to identify

❑ After the dam removal, it becomes important to **study the potential remobilization of contaminated sediments** from ponds and Eure River's channel.

AGU FALL MEETING
New Orleans
11-15 Dec. 2017