Pharmaceuticals and other pollutants in sediment cores from the lake of L'Albufera Natural Park (Valencia, Spain)

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INTRODUCTION

Pollutants are one of the human contributions to the environment that define the Anthropocene. Records derived from the chemical analysis of sediment cores are useful to trace the history of pollutant emissions. Also, vertical study of contaminants in the sediment cores allow us to see the accumulation trends and/or their leaching tendency as some of them could reach groundwater bodies.

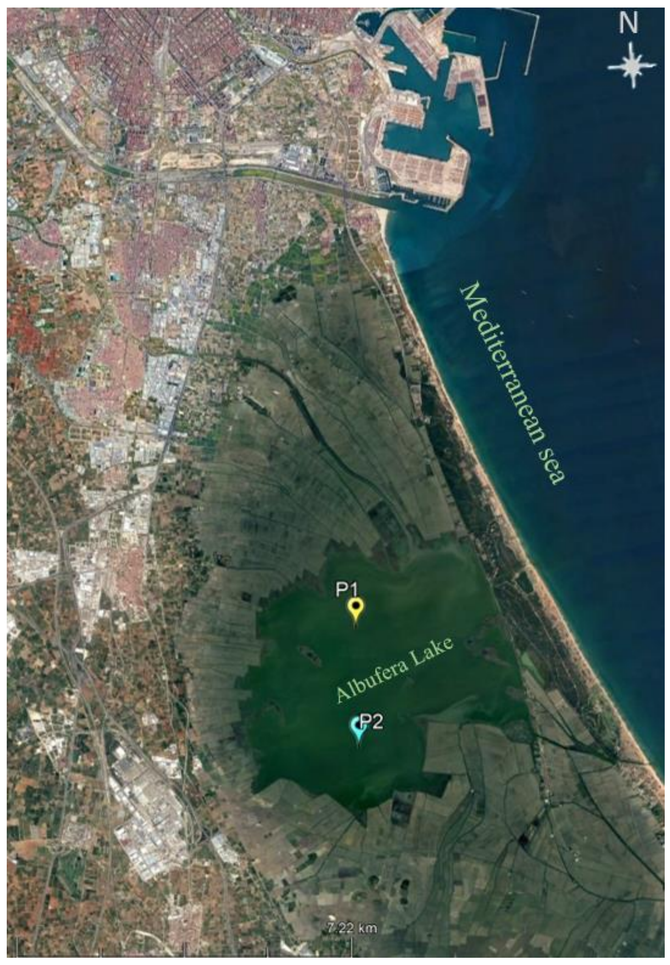
This work aimed to study the vertical variation of organic contaminants (OCs) and metals in sediment cores from Northern and Southern part of the L´Albufera Natural Park (Valencia, Spain) to obtain information regarding historical variation in the composition of sediments.

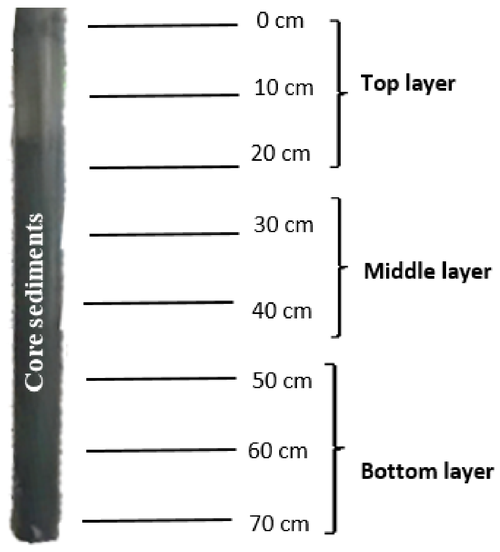
Sampling points/sediment sampling

- The study was carried out in the lake of L'Albufera Natural Park, located at 10 km southeast of Valencia (Spain).
- Albufera lake is located in the center of the Park, in the large alluvial plain formed by the river Turia to the north and the Xúquer to the south

- Two sampling points were selected (one in the north of the lake (P1) and another in the south of the lake (P2)).

A sediment core sampler (57 mm inner diameter; Beeker, Eijelkamp) was used to extract the cores from a boat where the water column was 80 cm deep, without disturbing the sediment–water interface.





Sediment core sampling

Map of L´Albufera National Park study area. Location of the sampling sites are highlighted in yellow (north point of the lake) and blue (south point of the lake).

EXPERIMENTAL

Determination of inorganic contaminants

Pseudo total content

Method 3051A of the US EPA (2007)

EDTA extractable fraction

Bioavailable metal = Extractable with EDTA

ICP-MS

Determination of organic contaminants

Polar compounds

5 mL MeOH + 5 mL McIlvaine buffer pH 4.5 + 2 M EDTA

SPE
Strata-X

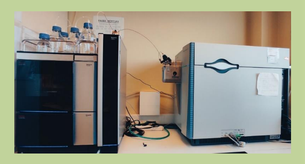
PPCPs, PFASs, OPFRs

Moderate polar compounds

QuEChERS

Extraction: citrate buffered QuEChERS

Clean-up: dSPE
50 mg PSA,
150 mg $MgSO_4$
50 mg of C_{18}



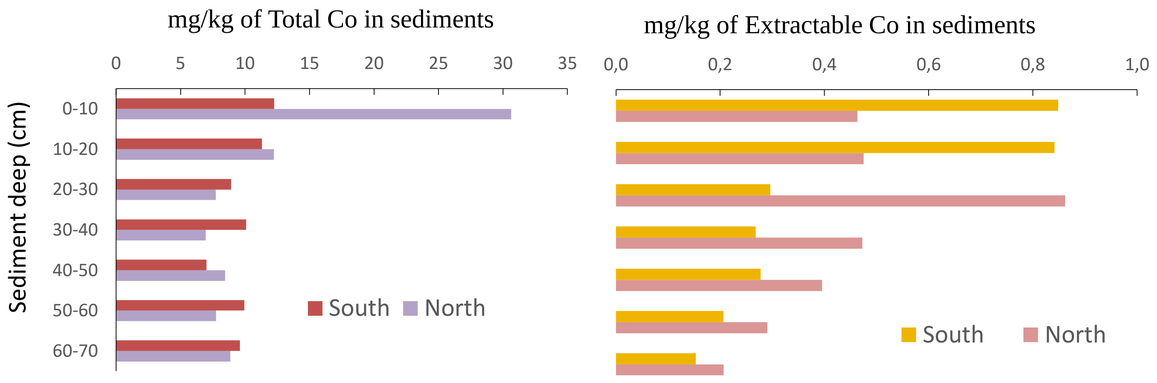
Orbitrap Exploris 120

RESULTS

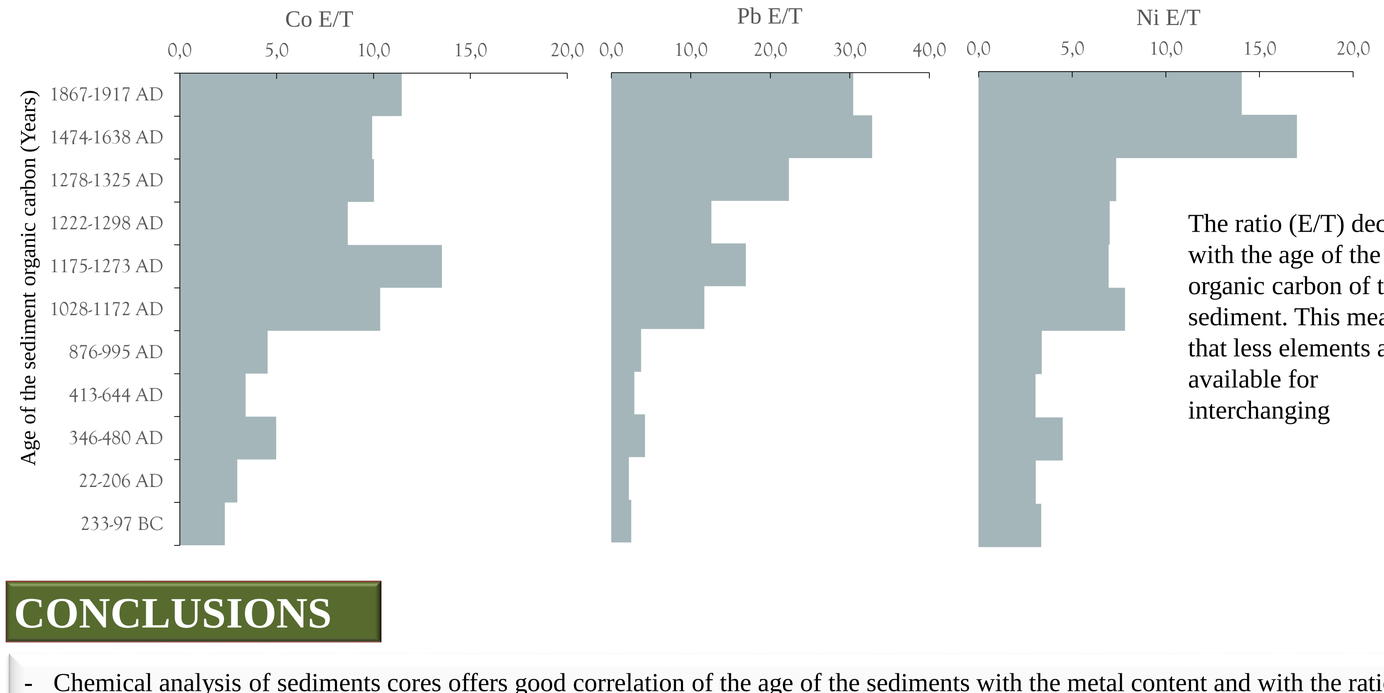
AMS 14C dating. Sediment chronology

The 14C dating was performed by Beta Analytic Inc. (Miami, USA) and ^{14}C-data were acquired with accelerator mass spectrometry (AMS) using 4 mass spectrometers with NEC accelerators and 4 Thermo IRMSs.

Average extractable and total content of Co in the two selected locations (North and South)

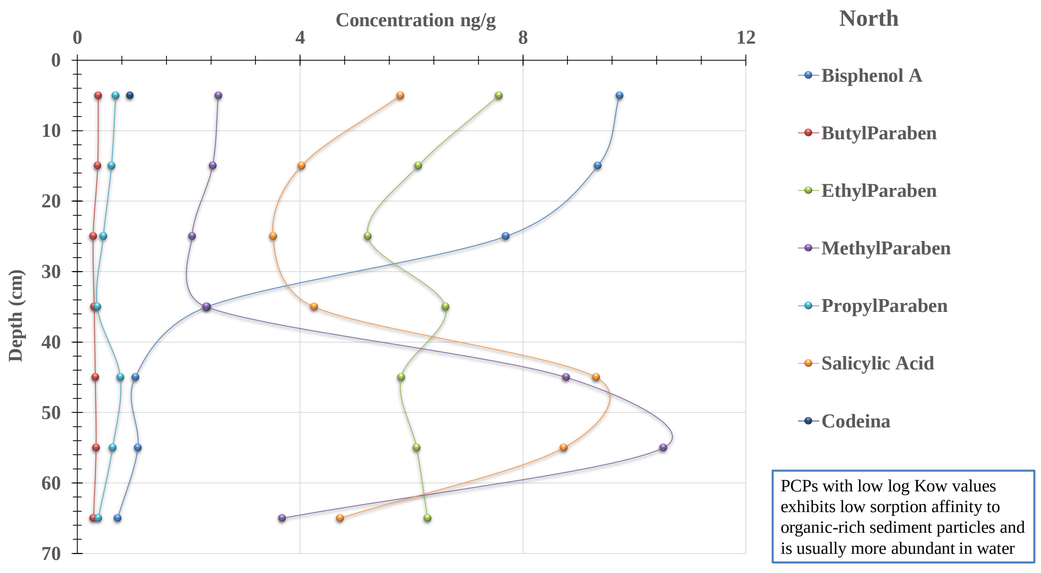


Behavior of the ratio Extractable/Total (E/T) of Co, Pb and Ni with the age of the organic carbon of sediments



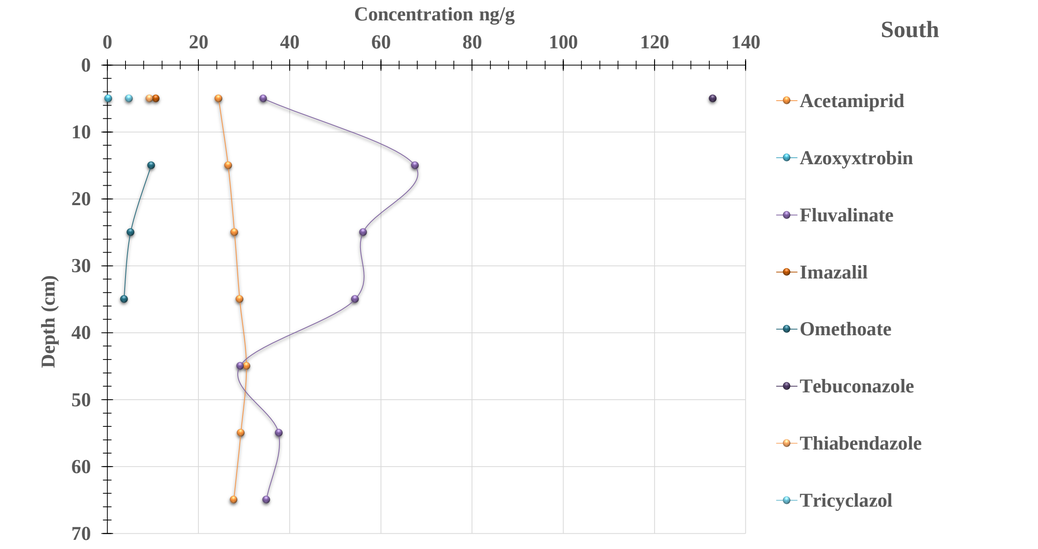
The ratio (E/T) decrease with the age of the organic carbon of the sediment. This means that less elements are available for interchanging

Behavior of PPCPs and pesticides at depth of sediments in the North and South



PCPs with low log Kow values exhibits low sorption affinity to organic-rich sediment particles and is usually more abundant in water

PPCPs	Bisphenol A	Butylparaben	Ethylparaben	Methylparaben	Propylparaben	Salicylic acid	Codeina
Log Kow	3.32	3.57	2.47	1.96	3.04	2.26	1.19



Pesticide	Acetamiprid	Azoxyxtrobin	Diazinon	Fluvalinate	Imazalil	Molinate	Omethoate	Tebuconazole	Thiabendazole	Tricyclazol
GUS*	0.94	3.1	1.51	-	0.26	1.89	2.73	1.86	1.94	3.89

GUS*: Groundwater Ubiquity Score

CONCLUSIONS

- Chemical analysis of sediments cores offers good correlation of the age of the sediments with the metal content and with the ratio extractable/total fractions. However, in the case of organic contaminants distribution through sediment was more chaotic and could be correlated with the GUS index (the comparison between the sedimentary occurrences of OCs and their historical use in the watershed is not so obvious because the layers with the highest concentrations dated very old geological ages)
- More than 50% of the PPCPs detected belong to the paraben chemical class and these findings indicated that parabens might be the top pollutants in the studied samples because of their widespread use in preservatives of pharmaceutical, personal care, and food products

Acknowledgements

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