Lithogenic and anthropogenic trace elements footprint in the estuarine sediments of the Artabro Gulf Rias (NW Iberian Peninsula)

Miguel Ángel Álvarez-Vázquez 1,2, Miguel Caetano1, Elena de Uña2, Carlos Vale2, Ricardo Prego2

1Instituto de Investigaciones Marinas (CSIC), Eduardo Cabello 6, E-36208 Vigo, Spain. 2Departamento de Historia, Arte e Xeografía (Universidade de Vigo). Campus Universitario As Lagoas, 32004 Ourense, Spain. 3Instituto Português do Mar e da Atmosfera (IPMA). Av. Brasil, 1449-006 Lisboa, Portugal.

mianalva@uvigo.es
mianalva@im.csic.es

Introduction

Rias are incised valleys where the freshwater-seawater transitional boundary varies with environmental changes. The estuarine sediments is thus a biogeochemical dynamic reservoir where trace elements (TEs) derived from lithogenic sources mix with TEs from anthropogenic origin [1]. This work reports the depth variations of As, Cd, Cr, Cu, Ni, Pb, V and Zn contents in sediment cores of five rias from the northwestern coast of Galicia, and identifies natural versus anthropogenic footprints characteristics of each system.

The Rias of Cedeira, Ferrol, Ares, Betanzos and La-Coruña, located in the northwestern coast of Galicia, are surrounded by different lithogenic domains and under the influence, of anthropogenic activities related to cities, industries and harbors. The main riverine streams are: Eume river (Ria of Ares), Mandeo (Betanzos), Das-Mestas (Cedeira), Mero (Coruña) and Grande-de-Xuvia (Ferrol).

The Artabro gulf is a set of middle size rias, with open fine sand beaches exposed to the surge and embied in the rias; estuaries in the head partially closed by a sandy bar, river mouth in dynamic equilibrium; and rocky bottoms in the mouth [2]. The lithology of this area is composed mainly by granitic rocks with different grade of metamorphism and different kinds of sedimentary rocks. It highlights an outcropping of ultrabasic rocks, the Cabo Ortegal Complex, close to the Ria of Cedeira.

Survey area

Survey area

Sampling

On July 2012, five inter-tidal muddy sediment cores were collected in the inner part of the Rias, sliced in situ in 25 layers of 2-cm thickness, stored in pre-cleaned plastic zip bags, and kept at 4° C. After drying at 45±5° C. Aluminium was determined after complete digestion [3] by FAAS (Perkin Elmer AA100) and TEs according to [4] using a quadrupole ICP-MS (Thermo Elemental, X-Series).

Results

In general, trace elements contents were lower in estuarine sediments from the Ares Ria and higher in the more populated and industrialized Ferrol and La-Corunia Rias. Higher contents of As, Cd, Cu and Zn were found in the rias of Ferrol and La-Corunia, this last one is specially loaded by Pb. The increase of Ni and Cr contents in sediments of Cedeira core are an effect of the local lithology.

Conclusions

Former contamination by As, Cd, Cu, Ni and Zn in the Ria of Ferrol.

Ancient contamination by As, Cd, Cu, Pb and Zn in the Ria of La-Corunia. The old contamination by Pb highlights the human footprint in the Ria.

High values of Cu, Zn Cd and Pb in Ferrol and La Corunia Rias evidenced severe contamination associated with historical industrial activities.

Natural enrichment in Cr, Ni and V of Cedeira sedimentary reservoir influenced by the lithology of Ortegal geological complex.

Rias of Ares, Betanzos and Cedeira look like unpolluted areas.

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References: