



Massive accumulation of highly polluted sedimentary deposits by river damming



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HIGHLIGHTS

- A delta-like anthropogenic deposit prograded into the reservoir behind the Flix dam.
- More than 3.6×10^5 t of anthropogenic waste was accumulated in less than 4 decades.
- A waste deposit with extreme levels of Hg and Cd was trapped in the Flix Reservoir.
- The main pollution was related to mercury cathode electrolytic technique and phosphorite waste.
- The waste deposit in the Ebro River course is threatening the Ebro Delta wetland.

GRAPHICAL ABSTRACT



ARTICLE INFO

Article history:

Received 12 May 2014

Received in revised form 22 July 2014

Accepted 23 July 2014

Available online xxxx

Editor: F.M. Tack

Keywords:

Damming

Sediment trapping

Industrial waste

Mercury

Ebro River

ABSTRACT

Uncontrolled dumping of anthropogenic waste in rivers regulated by dams has created contaminated deposits in reservoirs that have remained unidentified for decades. The Flix Reservoir is located in the Ebro River, the second largest river flowing into the NW Mediterranean, has been affected by residue dumping from a chlor-alkali electrochemical plant for decades. High-resolution seismic profiles, bathymetric data, surficial sediment samples and sediment cores were obtained in the Flix Reservoir to study the characteristics of the deposit accumulated by this dumping. These data were used to reconstruct the waste deposit history. Since the construction of the Flix Dam in 1948, more than 3.6×10^5 t of industrial waste has accumulated in the reservoir generating a delta-like deposit formed by three sediment lobes of fine-grained material highly contaminated by Hg, Cd, Zn and Cr (max: 640, 26, 420 and 750 mg kg⁻¹, respectively). This contamination was associated with the Hg that was used for the cathode in the electrochemical plant from 1949 and with the production of phosphorite derivatives from 1973. After the construction of two large dams only a few kilometres upstream during the 1960s, the solids discharged from the industrial complex became the main sediment source to the Flix Reservoir. The deposit has remained in the reservoir forming a delta that obstructs about 50% of the river water section. Its stability only depended on the flow retention by the Flix Dam. At present, this contaminated waste deposit is being removed from the water reservoir as it is a cause of concern for the environment and for human health downriver.

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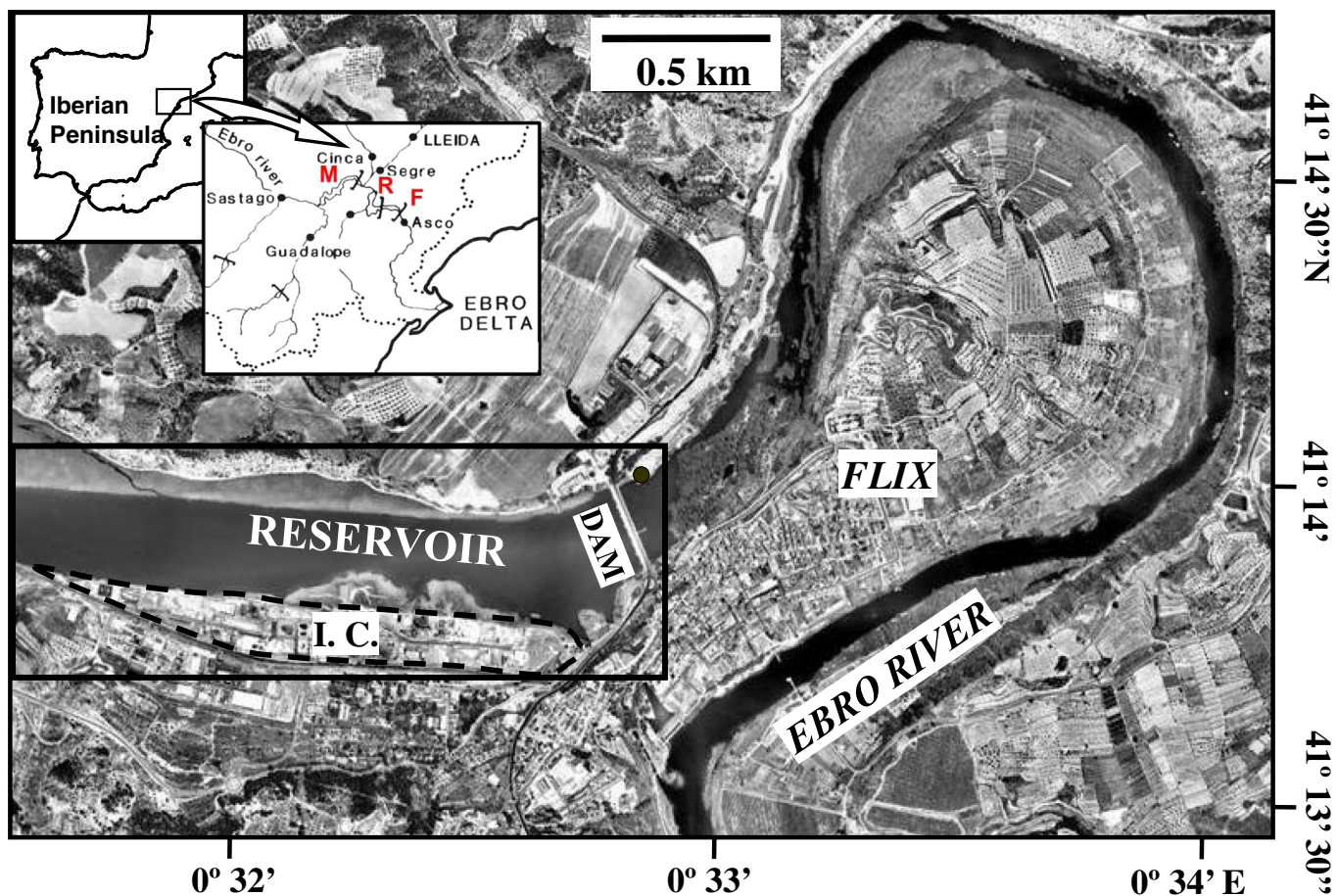


Fig. 1. Google Earth image showing the situation of the study area (black rectangle). IC, industrial complex (discontinuous line). The inset map shows the dams built in the lower Ebro River course. M: Mequinenza Dam; R: Ribarroja Dam; F: Flix Dam.

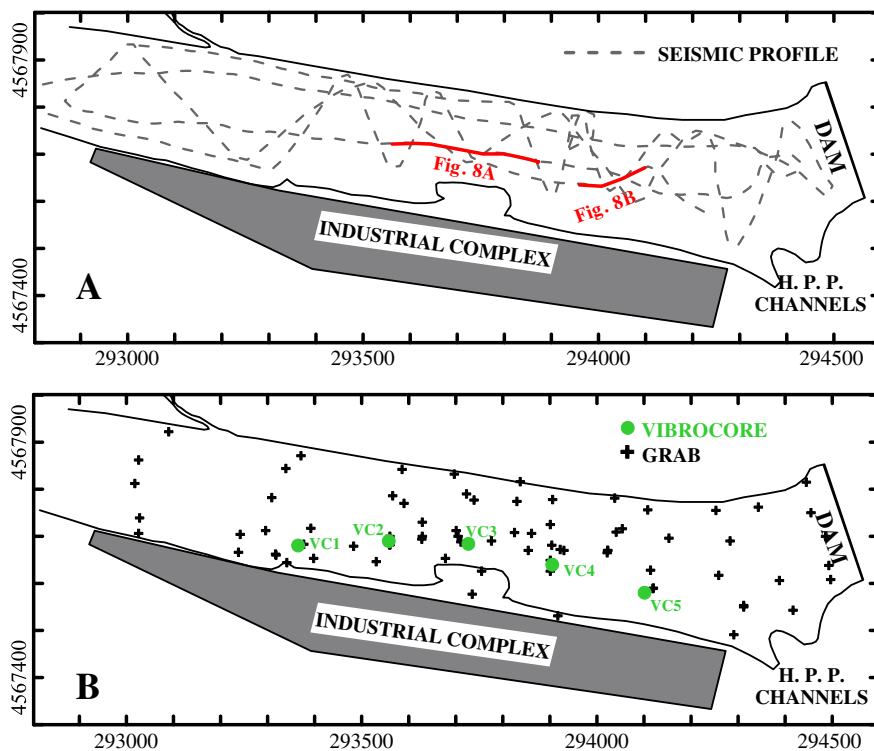


Fig. 2. (A) Map showing the tracks of the high-resolution seismic profiles and the echo sounder bathymetric profiles acquired in the Flix Reservoir. The red lines indicate the location of seismic profiles shown in Fig. 8. (B) Map with the location of surficial sediment samples taken in the reservoir with a grab (crosses) and a vibrocore (VC) (dots). Coordinates are in UTM, zone 31.

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