Heavy metal transition and paleoenvironment in Uranouchi Bay, Kochi Prefecture, Japan during the Anthropocene

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Since the industrial revolution, records indicate that human activities have had an impact on the global environment, leading to the proposal of a new geological epoch called the "Anthropocene" (Crutzen and Stoermer, 2000). While there have been analyses of sediment in bays surrounding industrial areas such as Tokyo Bay, Ise Bay, and Osaka Bay, there are few examples of analyses of sediments in inner bays in local area without industrial influence. The purpose of this study is to examine environmental changes during the Anthropocene recorded in the sediment of Uranouchi Bay, located in central parts of Kochi Prefecture, Japan. Surface cores were collected directly by a diver at a depth of 9.7 m. Non-destructive analyses, such as X-CT and MSCL, were performed. The cores were then split in half, digital images were taken, and an XRF core scanner (ITRAX) was used for elemental composition analysis. Furthermore, the core samples were sliced every 1 cm in depth, freeze-dried, powdered, and analyzed for organic matter and age dating. The sediments in the bay were composed of silty mud without no disturbance in the sediment structure. ITRAX and radiometric dating indicate that heavy metal elements (Cu, Zn, Ni, Cd, and Cr) had increased since 1964 in the inner bay and had nearly doubled at present. Total organic carbon (TOC) had also increased since around 1955, coinciding with the start of aquaculture of shellfish and fish. In addition, there was a significant change in the carbon and nitrogen isotope ratios of the organic matter, indicating changes in quality, denitrification, and the influence of human excrement and fertilizers. Mn concentration began to decrease around 1977, suggesting that the bottom environment in the inner bay became more anoxic condition.

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