

R&D Science Summary W5B-014

Pollution of Managed Realignment: Sediment Geochemistry at Orplands and Tollesbury, Essex, UK April 1995 – April 1997

Background to R&D project

The term managed realignment refers to the realignment of the sea defences, be it either forward or backward from its original position. In this report, investigations of pollution, sediment and geochemistry have been carried out at two managed retreat sites on the Blackwater Estuary in Essex. The term managed retreat refers to the breaching of the sea defences to allow flooding of coastal agricultural land behind the original sea defence barrier. This technique allows the establishment of salt marshes which are now considered to be areas of both economic and environmental importance as well as acting as hydraulic buffers to wave energy incidents on the coast.

In earlier studies of salt marsh sediments in the Blackwater Estuary, undertaken by Imperial College, for the former national Rivers Authority, a wide range of contaminants had been detected. While the concentration levels of the contaminants were not above pollutant criteria, it was evident from the surveys that some of the contaminants were not locally derived and hence were transported, either via atmospheric or hydrologic processes. The deposition of sediments with elevated levels of heavy metals and organic micropollutants is of concern in regard to the establishment of a healthy saltmarsh fauna and flora. Early establishment of salt marsh plants is essential to act as sediment traps to act in marsh accretion.

Since April 1995, Imperial College has undertaken annual sediment surveys at two managed retreat sites, one at Orplands and the other at Tollesbury, in the Blackwater Estuary, in order to assess the effects of saline inundation on sediment quality. These surveys, commissioned by the Environment Agency, include the analysis of metal partitioning in cored sediments collected before breaching and subsequent saline inundation and after saline inundation to determine how inundation affects partitioning and hence bioavailability of metals in the sediments. Results from this work will aid management decisions over such land-use where there may be concern on the geochemical interaction of inundated land with sea-water, and especially the effects on water quality and ecotoxicology where natural systems are utilised for human food production.

Results of R&D project

The geochemical development of the Orplands managed retreat site has been examined with reference to metals and nutrient anions. Soils and sediments at Orplands were characterised as having low anthropogenic heavy metal contamination. Partitioning studies of metals in sediment accreting at the site revealed an increased percentage of zinc (Zn), copper (Cu), nickel (Ni) and lead (Pb) in more labile (weak) associations with particulates, which may result from local pollution sources. The major change in metal concentration occurring at the site was the saturation of the soil with sodium (Na), calcium (Ca) and magnesium (Mg). Inundation of unvegetated soil led to homogeneous saturation in the surface layers of the soil. Inundation of vegetated soil led to the restriction of saturation to the top 10cm of the soil profile due to the development of a zone of anaerobic organic decomposition between 4 and 8cm. This zone was characterised by increases in the degree of labile associations with trace metals, indicating the potential for increased mobility. Increases in Ca concentration occurred only to the layer of accreting sediment indicating a solid phase import. Levels of Nitrate (NO_3^-) in soils were reduced as a result of inundation. The vegetated site was determined to be a source of NO_3^- to coastal waters.

