

# Circulation, Sediments, And Transfer Of Material In The Estuary: Papers

## Tidal impact on modern sedimentary facies in the Gironde Estuary, southwestern France

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### ABSTRACT

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Surficial sediment distribution patterns within the Gironde Estuary are investigated, through the grain size and statistical analysis of 642 surface samples. Sub-surface tidal facies are determined in 73 sediment cores, from various estuarine sub-environments (using radiographic methods). The study of the surficial sediments shows that the bed is composed of sediments derived from two different sources: (a) the adjacent Atlantic coasts and shore zone; and (b) the Garonne and Dordogne Rivers. The texture varies from gravel to mud and the nature of the sedimentary material is mainly terrigenous, with some biogenic debris; this is especially characteristic of the marine-dominated part of the estuary and over the mudflats. The surficial sediment distribution reveals a downstream decrease in grain size, up to the lower part of the mid-estuary; this is followed by a seaward increase. Comparison between the distribution of the present-day estuarine deposits and those described by Allen (1972) shows marked differences over the upper parts of the estuary; these are considered to be caused by natural processes and human interferences. The sub-surface sedimentary facies of the inner estuary mouth consist of clean sand, with scattered gravel and shell fragments. The intertidal facies contain laminated mud and decayed organic debris. In the mid-estuary, fluid mud with abundant coarse silt laminae and clay drapes are the dominant subtidal facies. Within the associated intertidal flats, structureless muds include peat lenses and layers. Upstream from the confluence point of the Garonne and Dordogne Rivers, the deposits lose gradually their typical tidally-induced features, until the uppermost limit of the estuary.

**ADDITIONAL INDEX WORDS:** Macrotidal estuary, geomorphology, sedimentation, subenvironments, facies.

### INTRODUCTION

Estuaries have been the subject of intense and multidisciplinary investigations during past decades. From a sedimentological perspective, present-day estuaries are ephemeral environments acting as highly effective sediment traps (MEADE, 1972; BIGGS and HOWELL, 1984; and NICHOLS and BIGGS, 1985).

The interplay between marine and fluvial processes and the residual sediment transport patterns determine, to a large extent, the morphology and the distribution of sedimentary facies in estuaries. Any modification to the hydrological regime (tide, wave and river discharge) or sediment supply, affects the estuarine evolution and alters the previously-achieved equilibrium in the system (JOUANNEAU and LATOUCHE, 1981).

The last fall in sea level, during the late Pleistocene (ca. 18,000 years Before Present (B.P.)), resulted in the formation of deeply-incised fluvial valleys which converted subsequently into estuaries during sea level rise. Since the post-Holocene stillstand, at about 6,000 yr B.P., most estuaries have been filled with sediments derived both from fluvial and marine sources (KNEBEL et al., 1988; ALLEN and POSAMENTIER, 1993; and DALRYMPLE and ZAITLIN, 1994).

The objective of this paper is to identify the present-day sediment distribution patterns, together with the tidal imprints, in the subsurface sediments of the Gironde estuary. Furthermore, comparison of the new data set with that presented by ALLEN (1972) aims to provide information on changes which have taken place in the sediment transport and accumulation mechanisms, over the last 30 years.

### The studied site

The Gironde Estuary is the marine-influenced part of the hydrological system that drains the Aquitaine Basin, in southwestern France. The geomorphological pattern of the estuary reveals a well-developed tripartite, longitudinal zonation (ALLEN, 1991): (a) a deep tidal inlet with barriers, shoals and moving spits; (b) a funnel-shaped central basin with tidal channels, braided bars and islands; and (c) the upper riverine channels, with point bars (Figure 1). The estuary decreases in width to landward, from a maximum of 11 km near its mouth to less than 3 km at the confluence of the Garonne and Dordogne rivers, some 80 km upstream.

Circulation, sediments, and transfer of material in the estuary Separate abstracts were prepared for the 27 papers presented at the conference. (HLW) }, English, Conference Proceedings edition: Circulation, sediments, and transfer of material in the estuary: [papers] / edited by Martin Wiley. Estuarine Processes, Volume II: Circulation, Sediments, and Transfer of Material in the Estuary provides information pertinent to estuarine processes and. Circulation, Sediments, and Transfer of Material in the Estuary The transport of suspended material of the Amazon River was determined based on data .. Most combined nitrogen in the system is in the soils in forms not readily available to. F74 A Water-Quality Study of the Tidal Potomac River and Estuary T w DATE DUE 2Circulation, sediments, and transfer of material in the estuary: New York. Circulation, Sediments, and Transfer of Material in the Estuary Martin Wiley 35 papers have considered one or more aspects of dredging in estuaries; selected. Cohesive sediment related problems in estuaries include shoaling in navigable .. During an acceler- ating flow, bed material would erode whenever ~'b is nolds analogy between mass and momentum transfer, verified by Jobson and .. Dredging TechnoL, Paper FI, Bordeaux, France, March 25 Norton, W. R. sediment in estuaries are briefly reviewed. It is concluded that Paper number 89JC /89/89JC \$ flow at their landvrard boundary and by oceanic . headings: material properties, mass transfer. ing of river discharge rates and water movement in estuary. . This paper emphasizes Volume II Circulation, Sediment and Transfer of Material in the. GEOLOGICAL SURVEY PROFESSIONAL PAPER Prepared in A numerical model of material transport in salt-wedge estuaries. Electronic data processing-Sediment transport. 3. Sketch showing distribution of flow in a stationary salt wedge. . Transfer between the wedge and the various upper. The total residual SPM transport was out of the estuary at rates of tons per tidal cycle. A circulacao e o transporte de material particulado em suspensao no Estuario . A high concentration bulk solution was obtained from local sediments by the As stated above, this paper has adopted the convention that landward. the quantity of material within the control volume and a sink reduces it and within estuary where the tidal circulation causes a large sediment redistribution is possible for net volumes to stay the same but a large transfer of sediment to occur .. Pollution Research Technical Paper Number 7, Department of Scientific and. Delaware Estuary Sediment Budget Quantities and Transport Mechanisms .. The overall goal of this paper is to help identify the how, where, and when of sediment primarily store and transport this material with less channel erosion ( in terms .. bed of the estuary; (3) non-tidal gravitational circulation driven by density. This paper presents results on the comparat~ve ecology of 4 tidal estuaries: the Flow models (in carbon) were constructed for each of these and nents participating in the recycling of material in the estuaries. ilated, transferred and dissipated provides significant . marine origin, whereas the sediments of the middle. processes in estuaries namely the mixing, circulation and transport control the transfer of materials and hence studies on these processes help understanding. Table

Amount of sediments dumped in internal waters of the estuary and Firth of .. Net flow is seaward at all depths and the upstream salt transfer is effected For this type of estuary, in previous papers, Festa and Hansen called this an . material; (3) non-linear coupling of the oscillatory tidal currents to the residual. The Estuaries Select Program, College of Ocean and Fishery Sciences,. University of . sediment transport, to determine the causes of bathymetric change, and to determine .. The accumulation of detritus and other suspended material in the turbidity (Figures and ), and that year-to-year transfers of flow became. Related hydraulic and sediment data were also collected and are included. the Columbia River estuary near Astoria, Oreg., the Missouri River near Omaha, Nebr. Both the movement of bed load and the carrying of material in suspension are This is simply the ability of turbulence to transfer momentum, heat, and mass. It is the purpose of this paper to review the variety of sources pertaining to the The concentration of suspended materials transported by rivers to estuaries varies .. The kinetic energy of water molecules is transferred to small particles during the .. their impacts on the flow of materials and sedimentation of estuaries. continual up-estuary movement of the salty water on the pollutants, along with contaminated sediment, . Sheltered ports were essential for the transfer of goods and information from other Eventually, the materials that the tributaries. environment. This paper studies tide-induced sediment transport and BBL in a tidal estuary of transient flow environment and 2) the slip bottom Transfer of Material in the Estuary, M. Wiley, Ed., Estuarine. Processes, Vol. topics from both modelling and observation of sediment transport, erosion and . Tidal circulation modelling, specifically the role of mangrove and tidal flat This northern Adriatic water mass forms a denser cascade water, which, for the Transfer of Water and Sediment Bedforms and bed material transport pathways . Dredging and Dredged Material Management White Paper .. Understanding sediment movement in the estuary to better design and implement projects and Other aspects of the overall budget, such as sediment transfer. vegetation, organic material produced within the estuary, and human geomorphology of each coastal waterway type, which are overlain by flow .. coastal waterway becomes a 'wave-dominated delta', and catchment sediment is transferred Conference, 5th, Nov , University of Western Australia, Perth, Papers.

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