Geophysical Research Abstracts
Vol. 18, EGU2016-13702, 2016
EGU General Assembly 2016

Recording of the Holocene sediment infilling in a confined tide-dominated estuary: the bay of Brest (Britanny, France)

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Modern estuaries constitute key areas for the preservation of sedimentary deposits related to the Holocene period. Several previous studies using stratigraphic reconstructions in such environments allowed to characterise the major parameters controlling the Holocene transgressive sequence and to decipher their respective role in the sedimentary infill: (1) the evolution of main hydrologic factors (wave or tide-dominated environment), (2) the sea level fluctuation and (3) the morphologies of the bedrock and the coastline. Nevertheless, the timing of the transgressive deposits and the detailed facies need to be precise in regard to the stratigraphic schemes. The Bay of Brest (Western Brittany, France) offers the opportunity to examine these points and to compare with previous studies. It constitutes an original tide-dominated estuary that communicates to the open sea (Iroise Sea) by a narrow strait. Two main rivers (Aulne and Elorn) are connected to a submerged paleovalleys network that was incised in the Paleozoic basement during lowstands and still preserved in the present morphology. It delineates the central basin surrounded by tidal flat located in sheltered area. The analysis of high and very-high resolution seismic lines recorded through the whole bay combined with sediment cores (up to 4.5 m long) and radiocarbon dating allow to precise the architecture and the timing of the thick Holocene coastal wedge. It is preserved from the valley network to the shore and presents a longitudinal variability (downstream-upstream evolution).

The infill is divided into two successive stages (corresponding to the transgressive and highstand system tracts) which laterally evolve from the paleo-valley to the coast. Two units constitute the transgressive system tract. The oldest, dated from 8200 to 7000 cal B.P. is composed of fine-grained, organic-rich tidal flat deposits located in the sheltered area and organised in levees on the terrace bordering the paleo-valley. A tidal ravinement surface (about 7000 cal B.P.) creates a major erosion of the levees and forms gullies on the tidal flat. The second unit is topped by the maximum flooding surface (MFS) and is characterised by shelly coarser sediments. It represents an episode of condensed sedimentation from about 4800 to 4000 cal B.P in the sheltered area, while tidal banks grew in the preserved paleo-channels. The high system tract (HST), dated from 2800 cal B.P to the present day, is formed by a muddy facies laminated with maerl bed (calcareous algae) and mixed with invasive fauna. Draping the previous units, it is interpreted as a prograding system that reflected an increasing fluvial influx potentially linked with the human activities. Our results support that the rate of sea-level rise, the tidal hydrodynamic and bedrock/coastal morphology are the main key-factors that control the infilling architecture of the bay of Brest in the Holocene time scale.