Sedimentary conditioning of a rocky strait during the Holocene transgression: Ría de Ferrol (NW Spain)

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Understanding coastal responses to relative sea level rise is key to be able to plan for future changes and develop a suitable managing strategy. The sedimentary record of the Late-Pleistocene and Holocene transgression provides a natural laboratory to study the long-term changes induced in coastal landscapes by the rapid sea level rise. As sea level rises, coastal morphology continually adapts towards equilibrium changing the landscape and reshaping the distribution of sedimentary environments.

The Ría de Ferrol is a confined tide-dominated incised valley located in the mesotidal passive Atlantic margin of western Galicia (NW Spain). A multidisciplinary approach was used to identify the elements of sedimentary architecture within its sedimentary record since the Last Glacial Maximum. The sedimentary evolution was reconstructed combining seismic and sedimentary facies analysis with radiocarbon, geochemical and pollen data.

The Ría de Ferrol is characterised by a particular morphology with a rock-incised narrow channel in the middle of the basin (the Ferrol Strait) connecting an inner shallower sector with an outer deeper sector. The inner sector is characterised by low energetic conditions and is where the main fluvial inputs occur. The outer sector is connected to the shelf.

The main factor influencing the sedimentary evolution of the Ría de Ferrol incised valley was Late Pleistocene and Holocene sea-level rise. However, this evolution was modulated by the antecedent morphology, particularly once the middle strait became flooded during the Holocene transgression. Three main phases of evolution are distinguished: a fluvial valley drained by a braided river system, a tide-dominated estuary and a shallow marine basin (ria).

During the lowstand of the Last Glacial Maximum (ca 20 kyr BP), the ria was a fluvial valley whose sediments are mainly preserved in the inner sector. Sediments cores recovered sediments from ponds and stagnant areas, dated to be older than 10790-11170 cal yr BP.

During the Holocene, the basin turned into a tide-dominated estuary whose facies distribution was conditioned by the strait. The strait acted as a rock-bound tided inlet enhancing tidal erosion and deposition at both ends, where an ebb-tidal delta and tidal sandbanks appear. At this time, extensive tidal flats occupied most of the inner sector, dissected by estuarine channels of varied dimensions. Radiocarbon data showed ages from 8610-8910 to 5760-5940 cal yr BP.
An erosive episode is identified after 6 cal kyr BP with the formation of a ravinement surface. Wave and tidal energy were split by the middle strait. A wave ravinement surface is identified in the outer sector, while a coetaneous tidal ravinement surface occurs in the inner sector. Slow sea-level rise after ca 4 ka BP finally forced rivers to retreat to the present position, causing the dispersion of their energy and leading to the final evolution of the area into a fully marine system.