



Quantification of century-scale human-driven coastline changes in the Adra River deltaic system of southeast Spain

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The Adra River, in the eastern sector of the Betic Cordillera in SE Spain, has a 744 km² catchment draining a highly mountainous region towards the Mediterranean Sea. River management (dam building and channel deviation) has controlled the recent coastline evolution and the activity of the submerged parts of the delta, with subsequent modification of the main depositional/erosional areas. This recent evolution of the Adra River delta in southeastern Spain has been reconstructed from historical maps, aerial photographs, and submarine multibeam bathymetric data.

We have distinguished three main evolutionary stages, whose development took place as a direct response to the main anthropic and natural influences on the river system. The first stage (6000 BP to 137 BP) represents the natural behaviour of the deltaic system with negligible anthropic influence. This long stage is characterized by the sediment infill of an estuary at a mean ratio of 0.56 m/year, and after the year 500 BP the coastline advance with the formation of a small asymmetric triangular delta in the natural river mouth and a typical prodeltaic deposit. The formation of the delta begun at around 0.09-0.17 m/year of advance, and towards the end of this stage (19th century), the amount of sediment supply increased to 0.56 m/year due to the confluence of both climatic and anthropic causes.

The second and third stages are characterized by anthropic interventions in the catchment and the river mouth, which heavily modified the natural dynamics of the deltaic system. The second stage (137 BP to 35 BP) coincided with damming of the natural river channel very close to its mouth and the construction of two successive artificial channels to deviate the river flow. The coastal dynamics changed during this second stage with erosion of the original delta and the formation of a new, asymmetrical delta at the mouth of the artificial channels eastwards of the natural one. This younger eastern delta corresponds with two infralittoral wedges in the submarine realm, which recorded changes of lateral redistribution processes, being interpreted in terms of a decrease in sediment supply from the river source. The third stage (35 BP to the present day) started with the damming of the trunk river in the central sector of the catchment, thus drastically reducing sediment flow to the coastal realm and triggering general erosion and coastline retreat.