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Holocene coastline changes in the Guadalfeo River deltaic system of SE Spain

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The Guadalfeo River is located in the central sector of the Betic Cordillera (SE Spain). It has a 1252.44 km^2 catchment draining a highly mountainous region towards the Mediterranean Sea. River management (dam building and channel deviation) has controlled the very recent coastline evolution and the activity of the submerged parts of the delta, with subsequent modification of the main depositional areas. This recent evolution has been reconstructed from historical maps, aerial photographs, submarine multibeam bathymetric data and high-resolution seismic surveys.

We have distinguished three main evolutionary stages, whose development took place as a consequence of the changing natural and anthropic influences on the river system. The first stage started with the formation of an estuary during the Holocene eustatic maximum at 4000-2000 BC (Hoffmann, 1987). The coastline advanced seawards from this moment on until 1500 AD, finally forming a delta. The coastline reconstruction at around 1500 AD is well documented with historical references to a narrow coastal plain and several lagoons. This 3500 year-long stage of estuary infill is characterized by an increase of around $6x10^6$ m^2 in the surface of the delta along a sinuous 12 km long coast, indicating a mean advance of the coastline of around 500 meters at 0.15 m/y.

The nautical charts by Montojo y Salcedo (1876) depict the natural channel and the presence of a very asymmetric delta associated with the natural river mouth. Between 1500 and 1873 AD, the delta increased its area by $13x10^6$ m^2, showing a mean advance of the coastline of 1232 meters in 376 years.

The second and third stages of evolution are characterized by anthropic interventions in the catchment and the river mouth. The second stage corresponds with the XX century and coincided with the construction of the Harbour of Motril from 1908 to 1927 and the waterway diversion of the natural mouth during the thirties of the last century. The new river's mouth is located 1800 meters westwards of the ancient natural one. The coastal dynamics changed during this second stage with erosion of the original delta eastwards of the Harbour. The third stage (2003 AD to present day) started with the damming of the trunk river in the central sector of the catchment, thus drastically reducing sediment supply to the coastal realm, thus triggering erosion and coastline retreat.