

Title: Integrated analysis of Mediterranean transition environments about climate, geoenvironmental and anthropogenic changes during the Late Quaternary

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Research program

Around 90% of the beaches in the world are in erosion, 5% is stable and only 5% is prograding. The retreating speed varies greatly from one area to another from a few meters to over 15 m a year, especially in Mediterranean-type morphoclimatic systems. The beaches represent a natural buffer between the water environment and the mainland, where sometimes dunes, watercourses, lagoons, and cliffs as well as cities are present.

Many factors contribute to the degradation of the Quaternary lagoon-dune-beach systems, among these the poor management of dam-river-coast systems. However, amongst various beach morphotypes, sandy and/or pebbly urban and lacustrine beaches represent a stimulating and new research topic. They show unique geomorphological, morphosedimentary, geonaturalistic, historical and tourist-recreational features. These beaches are also excellent training gymnasium for observing seasonal or daily morphological and sedimentological variations about changing weather conditions and climate trends. In some areas, beaches developed where before there was an artificial seafront only after the construction of other maritime works, such as ports, barriers, groins, while other beaches disappeared, at the same boundary conditions, for reasons yet to ascertain.

In the light of these elements, it is unquestionable that in the coming years these particular transition environments will be the subject of various national and international research programs, as indicated by the recent IPCC report on the potential effects of in-progress climate change on islands, lagoons, and cities considering the increase in flash floods and sea storms.

Proposal for a PhD position

Recently, a great interest of researchers and local authorities in understanding the geomorphic processes of the transition environments is evident. Indeed, it has been scientifically ascertained that there is a morphological control over the dispersion in basins of fluvial-marine and lacustrine sediments which contribute to the formation of depositional morphologies, such as dunes and submerged bars, fans, and hummocky structures, or erosional forms, such as deflation ones and underwater incisions. These sediments, mostly fine, could associate with allochthonous materials, such as clay debris, benthic bioclasts, microplastics, pollutants (PAHs, PCBs, heavy metals, rare earth elements, etc.), then migrate offshore and not to return more into coastal dynamics with loss of large sediment amounts and consequently economic deficit for the tertiary sector. Therefore, it is of fundamental importance to know the evolutionary dynamics of such environments, in particular, the urban beaches and the lagoons both for the emerged and submerged sector, in which allochthonous elements accumulate, taking into account their important geonaturalistic and tourist-recreational value. Furthermore, there is a geomorphological interest because these singular environments, formed even close to or between artificial barriers or within ports and

coastal lakes, have not yet been well studied and classified. The study will be carried on through targeted geomorphological surveys and sediment sampling, eventually through boreholes, at almost zero cost using local, national and international satellite images, cartographic and meteorological databases, with geospatial map processing using a GIS. Therefore, the activation of specific research on this new topic would allow filling most of the gaps and at the same time identify the best actions to mitigate erosion and pollution phenomena, following the European Community recommendations for Marine Spatial Planning, implemented by Italian Ministry of the Environment and Protection of the Territory and the Sea, from the programmatic guidelines of Ministry of University and Research on sustainability, resilience, adaptivity, urban security and health of those geo-environments with ecosystems at high naturalness or not, threatened by degradation or disappearance.