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Landscape evolution in the Po Plain between the Last Glacial Maximum and the present interglacial (∼25 - 7.5 ky BP)

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Sediment archives of foreland basins store precious information about the geomorphic response of alluvial and coastal systems to past climate oscillations. Abrupt changes in facies architecture denote strong landscape modifications and result from distinct processes acting over time.
During the Last Glacial Maximum (LGM, 25-18 ky BP), wide areas of North America and Eurasia were covered by ice sheets, and sea level was ∼120 m lower than at present. Between ∼18 and 10 ky BP, rapid ice melting forced eustatic rise at the exceptional mean rate of 10-15 mm/yr, prompting the worldwide landward migration of coastal environments. In the Po-Adriatic system, the coastline backstepped ∼300 km in ∼10 ky.
In this study, we selected a 1200 km2 wide area of the modern Po coastal Plain, in order to reconstruct landscape evolution in response to post-glacial climatic and eustatic changes. Our research is based on the sedimentological, paleontological and geochemical (sediment provenance) analysis of 15 cores, and on the correlation of ∼350 stratigraphic data (e.g. core and well logs, piezocone tests), with the aid of ∼150 radiocarbon dates.
The late Quaternary stratigraphy displays two main stratigraphic intervals. The Late Pleistocene succession is composed of aggradationally-stacked alluvial deposits marked by weakly developed paleosols. Early Holocene estuarine deposits, stacked in a retrogradational pattern, overlie this alluvial succession.
Based on the identification and mapping of laterally continuous stratigraphic markers (e.g. paleosols and flooding surfaces), we depicted the paleoenvironmental evolution of the Po Plain according to five key phases, between LGM and the present interglacial: (1) ∼25 ky BP (LGM), (2) ∼ 12 ky BP (Younger Dryas cold reversal), (3) ∼10 ky BP, (4) ∼8.5 ky BP, (5) ∼7.5 ky BP (maximum marine ingression).
Phases 1 and 2 document a typically alluvial environment, with sharp bipartition into a northern portion dominated by fluvial processes (Po River), and a southern interfluvial area, where pedogenetic processes prevailed. Phase 1 was characterized by less preserved interfluves, resulting from the lateral migration of the Po River and of its Apenninic tributaries. Phases 3 to 5 depict a pattern of coastal retrogradation, mostly reflecting the early Holocene sea-level rise. Phase 3 records the spread of wetlands and swamps in the study area and the development of a distributary pattern of Po channels. This facies configuration is interpreted as the innermost part of a wide estuary supplied by the Po River and its tributaries. Estuarine facies graded eastwards into nearshore deposits, during phases 4 and 5. Between phase 4 and 5 coastal barriers backstepped at a rate of about 10 m yrs-1, up to their maximum inland position.
Reconstructing landscape evolution in response to past climatic and eustatic variation may help predict the effects on vulnerable coastal settings of global warming and consequent sea-level rise, envisaged by the scientific community for the next decades.