Response of Mediterranean Deltas to Millennial-Scale Climatic and Sea-Level Fluctuations During the Holocene

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Detailed knowledge of natural climate variability is essential to understand and predict the future effects of climate change and the anthropogenic impact on vulnerable areas. Because of their geographical characteristics, wide portions of the Mediterranean area are particularly vulnerable to the effects of climate change: these include the major deltas (Ebro, Po, Rhône and Nile) and historical cities, such as Venice, in a precarious balance between land and sea. High-resolution record of climate change is generally based upon a variety of proxies, including ice cores, speleothems, tree rings and marine sediments. Within continental successions, lake deposits and their pollen record are traditionally regarded as the most powerful tool to detect climatic variability on a millennial to centennial scale. This study shows that deltaic and coastal depositional systems of Lateglacial to Holocene age represent invaluable archives where high-frequency climatic oscillations can be identified. Detailed sequence-stratigraphic studies from selected Mediterranean deltas reveal a post-LGM stratigraphic framework consisting of incised-valley fills and adjacent interfluvial sequences. Integrated sedimentologic, micropaleontologic and pollen investigations provide evidence for the widespread occurrence of millennial-scale (2-10 m thick), shallowing-upward depositional cycles (parasequences) fingerprinted by a diagnostic climatic (pollen) signature. TST parasequences, which developed under conditions of predominant sea-level rise, display significantly higher correlation potential than parasequences formed under low accommodation conditions (HST). Incised-valley fills, in particular, represent stratigraphically expanded, almost continuous successions where synchronous climatic-eustatic events of global significance are most likely to be deciphered. Although parasequence correlation across the deltaic depositional systems of the Mediterranean area can be limited by a number of factors (fragmentary record, ambiguous positioning of parasequence boundaries, mixing of conventional and calibrated ages, local interplay between climate, eustasy and sediment flux, and possible decoupling or diachroneity of major events), prominent climatic and eustatic events can be identified across the Mediterranean from the Lateglacial-early Holocene deltaic record. These provide possible scenarios of future coastal evolution under rapidly changing environmental conditions.