



A stratigraphic-palynological approach to link Holocene vegetation dynamics, depositional patterns and palaeoclimate variability: insight from the Po delta plain (Northern Italy)

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Sedimentary successions in the subsurface of Mediterranean delta-coastal plains represent useful archives to examine the interactions between Holocene depositional, environmental and climate dynamics.

The Holocene, fine-grained paludal succession at the landward margin of the Po delta plain (Northern Italy) proved to be rich in palynomorphs, which offered the opportunity: i) to improve our knowledge about climate and vegetation changes in the Eastern Mediterranean region during the last ~13 kyr BP and ii) to investigate the impact of such processes on the depositional evolution of coastal systems at millennial/sub-millennial timescales.

An integrated stratigraphic-palynological approach was undertaken on a 40 m-long cored succession, chronologically constrained by thirteen ¹⁴C dates. Forty-one samples were selected for quantitative palynological analysis in order to identify subtle changes in palaeoenvironmental and palaeoclimate conditions. Further insights into the palynological record were obtained applying statistical methods (cluster analysis, PCA, etc...).

Above alluvial deposits of Late Pleistocene age, the 25 m-thick Holocene succession is mostly made of an alternation of swamp clays and crevasse splay sands and silts, deposited in a freshwater environment with little to no halophytes. After filtering the facies-derived palynological signal, a series of well-known cooling events under climate optimum (or optimum-like) conditions were identified, marked by the sharp increase in mountain trees and shrubs. The three oldest events were assigned to the Younger Dryas (12950±130 cal yrs BP), the Preboreal Oscillation (~11455±195 cal yrs BP) and the Boreal Oscillation (~9335±135 cal yrs BP), respectively. A younger record of climate cooling was interpreted to reflect the so-called '8.2 event'; in our record it shows a complex internal bipartition, as mild conditions were rapidly recovered between the ~8.3 ky and ~7.7 ky cool spells. A similar pattern is observed in the central Mediterranean at a regional scale. In the Po coastal plain the 8.2 event has also a marked sedimentological expression, which corresponds to vertically stacked crevasse splay deposits, a few metres thick, that record the partial infilling of paludal basins.

Two additional cool spells were retrieved in correspondence of younger crevasse splay/distributary channel deposits, although their attribution to specific mid-late Holocene climate events is uncertain.

Our data highlight that an integrated stratigraphic-palynological approach can be a powerful tool to explore the link between vegetation dynamics, palaeoclimate and depositional trends, especially within oligohaline and/or freshwater successions, where other microfossils are absent or can provide only low-resolution information.