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A Global Synthesis with implications
for management of future coastal change

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Estimating the effect of the Po di Primaro delta-channel on the construction of the Holocene sedimentary wedge near Conselice (Northern Italy)

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Abstract

The deposition of the Holocene sedimentary wedge was simulated along a coast-transversal cross-section passing near Conselice, south of the Po River. The about 120 km long transect is parallel to the present-day Reno River, which coincides with a roman-age delta-channel (Po di Primaro river)(cfr. Bondesan 1990; Castiglioni et al. 1990; Bondesan et al. 1995).

We ran a finite-element two-dimension mathematical model (*Basin*, Bitzer 1996, 1999), calibrated using:

1) present-day topographic surface and bathymetry;

2) stratigraphy, architecture and depositional sequences of the costal sedimentary wedge, inferred from drillings, ^{14}C dating, geotechnical logs, archaeological excavations, subsoil texture and

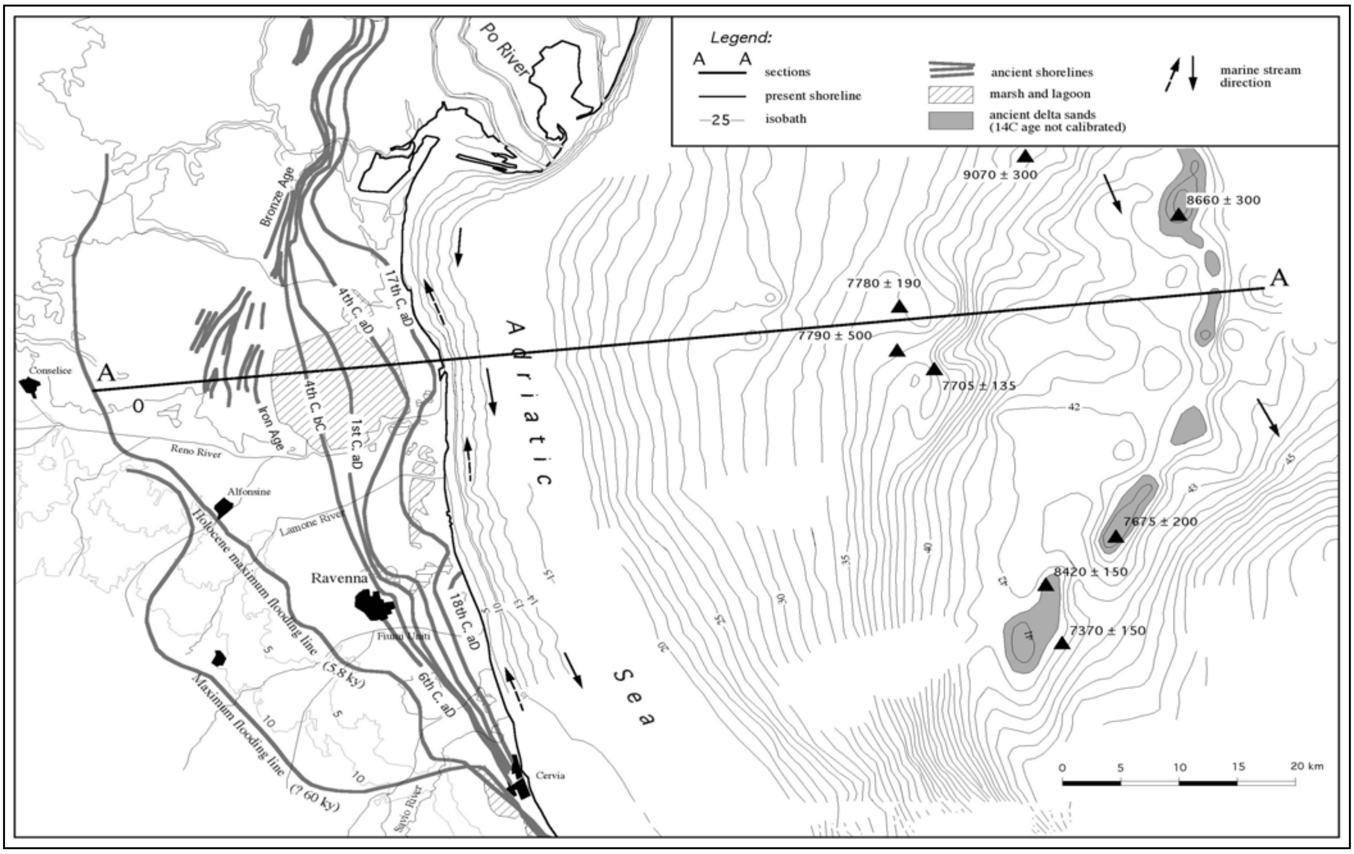

Figure 1. Location of the analised cross-section (A-A) on a detailed palaeogeographic-geomorphological map.

facies (Colantoni et al., 1990; Correggiari et al., 1996; Amorosi et al., 1999; Preti, 1999);

3) location of recent and ancient shorelines and eolian dunes (Ciabatti 1967; Bondesan et al. 1995). 4) an "hybrid" eustatic curve, i.e. the calibrated Fairbridge's curve (Fairbridge 1962), smoothed between 10 and 6 ka BP, assuming present-day constant sea level.

In order to reconstruct the best fitting depositional architecture in the section, a few assumptions have been made in addition to the above mentioned constraints, thereby reducing the number of uncontrolled parameters: 1- the initial geometry of marine bottom is gently dipping (about 0.3‰) northeastward in order to facilitate water discharge, and the paleo-surface shows a concave upward trend which connects to the inland surface; 2- the cross-section has been divided into 40 variably-spaced meshes, designed according to the present topographic profile; 3 - each mesh has a constant subsidence rate, which may nevertheless vary spatially; 4 - the granulometric composition (coarse vs. medium vs. fine) of the sedimentary input may change through time; therefore, the proximity of terrigenous sources, such as deltas or estuarine mouths, can be simulated; 5 - a constant longshore sediment flux has been assumed (i.e. the depositional system is closed).

Using variable time steps (500-200 years), the model reconstructed well the 2D-architecture of the Holocene sedimentary wedge. The sediment volume required to calibrate the simulations along the cross-section amounts to about 1.5 10^6 m^3. The calibrated sediment flux is nearly constant at about 100 m^3m^{-1} y^{-1} during protohistorical period (10-5 ka B.P.), and shows strong short-term fluctuations during historical periods: 250 $m^3m^{-1}y^{-1}$ at 2.9 ka B.P. (Iron age); 150 $m^3m^{-1}y^{-1}$ between the fourth century b.C. and the first century a.D.; 290 $m^3m^{-1}y^{-1}$ between the fourth and eighth centuries a.D.; 200 m^3m^{-1} y^{-1} between the twelfth and seventeenth centuries a.D., and finally 260 $m^3m^{-1}y^1$ after the seventeenth century a.D.

It seems obvious to correlate the phases of the simulated maximum sediment flux and shoreline progradation to the strong erosion events on the Apennines hillslopes, related to: 1) human activity, especially in terms of woodland destruction, which explains the sediment flux peak during and after Roman age; 2) minor climate changes; 3) the southward migration of the Po di Primaro delta channel, which seems to be the main cause of increased sediment input. In fact, the shift captured some apenninic streams (Reno, Idice, Santerno, Lamone, etc.) which collected sediments from an area of over 3000 km^2, and the input to the offshore Po Delta mouths increased significantly. This rapid progradation after the maximum Holocene transgression would act as a large-scale transversal barrier, causing the drop of the northwards longshore sediment transport.

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