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# High-resolution sub-bottom sonar imaging and 3D modeling of drowned Pleistocene river paleochannel architecture (Strunjan bay, Adriatic Sea)

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In the Gulf of Trieste (northern Adriatic), the seafloor is covered by up to several 100s of m of continental sediments, characterized predominately by alluvial and aeolian deposits that formed during Pleistocene sea-level lowstands. High-resolution multibeam bathymetry revealed the existence of several meandering river channels. One such channel appears to be vertically offset across a linear, NE-SW striking morphological flexure, which could be an expression of active faulting. Initial sub-bottom sonar profiles showed abrupt terminations of subhorizontal strata of Pleistocene sediments which roughly coincide with the flexure position.

To obtain a high-resolution 3D interpretation of this peculiar feature, we investigated the outermost part of the Strunjan bay (southern Slovenian coast). A grid of 25 m spaced sub-bottom profiles covering the area of 1225 x 500 m and comprising a total of 71 orthogonal profiles was acquired with the Innomar parametric sediment echo sounder SES-2000, using a sampling interval of 69 $\mu$s and a frequency of 8000 Hz. Data processing included conversion from proprietary to standard SEG-Y data format, deconvolution, elimination of swell movement and Automatic Gain Control. Geopositioned profiles were interpreted and correlated in IHS Kingdom seismic interpretation software, which was used to pick horizons and model 3D geometry of key stratigraphic surfaces.

Four distinct acoustic facies were resolved from the sonar profiles to a depth of up to 10 m below the seafloor. The first reflection represents the seafloor, ranging in depth from 20 to 26 m. Acoustic facies A in the immediate subsurface represents Holocene marine sediments that are up to 9 m thick. The paleochannel and associated river deposits are represented in the underlying acoustic facies B. Characteristic for this facies is strong attenuation of signal along the river channel which we interpret as a consequence of lateral channel migration and/or later gas accumulations in this facies. Acoustic facies C represents the position of the river channel prior to channel migration. This channel and its levees are partially eroded by the subsequent activity of the facies B channel. Acoustic facies D is characterized by strong reflections with parallel geometry and high to medium frequency, which become wavy and less pronounced towards the present-day shore, and is interpreted as alluvial plain deposits.

The new dataset shows that the lateral truncations of strata, initially assumed to be expression of faulting, are running parallel to the meandering paleoriver channel and must be therefore sedimentologically controlled. Furthermore, 3D stratal architecture clearly shows that the observed linear morphological flexure in seabottom bathymetry originated by sea-current erosion and not by faulting, and no vertical offsets of the river channel were found. Our work clearly demonstrates advantages of utilizing the 3D approach rather than interpretation from isolated 2D profiles when studying architecturally complex continental alluvial deposits.

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