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Seismic stratigraphy and sedimentology from a transgressed Late Pleistocene alluvial plain (SE Gulf of Trieste, Northern Adriatic Sea)

Ana Trobec (1), Andrej Šmuc (1), Sašo Poglajen (2), and Marko Vrabec (1)

(1) University of Ljubljana, Faculty of Natural Sciences and Engineering, Department of Geology, Ljubljana, Slovenia (ana.trobec3@gmail.com), (2) Harpha Sea d.o.o., Koper, Slovenia

With the onset of the Holocene sea-level rise the vast low-gradient Late Pleistocene (LP) alluvial plain of the present day Northern Adriatic Sea was rapidly transgressed and buried with Holocene paralic and marine deposits. The Gulf of Trieste is located in the northeasternmost part of the Adriatic Sea where continental sedimentary sequences were the last to be covered by Holocene sediment. Here, we present the first correlation of acoustic facies (AF) with sedimentary facies of the topmost units of the alluvial plain.

We used the Innomar SES-2000 sonar to acquire a dense grid of sub-bottom sonar profiles in the SE part of the Gulf of Trieste (Strunjan bay – Piran), which allowed us to determine six AF and model the geometry of their top surfaces. AF A is acoustically transparent and represents the Holocene marine sediment. AF B and C show a significant reflection of their top surface and are transparent with the exception of individual discontinuous low amplitude reflections. In the top surfaces of both facies a prominent channel is formed. AF D is characterised by subhorizontal high-amplitude high-frequency reflections. AF E is characterised by low-medium amplitude oblique discontinuous reflections. AF F is acoustically transparent.
The acquired geophysical data revealed an erosional scour in the seabottom where approximately 10 m of the seafloor sediment was eroded and overlain with a thin Holocene marine cover (1 m on average). Here we were able to sample the underlying top four non-marine AF with 2-m long PVC cores using the Uwitec gravity corer. The cores B1 (132 cm), C1 (132 cm), D1 (122 cm) and E2 (81 cm) were sampled at water depths of 25.0, 29.0, 30.3 and 31.5 meters respectively. The cores retrieved Holocene bioclastic sandy mud (AF A) on top and the target AF at the bottom. Core B1 contains AF B represented by light gray silt with plant material. Core C1 contains AF C composed of peat gradually transitioning into dark brown silt containing plant material and broken (gastropod?) shells. Core D1 contains AF D characterised by alternating beds of light grey fine sand gradually fining into silt. Core E2 contains AF E represented by light grey homogenous fine sand.

We conclude that AF A represents Holocene marine sediment, while AF B-E represent continental sediments. The continental depositional sequence records the sedimentary evolution of an alluvial plain between the Last Glacial Maximum (LGM) and the Holocene marine ingression. The loess base (E) formed in the LGM is periodically redeposited with floods as graded deposits (D). Avulsion and subsequent migration of a nearby river results in formation of organic-rich deposits and soil formation (C) and deposition of fine grained deposits during floods (B). Well-preserved morphological features of AF B suggest low erosion rates during transgression. Our work provides an insight into the LP-Holocene transition and represents the first reference for inferring sedimentological characteristics of AF in the Gulf of Trieste.