DELTAIC SEDIMENTARY STRUCTURE INTERPRETED FROM HIGH-RESOLUTION SEISMIC DATA: SADO ESTUARY, PORTUGAL (POSTER)

Pedro **Brito**[1], Pedro Terrinha[2], Luís Rebêlo[3] & Hipólito Monteiro[4]
[1] Dep. de Geo. Marinha, INETI. Estrada da Portela, 2720-866 Amadora; pedro.brito@ineti.pt
[2] Dep. de Geo., FCUL/LATTEX. Campo Grande edifício C6, 1149-016 Lisboa; pterrinha@fc.ul.pt
[3] Dep. de Geo. Marinha, INETI. Estrada da Portela, 2720-866 Amadora; luis.rebelo@ineti.pt
[4] Dep. de Geo. Marinha, INETI. Estrada da Portela, 2720-866 Amadora; hipolito.monteiro@ineti.pt

Introduction and study area

A high-resolution seismic reflection survey was carried out in the Sado estuary (Fig. 1) to investigate the sedimentary bodies that resulted from interactions between estuarine and shelf processes in this area, since the last glacial maximum (LGM). This work presents the first results based on the interpretation of these seismic lines focusing on the seismic-stratigraphic features that can be found in the Sado estuary ebb delta and their significance in the context of the transgression that followed the LGM.The Sado estuary is located on the west Portuguese coast, 50km to the south of Lisbon. It is a mesotidal bar-built estuary, with a mean depth of 5m, a submerged area of 180km^2 and a spring tidal prism of 4x10^{8}m^3. The estuary is connected with the ocean by an approximately 30m-deep and 2km-wide inlet, which is constrained to the south by the Tróia peninsula, a large sand spit nourished by a local northward littoral drift, and to the north by the Arrabida chain that protects the estuary from the predominant NW swell. Evidence from historical documents (e.g. Castelo-Branco, 1926) and morphologic interpretation (Quevauviller, 1985; Psuty & Moreira, 2000), suggest that the Tróia Peninsula was an island during the Roman period. Therefore, other inlet(s) should have existed southward of the present-day one. The Sado ebb delta is a submerged sand body, which extends approximately 5km offshore from the inlet gorge. It has an area of 47km^2 and a roughly triangular shape, ending abruptly to the offshore in a ≈2.5º slope that connects the delta surface (-5m) to the foot of the delta front (-40m). This shoal is cut by a navigation channel that is regularly dredged.

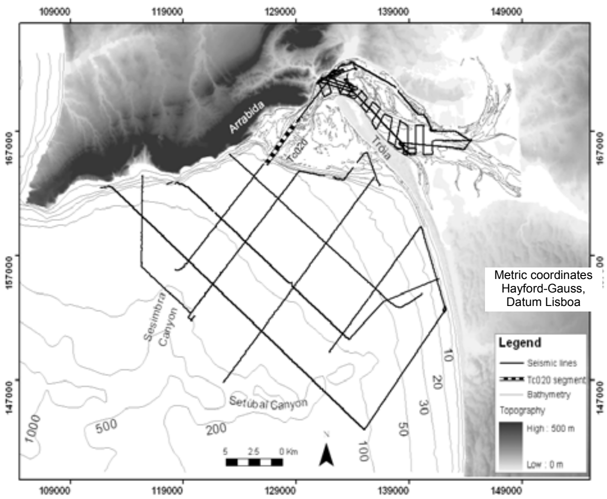

Figure 1 – Location of the surveyed seismic lines in the Sado estuary. Tc020 segment is represented as a dotted line.

Methods

322km of high-resolution single-channel seismic reflection profiles were collected in 2003 within the Sado estuary and adjacent coastal shelf, during the Tesa cruise carried out onboard the UAM Fisália (Fig. 1). Dip and strike oriented profiles were collected on the shelf, with a line spacing ranging from less than 1km to 5km and trackline positioning done with a differential GPS. A Boomer unit (EG&G 230-1 UNIBOOM) was used as seismic source, operated with an energy output of 100J or 200J depending on the water depth. The digitally recorded seismic signal has a frequency spectrum of 200-1850Hz, with an estimated vertical resolution of 2m. Seismic processing included frequency band pass filtering, predictive and spike deconvolution and trace mixing.

Results, Discussion and conclusion

Interpretation of a sector of the seismic line Tc020, surveyed along the navigation channel that crosses the delta (Fig. 1), leads to the identification of two major discontinuity surfaces, S1and S2, and the individualization of three seismic units, U1 to U3, (Fig. 2).Unit U1 was subdivided in two subunits (U1a, U1b), and is limited at the top by a seaward dipping erosive surface (S1), while its base was not imaged. Subunit U1a shows oblique sub-parallel reflections dipping seaward, in contrast with the oblique landward dipping reflections of subunit U1b. Unit U2 is limited by the surfaces S1 and S2, respectively at the base and top, and is characterized by oblique seaward-dipping reflections that downlap on top of S1. The thickness of U2 decreases seaward and the unit becomes almost reflection-free. Unit U3 sits on top of the S2 discontinuity and outcrops at the sea floor where sand waves develop; the geometry of the U3 reflectors downlapping on top of S2 discontinuity are typical of a progradant clastic body, i.e. a delta. Nevertheless, internal and frontal surfaces suggest a complex history of the delta growth. The geometry of S1, an irregular but continuous surface persistent down to a water depth exceeding 100m, suggests that it could correspond to the Flandrian transgression surface. Thus, unit U1 should be older than the trangressive ravinement, on top of which the present day ebb delta started building up. Subunit U1b possibly corresponds to a paleo-valley cut into U1 unit. The limited offshore extend of S2, present only in the submarine delta area, suggests that it could correspond to a tidal/wave ravinement surface, probably related to the closure of former inlet(s) located southward of the present-day one, to the onset of stronger currents in the modern inlet area. The subsequent deposition of the unit U3 probably occurred under conditions similar to the present-day ones.

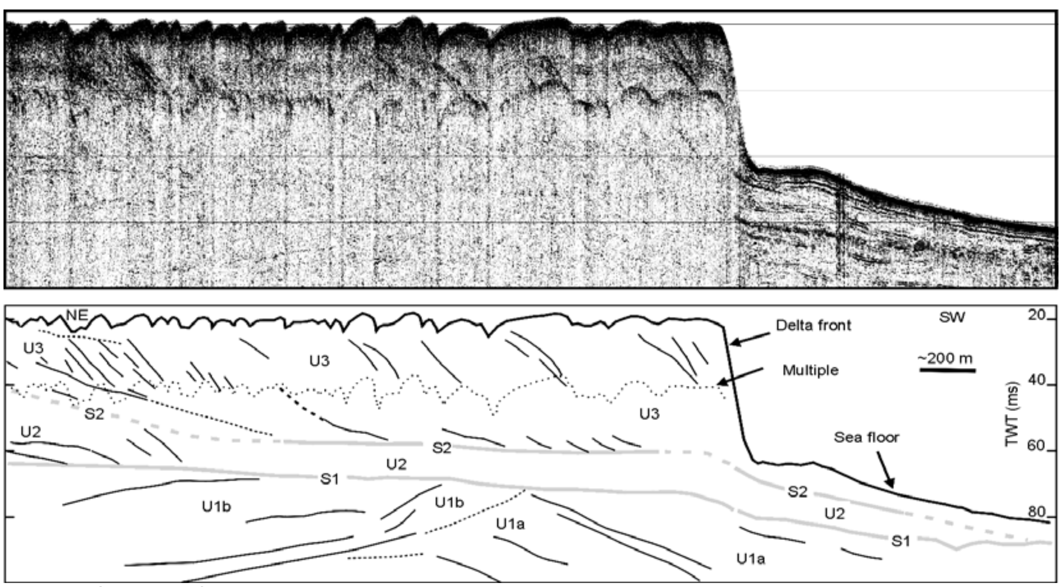

Figure 2 – Segment of the seismic line Tc020 (top) and interpretative sketch (bottom), showing 3 seismic units (U1 to U3) and 2 major discontinuity surfaces (S1 and S2). Location of the seismic line segment in Fig. 1.

Acknowledgments

Thanks are due to the FCT (Portuguese Science and Technology Foundation) for financing the INGMAR project (without reference), the STELIS project (POCTI/CTA/41754 /2001) and Pedro Brito's PhD scholarship (SFRH/BD/11748/2003) that supported this work. C. Andrade reviewed and added valuable comments to an early draft of this abstract.

References

Castelo-Branco, F. 1926. Da origem e do desaparecimento de Tróia de Setúbal. *Las Ciencias de Madrid*, Ano XIX(2): 445-461.

Psuty, N.P. & Moreira, M.E.S.A. 2000. Holocene sedimentation and sea level rise in the Sado estuary, Portugal. *Journal of Coastal Research*, 16(1): 125-138.

Quevauviller, P. 1985. Estuário do Sado - Costa da Galé análise geomorfológica e estudo de alguns aspectos sedimentológicos, *Direcção Geral do Ordenamento*, 85 p.