RELATIONSHIP BETWEEN THE OFFLAP-BREAK LOCATION OF HOLOCENE PROGRADING WEDGES AND WAVE CLIMATE IN SOUTHEASTERN IBERIAN PENINSULA

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Abstract

Wave climate exerts a significant influence on the development of Holocene sedimentary prograding wedges. This is demonstrated by the fact that near-bed orbital velocities between 0.10 and 0.14 m/s (threshold for resuspension) occur in the vicinity of the infralittoral prograding wedges (IPW) offlap-breaks during storm-weather conditions, but during medium wave energy conditions in the case of prodeltaic wedges.

Keywords: Alboran Sea, Continental Shelf, Waves, Sediment Transport

Introduction

Holocene prograding wedges are sigmoidal-shaped sedimentary bodies located between the infralittoral zone until the mid continental shelf. They are basically composed both infralittoral and prodeltaic wedges depending if littoral and fluvio-deltaic processes are dominant. The offlap-break determines an important physiographic change in the morphology of these aforementioned wedges and its depth in the infralittoral wedges has been related with the mean level of the storm wave base ([2],[1]).

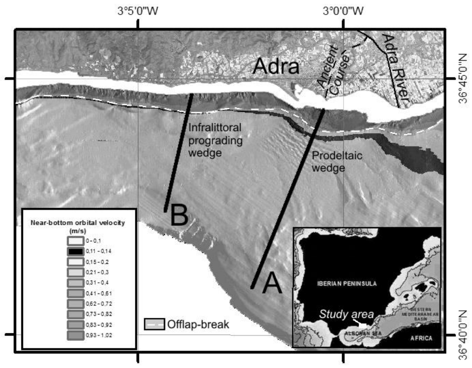

Fig. 1. Near-bed orbital velocity distribution in the study area.

Inner and middle shelf persistenly undergo bed stress exceeding the threshold of sediment motion. The magnitude and frequency of sediment transport , testing its role in the offlap-break point location.events are critical controls on the intensity of physical reworking ([4]). In this contribution, we aim to understand the controlling effect of different wave base levels on the prograding wedges deposits processes and evolution

Methods

Wave-generated near-bed flows are dependent on wave height, H, period, T, wavelength, L, and water depth, h. Near-bed wave orbital velocities (U_b) at the seabed have been calculated by using the following equation ([3]):

$$U_b = H / T \sinh (2 \pi h/L)$$

Three energetic wave levels have been used off the coasts of east-southern Iberia (Figure 1), following the classification by Ortega et al. (2004), to calculate U_b: a) High-energy storm conditions, with H=3.5 m and T=8 s (Figure 1); b) Medium-energy, for 50^{th}-percentile of the wave height, with H=1.5 m and T=7s; c) Low-energy fair-weather conditions, with H=0.75 m and T=4s. Water depth values (h) were collected with a 300 kHz Simrad EM3000D multibeam echosounder.

Results and discussion

Near-bed orbital velocities can be used to identify wave-driven sediment transport at a site given representative erosion thresholds. In the study area, those near-bed orbital velocities range between 0 and 1.33 m/s, with maximum values occurring over the topsets (Figure 1 and 2). Bottom wave velocity thresholds for resuspension range between 0.10 and 0.14 m/s, corresponding to bed shear stresses of 0.1-0.2 N/m^2 ([5]). The spatial distribution of this velocity interval correlates with IPW offlap-break location during highest stormy conditions, and with the offlap-break location of prodeltaic wedges during medium-energy conditions. This important difference must be due to the fluvio-deltaic processes dominance in the prograding wedges evolution, which determined differences on sediment supplies and sediment grain sizes.

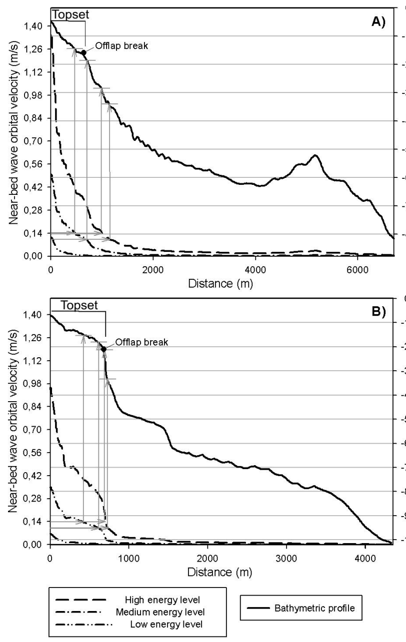

Fig. 2. Near-bed orbital velocity for three different wave conditions and water depth profiles in two locations of the continental shelf. A) Prodeltaic wedge. B) Infralittoral prograding wedge.

Conclusion

Wave energetic conditions have control the Holocene sedimentary prograding wedge morphology and evolution, since they conditioned the offlap-break position in time.

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