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## Holocene asymmetrical evolution in wave-influenced deltas: insights from OSL, shallow geophysics and geomorphology

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Wave-influenced deltas are morphological characterized by beach ridges disposed from different sides from the river mouth, governed by the increasing or decreasing of the proportional of high-angle waves and increasing wave asymmetry. The concept of asymmetrical evolution in a delta plain-view reveals the role of high-angle waves in a shoreline pattern, using the offshore wave approach, where the diffusivity can be positive or negative. In positive shorelines the wave angles are less than critical, and the shoreline tend to be smooth. On the other hand, if high-angles waves prevail, the coastline become unstable by the impact from anti-diffusive waves, creating a negative diffusivity shoreline. Morphological speaking, series of beach ridges normally are associated by positive diffusivity, and spits and sandwaves are typical features from negative or anti-diffusive waves high-angle waves. The east coast of Brazil present some of most representative wave-influenced deltas (São Francisco, Jequitinhonha, Doce and Paraíba do Sul) that since 1980's several works describe the Holocene palaeogeographical evolution. In this work, we present some insights revealed by Optically Stimulated Luminescence (OSL) geochronological data, ground-penetrating radar (GPR) profiles and geomorphological characteristics, to evaluated the asymmetrical Holocene evolution of Paraíba do Sul. We collect 20 samples distributed from both sides of the river delta, to describe the geochronological evolution. In each sample site, series of GPR profiles were surveyed in a common-offset mode, varies from 200 to 450 meters. The GPR signal adjustment of units provide by electromagnetically reflectors to meters, was use three common-mid-point survey. The geomorphology was interpreted by aerophotogrametric photos, obtained in 2005, with 1 meter resolution. The results showed that the Holocene evolution start after maximum relative sea-level (MRSL)  $\sim 5\text{ka}$ , with symmetrical pattern, i.e. with beach ridges observed in both sides of river mouth. After the MRSL the sea-level gradually decrease in altitude, and around  $\sim 2\text{ka}$  the morphology changes dramatically. The northern part became anti-diffusive, where series of spits emerge from sandwaves, enclosure coastal lagoons, accompanying the migration towards the north. On the other hand, the southern part experience higher prograding rates, by series of beach ridges. The migration of the river mouth toward the north, caused by oblique waves, indicate more accommodation space towards the south, filled by beach ridges formed by diffusive waves. The GPR signs reveals these differences in terms of morphostratigraphic patterns, where the beach ridges are altimetric higher than the spits, because the incorporation of aeolian sands, and overwash process and spit growth are detected in the north. The gently decrease in the altitudes in the both sides of the river mouth suggested the association with sea-level curves in Brazil, but the impact of high-angle waves describe morphological differences in the regressive barriers along Paraíba do Sul River

delta.