LINKING GPR AND OUTCROP DATA TO DELINEATE THE ARCHITECTURE OF WAVE-DOMINATED COASTAL TO SHALLOW MARINE SAND BODIES

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Ground-penetrating radar (GPR) is a reliable and useful method for the analysis of facies and depositional elements in the shallow subsurface, especially in sand-rich successions that usually form prolific hydrocarbon reservoirs in ancient successions. However, a comprehensive interpretation of the depositional character of radarfacies requires a comparison of their external and internal characteristics with sedimentary successions of similar setting exposed in outcrops. In the Paraná southern shore, in south Brazil, 120 GPR profiles acquired on the Holocene coastal barrier were interpreted under the scope of radarfacies recognition and mapping of truncation surfaces. The radarfacies were compared with depositional facies and elements of the Pleistocene and Holocene barriers exposed in nearby sand pits, in order to establish parameters for the interpretation of GPR profiles. Preliminary results show a good correspondence between metric to decametric features observed in GPR profiles and depositional elements exposed in outcrops. Five main radarfacies have been identified, delimited by their amplitude, frequency, continuity and geometry of reflectors. The low-angle clinoforms with moderate to high amplitude radarfacies is comparable to low-angle cross-stratified sand exposed in both Pleistocene and Holocene outcrops, being interpreted as foreshore deposits dipping towards SE/ESE. Their vertical dimensions reach up to 4.0 m. Small-sized clinoforms (up to 1.5 m) with low to moderate amplitudes, forming lenses and with dip direction opposite to the previous facies (dipping towards NW) are not comparable to any facies exposed in outcrops, but probably correspond to sand-rich bars in the upper shoreface, that migrates toward the continent. The chaotic radarfacies is composed of moderate- to high-amplitude reflectors that locally preserve the geometry of small-sized clinoforms. This radarfacies can be related to massive bioturbated sand and/or to cross-stratified sands correspondent to shoreface deposits. Outcrop analysis show that these deposits are lenticular, configuring centimeter-thick beds that are probably below radar resolution, resulting in a chaotic pattern. Reflectors with high amplitude and hummocky pattern occur sparsely in the study area and are composed of discontinuous, disturbed reflectors with metric dimensions comparable to hummocky or swaley cross-stratified sand interpreted as lower- to upper- shoreface deposits associated with high-energy oscillatory flows. The transparent radarfacies is commonly associated to channel-like erosive features interpreted as interstrand marshes filled with mud-rich sediments. The definition of radarfacies allowed the interpretation of important stratigraphic surfaces, such as downlap surfaces and truncation surfaces that separate at least two main progradational phases reflecting the superposition of foreshore over shoreface deposits. The first progradation phase, generally located below 10 m in the GPR profiles, is correspondent to the Pleistocene regression. Low-angle clinoforms from that phase are truncated in the topset by a ravinement surface that is probably associated to the Holocene transgression. The second progradation phase, located above the ravinement surface, is marked by a basal association of radarfacies correspondent to shoreface deposits and upper low-angle clinoforms from the foreshore. This phase is related to the Holocene regression. Locally, these clinoforms are truncated in the topset by erosive forms interpreted as interstrand marshes.

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