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The Boundary Hierarchy Model of a Washover Dominated Barrier Spit from Huangqihai Lake, North China

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Ground-penetrating radar data collected with a 400 MHz antenna and trenching studies of a barrier spit on the north shore of Huangqihai Lake provide information on the bounding surfaces of a barrier spit, with important implications for the coastal washover barrier boundary hierarchy and interpretations of this depositional record. The whole barrier system comprises barrier bar and salt marsh units — distinguished using GPR profiles. Linking radar and sedimentologic data allows us to develop a model of barrier bar evolution, indicating that this was formed during a cycle of lake-level change. A four-fold hierarchy bounding surface model, representing different levels of impact and genesis, is also defined. Each level of the hierarchy is enclosed by a distinct kind of surface characterized by different Ground-Penetrating Radar features, sedimentary characteristics (color, grain size, sorting, rounding and sedimentary structures) and origin. We suggest that this hierarchy model can be applied to any coastal washover barrier deposits.

The super bounding surface is the most significant and important surface because it covers the largest area and marks the longest time interval among all the hierarchical surfaces in the coastal barrier. It represents the cessation of peat deposition in a low-energy back barrier setting and the onset of washover laminated sands deposited in a high-energy setting. The 1st order bounding surface often separates two washover units which are formed by two different storm events. One washover unit, bounded by two 1st order surfaces, always shows an overall fining-upward trend due to the waning wave current energy. The 2nd order surfaces are not imaged in GPR profiles because the thickness of overlying fine-grained deposits is too thin. We interpret the surface, between two different lithofacies, as a 2nd order surface because the current regime changes across this surface from washover processes to suspension. 3rd order surfaces indicate continuous sedimentation of a similar bed type, minor erosion still exists because of an abrupt change in flow direction or flow velocity. These 3rd order surfaces are actually reactivation surfaces, which represent minor scouring and reorientation during sedimentation.