# Understanding Shallow Marine Clastic Reservoir Heterogeneity from Modern Analogs Resolved by GPR and Drone Imagery

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## Abstract

Clastic deposition in the continental and near shore environment is widely recognized as complex, and is controlled by allogenic processes such as eustasy and tectonics and autogenic processes influenced by fluvial discharge, wave and tidal energy, and morphologic inheritance. The dynamic nature of the processes that drive fluvial to shallow marine deposition results in deposits that exhibit abrupt lateral and vertical discontinuities in facies that juxtapose porous and permeable units with impermeable ones at multiple scales. The complex geometries and stacking patterns that form the depositional architecture of preserved continental and near shore depositional systems at the bed and bedset scale present significant obstacles when attempting to translate heterogeneity in depositional elements captured in conceptual geologic models to flow units in geostatistical reservoir models. Close examination of modern fluvial to shallow marine deposits of reservoir quality sand can improve our understanding of the internal structure of these deposits, as well as assist in better representing heterogeneity in reservoir models. A series of vibracore samples, GPR lines, and rotary-wing drone surveys, were acquired in the coastal plain of South Carolina to investigate the internal structure and stratigraphy of a preserved strand plain deposit, to define the morphological expression of its depositional features, and to estimate their reservoir characteristics. Strike and dip oriented reflection lines, as well as common midpoint surveys were collected in 100 and 200 MHz across Plio-Pleistocene age beach ridges comprising depositional element sets. These data are integrated with vibracore data and drone imagery to resolve the

geometry and internal structure of the deposit, including bedform types and scales, as well as internal surfaces, such as unconformity, flooding, and accretionary surfaces. Stratigraphic units can be differentiated on the basis of vibracores, as well as radar sections, with observed changes in radar velocity and facies correlative to structural and/or stratigraphic interfaces. The results are intended to establish the suitability of the imaged deposits as reservoir analogues for ancient continental to near shore equivalents. The high resolution imaging of modern deposits made possible by GPR and rotary-wing drones permit the construction of detailed 3D reservoir analogue models that can be used to condition subsurface geostatistical reservoir models by defining the geometries of impermeable surfaces and estimating reservoir heterogeneity at the sub-seismic scale.