

## **A New Look at the Stratigraphy and Depositional Setting of the Shallow Herrera Sands in Penal-Wilson-Barrackpore Field**

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### **Abstract**

The Penal-Barrackpore Anticline lies within the onshore Southern Basin foredeep and is one of a series of en echelon anticlinal structures developed during Early-Middle Miocene oblique collision of the Caribbean plate with the northward subducting South American continental crust. The Herrera deposits of this area have been described as deep-water turbidites, but with few details of the palaeoenvironment in which they were deposited. Herrera deposits are believed to have been sourced from the ENE-trending Proto-Orinoco during the mid-Miocene and are calcareous to non-calcareous, very fine- to very coarse-grained deposits encased in deep-water clays and marls of the Cipero Formation. Analysis of the full hole core from BP-344, showed the characteristic "salt and pepper" texture of white quartz grains, black chert, black limestone and other deposits. Bouma  $T_a - T_e$  units were also identified in the core. Dark brown to black clays were observed above and below these sand beds, which were of varying thickness across the cored interval. Grain size varied from fine to very coarse grained, suggesting different flow regimes. The abundance of deep-water arenaceous and calcareous benthic foraminifera that were analyzed from cores of Fortin West 214, Barrackpore 344, Marac 1 and Morne Diablo 34 indicates a middle to lower bathyal palaeodepth for the Cipero Formation. Using these data and analyzing SP & GR log signatures from the wells in the area, it is concluded that these sands were deposited on a slope fan - levee channel complex, as they showed blocky log signatures interpreted as predominantly channel sands in the Penal field, to primarily thinly bedded levee or splay deposits in the Barrackpore field to the east. The study area is characterized by mixed sand and mud filled channels and levees, mud slumps and slides that have localized sands. Previous deep-water depositional models were used to determine the setting where the sands were deposited. This new interpretation of the depositional environment and the further breakdown of its elements increases the prospectivity of the Penal Barrackpore Field. The proposed stratigraphic model is that of anastomosing channels and levees on multiple fans within the Southern Basin and off the flanks of the Penal-Barrackpore anticline. Some of these are stacked, while others are inter-fingering and adjacent to each another. This explains the rapid lateral changes in sand content between wells and creates opportunities to find new sands.