Importance of Mass Transport Deposits to Deepwater Turbidite Reservoirs, Niger Delta, West Africa

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Mass transport deposits (MTDs) represent a major component of the Miocene-Pleistocene Niger delta. The dataset for this study consists of a 3D seismic survey that covers about 500 km2 within piggy-back basins on the Niger delta slope. The deposition of MTDs has been found to have significant effects on the depositional setting of sub-basins in the study area. These included a change in channel morphology, a change in depositional axes, and erosional truncation of turbidite reservoir facies within confined channels. Channel morphology changed from highly sinuous in older sequences to relatively straight in younger sequences, after the deposition of laterally extensive, thick MTDs over older channel deposits. MTDs in the study section display a variety of associated seismic facies, which suggests a wide range of physical processes as well as constituent materials involved in their deposition. There is a reflection-free or transparent, wavy seismic facies (MTD I), which is probably associated with MTDs generated by highly plastic and fluidized flow, and which has undergone intensive folding and soft-sediment deformation. MTD I is the thickest and most laterally extensive seismic facies. There is also a very chaotic seismic facies with scattered and discontinuous high amplitude within relatively low-amplitude seismic reflections (MTD II), which probably resulted from a mixture of granular and muddy materials that led to disorganized impedance structure. A third facies has semi-continuous, generally very low-amplitude or transparent seismic reflections (MTD III), which probably belongs to muddy debris flows.

This study attempted to address three basic questions about MTDs: (1) how did the presence of MTDs affect reservoir facies in the Niger delta slope using the sub-basins in the study area as analogs; (2) because a variety of seismic facies could be interpreted as MTDs in the study area, could any of these MTD facies be good reservoir (3) how did MTDs deposition affect the paleotopography and accommodation space for overlying reservoir facies?

Some MTDs in the study area are erosive, and they truncate part or all of the underlying reservoir facies. Also, this study clearly shows that MTDs could act both as lateral and vertical seals for turbidite reservoirs.