

Paleodrainage Evolution of Northern South America and its impact on Exploration Success in the Guiana Basin

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ABSTRACT

Since 2015, the Guyana Basin has become one of the most exciting hydrocarbon provinces in the world and a key asset in ExxonMobil's portfolio thanks to oil discoveries in the Stabroek Block, offshore Guyana. New evidence indicates that uplift in the Northern Andes played a significant role in the sedimentary history of the Guyana Basin. Recognition of Devonian and Andean palynoflora within thick Messinian to recent mass transport complex (MTC) deposits in the Guyana Basin attest to their distant provenance, and comparable palynology results from industry wells in the Amazon fan (Hoorn et al., 2017) suggest a shared history. Modern sedimentation on the Guianas shelf is dominated by long- and along-shore bypass of fine-grained Amazon River derived sediment, and little material makes it into the deep-water Guyana Basin at present. The sudden and voluminous late Miocene onset of MTC accumulation in the Guyana Basin and contemporaneous growth of the Amazon Fan is temporally consistent with continental-scale drainage reorganization that occurred onshore that connected Andean sedimentation to the Atlantic margin for the first time. We hypothesize that MTC sedimentation was triggered by sudden availability of large volumes of fine-grained sediments to the Guianas margin coupled with Neogene high frequency and high amplitude sea level fluctuations (Milankovitch scale cycles) that allowed rapid accumulation of unstable sediment at the shelf-slope break. Frequent, possibly semi-continuous, slope failures led to thick MTC accumulations in the Guyana Basin down-dip. Our preliminary analysis indicates that without the combination of these factors, sedimentation rates in the Guyana Basin would have remained low throughout the Neogene and the basin-wide hydrocarbon system evolution would have been dramatically different.