Turbidite Systems Offshore Morondava Basin, Madagascar: Implications for Deepwater Exploration

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ABSTRACT

The offshore part of the Morondava Basin in western Madagascar has been targeted by just six wells to date, all drilled in shelfal waters in the 1970s and 80s on poor quality 2D data, in what we now know to be invalid traps and discovering only minor reservoir potential. OMV now has over 6000 km2 of high quality 3D seismic data through the deepwater part of the large Grand Prix Block, revealing several large turbidite systems that form attractive targets in both structural and stratigraphic traps. The main prospective reservoirs have been correlated with major unconformities on the paleo-shelf at the Cenomanian-early Turonian, Coniacian-Santonian, early Paleogene and Late Oligocene. Younger fan systems are also present but considered secondary objectives at this stage. The reservoir architecture includes both channel-levees and sandy fans dominated by numerous unconfined to weakly confined channel networks. The size of the individual fans varies from a few hundred square km to at least 1200 km2. There are at least three distinct entry points for the Grand Prix Block turbidites, correlating very well with the position of the present-day river systems and supporting the hypothesis that the major river systems that we see today in Madagascar had been present at least throughout much of the Late Cretaceous and the Cenozoic. The interpreted sand-rich nature of the fans is not surprising, given the quartz-rich hinterland: the basement that covers much of Madagascar, and the very thick Karoo sandstones outcropping along the eastern half of the onshore Morondava Basin. The overall concave-to-the-basin geometry of the Morondava transform margin has focused the reservoir systems into the Grand Prix area, with enough deposition to push the postulated Cretaceous source rocks into the oil-window. The Cenomanian-early Turonian turbidite reservoirs are contained in compound forced-fold structures related to Turonian intrusives with Coniacian-Santonian and Paleocene fan systems in simple differential compaction-related closures with stratigraphic upside. These reservoir targets stack up, and the repeatability of this trapping style across a large part of the deepwater fairway means that the long-overlooked Morondava Basin has the potential to form an important new oil province in East Africa.