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BIOGENIC GAS EXPLORATION IN MIOCENE CARBONATE, WEST SUMATRA, INDONESIA

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ABSTRACT

The West Coast Exploration Team of PT Caltex Pacific Indonesia is the operator for shareholder companies Chevron and Texaco of the Nias PSC in offshore West Sumatra, Indonesia. The primary exploration play was the Middle Miocene Isolated Reef Play, a biogenic gas play in the frontier block. 3D Seismic data over the Ibusuma Prospect and the subsequent Ibusuma #1 dry hole illustrate key elements in the reservoir development of a Middle Miocene carbonate platform and critical aspects of biogenic gas exploration.

Neogene carbonate reefs and platforms are prolific producing reservoirs in Southeast Asia, as seen at the Natuna, Arun and Northwest Java Basin fields in Indonesia, Luconia Platform fields in Malaysia and Yadana field in Myanmar. The Nias Block Middle Miocene Isolated Reef Play, in the Sumatran fore-arc basin, has a typically low geothermal gradient for a fore-arc basin, effectively precluding thermogenic generation of hydrocarbons. The low geothermal gradient favors biogenic gas generation and entrapment. Proven petroleum systems exist in this play (biogenic gas in Miocene pinnacle reefs) as demonstrated by 5 of 6 wells in this play type in the fore-arc being discoveries, including the source-reservoir system of the Ibusuma #1 well, as demonstrated by the nearby Union Oil Suma #1 well.

BIOGENIC PETROLEUM SYSTEM

The preliminary interpretation of the Ibusuma #1 well dry hole, indicates that the prospect failed due to poor timing between vertical gas generation and entrapment. The success of the analogous Union Oil Suma #1 and Singkel #1 discovery wells nearby, whose vertical charge should have been equally problematic, indicates there is most likely a lateral component of migration which charged them. While lateral migration of biogenic gas into traps is not considered typical and is poorly documented, it may be critical for traps such as this in which the reservoir and source are not thinly interbedded.

CARBONATE PLATFORM RESERVOIR FACIES DEVELOPMENT

The Ibusuma 3-D survey provided an excellent data set over a Middle Miocene carbonate platform in which facies models were developed based on seismic facies imaged using EDGE impedance contrast software. Reservoir properties are very well developed in all facies observed, averaging greater than 23% log porosity (13.4-39.6% SWC porosity) and with rotary sidewall cores with 16 to 70 millidarcies permeability. The reservoir facies interpretation developed using EDGE tied well with the FMI (high density resistivity logging tool) images. Therefore, EDGE is demonstrably an effective tool for carbonate facies imaging.

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