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[PS]Seismic Interpretation, Distribution and Numerical Modelling of Natural Gas Leakage on Block 2 of the Orange Basin, Offshore South Africa*

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Abstract

We have analysed several hundreds of km of 2-D seismic reflection profiles and ten wells, in an area of about 18750 km^2 corresponding to the exploration Block 2 of the Orange Basin, located offshore of the South African continental margin. Our main goals are: (1) to characterize the different natural gas leakage features present on the basin, (2) to understand their relationship with structural and stratigraphic elements, and (3) to quantify the liquid/gas hydrocarbon generation, migration and seepage dynamics through the post-rift history of the basin.

The seismic data reveals the existence of seven major seismic units separated by conspicuous stratigraphic unconformities. The Cretaceous mega-sequence is composed of five major seismic units: C1- Barremian to Aptian, C2-Early Aptian to Cenomanian, C3-Turonian to Coniacian, C4- Santpnian, C5-Campanian to Maastrichtian and the Tertiary is subdivided into two sequences: T1- Lower Tertiary and Unit T2-Upper Tertiary.

An extensional domain, characterized by basinward dipping listric faults rooted at an Aptian decollement level, have been identified between 500 to 1500 m of present-day bathymetry. A compressional domain, which accommodates the up-dip extension, is observed on the lower slope and is characterised by landward dipping faults and thrusting.

Based on their origin, the observed gas chimneys have been classified into two main categories: stratigraphically controlled and structurally controlled. The structural chimneys are mainly located upwards of the normal faults on the extensional domain, whereas the stratigraphically controlled ones are linked to the presence of onlaps and pinch-out within the Aptian sequence. No gas leakage features were identified on the contractional domain. In addition, some "giant" chimneys, with diameter of more than 7 km, were also identified although their origin is still a matter of study as the seismic record is not deep enough to identify the feeder system. Future numerical modeling of two major transects across these features should provide insights on the timing and amount of gas generation, migration and sequestration dynamics, as well as the nature of their feeding source.