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GAS CHIMNEYS FROM SOURCE TO SURFACE: IMAGING AND MODELLING IN THE CONNEMARA FIELD, PORCUPINE BASIN

A. Rabaute (1), P. Van Rensbergen (2), A. Colpaert (2) and M. Claeys (2)

(1) CNRS-CEREGE, Aix-en-Provence, Paris, France (rabaute@cerege.fr), (2) Renard Centre of Marine Geology, Ghent, Belgium

The Porcupine basin is a north-south trending graben of Jurassic age filled with Mesozoic and Tertiary sediments lying unconformably on upper Palaeozoic rocks. The basin formed as a result of an early abortive northeasterly arm of the Mid-Atlantic spreading ridge. It continues to be a subsiding basin at present time. The Connemara field is located in the northern part of the basin. Structurally, it lies at the confluence of two principal fault systems: a N-S fault regime characteristic of the main Porcupine basin, and the E-W and NE-SW trends of reactivated Caledonian faults. It can be imaged as a broad, tilted block faulted structure trending northeast-southwest, bounded by major faults to the east and west. Between these faults appears a structure broadly synclinal in section, dipping southwest, with an axis parallel to the trend of the major faults, filled of mesozoic sediments, and partly closed by the base of the Cretaceous unconformity. Hydrocarbons were found at the end of the 70sŠ in three reservoirs within the middle Jurassic in the synclinal structure. Tight 2D and 3D seismic coverage over the Connemara field showed the presence of vertical paths of fluid and/or gas migrating upward in the formation. Most of these chimneys stop at the Plio-Pleistocene boundary, about 0.1 msec TWT below the seafloor. None of them reaches the present-day surface. They are mostly located above the structural high corresponding to the tilted fault block (horst), and are found along a south-north trend starting above the N-S fault bounding the horst to the west. Some isolated chimneys were also detected in the western part of the field. Detailed interpretation of chosen seismic cross-sections throughout the field, constrained by well-logs and core analysis allowed to propose a scenario for the genesis of these features. Some of the oil generated in the middle Jurassic source rocks, further south of the Porcupine basin, migrated updip to

the north where it has either become entrapped within Jurassic reservoir layers, or percolated up fault planes to shallower layers where fluid and gas could escape through the more permeable upper Cretaceous and Tertiary sandstones. Another interesting feature is the abundance of pockmarks throughout the entire field. More than 1100 were mapped from 2D survey seismic profiles. They are known to form through the eruption of methane gas trapped in the sediments. They are proposed to be the expression at the surface of the fluid and gas that migrated from deeper parts of the basin, first through fault planes, then through the formation using more or less energetic ways (shock waves, percolation, diffusion).