Acoustic Evidence of Fluid Flow in Irish Offshore and Physical Property Measurements on Gas-Hydrate Bearing Sediments

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ABSTRACT

Natural gas hydrate (NGH) is important because of its potential importance as a near-future energy resource and their possible role as a factor in climate change. Large concentrations of NGH may exist within a Gas Hydrate Stability Zone (GHSZ) along continental margins and in permafrost terrain. High-resolution geophysical datasets have been integrated in the west offshore Ireland to determine the thickness of the GHSZ and the detailed morphology of its base, which is the focus of exploration activity. The objective of this study is to assist exploration for prospective NGH concentrations, which are dependent on migration pathways from source rocks or existing conventional hydrocarbon reservoirs and suitable host sediments within the GHSZ. The GHSZ thickness extends to maximum depths below seafloor of 645 m and 784 m in the Rockall and Porcupine basins respectively. Petroleum systems have been confirmed in both these basins. Biogenic gas has been documented in shallow sediments. Seepage at the seafloor (pockmarks) as well fluid flow- related acoustic features in the shallow sub-surface, have been identified both within and outside the GHSZ regions. Well-defined Bottom Simulating Reflectors (BSR) have not been found in the Irish offshore region. But this is now recognized as a positive exploration factor. For instance, in the northern Gulf of Mexico there is no widespread BSR, but moderate sized concentrations of NGH have been identified by seismic analysis and proven by drilling. Kilometre scale well-bed differentiated Cenozoic sediments were deposited in the Irish basins that could be excellent host horizons for NGH. Sandy limestone and calcareous sandstone cores from a bore hole located on the eastern margin of the North Bróna Basin (slope between the Porcupine High and the Rockall Basin), have been retrieved from the formation within the modelled hydrate stability zone. Investigations such as: i) influence of NGH pore saturation on Vp and Vs - wave velocity measurements , and ii) effect of grain size distribution and sediment microstructure of these cores on both the formation and dissociation of NGHs, are scheduled to be carried out after artificially growing NGH within these sediment cores. The anomalies in Vp and Vs measurements can be used to indicate and quantify the presence of gas NGHs in the sediments, and further assist in evaluating NGH saturation and resource estimation.