A Re-examination of Beaufort Sea-Mackenzie Delta Basin Gas Hydrate Resource Potential Using a Petroleum Play Approach

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Abstract

An environment favoring gas hydrate (GH) stability and a timely petroleum flux into suitable reservoirs are necessary conditions for GH accumulation. We re-examine the Beaufort Sea-Mackenzie Delta Basin (BMB) GH resource using a petroleum play approach. Geological factors, such as reservoir distribution and conduits/faults connecting gas sources to the GH stability zone control accumulation characteristics that may affect recovery technology and production potential. It is desirable to classify the resource as a function of its characteristics and geological setting. We used both a deterministic spatial model and a reservoir parameter probabilistic model to characterization the GH resource as a function of reservoir parameters that are potential proxies for technological and economic supply controls. Reservoir quailty and a spatial association with structure, probably indicative of the gas pathway from deeper levels, are key factors controlling resource volumes and accumulation characteristics.

The deterministic total estimate = 8.82×10^{12} m^3 GIP is illustrated by gas hydrate saturation (6.40×10^{12} m^3 and 4.59×10^{12} m^3 GIP if average gas saturation is >30% and >50%, respectively). A comparable expected total = 10.23×10^{12} m^3 GIP, (expected 6.93×10^{12} m^3 and 4.20×10^{12} m^3 GIP if gas saturation is >30% and >50%, respectively) is obtained using the probabilistic analysis. Estimates of regionally sequestered methane in GH constrain long-term regional methane flux rates. The flux rate is estimated <0.09-4.20 $mg/m^2/d$, which is lower than the tens to hundreds of $mg/m^2/d$ suggested recently. Understanding methane flux may also characterize seals and trap fill fractions in deeper conventional plays.