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Multi-scale characterization for pore systems of hydrate-bearing reservoir —Kerishna-Godavari Basin, India

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The microscopic pore system of hydrate-bearing sediments in the KG Basin was thoroughly described using X-ray computed tomography (XCT), low-field nuclear magnetic resonance (NMR), and N₂ gas adsorption (N₂GA) technique. Results indicate that the pore types are intricate, exhibiting a wide range of pore shape and limited connectivity. Foraminiferal shells contribute to the presence of certain pores, whereas micropores ranging from 4-20 μ m play a significant role in determining permeability. The absence of measuring closed pores with N₂GA resulted in a notable disparity in the overall pore volume when compared to NMR findings. NMR technique is used to monitor the phase transition process in pores as the temperature changes. The intensity value of the first peak signal of CPMG is measured, and the pure water signal is used as a reference to compute the amount of unfrozen water and the distribution of pore sizes. It is found that the water signal within the macropores is consistently rising, although it is considerably weaker compared to the micropores. The peak values in the mesopores, which belong to the medium range, are disordered. Analysis indicates that water migration takes place within the mesopores. The initial process of ice melting into water occurs within smaller holes.

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