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Methane hydrate formation in partially water-saturated Ottawa sand

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ABSTRACT

Bulk properties of gas hydrate-bearing sediment strongly depend on whether hydrate forms primarily in the pore fluid, becomes a load-bearing member of the sediment matrix, or cements sediment grains. Our compressional wave speed measurements through partially water-saturated, methane hydrate-bearing Ottawa sands suggest hydrate surrounds and cements sediment grains. The three Ottawa sand packs tested in the Gas Hydrate And Sediment Test Laboratory Instrument (GHASTLI) contain 38(1)% porosity, initially with distilled water saturating 58, 31, and 16% of that pore space, respectively. From the volume of methane gas produced during hydrate dissociation, we calculated the hydrate concentration in the pore space to be 70, 37, and 20% respectively. Based on these hydrate concentrations and our measured compressional wave speeds, we used a rock physics model to differentiate between potential pore-space hydrate distributions. Model results suggest methane hydrate cements unconsolidated sediment when forming in systems containing an abundant gas phase.