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Natural Concentration Mechanisms for Gas Hydrate

Dr. Warren Wood

Dr. Joan Gardner

Dr. Richard Coffin

U. S. Naval Research Laboratory

Summary

Gas hydrate, a solid form of natural gas and water, accumulates in sediments under conditions that are markedly different from those in which fluid hydrocarbons (natural gas, and petroleum) accumulate. Specifically, in coarse-grained sediment gas hydrate accumulation reduces the local permeability, making it self-trapping, and in fine-grained sediments gas hydrate formation may act as a wedge, driving sediments apart through crack enlargement. Natural gas, mostly methane hydrate, can exist only under high pressure and/or low temperature, i.e. marine environments with water depths greater than about 500 meters and temperatures less than about 10 degrees Celsius. Thus there exists a layer of seafloor sediment in which gas hydrate is stable, whose thickness increases with increasing water depth. Gas hydrate formation therefore requires that the methane (either in gas or dissolved in the pore water) move upward into this layer, or the Pressure-Temperature (PT) regime of a static accumulation changes, through seafloor cooling or subsidence. Upward flux of methane is the more common in areas where large and extensive accumulations are most likely, and is the focus of this presentation. In order to concentrate the gas hydrate by fluid and/or gas flux, there must be a balance between the methane flux and heat flux. Large fluxes of methane bring heat that destroys the trap. Prospecting for methane hydrate accumulations therefore requires an understanding of the geology, hydrology, and thermal regime of the area.