DRILLING FOR METHANE ICE: GAS HYDRATES IN CONTINENTAL MARGINS

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Methane gas hydrates — an ice-like form of methane and water stable under pressure and temperature conditions common in continental margin sediments — are increasingly being recognized as potential agents in global climate change, as a possible future source of clean energy, and as a key factor contributing to the instability of seafloor sediments. Characterization of methane gas hydrate deposits was the key focus of ODP Leg 164 (U.S. Atlantic passive margin) and a subsidiary target for drilling on the active Costa Rica margin (ODP Leg 170). Dr. Ruppel will outline the use of detailed downhole temperature measurements that provide a direct constraint on one of the fundamental physical parameters controlling the occurrence and stability of gas hydrate deposits. Coupling the thermal data with pore water geochemical analyses, seismic results, and physical properties measurements makes it possible to constrain the key physical parameters and fluid flow regimes that control the localization and concentration of gas hydrate deposits under in situ conditions. When the results obtained on ODP Legs 164 and 170 are combined with a new analytical model for the evolution of the three-phase gas hydrate system in porous marine sediments, clear physical explanations emerge for the observed distribution of free gas and gas hydrate. Most importantly, in situ observations can be directly linked to modeling results that constrain critical methane flux (biogenic methane production) and fluid flux rates for the nucleation, growth, and stability of gas hydrate deposits. Dr. Ruppel sailed as a physical properties/heat flow specialist on ODP Leg 164 and participated as a shore-based scientist for ODP Leg 170.