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Scientific Objectives of the Gulf of Mexico Gas Hydrate JIP Leg II Drilling

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Abstract

The Gulf of Mexico Methane Hydrate Joint Industry Project (JIP) has been performing research on marine gas hydrates since 2001 and is sponsored by both the JIP members and the U.S. Department of Energy. In 2005, the JIP drilled the Atwater Valley and Keathley Canyon exploration blocks in the Gulf of Mexico to acquire downhole logs and recover cores in silt- and clay-dominated sediments interpreted to contain gas hydrate based on analysis of existing 3-D seismic data prior to drilling. The new 2007-2009 phase of logging and coring, which is described in this paper, will concentrate on gas hydrate-bearing sands in the Alaminos Canyon, Green Canyon, and Walker Ridge protraction areas. Locations were selected to target higher permeability, coarser-grained lithologies (e.g., sands) that have the potential for hosting high saturations of gas hydrate and to assist the U.S. Minerals Management Service with its assessment of gas hydrate resources in the Gulf of Mexico.

This paper discusses the scientific objectives for drilling during the upcoming campaign and presents the results from analyzing existing seismic and well log data as part of the site selection process. Alaminos Canyon 818 has the most complete data set of the selected blocks, with both seismic data and comprehensive downhole log data consistent with the occurrence of gas hydrate-bearing sands. Preliminary analyses suggest that the Frio sandstone just above the base of the gas hydrate stability zone may have up to 80% of the available sediment pore space occupied by gas hydrate.

The proposed sites in the Green Canyon and Walker Ridge areas are also interpreted to have gas hydrate-bearing sands near the base of the gas hydrate stability zone, but the choice of specific drill sites is not yet complete. The Green Canyon site coincides with a 4-way closure within a Pleistocene sand unit in an area of strong gas flux just south of the Sigsbee Escarpment. The Walker Ridge site is characterized by a sand-prone sedimentary section that rises stratigraphically across the base of the gas hydrate stability zone and that has seismic indicators of gas hydrate.

Introduction

The Gulf of Mexico Methane Hydrate JIP is a consortium of energy and service companies, as well as government organizations, that began collecting data and performing research on marine gas hydrates in the Gulf of Mexico (GOM) in 2001. The project is sponsored by both the JIP members and the US Department of Energy (DOE). The last few decades have seen considerable interest in gas hydrates from both a resource perspective and the standpoint of potential seafloor stability concerns for conventional deepwater operations. Addressing either of these issues requires obtaining fundamental data on the properties of gas hydrate-bearing sediments, the formulation of predictive models for gas hydrate distribution and concentration, an understanding of wellbore and formation stability in gas hydrate-bearing sediments, and the development of methods to analyze existing and new data to infer gas hydrate concentrations.

The GOM JIP project is divided into three phases. The first phase concentrated on collecting laboratory data and developing seismic and wellbore models for analysis of marine gas hydrate-bearing sediments. The second phase of the project, carried out in 2005, concentrated on groundtruthing predictions about gas hydrate-bearing units by logging and coring fine-grained (clay- and silt-rich) marine sediments in Atwater Valley blocks 13 and 14 and Keathley Canyon block 151. These locations were chosen for field investigation based on (a) precruise seismic analyses that indicated the potential for gas hydrate occurrence and (b) the contrasting nature of the apparent fluid and gas flux regimes at the sites. In Atwater