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TITLE: India National Gas Hydrate Program Expedition 02 Summary of Scientific Results: Gas hydrate systems along the eastern continental margin of India

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ABSTRACT:

The primary objectives of the India National Gas Hydrate Program Expedition 02 (NGHP-02) were to obtain new data on the occurrence of gas hydrate systems and to advance the understanding of the controls on the formation of gas hydrate accumulations in the offshore of India. In accordance with the ultimate overall goal of the NGHP effort to assess the energy resource potential of marine gas hydrates in India, particular focus was placed on the exploration and evaluation of gas hydrate occurrences at high saturations in sand-rich systems. NGHP-02 operations were conducted from 3-March-2015 to 28-July-2015 off the eastern coast of India and included logging while drilling (LWD) operations at 25 locations, and coring and wireline logging operations at 10 locations, in the Krishna-Godavari and Mahanadi Basins. The formation of highly concentrated gas hydrate accumulations, which are more suitable for energy extraction, requires the presence of relatively coarse-grained sediments with porosity needed to support the migration and accumulation of gas, and the nucleation of gas hydrate. The results of downhole logging, coring and formation pressure testing operations during NGHP-02 have confirmed the presence of extensive sand-rich depositional systems throughout the deepwater portions of the Krishna-Godavari and Mahanadi Basins. Two areas of the Krishna-Godavari Basin, referred to as Areas B and C, contain substantial gas hydrate accumulations in sand-rich systems and therefore represent ideal candidate sites for future gas hydrate production testing. This summary and technical report includes a comprehensive synthesis of the geologic, geophysical, geochemical, and physical property data acquired during NGHP-02 as it relates to the controls on gas hydrate occurrence, particularly with regards to sand-hosted accumulations. In the Mahanadi Basin, despite the confirmation of extensive reservoir capacity, gas supply at the NGHP-02 sites was insufficient to charge the reservoirs with gas hydrates. In the Krishna-Godavari Basin, extensive reservoir systems were confirmed with sediment grain-sizes ranging from coarse-silts to gravels. These reservoirs range from fully- to partially-filled with gas hydrate. The gas is determined to be from only microbial sources, and in part migrated into the reservoirs from deeper systems. The controls on gas hydrate occurrence are complex and varied; and include substantial reservoir heterogeneity and sufficient permeability throughout the reservoirs and seals that allowed pervasive fluid flow into and through the hydrate-bearing systems. These discoveries are the most significant confirmation of the exploration approach that focuses on direct detection of hydrate reservoirs supported by comprehensive petroleum systems analyses.

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