High Concentration Methane Hydrate in a Silt Reservoir from the Deep-Water Gulf of Mexico

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Abstract

We present results from 30 quantitative degassing experiments of pressure core sections collected during Expedition UT-GOM2-1 from Green Canyon 955 in the northern Gulf of Mexico as part of the UT-Austin/DOE Deepwater Methane Hydrate Characterization and Scientific Assessment. The hydrate saturation (Sh), the volume fraction of the pore space occupied by hydrate, is 79-93% within sandy silt beds between 413 and 442 mbsf in 2032 m water depth. Sandy silt intervals at this site are tens of cm to meters in thickness and characterized by consistently high Sh (79-93%) and high compressional wave velocity (Vp) (2515-3012 m/s). The sandy silt beds are interbedded with clayey silt sections that have lower Sh (2-35%) and lower Vp (1684-2023 m/s). They are composed of laminae of silts with high-Sh within clay-rich intervals containing little-to-no hydrate. Degassing of single-lithofacies sections reveals higher-resolution variation of saturation than is possible to observe in well logs; however, the average Sh of 64% through the reservoir is similar to well log estimates. Gas recovered from the hydrates during these experiments is composed almost entirely of methane (99.99% CH_4, $_2H_6$ on average), with an isotopic composition (δ13C: -60.4 and -63.6 ‰ VPDB and δ2H: -178.2 and -179.0 ‰ VSMOW) that suggests the methane is most likely from a microbial source. A subset of six degassing experiments performed using very small pressure decrements indicates that the salinity within these samples is close to the average seawater concentration (35 parts per thousand), suggesting that hydrate either formed slowly or formed during a rapid event at least tens of thousands of years before present.