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MODELING POST-GLACIAL EVOLUTION OF GAS HYDRATE STABILITY ZONES IN THE NORTH ATLANTIC: IMPLICATIONS FOR MASS WASTING, MUD VOLCANISM AND POCKMARK FORMATION

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Gas hydrate dissociation has been postulated as a mechanism for porewater/free gas mobility and factor in mass wasting along continental margins. Using thermobaric models, we recognize several major GH stability regimes in the North Atlantic region: Post-Glacial evolution of the Gas Hydrate Stability Zone (GHSZ) thickness in response to competing effects of changing pressure and temperature explains why some major submarine landslides along the Norwegian-Barents margin may have been triggered by gas hydrate dissociation during the Holocene, not during the lowest sea levels of the Last Glacial Maximum (18-20 ka). (Norwegian researchers have dated the Storegga, Traenadjupet and Andoeya slides at 8.15ka, 4ka, and mid-Holocene, respectively). We predict that this result applies to all non-Polar Atlantic margins (**GHSZ REGIME I**) with large glacial-interglacial temperature changes, but only in water depths less than ca.800m. At greater depths and along all Arctic Basin margins (**REGIME III**), the bottom water has remained cold throughout, such that GH dissociation could only have been promoted during reduced LGM subbottom pressures (low sea levels). While methane release from Holocene slides cannot have initiated Northern Hemisphere deglaciation, it might have promoted Holocene ice sheet shrinkage in Antarctica. High latitude shelf seas (e.g., Barents and North Seas) were covered by LGM grounded marine ice sheets, creating subglacial GH stability zones (**REGIME III**). Early disintegration of these glaciers may have caused subjacent GH dissociation, possibly accounting for some of the early post-Glacial atmospheric methane

peaks seen in ice core records. The correlation of shelf-sea pockmarks with previous marine ice sheets (e.g, North and Barents seas) suggests many pockmarks were created upon deglaciation-induced pressure release and GH dissociation. **REGIME IV**: The Mediterranean outflow area was a special case, where Holocene initiation of warm, dense (saline) bottom-water outflow may have caused GH dissociation and mud volcanism in the Gulf of Cadiz area. **REGIME V**: Along the Atlantic margin of Eastern North America, north-flowing Gulf Steam water may have WARMED in early Glacial times, feeding moisture to the ice sheets in the north and perhaps, in combination with concomitant sea level falls, triggering gas release and updip migration from GH dissociation farther down the slope, such as suggested by linear pockmarks on the outer shelf off Cape Hatteras.