Central Scotian slope stability: the role of gas hydrates

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Gas hydrates are ice-like solids in which large quantities of methane are trapped in a solid phase as a result of suitable pressure and temperature conditions in the presence of an excess supply of methane gas. They are a potential fuel source, possible greenhouse gas contributor, and a geohazard concern due to their potential effect on slope stability. Gas hydrates may cause sediment failures by releasing methane gas when they dissociate (melt) resulting in an increase *in situ* sediment pore pressures. The purpose of this study is to search for the presence of gas in an area of known sediment instability on the continental slope east of Nova Scotia (Verrill Canyon area) using a geophysical approach. This area displays several sediment failures, between 15 and 12 ka. Geotechnical infinite slope stability analysis has shown that the area is inherently statically stable and that excess pore pressures were necessary to effect failure. Increased pore pressure probably resulted from one or more of: ground accelerations due to earthquakes or isostatic readjustments following glaciation, shallow gas charging, dissociation of gas hydrates, or rapid sedimentation during glaciation / deglaciation. Dissociation of gas hydrate is one of the proposed potential mechanisms. A drop in sea level or increase in bottom water temperatures (as during glaciation / deglaciation) may cause dissociation of gas hydrate, which would free methane and water, causing an increase in pore pressure. The presence of failures and pockmarks near the theoretical minimum stable depth (500 metres below sea level) is indirect evidence of gas hydrate existence. Hydrates in some locations can be detected on seismic reflection profiles by the presence of a BSR (a bottom simulating reflector, which corresponds to the bottom of the hydrate layer), or by using wide angle seismics (such as an ocean bottom seismometer, or OBS) to detect an unusually high velocity. Examination of 14 high resolution single channel reflection lines has not revealed any BSRs. An OBS was deployed where gas hydrates are most likely to be present (850 metres below sea level). A velocity model was produced from the OBS data, which displays no anomalous velocities. Therefore it is proposed that if gas hydrate is present, concentrations are too low to be detected by the seismic methods employed.