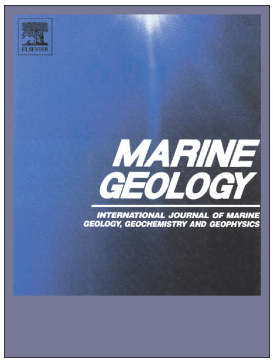

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PII: S0025-3227(17)30001-4
DOI: doi: 10.1016/j.margeo.2017.01.001
Reference: MARGO 5565

To appear in: *Marine Geology*

Received date: 12 July 2016
Revised date: 25 December 2016
Accepted date: 1 January 2017

Please cite this article as: H. Rashid, K. MacKillop, J. Sherwin, D.J.W. Piper, B. Marche, M. Vermooten , Slope instability on a shallow contourite-dominated continental margin, southeastern Grand Banks, eastern Canada. The address for the corresponding author was captured as affiliation for all authors. Please check if appropriate. Margo(2017), doi: 10.1016/j.margeo.2017.01.001

Slope instability on a shallow contourite-dominated continental margin, southeastern Grand Banks, eastern Canada

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Abstract

Submarine sediment failures and related mass-transport deposits (MTDs) are widespread on the eastern Canadian continental slope settings and in general, have been related to ice sheets crossing the outer shelf. The southeastern Grand Banks margin was not glaciated in the last 10^5 years and has a deep shelf break. As a result, the upper continental slope consists principally of sediment transported from the north by the Labrador Current. High-resolution seismic profiles and 10-m long piston cores show widespread sediment failure and MTDs in a plastered contourite drift from 500–1,000 m water depth. This study documents the stratigraphy of the past 48,000 years and the record of sediment failure events. Heinrich layers H1 to H5 have been recognized from distinctive petrology, physical properties, and bulk geochemistry and are constrained by numerous ^{14}C-AMS dates. The geotechnical analysis shows that the latest Quaternary sediment section is mildly underconsolidated, perhaps related to high sedimentation rates (up to 0.5 m/ka) enhanced by some leakage of deep fluids. Nevertheless, factor of safety calculations using S_u/P_0 and friction angles from triaxial testing suggest the slope is statically stable up to gradients of 9°. Atterberg limit measurements of silty contourite sediments indicate susceptibility to liquefaction under cyclic loading. There is evidence that apparently synchronous failure occurred over many tens of kilometres of the slope, probably as a result of rare passive margin earthquakes. These shallow water contourite deposits have a higher sand and coarse silt content, much less biogenic material, and more rapid variations in sediment and geotechnical properties than those of the deep-water equivalents, all of which make them more susceptible to sediment failure.