Chronology, Lithofacies And Origin Of Late Quaternary Mass Transport Deposits In Submarine Canyons, Scotian Slope, Canada

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ABSTRACT

Deep water geophysical exploration for hydrocarbons on the Scotian Slope has been intense over the past 5 years with > 60,000 line km of 2D and > 20,000 km2 of 3D seismic reflection data acquired, and five deep water exploration wells drilled. In support of this exploration, the Geological Survey of Canada, in partnership with other government agencies, NGO's and industry, has conducted a program to provide advice on the regional Quaternary geology and geotechnique for environmental and geohazard considerations. This effort has included assessment of industry and government high resolution geophysical data and acquisition of > 300 shallow piston cores with extensive geotechnical measurements.

The eastern Canadian Scotian margin is a glacially influenced, passive continental margin. Late Quaternary evolution of the margin has been considerably influenced by slope failure with submarine mass transport deposits comprising a significant component of the stratigraphy. Using industry seismic, high resolution seismic and surficial morphologic data, mass transport deposits of the entire suite of styles and scales have been observed. The surficial morphology of the slope shows broad intercanyon areas and well defined canyon systems with canyons that are 500 m deep and several km wide. Canyons provide a record of mass transport events, as they are the collectors of most of the downslope transport of sediment. This research focuses on mass transport deposits recovered from 10-m piston cores collected in submarine canyons of the Scotian Slope. The piston cores penetrate to approximately the last glacial maximum at 18 ka and in combination with regional multibeam bathymetry show a range of styles of mass transport deposits on canyon walls and floors. These deposits are characterized by four distinct lithofacies – folded mud blocks, stratified mud blocks, mudclast conglomerate, and diamicton – and are overlain by turbidity current deposits of well sorted sand. Stratified and folded mud blocks are sourced from canyon walls. Strength properties of clasts in mudclast conglomerate indicate that the source sediment was buried 12 m to 33 m, much deeper than the present cored depth. Mudclast conglomerate then, likely, has a source in canyon heads. Existing chronostratigraphic markers and new radiocarbon dates provide evidence for four to five episodes of sediment failure within the past 17 ka with a minimum failure recurrence interval of 3400 years. Earthquakes are the most likely mechanism for triggering cyclic, synchronous

failures in separate canyons. Recurrence interval of failures in canyons is higher than that on slopes lacking canyons, probably because local gradients are steeper.