Mass Transport Processes on Slope Sedimentation: Sediment Distribution on the SW Newfoundland Slope, Eastern Canada

Giles, Michael [1]; Mosher, David [2]; Wach, Grant D.[1] (1) Dalhousie University, Halifax, NS, Canada. (2) Geological Survey of Canada - Atlantic, Bedford Institute of Oceanography, Dartmouth, NS, Canada.

The continental slope of Eastern Canada outboard of the Halibut Channel, is an active exploration region, but was also the location of the 1929 Grand Banks Submarine Landslide that produced a deadly tsunami. The modern seafloor morphology of Newfoundland's (Nfld.) southwest (SW) slope shows evidence for significant channel incision and sediment failure. Understanding the geologic processes responsible for sculpting the modern seafloor is critical for mitigating geohazard risks when planning drilling and subsea developments. These processes are also used to develop sedimentation models to decrease risk associated with exploration for reservoirs within deepwater depositional systems.

Multibeam, 2D and 3D seismic data on the SW slope provides evidence of successive mass failure at a variety of scales. The occurrence of stacked, regionally extensive mass transport deposits (MTD) indicates this was a primary process for slope evolution during the Cenozoic. MTDs with volumes up to 150 km3 are identified between the Cretaceous and mid-Pleistocene. Above the mid-Pleistocene, MTDs with volumes less than 1 km3 are recognized. The mass failures are attributed to several factors: 1) The Laurentian Channel acted as a major ice outlet during Quaternary glaciations resulting in the accumulation of thick, unconsolidated sediments on the upper slope; 2) Seismic data suggest sandy intervals underlie the St. Pierre Slope with listric faults extending from surface escarpments to these intervals, providing evidence that these intervals act as detachment surfaces; 3) Gas hydrate is recognized in the Halibut Slope region and free gas is evident in cores recovered from St. Pierre Slope. Generation of gas within sediment reduces cohesive strength with the potential for failure; and 4) Ground accelerations due to earthquakes play a critical role in initiating sediment failure. The area overlies a paleo-transform fault that results in higher levels of seismicity compared to other regions of the Eastern Canadian margin.

Mass transport processes are a significant mechanism of sediment transport in the SW Nfld. slope region of the margin. These processes are dependent upon a variety of pre-conditioning factors, likely initiated by seismicity. The ubiquitous nature of such processes in the Cenozoic section is a critical component to deciphering and predicting reservoir distribution of underlying strata in this region and other similar geologic settings.