

The Quaternary Geology of Orphan Basin: Applications to Geohazard Evaluation for Hydrocarbon Exploration

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Abstract

Orphan Basin, a large deepwater basin off the northeast Newfoundland shelf, has recently come under lease for exploration. Since 2001, the Geological Survey of Canada has conducted four research expeditions to Orphan Basin, collecting piston cores and high resolution seismic reflection data, with the purpose of providing a regional surficial geological framework for this area. Stratigraphic ties are made to the Blue H-28 well and a long piston core MD95-2026 that penetrates to the penultimate glacial period.

Much of the Quaternary section consists of thick (> 50 metres) mass-transport deposits, with a recurrence interval of 75-100 ka, and a large trough-mouth fan seaward of Trinity Trough active at glacial maxima. In the southern part of the basin, several shallow seabed failures are recognised with a recurrence period of 3 ky; the most recent failure occurred at 6 ka and has a deposit thickness of 20 metres. Turbidity currents active during glacial maxima or triggered by slope failure have deposited muds over much of the basin and maintained channels in which gravel and sand were deposited. Pebbles and cobbles recovered during piston coring throughout the basin imply a greater presence of scattered boulders in the shallow subsurface compared to other exploration areas off the Grand Banks and Scotian Shelf. Much of the leased land in Orphan Basin is away from steep slopes and therefore the risk of seabed failure during drilling is low. However, ubiquitous mass-transport deposits, the presence of gravel and sand beds, and scattered boulders may provide some interesting engineering challenges.