

Slip Sliding Away: Enigma of Large Sandy Rafts Within a Gas Bearing Mass Transport Complex Offshore North West Greenland

David Cox¹, Mads Huuse¹, Paul Gannon², John Clayburn²

¹School of Earth and Environmental Sciences, University of Manchester, Manchester, Greater Manchester, United Kingdom.

²Cairn Energy PLC, Edinburgh, United Kingdom.

ABSTRACT

Within the North-East Baffin Bay province on the NW Greenland shelf, late Mesozoic to early Cenozoic rifting between Greenland and Canada has formed a series of grabens intersected by elongated ridges with graben infill of up to 13 km in places. This trend is observed within the Melville Bay area with the north west–south east orientated Melville Bay High (MBH) which was initially formed as a syn-rift horst and reactivated during the Eurekan Orogeny. Today, a 4-way-dip closed mass transport complex (MTC) covers a 420km² area directly above the mainly pre-rift sediments of the MBH within a Paleogene section and is likely of Eocene age. This suggests isolated basin deposition during rifting into the adjacent Melville Bay Graben (MBG) and subsequent deposition of the MTC-forming sediments during a thermal subsidence drift phase which may have occurred during a period of uplift quiescence on the high. The MTC displays landslide characteristics with jigsaw-like blocks that geometrically fit back together. The acoustic characteristics include bright ‘soft’ amplitudes at the top and ‘hard’ amplitudes at the base with polarity reversals observed around the edges of the MTC. These features provide a direction of deformation which is conformant with sliding being caused by post-rift tilt between the MBH and the adjacent basins after deposition of the MTC-forming sediments. The landslide deposit provides a high quality analogue of post-depositional sliding of reservoir facies along decollement levels. This may play an important role in the characterisation and understanding of other landslide features such as within the North Sea Tertiary. It also provides evidence for the timing and style of basin development within the Melville Bay region including the depositional history throughout rifting and the onset of post-rift orogenic uplift leading to slide emplacement. Observed hydrocarbon indicators serve to calibrate landslide lithology and provide evidence for a working petroleum system highlighting the petroleum potential of this under-explored region.