

## **Controls on the Spatial Distribution of Paleocene Deep-Water Systems in the Central Graben of the North Sea**

**Thomas Heard<sup>1</sup>, Efthymios Tripsanas<sup>1</sup>, David Hinds<sup>1</sup>, David Owen<sup>1</sup>, and Sarah Heal<sup>1</sup>**

<sup>1</sup>Shell, London, United Kingdom.

### **ABSTRACT**

The Paleocene deep-water systems in the Central Graben of the North Sea form some of the most prolific reservoirs on the UK Continental Shelf. Large-scale depositional environment mapping based on regionally correlative and seismically mappable seismic stratigraphic surfaces highlight the complex spatial distribution of the deep-water systems. The distribution of the Paleocene deep-water sedimentary systems in the Central Graben were controlled by irregular seafloor topography created by earlier Mesozoic rifting events, Early Cretaceous – Paleocene thermal subsidence and/or differential compaction, and active halokinesis. The main depositional trend in the Central Graben throughout the Paleocene was from the NW to SE, whilst a smaller scale lateral sediment input from the west was also prevalent. In the basin centre, the base of the Paleocene (lower Maureen Formation) is marked by a large, carbonate-rich MTC. Subsequently, NW-SE oriented deep-water fan systems of the Maureen Formation developed to the west and east of the MTC, and were laterally confined by structural highs to the east and west of the main fairway. Upper Maureen and lower Lista sediment failures on the western margin of the Central Graben resulted in the deposition of westerly sourced, large-scale MTCs on the basin floor, further complicating the seafloor bathymetry. This seafloor relief was further complicated by active halokinesis, which locally acted as points of gravity flow obstruction and diversion. The overlying Lista and Sele deep-water fan systems evolved in a basin with complex bathymetric relief, where fans were forced to focus and divert between and around topographic highs formed by the inherited Mesozoic structural relief and subsequent MTCs. Western and eastern NW-SE oriented deep-water fans developed which, on a gross sense, were stacked vertically on top of underlying fans as a result of confinement associated with the MTCs as well as structural highs such as the Jaeren and Forties-Montrose Highs. At a more granular level, the channel fairways of the Lista and Sele deep-water fan systems were laterally offset stacked relative to underlying Maureen-aged channel fairways suggesting that the depositional systems were in general weakly confined.