

Fenris reservoir characterisation and implication for HPHT exploration in the Central Graben

The deep parts of the North Sea Central Graben (below BCU) have a long exploration history. The most prospective intervals are found within the Upper Jurassic shoreface deposits (Fulmar / Ula formations) and turbidites (intra-Heather / Farsund Formation). Further prospectivity is also found in the middle Jurassic Pentland / Bryne formations, Triassic, Permian and Devonian.

The production potential of these HPHT plays in the Central Graben is proven by several successful developments. Embla was the first in 1993, followed by developments in the UK sector: Judy (1995); Erskine (1997), Shearwater (2000), Elgin and Franklin (2001), Jade (2002), Glenelg (2006), West Franklin (2007), Jasmin (2013) and Culzean (2019).

Aker BP aims to perpetuate this successful trend with the Fenris Field development, due to start production in 2027. Fenris (previously called King Lear) was discovered by Saga in 1989 with well 2/4-14. During the drilling operations, an underground blow-out developed, which took more than a year to control. Appraisal continued in the early 1990's and then in a second phase between 2012 and 2015 by Equinor. Two upper Jurassic reservoir intervals are present in a half-graben structure, the intra-Farsund Formation turbidite sandstones and the Ula Formation shoreface sandstones. The reservoirs have retained good porosity and moderate permeability despite being buried to depth of over 4700 m TVDSS. Overpressure has helped to preserve an open pore network during shallow to intermediate burial, whereas clay coating has prevented extensive quartz cementation at greater depths. Permeability reduction is caused by the transformation of K-feldspar and kaolinite to fibrous illite. Permeability effectiveness and connected volumes are further demonstrated by the flow rates and pressure depletion measured during the underground blow-out.

In addition to the Fenris development, several prospects and discoveries are being evaluated as tie-back candidates, utilising capacity available on the new gas-processing facilities built for Fenris on Valhall.