

Controls on Lower Carboniferous (Dinantian) Frontier Basin Exploration Play Success in the Mid-North Sea High

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ABSTRACT

The discovery of, and subsequent production from, the Breagh gas field in Quadrant 42 of the Southern North Sea challenges long-held views concerning the limited prospectivity of the Mid North Sea High. The occurrence of the field attests to a petroleum system having been active in the area, something that lends encouragement to further exploration efforts in the basin. We have integrated seismic interpretation of two proprietary 3D pre-stack time migrated (PSTM) volumes, a regional grid of 2D data acquired as part of the Oil and Gas Authority (OGA) Frontier Basins research program, well, core and field-data from coastal exposures in Berwickshire and Northumberland to determine the primary controls on the petroleum system. The results show that the Breagh structure formed in response to Mesozoic and Cenozoic folding to create a closure of erosionally truncated (subcropping) and highly faulted (compartmentalised) fluvio-deltaic reservoirs of Lower Carboniferous (Dinantian) age at Base Permian Unconformity (BCU) level which are then sealed by Upper Permian (Zechstein Group) evaporites. The absence of the Upper Carboniferous (Coal Measures Group) across the area implies that gas charge comes from Lower Carboniferous coals including those belonging to the Scremerston Coal Group. Halokinesis led to an elongate zone of salt withdrawal above which a narrow graben formed containing thick Mesozoic sediments that are characterised by slow seismic velocities. The faults defining the graben record the effects of listric detachment where withdrawal of the Zechstein group evaporites is greatest and led to the creation of turtle-back structures, the full appreciation of which governs depth conversion and accurate mapping at the reservoir level. Regional interpretations show that a late (Paleogene) tilt was also imparted and had an important effect since it led to Breagh lying on a westerly (re-)migration pathway.