

Role of the Base Permian Unconformity in Controlling Carboniferous Reservoir Prospectivity, UK Southern North Sea

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Unconformity surfaces are of fundamental importance for understanding petroleum prospectivity in many sedimentary basins. They commonly promote diagenetic change and either enhance reservoir porosity in subcropping sedimentary layers through leaching or promote cementation to create low permeability, poorer quality reservoirs. Conversely the nature of their supracropping sedimentary rocks may offer high permeability pathways for fluid flow (i.e. if coarse-grained deposits form a transgressive lag or channel fill) or act as coherent stratigraphic traps where the overlying rocks are sealing.

Integration of seismic, well-log and core data has afforded the opportunity to evaluate the effects that the Base Permian Unconformity (BPU) has on highly prospective Carboniferous gas-reservoirs which have been sealed beneath its overlying sealing Rotliegend Group Silverpit Claystone Formation cover in the UK Southern North Sea (SNS). Conventional wisdom has polarised views and has been a part of an on-going debate with opinion divided as to whether reservoir properties are enhanced or not by the unconformity. Given the significance for exploration, appraisal and development of the prospective Carboniferous play fairway in the SNS, the research has attempted to resolve this issue through seismic interpretation of the truncated subcropping clastic reservoirs, stratigraphic assessment of subcropping horizons and the systematic sampling and analysis of all relevant field exposures and cored sections. The holistic investigation has provided a new-found basis upon which to examine and quantify the evidence for and against their having been a significant weathered zone beneath the BPU that may enhance the development of secondary porosity and consequently improve reservoir predictions and potential.

The interpretation of high-fidelity 3D seismic data has also permitted the identification of a suite of WNW-ESE striking, sub-vertical Tertiary igneous dykes. These transect the Carboniferous sediments and the Base Permian Unconformity into the higher horizons and affect the reservoir quality by instigating diagenetic changes and the compartmentalisation of the reservoirs.