

## **Geology of the 5/22-1 (Errigal) Exploration Borehole, North East Rockall Basin, Offshore Western Ireland: The Role of North Atlantic Break-Up Magmatism on Petroleum System Development**

**Chris A. Jackson<sup>1</sup>, Craig Magee<sup>1</sup>, Carl Jacquemyn<sup>1</sup>**

<sup>1</sup>Earth Science and Engineering, Imperial College, London, United Kingdom.

### **ABSTRACT**

Large quantities of hydrocarbons reside in volcanically influenced sedimentary basins, many of which occur along continental margins. Despite commonly assuming magmatism negatively impacts petroleum system development, we have a poor understanding of its true role. We combine 3D seismic reflection, borehole, petrographic and paleothermometric data to document the geology of borehole 5/22-1, which drilled the Errigal prospect, NE Rockall Basin, offshore western Ireland. This borehole tested a four-way dip closure that formed to accommodate emplacement of a Paleogene igneous sill-complex during North Atlantic continental breakup. The borehole was unsuccessful, with only very minor traces of dead oil discovered. Two water-wet turbidite sandstone-bearing intervals occur in the Upper Paleocene. The lower interval contains two c. 5 m thick, quartzose-feldspathic sandstones of good reservoir quality, and several thin (<4 m), very poor-quality volcanoclastic sandstones containing abundant pore-filling and pore throat-bridging clay minerals; in contrast, the upper interval is dominated by the very poor-quality volcanoclastic sandstones. Volcanoclastic sandstones were likely derived from a volcanic terrain genetically related to the magmatism driving trap formation, with their poor reservoir quality reflecting diagenetic degradation of abundant volcanic grains. Paleothermometric data provide equivocal evidence for magmatism-related elevated temperatures in the Paleocene-to-Eocene succession, suggesting sill-induced heating was not solely responsible for the poor reservoir quality. The reason for failure of the Errigal, which is located only c. 42 km NNW of the Dooish gas discovery, is unclear, but we speculate the low bulk permeability of the heavily intruded Cretaceous mudstone succession impeded migration of sub-Cretaceous sourced hydrocarbons into supra-Cretaceous reservoirs. Although the failure of Errigal casts doubt on the prospectivity of this play type in this part of the NE Rockall Basin, breakup-related magmatism clearly drove formation of a large structural closure, with data from 5/22-1 also providing evidence for the local development of reservoir-quality, Upper Paleocene, deep-water reservoirs and thick, Eocene topseals. Post-Cretaceous deep-water stratigraphic traps on the flanks of intrusion-induced forced folds represent potential future exploration targets, in addition to more conventional, rotated fault-block traps containing Mesozoic reservoirs.