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Before the Oil: the Volcanoes of the North Sea

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ABSTRACT

The highly prospective Central North Sea continues to play an essential role in shaping the economy of Scotland and the rest of the UK. Its formation during the Jurassic Period, some 150 million years ago, was associated with a series of major volcanic eruptions, leading to the deposition of the Rattray and Ron Volcanics. Although North Sea stratigraphy is generally well understood, the volcanic interval is still relatively unknown.

The volcanics have been intersected during hydrocarbon exploration drilling and comprise a series of basaltic lava flows with cumulative thicknesses reaching up to 1.5km thick, illustrating the highly active and effusive nature of the volcanism. The lavas are interbedded with fluvio-deltaic sands, coals and shales of the Middle Jurassic Pentland Formation, which elsewhere forms a secondary reservoir in several Central North Sea hydrocarbon fields. The volcanics lie beneath the Kimmeridge Clay Formation, the main source rock for the North Sea petroleum system.

The Rattray and Ron Volcanics have been regarded as having little hydrocarbon potential within the highly prospective Central North Sea. However, in 2004 the Rosebank discovery in the Faroe-Shetland Basin lead to a new hydrocarbon play concept of intra-basaltic fluvial clastic reservoirs, a play type that has not yet been actively investigated within the Rattray and Ron Volcanics. Numerous Rattray wells contain trace hydrocarbons within the intra- and post-basaltic clastic systems. This project investigates any potential intra-basaltic play fairway in the area.

Mapping the complete volcanic sequence in 3D will elucidate the eruption history of the Rattray and Ron Volcanics. Creation of a high resolution stratigraphy for the volcanics using petrophysical and seismic facies analysis will allow identification of major eruption phases and hiatuses, establishing the relationship between eruption, onset of basin rifting and potential Central North Sea thermal doming. Various datasets will be integrated including regional 3D seismic interpretation, well analysis, geochemistry and biostratigraphy, linking the eruption of the Rattray and Ron Volcanics to the evolution of North Sea basin rifting.