Irish Sea basins

Introduction and review

R. E. DUNAY

Mobil North Sea Limited, 3 Clements Inn, London WC2A 2EB, UK

The onshore Triassic sandstones adjacent to the East Irish Sea Basin (EISB) have been recognized as potential hydrocarbon reservoir since the discovery of the Formby Oil Field, first drilled in 1939 on an active seep by D’Arcy Exploration Company, a predecessor of BP (Kent 1985). From this small shallow onshore oil accumulation, in which the Triassic reservoir is sealed by Quaternary Boulder Clay, a total in excess of 70,000 barrels of oil was recovered by the cessation of production in 1965.

The first commercial offshore gas discovery, the South Morecambe Field, was made in 1974 by a subsidiary of British Gas plc. This field, which lies within Blocks 110/2a, 110/3a and 110/8a, is the largest accumulation found to date in the EISB, with recoverable reserves in excess of 4 TCF, contained within the Triassic Sherwood Sandstone Group (Bushell 1986). This success was followed in 1976 by the discovery and subsequent delineation of the North Morecambe Field, which occurs in the northern portion of Block 110/2a. This accumulation contains proven gas reserves of 1.08 TCF, also within Triassic Sherwood Sandstone reservoirs (Stuart 1993).

The discoveries in Block 110/13, made in 1990 and 1991 by Hamilton Bros Theatre Oil and Gas Ltd, are extremely significant. The Douglas Field, with oil reserves in excess of 100 MMBBL contained in Triassic sandstones, is the first commercial oil accumulation reported in this area since the discovery of the Formby Field. The adjacent Hamilton and Hamilton North gas accumulations are reported to have total reserves of approximately 800 BCF, also in Triassic sandstones. In 1992, Hamilton reported a significant Triassic oil and gas discovery on Block 110/15, a 12th Round Block adjacent to the Formby Field. These recent successes, coupled with other non-commercial, as well as rumoured, discoveries indicate that the ultimate hydrocarbon potential of the East Irish Sea Basin is yet to be realized.

Eight papers are presented in this section. Three of the papers, by Jackson and Mulholland, by Hardman et al., and by Meadows and Beach address, respectively, regional aspects of the tectonic regime, geochemical modelling, and Triassic reservoir quality within the East Irish Sea Basin. The papers by Arter and Fagin, and by Naylor et al. concern exploration evaluation of the northern portion of the EISB and the neighbouring Kish Bank Basin, offshore Eire, respectively. The three remaining papers, by Knipe et al., by Cowan et al. and by Stuart are devoted to studies on the two Morecambe gas accumulations.

Jackson and Mulholland conclude that the Carboniferous/Lower Jurassic succession in the EISB and associated basins exhibits four distinct structural styles. The Morecambe gas fields are considered to occur in a structural style characterized by large tilted fault blocks with stacked halite detachments. The Douglas and Hamilton discoveries are considered to occur in a structural style distinguished by small step-faulted tilted blocks without thick halite deposition. The authors correlate the Permo-Triassic succession of the EISB and adjacent basins with that of the Southern North Sea, and postulate that permanent physical barriers between these basins were absent during the Permo-Triassic. Hardman et al. indicate that Namurian (E2-R1) shales comprise the major source rock for both gas and oil accumulations in the EISB. They suggest that maximum burial occurred during early Tertiary time, with a subsequent two-stage inversion event. The present distribution of hydrocarbon type throughout the EISB is thought to be controlled by the maturity and timing of migration in the various areas coupled with the effects of the Tertiary tectonic event. Meadows and Beach address the reservoir quality of the Triassic Sherwood Sandstone. The variability in reservoir quality between the fluvial, sheetflood, and aeolian facies associations is considered to be controlled by the distribution of quartz cement, with the better reservoir quality of the aeolian facies association being due to a relative lack of quartz cement. The authors suggest that these differences in quartz content may be caused by differences in sand provenance.

Arter and Fagin discuss aspects of exploration in the northern EISB, where Tertiary dolerites are intruded into the Triassic succession. These intrusions can result in velocity pull-ups, creating false structures on the time maps of the Triassic reservoir. Subsequent drilling also revealed halite cement within the Triassic reservoir. The authors postulate that dyke intrusion may have mobilized the halite, causing the observed porosity reduction within the Triassic sandstone objective. Naylor et al. report on the exploration results within the related Kish Bank Basin, offshore Eire. Two wells tested the Permo-Triassic objective, neither discovering hydrocarbons. Valid structures were drilled, and the reservoir quality of the Permo-Triassic sandstones was good, as was the seal. The authors suggest that the lack of exploration success is due to the absence in this basin of good quality Westphalian and other Carboniferous source rocks.

In regard to the Morecambe papers, Knipe et al. address the tectonic history of the Morecambe area. The authors produce a new model for the structural evolution of the South Morecambe and North Morecambe Fields. They have related the growth of platy illite to the structural model, which has facilitated mapping of the Top Platy Illite surface outside well control. Cowan et al., in their dipmeter study of Morecambe wells, conclude that the distribution of the Triassic reservoir facies associations has been controlled by the structural evolution of the area. The major fluvial channel associations display dominantly westerly palaeocurrent orientations. In the final paper in this section, Stuart describes the geology of the North Morecambe Field. Although the geology here is similar in many respects to that of South Morecambe, significant differences are reported. For example, in contrast to the South Morecambe structure, which was breached after initial hydrocarbon emplacement and subsequently re-charged with gas, the North Morecambe structure remained intact and contains early emplaced hydrocarbon. The author also demonstrates the separation of the North Morecambe accumulation from that of South Morecambe.

References

