

Atlantic margin: Faeroe–Shetland

Introduction and review

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Exploration in the Faeroe–Shetlands Basin has seen a roller-coaster ride of expectation since the last conference on the ‘Petroleum Geology of northwest Europe’ in 1992 (Parker 1993). Initial euphoria and intense industry interest followed the discovery of the Foinaven and Schiehallion fields, in 1992 and 1993, respectively. The excitement of the 16th Round awards in 1995, had given way to a more realistic mood following the generally disappointing results of the post-16th Round drilling and the lack of success in extending the Palaeogene play away from the BP/Shell discoveries in the Foinaven Sub-basin (the Foinaven, Schiehallion, Loyal, Foinaven East and Sulven fields). This sombre mood was tempered by the expectation of rich pickings in the unlicensed White Zone, and the more immediate attractions of UK out-of-round licensing north of the Schiehallion Field and in the First Faeroese Licence Round. Consequently the papers in the session were guardedly optimistic in tone, and, although significant information was shared, this was clearly done in the context of a competitive environment. In contrast to the other Atlantic margin session, ‘offshore Norway to offshore Ireland’, which, as one commentator put it, ‘was held in the big hall to allow room for the arm-waving’, most of the Faeroe–Shetland papers gave solid technical information, but discussion was clearly limited by the pending licensing opportunities.

Dean *et al.* attempt the daunting task of updating the regional development of the basin in the light of the recent drilling activity. They emphasize the role of the ductile Late Cretaceous shales as a diffuser of strain, the polyphase nature of the Cretaceous rifting events and the rift-associated uplift of the Paleocene events. It is certain, however, that the last word has yet to be spoken on the basin development of this complex area, with key Mesozoic penetrations along the basin axis still scarce.

Much of the material presented relates to the igneous history of the margin. Naylor *et al.* present the Atlantic Margin Group’s (Enterprise, Mobil and Statoil) stratigraphic framework which integrates the Palaeogene igneous history of the margin with its sedimentation history. This is one of a number of industry efforts to correlate igneous and sedimentary events in order to make consistent time-slice palaeogeographical reconstructions, and understand the local effects of igneous activity on sedimentation, diagenesis and maturation. As they all feed off the same or similar base data, these various integrated solutions are rapidly converging, although the different lithostratigraphic and sequence stratigraphic nomenclatures tend to obscure this. Kjørboe in her paper, approaches the same problem, from the Faeroes side with an emphasis on the description of the sequence stratigraphy of the lavas of the Faeroe Basalt Plateau, and their correlation with the Faeroe–Shetland Basin. Ritchie *et al.* present a paper compiling

chronostratigraphic data from the region which suggests two major pulses of igneous activity within the North Atlantic Igneous Province during the Early Tertiary.

Clift presents a paper which predicts the thermal history throughout the Northwest European Shelf during magmatic underplating. He shows that single stage emplacement systematically over-estimates the heat flow associated with the underplating.

With the problems of sub-basalt imaging, particularly on the Faeroes side of the Faeroes–Shetland Basin, gravity data will form an important part of at least the pre-bid evaluations. Ashcroft *et al.* are able to demonstrate the use of regional gravity data using a single regional cross-section, arguing that the Flett Ridge does not have Lewisian core but is most probably pre-Cretaceous.

Hydrocarbon migration models for the Faeroe–Shetland Basin are complex, and because of the difficulty in mapping the source rock, they are all poorly constrained. Most workers favour early trapping followed by pulses of re-migration. This model is presented in two papers, one by Lamers & Carmichael, who termed it the ‘motel model’, and the other, more flamboyantly, in Iliffe *et al.*’s modelling study of the White Zone where it is described as the ‘whoopee cushion effect’. Parnell *et al.* demonstrate support for this general model. Integrating AFTA, VR and fluid inclusion data, they show that the Jurassic reservoirs of the Rona Sandstone have seen two hot flushes; one in the Late Jurassic to Early Cretaceous and a second in the Early Tertiary.

The paper by Sullivan *et al.* on reservoir quality, emphasizes the role of chlorite in preventing quartz cementation of the Paleocene reservoirs, which as usual, left the audience at the conference wondering how to predict or risk this phenomenon. But Sullivan *et al.* go much further to explain the complexity of the trapped formation water, with variable salinity within the reservoir, and how this had been unravelled by a combination of new techniques (NMR logging, strontium isotope residual salt analyses and Dean-Stark analyses on samples using deuterium-spiked mud).

At one time rumour had it that amplitude versus offset (AVO) analyses were the key to direct hydrocarbon detection in the Paleocene of the Faeroe–Shetlands Basin. The BP/Shell papers (Leach *et al.* and Lamers & Carmichael) provide clear hints that life is not simple in this regard. Margesson & Sondergeld go much further, and in a post-mortem of an unidentified Amoco well, show from core and log data that elastic anisotropy in shale and tuff sections do generate strong AVO anomalies, unrelated to hydrocarbon pore fill.

Lamers & Carmichael summarize the Paleocene play in the basin as a whole emphasizing that, despite all ingredients of a successful play being present throughout the basin, the critical

element is trap definition. In deeper areas this is obviously less clearly revealed by direct hydrocarbon indications from 3D seismic and consequently such areas have much greater pre-drill risk.

In a refreshing break from the Paleocene, **Grant *et al.*** present the results of the recently drilled Well 206/4-1 which had unsuccessfully tested Turonian sandstones in a hanging wall closure down-dip from the Rona Ridge. Although the extent of the play fairway is restricted, the paper serves as a reminder of the Cretaceous deepwater sandstone potential along the margin, as a whole, from the recently licensed Rockall Trough to northern Norway.

Current views on the discovered accumulations are summarized by **Cooper *et al.*** (Foinaven), **Leach *et al.*** (Schiehallion/Loyal), **Herries *et al.*** (Solan and Strathmore) and **Goodchild**

et al. (Victory). The Victory and Solan/Strathmore papers, dealing with as yet non-developed fields, give valuable information on the associated Mesozoic plays, whilst the Foinaven and Schiehallion papers provide interesting insights into the critical success factors associated with these two fast-tracked developments. Let us hope that by the time of the next Barbican conference these fields are accompanied by further economic developments; perhaps in the Mesozoic section of the basin proper?

Reference

- PARKER, J. R. (ed.) 1993. *Petroleum Geology of Northwest Europe: Proceedings of the 4th Conference*. Geological Society, London.