Exploring the Norwegian Atlantic Margin: Møre and Vøring Basins

By the end of 2018 TGS will have acquired a total of 45,000 km² of high resolution 3D seismic across the Møre and Vøring Basins in the Norwegian Sea. This article summarises how the project has utilised the triple-source seismic acquisition technique, and how successful deblending technology ensures that these data can be used to explore shallow gas targets and image below the volcanic facies and the deeper Jurassic pre-rift structures. Consequently, new play concepts and ideas regarding prospectivity are being considered.

The Atlantic Margin (AM17) 3D seismic project in the Norwegian Sea covers vast deepwater areas off the coast of mid Norway (Figure 1). The area is still immature, with just a few wells targeting big dome structures created by Tertiary inversion.

The Møre and Southern Vøring Basins are challenging seismic terrains that include soft sediment deformation in the overburden, shallow gas, Holocene to Pleistocene seafloor slides, a volcanic sill intruded Cretaceous basin and sub-basalt targets within the Møre Marginal High. Figure 3 is from the Southern Møre Basin and shows some of the challenges that the region presents. In the centre we see two types of soft sediment deformations: to the left a low relief mud diapir and to the right a terrain of possible sand injectites. Both diapir types are often triggered by gas. The sill intrusions in the Cretaceous below have created migration paths and structural closures by altering the rheology (stiffness) of the basin, and might have also intruded through a source rock. We observe many deep sills within the Blålange Formation, classified as a good marine source rock in the Helland Hansen well (6505/10-1). There are clear seismic imaging challenges with regard to volcanic sills and the side effects of these in data processing, but they also create positive effects like structural traps in an almost flat basin floor, aiding migration and even generating hydrocarbons.

Figure 2 shows the Top Eocene horizon picked in the AM17 dataset in the Southern Vøring Basin. The Helland Hansen two-part dome is seen to the right (east), before the line passes the ‘Middle Dome’ and into the rugged surface where hydrothermal vent systems and shallow sill intrusions create numerous structural closures in the west. A new play consisting of three-way closure and cross-cutting gas hydrates in the west, trapping free gas in Miocene beds over a vast area, is seen at the top of the seismic line.

Figure 1: Location of the TGS Atlantic Margin 3D seismic project in the Norwegian Sea.

Figure 2: Top Eocene horizon across the Atlantic Margin North 3D in the Southern Vøring Basin. Structural highs are represented in red.

Figure 3: Fast track PSTM seismic profile through the Southern Møre Basin.
In 2017 TGS commenced the largest 3D seismic campaign in Europe. Known as the Atlantic Margin 3D, this project in the Norwegian gas cover a region which is known to be rich in gas and oil, and is also home to a number of important structures. The project was designed to provide a high-resolution, high-quality 3D dataset that would enable an in-depth understanding of the basin and its potential for hydrocarbons.

The area covered by the new 3D has water depths from 500 to 2,000 m, and the deep sedimentary basin is home to a number of important structures. The data that we wish to image have decayed to be as much as 30–40 ms in some areas, so we need to get high resolution before the subsequent shot arrives. Within the first 10–15 ms, we can achieve this resolution, but beyond that, the data that we wish to image have decayed.

The area offers a range of challenges to be tackled in data processing, including high mud levels, high internal noise, and complex geology. Nevertheless, the data that we have acquired, with a further 11,000 km² of 3D seismic, have been acquired, with a further 11,000 km² of 3D seismic, and the first megaseismic line was acquired in August 2017.

With the acquisition of new seismic data, the area offers a range of opportunities to explore new gas prospects. The area is still being explored, and there are still many unexplored areas that could be potential targets.

New data – New Play Ideas

The area covered by the new 3D has water depths from 500 to 2,000 m, and the deep sedimentary basin is home to a number of important structures. The data that we wish to image have decayed to be as much as 30–40 ms in some areas, so we need to get high resolution before the subsequent shot arrives. Within the first 10–15 ms, we can achieve this resolution, but beyond that, the data that we wish to image have decayed.

The area offers a range of challenges to be tackled in data processing, including high mud levels, high internal noise, and complex geology. Nevertheless, the data that we have acquired, with a further 11,000 km² of 3D seismic, have been acquired, with a further 11,000 km² of 3D seismic, and the first megaseismic line was acquired in August 2017.

With the acquisition of new seismic data, the area offers a range of opportunities to explore new gas prospects. The area is still being explored, and there are still many unexplored areas that could be potential targets.