Barents Sea "Nondiscussed" Area

The disputed area between Norway and Russia in the Barents Sea, equalling the Norwegian North Sea in size, has a different petroleum system than the proven oil and gas provinces to the west and east. With pre-Jurassic source rocks, the most obvious targets are in Triassic clastics and Paleozoic carbonates.

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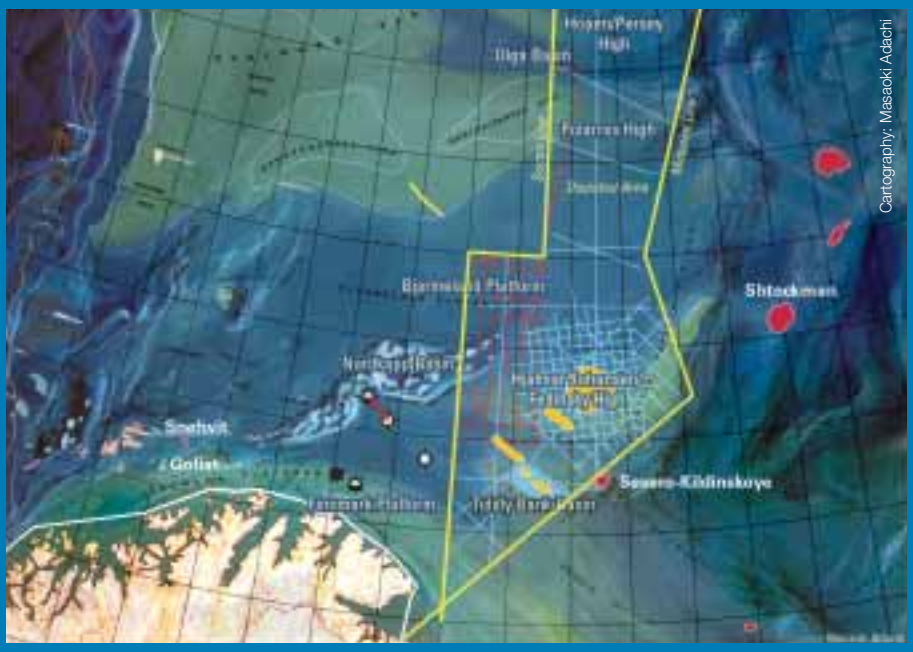
An open and free discussion based on factual knowledge is a cornerstone of scientific understanding. However, sometimes facts can obstruct progress, especially in politics. For the last 30 years the Norwegian geoscientists have largely kept silent regarding the geology of the disputed Barents Sea area, so as not to interfere in the boundary negotiations that the Norwegian Foreign Department has been conducting on and off with the Russians. This lack of factual knowledge in this area has left the field open to speculation and journalistic sensationalism with regards to its potential for oil and gas production.

A disputed area the size of the Norwegian North Sea with large identifiable structures not too far from several giant gas fields naturally creates curiosity and speculation (Geo ExPro No 1/2005). What do the current data actually tell us about the petroleum geology and prospectivity? The Russians collected geological and geophysical data into the early 1990s in the disputed area and are regular publishers in scientific journals. On the Norwegian side the Norwegian Petroleum Directorate (NPD) has only published titbits of information on their website, and the major oil companies operating in the region are keeping quiet.



The disputed area is limited to the east by the Norwegian claim along the midpoint line. The Russians argue for a sector line division that the Soviet Union unilaterally claimed already in 1926. In the current negotiations a compromise agreement has reportedly now been reached on the northern part of the border, but there is as yet no agreement on the southern potentially most prospective part of the area. Prospects identified by the Russians are shown in yellow. Proven gas fields (red) and oil fields (green) outside the disputed area are also shown. 2D Seismic lines acquired by the Russians are shown in blue and by the Norwegians in red.

Structural outline

The main structural elements in the disputed area are from south to north: the Finnmark Platform, the Tiddly Bank Basin, the Hjalmar Johansen (Fedinsky High), the Nordkapp Basin, the Bjarmeland Platform, the Central Bank High and the Hopen/Persey High. To the east lie the hydrocarbon prolific South and North Barents basins, while to the west the Hammerfest Basin has finally proven its commerciality (GEO ExPro No 1, 2006).

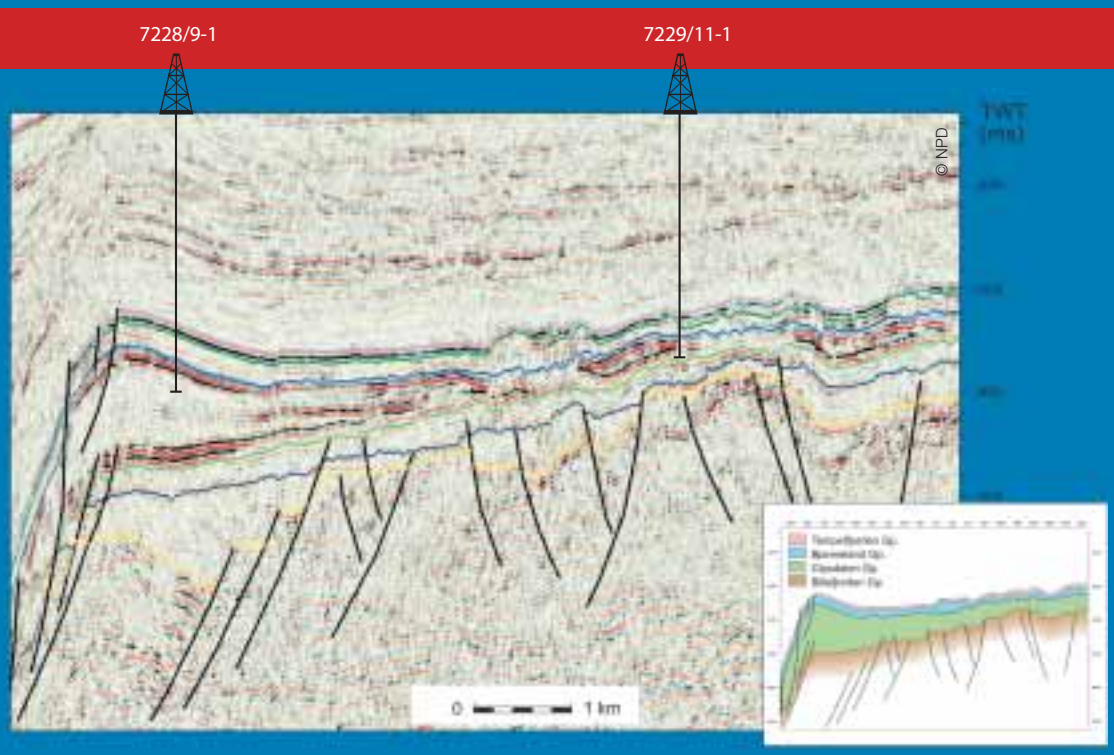
However, it is misleading to postulate that huge Russian gas discoveries in the Jurassic to the east can be duplicated in the disputed area based on its proximity. The reason is the presence of a marked transition from the Jurassic aged gas fields in the Barents basins up on to the platforms where the Jurassic aged sediment cover is thin and lying at a shallow depth.

Paleozoic and Mesozoic aged rocks subcrop below the Quaternary in the disputed area with no Tertiary aged sediments present. In the Nordkapp and Tiddly Bank basins, Triassic sands trapped against salt pillows are the main prospects. Triassic fluvial sands trapped against salt have been found to be gas bearing in the Pandora discovery in the southern Nordkapp basin. Statoil is currently testing this play model, with a second well in the basin.

Triassic potential

Triassic aged clastics are the most obvious Mesozoic target for hydrocarbon exploration on the platforms. Triassic fluvial sands have been found to be gas-bearing in the Severo Kildinskaya field close to the disputed area. The sands are reported to have reasonable porosity and relatively low permeability, but net to gross ratio and thus connectivity is a key parameter.

In the Norwegian sector, amplitude mapping on 3D seismic data have been successful in establishing Triassic clastic fairways. However, the key well drilled by Statoil last summer on the Finnmark Platform close to the disputed area, targeting a huge stratigraphic trap, was abandoned as a dry well probably because of lack of a good migra-



2D seismic line through wells 7228/9-1 targeting Triassic sands above a salt pillow on the southeast rim of the Nordkapp Basin and 7229/11-1 targeting Paleozoic carbonates on the Finnmark Platform; thus illustrating similar prospects to that will be targeted in the disputed area. Reservoir development and migration pathways hopefully will improve closer to the flanks of the South Barents Basin.
Ref: G.B. Larssen et al; Upper Palaeozoic Lithostratigraphy of the Southern Norwegian Barents Sea, Norwegian Petroleum Directorate, 2002.

tion pathway and/or poor seal.

With ample mature source rock and shorter migration pathways from the South Barents Basin up on to the platform margins in the disputed area, careful exploration with state of the art technology could result in more attractive Triassic gas prospects being discovered than those encountered so far.

Paleozoic potential

In the Paleozoic, the most attractive prospects are shallow water platform carbonates of Permian and Carboniferous age. Four wells have tested carbonate prospects on the Finnmark Platform east of the Nordkapp Basin. With one minor non-commercial oil and gas discovery, two wells with oil shows and one dry well, some of the play models are confirmed, but to date success has been limited. Reservoir development is primarily related to dissolution during subaerial exposure, or re-deposition of bioherm build-ups.

The Paleozoic oil discovery was made in a reservoir rock composed of Upper Permian spiculites, a very unusual reservoir rock type made up of silica sponge spicules that have a very limited areal potential, being easily transformed to chert during diagenesis.

The Permo-Carboniferous build-ups constitute prolific reservoirs in the Pechora Basin far to the east, and together with the Triassic clastics represent the main potential reservoir horizons in the disputed area. The Russians have pointed out numerous seismic anomalies that could be related to both Triassic sands and Permo-Carboniferous bioherm build-ups. More extensive and better quality seismic data are required in order to properly evaluate the reservoir potential.

Pre-Jurassic source

With respect to source rock, the prolific Jurassic Hekkingen Formation has barely reached maturity in the South Barents Basin to the east. However, shales in the Upper Permian Tempelfjorden Group are in the oil window along the platform margin and on the Hjalmar Johansen/Fedinsky High and are gas-prone in the deeper northern parts of the disputed area.

The recently discovered deeper oil bearing formations in the Goliat oil field to the west are important evidence for the presence of a pre-Jurassic source rock of probable Middle Triassic age.

A main problem on the Barents Shelf is the Cenozoic deep erosion that has breached earlier oil reservoirs either by fault-induced leakage or by gas expansion due to uplift. Erosion has been in the order of 1000-2000 metres in the disputed area, and is a negative factor in the prospectivity evaluation.

From a structural point of view, the Hjalmar Johansen (Fedinsky High) is a huge basement induced uplift some 130 km in diameter. The Russians have indicated and named five potential prospects in the vicinity of the high. The deepest targets in the Paleozoic are within acceptable depths for reservoir preservation. This high and the eastern end of the Nordkapp Basin are potentially the two most attractive areas for future exploration. Mapping over this structure has been based on a fairly dense seismic grid.

In conclusion, the sparse data collected so far indicate that factors necessary for hydrocarbon generation, migration and preservation are in place within the disputed area. Structures forming large potential traps have been identified. However, drilling must be used to assess the quality of the source and reservoir rocks, thereby confirming the commerciality of a discovery.

No need to rush

Negotiations to fix the offshore boundary between Russia and Norway have been ongoing for over 30 years. Oil companies are encouraging the Norwegian Government to resolve the dispute quickly, so that it would not be a potential obstacle in negotiations for Russian Barents Sea licenses.

However, with the huge areas of unexplored and undisputed territory available in the Arctic on both sides of the disputed area, there should be no need to rush for an agreement. With the ongoing Russian research and publishing of data in the disputed area, the Norwegian geoscientists should be equally active in pointing out to the Norwegian public the potential values that may be negotiated away if the desire to reach an agreement quickly takes precedence.[1]

[1] *This article is based on a multi-client report that Sagex (www.sagex.no) has generated on the petroleum geology of the Central Barents Sea.*