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same people the Scandinavian sources call *Bjarmar*.

In his account, Ohthere also refers to *Terfinna land*, which scholars place on the southern (or south-eastern) shore of the Kola Peninsula (east of the River Varzuga), since all the known variations of the name *Ter* (i.e., Ru. *Terskii bereg*) are connected with this area. It is assumed that the «Terfinnas» were a group of Saami, possibly the same group that is otherwise mentioned in writing only in the stanzas at the end of *Ǫrvar-Odds saga* as *tyrfi/tyfni/tyfvi/gamlir/þannig Finnar*.

It is reasonably clear from Ohthere's log that he did not sail across open water and consequently could not have reached the Northern Dvina River, as has often been suggested. Instead, it is more likely, both on the basis of the log and the location of *Terfinna land*, that Ohthere reached one of the rivers on the southern coast of the Kola Peninsula. Varzuga is currently the most popular choice for Ohthere's destination, but Umba, Vyg, and Kandalaksha Bay among others have also been suggested.

MERVI KOSKELA VASARU

See also: Bjarmaland; History; Vikings.

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Oil and gas extraction in the Barents Region is dominated by Norway and Russia. This article will outline the most important oil and gas extraction projects in the region, covering historical developments, jurisdictional issues, the role of international oil and gas companies, transport, and environmental issues.

Norway and Russia are the main players in the area. Norway started exploration in 1980 at

The Goliat Oil Platform during transportation off Hammerfest in Finnmark, Norway, 2015. Photo: Thomas Nilsen / BarentsObserver.

the Tromsøflaket offshore bank in the south-western part of the Barents Sea. Over the next 20 years there were several minor, and two major discoveries – the Snøhvit gas field, discovered in 1984 by the oil and gas company Statoil, and the Goliat oil field, discovered in 2000 by the oil company Agip. A third major oil discovery, Skrugard, was made by Statoil in 2011, leading to new optimism about the resource potential of the region. In the same year remaining reserves in known fields amounted to 193 million tons oil equivalent (mtoe) of which 70% was natural gas. Exploration activity in the Norwegian Barents Sea has not, however, been very intensive with only some 75 exploration wells drilled as of 2011, and there are expectations that sizable new sources remain to be discovered. Official estimates put undiscovered resources at 735 mtoe.

The only site for Norwegian production is the Snøhvit field, which was opened up in 2007 as the first large liquefied natural gas (LNG) project in Europe. The field is located offshore, 140 km north-west of Hammerfest. Development of the project was halted several times as the market forecast was not deemed promising and only after 2000, with positive expectations of the US gas market and tax concessions, did it go ahead. It was still a difficult launch involving commercial uncertainty and cost overruns and initial serious technical problems. The field has recoverable reserves of 173 billion standard cubic meters (BCM) of natural gas and 22 BCM of condensate requiring for its development subsea installations at water depths of about

The liquefied natural gas (LNG) terminal on Melkøya, Hammerfest, Norway. Winter 2006–2007. Photo: Janter / Wikimedia Commons / CC BY-SA 3.0.

300 meters. The gas is piped to shore, where a liquefaction plant has been built at Melkøya. The field is expected to produce approximately 6 BCM annually, of which 2.6 BCM have been contracted by Statoil for the US market, 1.6 BCM for Spain, and 1.7 BCM for the other main partner companies, Total and GDF Suez. The next field to come on stream will be the neighbouring oil field, Goliat, where production is expected to start in late 2014. The field is operated by the giant Italian energy company ENI and is estimated to have 23.2 million tons of recoverable oil.

The Soviet Union started seismic surveying in the Barents Sea in the 1970s. In the 1980s, a systematic exploration effort revealed, in 1988, gas fields in the «super-giant» category in the north-western part of the Russian Barents Sea, including the Shtokman field. In the south-eastern part, usually referred to as the Pechora Sea, a number of promising geological structures were identified and some smaller oil fields were discovered, notably Prirazlomnoe in 1989. In the 1990s, exploration activity declined drastically for both financial and organizational reasons.

In all, only about 70 exploration wells have been drilled in the whole of the Russian Barents Sea, around the same number as on the Norwegian side, but the discovery rate has been much higher. According to Russian estimates, there are some 3,700 mtoe of recoverable resources in the structures that have been studied in detail. This is more than the remaining reserves on the entire Norwegian continental shelf. Although considerable uncertainty attends the Russian estimates, there is little doubt that the resource potential is substantial.

Apart from the limited test production of oil off Kolguyev Island which started in 1982, as of early 2014 no production has taken place in the Russian Barents Sea, but two projects have been under development for some time. The Shtokman gas and condensate field, located 650 km north-east of Murmansk city and 540 km from shore at a sea depth of 320–340 m, is one of the largest offshore gas fields in the world, with reserves of 3,800 BCM. Various options for development have been discussed over the years, but only with the establishment in early 2008 of Shtokman Development AG (SDAG) with Gazprom (51%), Total (25%), and Statoil (24%) as partners, did a concrete plan materialize. The full development of Shtokman is envisaged in three stages, each producing up to 23.7 BCM per year, but SDAG would only be responsible for the first one. The company initially wanted an exclusive LNG development and later plans considered dividing the output 50/50 between LNG and gas transported by pipeline to the Baltic Sea and further via the Nord Stream pipeline to Germany. Final investment decisions for the project have been postponed several times. Much of the gas was

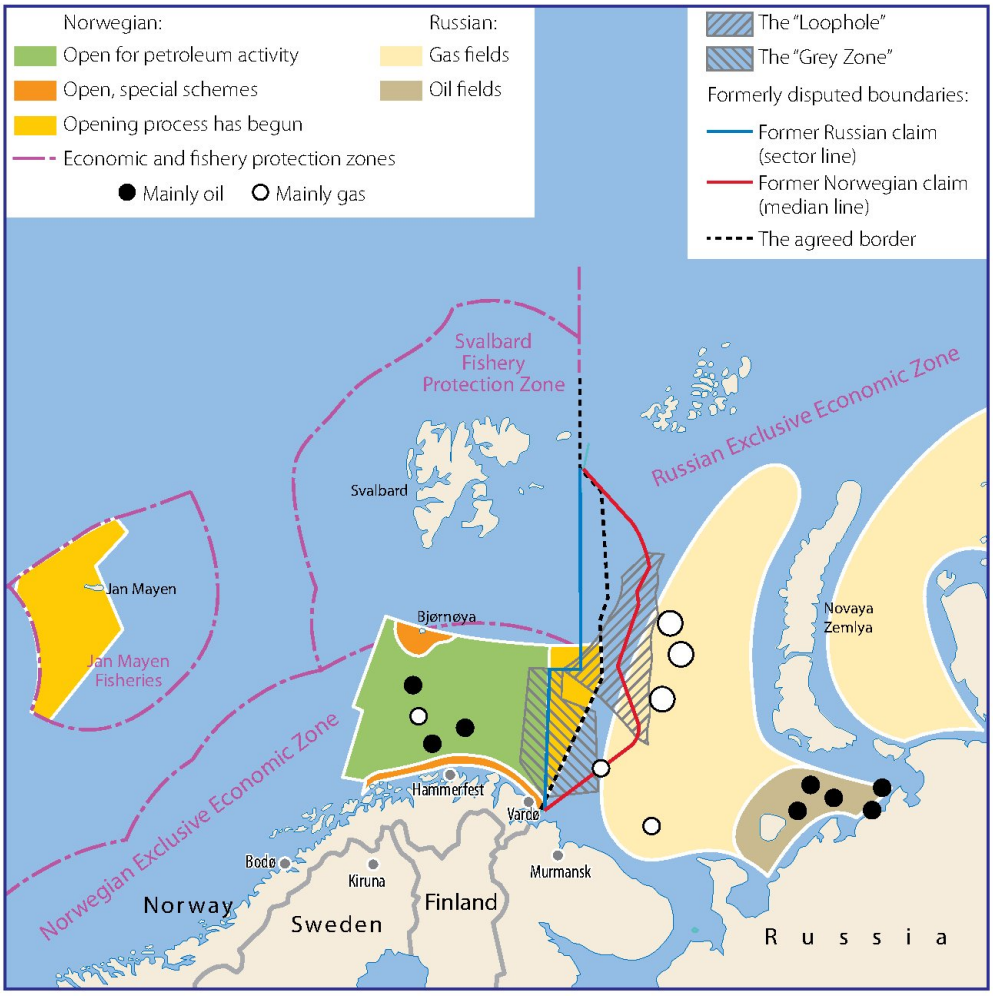
intended for the American market. The «shale gas revolution» in the US has, however, more or less eliminated the need to import and has strongly contributed to the increased uncertainty about international gas prices. In 2012, it became clear that the partners were not willing to pursue development and the project was put on hold, although not totally abandoned. There will be discussions in coming years about new solutions to reduce costs and also about bringing new partners into the project to make it feasible.

The Prirazlomnoe oil field is located in the Pechora Sea 57 km offshore from Varandey, at a depth of only 20 meters. Recoverable reserves of 46.4 million tons have been announced, sufficient to support an annual output of 6 million tons. A platform has been under construction intermittently since 1995. It is in the form of a huge steel caisson, placed on the shallow ocean floor almost like an artificial island, containing production and storage facilities and serves to protect the installation from the severe ice problems in the area. The platform was towed into position in early 2012 and, after various problems production started in late 2013. It is being operated by a subsidiary of Gazprom.

Onshore, west of the Ural Mountains, the Timan-Pechora petroleum basin includes territory both in the Komi Republic and in the Nenets Autonomous Okrug. In Komi, developments started in the 1960s and output grew until the early 1980s, when it peaked at about 21 million tons of oil, and 20 BCM of natural gas, respectively. In 2010, 13 million tons oil and only 3 BCM of natural gas were produced. In Nenets, activities started in the 1990s and involved several international companies, particularly Conoco, but also Total and Norsk Hydro. By 2009, oil production had reached about 18 million tons per year. Production from the northernmost fields is piped to a sea terminal in the shallow Pechora Sea, 22 km off the coast at Varandey. From there oil is transported by small tankers to a reloading terminal in Kola Bay where it is transferred to super tankers for onward shipping to export markets. This terminal has a capacity of approximately 12 mtoe per year. Production from the southern fields is piped through Komi into the Russian main pipeline network. The resource potential in Nenets is considerable, allowing for increased oil output. Natural gas is, so far, only produced for local needs due to the lack of pipeline connections.

Jurisdictional issues. A dispute arose between Norway and the Soviet Union over an area in the Barents Sea and Arctic Ocean of some 175,000 km^2 when developments in the law of the sea during the 1970s granted coastal states sovereignty over continental shelves to a minimum of 200 nautical miles from shore, without determining how delimitation of neighbouring shelves should be carried out. There has only been limited seismic surveying in the area. An agreement on delimitation was finally reached in 2010 and came into force in July 2011. The area was divided fifty-fifty and fields crossing the boundary have to be developed in co-operation. Norway immediately started seismic surveying in the western part of the formerly disputed area. On the Russian side, where most of the area has been licensed to the state-controlled company Rosneft, surveys began in 2012. The settling of the delimitation dispute provides new opportunities, and reasons, for increased Norwegian-Russian co-operation in the area in oil and gas production, shipping and environmental issues.

However, full international agreement about jurisdictional issues in the maritime zones around the Svalbard Archipelago has not yet been reached. In the Svalbard Treaty of 1920, Norway was granted «full and absolute sovereignty» over the islands, defined by coordinates often referred to as the «Svalbard box». According to the Treaty, Norway cannot discriminate against the subjects of the other signatories regarding most forms of economic activity or impose higher taxes than are needed for the administration of the islands. The controversy pertaining to the provisions of the Treaty is linked particularly to the sea areas beyond Svalbard's territorial waters, and the ocean floor. It is not known whether or not there are promising areas for petroleum activities here. Norway



Border demarcations regarding natural resources in the Arctic Ocean.

maintains that the provisions of the Svalbard Treaty do not apply to the maritime zones around the islands, and that they are subject to unrestricted coastal state (Norwegian) jurisdiction, based on the modern law of the sea. Thus, the continental shelf around Svalbard is seen as a continuation of the continental shelf of mainland Norway (except for the 20 km narrow strip of territorial waters surrounding the islands). Some signatories to the Svalbard Treaty have taken the contrary view that Svalbard is entitled to maritime zones governed by Norway in the same way as the islands. But in either case it is up to Norway to decide whether this part of the continental shelf should be opened up for commercial activities and so far this has not happened.

The role of international oil and gas companies. A number of large and small international and Norwegian oil and gas companies have been engaged from the start on the Norwegian shelf with Statoil, Norway's largest firm, as the dominant enterprise. This is also the model for Norwegian petroleum activities in the High North. Gazprom, as Russia's largest company and the world's biggest producer of gas, dominates Russian gas production (c. 85% of total Russian output) and, as the sole Russian gas exporter, commands the main pipelines. Moreover, it has a monopoly by law on offshore gas activities.

There is more pluralism in the oil sector, but in recent years the Russian gas and oil producer Rosneft has gained an increasingly dominant position, partly through its offshore oil monopoly. In the Barents Region, Rosneft is also very active onshore, with Lukoil as the other major Russian oil player. All oil trunk pipelines (except the Caspian Pipeline Consortium) are owned and operated by the state monopoly Transneft and oil products pipelines are owned and operated by its subsidiary Transnefteprodukt.

So far, the participation of international oil companies in the Russian oil and gas sector has been limited. In the Barents Region, the Shtokman project, involving Statoil and Total, is on hold but, in April 2012, Rosneft concluded an agreement with ExxonMobil for the exploration and possible development of a large area in the northern part of the Kara Sea. Shortly afterwards the company also signed agreements with the Italian energy company ENI to explore and subsequently develop resources in the southern part of the formerly disputed area in the Barents Sea, and with Statoil to join in the exploration of the northern part of the Kara Sea.

According to the agreements with ENI and Statoil the first exploration drilling should take place before 2020. Rosneft's deals with these three foreign companies follow the same pattern – joint ventures for exploration of, and eventual production from, the assigned blocks. The foreign companies together will hold a third of the shares in each joint venture and Rosneft two thirds. The foreign companies will cover all the costs incurred in the geological prospecting (seismics) phase and for a certain number of exploration wells and will also compensate Rosneft for «historical costs» – the initial prospecting – and a third of the price paid for acquiring the licenses. This parallels the Norwegian «carrying interest» system from the 1970s, where minority foreign shareholders were expected to cover all exploration costs in a field, even though Statoil possessed a majority share.

Transport. The Ukrainian gas disputes, which reached a preliminary climax in January 2009, added to the Russian feeling that their country is politically and economically locked in. Russia needs predictable terms of trade and transit with the CIS (Commonwealth of Independent States) countries and also wants alternative transportation routes. With the exception of LNG projects, gas from the Barents Region must be transported in pipelines. With the offshore Nord Stream gas pipeline now in operation, one additional route for gas from Siberia to Germany has been established. This line could also carry gas from the Barents area if a link between the Kola Peninsula and Vyborg near St. Petersburg were to be built. Another alternative would be to connect Barents Sea gas fields to an extension of the Norwegian pipeline system, which currently only reaches the central parts of Norway.

Oil transport in the area is also expected to grow significantly over the coming years and help to diversify Russian oil exports. Today, most of these exports are tied to land-based pipelines through Belarus, Ukraine, Lithuania, Poland and Slovakia. Oil is also transported by rail. In the European part of Russia, sea-based shipments of oil can be made through the Black, Baltic, and the Barents Seas. In the Barents Region, processing plants have been established in the towns of Ukhta (oil) and Sosnogorsk (gas) in the Komi Republic, and a smaller shipping terminal for crude oil is in operation in Varandey in Nenets. With more plans being realized, the increase in oil production in the Russian High North could reach as much as 2.5 million barrels per day in 2016–2017, most going for export. Significant volumes of oil products are also being shipped from various harbours in the Barents area: Murmansk, Vitino, and Arkhangelsk.

Three LNG plants for natural gas have been proposed on the Russian side; one not too far from Murmansk, near the village of Teriberka to process Shtokman gas, a second in Nenets, and a third on the Yamal Peninsula. The outlook for Arctic LNG, however, has recently become more uncertain and the realizations of new projects may be postponed for several years. Nevertheless, because of the oil exports we can expect an increased number of vessels to pass

through the ice-free Norwegian and Russian waters around Kola and Finnmark.

Environmental issues. Offshore and onshore terminals, and their connection to hydrocarbon deposits and export routes, are becoming increasingly important in the handling of economic and environmental challenges, both in Russia and Norway. The Barents Region with its cold climate and waters represents a vulnerable environment regarding wildlife, bio-diversity, fisheries, and nature.

At present, shipping is considered to pose the most severe environmental threats. There is already a risk of oil spills from the increased oil tankers traffic, but nuclear accidents and the handling of nuclear waste in the area also pose threats. The additional concerns raised by increased petroleum activity are currently leading to calls for greater co-operation between Norway and Russia, not least in establishing an early warning and notification system. In the past, Russia has not given environmental problems as much attention as many western countries have, but an energy policy for the period up to 2030 has now been included in the Energy Strategy document from 2009. The Strategy objectives include improved energy efficiency as well as limitation of the impact of the fuel and energy complex on the environment and climate.

Norwegian-Russian Policy Convergence? Both Norway and Russia have allowed a heavy governmental hand to control their petroleum industries and to derive economic and political benefits from these activities. However, a number of differences in political structure, ideological adherence, economic systems, as well as cultural and geographical features have resulted in very different policies.

In the post-Soviet and internationally more integrated world, where political systems are changing and international affairs and trade relations are globalized and fluid, both countries have been formulating new policies. Russia on its (long) march to becoming a market economy has experienced the most dramatic changes, but Norway with its traditional social democratic system has also been moving towards more liberal political solutions.

The gradual convergence of policies indicates that co-operation between Russia and Norway and other western countries will improve, not least following Russian WTO membership. Knowledge, good relations, and confidence-building will determine how Norway and Russia are able to co-operate in the Barents Region. Both countries have shared interests in establishing an infrastructure and industrial technology. There is also the question of managerial and organizational competence in the development and operation of complicated fields, in conjunction with better and more predictable legal and political frameworks. Petroleum developments in the Barents Region may become a forerunner in the process, but it may still take time before the situation becomes a predominantly business-to-business relation.

The development of Barents Sea oil and gas will require higher market prices than are required for North Sea and onshore Russian petroleum production. The introduction of new subsea technologies and organizational concepts, substantial amounts of capital, good transport solutions, political will, and a predictable legal and political framework are all essential. Protection of the environment is imperative. Some projects will also need international collaboration.

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See also: Barents Sea; Disputed area; Economic development; Energy industry; Environment – threats and policies; Fishery industries; Grey zone; Mineral resources and mining; Nature protection; Nord Stream; Svalbard; Svalbard Treaty; Transport.

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