



2013 Minerals Yearbook

DENMARK, THE FAROE ISLANDS, AND GREENLAND

THE MINERAL INDUSTRIES OF DENMARK, THE FAROE ISLANDS, AND GREENLAND

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DENMARK

Denmark's mineral resources are limited and comprise mainly industrial minerals and mineral fuels; the country's production of these minerals is not substantial. Denmark is a member of the European Union (EU) and is located at the junction of the Baltic Sea, the North Sea, and the Skagerrak Strait (U.S. Department of State, 2012).

In 2013, the EU member countries remained Denmark's most important trading partners—EU countries accounted for 70.5% of Denmark's imports and 62.2% of its exports. The United States was Denmark's third ranked non-EU trading partner (after China and Norway), in terms of value, accounting for a 21.6% share of Denmark's total imports; the United States was the principal non-EU destination for Danish goods, receiving 19.2% of all Danish exports (Statistics Denmark, 2014).

Production

Denmark lacked economically exploitable metallic mineral resources; however, industrial minerals, such as chalk, cement, clays (including bentonite), lime, salt, and stone were produced in the country. Damolin A/S was the world's only commercial producer of moler, which is a natural mixture of diatomite and smectite clay. This product is known generically as moclay. The range in uses for this mineral is wide, including cat litter, filtration systems, and insulation bricks (table 2; Damolin A/S, 2014).

Structure of the Mineral Industry

Private ownership, exploration, development, and production of minerals are allowed under Danish law. The permitting procedures for mineral production are developed and administered at the national level. Regulations concerning the mineral industry are comparable with those of other EU countries. The Danish mineral industry was mostly privately owned. One of the principal exceptions is Nordsøfonden, which is Denmark's state oil and gas company. Nordsøfonden has had a 20% interest in all new licenses in the Danish oil and gas sector since 2005. The company was also a non-operating partner in the Dansk Undergrunds Consortium (DUC), with a 20% interest in its concession area (Ministry of Foreign Affairs, 2012; Nordsøfonden, 2014).

Table 2 is a list of the country's major mineral industry facilities, their capacities, and their locations.

Commodity Review

Metals

Iron and Steel.—NLMK DanSteel A/S (DanSteel), which was a subsidiary of NLMK International of Russia, was the only steel-plate producer in Denmark. On April 23, DanSteel began production at its new steel rolling mill. The new mill would be able to produce plates up to 4 meters (m) in width. The investment cost was reported to be about \$131 million¹ (NLMK DanSteel A/S, 2013).

Industrial Minerals

Cement.—Aalborg Portland A/S (a subsidiary of Cementir Holdings S.p.A. of Italy), was the main producer of gray and white cement in Denmark. Aalborg operated seven kilns at its plant in Rordal, which had a combined capacity of 2.7 million metric tons per year (Mt/yr) of gray cement and 850,000 metric tons per year (t/yr) of white cement. The gray cement was sold mainly on the Danish market, whereas the white cement was marketed on the international market. Aalborg also produced ready-mix concrete (Cementir Holding S.p.A., 2014).

Salt.—Akzo Nobel A/S's production of salt at Mariager was based on vacuum salt technology. The main materials were raw brine produced by solution mining in multieffect evaporation plants located at Hvornum. The salt produced was suitable for the electrolytic production of caustic lye, chlorine, and sodium chlorate. Akzo Nobel was issued a new 30-year license to extract salt. This license extended the one that had been scheduled to expire in 2013 (Akzo Nobel A/S, 2014).

Mineral Fuels and Other Sources of Energy

The Government's revenue from natural gas and petroleum production in 2013 was valued at \$3.86 billion. This was a decrease of about 12% (calculated in Danish kroner) from 2012 when Government revenue totaled \$4.42 billion. This decrease in revenue was attributable mainly to the decrease in production from the Danish natural gas and petroleum fields. Even with the decrease in production, Denmark was expected to remain a net exporter of petroleum through 2021 and of natural gas through 2025 (Danish Energy Agency, 2014).

Geothermal Energy.—The Geological Survey of Denmark identified significant geothermal resources in porous sandstone layers beneath the surface in Denmark. These resources are related mainly to the Mesozoic succession of the Danish basin and the Fennoscandian Border Zone, and had been

¹Where necessary, values have been converted from Danish kroner (DKK) to U.S. dollars (US\$) at an average rate of DKK5.7=US\$1.00 for 2013.

discovered as a result of the drilling of about 60 deep wells drilled either for geothermal energy, hydrocarbons, or natural gas storage. Denmark's geothermal plant located at Thisted in northwestern Denmark produced heat from water that was heated to 44 degrees Celsius (111 degrees Fahrenheit) by geothermal processes and pumped from the Upper Triassic Gassum formation sandstone aquifer at about a 1-kilometer (km) depth. The wide distribution of such underground reservoirs could make it possible for many of the existing district heating networks to make use of the high-efficiency geothermal heat (Vangkilde-Pedersen, Ditlefsen, and Højberg, 2012, p. 39–40).

Outlook

It is likely that continued research in new technology and the testing of new exploration methods will play a major role in Denmark's future natural gas and petroleum production. Even though Denmark is expected to remain a net exporter of petroleum until yearend 2021 and of natural gas until yearend 2025, the Danish Government is likely to continue its efforts to become fully independent of fossil fuels by 2050. The development of mineral deposits in Greenland will affect how the Government deals with the subsidies it gives to the autonomous region of Greenland, although the benefits gained from such development are still unclear.

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FAROE ISLANDS

The Faroe Islands, which is a self-governing overseas administrative division of Denmark, had no significant identified mineral resources, although a small amount of crushed stone was thought to be produced for domestic consumption. The Faroese economy depended mainly on fishing and salmon

farming and was aided by an annual subsidy of about 6% of the gross domestic product from Denmark. The main involvement of the Faroe Islands in the international mineral industry was as a market for imported materials, principally cement, fertilizer materials, and fuels.

In November, Statoil ASA of Norway was reported to have entered into an agreement with the Austrian oil and gas company OMV Group to farm out five of Statoil's exploration licenses in the Faroe Islands and two in Norway. Even after this agreement, Statoil is still the largest license holder in the Faroe Islands, and the company reported that it was preparing to drill two new wells in 2014 (Oil and Gas Journal, 2013).

Outlook

The search for crude oil will continue to be the most important activity in the mineral resource industry in the Faroe Islands for the foreseeable future. Several companies will continue to be engaged in geophysical exploration and exploration well drilling. Future discoveries in the Faroe Islands could make the eventual production of petroleum possible.

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GREENLAND

Greenland (officially known as Kalaallit Nunaat) is officially part of the Kingdom of Denmark, but in 2009, it was granted a higher degree of autonomy by the Danish Government when it transitioned from home rule to self-rule. Greenland's economy depended mostly on fisheries, and in 2013, only 2% of exports were derived from mining, mainly gold and olivine. Greenland also benefits from an annual grant from Denmark that amounts to approximately \$540 million which covers about one-half of its public expenditures. Greenland receives annual support from the EU of about \$32.8 million, which is mostly used to support education and the fisheries industry (Greenland Minerals and Energy Ltd., 2013; Government of Greenland, 2014).

In October, the Parliament of Greenland decided to remove the long-standing zero-tolerance policy concerning the production of uranium and other radioactive elements. This change in policy opened up the possibility for Greenland to exploit its uranium deposits and also have access to its coincident rare-earth elements (REE) deposits. Greenland has six rare-earths projects, of which the most important are the Kvanefjeld and the Kringlerne projects, which are located in the Ilimaussaq complex. Other projects of note are the Milneland, the Motzfeldt, the Sarfartoc, and the Tiquisaaq projects. Greenland could become a leading supplier of rare earths, with an average annual production target of 60,000 metric tons (t) by 2020, representing approximately 30% of the world's supply. Greenland may have the potential to exceed China's REE production in the future (Greenland Minerals and Energy Ltd., 2013; Pieterse, 2013, p. 14–15; 2014).

In 2013, 28 new mineral licenses covering a range of minerals were granted, 8 were renewed, and 8 were terminated. Of these 44 licenses, 15 were for exploration (Bureau of Minerals and Petroleum, 2013, p. 5–6; 2014, p. 9).

Commodity Review

Metals

Gold.—In February, Angel Mining (Gold) A/S, which was a wholly owned subsidiary of Angel Mining plc of the United Kingdom, was put under administration (that is, put under a court-appointed administrator) and suspended trading. In October, the company stopped production at the Nalunaq gold plant and its employees were laid off. The company previously had expected have a production capacity of about 700 kilograms per year of gold. When the company was acquired in 2009, the company had stated that, to meet the challenge of the high recovery cost, it would invest in a processing plant at the mine and would build it as the first underground cyanide leaching plant. Angel Mining planned to minimize transport and refining costs by shipping gold dore. Problems with equipment and production impeded the company from reaching its production target until finally the project was put under administration when the international gold price made it unprofitable to continue the mining operations (Angel Mining plc, 2013a, b).

Iron and Steel.—On October 23, London Mining Greenland A/S was granted an exploitation license for the Isukasia iron ore deposit, which is located 150 km from the capital Nuuk. The project will consist of an open pit mine, a processing plant, a slurry pipeline, and a port with connecting infrastructure. The project was expected to employ as many as 3,000 workers during the construction phase and about 700 to 800 during the production phase. The resource was calculated to have more than 1.1 billion metric tons (Gt) of ore, and the mine was expected to produce 15 Mt of high-quality iron ore concentrate annually (Bureau of Minerals and Petroleum, 2014, p. 1).

In 2013, Red Rock Resources plc of the United Kingdom had encouraging results from its exploration project on the Melville Bugt iron ore project. A Joint Ore Reserves Committee-compliant estimate listed estimated reserves of 67 Mt of iron ore grading 31.4% iron and 51.2% silica oxide. Twelve additional exploration targets were identified and estimated to have a tonnage of between 158 and 470 Mt of iron ore grading between 27% and 47% iron. Red Rock's 1,570-square-kilometer (km²) license area is located in northwestern Greenland about 150 km south of Qaanaag (Red Rock Resources plc, 2014).

Lead and Zinc.—Black Angel Mining A/S, which was a wholly owned subsidiary of Angel Mining plc, was put under administration at the same time as its sister company Angel Mining (Gold) A/S. Angel Mining plc studied the feasibility of continuing to develop the Black Angel Mine, which is located in the Municipality of Qaasuitsup; however, the company reached the conclusion that the level of investment needed to develop the mine up to a production point was not economically feasible under current conditions. The company decided to offer the mine and the licensing for sale while trying to extend its exploration licenses with the Bureau of Minerals and Petroleum.

The mine last operated between 1973 and 1990, during which time about 12 Mt of ore was extracted with average grades of 4% lead and 12% zinc (Angel Mining plc, 2013a, b).

Nickel.—In 2013, North American Nickel (NAN) had high-grade results from its drilling in the Maniitsoq nickel, copper, cobalt, and platinum-group-metals project in southwestern Greenland. High-grade nickel, copper, and cobalt mineralization was intersected at the Imiak Hill, the Imiak North, and the Spotty Hill deposits, with assays returning grades of up to 7.06% nickel. NAN's exploration license for the Maniitsoq project covers 5,106 km² and contains several high-grade nickel, copper, and nickel- and copper-sulfide occurrences (Bureau of Minerals and Petroleum, 2014, p. 3).

Industrial Minerals

Gemstones.—True North Gems Inc. of Canada completed the public hearing stage of the Aappaluttoq ruby and sapphire deposit at Qeqertarsuaatsiaat in west-central Greenland. The Aappaluttoq project was an open pit mine operation with the capacity to concentrate ore at the mine site in Aappaluttoq and to clean, sort, and classify the concentrate in Nuuk. The indicated resource estimate was 189,100 t with 313 grams per metric ton (g/t) corundum, equaling 59,200 kilograms (kg) of corundum (296.5 million carats). The amount of near-gem and gem-quality corundum was estimated to be 31.3% ruby and 40.8% sapphire (Bureau of Minerals and Petroleum, 2013, p. 2).

Rare Earths.—Greenland has issued several exploration licenses for REEs since it changed its policy on exploitation of radioactive minerals in October 2013. The Kvanefjeld deposit was owned by Greenland Minerals and Energy (GMEL) of Australia and is located in the northern Ilimaussaq complex in the southwestern tip of Greenland. GMEL was continuing with its investigation of the Kvanefjeld deposit, which the company reported to be a significant REE deposit that also contains uranium and zinc. The Kvanefjeld deposit was thought to be second in size only to the large Bayan Obo REE deposit in China. The main focus of GMEL's investigation was to develop an effective method of beneficiating the multielement ores. The Kringlerne deposit was owned by Tanbreez Mining Greenland ALS and is located in southern Greenland between Narsaq and Qaqortoq; this project was also known as the Tanbreez project (Greenland Minerals and Energy Ltd., 2014; Pieterse, 2014, p. 10).

In September, Tanbreez applied for an exploration license for the Killavaat Alannguat multielement deposit in southern Greenland. The resource was calculated to contain more than 3 Gt of eudialyte-bearing ore. The company planned to extract eudialyte concentrate and feldspar from an estimated 500,000 t of ore annually during the lifetime of the deposit. From the eudialyte, the company planned to extract tantalum, niobium, REEs, and zirconium. This project would include the construction of an open pit mine, a processing plant for magnetic separation, a port and helipad, a camp, a tailings deposit, and a connecting infrastructure for the complex. The company expected to employ up to 135 people during construction and about 90 during production. The public hearing process began in the fall 2013 (Bureau of Minerals and Petroleum, 2013, p. 2).

Natural Gas and Petroleum.—The Arctic resource is composed largely of natural gas and natural gas liquids, which were significantly more expensive to transport over long distances than petroleum; however, there were expectations that melting ice would clear the way for more resource development of vast offshore oil resources. Most of the Arctic resources are located in an area that is already claimed by Arctic nations [defined as the permanent members of the Arctic Council, including Canada, Denmark (which includes Greenland and the Faroe Islands), Finland, Iceland, Norway, Russia, Sweden, and the United States]. China can only affect production through partnerships with local companies and authorities to finance infrastructure in exchange for mineral resources, something that could benefit Greenland's economy greatly in the future (Pieterse, 2013, p. 15).

Outlook

After Greenland changed its legislation to permit the exploitation of radioactive minerals, several companies initiated exploration efforts; however, the conditions of extraction and the size of the investment necessary for this type of enterprise mean that only well-developed and well-funded projects that are seen as able to live up to their production potential will be realized. More areas for exploration in Greenland are expected to open up if the ice sheet recedes, especially in the Arctic Sea and especially for crude oil and natural gas. The country's political autonomy and the likelihood that the Government of Greenland will continue to see the new sources of revenue as instrumental in achieving economic autonomy from Denmark are reasons to expect the continued development of the mineral industry in Greenland for the foreseeable future.

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TABLE 1
DENMARK: PRODUCTION OF MINERAL COMMODITIES¹

(Metric tons unless otherwise specified)

Commodity ²	2009	2010	2011	2012	2013 ^e
Aluminum metal, secondary	30,700 ^r	30,600 ^r	30,600 ^r	30,600 ^r	30,700
Cement: ³					
Gray thousand metric tons	1,060 ^r	1,060 ^r	1,310 ^r	1,300 ^r	1,300 ⁴
White do.	480 ^r	480 ^r	510 ^r	520 ^r	530 ⁴
Chalk, calcium carbonate thousand cubic meters	2,735	2,700	2,600	2,600	1,893 ⁴
Clays: ³					
Bentonite	24,040	23,832	38,300	30,330 ^r	56,355 ⁴
Moler, extracted thousand metric tons	202	225	225	225	225
Gas, dry natural million cubic meters	10,488 ^r	10,241 ^r	8,829 ^r	8,016 ^r	8,000
Gold ⁵ kilograms	-- ^r	-- ^r	103 ^r	307 ^r	100
Petroleum:					
Crude ³ thousand 42-gallon barrels	97,455	90,338	80,665	73,821 ^r	64,021 ⁴
Refinery products:					
Liquefied petroleum gas do.	1,606	1,752	1,533 ^r	1,862 ^r	1,800
Gasoline do.	17,666	15,330	15,768 ^r	17,046 ^r	17,000
Jet fuel do.	3,212	3,416	2,154 ^r	1,752 ^r	1,700
Distillate fuel oil do.	24,674	22,703	21,280 ^r	25,331 ^r	25,000
Residual fuel oil do.	8,139	7,665	7,373 ^r	8,432 ^r	8,400
Total do.	57,100	50,866	48,100 ^r	54,423 ^r	53,900
Salt, all forms	511,063	601,046	600,000	600,000	600,000
Sand and gravel thousand metric tons	18,794 ^r	17,901 ^r	19,966 ^r	18,981 ^r	17,762
Silver ⁵ kilograms	--	--	--	-- ^r	--
Stone, crushed thousand metric tons	312	640	542	500	512 ⁴
Sulfur, recovered	3,200	3,246	3,045	3,400	3,599 ⁴

^eEstimated; estimated data are rounded to no more than three significant digits; may not add to totals shown. ^rRevised. do. Ditto. -- Zero.

¹Table includes data available through July 24, 2014.

²In addition to the commodities listed, kaolin, lime, naphtha, and peat were thought to be produced, but data on production was inadequate to make reliable estimates of output.

³Volume based on reported sales.

⁴Reported figure.

⁵Production from Greenland.

TABLE 2
DENMARK AND GREENLAND: STRUCTURE OF THE MINERAL INDUSTRIES IN 2013

(Thousand metric tons unless otherwise specified)

Country and commodity		Major operating companies and major equity owners	Location of main facilities	Annual capacity
DENMARK				
Cement:				
Gray		Aalborg Portland A/S (Cementir Holding S.p.A.)	Plant at Rordal	2,700
White		do.	do.	850
Chalk (calcium carbonate)	thousand cubic meters	A/S Faxe Kalkbrud	Quarries at Stevns and Sigerslev	280
Diatomite (moler)		Damolin A/S	Quarries on Mors and Fur Islands	250
Lime		A/S Faxe Kalkbrud (Aalborg Portland Holding A/S)	Plant at Stubberup, near Fakse, on Zealand Island	200
Natural gas	million cubic meters	Maersk Olie og Gas A/S	Roar and Tyra Gasfields, Danish North Sea	2,550
Petroleum:				
Crude	42-gallon barrels per day	Dansk Undergrunds Consortium ¹ (DUC) (A.P. Møller - Mærsk (31.2%), Chevron Corp. (12.0%), Nordsøfonden (20.0%), and Royal Dutch Shell plc. (36.8%).	16 fields in the Danish North Sea	173,000
Do.	do.	DONG Energy AS	5 fields in the Danish North Sea ²	NA
Do.	do.	Hess Corp. ³	1 field in the Danish North Sea	NA
Refined	do.	Statoil A/S	Kalundborg	110,400
Do.	do.	Dansk Shell A/S (Royal Dutch Shell plc., 100%)	Fredericia	63,000
Salt		Akzo Nobel A/S	Mine (brine) at Hvornum, plant at Mariager	1,000
Steel, semimanufactures		NLMK DanSteel A/S (NLMK International, 100%)	Plant at Frederiksværk	250
GREENLAND				
Gold	kilograms	Angel Mining plc ⁴	Nalunaq Mine at Nanortalik	1,100

Do., do. Ditto. NA Not available.

¹Maersk Olie og Gas A/S is the operator for all DUC activities.

²A sixth field, the Herje field, was expected to begin producing oil and gas in 2016.

³HESS Corp. operated and owned 65.1% of the south Arne field. DONG Energy A/S owned 36.8%, and Danoil owned A/S 1.7%.

⁴Mine was placed under administration; operations were suspended in 2013.