Today we see an increased interest in exploration and investments in mineral production in the high north territories and in the Arctic. As one example, iron ore mines are increasing their production and new mines are opening in all four countries in the Barents regions. LKAB in Gällivare-Kiruna increase the production, Sydvaranger in Kirkenes has re-opened an old mine, Northland Resources are opening new mines in the Swedish-Finnish border areas around Kolari and Pajala, while Russia’s Severstal invests in the iron-ore mines in Olenogorsk (slide 1).

The main drivers of new investment are the high prices of raw materials, which are making new mines – and the reopening of older ones – more profitable. As an example the price of copper has increased more than 300% the since year 2000 (slide 2).

The main driving force behind the high raw material prices is the current economic development we see in Asia, where big nations like China and India, have had a substantial economic growth the recent years, a trend which is expected to continue for the foreseeable future.

Since this conference is addressing "tipping points", it is timely to mention that: - yes, we are facing a global tipping point. By this I am not referring to the physical, but to the economic climate. According to PricewaterhouseCoopers EU stood for 25% of the global value creation in year 2000, followed by the USA with 23%, while China was left far behind with 7% (slide 3).

This will change dramatically. Towards 2030 China will stand for 19% of global value creation, USA 16% and EU 15%. India will reach a remarkably 9%. Hundreds of millions of people will be lifted from poor living conditions up to standards which we in the west take for granted.

Given the prognoses that the world population will increase from 6,2 billion today, and to 9,2 billion in 2050, the picture is pretty clear. There will be an enormous demand and battle for natural resources; food, water, energy and minerals. Since significant amounts of the worlds mineral resources are located areas north of the Arctic Circle, the hunt for new mineral resources will be one the major driving forces leading future development in the Arctic.
Let us take a short roundtrip in the Circum-Arctic, to see what currently is going on (slide 4).

**Alaska:**

Historically, mining has been a cornerstone of Alaska’s economy. Many roads, docks and other infrastructure throughout southern Alaska were originally constructed to serve the mining industry. Major communities like Fairbanks, Juneau and Nome were founded on mining activity (slide 5).

Alaska’s mining industry includes exploration, mine development and mineral production. The industry produces zinc, lead, gold, silver, coal, as well as construction minerals such as sand, gravel and crushed-rock. Minerals are the state’s second largest export commodity and minerals accounted for 30% of the state’s total export (slide 6).

Industry interest in Alaska’s mineral potential is increasing, along with its accompanying spending. Active mining claims currently cover 3.6 million acres of land in Alaska, less than two percent of the state’s total land mass. Alaska’s gold resources have grown from just a few million ounces in 1980 to nearly 140 million ounces. New resource estimates expected to come out of the Donlin and Golden Summit projects are likely to result in a significant increase to Alaska’s gold resource base.

The Pebble East and West porphyry copper ore bodies, which are located in the Bristol Bay watershed, have reserves and resources which place them, together, as the second largest copper deposits in the world, with major contents of gold and molybdenum as well (slide 7).

In the recent December 2010 issue of National Geographic, the story "Alaska's Choice Salmon or Gold" addressed the concerns of how this potential huge mine will affects the salmon fisheries in the Bristol Bay Region. High environmental standards to minimize any aspects of environmental impacts, will be required for all steps of the development of the project (slide 8).

In Alaska, Federal lands constitute 64% of the onshore portion of the state, and 37% of all Federal lands in the Nation. At present time, the geologic maps available for these lands are reconnaissance in nature and do not provide the type, scale, quality, or quantity of geoscience data needed for effective land-use decisions.

Therefore, a USGS Alaska Mineral resource project has been launched to address the need for detailed geologic mapping. By providing geologic, geophysical, and geochemical data for
identified areas on a finer scale than previous maps, this project directly addresses issues of highest management and scientific priority.

**Canada:**

Canada's mineral resources are diverse and extensive. Across the Canadian Shield and in the north there are large iron, nickel, zinc, copper, gold, lead, molybdenum, and uranium reserves. Large diamond deposits have been recently developed in the North-West Territories, west of Hudson Bay, making Canada one of the world's largest producers. New deposits have been discovered south and east of the Bay, and experience from Canada has contributed to discoveries on Greenland (slide 9).

Major sites of mineral development in Canada include the nickel-copper-cobalt deposits at Voisey’s Bay in Labrador. But it is the northern diamond mines that have stirred the greatest excitement. There are five diamond mines in Canada. Three of them are in the Northwest Territories. In 1991, diamonds with economic potential were discovered in diamond-bearing kimberlite rock at Lac de Gras, some 300 km north of Yellowknife. The Ekati Diamond mine near Lac De Gras was Canada's first diamond mine (slide 10).

The discovery was a major success, and led to an exploratory rush unprecedented in Canadian mining history. The Ekati diamond mine began operating in 1998. There are also other diamond mines and junior mining companies in the vicinity including: Diavik Diamond Mine; Snap Lake Diamond Mine, the Misery diamond quarry, the Gahcho Kue diamond project and the now-defunct Tahara Diamond mine. Most of the diamond projects are approximately 300-500 kilometers northeast of Yellowknife by the "Ice Road".

The Baffinland Iron Ore Mines Corp. has confirmed that the Mary River project in Nunavut is one of the largest undeveloped iron ore deposits in the world, containing more than 400 million tons of proven and probable reserves averaging 65% iron. This iron ore was first discovered in 1962. The feasibility study estimates it will cost 4.1-billion Canadian dollars to build Mary River, including 145 km of rail lines as well as ports to accommodate the ice-breaking ships that will transport the iron ore to steel-making customers in Europe. The plan is to start production by 2014. The Mary River project is expected to produce 18 million tons of iron ore a year over a 20-year mine life (slide 11).

In 2009 the Canadian government introduced a strategy for economic development in the North and the Arctic. The strategy document identifies mine properties and deposits in the Northwest Territories and the Nunavut, including copper, silver, gold, diamond, rare earths and uranium properties (slide 12).
One of the aims of this strategy was to build investor confidence in mining and natural resource development in that region. In the Canadian Northern Strategy, mining activities and major projects are described as the cornerstones of sustained economic activity in the North and the key to building prosperous Aboriginal and Northern Communities.

The large-scale projects already underway barely scratch the surface on the North's immense store of mineral resources, but the full extent of the natural resources in the Canadian Arctic is still unknown. Consequently, a significant new program on Geo-Mapping for Energy and Minerals combining the latest technology and geoscientific analysis methods to build the understanding the geology of Canada's North, including the Canadian Arctic Archipelago, has been started. The new program has a 100 million Canadian dollar budget. The goal of the program is to highlight areas of mineral exploration potential, to guide and inform the private sector in its mineral exploration, and through this to lead to more effective private sector exploration investments.

The Canadian Northern Strategy also calls for establishing conservation areas and national parks in the North, and allocated 15 million Canadian dollar over three years to create and expand protected areas in the Northwest Territories.

**Greenland:**

Greenland records over 4 billion years of earth history, preserving many dynamic geological events conducive to mineral deposit formation. Generally, Greenland’s geology is continuous with that of Canada and Northern Europe (slide 13).

Greenland is relatively unexplored, but exploration efforts are now increasing. Only 15% of Greenland is ice free with the remaining bulk permanently frozen under the Inland Ice Cap. Therefore, exploration efforts are restricted to the coastal portions of the island. These coastal areas provide a transect across the diverse geology of Greenland, exposing numerous mineral belts that are highly prospective for gold, nickel, platinum group elements (PGE), copper, lead, zinc, molybdenum, diamonds and specialty metals including rare earth elements (slide 14).

Greenland aims at making mineral resources one of its primary industries. Developments within mineral resource activities must therefore be in dialogue with the people of Greenland. As a consequence, BMP is striving to establish a clear and comprehensible framework for mineral resource activities via a number of information activities, in order to encourage a successful working relationship between the mining industry and the public.
This change in the structure of the government of Greenland has opened the door to international mining companies wanting a foothold in one of the last untapped mineral frontiers in the world. Greenland is still administered by Denmark but under its self-governance structure, it now controls its own mining laws (slide 15).

Rare earth metals are valued for their unique magnetic, optical and catalyst properties, and are used in the clean energy technologies. Special attention has been given to the potential of rare earth elements in Greenland. Kvanefjeld, a part of the Ilimaussaq intrusive complex, is a major deposit of rare earth oxides and of uranium (slide 16).

Today, more than 90% of the world production of rare earth metals is produced in China, and export restrictions have been established. Clean energy technologies currently constitute about 20% of global consumption of critical materials. As clean energy technologies are deployed more widely in the years to come, there might be significant supply shortage of rare earth metals, at least on a short term (slide 17).

**Arctic Russia:**

The estimated value of minerals in Arctic Russia stands at 1.5-2 trillion US dollars. In the past 5 years 25 mines have been operating. Most of the largest are nickel-copper mines; but also gold, iron ore, tin, uranium and phosphate are extracted. There are also abundant placer deposits on the continental shelves, of which gold and tin are economically most important. Placer diamonds, amber and fossil ivory are also present (slide 18).

The subsurface of the Kola Peninsula contains a remarkable abundance of various minerals. Among the resources of interest are copper, iron, nickel, cobalt, titanium, rare metals, ceramic raw materials, mica, precious stones, and the largest apatite deposits in the world (slide 19).

A large part of the almost 11 million tons of ore mined annually in Russia consists of apatite and nepheline. Three-quarters of the phosphate fertilizer in Russia is manufactured from apatite concentrate from the Khibiny deposit located on the Kola Peninsula (slide 20).

Of particular interest are the huge deposits of nickel, which were discovered southeast of the estuary of the River Yenisei in the 1930s. After the war, Norilsk Nickel became the largest mining and smelting operation in the Arctic. The Norilsk Nickel company includes the Severo-nickel and Pechenga-nickel operations on the Kola Peninsula and major investments worldwide, including the Harjavalta smelter in Finland. Norilsk Nickel is now one of the biggest mining groups in the world. It 2007 it produced around 18% of the world’s nickel, 46% of the world’s palladium and 12% of the world’s platinum (slide 21).
Svalbard:

Since the resettlement of Svalbard in the early 20th century, coal mining has been the dominant commercial activity. At present the Norwegian Store Norske and the Russian Arktikugol remain the only mining companies on Svalbard (slide 22).

Store Norske Spitsbergen Kulkompani, a subsidiary of the Norwegian Ministry of Trade and Industry, operates Svea Nord in Svea and Mine 7 in Longyearbyen. The former produced 2.4 million tons in 2009, while the latter uses 35% of its output to Longyearbyen Power Station. Since 2007, there has not been any significant mining by the Russian state-owned Arktikugol in Barentsburg. The activity in Barentsburg is now about to restart (slide 23).

Store Norske is also looking for gold on Svalbard. Recent investigations of gold-bearing deposits in St. Jonsfjorden show gold-content varying from a few g/t up to 1000 g/t, with an average of 300 g/t. An exploration program, including drillings, of the gold-bearings deposits will be continued this summer.

Fennoscandia:

The Fennoscandian Shield comprises a diversity of geological settings containing large resources of mineral deposits, and the Barents Region is one of the most important sources for metals and minerals in Europe. The resources include industry mineral for a number of applications and uses, energy minerals and not at least important metals (slide 24).

Due to the sharp increase in demand for such natural resources, it is not surprising that billions of euros have been and will be invested in mining areas and processing facilities in the area. I already mentioned the recent new investments in the iron-ore mines in my introduction, but also other metal resources will be developed. A 400 million Euro investment in a new nickel and copper mine near Sodankylä in Finnish Lapland is underway. In Kvalsund in Norway’s Finnmark region, an abandoned copper mine could be reopened, and a larger copper-precious metal deposits nearby is one of the most promising deposits in Norway.

The Fennoscandian Ore Deposit Database (FODD) is a comprehensive numeric database on metallic mines, deposits and significant occurrences in Fennoscandia. The maps and the database have been compiled in a joint project between the geological surveys of Finland, Norway, Russia and Sweden. The database contains information on 1300 mines, deposits and significant occurrences across the region. Of all deposits listed in the database, 56% have not been exploited at all. However, a number of these might well be economic in the future with additional reserves based on further exploration (SLIDE 25).
There are 47 large mines, 51 large unexploited deposits and 57 potentially large deposits in the database based on the relative value of the in situ metal contents. The FODD contains information on location, mining history, tonnage and commodity grades with a comment on data quality, geological setting, age, ore mineralogy, style of mineralisation, genetic models, and the primary sources of data.

Here is a detail of the database showing the iron-ore deposits in Kirkenes and the nickel-copper deposits in neighboring Pechenga area in Russia (slide 26). On this slide showing the magnetic anomaly geophysical data as the background, we can see that the prospective metallic deposits are restricted to certain areas. Modern and high-resolution geophysical data are needed for effective exploration of the potential resources (slide 27).

The Norrbotten and Västerbotten counties in Sweden are well established a key mineral deposits provinces. Today, Kiruna-Malmberget os the worlds largest mining operation north of the Arctic Circle. Several new deposits are in the pipe-line, and there are planned investments for more than 30 bill. SEK in the mining sector (slide 28).

Exploration and exploitation of mineral resources has been a priority area in Finland. This slide shows the current mines and advanced projects. As an example four gold mines have been opened in Finland since 1980. The most recent mine, Kittilä, opened in 2008. It is the largest gold deposits in western Europe with a resource of 5,7 Moz (slide 29).

Ore output from mines in Finland since 1950 is now at a peak, and is expected to further increase in the nearest years. Recently, Finland has launched a new national mineral strategy with the following vision towards 2050: "Finland is a global leader in the sustainable utilization of mineral resources and the minerals sector is one of the key foundations of the Finnish national economy"(slide 30).

Norway is currently also developing its own strategy and plans for further development of the mineral sector. Steps are taken to increase the coverage of relevant geological and geophysical information of the northern counties Finnmark, Troms and Nordland, where a four-year program with a total budget of 100 million Nkr now is started within the frame of the government's Northern territories strategy (slide 31).

Future challenges:

To conclude: The Arctic and the high-north territories contain large amounts of mineral resources, which are likely to be explored and mined in the years to come (slide 32).
Stille large areas are underexplored, and extensive new geological and geophysical investigations will be carried out to fill the knowledge gaps. To better find more scattered deposits, such as deposits of rare earth minerals, we also need detailed geochemical analyses and advanced mineral characterization.

Independent of where the resources are found, in the Arctic or somewhere else in the world, we need improved processing technology to fully utilize the potential value of the resources.

Other challenges include environmental issues, potential land conflicts, and of course, the access to a well established regional infrastructure. The distance to markets is a challenge over most of the Arctic and high-north regions, but in some areas will also benefit from proximity to ice-free harbors, as found along the Norwegian coast.

The interest for the Arctic mineral resources will continue to increase in the years ahead of us. Mining is bound to be one of the major cornerstones for future development in the Arctic. Good solutions for most of the upcoming challenges – from exploration for the resources, through mining and processing operations, environmentally acceptable disposal of waste and transport of products – need a knowledge- and research-based approach to give the greatest chance of success and environmental sustainability.