

33 IGC excursion No 37, August 01 – 05, 2008



33 IGC, The Nordic Countries

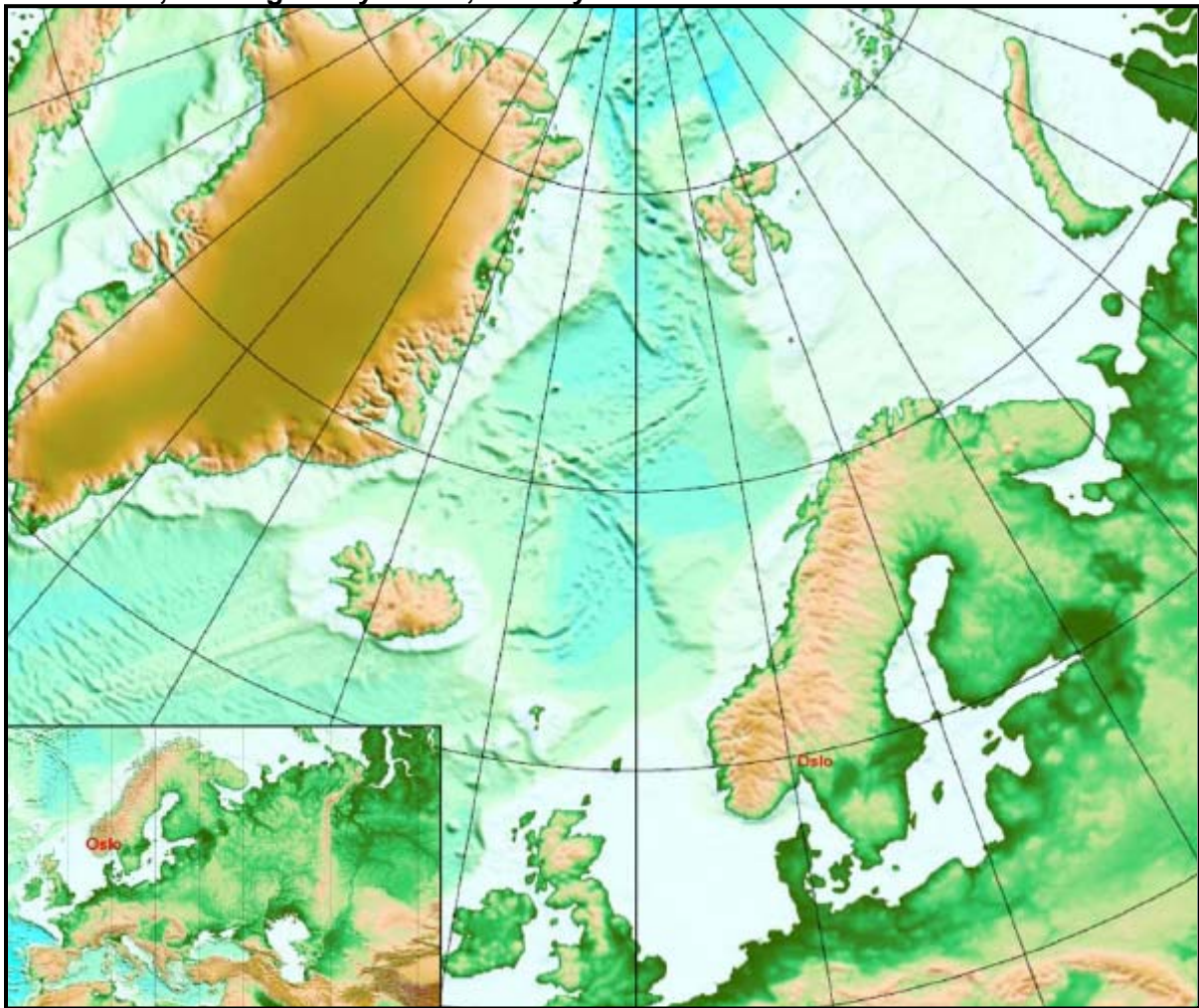


## Industrial mineral producers in Norway

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## Abstract

No. 37. Industrial mineral producers in Norway

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In this excursion the participants will visit the world leading producer of olivine (North Cape Minerals at Åheim) as well as the process plant of the world leading producer of carbonate slurry coating for paper (Hustadmarmor at Elnesvågen). In addition a visit will be paid to one of the largest carbonate deposits in Europe (Tromsdalen limestone in Verdalen) which now is being planned for a strong increase in the production. Finally a visit to the large carbonate deposits in the Brønnøy area from where Hustadmarmor is getting its mined raw materials.

Duration: 5 days

Time: 1 - 5 August

Max number of participants: 20

Price pr participant: €1890

## Logistics

### Dates and location

**Timing:** From 1. August– to 5. August

**Start location:** Vigra Airport, Ålesund, 1. August, 10 o'clock am.

**End location:** Brønnøysund 5. August, 3 o'clock pm

### Travel arrangements

The start location Ålesund is easily reached by morning air from Oslo (SAS-Braathen).

Homepage: [www.sasbraathen.no](http://www.sasbraathen.no)

The end of the excursion will be at Brønnøysund 5. August 3 o'clock pm. Return to Oslo may be by air (Widerøe). Home page [www.wideroe.no](http://www.wideroe.no), or by Coastal Express to Trondheim and train or plane to Oslo. The Coastal Express leaves from Brønnøysund at 5 pm every day and arrives in Trondheim early in the morning the next day.

### Accommodation

All accommodation during the excursion will be at hotels with reasonable high standard. For those who wish to go to Ålesund the day before the start of the excursion may find several hotels in Ålesund. To your information the overnight lodging the first night of the excursion will be at Rica Parken Hotel in Ålesund.

### Field logistics

Bus transport is used for the whole excursion. No field equipment is needed. Ordinary boots is however recommended as well as clothing suited for the possibility of rain during visits in the mines or for stops at tourist places along the route.

Normally the companies will serve with special clothing if needed due to security reasons.

## General Introduction

The main purpose of the excursion is to introduce the participants to some of the leading producers of industrial minerals in Norway as well as globally. Some of the deposits are classified as “World Class Deposits” e.g. olivine at Åheim and the carbonate deposit at Verdal. The excursion comprises both geological information regarding the deposits as well as technical information regarding the production.

## Excursion Route

The map shows the route the excursion will follow. The producers to be visited are shown on the map.



The participants will visit the world leading producer of olivine (North Cape Minerals at Åheim) as well as the process plant of the world leading producer of carbonate slurry coating for paper (Hustadmarmor at Elnesvågen). In addition a visit will be paid to one of the largest carbonate deposits in Europe (Tromsdalen limestone in Verdal) which now is being planned for a strong increase in the production. Finally a visit to the large carbonate deposits in the Brønnøy area from where Hustadmarmor is getting its mined raw materials.

During the tour we will stop at places offering special sceneries such as the Atlantic Road north of Molde and cultural sights as the old Løkken Mine (started in 1654 – closed in 1987)

and Museum in Orkdal 70 kilometres SW of Trondheim and the historical site of Stiklestad at Verdal.

## Excursion Stops

### Day 1 August 1<sup>st</sup>.

Bus from Ålesund Airport Vigra at 10 o'clock to North Cape Minerals olivine mine and processing plant at Åheim. Arrival Åheim at 12 o'clock.

The Gusdal olivine pit, near Åheim, south-western Norway, is a world class olivine deposit situated in the Almklovdalen peridotite massif. The peridotite massif is a large Alpine-type ultramafic body emplaced within the granitoid gneisses of the Western Gneiss Region.

The massif has a ring-shaped, 700-1200 m wide, exposure around the Helgehornet mountain, and is interpreted as a trough structure enclosing this gneissic mountain. The massif is composed of a dunitic core mantled by serpentinitized ultramafites. The dunitic core shows a systematic large-scale zoning with up to 300 m thick zones of dunite, and chlorite bearing dunites, and 1-20 m thick zones of eclogite and chlorite-amphibole dunites.

The dunitic core is represented by chlorite- and amphibole bearing peridotite, containing forsterite, chlorite, chromite ( $\pm$  serpentine, pyroxene, amphibole, biotite/phlogopite, talc, magnesite, and pyrrhotite).

The foundation for the utilisation of olivine as an industrial mineral was developed by Professor Victor M. Goldschmidt (1888 – 1947), and olivine is now used in a range of products. The largest volumes are as slag conditioner in the production of pig iron, but olivine is also used as foundry sand, in refractories (e.g as raw material in the NCM owned refractory plant for brick and monoliths at Åheim), in abrasives (e.g sand blasting), in mineral wool, as a heavy concrete additive, as ballast material, in subsea cover of pipelines, in heat accumulation material and increasingly in environmental applications as filter and cover layers for polluted seabeds, water purification (heavy metal adsorbent), and for soil improvement. Research is also done on using olivine in CO<sub>2</sub> sequestration.



*Gusdal Olivine Pit*



*The olivine manufacturing plant at Åheim*

Mining started on the dunitic part of the Almklovdalen massif in 1948 by A/S Olivin, producing 4.000 MT for refractory purposes and mineral wool. In 2003 A/S Olivin was bought by North Cape Minerals. NCM was established in 1993, and is owned by the American Unimin Corporation (89%) and the Norwegian mineral company Franzefoss (11%). Unimin is owned by the Belgian Sibelco Group.

North Cape Minerals has about 400 employees, of which about 120 are at the Åheim location, and an annual turnover of about NOK 1000 millions. The total production is about 4 MT/year, of which the Gusdal olivine pit contributes about 2 MT. With this production rate the proved reserve life is about 150 years, with a potential property life of more than 400 years, making this the largest commercial olivine deposit in the world.

August 1<sup>st</sup> afternoon. Bus to Ålesund and overnight lodging.

## **Day 2 August 2<sup>nd</sup>.**

Bus from the hotel to Hustadmarmor production plant. Approximately two hours drive. Hustadmarmor AS is the world leading producer of pigments to the international paper industry. A local mine and a limestone mill were started back in the 1940ies and in 1977, a cooperation with the Swiss company OMYA AG was initiated. The Steinsvik family and OMYA has been the owners since then, but in 2007, the Steinsvik family sold the last 21% of the shares. They are still the owner of Hustadkalk which is supplying all the raw material to Hustadmarmor.

Hustadmarmor has been a successful story and in 2006 the turnover was 1,7 mill NOK and the result was 320 mill NOK.



*Hustadmarmor AS. Raw material storage and raw material ship nearest, processing plant and tank ship loading liquid marble in red.*

Each year, the company exports more than 3 million tonnes of liquid marble to the paper industry where it is applied as filler and coating of paper.

All together 5-6 billion NOK is invested at Hustadmarmor. In addition more than 3 billion dollars are invested in 16 ships that transport the products to the costumers. All the ships are built by a company nearby.

The raw material supplied by Hustadkalk AS comes from 4 mines, 3 local mines in addition to Brønnøy Kalk.

The crushed raw material is transported to the plant by ships and goes through the beneficiation process before it is micronized and shipped as slurry (liquid marble).

Afternoon: Bus to Baardshaug Herregaard in Orkanger and overnight lodging.

### **Day 3**

Day 3 is a day of culture.

In the morning, a visit will be paid to the historic sulphide mining area at Løkken. In the time period 1657 to 1987, one of the largest sulphide mines in Norway were developed at Løkken with more than 1000 employees at its maximum. The visit includes both a visit in the mine museum as well as a guided tour in the old mine.

After lunch bus to the Stiklestad National Culture Centre in Verdal. Stiklestad is the battlefield where King Olav Haraldsson fell 29. July 1030, and he became known as St. Olav. The battle of Stiklestad represents the introduction of Christianity in Norway. The battle and the saint king made it possible for Stiklestad to act as a symbol of both Christianity and the kingdom. Dinner and overnight lodging at the Stiklestad Hotel (more info: <http://www.stiklestad.no/>).

### **Day 4 August 4<sup>th</sup>.**

Bus to Verdalskalk A/S and the Tromsdalen limestone deposit.

Verdalskalk is owned by Franzefoss (55%), Faxe kalk (35%) and Nordkalk(10%). The annual production is about 1 MT/year. Verdalskalk has 50 employees and an annual turnover about NOK 90 millions.

The deposit is situated in Tromsdalen and is a pure, low metamorphic limestone of Silurian age. The colour is normally blue-greyish due to fine disseminated organic material with some lighter parts being used as fillers. About 500.000 T/year is used as raw material for precipitated calcium carbonate (PCC) and is exported to Sweden and Finland.

The rest of the production is used in a number of products and processes eg the metallurgical industry, mineral fibres, paper, agriculture and for lime production.



*The Tromsdalen limestone deposit*

Afternoon: Bus to Brønnøysund and overnight lodging.

### **Day 5: August 5<sup>th</sup>.**

Visit at the mining site of Brønnøy Kalk AS.

Brønnøy Kalk AS is owned by Hustadkalk AS. Hustadkalk is the raw material supplier of Hustadmarmor AS, which is the world leading producer of liquid marble (fillers and coatings) for the paper industry. Hustadmarmor is owned by the Swiss company OMYA AG.

In 2006 Brønnøy Kalk AS produced and delivered ca 2 million tonnes raw material and the company thus covers 2/3 of the Hustadmarmor AS raw material needs.

Brønnøy Kalk AS employs ca. 80 persons, where ca 40 is in permanent positions and ca 40 works for different contractors.

In the mid 1990ies, one became aware of the big graphitic holding deposits of marble in the Velfjord area. There had already been many activities on the small deposits of pure, white marble. The size of these deposits made it interesting to start an intensive research and development on how to make use of the recrystallized graphite holding marbles.

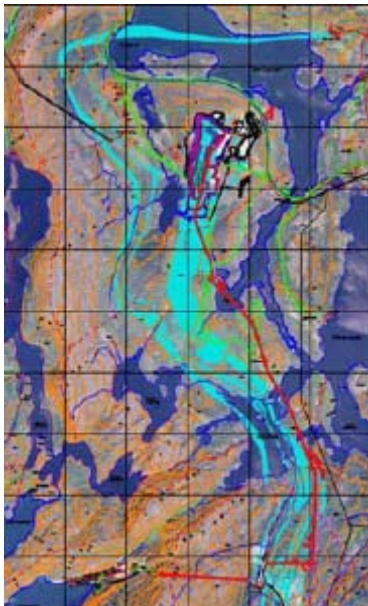
The first prospecting drill hole was positioned in July 1996 and since then more then 31.000 meters are drilled divided on 170 holes. Regular production started in 1998.

The rocks in the Helgeland area is interpreted to be a part of the American plate before the Caledonian orogeny. The calcitic marble produced by Brønnøy Kalk is originally calcitic sediments deposited in the ocean outside America. In the orogeny, the pressure and temperature transformed the limestones to marble. The carbonate structure covers a big area.

In the mining area, the rocks have a north-south going strike with 30-60° dip towards east.

The rocks comprise alternating layers of marble with varying amount of other minerals. Based on visual appearance and amount of other minerals, the marble is divided in 4 main types: speckled (from graphite), banded, impure and sulphide speckled. Only the speckled and the best banded marble is mined and the thickness of these layers varies from some tenth meters to more than hundred meters. The raw material is mined in an open pit at Akselberg where blast in the order 10-100.000 tonnes are drilled, loaded and blasted. The blasted raw material is transported 5 km through a tunnel to the crushers. After 2 crushing steps the material size is <50 mm and is stored on a big storage. From the storage the material is transported by conveyor belts to the ships loading 15-30.000 tonnes

The requirements for the raw material are strict and a quality control system is essential to be able to meet the requirements. Each blast is samples and analysed to be able to meet the requirements and utilize the deposit more optimally.



*Marble deposit (blue) and open pit of Brønnøy Kalk AS*

End of excursion: 3 o'clock pm

Afternoon: Plane or Coastal Express to Trondheim and train back to Oslo.