Potentials for Mineral and Hydrocarbon Development in the Northern part of Greenland

WWF Seminar Iqaluit, 4-5 June 2013

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Agenda

- The Greenland Government’s vision for the mineral resources area
- Mineral resources potential in the Northern part of Greenland
- Current licences and activities in the Northern part of Greenland
- Regulatory regime
- Nature, environmental and socio-economical considerations in mineral resource development
The Greenland Government’s vision for the mineral resources area

- The Greenland Government wishes to use the Greenland mineral resources to create growth and prosperity for the Greenlandic people.
- The mineral resources area shall be a commercially viable sector of the Greenland economy.
  - Currently the Greenlandic economy is based mainly on fisheries and a yearly grant from Denmark.
  - The economy needs to be diversified.
  - High unemployment rate - an urgent need for jobs.

- Due considerations to health, safety, nature and environment is a prerequisite for development of mineral resources projects in Greenland.
The Greenland Government’s vision for the mineral resources area

- Development of the mineral resources sector should take place in such a way that the Greenlandic society benefits the most
- Greenlandic workforce and Greenlandic companies should be involved at the greatest extent possible
- Greenland should be secured a fair share of the economic profit from the extraction of mineral resources
Mineral Resources Potential in the Northern Part of Greenland
Zink Potential in the Northern Part of Greenland
Mineral Resources Potential in the Northern Part of Greenland

- Promising Zink and Lead Province North of 81° N
  - The North Greenland has shown a great potential for zinc and lead occurrences.
  
- The favourable geology of North Greenland is related to the formation of the Franklian Basin. The east-west striking basin comprises in the southern part of a carbonate platform and towards north of deeper deposited through sediments such as mudstones and shales. The carbonate platform has the Mississippi Valley Type (MVT) of zinc-lead deposits and the through sediments host the sedimentary exhalative deposits (SEDEX). MVT deposits are found in Washintong Land and Navarana Fjord and a SEDEX deposit representative is the well-known Citronen Fjord deposit.
Mineral Resources Potential in the Northern Part of Greenland

Mean estimate in the West Greenland - East Canada province:

17,000 mmboe of oil and gas

Mean estimate in the East Greenland province:

31,000 mmboe of oil and gas.

USGS 2008 assessment of undiscovered oil and gas resources
Current licences and activities in the area

- Avannaa Resources Ltd
  - Lead, zink
  - Initial prospecting, rock and sediment sampling

- Licence under application

- NAMA Greenland Ltd
  - Iron, copper, zink, titanium
  - 2013: drilling (activity under application)

- Oil/gas exploration licences
  - Statoil, ConocoPhillips, DONG, Mærsk Oil, Shell, GDF Suez, Cairn Energy

- Seismic activities
- Environmental studies
- Site surveys

- Citronen Fjord Project
- Ironbark Zink Ltd
- Lead, zink
- Progressed mineral exploration
- Environmental baseline studies
- Socio-economic studies
Citronen Fjord Project

- Current licensee: Ironbark Zink Ltd (Australia)
- Ressource discovered in 1993 by the company Platinova
- Ressource: 71 - 132 million tons zink ore, grade 4.5-5.7%
- Extensive exploration activities (approx. 35,000 m drilled)
Citronen Fjord Project

- Development costs: approx. USD 500 mio.
- Planned production: 14 years
- Logistical challenges: Sailing possible 6-10 weeks/years

Would be amongst the 10 largest zinc mines in the world

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<tr>
<th>World Class Zinc Mine / Deposit</th>
<th>Company</th>
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<td>McArthur River</td>
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<td>Red Dog</td>
<td>Teck Resources</td>
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<td>Rampura Agucha</td>
<td>Hindustan Zinc</td>
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<td>Lanping</td>
<td>Government &amp; Sichuan Hongda</td>
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<td>Shalkiya</td>
<td>Shalkiya Zinc Group</td>
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<td><strong>Citronen</strong></td>
<td><strong>Ironbark Zinc Limited</strong></td>
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<td>Century</td>
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<td>BHP Billiton / Xstrata / Teck / Mitsubishi Corporation</td>
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Citronen Fjord Project

- Environmental baseline studies
- Draft EIA
- Preparing Social Impact Assessment
- Expects application by primo 2014
- -> public hearing process
Offshore oil/gas exploration licences

- Offshore Nuuk
- Disko West
- Open Door
- Baffin Bay
- Greenland Sea
Greenland Sea Licensing Round 2012/2013

Licensing area covers 49.949 km²

Phase 1: Expected finalised summer 2013

Phase 2:
Pre-qualification process: 1 July 2013

Licence application deadline: 15 October 2013
Regulatory Regime


- General rule:
  - The Act aims to ensure that activities under the Act are securely performed as regards safety, health, the environment, resource exploitation and social sustainability as well as properly performed according to acknowledged best international practices under similar conditions

- Framework legislation – allows for continuous adaptation to improvements to Best Environmental Practice and Best Available Techniques
Regulatory Regime

- To conduct an exploration activity a company would need:
  - A licence
  - An approval of the specific activity

- An activity is regulated by:
  - The Mineral Resources Act
  - Applicable Executive Orders
  - Applicable BMP Guidelines
  - Applicable standards (i.e. NORSOK)
  - Licence terms
  - Approval terms
Nature, environmental and socio-economical considerations


- The assessments and decisions of the Mineral Resource Authority regarding environmental issues are based on assessments and proposals for decisions from one or more scientific and independent environmental institutions.

- (§ 3a, 4)
Nature, environmental and socio-economical considerations

- Decisions regarding principal or larger issues, i.e. hydrocarbon exploration licences, mineral exploitation licences etc. are taken by the 8 members of Naalakkersuisut collectively.

- Furthermore, an Inatsisartut Committee is informed before a decision on the above is made.
Nature, environmental and socio-economical considerations

- Before opening up an offshore area for oil/gas licences, a **strategic environmental impact assessment** is made.
  
  - Regional in scope
  - Lifecycle of potential projects
  - Possible impacts from routine activities
  - Possible impacts from major accidents
Nature, environmental and socio-economical considerations

- Baffin Bay between 71° and 78° N
- Northeast Greenland between 68° and 81° N
Nature, environmental and socio-economical considerations

- Sensitive areas are identified
- Data gaps are identified
  - Further studies are conducted if licences are awarded
  - SEIA is updated
  - Activity specific EIAs
- Geographical placement of licence blocks
  - Geological prospectivity and environmental conditions feed into decision making process
- Possible mitigation measures
Environmental regulation of seismic activities Baffin Bay 2012

Study of cumulative effects of seismic activities on whales in the Melville Bay

1) Counting of narwhales before, under and after seismic activities

2) Deployment of acoustic bouyes to record the seismic noise at Qimussersiarsuaq
Environmental regulation of seismic activities Baffin Bay 2012

3) Is the narwhale hunting affected by the seismic activities?

- Interviews
- Scientists’ participation in hunting trips
- Collection of samples from the caughted animals