

Notat

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Dundas Titanium A/S

Project Description for SIA

Dundas Ilmenite Project

## Introduction to the project

The purpose of the Dundas Ilmenite Project is to extract ilmenite from the onshore raised and active dry beaches of the 'black sand' deposit on the south coast of Steensby Land peninsula in Northern Greenland in the vicinity of the abandoned and closed settlement of Moriusaq.

The black sand is located on the surface of the raised and active dry beaches, and the project therefore does not include underground mining.

The black sand at Dundas consists of a large proportion of the titanium-iron-oxide mineral named Ilmenite. Ilmenite is a titanium-iron oxide mineral ( $\text{FeTiO}_3$ ) that is mined and processed for its titanium. Titanium dioxide ( $\text{TiO}_2$ ) is an important commodity used as pigments in paint, plastics, enamels, paper and in cosmetics and in the making of different metal alloys.

The ilmenite-bearing black sand is also sometimes referred to as 'heavy mineral sands' due to the mineral ilmenite being a dense (heavy) mineral. Other 'heavy minerals' in the black sand in the project area are magnetite (iron-oxide mineral), pyroxene and amphibole (silicate minerals). In addition to the heavy mineral assemblage identified above, the black sands in the project area also contain a higher proportion of lighter coloured and less dense but non-valuable 'normal sand' minerals such as quartz, feldspars and micas etc. None of the sands in the project area are reactive in any way. There are no harmful toxic heavy metals or radioactive isotopes present in these beach sand deposits.

The Dundas Ilmenite Project is owned by Dundas Titanium A/S, a company registered in Greenland. Dundas Titanium A/S owns 100% of the current exploration license (number 2015/08) and has been responsible for all the exploration work at the site carried out over the last three years. Dundas Titanium is 100 % owned by Bluejay Mining plc, a company registered in the United Kingdom.

The license covers an area which is approximately 30 km long and 2 km wide, as illustrated on the map below. The area is located in the Municipality of Avannaata, around 80 km South of Qaanaaq. The abandoned settlement Moriusaq is located within the license area.

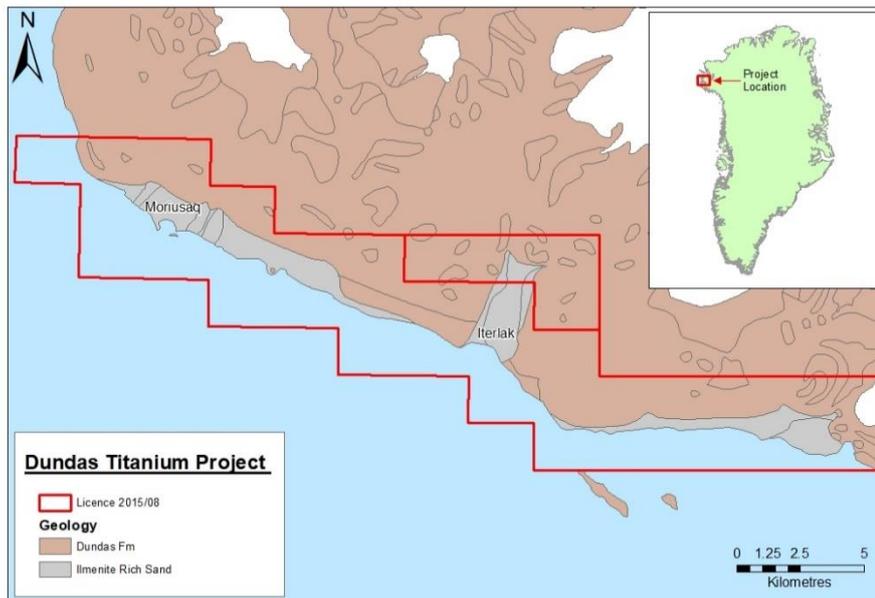


Figure 1 Extent of the exploration license that cover the Dundas Titanium Project; only the onshore raised beaches from the northwestern corner, west of Moriusaq (top-right corner of the onshore license area), to the Iterlak river delta are considered in the current mining scenario. The red outline shows the extent of the Bluejay exploration licenses.

## Planned project design

### The mining project

- The Project will consist of onshore automated continuous surface miners, a wet plant, a dry plant, a small port, a ship-loading facility, an airstrip, workforce accommodation, concentrate storage, and general utilities such as power and water supply.
- The construction period is expected to be around 18 months (two summer seasons), and whilst the feasibility study has initially identified a 10 year mining operation it is expected that additional resources in the area should be capable of supporting an operation for many more years.
- The mining operation will take place on the raised beaches (containing black sand with ilmenite accumulations over widths of more than 1 km) and active dry beaches (the area seaward of the frontal dunes).
- The project has a current indicated and inferred resource for the raised beaches and active dry beaches west and east of Moriusaq of 101 million tonnes at 7.1% ilmenite in-situ.
- The expected annual production is 440,000 ton of ilmenite in concentrate.

The mining and beneficiation process carried out in the Project will consist of three overall processes: mining, wet gravity processing and dry magnetic processing. Each process is described below.

### Mining:

- Where present, the top-most part of the raised-beaches with organic plant-material, the so-called top-soil, will be stripped off and deposited for later remediation work when the ilmenite has been mined from the black sand and the mining voids have been back-filled with sand rejected by the wet gravity separation.
- The black sand will be mined by automated mining machines (so-called 'continuous surface miners') that 'harvest' the black sand through cuts by rotating cutter-heads. No drilling or blasting will be needed.
- Mined black sand will be loaded on mining trucks that will transport the sand to the wet gravity processing plant.

### Process at the wet plant

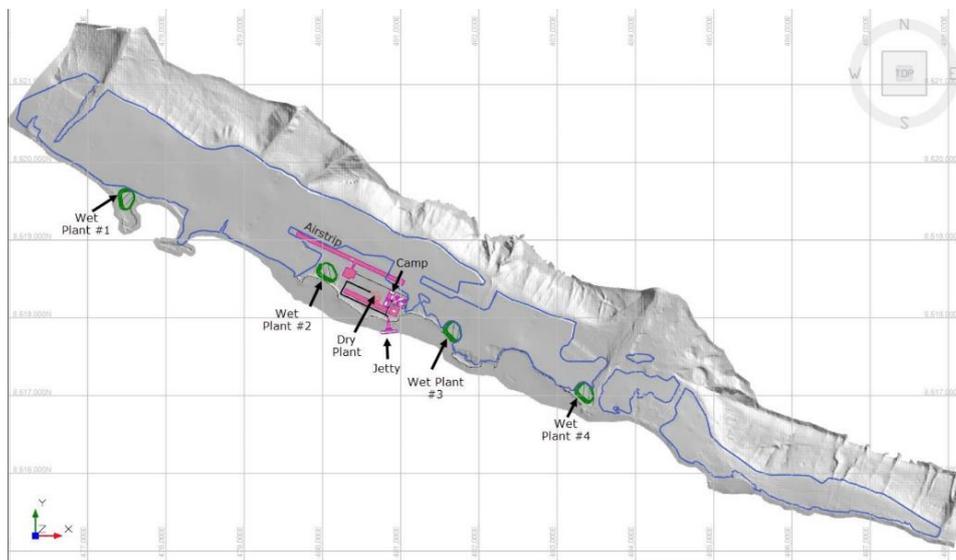


Figure 2 Map of planned infrastructure at Dundas Titanium Project. The blue line indicate areas that will be mined during the current planned mine-life. Mining will be initiated in the north-western (top right) corner of the area and will progress towards south-west (bottom left corner). The green outlined areas indicate the various locations of the Wet Plant during the life of the mine. Purple outlined areas outline other infrastructure at the mine-site (airstrip, camp/accommodation, dry plant, jetty/port/shipping facilities).

- Before entering the wet plant the mined material will be screened to remove oversize material and the material will be heated in a rotary kiln for de-icing.
- The wet plant, screens and the rotary kiln will be mobile so that it can be moved to new positions (relocation every 2-3 years) and follow the operational area for the continuous surface miners.
- At the wet plant the mined screen sand will be separated into two fractions through a two-step gravity separation: one fraction with 'heavy minerals' (app. 10 % of the mined volume) and one fraction with 'light minerals' (app. 90 % of the mined volume). The gravity separation is a simple washing process in which the black sand basically is washed in gravity separators. The water used for the washing will be normal seawater. No chemicals, crushing or liberation of the minerals are needed in the process.

- The sea-water used in the gravity separation will be pumped back to the sea after use. The returned sea-water will be pumped to deep water (at approximately 10 m water depth and discharge areas will be selected according to areas that already have muddy bottom-conditions). The returned sea-water contains no added chemicals.
- After beneficiation the 'light minerals' will be transported back to the earlier mine cuttings where it will backfilled together with the oversize screened material. At the very end, the backfilled cuttings, will be covered with the earlier removed organic-bearing top-soil material. There is expected to be no discernible impact to the original environment after the final layer of topsoil is replaced and the area remediated back to its natural state.
- After beneficiation at the wet plant, the 'heavy mineral concentrate' (consisting of approximately app. 88% ilmenite with the remaining 12% being composed mainly of magnetite and other heavy minerals) will be transported to the dry plant.

#### **Process at the dry plant**

- Before entering the the dry plant, the 'heavy mineral' fraction material from the wet plant will be dried and all moisture will be removed.
- The dry plant is a fixed plant that is located close to the established storage and port facilities.
- Thorough a magnetic separation by different magnets in the dry plant The heavy minerals will be refined into >99% clean 'premium ilmenite product', a 'standard ilmenite product' and a rejected non-valuable heavy mineral fraction (magnetite, amphiboles and pyroxene).

#### **Shipping and storage**

- The ilmenite products will be stored in a large storage facility at the mining site.
- During the ice-free shipping window (June-October) the material will be shipped by bulk-carriers to an international, all-year around open water, storage location or directly to customers. A rock-filled steel piled berth and ship-loading facilities will be part of the infrastructure.
- With the planned production, the shipping will include approximately 10-12 return trips with vessels of the type 42,000 DWT Supramax or similar. Besides that, approximately 4 ships will supply the operation with fuel and other supplies during the shipping window.
- The Ilmenite products from the Project will be sold on long-term agreements to the international market.

## **Employment and infrastructure**

- The project is expected to employ up to 270 employees during construction and around 175 employees during operation. Approximately 120 persons will be at the site at anytime.
- Greenlandic employees will be preferred when skills and experience allows. The goal is to employ as high a share of Greenlandic employees as possible.
- On average the share of unskilled workers will be app. 54 %, skilled workers 39% and academics 7%. On the last page of this brief, an anticipated breakdown of expected positions is presented.

- The mining site is expected to be in operation year round. It is planned that employees will work in rotations of six weeks on site, and three weeks off site.
- Employees will be transported directly to the site by chartered flights from a central hub. An airstrip will be build on the site as part of the infrastructure.
- Beside the mining and processing facilities, accommodation, office, medical & safety and workshop facilities will be built as part of the infrastructure at the mine.
- The company will offer on-the-job and continued training for workers. The company will also actively work with the Greenland School of Minerals & Petroleum ('Råstofskolen') to develop training programmes and internships for students from the school. Already in 2019, training activities have been initiated in corporation with the Greenland School of Minerals & Petroleum. Furthermore, local contractors will, when possible and feasible, be preferred and used to support and supply the operation.

## **Local use and access**

- Interviews with former residents of Moriusaq, and hunters and fishermen from Qaanaaq, have illustrated that the license area is only used for overnight stays when transferring from one location to another. None, or only very limited, hunting and fishing activities take place in the license area.
- The black sand located under Moriusaq will be mined, which means that the buildings will be removed. The cemetery area at Moriusaq will not be mined.
- Because of safety aspects (e.g. heavy machinery operations), access to the mine area and mine site will be restricted and monitored. It is being considered, to enable persons travelling through the area to stay in a guest-house/room at the site, either in the accommodation camp, or in one or two renovated houses from Moriusaq.
- The Dundas Ilmenite Project will welcome dialogues and cooperation with the local communities and stakeholders throughout the mining period and will consider different ways of supporting and engaging with the local communities in the region. The Project have also already discussed its involvement in the regional setup concerning Search-and-Rescue and medical evacuation.
- A grievance mechanism will be established, ensuring that the local population can always contact the company, and that these contacts are handled and responded to.

## **Environmental impacts**

- An Environmental Baseline Study and Environmental Impact Assessment will ensure that the project is carried out at the highest standards with solutions that are optimised for minimal environmental impact. As the prior environmental studies in the region was limited was the studies carried out during a three-year period instead of only two. No serious environmental impact or risks have been identified by the studies. Mitigations of identified lower impact or risks areas will be implemented. Continuous environmental monitoring will be carried out during the entire mining period.
- The company is not applying to do offshore mining in the current project. Offshore areas as well as active glacial river-delta areas constitute a potential large resource of black

sand and the project may in the future be expanded to these areas also. However, this will constitute a different mining and operational scenario and will also constitute separate Environmental and Social Impact Assessments – and a separate mining application for such an operation. Subcontractors from Dundas Titanium A/S have carried out environmental base line studies in the above-mentioned areas and will continue to do so over the next year in order to build a very solid background and documentation for environmental assessments in these areas if an expansion is wanted in the future.

More information on Dundas Titanium A/S, Bluejay Mining Plc and the project can be found on [www.titanium.gl](http://www.titanium.gl) (in English)

## Detailed breakdown of positions at the project

Position	Education/training	Number of positions
<b><i>Mining</i></b>		
Mine manager	High level professional / academic	1
Mining shift supervisor	Skilled supervisors	3
Shift operators	Unskilled	60
Maintenance supervisor	Skilled supervisors	2
Shift Maintainers	Skilled artisans	9
Mine planning engineer	High level professional / academic	1
Mining engineer	High level professional / academic	1
Mine surveyor	Skilled artisans	2
Mine geologist	High level professional / academic	2
Mining pit technician	Unskilled	2
<b><i>Processing</i></b>		
Plant manager	High level professional / academic	1
Metallurgist	High level professional / academic	1
Lab chemist	Skilled artisans	3
Process/laboratory technician	Skilled artisans	3
Shift coordinator	Skilled supervisors	3
Wet concentrator plant control room operator	Skilled artisans	3
Plant Operator	Unskilled	3
Shift Maintainer	Skilled artisans	3
ROM Stockpile/outstations operator	Unskilled	3
<b><i>Engineering</i></b>		
Engineering manager	High level professional / academic	1
Electrical supervisor	Skilled supervisors	1
Programmable logic controller/instrument technician	Skilled artisans	3
Electrician	Skilled artisans	3
Maintenance planner	Skilled supervisors	1
Mechanical supervisor	Skilled supervisors	1
Mechanical fitter	Skilled artisans	6
Sewage treatment plant/wet concentrator plant/incinerator/diesel operator	Skilled artisans	2
Power plant/boiler operator	Skilled artisans	3
Fuel storage/dispensing operator	Skilled artisans	3
<b><i>Administration</i></b>		
Dundas Greenland general manager	High level professional / academic	1

Administration manager	High level professional / academic	1
Chefs	Skilled supervisors	3
Kitchen staff	Unskilled	6
Waiting/service staff	Unskilled	6
Accommodation supervisor	Skilled supervisors	3
Cleaning staff	Unskilled	6
Harbour master	Skilled supervisors	1
Warehouse officer	Unskilled	2
Shiploader/product handling/storage operators	Unskilled	6
IT/communication technicians	Skilled artisans	2
<b><i>Safety, security health, environment and quality</i></b>		
Safety, security, health, environment and quality manager	High level professional / academic	1
Medical/health support	High level professional / academic	1
Safety/training officer	Skilled artisans	2
Environmental officer	Skilled artisans	2
Medical Officers/nurses	Skilled artisans	2
<b><i>Off-site employees</i></b>		
Dundas off-site commercial manager	High level professional / academic	1
Human resources supervisor	Skilled supervisors	1
Payroll supervisor	Unskilled	1
Management accountant	Skilled supervisors	1
Accounts received/payable	Unskilled	1
Cost accountant	Skilled supervisors	1
Logistics supervisor	Skilled supervisors	1
Purchasing officer	Unskilled	1
Shipping coordinator	Unskilled	1