

## FinnAust Mining plc

February 2016

### BUY

#### Stock Data

Share Price:	2.08p
Market Cap:	£6.2m
Shares Out:	295.9m

#### Company Profile

Sector:	Mining
Ticker:	FAM
Exchange:	AIM London
Website:	www.finnaust.com

#### Activities

Mineral exploration in Greenland, Finland and Austria. Primary focus on the high-grade Pituffik titanium project in northern Greenland. Large portfolio of quality exploration licences in Finland covering areas of high geological prospectivity in historic mining districts.

#### Performance Data

52 Week Range:	0.45p to 2.38p
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#### Directors

Graham Marshall	Non-Exec Chairman
Rod McIlree	MD
Dan Lougher	Non Exec
Greg Kuenzel	Non-Exec

#### Major Shareholders

Western Areas Ltd	60.34%
Magnus Minerals	4.73%

## Northern Exposure

**FinnAust Mining Plc** is an AIM-quoted (ticker: FAM) exploration company with an impressive portfolio of projects covering highly prospective exploration ground in Greenland, Finland and Austria. The near-term strategy is to develop cash-generative projects in low-risk jurisdictions. The current focus is on the high-grade Pituffik titanium project in northern Greenland.

**High-grade.** Extensive occurrences of high-grade mineral sands have been identified at Pituffik, part of a province several hundred kilometres long. FAM has identified ilmenite-rich (a titanium mineral) sands in onshore, active beach and off-shore areas. The sands in the active beach zone in particular have been demonstrated to contain extremely high concentrations of ilmenite. Sampling to date suggests that Pituffik has potential to become one of the highest grade ilmenite deposits worldwide.

**The titanium game.** Ilmenite is one of the main inputs for the production of titanium dioxide (TiO<sub>2</sub>) feedstocks. The most important market for which is the production of TiO<sub>2</sub> pigment, a \$13bn global market, with the main end use being for paints, coatings and plastics. There is no effective substitute for TiO<sub>2</sub> pigment. TiO<sub>2</sub> demand is closely linked to GDP growth, urbanisation and rise in disposable income.

**Off-shore potential.** FAM recently completed a bathymetry and seismic profiling survey, the results of which suggest that the shallow marine environment contains significant amounts of ilmenite-rich sediment extending for >30km in strike, effectively a new discovery for FinnAust, increasing the resource potential of the project by an order of magnitude, in our view. Significant potential also exists in the near-shore zone.

**Stable jurisdiction.** Despite being fairly remote, Greenland is an attractive mining jurisdiction with a stable pro-mining government. Geologically, the country is highly prospective, yet underexplored, offering considerable potential for agile explorers.

**Cornerstone support.** FAM has access to a wealth of technical and financial support through 60% shareholder Western Areas Ltd, a A\$500m market cap, low-cost nickel producer with a robust balance sheet - a valuable strategic partner, in our view.

**Positioned for the uptick.** FAM has taken advantage of opportunities arising from the current cyclical downturn in commodities to build a substantial land-bank of projects in safe jurisdictions with high geological prospectivity. These include Finnish licences in prolific past-producing districts that can be reactivated when markets improve.

**Next steps.** FAM aims to undertake bulk sampling at Pituffik during 2016 in order to generate sufficient sample material to initiate off-take discussions with interested parties and deliver proof of concept production by 2017. The strategy is to investigate potential for a low-cost operation producing near-term cash flow to subsidise future exploration. Results are also due from sampling undertaken in the 2015 field season.

**We initiate coverage on FinnAust with a BUY rating.** FAM has an unrivalled opportunity to evaluate and develop one of the world's highest grade ilmenite projects. In particular, Pituffik provides investors with exposure to a fast-moving titanium-play at an early stage of development with potential to provide significant value uplift, in our view

# Contents

FinnAust Mining: Northern Exposure .....	3
Location – Safe and Sound.....	4
Strategy – Exploration Arbitrage .....	4
Board and Management .....	5
Mineral Sands Industry Leaders Add Expertise .....	6
Share Price Performance .....	6
Company Structure.....	7
Capital Structure .....	7
Western Areas: Cornerstone Shareholder.....	8
Short-term work programme in Greenland.....	8
Pituffik Titanium Project .....	9
Location – The High Arctic .....	9
Infrastructure – Remote but accessible.....	10
Licences – Low holding cost.....	11
History – A long history but relatively underexplored.....	11
Regional Geology – basaltic dyke swarm the source.....	12
Local Geology and Setting – Coastal targets.....	13
Deposit Model - active beaches and offshore the prize .....	14
Resource Potential – potentially large resource.....	15
Moriusaq – the primary focus .....	18
Bathymetry Survey (2015) – significant off-shore potential.....	19
Acoustic mapping pin points target units .....	21
Bathymetric Results – extensive off-shore mineral sands identified .....	22
Mining – Low cost techniques .....	24
Processing Options .....	25
Product specifications & end use markets .....	25
Next Steps: Bulk sampling to commence in 2016.....	28
Valuation Considerations.....	29
Greenland – an attractive jurisdiction .....	30
Finnish Projects – positioning for the upturn .....	31
Titanium Market Dynamics.....	32

# FinnAust Mining: Northern Exposure

FinnAust Mining ("FinnAust") is an AIM-quoted (ticker: FAM) exploration company with a diverse range of projects in Greenland, Finland and Austria. FinnAust has carefully assembled an impressive portfolio containing some of the most prospective exploration ground in the Nordic region, in our view. The company has successfully taken advantage of the structural downturn in commodity prices to acquire high-quality assets at a low cost. The near-term focus is on developing cash-generative projects in low-risk jurisdictions, whilst retaining a long term pipeline of projects in underexplored regions that can be reactivated and fast-tracked in the next cyclical commodity sector recovery.

Western Areas Limited, a leading Western Australian nickel producer (ASX: WSA, Mkt Cap: A\$500m, US\$350m has Board representation and will hold a 43% interest (60% currently) in FinnAust post the closing of the Bluejay Mining transaction. We view the presence of a supportive cornerstone shareholder as a considerable positive for FinnAust. Western Areas produces c.25ktpa Ni, is debt-free, pays a healthy dividend (3.5% yield in FY15) and has a robust balance sheet (cash of A\$38m at the end of December 2015).

FinnAust is primarily focused on its 60% interest in the Pituffik Ilmenite project in northern **Greenland**, one of the world's highest-grade, undeveloped heavy mineral projects. Pituffik forms part of the Thule Black Sand Province; several hundred kilometres of coastline with elevated ilmenite and magnetite occurrences. FinnAust is investigating the potential of both onshore and off-shore deposits to provide a low-cost, near-term production opportunity. Ilmenite ( $\text{FeTiO}_2$ ) is a titanium-bearing mineral, and the primary feedstock for the production of  $\text{TiO}_2$  pigment used in a variety of paints, plastics and paper.

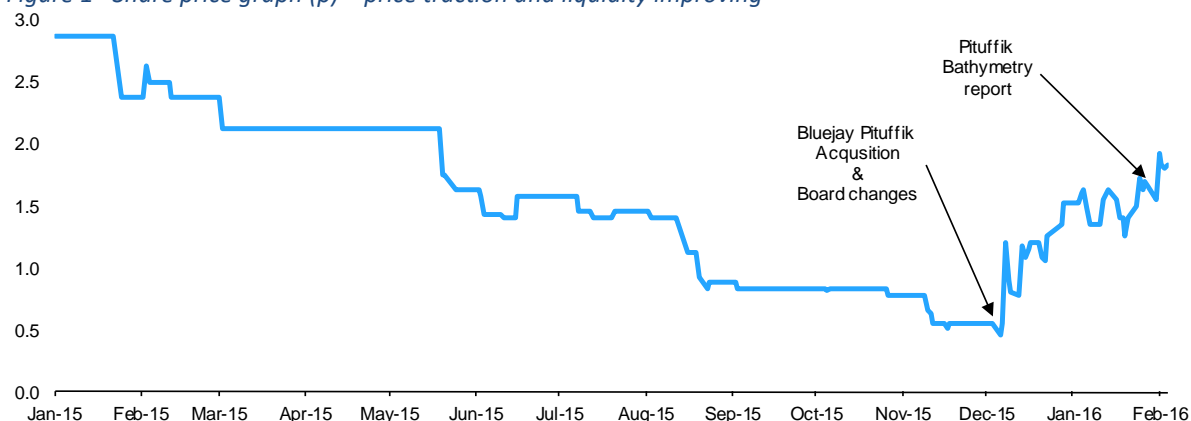
In **Finland**, FinnAust has a multi-commodity portfolio of projects including high-grade magmatic copper and nickel deposits and copper-lead-zinc VHS-style deposits. FinnAust controls key licences in some of the most historically prolific mining areas in Finland, including the Outokumpu Copper Belt. Exploration is on hold pending an improvement in market conditions and the new focus on Greenland, with the Finnish projects being maintained on a low-cost holding basis.

In **Austria**, FinnAust holds an 80% interest in the Mitterberg Copper Project, an ancient copper mining district with a rich mining history, but an area that has seen minimal exploitation in modern times.

FinnAust acquired the Finnish and Austrian projects in 2012 as part of a reverse takeover of AIM-quoted Centurion Resources, raising £3.4m in the process. The Pituffik titanium project was acquired through the acquisition of a 60% interest in Bluejay Mining in December 2015, the owner of the project.

FinnAust's share price has displayed a degree of weakness over the last 12 months, in-line with peers due to considerable commodity sector headwinds and weak sentiment. However, the shares have gained considerable traction since December 2015 as a direct result of the Bluejay acquisition, Board changes and new strategy.

Figure 1 –Share price graph (p) – price traction and liquidity improving



Source: Reuters

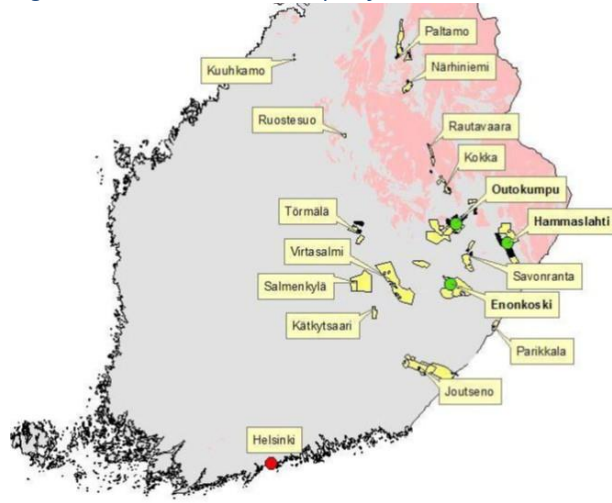
## Location – Safe and Sound

FinnAust's primary exploration portfolio comprises the Pituffik ilmenite (titanium) project in northern Greenland, plus a suite of copper, nickel and PGE projects in Finland.

Figure 2 – Location - Pituffik



Figure 3 – FinnAust's Finnish portfolio



Source: FinnAust

## Strategy – Exploration Arbitrage

### Current market conditions offer opportunities...

FinnAust's strategy has been to build a portfolio of quality, early stage exploration projects in order to take advantage of the opportunities arising from the current cyclical downturn in commodities. The stuttering of China's growth engine, oversupply and general weak sentiment have weighed considerably on both metal prices and mining equities. The first cost cutting to hit the mining industry in this situation is invariably focused on exploration, especially expenditure on greenfield exploration. Many companies in the sector are saddled by a considerable debt burden built up due to over-leveraging during the last commodities bull cycle, necessitating an inward-looking focus on servicing debt, attempting to maintain dividends, cost optimisation, project disposals, and of course drastic cuts in exploration expenditure. These actions effectively focus on short-term preservation, but are damaging the long term sustainability of the industry by disrupting the exploration pipeline. This however, has created an "exploration arbitrage" situation where agile, debt-free explorers with vision and funding can take advantage of mispriced high quality exploration opportunities.

### ...enter FinnAust

FinnAust has concentrated on building a substantial land-bank of projects in safe jurisdictions with high geological prospectivity. This immediately insulates investors from some of the political / sovereign risks encountered in other regions such as West and Central Africa, and South America. In only the last ten years, both Finland and Greenland have opened their doors for exploration by foreign entities, offering opportunities to apply new technology and advances in exploration techniques. Furthermore, climatic changes in Greenland have caused the ice-sheet to retreat, exposing new areas for exploration for the first time.

FinnAust has adapted to the weak market conditions for junior resource companies to focus on options to drive near-term cash flow. Building the exploration portfolio now, should ensure that the company is well placed when commodity markets rebound. The present focus is on Greenland to drive shareholder value, with the company's Finnish projects being maintained in a low expenditure state, until markets improve. The new focus on titanium is a sensible strategy in our view, with titanium considered to be a "quality of life product" a metal linked to GDP growth, urbanisation and with a strong correlation with disposable income and end-use demand such as 3D Titanium printing, vehicles, alloys and light weight frames, white goods, house paint and tiles, all likely growth areas, in our view.

## **Board and Management**

### **Board**

#### **Graham Marshall - Non-Executive Chairman**

Graham Marshall has spent over 25 years as a senior executive in the mining and engineering industries and has held directorships and senior management positions with a number of public and private companies, including Pacific Ore Limited (ASX:PSF) and West Peak Iron Limited (ASX:WPI). He is currently the general manager - commercial at Western Areas Limited. Mr Marshall has extensive commercial, corporate services and project development experience and holds a Diploma of Project Management.

#### **Rod McIlree - Managing Director**

Mr. McIlree has more than 20 years of experience in both the resources and financial sectors. Rod worked initially as an exploration geologist for global mining houses before migrating to the financial and advisory industry where he worked as a mining analyst and corporate adviser to listed exploration and mining companies with projects across a broad spectrum of commodities and countries.

Rod was a key member of the teams responsible for several successful mining companies with assets in frontier jurisdictions, including but not limited to, Medusa Mining, Anvil Mining, and Kingsrose Mining. He was the founder and Managing Director of ASX listed Greenland Minerals and Energy Ltd and is currently a Non-Executive Director of AIM listed Noricum Gold Limited.

#### **Dan Lougher - Non Executive Director**

Dan Lougher is a qualified Mining Engineer with over 30 years' experience in all aspects of resource and mining project exploration, feasibility, development and operations. Mr Lougher has developed a significant corporate network in the financial and mining community both in Australia and internationally. Mr Lougher is a director of Mustang Minerals Corporation and CEO of Western Areas Limited, the ASX-listed nickel producer. Mr Lougher is a member of the Australasian Institute of Mining & Metallurgy.

#### **Greg Kuenzel - Non-Executive Director**

Greg Kuenzel holds a Bachelor of Business Degree and is a member of the Institute of Chartered Accountants in England and Wales. He has extensive experience in providing accounting and corporate advice in a diverse range of industry sectors including mining and resource development in the UK, USA and Australia. Mr Kuenzel is currently Chief Executive Officer of AIM listed Noricum Gold Limited, with operations in Austria.

### **Senior Management**

#### **Urpo Kuronen - Chief Operating Officer**

Mr Kuronen worked as a geologist for Outokumpu company in various positions for over 20 years. In 1995 he was appointed as an Exploration Manager of Outokumpu Mining Australia Pty Ltd in Perth and joined FinnAust Mining Management Oy in 2011.

#### **Garth Palmer - Company Secretary**

Garth Palmer holds a Bachelor of Commerce Degree and is a member of the Institute of Chartered Accountants in Australia. Mr Palmer began his career at Horwath Chartered Accountants in Perth (now part of BDO) in the audit and corporate services division before moving to KPMG's audit and risk advisory team. Mr Palmer has been working with AIM listed companies, predominantly within the mining and resources industries, providing corporate and financial consulting services.

## Mineral Sands Industry Leaders Add Expertise

In February 2016, FAM appointed independent experts Mr. Peter Waugh and TZ Minerals International Pty Ltd ("TZMI") to assist in the company's strategy to rapidly assess the near term production potential of the Pituffik Titanium Project in Greenland. FAM will benefit immensely from their collective experience in the mineral sands sector, and the appointments also demonstrate FAM's commitment to the Pituffik project and sector.

TZMI is a recognised leader in the provision of accurate and up to date technical, engineering and marketing support within the mineral sand industry with over 20 years' experience in the sector. TZMI's expertise and support will be of great benefit as FAM continues its assessment of Pituffik.

The initial scope of work conducted by TZMI will focus on leveraging the advantageous characteristics of the mineralisation at Pituffik, such as grade, volume and composition, to create cost effective development scenarios that can then be assessed by FAM and potential investors.

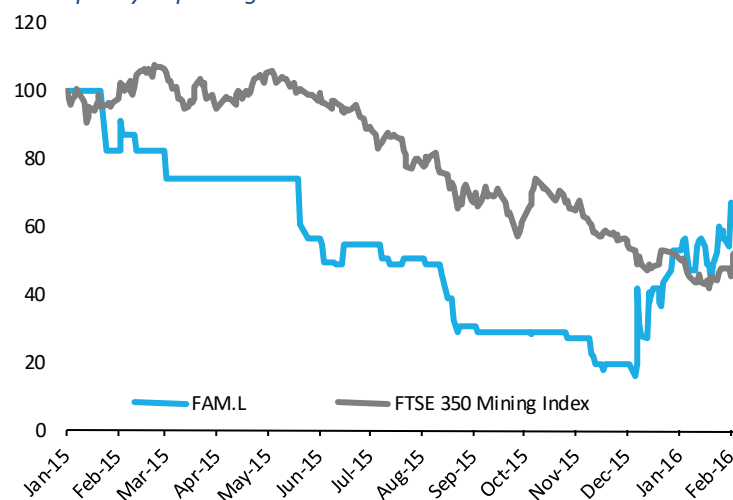
In addition, downstream processing expert, Mr Peter Waugh has also been engaged to further strengthen the back-end of the business. Mr Waugh, a veteran of the TiO<sub>2</sub> industry has broad industry management experience as well as valuable knowledge of the international titanium dioxide pigment industry. He brings over 30 years' experience in the mineral and chemical industries including senior roles such as Technical Director of a major TiO<sub>2</sub> pigment supplier. Mr Waugh will assist with end-user and off-take arrangements as well as timely metallurgical management and advice.

## Share Price Performance

FinnAust's share price has tracked in-line with the wider mining sector, which has displayed considerable malaise, particularly during 2015. Over the last 12 months alone, the FTSE 350 Mining index has lost 48% of its value, compared to only 37% for FinnAust shares. Base metal prices and related equities have been hit especially hard on the back of the substantial falls in metal prices; for example, LME copper and nickel prices are down 36% and 40% respectively over the last two years.

The Blue jay acquisition and related change in strategy appears to have driven a re-rating in the company's shares since December 2015, a positive validation of FinnAust's recent strategy and renewed management focus, in our view.

*Figure 4 –FAM Share price vs FTSE 350 Mining (indexed) – price traction and liquidity improving*



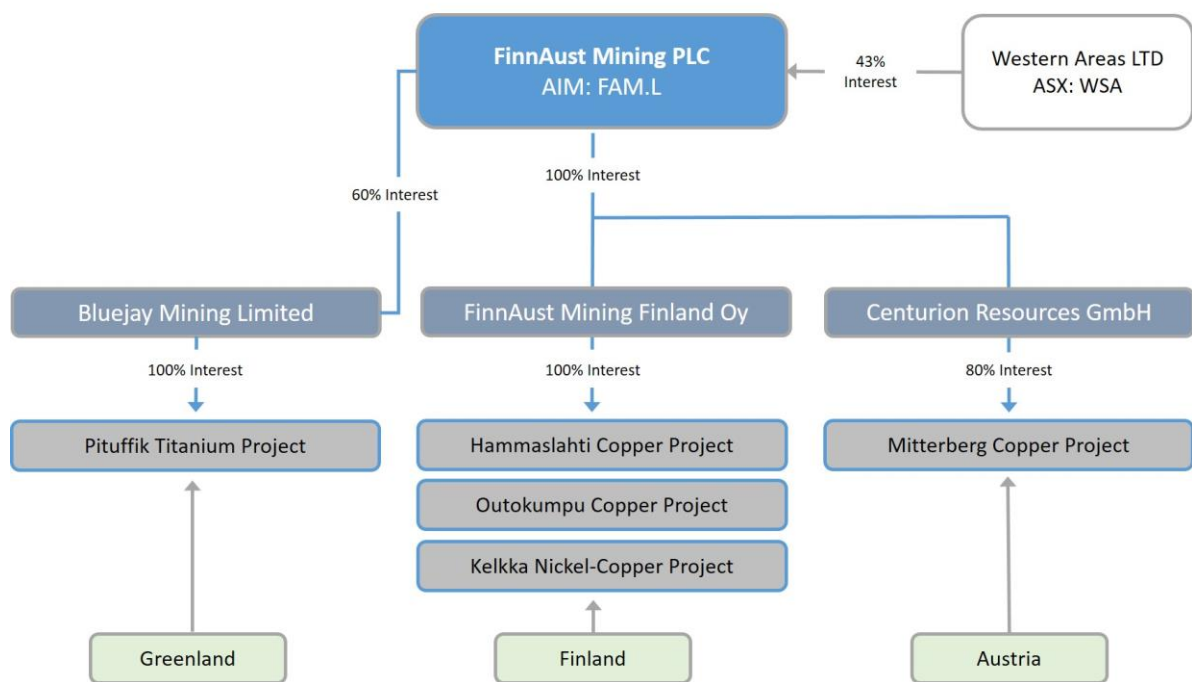
Source: Reuters

## Company Structure

FinnAust has a relatively simple structure. The company is incorporated in England and Wales, with the company's shares quoted on AIM. FinnAust currently holds an effective 60% stake in the Pituffik Titanium project as a result of the acquisition of a 60% interest in Bluejay Mining (a private company) announced in December 2015 (closing Q1 2016). FinnAust retains the option to acquire the remaining 40% of Bluejay mining for £594k to be satisfied through the issue of 108m shares. The company's projects in Finland are wholly owned.

The company initially listed on AIM in November 2012 as Centurion Resources, focused on the Mitterberg project. A year later in November 2013, Centurion acquired FinnAust Mining plc for £7.7m in shares, with the transaction constituting a reverse takeover. As part of the deal, Centurion raised £3.4m to fund exploration of FinnAust's Finnish assets, and subsequently changed its name to FinnAust Mining plc.

Figure 5 - Company Structure (assuming completion of Bluejay Mining acquisition)



Source: FinnAust

## Capital Structure

FinnAust had 295.9m shares on issue as of the end of December 2015. The company's major shareholder is ASX-listed Western Areas Limited holding 60.34%. Once change of control consent is received for the Bluejay acquisition from the Greenlandic authorities, consideration and placing shares will be issued. This will result in FinnAust's share count increasing to 429.9m, with Western Areas' interest reducing to c.42.7%. The Bluejay vendors will hold 128m shares, c.30% of the company. Following completion of the placing and acquisition, free float will be approximately 30% excluding the holdings of the vendors of Bluejay and Western Areas. FinnAust Management will hold c.16%, post Bluejay transaction.

Equity dilution has been well managed over the years with only limited raisings undertaken for specific strategic objectives. Major placings include; £1m on admission to AIM in November 2012 (at 1p/sh); £200k in July 2013 (at 1p/sh) for evaluation of European opportunities; £3.4m in November 2013 in conjunction with the FinnAust acquisition with proceeds for Finnish exploration (at 5p/sh post 1:10 consolidation); £1.1m in October 2014 (at 2.25p/sh) to accelerate drilling at Hammaslahti; Importantly in December 2015 as a strong show of support for the company both Western Areas Ltd and the current management team invested £200k at 2p/sh (a >250% premium to the then share price of 0.45p). The completion of this placement will occur upon Greenlandic regulatory approval for the change of control aspects of the transaction.



## Western Areas: Cornerstone Shareholder

Western Areas Ltd (ASX: WSA) being a major shareholder is a considerable positive, in our view, providing a wealth of technical and development expertise, plus WSA has a track-record of supporting FinnAust in fund-raising. Western Areas is one of the success stories of the Australian mining scene, having been built from a \$5m IPO in 2000, to a market capitalisation of over \$1bn at its peak in 2014. Western Areas produces c.25ktpa Ni, and is a debt-free dividend payer (3.5% yield in FY15) with a robust balance sheet (cash of A\$38m at the end of December 2015).

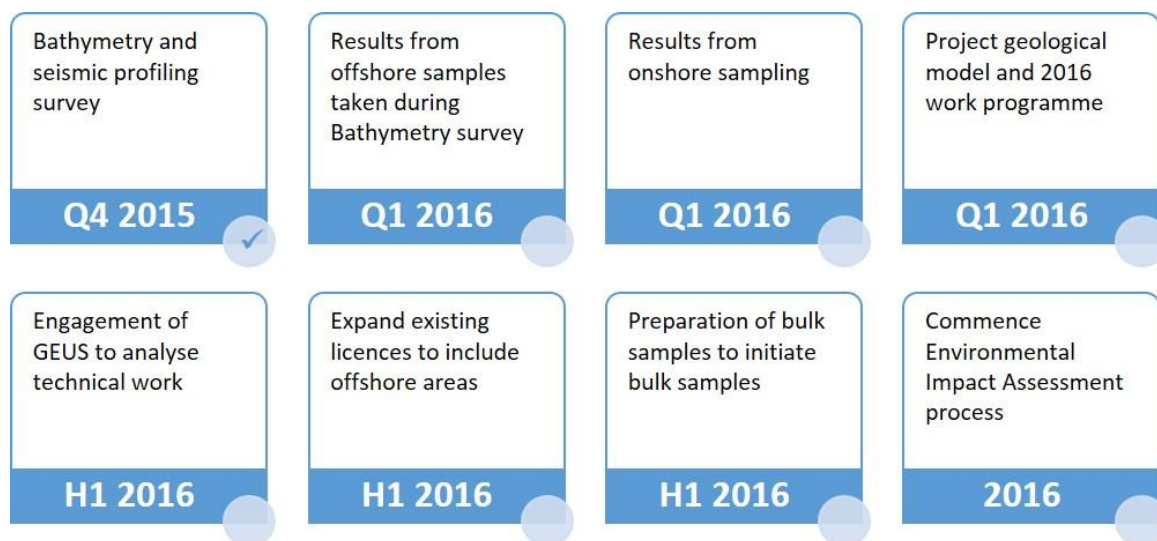
Production is built around two of the highest grade underground nickel mines in the world, Flying Fox and Spotted Quoll, both within Western Area's Forrestania project area in Western Australia. WSA is one of the nickel industry's lowest cash cost producers. An impressive partner for FinnAust, in our view.

## Short-term work programme in Greenland

FinnAust is focussed on determining the nature and extent of the Pituffik deposits in order to generate initial proof of concept bulk samples with the aim of ultimately generating cash flow. The aim is to create a company capable of self-funding exploration on its projects. With this in mind, FinnAust has set out a three to six-month strategy as set out below.

We expect increased news flow in 2016 largely focused on Greenland as results start to flow in from various sampling programmes conducted during the 2015 field season. The company's longer term strategy is to deliver proof of concept production by 2017. We do not expect much material news flow from the company's Finnish assets until FinnAust makes a decision to re-start exploration in the country.

Figure 6 - FinnAust's near-term strategy focusing on Greenland



Source: Adapted from FinnAust presentations



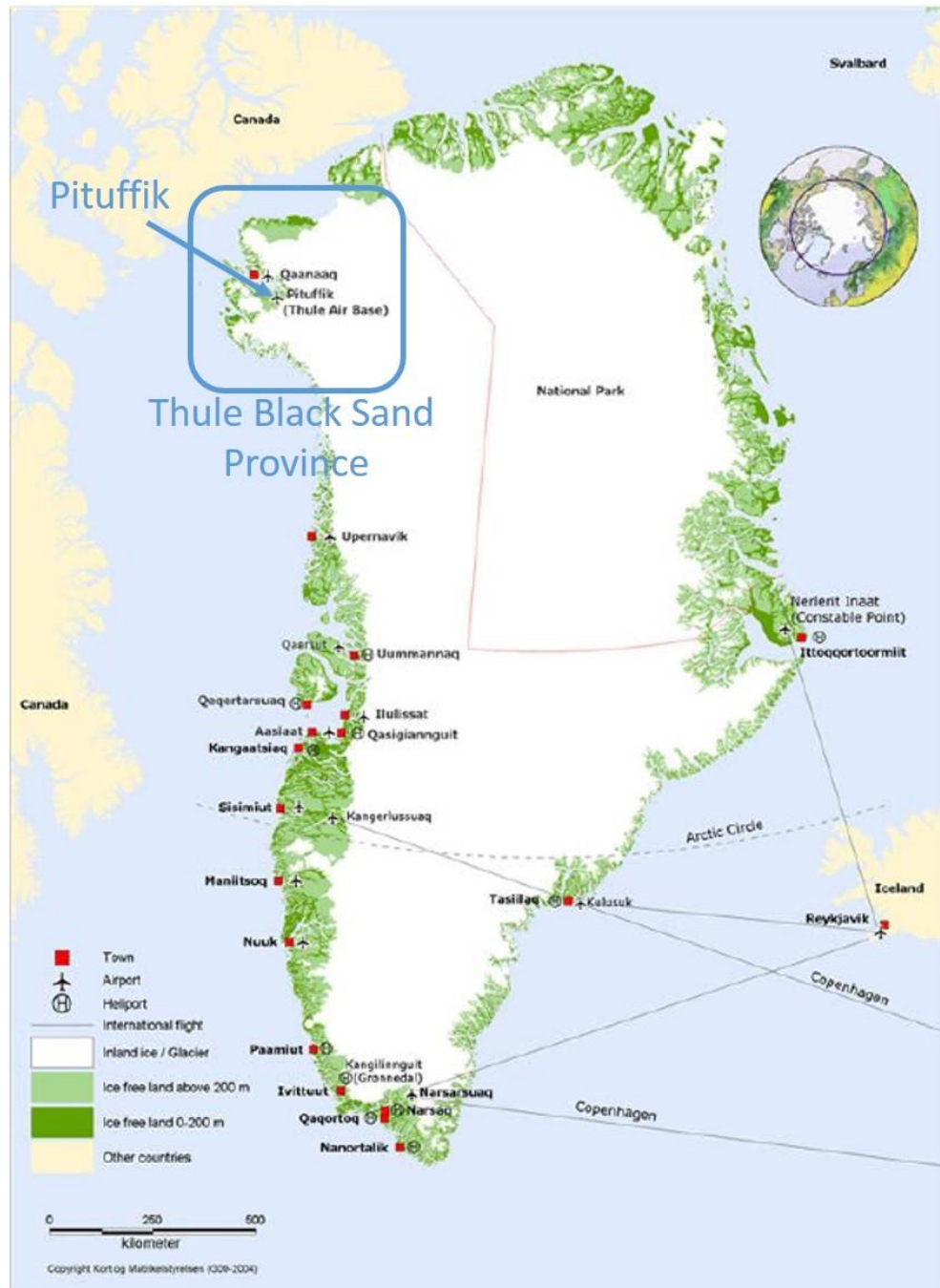
# Pituffik Titanium Project

Pituffik Titanium is an early-stage exploration project, comprising a series of licences in north west Greenland. The project is located in the Thule Black Sand Province, where significant accumulations of ilmenite-rich sands have been identified. Ilmenite ( $\text{FeTiO}_2$ ) is the primary feedstock mineral for the titanium industry.

## Location – The High Arctic

Pituffik is located in north west Greenland, centred on the settlement of Moriusaq, approximately 1,225km north of the Arctic Circle at 77° N. The project sits on a peninsula known as Steensby Land.

Figure 7 - Location Map – Pituffik and the Thule Black Sand Province

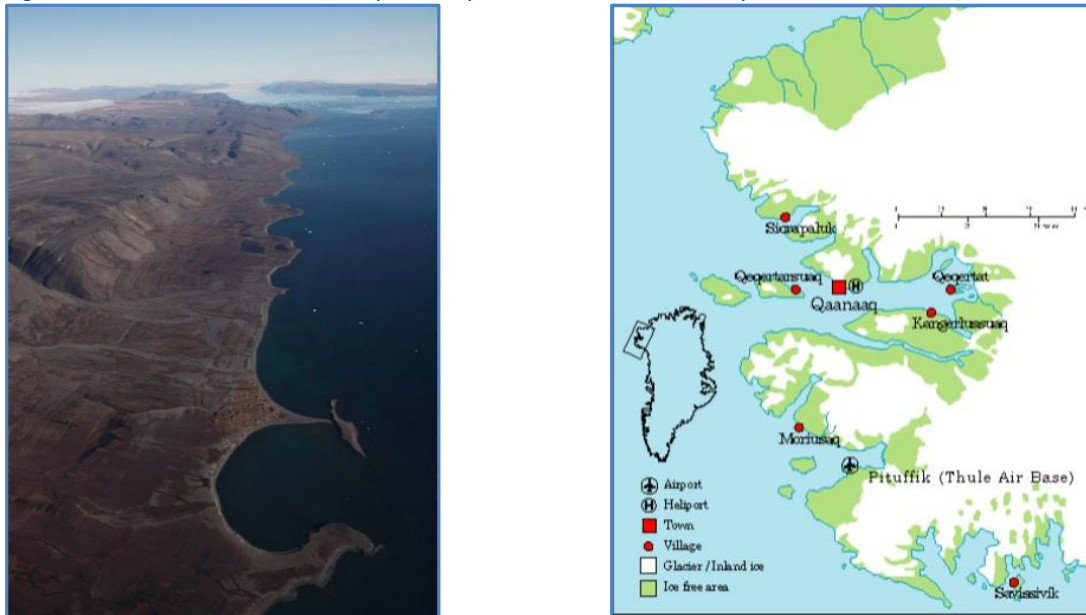


Source: GEUS

## Infrastructure – Remote but accessible

Despite being located in a remote region of Greenland, the Pituffik project benefits from being located 42km from Thule Air Base, a US Air Force airbase. Primary air access to the project is either via Thule Airbase which has a 3,000m runway, or the civilian airport at Qaanaaq. Air Greenland services Qaanaaq by plane and helicopter and the settlement can be accessed twice a week from Copenhagen. It is possible to access the area from Thule Air Base, although a permit is required and it is not open for regular passenger traffic. Thule's North Star Bay is also home to northernmost deep-water port in the world.

*Figure 8 – Location – near to a deep-water port and international airport*



Source: GEUS, FinnAust

It should come as no surprise that the climate is rather cold and harsh, and although this presents a variety of challenges and additional costs associated with operating in the high Arctic, it is not an outright barrier to development for quality projects in the region, in our view. It does however mean that the annual operating window is rather short and shipments of ilmenite product would not be possible in mid-winter.

### Shipping possible for five months per year

Profound change is occurring in the high arctic with the effects of climate change being most pronounced in this part of the world. 20 years ago these areas were only accessible for between 2-3 months of the year, now its more like 6. An independent report published November 2015 by globally recognised SRK consultants suggests that ice-class ships could access Moriusaq for up to five months per year as singular vessels with potential to increase that number to 7 utilising arctic tugs from the nearby base. The climate is classed as “Polar Tundra”, with the ground affected by permafrost and only the top metre thawing in summer. Whilst this may present an issue for traditional mining projects, it is likely to be less of an issue for a mineral sands operation such as Pituffik which would potentially mine active beaches, or shallow off-shore. Temperatures vary from -29°C in January to +8°C in July. The sun stays below the horizon from late November to February, but then stays above the horizon 24 hours a day from May to August.

There is little in the way of population in the area and the local settlement of Moriusaq has officially closed and all inhabitants have left, most of whom have moved to Qaanaaq. It is worth noting that Moriusaq still has all of the infrastructure associated with a remote such as power station, internet, communications network and housing, all of which can be quickly and cheaply brought back into operation for minimal cost via the government. This illustrates that critical basic infrastructure and services could be up and running quickly and for low cost.

## Licences – Low holding cost

FinnAust, through Bluejay Mining, holds an Exploration Licence with Exclusive Exploration Rights over the ground constituting the Thule project. The licence covers 126km<sup>2</sup> and is divided into three sub-areas; A, B and C. The licence is valid for a period of five years until December 2019 and it is possible to renew a licence for up to a maximum of 22 years, giving the company more than sufficient headroom to thoroughly evaluate the area. The licence covers exploration for all minerals except hydrocarbons and radioactive elements.

Following the adoption of the *2009 Act on Greenland Self-Government* by the Danish Parliament, Greenland has legislative and executive powers in the area of mineral resources, through a number of sub-agencies including the Mineral Licence and Safety Authority (MLSA) and the Ministry of Mineral Resources (MMR). The MLSA issues three types of licence: Prospecting, Exploration, and Exploitation. There is an annual minimum expenditure obligation attached to the exploration licence. The amount payable is a function of the number of years that the licence has been held and the total area of the property. The expenditure requirement is not too onerous, being DKK 358k (£37k) in year one, and only increasing to £137k in year 5, assuming no reduction in the size of the property.

The next permitting step if Pituffik is advanced would be an application for an Exploitation licence, which is granted for a commercially viable deposit where a BFS has been submitted and an Environmental Impact Assessment (EIS) has been approved. Exploitation licences are granted for a period of up to 30 years.

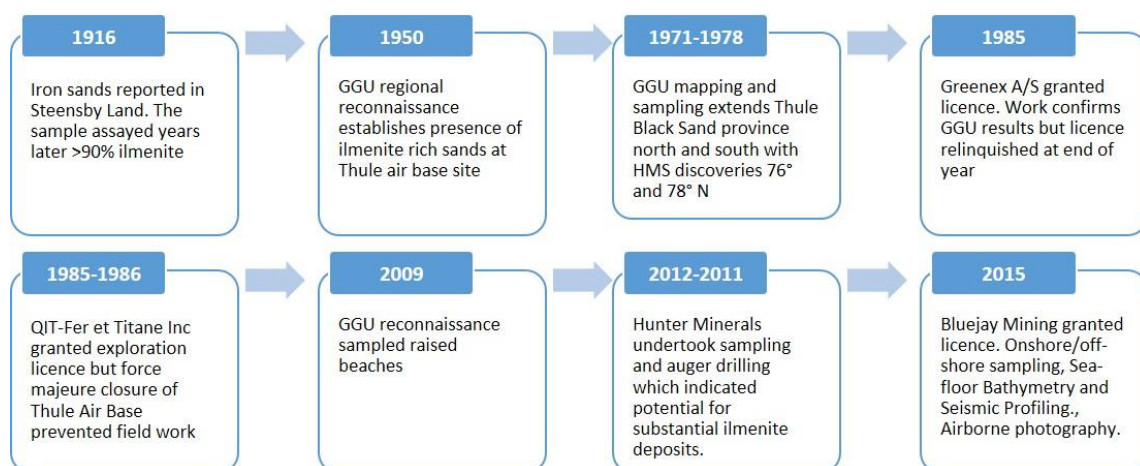
### Amending the licence to include off-shore would be a major fillip

Under current legislation, an exploration licence is only valid for on-shore land areas unless a specific allowance is noted. Under the standard terms for exploration and prospecting licences in Greenland", section 2 on Licence area, it says that: "Normally a licence area includes only land areas, but sea areas to a certain depth may upon application be included". FinnAust is in discussion to amend the licence with regulators, who do not regard this as an issue. This view is supported by the fact the company have been allowed to undertake off-shore surveying. Given the potentially higher grades and larger volumes of ilmenite bearing sands thought to exist in the shallow marine and active beach zone, a successful amendment would be a significant result for FinnAust.

## History – A long history but relatively underexplored

Ilmenite bearing sands were first identified in the Thule Province in 1916, with exploration work undertaken by several parties over the last 40 years. However, FinnAust is the first owner to undertake a comprehensive programme focused on commercial development opportunities, and we view the licence as relatively underexplored. In particular, FinnAust is the first company to undertake Bathymetry, the results of which have highlighted large volumes of high-grade ilmenite sediments in the shallow marine environment.

Figure 9 - Exploration history of the Thule Black Sand Province



Source: FinnAust, Hunter Minerals, GGU, SRK

## Regional Geology – basaltic dyke swarm the source

The Thule region is covered by an ice-sheet but rocks outcrop up to 50km from the coast.

The general regional geology of the Thule District is dominated by a Precambrian gneiss-supracrustal rock complex unconformably overlain by the Meso-Neoproterozoic Thule Supergroup, a middle to late Proterozoic Basin. The Precambrian rocks extend across from Canada and are largely composed of high-grade Archean-Palaeoproterozoic crystalline basement (2.7-2.9Ga).

The Thule Supergroup dips shallowly to the southwest and is comprised of an un-metamorphosed and undeformed sedimentary and volcanic succession which is cut by prominent basaltic and sills and dykes.

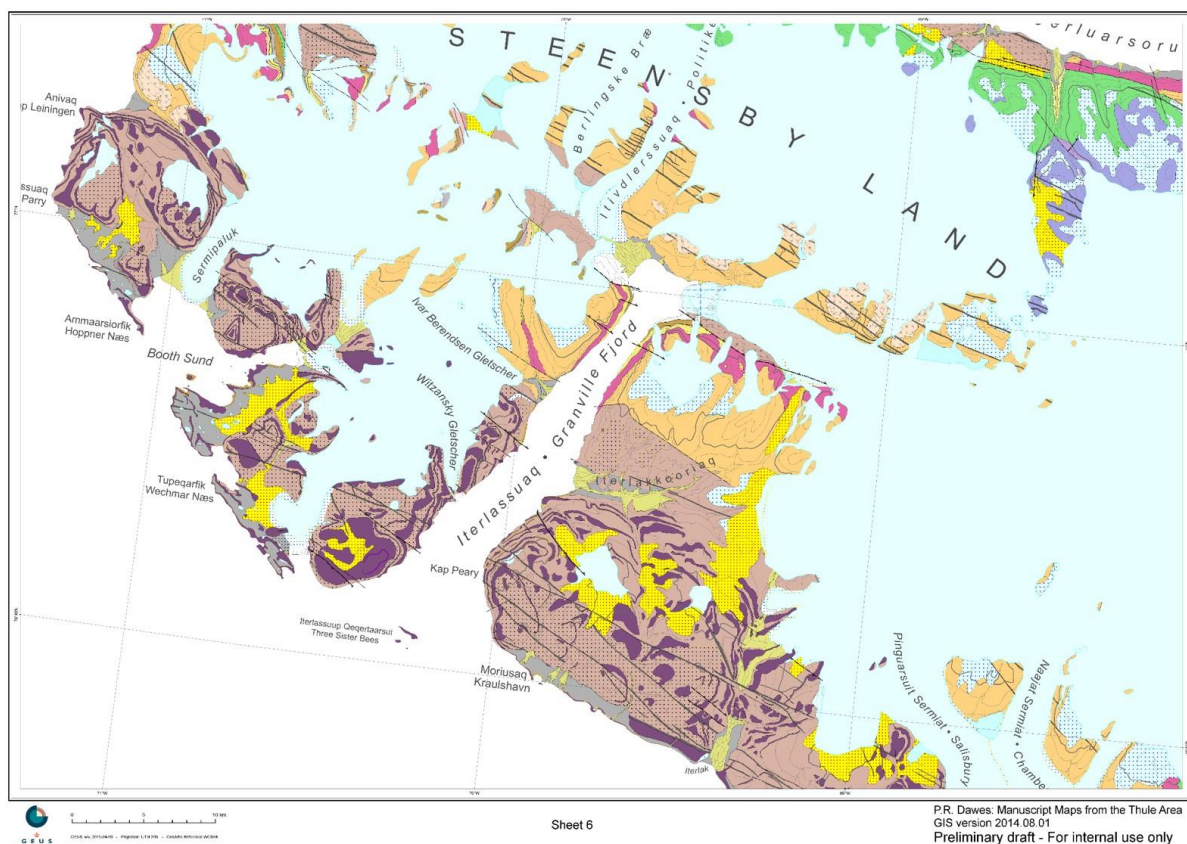
### Extensive dyke swarm the source of titanium

The key takeaway from a regional view point is the intrusion of the basaltic dykes into the Thule Supergroup. These regionally extensive dykes belong to two distinct swarms; the Melville Bugt Dyke Swarm (1.1-1.0Ga) and the later 750-650Ma Thule Dyke Swarm (“TDS”).

It is important to note that the TDS dykes and sills have a high titanium content, reported to be as high as 6% (Dawes, 1989), representing some of the most titanium enriched basalts in the whole of Greenland, with the highest grade material from the entire region identified at Pituffik.

These titanium rich basalts comprise as much as 50% of the total Thule Supergroup stratigraphy in coastal areas, with sills and dykes having been mapped up to 100m and 150m thickness respectively. This is encouraging as it suggests that the area has the potential to host significant accumulations given the pervasive nature of the high-titanium bearing basalts.

Figure 10 - Regional Geological Setting



Source: FinnAust



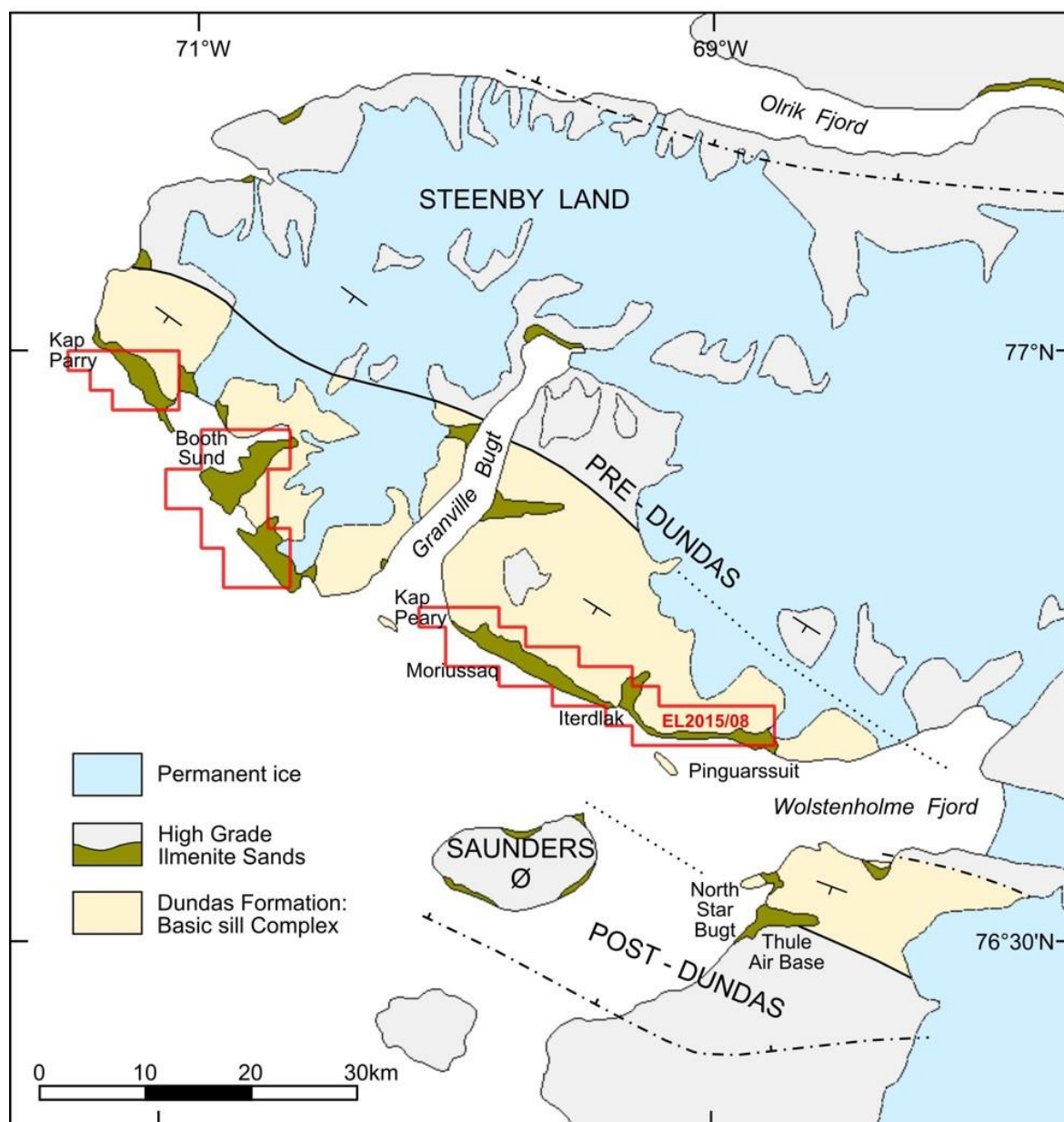
## Local Geology and Setting – Coastal targets

Locally, the Thule Supergroup rocks in the Steensby Land area that host the Pituffik project are dominated by the Dundas Formation, a thick 2-3km sequence composed of sandstone, siltstone and shale with minor carbonate, chert and evaporates.

The important area to focus on in the figure below is the 80km long south-west Moriussaq coast of Steensby Land which constitutes the Thule Black Sand Province. The raised beaches and marine deposits are represented by the black shaded areas in the map.

The Pituffik project area is dominated by an extensive, flat coastal plain, with a maximum elevation of 60m. Raised beaches can be found for a distance of 3km inland.

Figure 11 - Setting of the Thule Coastal Plain



Source: GGU, Dawes 1989

## Deposit Model - active beaches and offshore the prize

The ilmenite bearing sands at Pituffik occur in three main settings as detailed below.

- Raised beaches
- Active Beaches
- Drowned Beaches: Near-shore and shallow marine.

The first two settings have been the primary focus historically, but FinnAust has recently started investigating the shallow marine environment, which has the potential to host significant accumulations of ilmenite sands. The ilmenite concentration in the onshore deposits is considerably lower than those obtained in the active beach zone, hence the interest in active beach and off-shore areas. Note that the  $\text{TiO}_2$  content within the individual ilmenite grains in both environments is fairly constant at c. 47%  $\text{TiO}_2$ .

**Raised beaches** typically form flat top benches with distinct frontal scarps. The beaches are up to 1km wide along a 20km coastal stretch with their formation related to glacio-isostatic uplift raised marine and littoral deposits. Hunter Minerals (March 2012) reported that raised beaches sampled in the area returned an average content of 12%  $\text{TiO}_2$  in the sand, within a range of 6-23%. Dawes (1989) found that a grade of 12%  $\text{TiO}_2$  in sand equates to 20% ilmenite.

**Active Beaches** in the area vary in width, but areas of sandy beach up to 10m wide are broken by basaltic outcrops. The ilmenite concentration of the active beaches is considerably higher than the onshore and raised beaches. Historical sampling of current beach lines by GGU (Geological Survey of Greenland) indicated some of the samples richest in black minerals have opaque fractions up to 95%, with more than 70% absolute weight of ilmenite. Hunter Minerals (March 2012) reported that sampling of the active and raised beaches returned grades of up to 60% Ilmenite. Dawes (1989) found that a sand content of 43%  $\text{TiO}_2$  equates to 70% ilmenite in the active beach.

**Near-shore and shallow marine** represent the next focus of exploration. GGU (Dawes 1989) noted that the high-grade sandy beaches appear to extend somewhat seawards below the tide level suggesting considerable potential for heavy mineral sand deposits in drowned beaches. FinnAust has followed up on this theory with considerable success, via a recent Bathymetric survey, covered later in this note.

Figure 12 – Raised Beach



Figure 13 – Active Beach



Source: FinnAust

Note the closed settlement of Moriussaq in the background of the active beach photograph above. Historical sampling and microprobe analysis indicates that the ilmenite compositions from both of the above beach environments are chemically similar. This would bode well from a resource perspective, in our view, if the active beach deposits are confirmed to extend into the drowned beach zone.

## Resource Potential – potentially large resource

### Too early stage for a JORC-compliant estimate...

Pituffik is an early stage exploration project and as such there is currently insufficient or appropriate data available to enable a JORC-compliant Mineral Resource estimate to be compiled.

Although mapping and sampling to date clearly indicates the likelihood of a substantial ilmenite deposit, the thickness of the sands and morphology of the underlying rocks is unknown. Thus, the full extent of both onshore and offshore deposits is unknown, and without an accurate assessment of the total black sand volume, there can be no basis for a resource calculation at this stage.

### ...but the extent of heavy mineral sands is clear

Based on geological work so far and in particular the extent of the raised beaches and deltas identified from aerial photographs and the thickness and extent of sediments identified from recent Bathymetry, it is clear that the potential volume of mineral sands justifies further investigation. Black sands have been noted along the entire coast and based on the potential strike lengths of beach-style deposits, it is not difficult to envisage a substantial resource tonnage. However, we expect FinnAust to work towards defining a more discrete resource based on ilmenite/titanium grades and other practical mining considerations that could support a low capital intensive and low operating cost operation.

### Two primary targets; Moriusaq the first cab off the rank

The beaches and coastal zone around the former Moriussaq settlement and adjacent south-east trending coastline are generally accepted to be the most promising black sand occurrences from an economic point of view, according to FinnAust and The Geological Survey of Denmark and Greenland (GEUS).

FinnAust has identified two primary targets in the area:

1. Moriusaq – the more advanced project and the highest grade based on sampling to date
2. Interlak – a potentially large volume deposit with grade upside

Management plans to advance Moriusaq first by virtue of the fact that the marine environment offers a simpler and lower cost development opportunity. The reason is that it is likely that dredging could be employed to exploit the sands, a relatively low operating cost extraction technique commonly employed in the mineral sands business.

*Figure 14 – Moriusaq - advanced and high grade*



*Figure 15 – Interlak – large volume and grade upside*



Source: FinnAust



### Grade – High ilmenite concentration but TiO<sub>2</sub> content of the ilmenite is rather low

Initially, the two main parameters of interest for a mineral sand deposit such as Pituffik are the heavy mineral grade (in this case this essentially means the ilmenite percentage as Pituffik's mineral assemblage is ilmenite dominated) and then the TiO<sub>2</sub> content of the individual ilmenite grains. Zircon, Rutile and Leucoxene content is either negligible or has not been outlined, and thus the focus is firmly on ilmenite for this project.

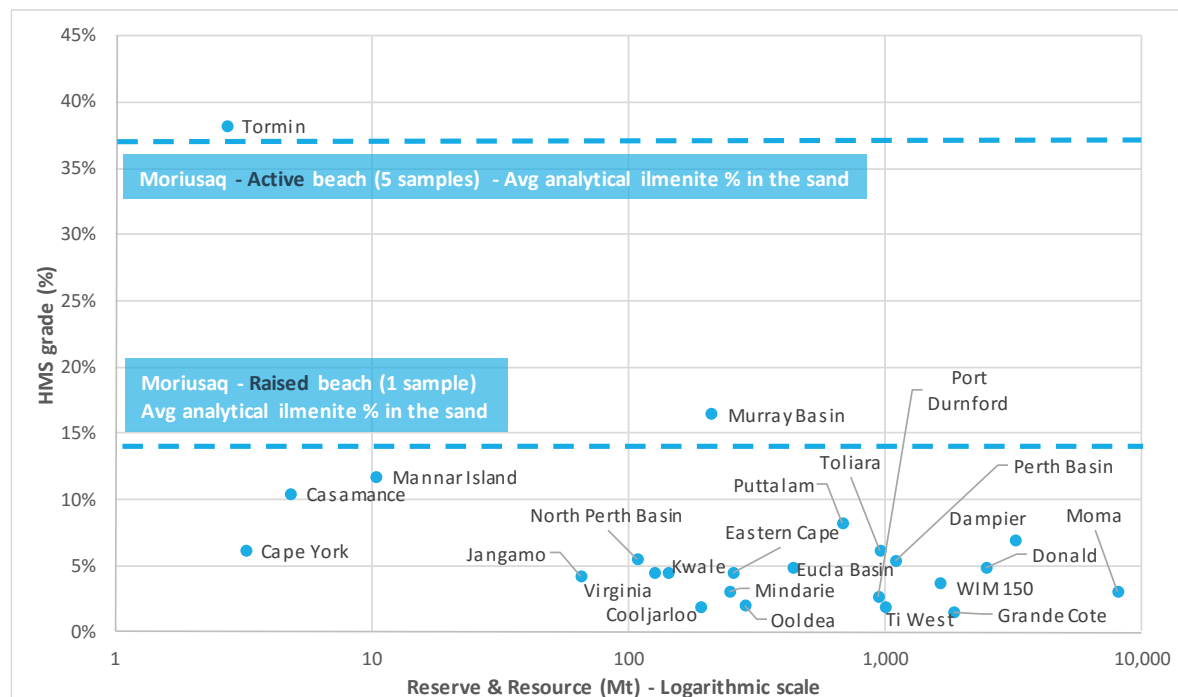
- **Heavy Mineral Grade.** In terms of heavy mineral (opaque fraction), largely ilmenite in this case, the grade of sand sampled at in the Moriusaq is extremely high grade with reference to current global mineral sand projects. The highest grades encountered in sampling so far are an opaque fraction of 95% with c.73% absolute ilmenite (GGU, Dawes 1989). Analysis of Moriusaq sand samples by Qit-Fer et Titane in 1995 indicated an average ilmenite content of 37.2% from active beach samples, and 14 % ilmenite from a raised beach sample.
- **TiO<sub>2</sub> content of the ilmenite.** Early microprobe analysis by GEUS in 2015 indicated that the TiO<sub>2</sub> content of the ilmenite does not exceed 50%, but it did indicate that it is very constant at about 46-48% wt.% for ilmenite grains taken from heavy mineral concentrates from both uplifted and active beaches.

### Overall potential HMS grade stands well above peers

The relatively low TiO<sub>2</sub> content of the ilmenite means that it is likely that a concentrate from Pituffik would not be classed as a high-grade feedstock (specifications typically >c.55% TiO<sub>2</sub>), being more suitable for production of a high TiO<sub>2</sub> slag, or direct use in the sulphate process as currently being employed in China and Norway. Direct use in the sulphate process would potentially generate the greatest revenue.

The high overall heavy mineral sand (ilmenite) grade is a distinct advantage for producing a concentrate at a relatively low cost. For more on chemical composition, deleterious elements and potential saleability refer to the section on processing options later in this note.

Figure 16 - HMS Grade /Resource Tonnage plot for currently active mines – Pituffik grade stands out



Source: Adapted from SRK (2015)

Note: Data for active mines is % total HMS in ore

Moriusaq data is grade only and based on the average % of analytical ilmenite in sand samples for active beaches (5 samples: 33%, 42%, 60%, 39%, 12% ) and raised beach (1 sample, 14%) used as a proxy for total HMS content of the sand. Data from Dawes (1989) and Cosette (1985).

### **Tonnage – supporting a small high-grade operation makes sense...**

After reviewing the data and work so far, we believe that a sensible strategy would be to initially outline a smaller resource given the potential scope and extent of deposits in the area. It would be a better use of company funds to delineate a high-grade resource capable of supporting a smaller low-cost mining operation. With a lower barrier to entry in terms of capital expenditure and opportunities for nearer term cash flow, this may potentially help subsidise further exploration and evaluation work.

No detailed historical estimate of potential tonnage exists although GGU (Appel 1991) estimated a potential tonnage at Moriusaq alone of 80Mt based on the aerial extent of beaches and an assumed 2m sand depth. Clearly, this could be a rather conservative estimate if the depth to bedrock is found to be greater. In this regards, the true depth of the black sand deposits, especially in the raised beach area, are largely unknown due to previous operators not having the appropriate auger to penetrate beyond 1 metre. As such, it is possible to envisage that even simplistic volumetric calculations using an assumed specific gravity, based on the extensive strike length and even a moderate depth assumption, could potentially yield a substantial resource, and this does not even take account of off-shore deposits.

### **...Off-shore could be a game-changer**

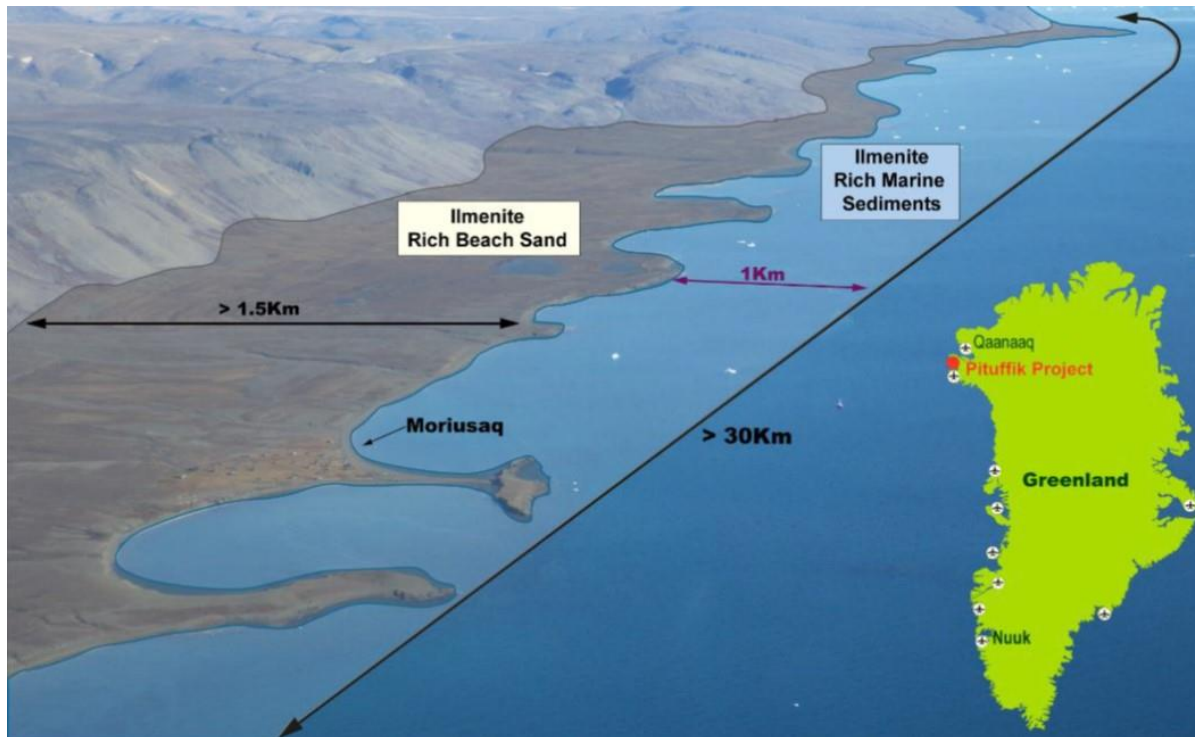
A recent bathymetry survey by FinnAust indicated the potential for large volumes of ilmenite rich sediments in the shallow marine environment with prospective sediments identified over 30km in length and 1,000m in width, with sedimentary horizons on average more than 5m thick and up to a maximum thickness of 27m. Refer to the section on Bathymetry results later in this note for further detail.

The results appear to confirm previous estimates that the palaeo-sea surface was located 35m below present day, leaving significant scope for drowned fossil beaches. Evidently, inclusion of off-shore deposits could materially increase the contained tonnage of a resource estimate.

## Moriusaq – the primary focus

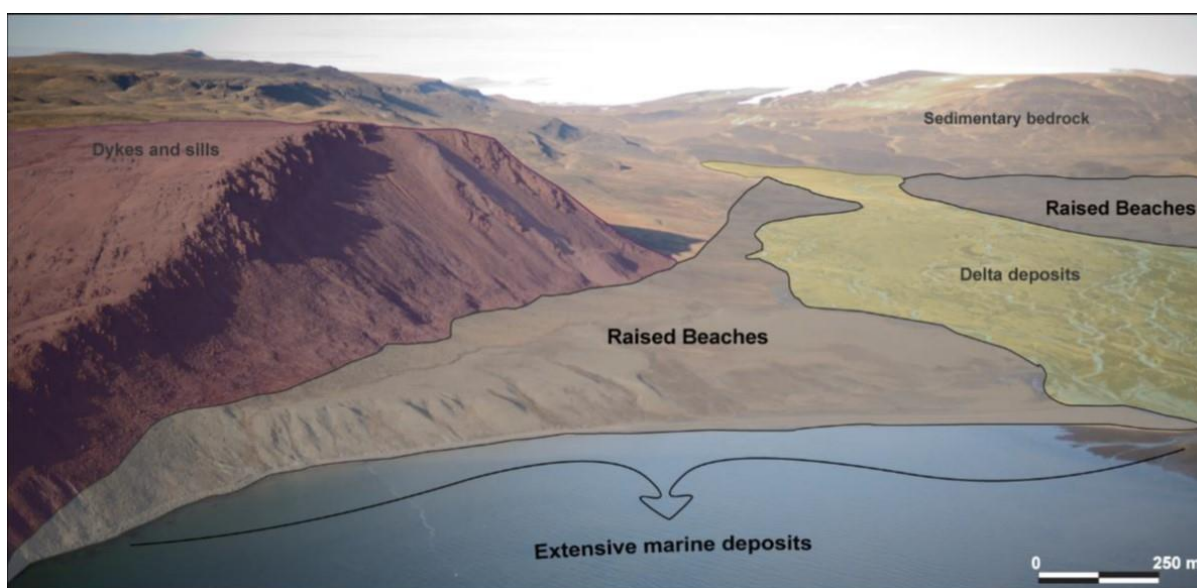
As detailed above, Moriusaq represents FinnAust's primary exploration target for the upcoming 2016 field season. There are two key areas to the Moriusaq deposit; the drowned beach and extensive marine deposits (underwater) and the raised beach (above sea level). Moriusaq has been the main area of interest by previous owners and GEUS. Results from FinnAust's 2015 field programme continue to demonstrate the extensive and high grade nature of the onshore accumulations of ilmenite. Note the lack of ice cover in the photographs below.

Figure 17 - Moriusaq – Drowned, active and raised beach targets – notice the 30km strike of ilmenite sands



Source: FinnAust

Figure 18 - Moriusaq – Raised beach target – note proximity to basaltic source rocks

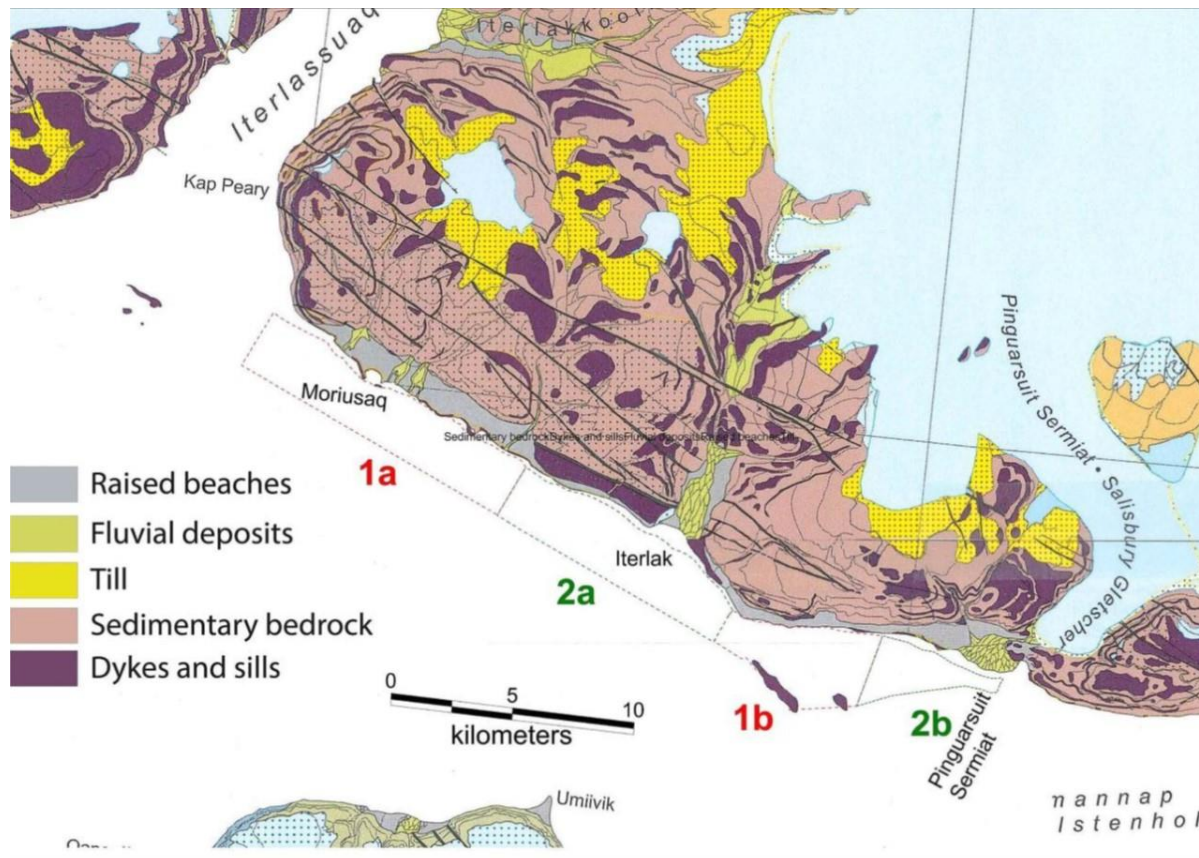


Source: FinnAust

## Bathymetry Survey (2015) – significant off-shore potential

In late 2015, FinnAust contracted GEUS to complete a seafloor bathymetry and boomer profiling survey over the moderate to shallow waters adjacent to the shore at Pituffik. This survey, part of a broader exploration programme, was designed in conjunction with an offshore grab sampling programme, also conducted by GEUS, focused on mapping the offshore sediments and testing for deposits of heavy mineral sands.

Figure 19 - Moriusaq – Drowned beach target – notice the 30km strike length of ilmenite sands



Source: GEUS, FinnAust

The aim of the survey was to map the seabed bathymetry and the potential thickness of submerged beach sand in the nearshore survey area at a water depth of <40m. The survey was completed along the coast adjacent to the closed settlement of Moriusaq in northwest Greenland. A total of 300km of surveying was completed with the line spacing being between 150m and 250m, the trace of which can be seen in the figure below.

Figure 20 – Survey track lines

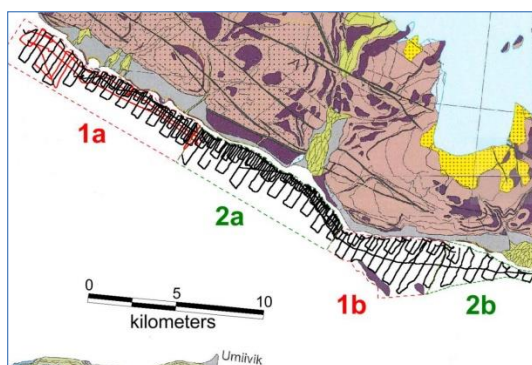


Figure 21 – Survey underway with closed town of Moriusaq in background



Source: FinnAust, GEUS

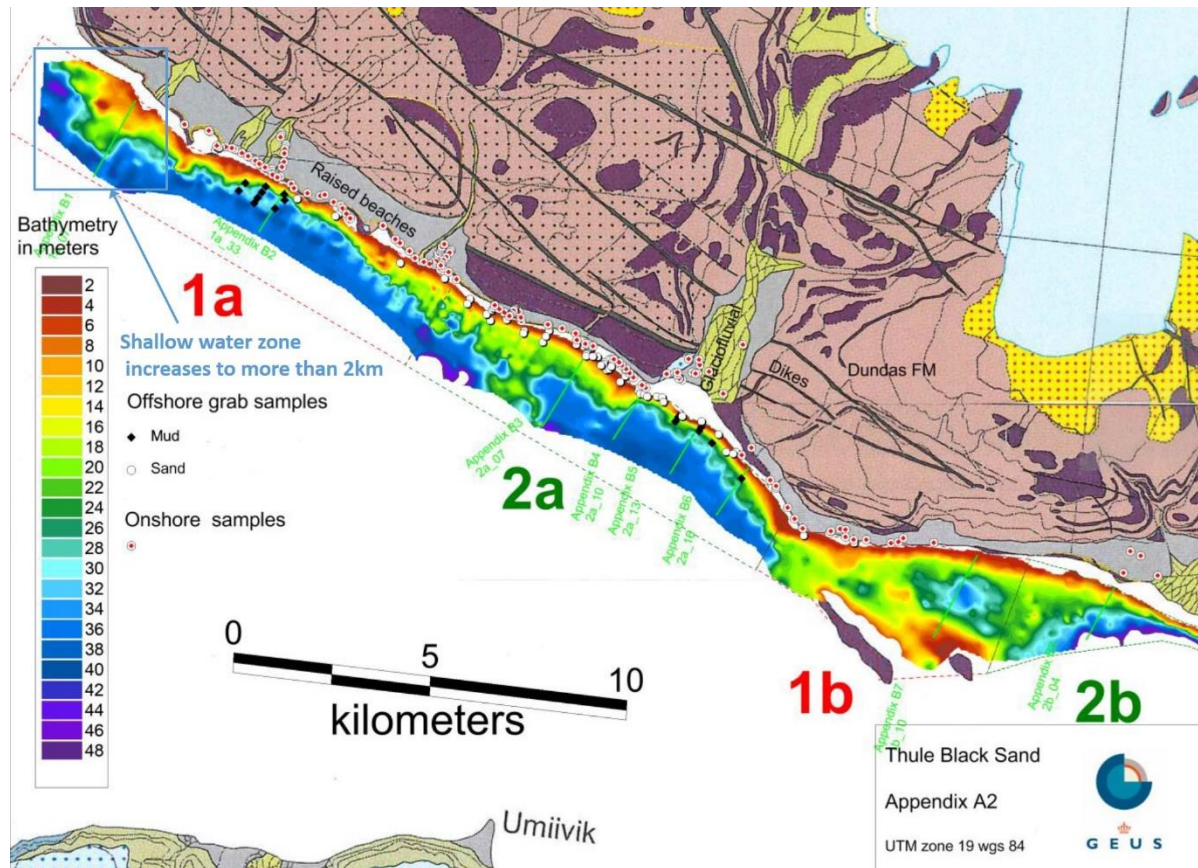


## 2km shallow zone off the coast of Moriusaq

Bathymetric measurements were made with a Transducer echo sounder to centimetre accuracy. The bathymetric map shows in general that moderate depths of water (30m) are reached at distances of 1km to 2km from shore. In area 1a, the central offshore area is dominated by a narrow zone with shallow water.

In the westernmost area close to Moriusaq, the shallow water zone increases to more than 2km and water depths of only a few meters are found in some small areas. This represents a key focus area for FinnAust's work programme in 2016.

Figure 22 - Bathymetrical map of the survey area



Source: GEUS, FinnAust

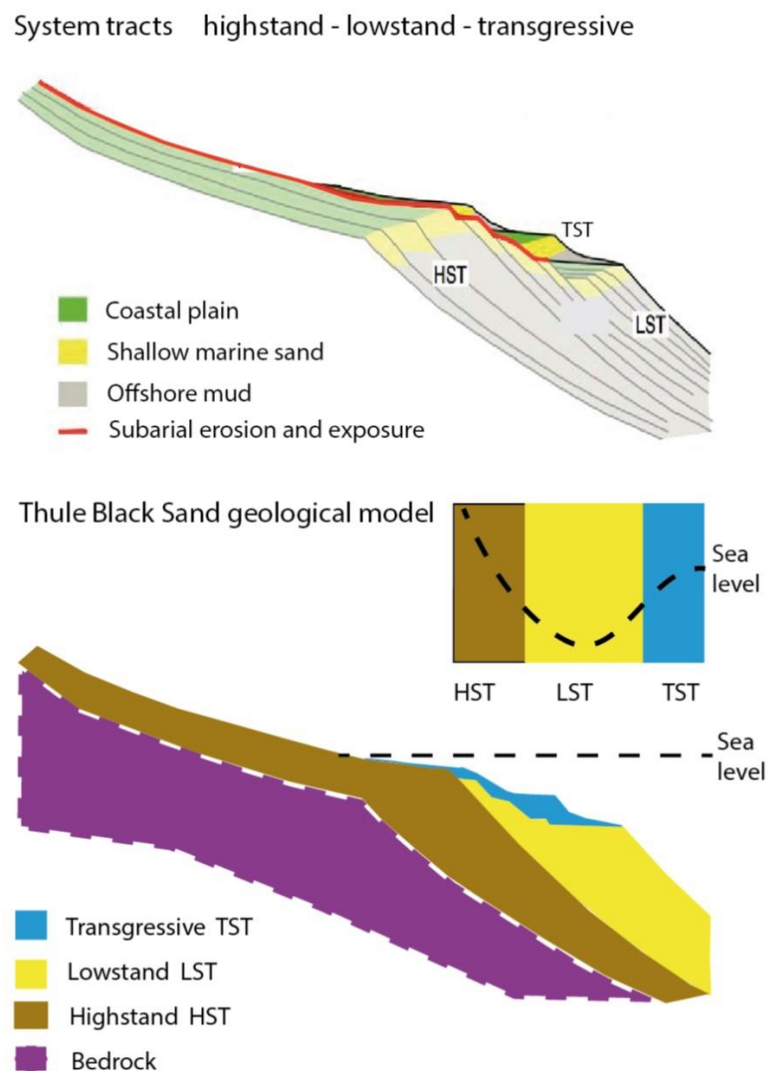
## Acoustic mapping pin points target units

Acoustic mapping to determine the thickness of potential offshore heavy mineral sand deposits was completed via C-boom survey. The C-boom system comprises a seismic source and a mini-streamer that can penetrate up to 20m into the seafloor.

Given that potential black sand resources are expected to be found in the coastal plain and in the shallow marine sand zones, the zone from 30m above present sea level to 30m below present sea level is a potential target area. Interpretation of the acoustic mapping data has resulted in the identification of four distinct stratigraphic units:

- **Transgressive** - water depths of <20m. The youngest unit, proven to host heavy mineral sands
- **Lowstand** – observed at water depths of >20m, a characteristically sharp lower unconformity boundary is characteristic for the unit. Proven to contain heavy mineral sands.
- **Highstand** - observed at water depths of >30m, the earliest unit, resting on bedrock. Heavy mineral potential virtually untested.
- **Sedimentary bedrock** – forms the basement which is a well-defined seismic reflector

Figure 23 - System tracts and major stratigraphic units

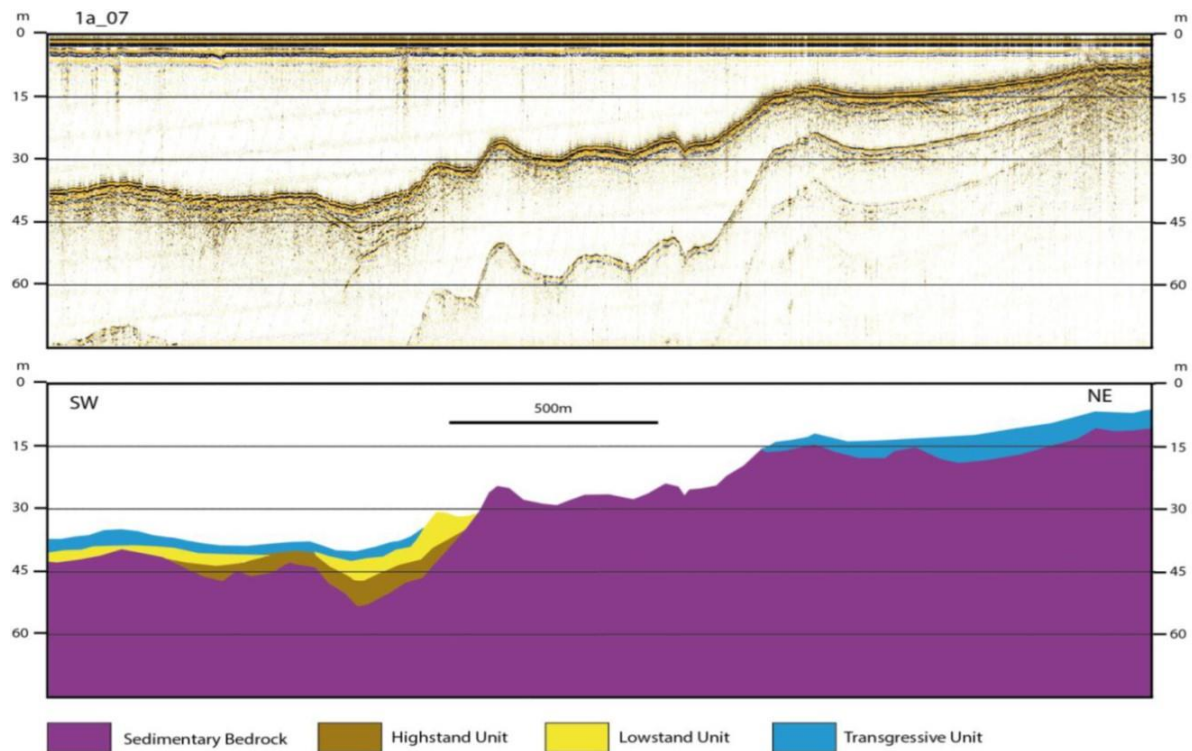


Source: GEUS (Jenson et al, 2015)

## Bathymetric Results – extensive off-shore mineral sands identified

The results of the survey suggest that the shallow marine environment contains significant amounts of ilmenite-rich sediment, effectively a new discovery for FinnAust, increasing the resource potential of the entire project by an order of magnitude, in our view. The section line below, adjacent to Moriusaq, indicates a transgressive heavy mineral sand-bearing unit from shore to a depth of around 15m. Visual estimates of ilmenite in sediments in this area indicate that results of up to 65% can be expected, according to FinnAust.

Figure 24 - Section line 1a\_07 through the shallow zone at Moriusaq

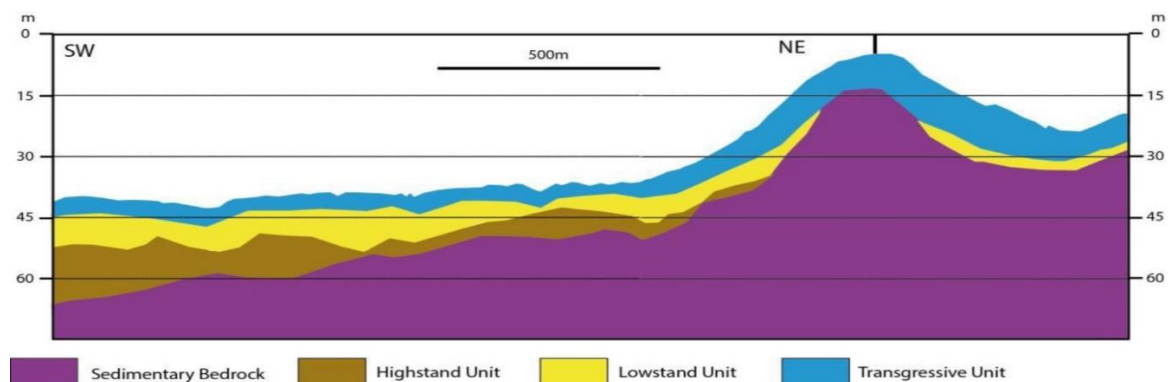


Source: GEUS

## Interlak could be the hidden monster

Some of the most extensive and thick transgressive and lowstand units were identified in the Interlak area as shown in section 2a\_07 below. Here a transgressive heavy mineral-bearing unit is visible from shore continues for the entire line. This unit has numerous grab samples that show mineral sands are present.

Figure 25 - Section line 2a\_13 through the shallow zone at Moriusaq



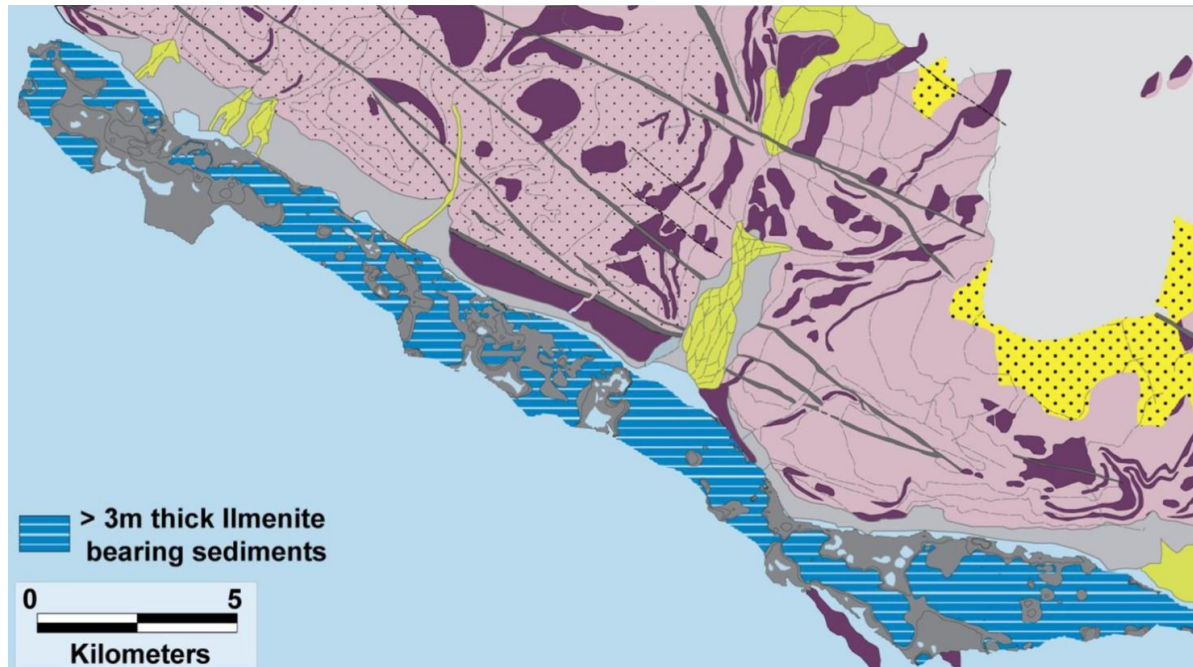
Source: GEUS



### Modelling by GEUS demonstrates the extent of thick sand units

GEUS has modelled the potential offshore heavy mineral sand resources by combining the lowstand and transgressive sequences, the two stratigraphic units that have been proven to host heavy mineral sands. The thickness of both these prospective sand units has been modelled for the entire survey area, with the results presented in the map below.

*Figure 26 - Thickness of combined lowstand and transgressive sequences as modelled by GEUS*



Source: GEUS

The shallow water transgressive sand unit has been mapped up to 15m thick in the areas 1a and 2a, correlating to the Moriusaq and Interlak areas respectively. The overall survey data shows a mosaic of areas with more than 5m sediment thickness and pockets in excess of 10m thickness. The map above demonstrates the prolific extent of sediments with a thickness greater than 3m.

### Near-shore not surveyed but could contain the highest grade deposits – one for 2016...

The shallow, near-shore beach line has the potential to host the highest-grades in the entire Pituffik project area, yet it was not covered as part of the survey, as the survey boat was not able to operate effectively in waters of less than 3m due to seismic response times and survey noise. Work during 2016 will focus on this area.

FinnAust and GEUS have visually confirmed very high grade titanium mineralisation along the entire project length. The depth of this material is unknown, but expected to be more than 1m. This ±200m wide strip of beach line is an attractive target by virtue of the near-shore location and high grade which is likely a result of the active erosional/deposition domain producing well-sorted ilmenite rich sands.

Also not surveyed was a tombolo directly adjacent to the town of Moriusaq, which also provides cover for a significant depositional environment where ilmenite rich sediments can accumulate. The “high stand” sequence wasn’t sampled during 2015 and continues to represent an attractive exploration target despite being in slightly deeper water of 20-30m. Thus, even though the project has had a long history, this new survey data suggests to us that the investigation into commercially viable deposits has only just begun.

### Off-shore sample results expected shortly

GEUS collected 69 off-shore grab samples in the near-shore, shallow part of the survey area which may conclusively prove that the high-grade TiO<sub>2</sub> rich sediments extend off-shore.

## Mining – Low cost techniques

There are essentially two possible extraction techniques that could be employed at Pituffik, depending on the nature of the deposit mined: dry mining and dredging.

### Onshore - straight-forward, flexible techniques such as...

For land based raised beach type deposits, we envisage conventional small-scale surface truck and shovel mining techniques to be viable. This “dry mining” technique would have the advantage of being a tried and tested method with a low up-front capital cost and easy access to suitable mining equipment. Furthermore, this technique would enable a great deal of flexibility to mine different areas of the deposit and flex production rates accordingly. Due to the likely relatively small size of a potential mining operation at Pituffik, higher throughput and more capital intensive mining techniques such as continuous miners and bucket wheel excavators are not necessary.

#### ...Dozer trap mining

A possible mining method would be the “dozer trap” technique which has been employed in the mineral sands industry for the last 15 years, and is gaining in popularity due to its flexibility and reliability. For example, dozer trap mining is being employed successfully at Base Resources’ (AIM: BSE) Kwale HMS mine in Kenya, Iluka’s Twin Hills mine in Australia, and has also been selected for Sheffield Resources’ (ASX: SFX) Thunderbird deposit, also in Australia. Employing this method would also be more environmentally friendly, if used in conjunction with strip mining and backfilling. The simple technique involves dozers delivering or “pushing” ore into traps attached to mobile mining units, which could then slurry undersize to a wet concentrator plant. Dozer mining is well suited to unconsolidated and free flowing sand deposits. Ore could also be loaded directly onto ships if direct shipping is proven to be possible, which eliminates double handling.

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*Figure 27 - Dozer Trap Mining at Iluka’s Twin Hills mine, Western Australia*



Source: Sheffield Resources

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### Off-shore – Dredging: the lowest cost option

Off-shore mining, including the near-shore active zone could potentially be mined using a wet dredging technique. Dredging is commonly used in submerged mineral sand deposits and broad continuous dune type orebodies below the water table, or with a ready supply of water.

Dredging involves various methods of extracting ore by a combination of bucket excavators and/or pumps on a floating dredge, with slurried sand then pumped to a nearby wet concentration plant to produce a heavy mineral concentrate, which is then transferred to a mineral separation plant. Dredging is generally the lowest operating cost technique due to its higher throughput. However, it is less selective and has lower flexibility than dry mining.

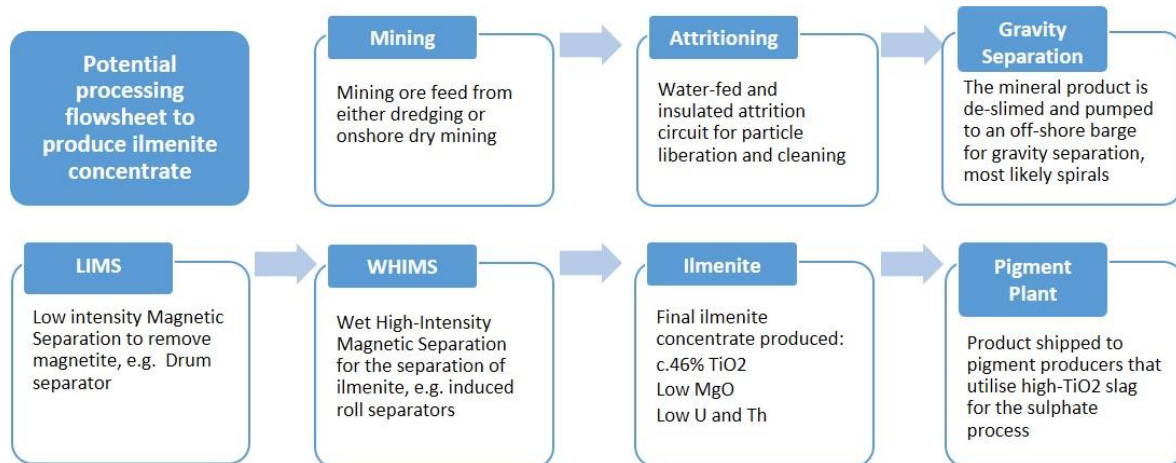
Dredging is being employed by Sierra Rutile (AIM: SRX), Kenmare Resources (LSE: KMR) and Mineral Deposits Limited (ASX: MDL). MDL uses the technique to mine dune deposits adjacent to the shore line at its Grand Côte deposit in Senegal.

## Processing Options

### Conventional technology

Onsite processing of heavy mineral concentrate is likely to be fairly straight forward, utilising conventional mineral sand separation technology. Bluejay mining commissioned KeyPointe PTY to investigate processing options. KeyPointe envisioned a process involving standard gravity and magnetic separation, a fairly simple process to remove the waste magnetite and then selectively remove the valuable ilmenite. We think this process route is realistic, although the process may require minor modifications in order to deal with the challenges of operating a processing plant in the High-Arctic and extremely low temperatures.

Figure 28 - Potential processing route for Pituffik ilmenite ore



Source: Adapted from KeyPointe (2015)

## Product specifications & end use markets

The relative value of titanium feedstocks in the first instance is largely determined by the TiO<sub>2</sub> content. Once ore is split into pure ilmenite, it then needs to be converted into pure titanium oxide. The two main process pathways for TiO<sub>2</sub> are the sulphate route and the chloride route. The selection of process route depends on a number of factors:

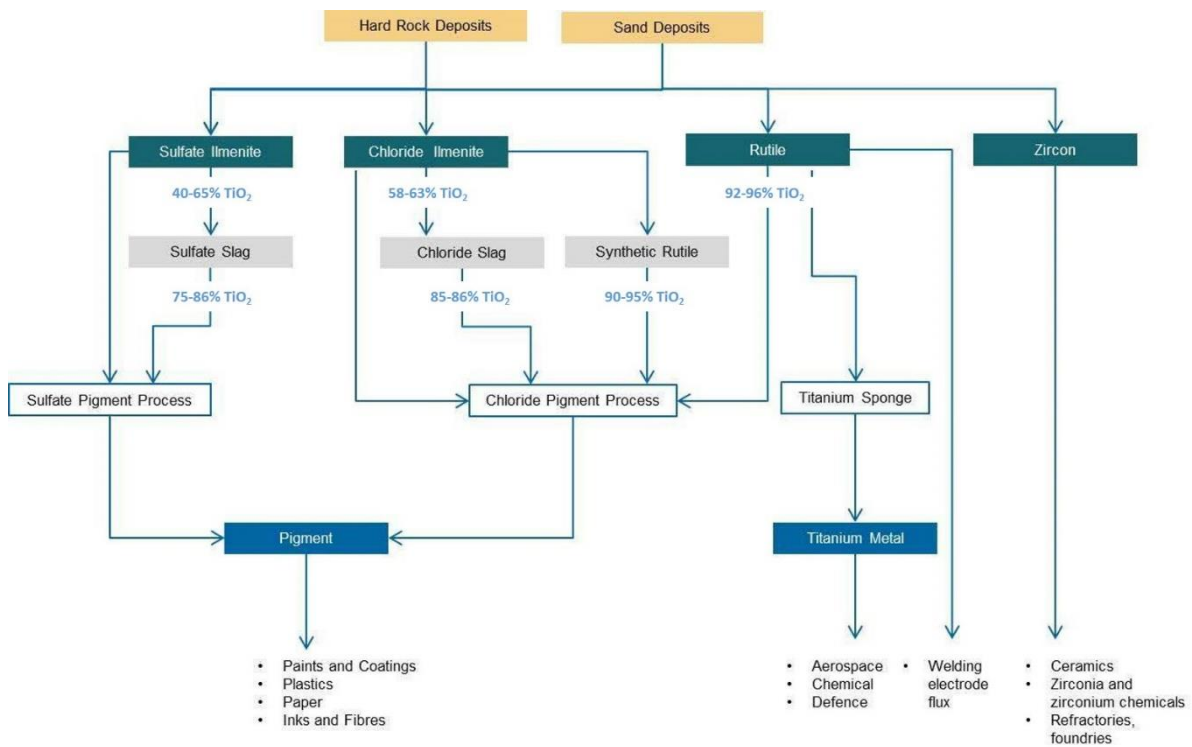
- **Sulphate Process.** An older batch process for lower grade feedstocks. The process utilises lower grade feedstocks (c.<58% TiO<sub>2</sub>) such as sulphate ilmenite, which is treated with sulphuric acid, putting the iron and titanium into solution to remove iron and producing a TiO<sub>2</sub> particle of the right crystal form, particle size/distribution and purity. Slag is also a common sulphate process feedstock.
- **Chloride Process.** A generally lower cost, more efficient process at larger scales but one that requires purer ore (ideally >90% TiO<sub>2</sub>), with major producers such as Tronox, Cristal, Kronos and Huntsman generally blending feedstocks to between 85-90% TiO<sub>2</sub>. This makes natural rutile, upgraded synthetic rutile (from ilmenite) and chloride slag the preferred feedstocks.

### TiO<sub>2</sub> slag – an intermediate product

Titanium slag is essentially an intermediate product in the value chain (next page) and one of the main inputs into the sulphate pigment production process. Chloride slag can also be produced. Slag is produced by reduction of ilmenite to pig iron with almost everything else (which doesn't reduce in the furnace) reporting to the slag. This process upgrades the ilmenite and yields a high TiO<sub>2</sub> slag typically containing 70 - 85% TiO<sub>2</sub> which is used as a feed stock for TiO<sub>2</sub> pigment production. High grade pig iron is produced as a valuable by-product.

RTIT in Canada use 38% TiO<sub>2</sub> to make sulphate slag (high MgO); RBM in S Africa use ~48% TiO<sub>2</sub> to make chloride slag (low MgO). Eramet in Norway use 45% TiO<sub>2</sub> for sulphate slag (high MgO). RTIT use ~60% TiO<sub>2</sub> from Madagascar to make high TiO<sub>2</sub> chloride slag. Ilmenite from Senegal >55% TiO<sub>2</sub> is to be used to make chloride slag in Norway.

Figure 29 - Titanium industry integrated value chain – note  $\text{TiO}_2$  content in blue



Source: Adapted from Iluka

### Direct sulphate feed or high Titanium slag potential uses for Pituffik product

Previous metallurgical test-work by 3 R Associates (Reeves 1997) indicated that ilmenite from Pituffik is unlikely to be suitable as high-grade feedstock for the chloride process or for upgrading to synthetic rutile, by virtue of its relatively low  $\text{TiO}_2$  content at 46-48%.

FinnAust's current thinking is to investigate whether the product may be suitable for direct use in the sulphate process, which would provide attractive margins, if Pituffik's cost of production is low. Most European sulphate process sites blend ilmenite and sulphate slag, and many have been increasing the amount of ilmenite in the blend. There are approximately 13 sulphate plants in Europe that at least use some ilmenite, and many more worldwide. There are significant tonnes of ilmenite <50%  $\text{TiO}_2$  in use for direct pigment production.

Historical work also appears to suggest that the ilmenite product may also be suitable for production of a high  $\text{TiO}_2$  slag via the sulphate process, as the level of oxides in Moriusaq concentrate is lower than most ilmenite smelted, according to Reeves. More test-work is needed on the potential to produce chloride slag, which has application in both the sulphate and chloride processes as conventionally 10-20% of chloride slag is used in the sulphate process.

The final quality of slag is highly dependent on the quality of the ilmenite as virtually all the impurities, together with any impurities in the reductant, report to the slag. Thus it is the level of impurities in the ilmenite, rather than its  $\text{TiO}_2$  content itself that is the most important criterion for slag production. Lower  $\text{TiO}_2$  ilmenites are sometimes preferred, as the high iron content provides suitable thermodynamic conditions to initiate smelting.

Thus, whilst early stage, there are a number of different routes and opportunities for marketing Pituffik ilmenite.

### Low deleterious elements compensate for lower TiO<sub>2</sub> content...

The main likely positives of Pituffik ilmenite are: 1.) very low radioactivity compared to a typical sand ilmenite (but similar to hard rock) 2.) easily digested in sulphuric acid at low acid strength (like hard rock), 3.) less acid insoluble material (e.g. silicates) than a typical hard rock, 4.) and potentially lower process usage of scrap iron. The key for a viable sulphate process based on ilmenite is to extract value from the iron otherwise there is a significant cost associated with disposal.

Furthermore, the concentrate produced from Pituffik ore was found by Reeves (1997) to be low in MgO and other oxides which is a favourable characteristic. This means that the Pituffik concentrate containing less than 4% non TiO<sub>2</sub>-Fe<sub>2</sub>O<sub>3</sub> oxides compares well to ilmenites from other global projects than generally contain a range of 4-10% content of “other oxides”.

### ...opening up more processing options

Although the CaO content of Pituffik’s ilmenite is at the higher limit of specifications for slag production at 0.2% CaO, Reeves reports that an additional step such as Rio Tinto’s UGS (UpGraded Slag) process (as used at the QIT smelter) could be employed, a complex leach with HCl to give a product >90% TiO<sub>2</sub> suitable for the chloride process. However, it is patented and expensive to build/operate. This process was designed to upgrade sulphate slag to produce a more highly concentrated slag to compete with synthetic rutile, for the many titanium pigment producers that use the chloride process.

Reeves (1997) considered that alternative technologies such as a molten salt bath and selective chlorination would effectively deal with elevated CaO content, although further studies into the commercial viability of these techniques would be needed, as they have not been commercially proven. However, HCl based TiO<sub>2</sub> processes under development (e.g. Argex) could readily use this ilmenite. Other important criteria for the production of chloride grade slag are low levels U and Th and low SiO<sub>2</sub> and Al<sub>2</sub>O<sub>3</sub>, of which Pituffik ilmenite is low in all of the above.

Pituffik’ has the potential for a relatively low production cost, given the high heavy mineral grade, free digging (or dredge) and no significant magnetics which would require electrostatic separation. This is important given the relatively lower value of the mineral assemblage, i.e. no rutile, zircon or monazite.

### Global TiO<sub>2</sub> slag capacity – Canada the closest

There are six large commercial scale TiO<sub>2</sub> slag smelters located outside of China. The two closest are; Rio Tinto/RTFT’s QIT smelter in Sorel Quebec, Canada, and MDL/Eramet’s Tyssedal smelter in Norway. We believe the majority of these smelters are technically capable of taking a similar ilmenite product to that which could be potentially produced at Pituffik. We include them only as an illustration, noting that most slag producers have their own captive supply of ilmenite. There are many more opportunities to supply ilmenite for direct use in the sulphate process than supplying for slag, but we expect all avenues to be explored.

*Table 1 – Titanium slag smelters*

Company/Name	Location	Capacity (ktpa TiO <sub>2</sub> slag)	Feedstock Source	Shipping Distance from Pituffik (km)
Rio Tinto/QIT	Quebec, Canada	1,200	QMM Madagascar (60% TiO <sub>2</sub> ) Lac Allard (35% TiO <sub>2</sub> )	4,000
MDL & Eramet / TTI smelter	Tyssedal, Norway	200	Tellnes Norway (44% TiO <sub>2</sub> ) Grand Cote, Senegal (50% TiO <sub>2</sub> )	5,000
Tronox/Namawka	South Africa	190	48 % TiO <sub>2</sub> sand ilmenite	14,200
Rio Tinto/RBM	Richards Bay	>1,000	49 % TiO <sub>2</sub> roasted sand ilmenite	16,000
Tronox/KZN	South Africa	220	Hillendale (45% TiO <sub>2</sub> ) ceased) Fairbreeze, South Africa	16,200
Cristal/Jazan	Saudi Arabia	500kt (could be scaled to 1Mt)	-	11,500km (via Suez)

Source: Adapted from Tata Steel and company reports

## **Next Steps: Bulk sampling to commence in 2016**

FinnAust aims to undertake bulk sampling during 2016 in order to generate sufficient sample material to initiate off-take discussions with interested parties. We view this as an important component of the work programme as determination of product specifications is a critical path for the marketing of mineral sand products.

## **GEUS Recommendations**

GEUS's recommendations for follow on work in the area consist of:

- Scanning electron microscopy on samples of heavy mineral concentrate.
- 3D off-shore modelling linking aerial photo and sample data with bathymetric data.
- Depositional environment study to define areas with potential for HM accumulations.
- Detailed on-shore GPR (ground penetrating radar) survey between Moriusaq and Interlak to establish the structure of raised terraces and depths to bedrock.
- Off-shore Vibrocore sampling to obtain core samples providing detailed data on the thickness and nature of mineralised sands.



## Valuation Considerations

### Valuation is challenging at this stage

Given the early stage of the Pituffik project, limited exploration data and the fact that the deposit does not yet support a JORC-compliant mineral resource estimate, it is challenging to estimate a value for the project in its current stage, in our view. Although the project has a long exploration history, the continuity, grade and tonnage of the deposit, and the resource potential remains an unknown quantity.

Clearly, significant potential exists as we have outlined earlier in this note, but at present we have not attempted to calculate a value for the project. Our usual valuation method is to calculate an NAV based on DCF modelling (discounted cash flow) but without even scoping-level assumptions for production, opex, capex and timelines, this method is not appropriate just yet. Similarly, with the project being pre-resource, there is limited applicability to using peer-group averages based on a \$/tonne metric.

In any case, direct peer comparisons for mineral sand deposits have limited value, in our view, due to the wide variation in mineral sand orebody characteristics and multiple product streams, i.e. varying mineralogy (rutile, ilmenite, zircon) and variable TiO<sub>2</sub> content.

### SRK assigned a maximum value up to \$24m

SRK, in a technical report (November 2015) determined a valuation range of \$0.6m to \$24m based on a variety of approaches including a cost appraised method for the lower valuation and a comparison with other operations for the maximum valuation.

It is important to note that SRK's valuation is based only on an onshore operation and excludes the potential of offshore dredging, which we view as the more lucrative mining approach.

Based on the current number of shares in issue, SRK's valuation would equate to 5.2p/sh, excluding any further equity dilution from funding. Based on the number of shares in issue post Bluejay acquisition, SRK's valuation would equate to 3.6p/sh. It is pertinent to note that this valuation pertains to Greenland only and excludes FinnAust's Finnish and Austrian portfolio.

### Plenty of scope for uplift

The key take-away is that the Pituffik project is challenging to value at present by virtue of its early stage, but we see significant scope for value accretion as FinnAust undertakes further exploration and evaluation work.

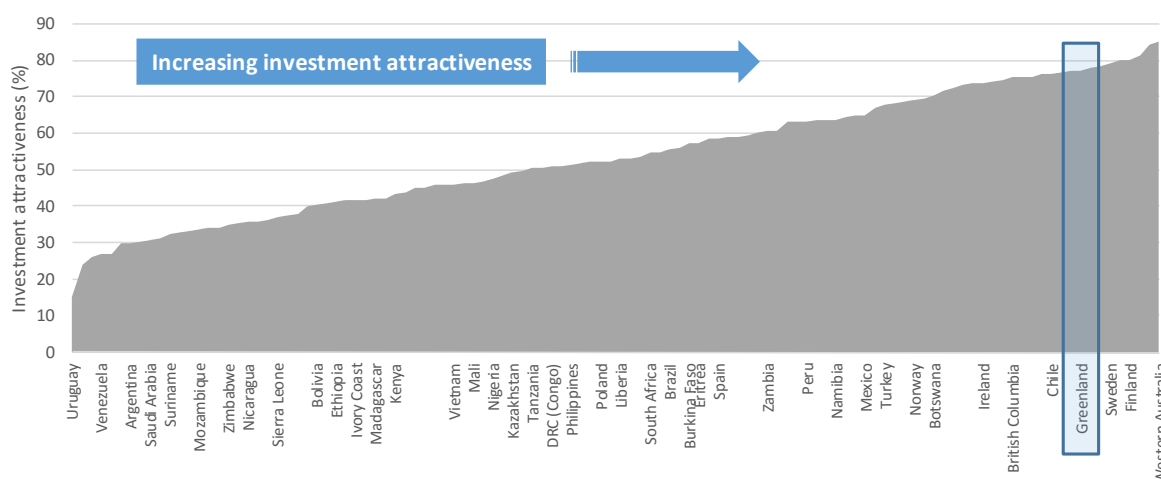
The acquisition price of £0.9m for a 60% interest in Bluejay Mining equates to an implied acquisition price of US\$2.3m for the Pituffik project on a 100% basis.



# Greenland – an attractive jurisdiction

The Fraser institute ranks Greenland 9<sup>th</sup> out of 122 global jurisdictions and countries, in terms of investment attractiveness. The ranking is based on a variety of detailed rankings with the overall Investment Attractiveness Index constructed by combining the Best Practices Mineral Potential index, which rates regions based on their geological attractiveness, and the Policy Perception Index, a composite index that measures the effects of government policy on attitudes toward exploration investment.

Figure 30 - Investment attractiveness ranking – Greenland tops the charts



Source: Fraser Institute 2013

## A stable political platform...

With a tiny population of approximately 56,000, Greenland is stable and democratic with a government well-disposed to foreign investment. Greenland left the EEC in 1985 (EU since 1992) and as such, the EU's occasionally restrictive laws do not apply to Greenland (barring certain areas of trade). Greenland remains close politically and economically with Denmark and the Nordic members of the EU in particular although Japan and China are becoming increasingly important trading partners. Greenland was granted self-governing powers in 2009 after the results of an overwhelming referendum in favour of such in 2008.

The country's economy is underdeveloped and still highly dependent on Denmark for an annual US\$600-650m subsidy (2012) which comprises over 30% of GDP. Other important sectors of the economy are fishing, hunting and tourism which are exposed to market volatility. The government of Greenland is the island's largest employer with the fishing industry the largest non-state sector.

## ...but a challenging environment

Greenland is remote, isolated and in some regards; inaccessible. There are no major road networks on Greenland and all internal transportation is conducted largely by air. In addition to these factors, the climate is harsh and cold and operations will be more expensive than those conducted in more temperate areas of the world. Harsh weather conditions are also likely to subject exploration activities to delays or confine work to particularly times of the year.

In particular, the field season at Pituffik is short and with pack ice forming in early Autumn, the operating window for product shipments is short, with a likely maximum of five months. Infrastructure will likely be more expensive to install and conducting exploration or developing a mining may present challenges in terms of logistics and climate. That said, this has often acted as a barrier to entry to Greenland, which is now an opportunity for FinnAust. Also, it has not stopped other companies developing mines in the country.

# **Finnish Projects – positioning for the upturn**

FinnAust controls numerous licences covering extensive ground in Finland in highly prospective geological districts. FinnAust's Finnish projects are being maintained on a low-cost holding basis whilst the company focuses on Greenland, and exploration will re-started when market conditions provide sufficient incentive. Work continues at a desktop level. The company holds 76 exploration permits (13,192 hectares) in Finland.

The country has a strong mining culture and supportive mining legislation. Infrastructure and power is world-class, as would be expected of a first-world European country. A variety of commodities are mined in the country including iron, chrome, nickel, cobalt, copper and precious metals. Major mines include First Quantum's Kevista (FY15 production 8.8kt Ni, 17.2kt Cu, 60koz Pt+Pd) and Pyhasalmi (FY15 12kt Cu, 21kt Zn), Agnico Eagle's Kittila (FY15 177koz Au) and Boliden's Kylylahti (FY15 c.10kt Cu) mine amongst others. Major companies such as Anglo American are active explorers in the country.

## **Outokumpu Copper Project**

Outokumpu is located in eastern Finland on the N-S trending 210 km long Outokumpu Belt, a prolific Cu-Co belt characterised for its high-grade deposits including the world famous Outokumpu copper mine, which produced a total of 34.4Mt of ore at average grades of 3.6% copper, 1.2% zinc, 0.22% cobalt and 0.1% nickel between 1914-1988. The district also hosts Boliden's Kylylahti mine.

FinnAust has identified multiple targets for drill testing adjacent to and along strike from the Outokumpu Copper mine. The company is exploring for Outokumpu-type high grade, large magmatic copper deposits within the tenure and has completed 1,462m of drilling in four holes at the project. In January 2016, FAM secured a further two ELs bringing total holding to 6,130 hectares composed of 52 licence areas. The claims expire in 2017 – 2018 and the new ELs in 2019 – 2020. A three-year extension can be applied to all of the claims and ELs.

## **Hammaslahti Copper-Gold-Zinc Project**

The Hammaslahti area is considered prospective for VMS-style mineralisation, and hosts an historic namesake Cu-Zn mine that was operated by Outokumpu as a series of open pits and an underground mine until 1986. Total production from the mine was c.7Mt at 1.16% Cu. Drilling by FinnAust has confirmed extensions to the old Hammaslahti mine with down plunge extensions intersecting 3.4m @ 11.5% Cu and 3g/t Au and numerous targets have been identified which have strong potential to host near surface mineralisation.

FinnAust completed 10,366m of drilling (45 holes) across the project, discovering new lodes and extensions to the previously mined zones, with copper grades identified over substantial widths. The mineralisation discovered as part of the programme is relatively shallow and proximal to the historic pit and underground drives, and FinnAust believes that this mineralisation is part of a relatively continuous north to south plunging lode transitioning from shallow zinc and gold in the north to copper as it deepens in the south.

FinnAust is using ZTEM technology (a new airborne EM technique) to target massive sulphide mineralisation, with the technique viewed as a breakthrough geophysical tool for making new discoveries. The 2012 programme was the first time ZTEM had been applied in Finland. In January 2016, FinnAust was granted a further licence in Hammaslahti, increasing the total landholding to 12,317 hectares, with this latest licence containing locations correlating to historical outcrop samples with high Cu, Zn, Pb, Ag and Au grades.

## **Kelkka Nickel Sulphide Project**

FinnAust's Kelkka licences are targeting high-grade Ni-Cu-PGE deposits in the 5km vicinity of the historic Enonkoski mine. The mine was operated by Outokumpu from 1985-1994 producing 7.3Mt at 0.83% Ni and 0.23% Cu. FinnAust has completed 3,570m (21 holes) with the best intercept to date 1.5m @ 0.68% Ni, 0.31% Cu from 61.5m, identifying previously undiscovered remobilised sulphide veins and veinlets, an encouraging result from only limited drilling. The best historic drill intercept is 15m @ 6.9% Ni, 2% Cu and 0.33% Co. The Kelkka licences cover a total area of 5,730 hectares.

# Titanium Market Dynamics

## The titanium game

The mineral sands industry is the main supplier of titanium raw materials for the production of titanium dioxide (TiO<sub>2</sub>) feedstocks, a c.\$13bn pa global market. Feedstocks are used primarily for the production of titanium pigment and titanium metal (titanium sponge and flux for welding). The pigment market accounts for around 90% of total demand for titanium feedstocks.

“Mineral sand” refers to a concentration of heavy minerals with a specific gravity of >2.9, often found in sand deposits. Mineral sands generally provide two main product streams; TiO<sub>2</sub> minerals and zircon.

*Table 2 – TiO<sub>2</sub> minerals*

Titanium Form	Chemical Formula	TiO <sub>2</sub> content (%)	Typical Process route
Rutile	TiO <sub>2</sub>	92-96	Chloride
Leucoxene	Fe <sub>2</sub> Ti <sub>3</sub> O <sub>9</sub>	65-90	Chloride
Synthetic Rutile	-	85-95	Chloride
Ilmenite (Chloride)	FeTiO <sub>3</sub>	58-62	Chloride
Ilmenite (Sulphate)	FeTiO <sub>3</sub>	45-55	Sulphate

Source: Iluka, company reports

- **Ilmenite** – more commonly occurring than rutile and a lower grade feedstock by virtue of its iron content. Ilmenite contains fewer TiO<sub>2</sub> units than rutile and is processed predominantly via the sulphate route. Ilmenite also used for production of slag and synthetic rutile.
- **Leucoxene**. Formed through extensive weathering of ilmenite, which upgrades the TiO<sub>2</sub> content. Leucoxene has a particular application to the welding and electrode flux market, and is used by Chemours in the chloride process.
- **Rutile** – the highest TiO<sub>2</sub> naturally occurring titanium mineral, known as a “high-grade” feedstock with regards to pigment manufacture as rutile’s high TiO<sub>2</sub> content means that it requires less processing than other feedstocks because there is less iron to remove. Rutile is also the preferred source for titanium metal production. Rutile for pigment is processed exclusively via the chloride route as rutile cannot be digested in sulphuric acid.
- **Synthetic Rutile** is produced through the upgrading of ilmenite to remove the iron impurities and yield a TiO<sub>2</sub> product suitable for the chloride process. The process upgrades the TiO<sub>2</sub> content from c.50% in ilmenite to >90%, similar to natural rutile. Iluka is the world’s largest producer of synthetic rutile.

## Two main processes for pigment production

Once ore is split into pure ilmenite, it then needs to be converted into pure titanium oxide. The two main process pathways for TiO<sub>2</sub> are the sulphate route and the chloride route. The selection of process route depends on a number of factors. The chloride process is the fastest growing market as China builds out capacity.

- **Sulphate Process**. An older batch process for lower grade feedstocks. The process utilises lower grade feedstocks such as sulphate ilmenite (c.<55% TiO<sub>2</sub>), which is treated with sulphuric acid, putting the iron and titanium into solution to remove iron and producing a TiO<sub>2</sub> particle of the right crystal form, particle size/distribution and purity. Slag is also a common sulphate process feedstock.
- **Chloride Process**. A generally lower cost, more efficient process at larger scales but one that requires purer ore (ideally >90% TiO<sub>2</sub>), with major producers such as Tronox, Cristal, Kronos and Huntsman generally blending feedstocks to between 85-90% TiO<sub>2</sub>. This makes natural rutile, upgraded synthetic rutile (from ilmenite) and chloride slag the preferred feedstocks.

In North America virtually all TiO<sub>2</sub> production is via the chloride route but there is still significant sulphate capacity in Europe. In contrast, virtually all Chinese production (the biggest manufacture and producer of TiO<sub>2</sub>) is via the sulphate route at present. Globally 55% of TiO<sub>2</sub> is produced via the chloride route, and 45% via the sulphate route.

## Titanium end use

Of all  $\text{TiO}_2$  feedstocks, 90% are used for the production of pigment, which in turn has application in the paint, plastics and paper industries. The balance is used for the production of titanium metal for welding, or titanium metal (via sponge) for a variety of high-tech aerospace and military applications.

Figure 31 –  $\text{TiO}_2$  Feedstock end-use

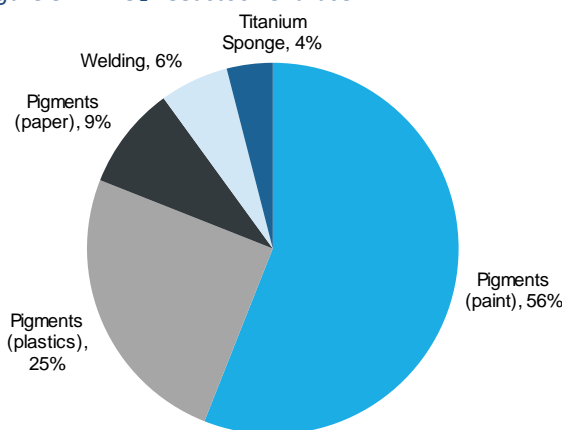
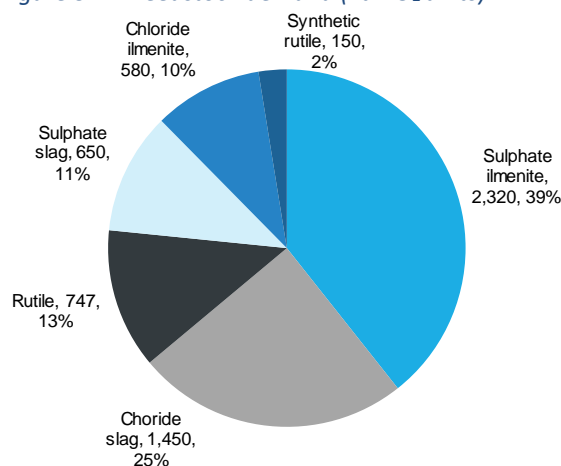


Figure 32 – Feedstock demand (kt  $\text{TiO}_2$  units)



Source: TZMI, Iluka, Sierra Rutile

## Pigment Market

The most important market for titanium dioxide bearing feedstocks (ilmenite, rutile, synthetic rutile and slag) is in the production of titanium dioxide pigment which has annual sales in excess of 5mtpa and an annual current value in excess of \$13bn. Historically the market has grown in line with global GDP, so around 3%pa, but with short term volatility. The final product is a fine white powder of high purity and sub-micron size. Consequently, much of the production process involves separating the non- $\text{TiO}_2$  elements, dominated by iron, before creating a particle of the desired crystal form and size followed by treatment to ensure the final particle has properties best suited to the chosen application.

Two crystal forms of  $\text{TiO}_2$  are used in pigment: rutile, which dominates, and anatase, which is sold in smaller quantities and can only be produced by the sulphate process. Rutile has the highest refractive index of any natural mineral and so if manufactured at the optimum particle size and size distribution is very effective at scattering light and so hiding what is beneath it. This property, known as opacity, is one that differentiates  $\text{TiO}_2$  from other pigments. The other important parameters are: optical properties (whiteness, gloss in addition to opacity), ease of dispersion of the powder in the final application, stability in UV light, durability and inertness.

About 60% of  $\text{TiO}_2$  pigment is used in coatings such as architectural or automotive paints and 25% in plastics. Use in paper (~7%) is important in North America with the remaining markets in inks, fibres (anatase only), cosmetics and pharmaceutical products. Whilst small in volume there are growing markets for  $\text{TiO}_2$  in applications such as DeNOx catalysts. There is no effective substitute for  $\text{TiO}_2$  pigment; no other material can combine the all of the properties listed, and none can match the hiding power due to a lower refractive index.

## Titanium Metal & Welding

Titanium metal, whilst a smaller market has experienced strong growth and still remains an important segment of demand. The metal is highly strategic and used for the manufacture of aircraft engines and frames, medical and sporting equipment, and a variety of military purposes. In welding, titanium is used as flux during fabrication, for example steel construction, or the ship building industry.

## TiO<sub>2</sub> demand looks set to grow

### Industry uptick expected in 2017

We expect titanium feedstock demand to pick up in late 2016, as inventories normalise and appetite for feedstock returns. The global titanium feedstock market remained oversupplied in both 2014 and 2015, with resultant price decreases felt across the board for ilmenite and rutile. Weak demand conditions have exacerbated the inventory overhang, as the supply response to strong prices in 2013 has been left high and dry by the market downturn. Given the current overhang of ilmenite inventories we do not see prices recovering materially until 2017.

According to market estimates, including TZMI, the surplus position at the end of 2014 was estimated at more than 1.2Mt TiO<sub>2</sub> units, with the pigment sector characterised by low utilisation rates and over capacity. The current excess of TiO<sub>2</sub> pigment capacity over demand is 32%, according to Artikol. Titanium feedstock demand often shows seasonality effects with the June and September quarters often showing an upswing due to the northern hemisphere painting season – a prime demand factor for paint, and in turn pigment, although the effect of this in 2015 was subdued.

### Some signs of recovery

Although overall feedstock demand remains sluggish and below historical trend, elements of the market have seen demand recovery. In 2015, Iluka restarted its largest and previously idle synthetic rutile kiln in Western Australia, reflecting firmer conditions for upgraded feedstocks.

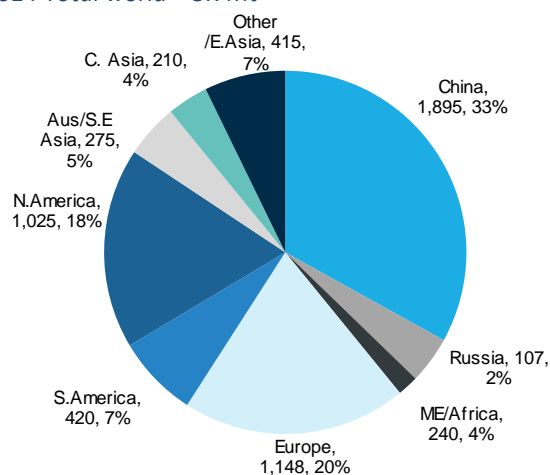
The mineral sand market is complex and rather opaque, however see a normalisation of demand over the medium to long-term, once inventories have been drawn down, and believe demand looks set to return to a steady trajectory. Although economic growth in China is forecast to be more subdued going forward, Chinese GDP growth is still pegged to remain at c.7% over the next two years according to The World Bank.

### Chinese pigment growth forecast to remain strong

TiO<sub>2</sub> pigment demand grew on average by 3.3% p.a from 1977-2007, 1.4% from 2007-2014 and is forecast to grow at 4.1% p.a from 2014-2020, equating to an increase in demand to 7.3Mt from 5.7Mt currently, according to Artikol, the titanium specialists. Much of this is expected to be driven by China, with a forecast grow rate of 6.8% p.a until 2020.

Pigment plant utilisation rates remain low, 60-70%, compared the usual c.90%. In an effort to reduce pigment production, it is common for plants to reduce operating time, but also switch to feedstocks with a lower TiO<sub>2</sub> content to maintain throughput but produce less pigment.

Figure 33 – World TiO<sub>2</sub> Pigment consumption (Mt/%). 2014 Total world = 5.7Mt



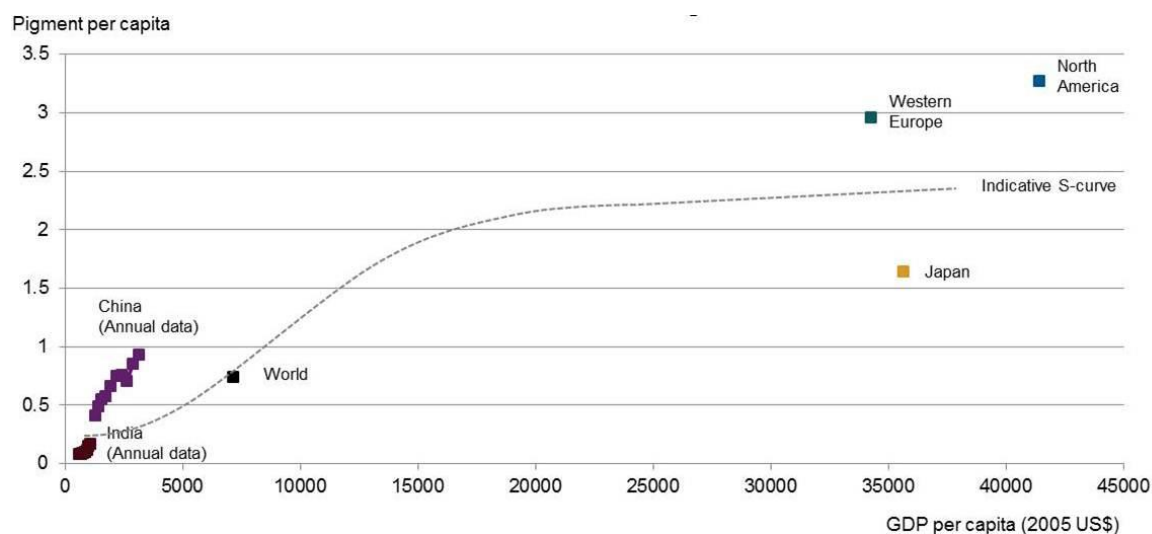
Source: Artikol (2015)

## Macroeconomic matters – emerging from a cycle low?

TiO<sub>2</sub> is considered to be a “quality of life product” with consumption increasing as disposable income increases. Demand for titanium products is generally considered to be mid to late-cycle, with a strong correlation with disposable income and demand for mineral sands products in end-uses such as cars, white goods, house paint and tiles etc. It’s the familiar China story again, urbanisation, rising incomes, and a concomitant increase in demand.

Titanium pigment is primarily used in paint and coatings and thus there is a direct correlation to construction activity, housing starts and industrial activity. We believe the use of titanium metal in aircraft applications will continue to be a growth area. The high strength to weight ratio of titanium provides tangible benefits in terms of fuel efficiency, which we expect to remain an important environmental issue.

Figure 34 - TiO<sub>2</sub> Pigment Intensity of use – China could move up the S-curve



Source: Iluka

The titanium sector is an opaque and fragmented market, but we believe that demand will ultimately return as the industry moves out of the low cycle, fuelled by macro drivers such as GDP growth, urbanisation, construction and increased intensity of use. Even though Chinese growth has been stunted, demand for mineral sand products is skewed towards mid to late-cycle, along with rising incomes and living standards. China and India still have a lot to give in this regard, although the rate of potential demand growth remains uncertain.

Figure 35 - Illustrative Mineral Sands Cycle



Source: Iluka

## Supply

TiO<sub>2</sub> supply is dominated by a small number of large mining groups. Extensive vertical integration is a feature of the industry, typified by close relationships between miners and pigment producers. Major producers include Kenmare Resources, Iluka, Rio Tinto, Tronox and Base Resources.

### **Dearth of quality projects**

Based on the known geology of potential new deposits in the pipeline, the trash component of the HM assemblage is increasing, whilst the valuable heavy mineral grade is declining, according to Iluka. Furthermore, there is a lack of quality projects in the pipeline. The low-hanging fruit has been picked and orebodies are becoming increasingly complex, with inferior mineral assemblages, higher strip ratios and significant hurdles to commercial production.

Investment in new capacity has largely been delayed or abandoned, while some US and Australian mining operations are closing this year due to orebody depletion. Along with the fact that some pigment production capacity has been temporarily or permanently shut down, this bodes well for the future recovery of the sector.

### **Build up in ilmenite inventories is the near-term challenge**

The near-term challenge for the feedstock industry is the significant build-up in ilmenite, which currently obscures the otherwise fairly finely balanced supply/demand fundamentals. The inventory overhang has weighed on sentiment considerably, although there has been some progress with producer restocking. TiO<sub>2</sub> inventories have largely normalised, back down to 60 days, from 100 days in 2012. Between 40 to 60 days represents a normal range for TiO<sub>2</sub> pigment. At the end of the last reported half year, Iluka reported \$800m in inventory for HMC and ilmenite, up from \$250m in mid-2010.

### **Iron ore price crash should take substantial ilmenite supply off the table**

The primary source of TiO<sub>2</sub> domestically in China is from ilmenite as a by-product associated with magnetite production. The pullback in iron ore production is likely to reduce Chinese domestic supply of TiO<sub>2</sub> feedstocks.

Chinese domestic ilmenite is typically a by-product of magnetite, largely mined in the Sichuan Province. Iluka estimates that 1 tonne of ilmenite is produced from the mining of 30 tonnes of magnetite. The downturn in the iron ore price is likely to significantly curtail Chinese domestic production, the majority of which occupies a marginal position on the cost curve. This would in turn restrict domestic supplies of ilmenite, making China more reliant on imports.

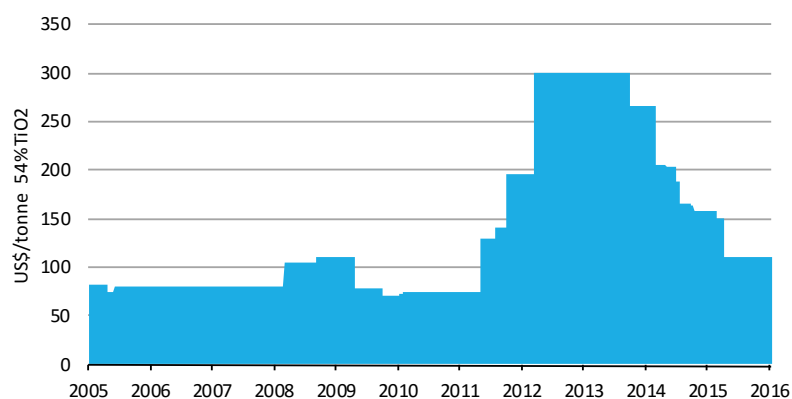


## TiO<sub>2</sub> and ilmenite pricing trends

Prices for mineral sand products have been relatively stable, except for a period of exceptional price increases from 2011-2013. The resurgence of demand, particularly from the Asia-Pacific region, after the global downturn in 2009, led to supply deficits across the sector. The supply response lagged demand due to a lack of investment in the industry, exacerbated by production disruptions and difficulties in ramping up expansions.

Strong demand and a weak supply response took the industry by surprise, and along with low inventory levels, prices quadrupled over a 12-18 month period. As China's growth engine slowed and supply caught up, the market moved to oversupply and prices adjusted accordingly. The sluggish global economy increased pressure on downstream pigment producers, reducing profitability and in turn demand for feedstocks.

Figure 36 - Ilmenite price graph (\$/tonne) for 54% bulk concentrate



Source: Metal Bulletin

### Positive market trends

There are some positive market trends, with major pigment producers Tronox, Kronos, Huntsman and Chemours all announcing attempted price increases for TiO<sub>2</sub> in December 2015 by \$150/t on average, or as contracts allow. The increase suggests that TiO<sub>2</sub> producers are feeling more optimistic, with supply cuts feeding through and anticipated rising demand in the coatings industry. The major titanium producers cut c.320kt of TiO<sub>2</sub> capacity by the end of 2015, according to Bloomberg, approximately 6% of global 5.3Mt of TiO<sub>2</sub> demand.

Figure 37 – Pigment producers feeling the pain

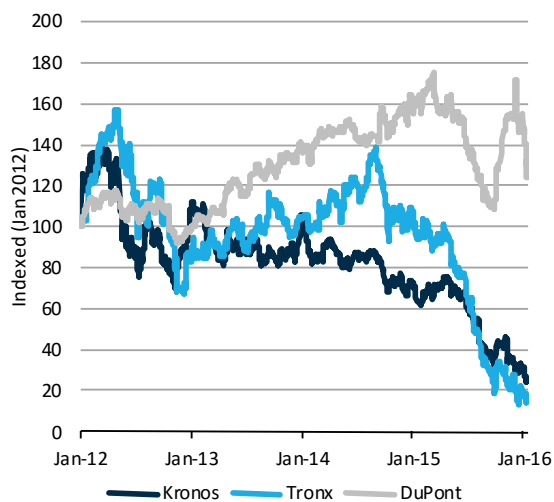
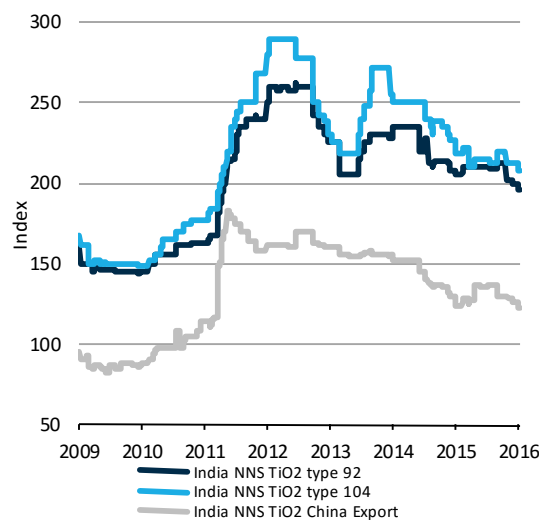


Figure 38 – Asian TiO<sub>2</sub> price index



Source: Reuters, Company reports, Bloomberg

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