

Mining Note

FinnAust Mining*

FAM LN

BUY
Target Price 15p

24 Oct 2016

Stock Data

Ticker	FAM LN
Share Price:	7p
Market Cap:	£35m

Price Chart



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Pituffik – ‘the place where they tie their boats’

FinnAust Mining is advancing toward mining titanium rich, ilmenite mineral sands at its 60% owned Pituffik mineral sands project on the coast of Greenland. The company also has other base metal and mineral licenses in Finland and Greenland which it is evaluating with the support of its major shareholder, Western Areas.

- The nature of Pituffik deposit is very different from other mineral sands deposits and experts suggest Pituffik titanium mineral sands grades may rank among world's highest. Pituffik's mineralogy is much simpler and the deposit is seen as unusually consistent.
- Tonnage, consistency and metallurgical evaluation should help confirm potential value of the in-situ deposit. Quality of mineral sands concentrates is critical with Pituffik appearing suitable for sulphate production. Processing, as with all ilmenite, is required to reduce impurities to acceptable levels.
- Simple removal of silicates improves the ilmenite product and optimisation of the process route will further improve the product. A major bulk sample is planned with which to prepare samples for testing by consumers.
- **Royal IHC**, the Dutch dredging company, is supporting work on the dredging of shallow and near shore marine mineral sands. The support of such a major dredging company is a major positive for the company.
- **Demand** for ilmenite concentrates should continue to rise as cost and pollution causes China to cut production of titanium from titano-magnetite iron ores.
- **Avannaa acquisition** gives the FinnAust team more to look at in Greenland and option value over some potentially large exploration projects.
- **Valuation on 100% of Pituffik:** We value the project at an IRR of 43% and a \$144m NPV on an 8% discount rate. This give us an NPV per share of 19 pence.
- **Assumptions:** Ilmenite production 332,500tpa. Ilmenite price \$130/t less a 10% discount reducing the price to \$117/t. Shipping \$40/t (>\$10/t to Canada). Mining and processing \$15/t. Capital cost \$60m, though preliminary estimates are significantly lower. Royalty rate 2.5%. Corporate tax 30% starting in year 4.
- **Climate:** The project is located in the high Arctic limiting mining to between 3-5 months per year. The project will be subject to campaign mining through the summer. The ground is subject to permafrost with the top meter or so thawing through the summer months hence the preference for dredge mining.
- **Location:** Greenland should offer relatively simple extraction site with no community to move and relatively few environmental issues. Work continues with the support from Greenland government agencies.
- Its near-shore, shallow-marine location on the West coast of Greenland means temperatures fall to a relatively mild -29C for the Arctic through January and February. Ilmenite mineral sands should not freeze below sea ice.

**We are grateful for the contribution made by Phil Swinfen toward the preparation of the note*

Road to value

FinnAust are busy working through a myriad of issues to demonstrate the potential value of the Pituffik project in Greenland.

The FinnAust team are working through the key issues to determine optimum routes to production and how to maximise value for mining Pituffik's mineral sands. The consistency and relative purity of the deposit is due to its localised source, relative youth of deposit and homogenous nature of basalts in the area. Eg sediments from the same source were eroded and deposited within a relatively short period of time.

Our valuation figures are still relatively approximate though we hope comparison with the company's peers, expert opinion, other information and some cautious estimation should support our valuation. The team are preparing information for pre-feasibility study work and are focusing attention on the preparation of samples to secure offtake supply.

Valuation

Assuming FinnAust completes the BlueJay acquisition for the remaining 40% through the issue of 108m shares

IRR - 43%

NPV - \$144m at a 10% discount rate = 17 pence per share

Target price: 15 pence per share

Our Target price is derived through a 30% discount to our NPV to take account for the early stage of the project. We expect to reduce this discount as the project advances and more certainty is developed.

Assumptions:

Production 332,500tpa ilmenite concentrate, around 50%.

Ilmenite prices \$130/t less a 10% discount assumed giving \$117/t. Ilmenite are said to have suffered their worst year in history last year as consumers worked their way through stocks at a time of slowing GDP growth. See section on ilmenite prices.

Mining and processing \$15/t of concentrate assumed. (Kenmare's cash operating costs are around \$6.60/t of ore mined and processed in 2015. This provides a useful comparison)

Shipping \$40/t includes transshipping to Panamax carrier, not ice-class vessels. We are aware of much keener shipping rates to Canada, the US and Europe but have used a more demanding \$40/t to include the potential to ship to China. Ilmenite concentrates may be shipped to a variety of destinations depending on grade and impurities.

Capital cost \$60m, though rough preliminary estimates are for \$50m.

Royalty rate 2.5%. Royalty rates for Pituffik may be set lower due to its location in the Arctic Circle and special dispensation offered by the Greenland government to encourage mining activity in the area.

Corporate tax 30.3%. We have assumed a three-year tax holiday. Corporation taxes also provide an offset royalty rates.

The maiden resource estimate due before the end of the year as a milestone that may put Pituffik on the map as a large high-grade undeveloped ilmenite project.

FinnAust has now secured title over the off-shore (previously just on-shore), and we see these marine extensions of the ilmenite-rich sediments as helping to secure a longer term potential for the project. Recent metallurgical and marketing analysis indicate potential to start off-take discussions next year which may accelerate financing and the creation of new value.

Peer Group

A number of FinnAust's potential peers in relation to the Pituffik minerals sands are listed below.

As with all comparative tables the Peer Group has its idiosyncrasies. Sierra Rutile is currently subject to a bid by its larger peer Iluka Resources. We expect the bid to go through assuming anti-competition board approval. Sierra Rutile mines rutile which substitutes for ilmenite in Sierra Leone.

Kenmare and Base Resources are better comparators. Both are in higher risk locations in Africa and both have suffered challenges through commissioning. Recent low price levels have not helped either.

Tronox is a US based, global mining and chemicals business. The company mines titanium ore, zircon and other minerals. It also mines trona ore to produce natural soda ash, sodium bicarbonate, sodium sesquicarbonate, and caustic soda. The company has an integrated TiO₂ value chain including pigment manufacturing plants in the US, Holland and Australia.

FinnAust offer potential to develop the Pituffik mineral sands and potentially rival its smaller peers in time.

Peer Group – titanium mineral sands producers

Company	Ticker	MCap, \$m	EV, \$m	Sales 17e, \$m	EBITDA 17e, \$m	EV/ Sales	EV/ EBITDA	Res, mt	THM, %	Ilmenite, %	Rutile, %	Zircon, %	Product
Tronox	TROX US	955	3,829	2,280	399	1.7	9.6	1,426	5.0%	2.4%	0.4%	0.4%	Vertically Integrated producer using internally sourced raw materials including Ti slag, synthetic rutile, and rutile (by-product of zircon and pig iron)
Kenmare Resources	KMR LN	422	767	226	68	3.4	11.3	8,036	3.0%	2.5%	0.1%	0.2%	Ilmenite, rutile, zircon
Iluka Resources	ILU AU	1,858	1,951	674	218	2.9	8.9	2,460	7.0%	4.2%	0.4%	0.7%	Ilmenite, synthetic rutile, rutile, zircon
Sierra Rutile	SRX LN	222	271	156	48	1.7	5.7	867	1.2%	0.2%	0.9%	0.1%	Rutile (with minor amounts of ilmenite and zircon)
Base Resources	BSE LN	92	284	156	73	1.8	3.9	135	4.2%	2.4%	0.5%	0.3%	Ilmenite, Rutile, zircon
FinnAust Mining	FAM LN	41	40										

Source: Company, Bloomberg

The Pituffik project

FinnAust's Pituffik project translates as the 'Place where they tie their boats'. This is particularly appropriate for a natural harbour which should make a good location for simple dredge mining and processing.

Management are working through the critical issues to ensure concentrate production is viable and is able to meet the conditions demanded by consumers in the market. Expert opinion suggests a saleable concentrate may be produced using a simple gravity plant although the added benefit of using simple magnetic separation means the project is likely to go this route.

Grade: Overall ilmenite grades should average between 15%-50% for the inferred resource and 12%-25% for the larger exploration target. A recent SRK report indicates there is 'up to' 95% HM sands with more than 70% absolute weight of ilmenite. Some areas are shown to run at 95% ilmenite and a new discovery just east of Interlak that has potential to be a large occurrence of material grades >75% ilmenite. The resource appears to contain no rutile and with minor zircon content though it is still a bit early to know.

The average TiO₂ content in the ilmenite is so far shown at around 46.5% though again this number is bound to change.

FinnAust aim to publish a significant JORC Exploration Target later this year to give some scale to the potential deposit. So far pictures of the location of sampling show the project to be of some scale.

Impurity levels suggest the ilmenite concentrate should be suitable for sale for sulphide processing but may or may not be suitable for the more exacting chloride process on further processing. It is still early days from a metallurgical perspective and while a preliminary review of the metallurgical work by experts suggests a suitable concentrate may be made for the higher value chloride process though this will need further work to verify.

A comparison of selected ilmenite concentrate specifications

	Pituffik FAM expected product	Norway Tellnes	Russia Kuranakh	China Panzihua
TiO ₂	46.5	44.7	48.2	47.5
FeO	39.7	33.6	>37.5	34.3
Fe ₂ O ₃	11.3	11.6	<8.5	5.6
Al ₂ O ₃	0.14	0.74	<3.0	1.3
SiO ₂	0.5	3.1	<2.1	3
Cr ₂ O ₃	0.06	0.09	<0.065	0.02
ZrO ₂	0.12	0.03		
CaO	0.1	0.19	<0.23	1.3
MgO	0.7	3.2	<2.2	5.3
MnO	0.55	0.26	<0.63	0.7
Nb ₂ O ₅	0.02			0.03
P ₂ O ₅	0.01		<0.05	0.02
V ₂ O ₅	0.38	0.24	<0.15	0.1

Vanadium and chrome are critical impurities. Their content should be kept below certain levels from the perspective of many consumers. While Pituffik's vanadium is slightly higher than the 0.3% level, its chrome content is low offsetting the higher vanadium level. These minerals serve to discolour pigments. The table shows low the range of minerals within an optimised concentrate indicating the removal of silica bringing V₂O₅ levels to close to acceptable levels. The implication being that further refinement of the process should enable the production of a concentrate which is saleable directly to sulphide consumers or for blending with lower vanadium concentrates before onward sale.

The current proposal for a gravity only concentrate plant is suitable for sulphate processing but would need to have a magnetic separation step at around 3000 Gauss on the concentrate to potentially qualify for consumers who use chloride processing.

As a result, FinnAust reckon their concentrate should be suitable for consumers worldwide though most sulphate production is based in China. We assume FinnAust work to a tight schedule in a relatively short field season, though the window for shipping will be longer. We suspect there are a number of techniques for extending the length of the field season.

What's been achieved? What's next?

FinnAust is ticking the box with some project milestones at Pituffik. In particular, the completion of the acquisition of Blue Jay Mining to secure the Pituffik project, and the receipt of an expanded licence to cover off-shore areas have been achieved. The acquisition of Avannaa Exploration is another event in the company's strategy to build up the asset base during the current down-turn (or at least while valuations remain subdued).

We expect further news flow to continue in H2 2016 and into next year. With staff and consultants working on various disciplines, and the 2016 field season underway, we see high-levels of news flow imminently.

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

Figure 1 - Key achievements and upcoming catalysts



Source: Company, SP Angel

Financials and corporate update

Balance sheet bolstered

FinnAust raised £1m in March 2016 through the issue of 50m shares at 2p/sh. The proceeds will be used to support the 2016 exploration work programme at Pituffik. In a vote of confidence in the Pituffik project, approximately 50% of the funds raised came from new investors. The placing complements the £200,000 (also at 2p/sh) investment by management and major shareholder Western Areas Limited in December 2015, as part of the acquisition of a 60% interest in Blue Jay Mining.

In July, FinnAust raised a further £500,000 at 5p/sh to existing and new shareholders. The funds will be used towards implementing the accelerated work programme at Pituffik, as well as due diligence on potential acquisitions.

Following the above placings, post completion of the 60% acquisition of Bluejay, and subsequent issue of equity and warrants to advisors, FinnAust has 494m shares in issue.

Majority interest in Pituffik secured

FinnAust completed the 60% acquisition of Bluejay Mining in early March, following receipt of change of control consent from the Greenlandic authorities, giving FinnAust a majority interest in the Pituffik project. Under the terms of the acquisition, the company retains an option to acquire the remaining 40% of Bluejay through the issue of 108m shares, exercisable until 11th February 2020. The option is exercisable at the company's discretion and it should be noted that the option will not be exercised if it would trigger a reverse take-over under AIM rules (i.e. a mandatory offer by the venders of Bluejay Mining).

Board Change: Dan Lougher retirement as transaction completes

In March, Dan Lougher retired from the company's Board as a Non-Executive Director as part of the successful acquisition of the Pituffik project. Mr Lougher is currently the Managing Director of Western Areas, FinnAust's largest shareholder. With the completion of the transaction Western Areas is comfortable that the company is moving in the right direction and no longer requires the hands-on role Dan provided previously. Western Areas still maintains representation via Graham Marshall (General Manager Commercial of WSA) who was appointed Chairman of FinnAust in December 2015.

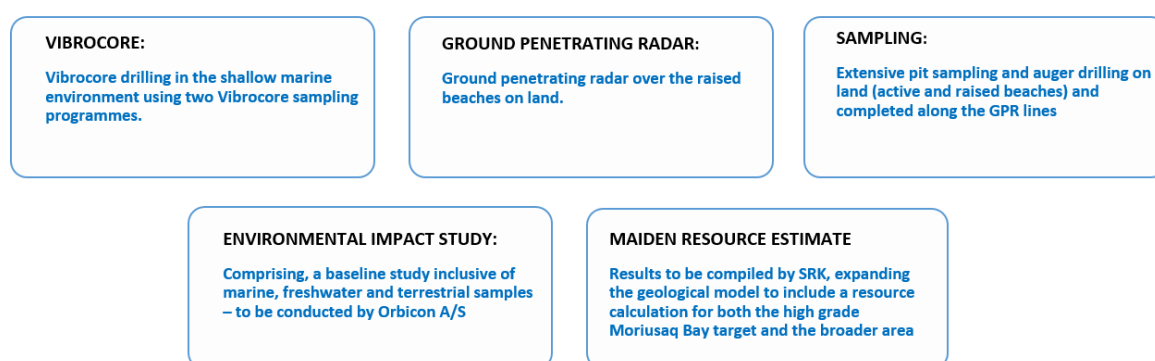
2016 exploration programme exceeds expectations

In mid-July, FinnAust received approval from the Mineral Licence and Safety Authority ('MLSA') for its 2016 work programme at the Pituffik. The programme, which has been expanded due to the planned working being completed ahead of schedule. The fieldwork is progressing well, and has been successful in identifying large volumes of ilmenite rich sands indicating the potentially large scale of the project.

Aims of the programme – pointing towards a maiden resource estimate

The 2016 programme is focusing on the key target areas of Pituffik - the active, raised and drowned beaches. The key deliverable is data to support a maiden resource estimate, anticipated by the end of 2016. The 2016 exploration programme has been designed by, and is being executed by GEUS, in conjunction with SRK. FinnAust has received approval for all activities proposed in the 2016 exploration programmes including the environmental assessment programme, and at the time of writing, the planned programme is largely complete.

Figure 2 - FinnAust's 2016 Exploration Work Programme – core work programmes



Source: Company

FinnAust's 2016 field programme is aimed at fulfilling the two near-term aims of 1.) compiling a maiden resource estimate by the end of 2016 and 2.) working towards the bulk sample to be extracted in 2017. The bulk sample should also confirm the selection of process route as part of the metallurgical test-work.

FinnAust has identified two key project areas:

Moriusaq – the most advanced and has returned the highest ilmenite grades to date.

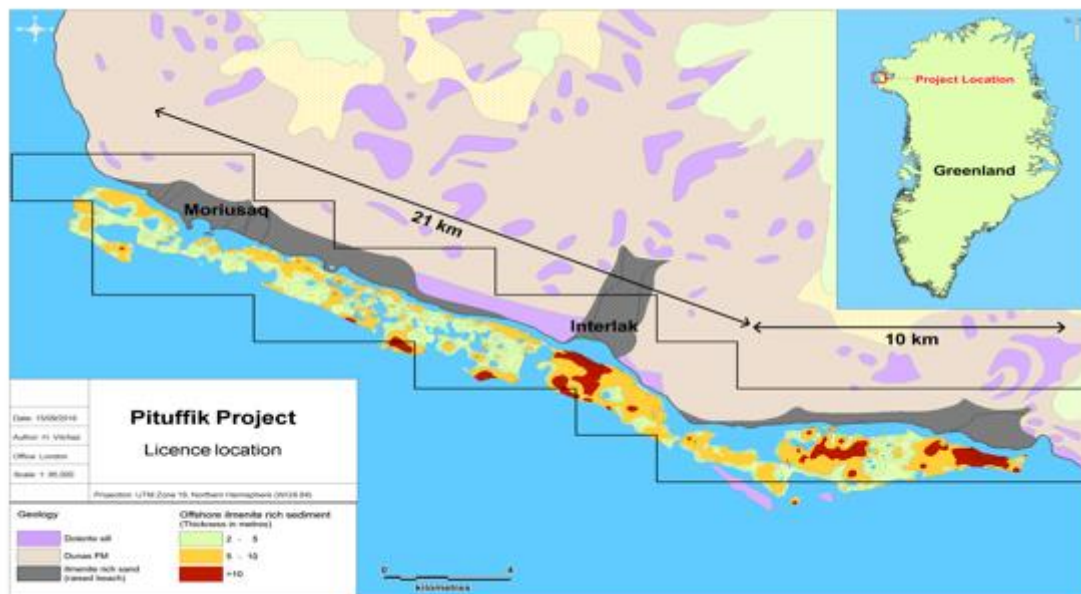
Interlak – the largest volume of heavy mineral sands with grade upside potential.

Following on from the granting of an expanded exploration licence covering the off-shore environment, exploration activities are focusing on the methodical sampling of these drowned beach sediments in the shallow marine environment. This will ensure high quality data inputs into the resource calculation.

This systematic sampling approach has been duplicated over the active and raised beaches using ground penetrating radar and auger drilling as well as pit sampling. This will create a three-dimensional model of all the sedimentary material along the coast, both above and below sea level, in a swathe some two kilometres wide. The GPR surveys will help define the basement and overlying sediments to outline the potential volume of ilmenite bearing sediments that comprise the raised beach targets.

In addition, the environmental baseline study has recently been approved - a prerequisite for an exploitation licence application. This study will include environmental baseline activities such as the collection of marine, freshwater and terrestrial samples to record the state of the environment prior to any ground disturbing activities as well as more detailed surveys of the benthos, arctic tern, common elders as well as vegetation assessments.

Figure 3- Preliminary drill hole and ground penetrating radar survey design for the Moriusaq area



Source: Company

Work programme – findings so far

Preliminary findings from the fieldwork so far (as of the end of August) are summarised in the following bullets. Overall, the general theme is that virtually every target tested appears to have confirmed the presence of significant volumes of titanium—rich ilmenite sands:

Trenching over the main project areas has identified large volumes of ilmenite rich sands.

Ground Penetrating Radar has identified buried layers, of what is expected to be high concentrations of heavy minerals.

Auger holes - 260 holes have been completed on raised beaches showing significant horizons of ilmenite rich sands.

150 vibracore holes have been completed off-shore (up to 3m), with reduced penetration in the Moriusaq Bay area due to almost pure layers of ilmenite-bearing sediments encountered.

A large metallurgical sample is en-route to the process and metallurgical consultants.

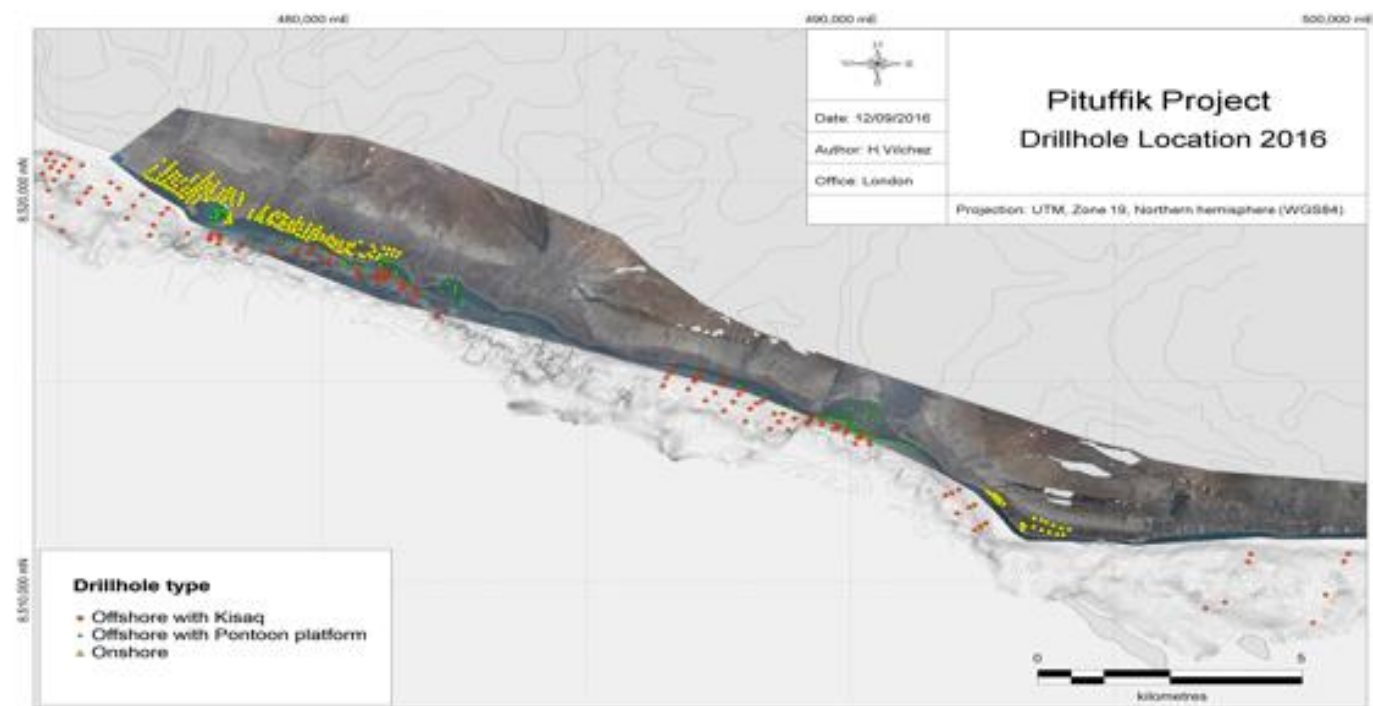
Auger Drilling – ilmenite sands intersected in all targets

Auger drilling on raised beach targets has intersected ilmenite-rich sands in all target areas tested as part of the programme. This low-cost technique has proven an excellent tool to test the extensive near-surface targets in order to define targets for deeper drilling. 260 auger holes have been completed to date, with additional holes expected before the season end.

Figure 5 (LHS) below demonstrates the extensive nature of ilmenite sands in the project area. We are extremely encouraged by the fact that thick ilmenite sand has been intersected in every auger hole in the Moriusaq area.

Given that the programme was advanced earlier than expected, the company has expanded its programme to include infill drilling focused on the regional extent of raised beaches between Moriusaq and Interlak (± 15 km).

Figure 4 - Sampling locations – on and off share



Source: Company

Figure 5 - (LHS) Auger sample from raised beach – the black material is ilmenite rich sediment; (RHS) Initial trenching demonstrating ilmenite depositional modes; The black banding is virtually pure ilmenite



Source: Company

Trenching at Interlak points to volume

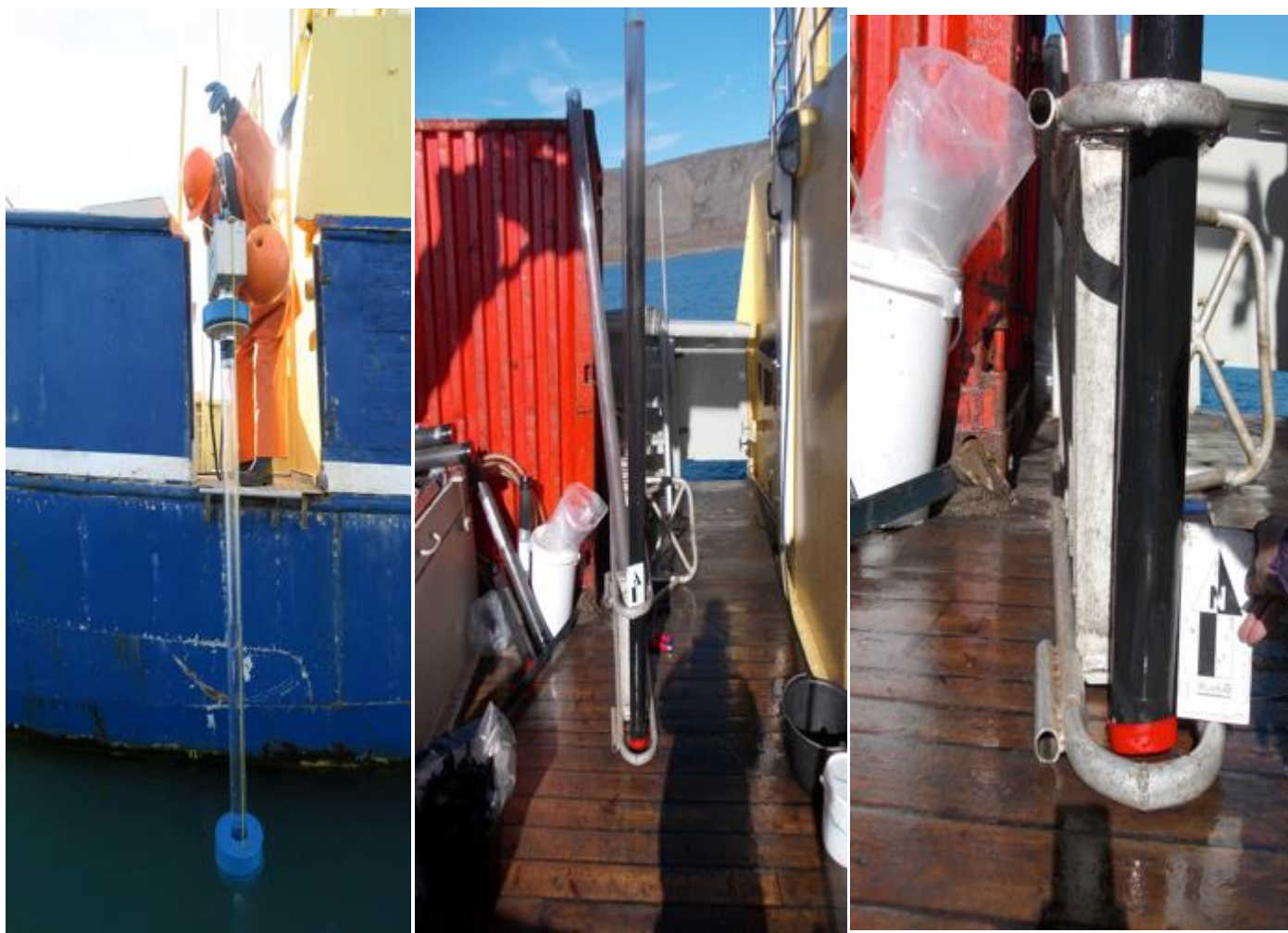
Extensive trenching and pitting has also been completed on the very large-scale raised beaches at Interlak. Thick bands of almost pure ilmenite have been identified (see Fig 5 RHS) whilst the total depth of ilmenite-bearing sediments remains unknown (i.e. open to depth) due to the base of the trenches ending within the ilmenite-rich zone. This clearly has significant implications for potential resource size and grade, and confirms FinnAust's exploration thesis.

Vibracore hits home off-shore

Vibracore units have been deployed in both the near-shore Moriusaq Bay as well as shallow marine areas immediately adjacent to the active beach zones. Vibracore is a sampling technology used to collect core samples of underwater sediments.

Intriguingly, the unit and vessel operating in Moriusaq Bay encountered reduced penetration due to almost pure and compacted layers of ilmenite-bearing sediments and cobble. A programme of 165 holes has been completed with almost all target areas returning results of note (see Figure 7).

Figure 6 - Ilmenite rich black sand accumulations from shallow marine <15m



Source: Company

Development Team Assemble!

The last few months has seen FinnAust make a number of appointments demonstrating the company's commitment to progress and fast-track Pituffik towards production, in our view, and provide key deliverables on the critical path towards development.

The appointment of consultants and specialists covers a wide range of disciplines, from geology and exploration, through to permitting and metallurgy. In particular, FinnAust has selected two Danish groups in March to complete the Social Impact Assessment (SIA) and Environmental Impact Assessment (EIA). The completion of an EIA is particularly important as a requirement for commencement of mining. By putting in place consultants and expertise covering the full range of development disciplines, it is clear that FinnAust is firmly focused on progressing Pituffik through to production.

GEUS – Exploration and Logistical Support

GEUS, who were contracted by Bluejay Mining in 2015 to provide exploration and logistical support, have further been engaged for 2016 to design and assist in the execution of the 2016 field season. GEUS also have a critical role to play in development studies, having been contracted to complete metallurgical test work in order to produce representative samples of Pituffik concentrate.

SRK – Geology and Resource Estimation

SRK was appointed to review and standardise exploration activities in order to generate a geological model and initial resource estimate for the high-grade Moriusaq target by the end of 2016. SRK will also act as a Competent Person for the mineral resource estimation. SRK Exploration is a branch of the global SRK Consulting Group and a top quality provider of exploration services, in our view. We believe this signals that FinnAust are prepared to invest significantly in the development of Pituffik, with high-quality appointments early on setting the tone.

NIRAS and Orbicon – Permitting, SIA and EIA

NIRAS, a Danish based multidisciplinary consulting group has been appointed to complete the SIA at Pituffik. The SIA will fulfil regulatory and permit requirements as specified by the Greenlandic Mining Resource Authorities ('MRA') and in compliance with international standards. Orbicon, also a Danish firm, is a technical advisory company which provides engineering and environmental consulting services. Orbicon will support FinnAust in the completion of the EIA in accordance with MRA guidelines.

The appointment of the two groups recognised as leaders in their fields in Demark is significant. Both groups are experts in operating in Greenland and have been involved in infrastructure and mining projects in the region, including advising the US Air Force at the nearby Thule airbase. The appointments complement FinnAust's in-house expertise and provide a solid base to fast track permitting and development milestones at Pituffik.

KeyPointE and QuedTech – Metallurgy

In June, FinnAust appointed KeyPointE and QuedTech, recognised experts in the Mineral Sands space, to complete the next phase of metallurgical test work at Pituffik. Work will begin immediately on the production of a high purity ilmenite concentrate for analysis and distribution. Studies will then focus on finalising, scaling up and optimisation of the process flow-sheet in order to support large-scale production of a similar high purity ilmenite concentrate. Ultimately, the metallurgical test-work is expected to evolve into pilot scale continuous testing later in the year.

The outputs from metallurgical test-work will also feed into preliminary engineering design to aid estimation of mineral processing capital and operating costs and allow the company to create development scenarios. The best development scenario will be included in an Exploitation Application, which FinnAust is aiming to lodge in Q1 2017. Metallurgical parcels will also be utilised to conclude sales agreements for Pituffik concentrate.

Royal IHC – Dredging

In June, the company appointed Royal IHC, a major Dutch dredging company, to support dredging activity at Pituffik. Royal IHC is a word-leader in the provision of cost effective wet

mining solutions and dredging equipment. IHC has a wealth of experience in both deep and shallow water marine environments. IHC and FinnAust will work together to define and optimise a development solution to support the proof of concept bulk sample, which is planned for 2017.

IHC will also contribute high-level cost estimation for Pituffik in order to evaluate the potential for a sustainable, long-life mining operation at Pituffik. Efficient and effective dredging techniques will form the backbone of a potential mining operation; one where successful execution will have a significant impact on project economics. Thus we are encouraged by the appointment and focus on dredging at this early stage in project development.

3D Model demonstrates large scale of deposit

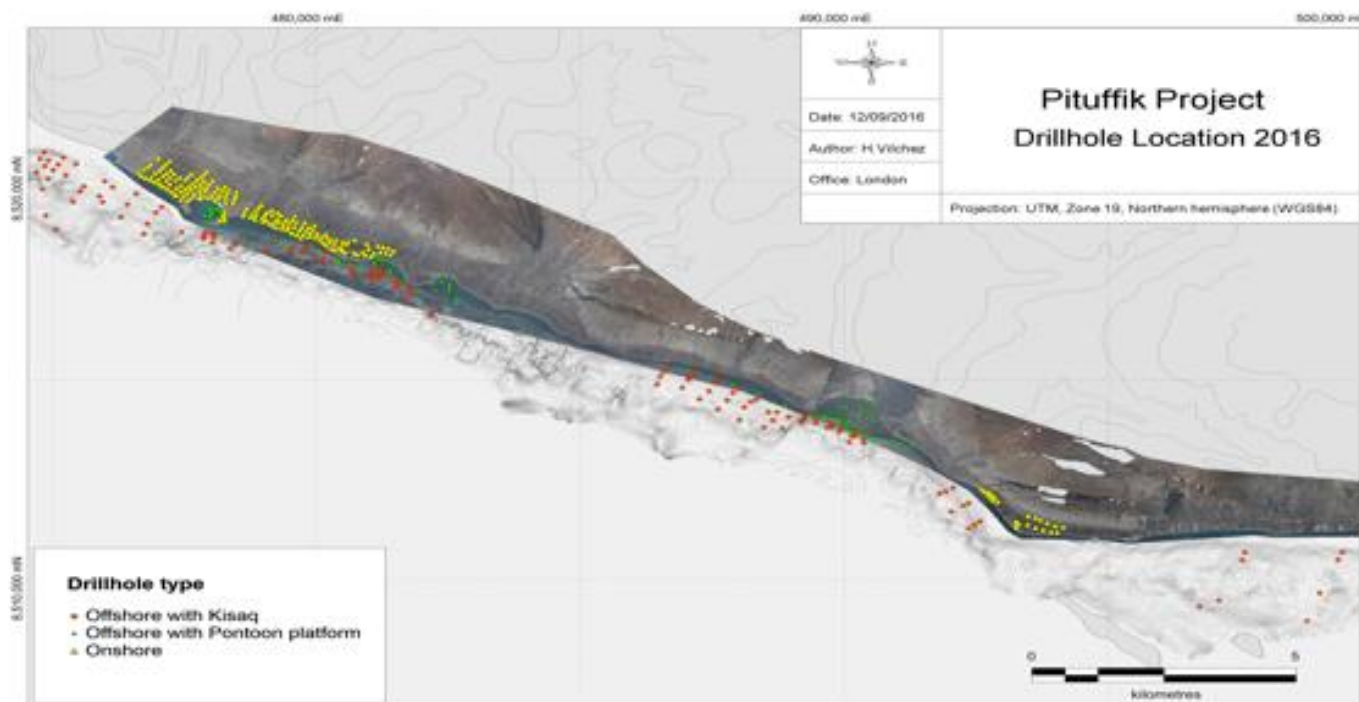
Scaling Up – Potential revealed

Photogrammetry and an updated 3D geological model completed in May 2016, have for the first-time, demonstrated the potential scale and dimensions of the Pituffik project. FinnAust reports that very large volumes of ilmenite-bearing sediments have been identified within the raised beach environment based on the new photogrammetry images. This is in addition to the very large volumes of ilmenite-bearing sediments already identified within the shallow marine (near shore) environment using last year's bathymetry and boomer profiling data.

What does all this mean? Essentially, for the first time, all the survey data has been compiled into one complete 3D geological model for both the on-shore and off-shore areas. This ultra-detailed high resolution model has allowed FinnAust to get a clear understanding of the project dimensions, and the early indications are promising, in our view. The model will form the backbone of future project planning including permitting and the maiden resource estimate.

FinnAust already assumed that large volumes of ilmenite-bearing sediments were present in the marine deposits above the underlying basement with thick ilmenite rich sediments extending for >30km in length and >1,000m in width, with sedimentary horizons on average more than 5m thick (up to a maximum thickness of 27m). The recently completed photogrammetry will define the topographic surface above sea level, marking the top of the ilmenite bearing sediments.

Figure 7 - Flight path of aerial photography undertaken at Pituffik



Source: Company

Photogrammetry gives an Eagle's Eye View

Photogrammetry entails taking multiple overlapping photos of the ground from an aircraft. These photos are processed to create a stereographic view that can give a sense of depth and can be processed to create a 3D representation of the surface terrain through a digital terrain elevation model ('DTEM'). The survey was conducted utilising an Air Greenland Bell 212 helicopter stationed at Thule Airbase

The photogrammetry was the last component required to generate the 3D model (to add to the offshore bathymetry and seismic profiling) of the Pituffik area, to cover both on-shore and off-shore areas. The regional extent of the ilmenite-bearing sediments can clearly be seen from the aerial photos. We believe that this initially ticks the box in terms of scale, and

FinnAust will now concentrate on the work programmes and honing in on key areas that suit the company's aim of fast-tracking a low-cost mining operation into production.

Furthermore, in addition to the scale and volumes of mineralisation, the recent results continue to demonstrate the continuity of the high-grade ilmenite bearing sediments, another positive factor in terms of establishing a potential mining operation.

Figure 8 - From a height of 1500m the high grade black sands of Pituffik are clearly visible



Source: Company

Looking towards a Maiden Resource estimate

With the 3D geological model complete, work will now focus on bringing together the various work streams, and the work being undertaken in the 2016 field season by SRK and GEUS in order to deliver a maiden resource estimate from the work carried out so far. We view the maiden resource as a significant milestone.

Pituffik Concentrate Analysis and End-Markets

FinnAust has made solid progress on the metallurgy front, having received the stage 2 analytical and processing results of the ilmenite separated from the heavy mineral concentrate from Pituffik. The company has also received market analysis covering all aspects of the Titanium Sector from leading consultants TZMI.

Results from both of these studies supports FinnAust's view that developing a long-life mining operation at Pituffik may be achievable. The initial ilmenite concentrate analysis suggests that concentrate could be suitable for a number of production processes; namely for direct use in the sulphate production process, and with a very small amount of further purification, also suitable for chloride slag manufacture to produce TiO₂ pigment or metal.

To complement this, the TZMI analysis suggests that both the chloride slag and sulphate routes are large and growing global markets with potential end-sale customers identified in Europe and Asia. TZMI has identified increasing ilmenite supply deficits into the medium and longer term. This gives FinnAust the opportunity to push Pituffik through to production and deliver product into this anticipated short-fall.

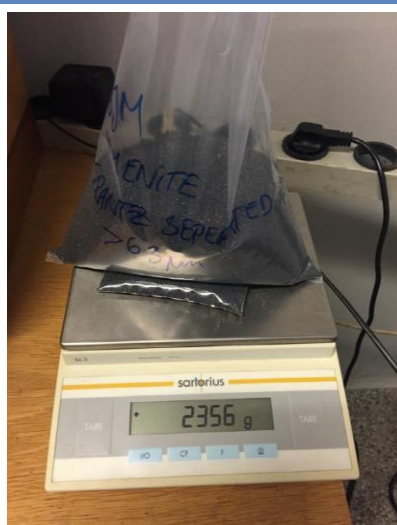
Pituffik should produce a high-quality pigment product

Initial analytical results indicate that the Ilmenite concentrate from Pituffik in its current non optimised form is well suited for direct use in the sulphate production process of Titanium Dioxide pigment ('TiO₂'). The ilmenite concentrate was produced by GEUS. Recall that there are two main processes for the production of titanium pigment; the Sulphate Process and the Chloride Process, the selection of which depends on a number of factors. In general, the sulphate process utilises lower grade feedstocks such as sulphate ilmenite (c.<55% TiO₂), whereas the chloride process uses higher grade feedstocks and is the fastest growing market as China builds out capacity.

The key take-away from the results is that given the low level of deleterious elements (i.e. impurities) detected in the concentrate suggests that the final pigment product should be of high quality. Taking this one step further, the analytical results suggest that the product should be easily soluble in a relatively low strength sulphuric acid and could operate at high process efficiency.

In addition, the non-optimised ilmenite concentrate from Pituffik has given the company a high degree of confidence that with a very small amount of further purification on larger samples from the main zones at the Project, the concentrate could also be suitable for chloride slag manufacture to produce either TiO₂ pigment or titanium metal.

Figure 9 – Finitial non-optimised concentrate of Pituffik ilmenite produced by the Geological Survey of Denmark and Greenland (GEUS)



Source: Company/GEUS

TZMI identifies both sulphate and chloride as prospective markets.

The analysis of Pituffik concentrate discussed above, ties in with the detailed market analysis provided to FinnAust by TZMI. The leading mineral sand and titanium consulting group have identified that both the sulphate and chloride pigment manufacturing processes as “equally important and prospective markets for FinnAust”.

According to TZMI analysis, sulphate and chloride titanium slag furnaces have traditionally utilised captive sources of ilmenite located close to these smelters. However, chloride slag requires ilmenite with specific quality characteristics and as local supply sources deplete, importing ilmenite for smelting is becoming an increasing feature of the industry. Examples of this include ilmenite from Senegal being exported to Norway and China importing significant quantities of ilmenite as chloride slag smelter feed.

Given the low content of deleterious elements as discussed previously, the low-impurity ilmenite concentrate from Pituffik has potential to find applications in either market. This is an important development for the company and will bolster off-take discussions which FinnAust plans to commence shortly and produce an outcome by the end of the year.

Ilmenite deficit set to emerge

Ilmenite is the primary source of titanium dioxide (TiO_2), which is a pure white, highly refractive and ultraviolet light absorbing pigment that is primarily used in paints and plastics, as well as paper, textiles and inks and TiO_2 3D printing. TZMI has identified a strategic sales opportunity to supply producers who directly use ilmenite in the sulphate production process of TiO_2 , with potential customers identified in Europe and Asia. According to TZMI the current annual requirement in this market alone is in excess of 5Mt of ilmenite and is forecast to grow steadily over the next 10 years.

Thus, TZMI expects increasing ilmenite supply deficits to emerge to the medium and longer term. This gives FinnAust an opportunity to develop Pituffik, the timing of which could potentially see the company deliver Pituffik product into this projected market shortfall. The inclusion of chloride slag production as a second potential major market provides the company with increased optionality with respect to end-users.

What we know so far...

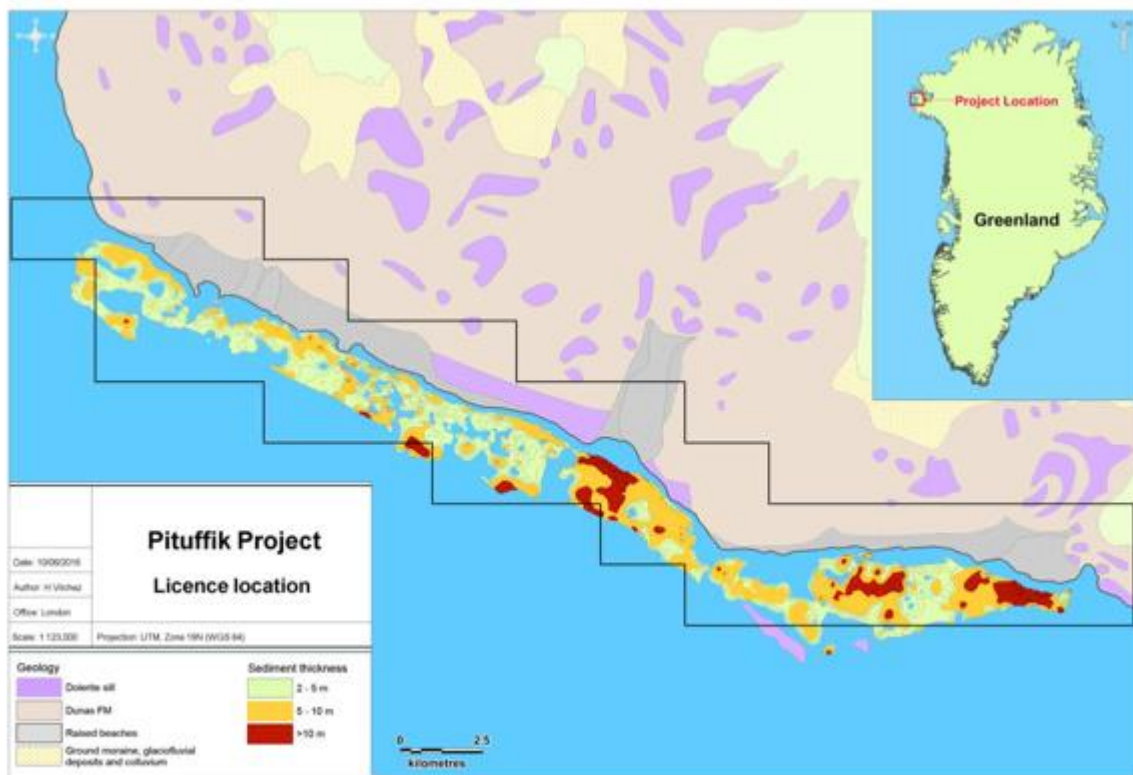
- The deposit is potentially very large, with the extent recently demonstrated by various surveys
- The deposit is exceptionally high grade in terms of the ilmenite content of the sediments
- Pituffik produces an exceptionally clean (i.e. high quality) concentrate, low in deleterious elements
- The concentrate is potentially suitable for both of the primary pigment production processes
- TZMI has identified potential customers in Europe and Asia

FinnAust reports that it will continue to optimise the Pituffik heavy mineral concentrate, and further explore marketing initiatives.

Offshore Exploration Licence Granted

In July, FinnAust reported that it had been granted an extension of its existing licence to include all minerals within the shallow marine environment at Pituffik. This is the first marine based exploration licence for minerals granted by the Self Rule Government of Greenland. This is a major achievement for FinnAust and confirmation of the company's ability to navigate the legislative and permitting process, as well as demonstrating the supportive framework for mineral development in Greenland.

Figure 10 - Expanded licence area, now covering marine sediments



Source: Company/GEUS

On-shore and Off-shore secured

Critically, the expanded licence now includes marine extensions of the titanium rich black sands. Modelling suggests that these “drowned beaches” contain ilmenite bearing sediments similar to that of the active and raised beaches at Pituffik, but in much larger volumes, according to FinnAust.

The importance of the granting of this off-shore licence cannot be understated as it provides title over the marine sediments, which have already been identified as having potential to host significant volumes of ilmenite-rich sediments. Bathymetry suggests that these sediments range in thicknesses between 3-27m with an average of 5m. The new licence expands the existing licence to an area of approximately 150km², half of which covers the shallow marine environment. Thus, the potential implications for building a substantial resource base is clear now that the off-shore area can be included in the project's development plans.

The rolling-in of the drowned beaches with the raised and active beach environments under one new licence should also greatly assist at the permitting level going forward.

Avannaa Acquisition

Building the pipeline at the bottom of the cycle

In early September, FinnAust announced the acquisition of a 100% interest in Avannaa Exploration, a mineral exploration company with Ni-Cu-Pt and Pb-Zn-Ag projects in Greenland. Whilst the company's primary focus remains on progressing Pituffik towards production, the acquisition has a number of advantages and complements the overall strategy focussed on Greenland.

Primarily, we see this as a continuation of FinnAust's strategy to build up the company's asset base whilst current industry valuations largely still reflect the cyclical low-point of the commodity cycle. This gives FinnAust the opportunity to acquire high-quality projects at a low cost, which provides optionality in the future for the next up-swing in the cycle.

Whilst this strategy of building up the project portfolio during low points in the commodity cycle is not new, we believe that it has been reasonably well executed by FinnAust. In particular, the new acquisition provides access to two projects; Disko and Kangarluarsuk where historical drilling and/or sampling has already proven the existence of high-grade mineralisation, and multiple drill-ready targets. FinnAust may benefit from considerable historical expenditure on the projects by major mining companies, estimated at c.\$60m by FinnAust. The projects provide the prospect of outlining high-grade and high-tonnage orebodies, leap-frogging the high-risk and capital intensive early exploration phase. Finally, the projects bolster FinnAust's Greenland portfolio and leverage off management's considerable local expertise and knowledge that is already in place. It is also worth noting that the projects have a minimal holding cost to maintain in terms of the licences, due to the historical exploration expenditure.

The terms – cheap entry point

The Avannaa acquisition price is £500,000, to be satisfied through the issue of around 7.45m new shares at a price determined on a volume weighted basis between the date of the agreement and the date of approval by the Greenland government less 5%. The consideration has no cash component and the acquisition is conditional on Greenland government approval.

Disko Ni-Cu-PGMs – The Norilsk Analogue

Disko-Nuussuaq is a magmatic nickel-copper-PGM project in West Greenland. Exploration commenced in the 1960s with Inco, but primarily, the project has been the subject of three decades of exploration; Cominco in the 1980s, Falconbridge in the 1990s and Vismand Exploration in the 2000s before passing to Avannaa. Falconbridge undertook the most comprehensive investigations, drilling 25 holes <200m although drill-testing was aborted due to difficult drilling conditions. Although Disko has been the subject of numerous geochemical and geophysical surveys, it has seen limited drilling and we view the potential as largely untested.

Infrastructure – one of the most active areas of Greenland

Disko has the advantage of being located in one of the most economically active areas of Greenland with good access and a fully functional logistics network as a result of the excellent modern infrastructure in the region. This stems from the region having a strong association with mining as evidenced by historically operating mines such as the Qullissat coal mine and the Black Angel Pb-Zn mine.

Figure 11 – Disko location, infrastructure and logistics – note also location of Kangerluarsuk



Source: Avannaa Exploration

While we still consider Greenland to be a remote location, it is still accessible and Disko benefits from the following:

Deepwater container ports at Ilulissat c.160km and Aasiaat c.180km from Disko – with sea free access 9 months of the year and all-year round access for ice-strengthened vessels. The Royal Arctic Line regularly sails to the Disko /Uummannaq area.

Air routes – the area is serviced by regular international flights from Copenhagen and Reykjavik and numerous local flights operated by Air Greenland. 2-3 helicopters are permanently based at Ilulissat.

Power – small towns in Greenland are typically powered by diesel generator, but Ilulissat and Qqaatsut are powered by a 65GW subterranean hydro-power station. Also available are hospitals, hotels, construction facilities, workshops, shops...

The Norilsk Analogue

The culmination of over 30 years' exploration and analysis indicates that the Disko region has all of the components required to produce massive sulphide and disseminated Ni-Cu-PGE deposits of the Norilsk type.

Magma composition. High-magnesium, olivine-rich magma – The Vaigat Formation of the West Greenland Palaeocene Basalt Province contains one of the world's largest accumulation of high-magnesium picritic lavas outside Siberia. Picrites are genetically important because they high temperature, low viscosity melts and thus assimilate more crust leading to sulphur saturation. The Vaigat picrites have been found to range from 7-29% MgO. Evidence from sulphide globules in basaltic glass demonstrate that the picrite was sulphur saturated.

Sulphide/sulphur-bearing country rocks – Sulphur-bearing black shales and coal beds are common throughout the sedimentary package of the Atane Formation that directly underlies the flood basalts. A key line of Norilsk analogy is the eruption of lavas through an into a sedimentary basin.

Prolonged episodes of assimilation of siliceous crustal rocks – Numerous geochemical studies support large scale assimilation of sediments for significant units of the Vaigat Formation lavas, as much as 40% shale (Asuk Mb) and 12-24% sandstone (Kuugannguaq Mb). i.e. the magmas are contaminated. Furthermore, these two units have been demonstrated to develop significant volume; covering 1,000km² at Asuk and up to 150m thick and covering 200km² at Kuugannguaq.

Level of erosion – is deep enough to expose the base of the volcanic pile both in Norilsk and Disko.

Chalcophile element depletion in crustally contaminated rocks – Many of the volcanic units show strong chalcophile element depletion, and several units show extreme nickel and PGE depletion.

Proximity to crustal-scale faults – Kuugannguaq-Qunnilik fault complex is a major structural feature in West Greenland, traceable for 200km and cutting through the licence area. It is considered to be analogous to, and on the same scale as, the Norilsk-Kharaelakh fault in the Siberian traps

Proximity to magma conduit system – The volcanic stratigraphy and structure is reasonably well described and suggests that the Kuugannguaq and Aaffarsuaq valleys are possible loci of eruptive centres aligned along the Kuugannguaq-Qunnilik fault system – a crust penetrating structure and an important part of the volcanic plumbing system.

Why is all this important?

Large nickel sulphide discoveries are rare. Most of the existing Ni-sulphide camps were discovered in 1970s and it is our view that big discoveries are more likely in frontier locations, i.e localities like Greenland.

Norilsk Nickel is the world's largest producer of nickel and palladium and one of the largest producers of platinum and copper. Production is centred on Norilsk – Talnakh group of deposits within the Norilsk layered mafic intrusion complex in Siberia.

The geology of the West Greenland Palaeogene Igneous Province is similar to that of Norilsk in Russia where massive sulphide ores tend to form dykes and flat-lying sheets and lenses at the bottom of intrusions.

The genetic model of the formation of massive sulphides in mafic layered intrusions is well known. Exploration focuses on identified thick MgO-rich ultramafic sequences proximal to sulphur-rich sediments. This sets up the possibility that the high-MgO magmas may have assimilated sulphur-bearing crustal material leading to sulphur saturation. This is important because sulphur saturation of the silicate liquid allows an immiscible sulphide liquid to form, i.e. sulphide melt droplets within the magma. This is a key ore genesis mechanism for Ni-Cu-

PGE mineralisation as the sulphide melt acts as scavenger and metals such as nickel preferentially partitions into the sulphide.

The metal-containing sulphide droplets then tend to concentrate preferentially near the base of the magma due to the density contrast between the silicate and sulphate liquids. Economic concentrations of sulphide are often encouraged where crustal structures create traps and flow-rate changes for ascending magmas creating favourable environment for settling and differentiation.

Exploration focus remains on crustally contaminated magmas as without crustal contamination, it is unlikely that the magma will reach sulphide saturation in order to form sulphide droplets to scavenge the silicate melt for metals.

Whilst many geological environments have a number of attributes suitable for the formation of these types of Ni-sulphide orebodies, the fact that Greenland (and the Disko project) has all the required prerequisites is rare and provides a target for further exploration. The fact that massive sulphides have already been identified also provides proof that the system was conducive for the formation of mineralisation.

Analysis undertaken so far suggests that sulphide segregation has occurred at Disko, with considerable volumes of melt interacting with high-sulphur sedimentary sequences, precipitating Ni, Cu and PGMs within the conduit system. According to work by Avannaa Resources, the abundance of sulphide inclusions from the lavas suggest that sulphur saturation and segregation were common and reoccurring processes that affected all the major crustally contaminated lava units at Disko. These features represent highly prospective exploration targets.

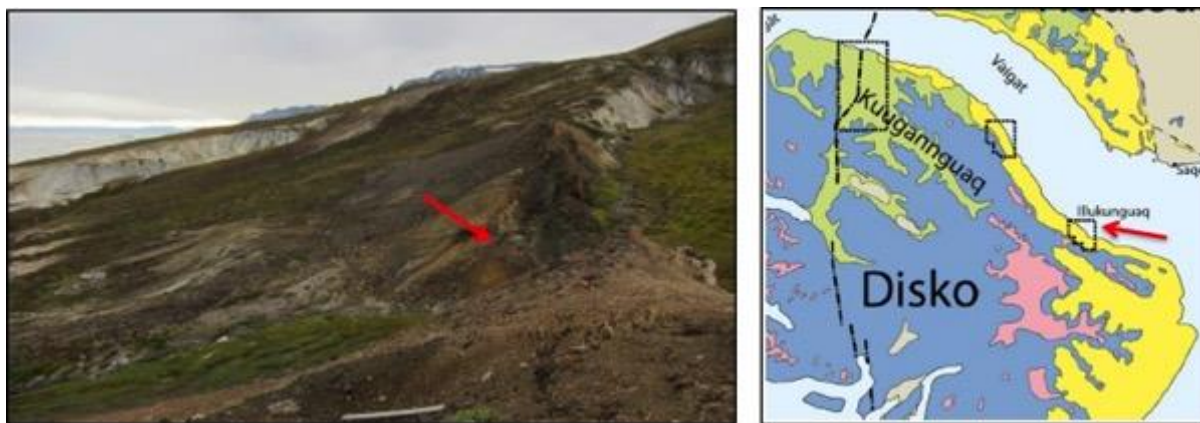
High-grade massive sulphides have already been discovered

The Norilsk analogy model for Disko has been confirmed by the presence of small high-grade mineralised massive sulphide deposit outcropping at Illukunnguaq in the eastern portion of the Disko licence. The deposit, a pod of massive sulphide within the lower margin of the Illukunnguaq dyke was first discovered in 1872, drilled by New Quebec Mining Company in the 1960s and sampled by Falconbridge in 1991. The size of the body has been estimated at 28 tonnes, with Falconbridge samples of the remnant rubble returning assays of 6.86% Ni, 3.71% Cu, and 2g/t PGMs.

The massive Ni-pyrrhotite body is interpreted to represent a massive of sulphide melt injected from a larger pool of sulphide melts along the edge of the dyke, suggesting that the dyke intersected mineralisation at depth.

Several attempts were made to drill nearby geophysical anomalies that may represent larger accumulations of massive sulphide, but were abandoned due to bad ground. Thus, the vicinity remains largely untested.

Figure 12 – Outcropping massive sulphide bony at the Illukunnguaq dyke

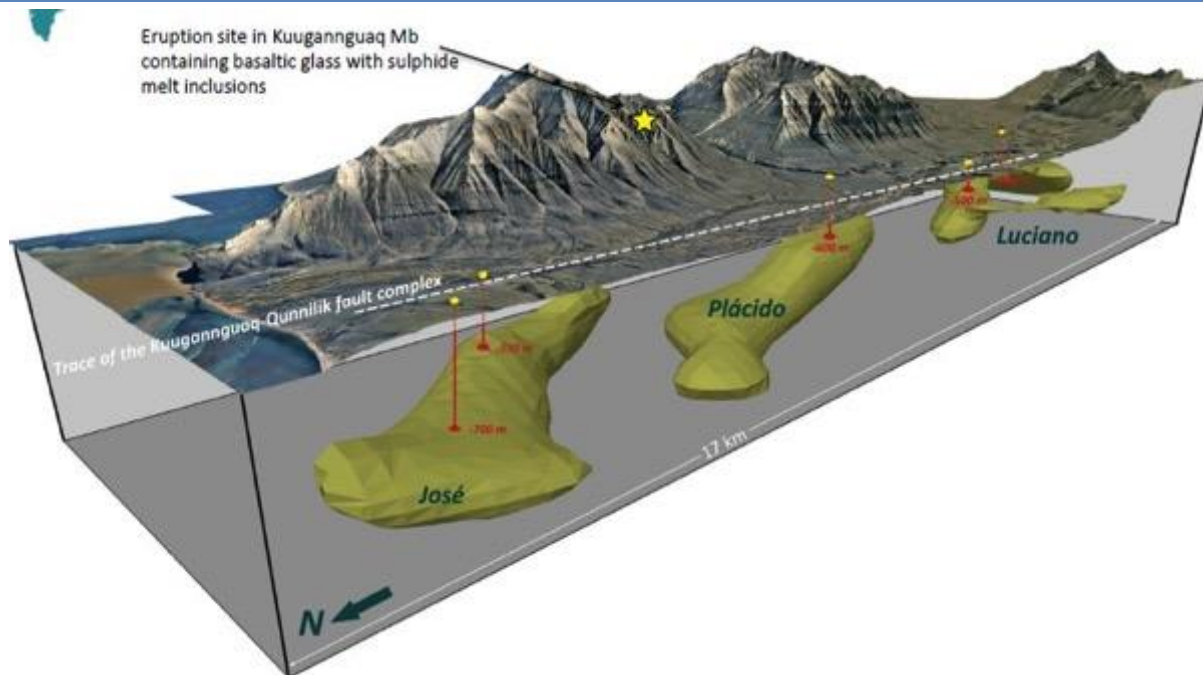


Source: Avannaa Exploration

District Potential is wide open

In 2012-2013, Avaanna conducted a significant programme of seismic, magnetic and airborne audio-frequency magnetic (ZTEM) surveys in the northern Disko and southern Nuussuaq areas. The work identified a total of seven conductors; the four largest having dimensions of 4km x 900m, 5.9km x 1km, 3.8m x 700m and 4.8km x 1.1km, commencing at a depth of between 500-600m below the valley floor.

Figure 13 – ZTEM 3D Inversion: Conductors in the Kuugannguaq Valley



Source: Avaanna Exploration

Targets are drill-ready

The conductors coincide with the trace of a major fault complex and an eruption site where basaltic glass containing sulphide melt inclusions has been identified. With the conductors representing conductive, i.e. potentially sulphides formations, the recent work by Avaanna has identified a number of clear drill targets which have not yet been drill-tested. Thus FinnAust gains the benefit of the recent geophysical data and interpretation work, with several anomalies representing walk-up targets that could form the first thrust of a new exploration programme.

Kangerluarsuk Pb-Zn – drill ready Sedex targets

The 102km² Kangerluarsuk licence is located in western Greenland, within a major Palaeo-Proterozoic sedimentary basin with abundant Pb-Zn showings. Kangerluarsuk is directly next to a deep-water fjord, with ship access eight months of the year.

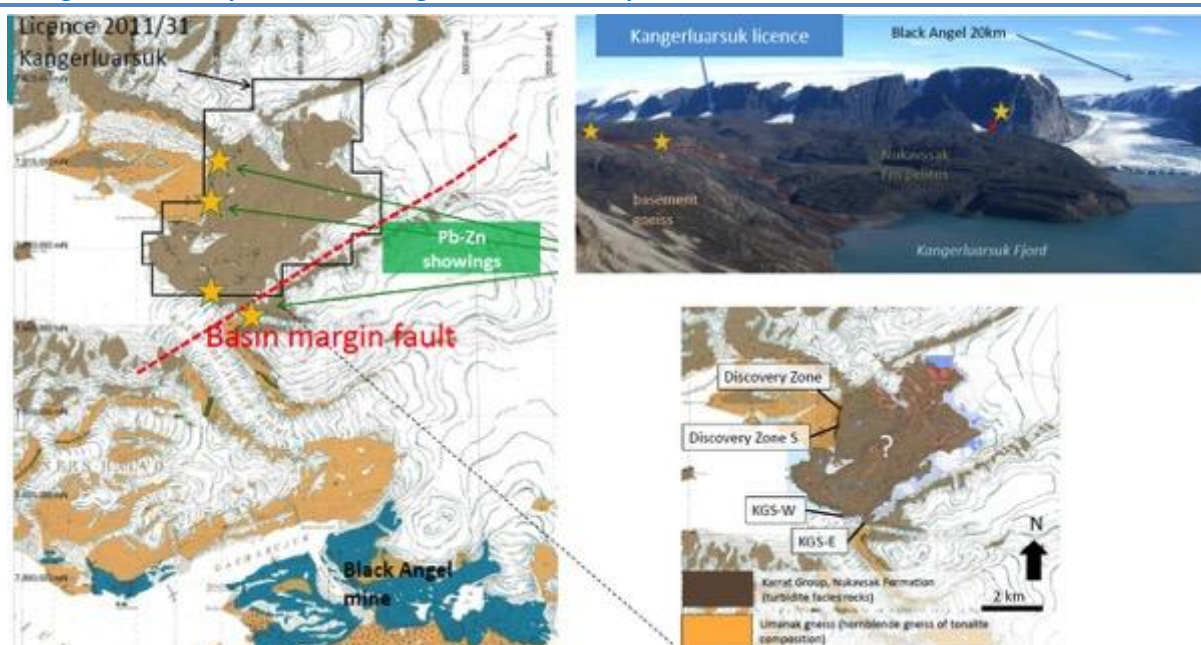
The area is approximately 20km north of the historically operated Black Angel Pb-Zn mine, perhaps Greenland's most famous mine. Black Angel was operated by RTZ and Boliden, with the main production phase between 1973 and 1990. Historical production amounts to 11.2Mt grading 12.4% Zn and 4.2% Pb.

A Sedex Environment and the strongest zinc anomaly cluster in Greenland

The rationale for the licence is similar to Disko, being located in a geologically favourable environment with promising exploration results from previous operators. Kangerluarsuk is situated in a favourable starved sub-basin, with the Karrat Group Palaeoproterozoic metasediments underlying the area.

Detailed geological mapping has identified a thick uniform pile of metasediments, mainly consisting of turbidites and sulphide-bearing shale beds. Several growth faults have been identified which may have acted as conduits for metal-bearing brines.

Figure 14 – Kangerluarsuk – expressions of a large buried Sedex deposit?



Source: Avannaa Exploration

Three drill-ready target anomalies

Ore grade mineralisation has been identified over a 9km strike length, which the previous operator Avannaa believes has the potential to represent distal expressions of a large buried Sedex deposit. Stream sediment data, apart from representing some of the strongest zinc anomalies in Greenland, has produced multi-metal anomalies consistent >100km², suggesting polymetallic deposit potential.

In 1992, RTZ discovered thin but ore-grade Sedex mineralisation at the basin margins with samples returning grades of up to 41% Zn, 9.3% Pb and 596g/t Ag (from separate samples) throughout the area. From 2001, Avannaa's exploration work was aimed at targeting a buried deposit with a comprehensive soil sampling programme and a ZTEM survey supported by in-depth geological and structural analysis.

This work has yielded three high-priority drill targets, defined by surface sample anomalies and supported by deep conductors identified through 3D inversion of the ZTEM survey. Furthermore, these anomalies are also corroborated by the structural model.

Thus, in our view Kangerluarsuk represents another fast-track entry into a district-scale play, and whilst early stage, there is opportunity for FinnAust to hold the project in inventory and to add further value.

Titanium market review

Price outlook

Rio's TiO₂ contract volumes (c.25% of the total TiO₂ market)

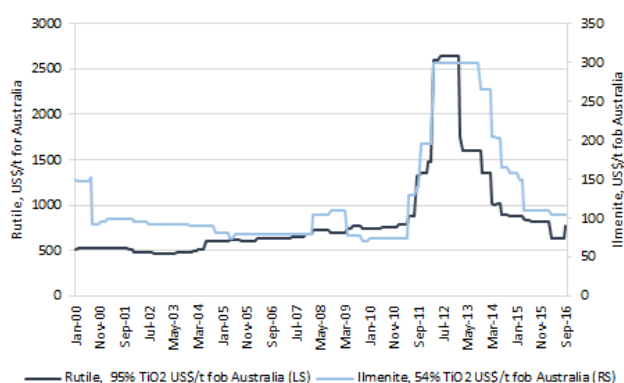


Source: Company data

Titanium products such as concentrates, sponge, metal or scrap are not traded on public commodity exchanges with pricing negotiated between producers, traders, processors and industrial users directly.

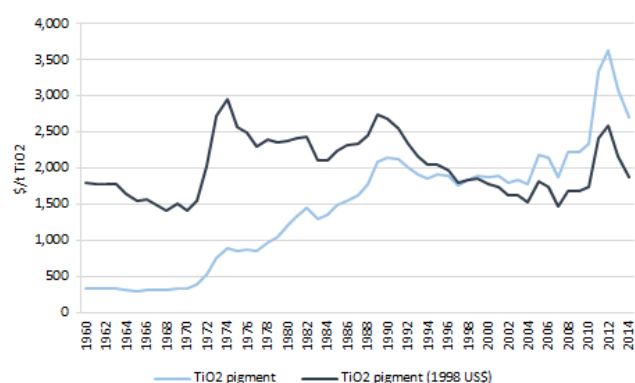
Concentrates market has long operated under “legacy contracts” in the pigment industry (90% of total demand) which typically had a maturity of 10 years with prices being adjusted by inflation rate. Since 2010, the move was for a more market based pricing with major mineral sands’ producers switching to new shorter maturity terms (quarterly/semiannual). The extended period of relative price stability pre-2010 is reflected in the minerals sands’ (ilmenite and rutile) price chart below.

Rutile and ilmenite (TiO₂ pigment and titanium metal feedstock) prices

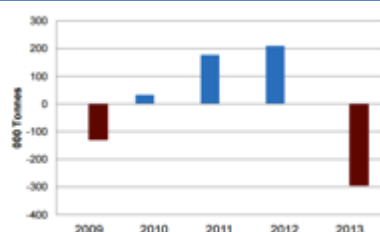


Source: MetalBulletin, Company data

TiO₂ pigment global price, US\$/t



Change in global TiO₂ inventories



Source: Company data

Strong demand from global pigment producers as well as restocking among industry users saw prices for titanium dioxide (TiO₂) pigment feedstock ramping up through 2011/12. In late 2012 and early 2013 as demand slowed among other things on weaker construction activity in Europe and China the market entered into a destocking cycle with pigment manufacturers decreasing capacity utilization placing the TiO₂ concentrate prices on a falling trend since then. Premium feedstock products such as rutile and synthetic rutile posted heavier losses compared to lower grade ilmenite through 2013/14 period as pigment producers prioritised production at lower cost sulphate pigment plants using ilmenite based feed.




Capacity utilization at pigment plants is ultimately one of the major indicators of demand and price drivers for pigments’ feedstock. Global capacity utilization among pigment producers went from 92% in late 2011 to mid-70s in 2012. In 2013, pigment plants’ operating rates remained sub-80% with producers maintaining cautious approach to the recovery in the market and working their way through ample pigment inventories. Stockpiles peaked at over 100 days in 2013, but have trended down in H2/13 towards 60-65 days. This compares to typically 45-50 days’ worth of inventories required to have an effect on market prices. De-stocking continued in 2014 with a number of pigment producers reporting utilisation rates of 85% against softer ilmenite and rutile prices.

Company reports point to an improvement in the pigment industry in H1/16 following an extended period of weakness with inventories said to have normalised and increasing utilisation rates at pigment plants which coincided with a general improvement in the commodities sector driven by increased stimulus and stronger property market in China.

Demand - Commodity

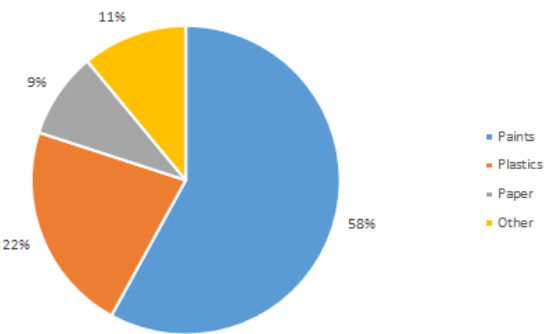
Titanium is a high strength low density and high thermal stability metal with good corrosion resistance. The metal is as strong as steel, but 45% lighter. It is two times stronger than most commonly used aluminium alloys with significantly better anti-corrosion properties when compared to stainless steel. However, despite being relatively abundant, expensive processing, refining and fabricating of titanium makes it a pricey alloying agent with the metal production accounting for less than 10% of the world’s annual titanium supply. Around 90% of the titanium produced is used as TiO2 feedstock for pigment production found in paints, plastics and paper industries.

TiO2 end markets

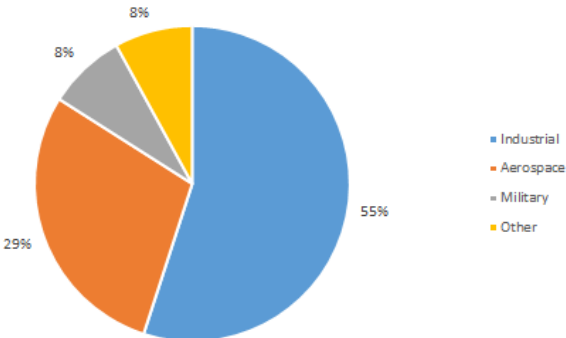
 <div>4% - 10 YEAR AVERAGE ANNUAL GROWTH</div> <div>12% - 10 YEAR AVERAGE ANNUAL GROWTH</div> <div>12% - 10 YEAR AVERAGE ANNUAL GROWTH</div> <div>EMERGING GROWTH SECTOR</div>	PIGMENT	Attributes Opacity (whiteness) UV resistant Non-toxic and inert		End use examples Paints and coatings Paper Inks Packaging
	TITANIUM METAL	High strength to weight ratio Corrosion resistant		Aircraft engines and frames Defence armourments Chemical & desalination plants Offshore oil and gas components Medical applications Sporting equipment
	WELDING	Corrosion resistant		Steel construction Ship building
	NANOMATERIALS	Many unique properties		Dye-sensitised solar cells Water purification Cancer treatments Noise absorption

Source: Company data

Pigment market demand breakdown



Titanium metal end uses



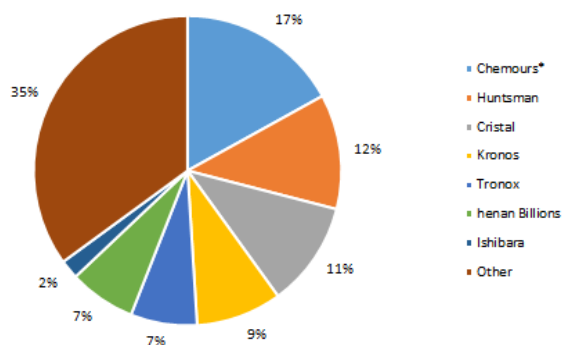
Source: Company data

Titanium dioxide use as the principal white pigment dominates the market for inorganic synthetic pigments thanks to its physical properties such as high refractive index guaranteeing high opacity, whiteness, and chemical inertness. As such TiO2 is found in car paints, PVC windows and doors, glossy magazines, clothing and even toothpaste. In fact, any product that requires a white or bright coloured surface most likely uses titanium dioxide pigments.

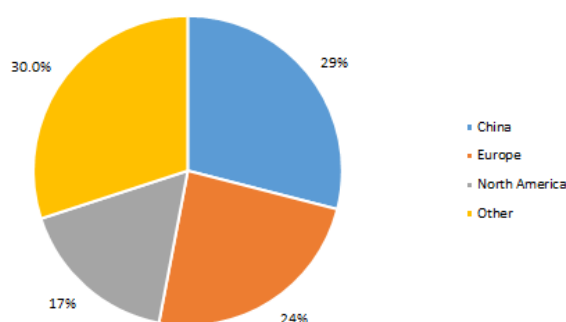
Pigment production sector is a highly consolidated industry with top five companies representing c. 60% of the world’s TiO2 feedstock demand. The industry is characterised by high entry barriers including heavy capital costs, proprietary technology and significant lead times (c. 3-5 years per project) necessary to build new processing facility. As such producers

are exerting good control over the market quickly adjusting utilization rates to end demand which directly effects orders for TiO2 pigment feedstock.

TiO2 pigment production capacity breakdown



TiO2 pigment demand breakdown by region



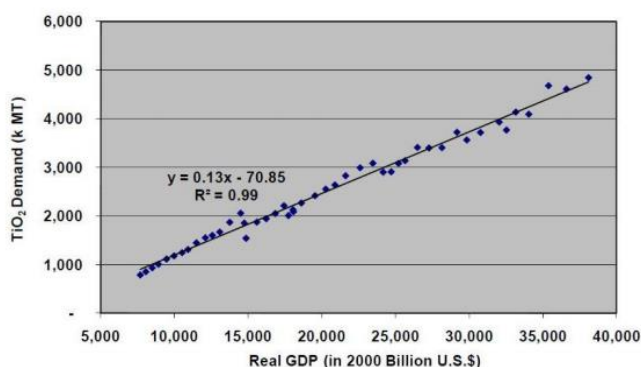
*Chemours is a 2015 spin off from DuPont

Source: Company data

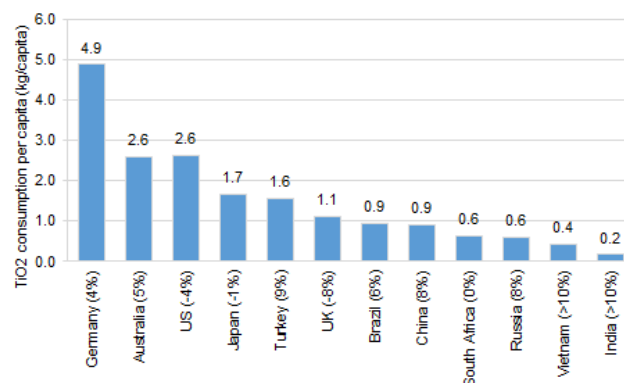
TiO2 pigment is considered a nonessential or “quality of life” product, and, hence, is highly geared to general economic activity making it strongly correlated with the world GDP growth rates. In particular, consumer sentiment as well as residential and commercial property construction sectors are strong demand drivers.

TiO2 consumption per capita rates for emerging economies lag that of Western developed nations significantly and are future growth markets expected to drive increase in global demand. Given lower per capita base, demand growth rates in emerging markets such as BRIC countries averaged 6-10% through the 2004/11 period compared to 4-5% recorded in Germany and Australia or even declines in the US (-4%) and Japan (-1%).

TiO2 demand v Real GDP regression (1960-2006)



Titanium metal end uses



Source: Company data

The single largest industry for the titanium metal remains aerospace accounting for a third of the market demand (commercial and military combined). In 1950-60s the Soviet Union pioneered the use of titanium in military and submarine applications. Starting from the use in military aviation in early 1950s and then moving across to the commercial sector, titanium is considered an “aerospace metal” since then. High strength to weight ratio makes it ideal for aircraft engines and frames increasing airplanes’ fuel efficiency. Its corrosion resistance is utilised in industrial chemicals and desalination plants, heat exchangers, oil and gas drilling components and power plant cooling systems. Other uses include consumer goods and the medical, oil and gas, pulp and paper, and specialty chemical industries.

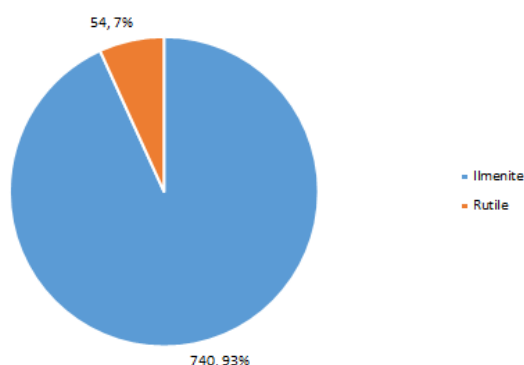
Less than 5% of the market is accounted for the titanium use in welding rods used in construction and ship building.

Supply - Commodity

Titanium is supplied as ilmenite, leucoxene, rutile, synthetic rutile (a chemically modified ilmenite with iron removed¹) and titanium slag (ilmenite containing ores smelted in furnaces with slag tapped as a by-product of pig iron production). Rutile concentrate is a higher grade and cleaner feedstock containing 92-96% TiO₂ and is more efficient processing material compared to leucoxene (typically 65-91% TiO₂), ilmenite (35-65% TiO₂), synthetic rutile (85-90% TiO₂), titaniferous slags (75-85% TiO₂).

Titanium containing minerals are primarily produced using hydraulic mining, dredging and dry open pit mining techniques of hard rock deposits or accumulations in ancient beach sands. Ilmenite is by far the most abundant titanium mineral accounting for c. 95% of known mineral reserves of ilmenite and rutile according to the latest USGS data.

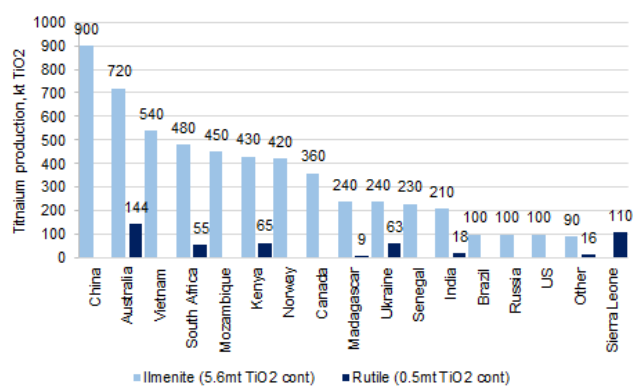
World ilmenite and rutile reserves (794mt TiO₂ contained as of 2015)



Source: USGS

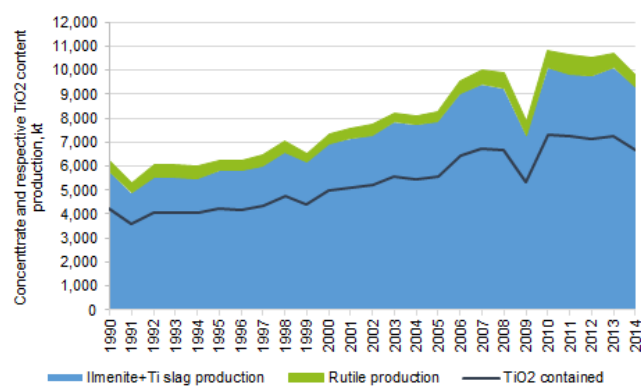
Ilmenite and rutile concentrate production totalled 6.1mt TiO₂ contained in 2014 (2013: 6.0mt TiO₂). Reflecting higher share in the reserve base, rutile concentrate production accounted for roughly 10% of the annual TiO₂ concentrate production.

Distribution of ilmenite and rutile production in 2015 (5,610kt and 480kt, respectively)



Source: USGS

Concentrate production (ilmenite+leucoxene+rutile+titaniferous slag), kt TiO₂ contained

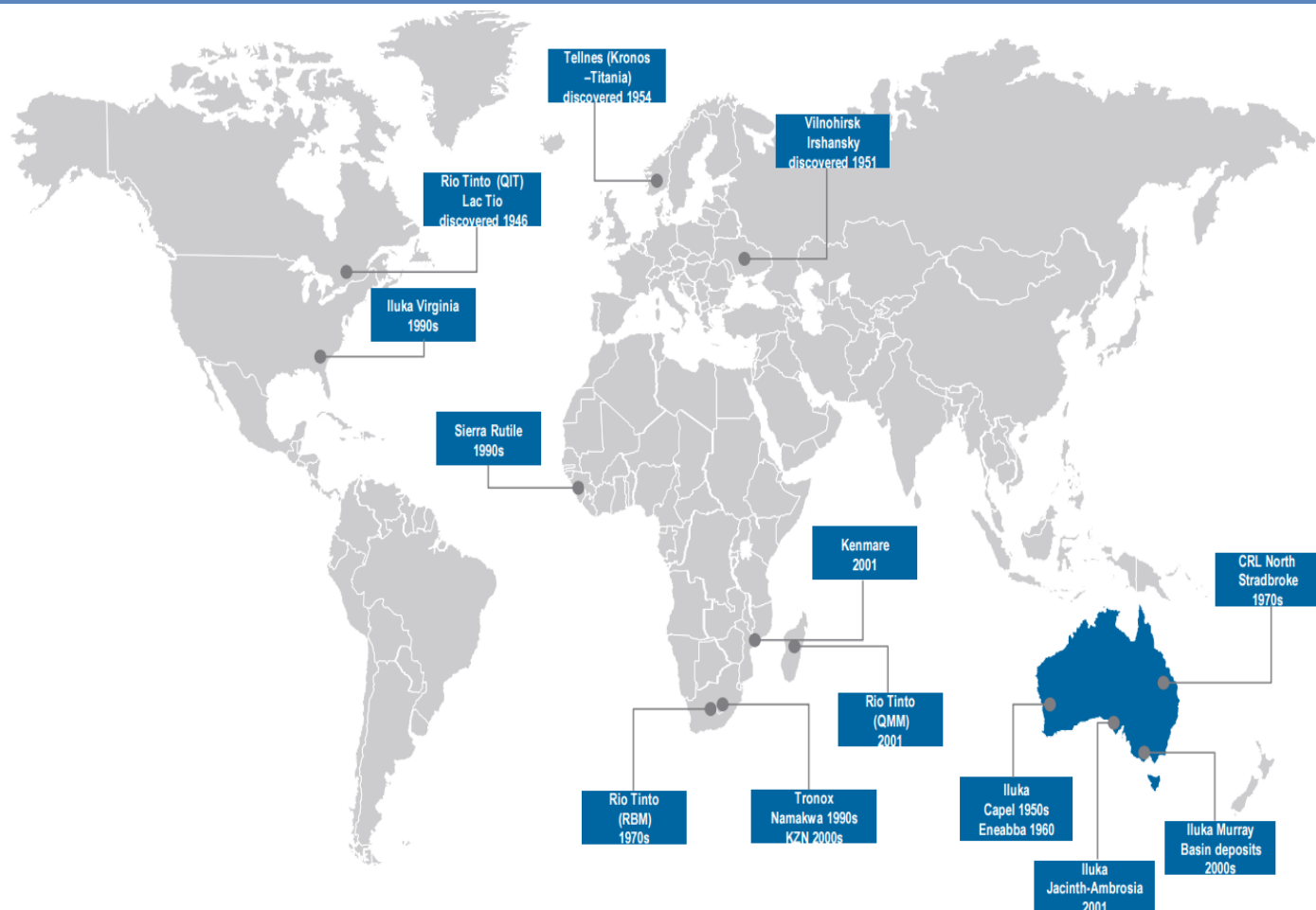


Geographically, top five producers account for 55% of the world ilmenite production including China (16%), Australia (13%), Vietnam (10%), South Africa (9%) and Mozambique (8%). In Mozambique, ilmenite/rutile/zircon Moma deposit is operated by Kenmare Resources supplying c.8% of the TiO₂ feedstock market. In Madagascar (5% of world ilmenite supply), Rio, the world's largest mineral sands producer, operates one of its mines that feeds the RTFT (Rio Tinto Fer et Titane) metallurgical complex in Canada for production of titaniferous slag.

¹ Typically, 1t of ilmenite produces 0.5-0.6t of synthetic rutile containing 88-95% TiO₂.

Mined rutile production is driven by Australia (30%, Iluka Resources), Sierra Leone (23%, Sierra Rutile), Kenya (14%, Base Resources), Ukraine (13%, Ostchem) and South Africa (11%, Tronox and Rio Tinto)

Major TiO₂ feedstock mining operations



Source: Company data

Mineralogy and deposits

The majority of titanium minerals² occur in placer sand style deposits found in Australia, Africa, the US and India with heavy minerals (HM) also mined in hard rock deposits in Canada, Ukraine, Russia, China and Norway.

In both types of deposits the system is fed by a hardrock source, only in mineral sands' case, the source rock is being eroded and carried by rivers to coastlines to form economic concentrations along ancient beach lines and associated environments. Typical characteristics of the HM deposit is its grade (HM contained/Ore tonnage) and the assemblage (the composition of minerals within the HM inventory). Normally, mineral sands deposits contain 0.5-20% HM with titanium containing minerals dominating the mix in a ratio of 5:1 to zircon contained.

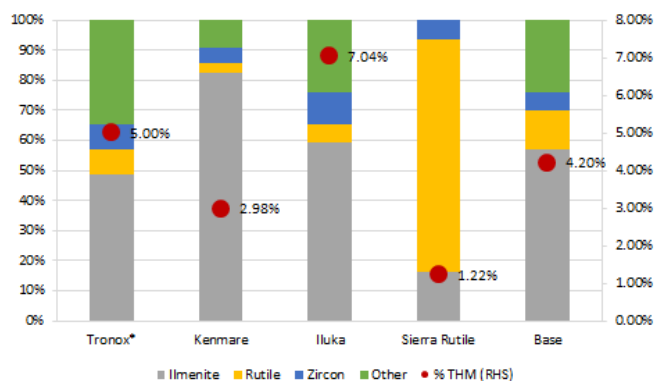
Given a significant difference in prices for the discussed minerals³, the grade of the deposit measured as a total heavy minerals (THM%) contained is as important as the heavy mineral assemblage in evaluating the economics of the project. For instance, Kenmare Resources mineral resources in Mozambique are predominantly ilmenite (>80% in total assemblage) with a THM% of 3.00%, nearly three times the 1.10% THM across Sierra Rutile assets in Sierra

² Mineral sands refer to heavy minerals (HM/THM) with a specific gravity greater than 2.85t/m³ containing such minerals as rutile, ilmenite, leucoxene, zircon, monazite and other.

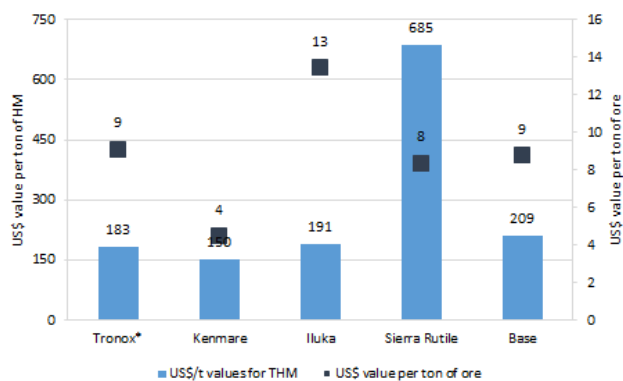
³ Price assumptions used in calculations of US\$ values per ton of ore in-situ: ilmenite: US\$100/t, rutile US\$800/t, zircon US\$800/t, other HM were assigned no value.

Leone. However, since rutile accounts for 80% of THM in Sierra Rutile's resources, the actual US\$ value of ton of ore in-situ is US\$8/t versus US\$4/t for Kenmare (see chart below).

THM assemblage across a selected number of producers v total %THM contained in mineral resources



US\$ value per ton of HM contained in-situ based on reference prices for major HM minerals v US\$ value per ton of ore contained in situ



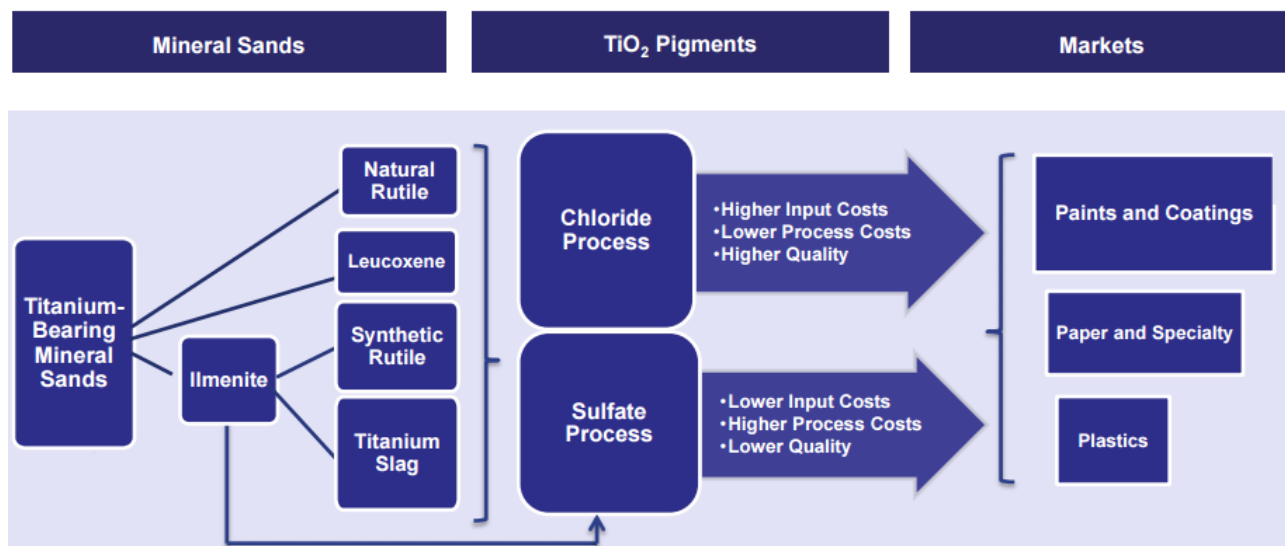
*THM assemblage and grades are for Total Mineral Resources (MI&I) except Tronox (PP Mineral Reserves only)

Source: Company data, SP Angel

Processing

Mined sands processing is based on physical properties of valuable minerals including magnetic susceptibility, electrical conductivity and specific gravity. Lighter gangue material is separated from denser HM by the use of gravity separators such as spirals, classifiers and air/wet shaking tables. Iron containing ilmenite is separated using magnetic roll separator, while highly conductive rutile and leucoxene are separated from less conductive zircon through the application of electrostatic separators. Depending on the TiO₂ grade final concentrates are either processed directly by TiO₂ pigment plants or further treated to upgrade the quality of the feed as in production of synthetic rutile and titaniferous slag from ilmenite.

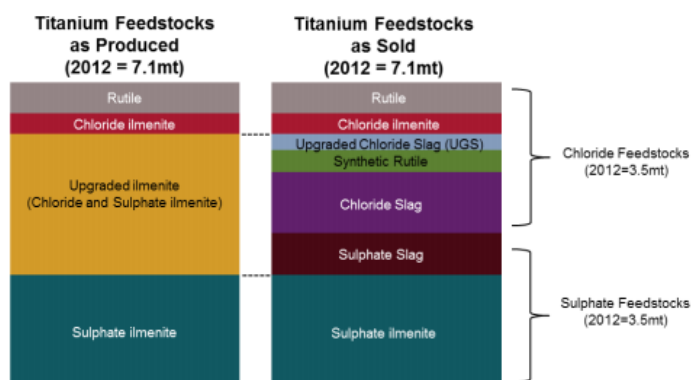
TiO₂ pigment production scheme



Source: Company data

Beneficiated ores and synthetic concentrates are used in TiO₂ pigments production involving two major processing routes: sulphate and chloride processes. Most sulphate pigment plant capacity is in China, while the US and Europe predominantly use the chloride pigment process. The sulphate process uses a cheaper and lower grade feedstock such as ilmenite and slag which are treated with sulphuric acid. The produced cheaper pigment is preferred by industrial users in paper, food, cosmetics, rubber and inks industries. The chloride process tends to produce pigments with better durability characteristics found in autos and durable plastic goods. During the process the feedstock is treated with chlorine and carbon that yields titanium tetrachloride (TiCl₄) as an intermediary product which is oxidised to TiO₂ for

application in pigments, but can also be reduced with either sodium (Na) in the Hunter process or with magnesium (Mg) in the Kroll process for production of porous titanium material called sponge, an intermediary product for titanium metal. The sponge gets crushed with the metal separated from salts (NaCl or MgCl₂) and is used for production of titanium ingots which are then rolled or forged according to standard or customer tailored specifications.

TiO₂ feedstock breakdown by the source (2012)


Source: Company data

Forms of titanium	TiO ₂ %	Magnetic Susceptibility	Electrical Conductivity	Specific Gravity
Rutile	95-97%	Low	High	4.2-4.3
Synthetic rutile	88-95%	-	-	-
Lecoxene	70-91%	Semi	High	3.5-4.1
Ilmenite		High	High	4.5-5.0
- sulphate	52-54%			
- chloride	58-62%			
Slag		-	-	-
- sulphate	80-85%			
- chloride	85-90%			
- upgraded	95%			

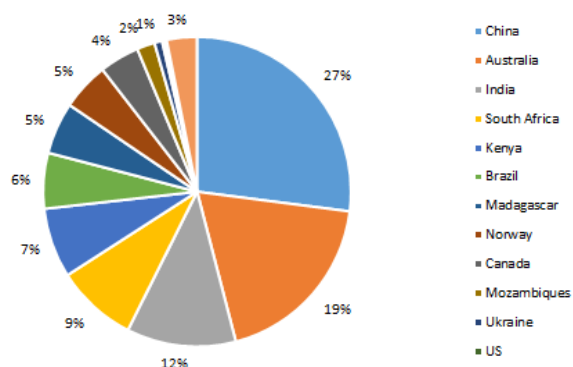
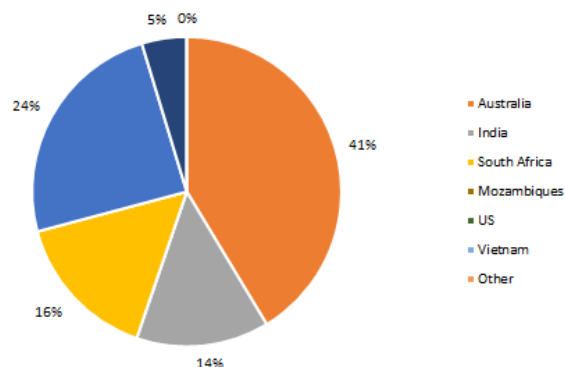
Titanium metal production flowsheet and value accretion at each production stage (Kroll process)



Source: Company data

Resources and Reserves

Ilmenite reserve base is better spread among different jurisdictions compared to higher grade rutile deposits as presented by the breakdown in graphs below (USGS).

World ilmenite reserves (740mt TiO₂ contained as of 2015)

World rutile reserves (54mt TiO₂ contained as of 2015)


Source: USGS

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