BlueJay Mining

Treasure Island: unlocking Greenland's mineral potential – initiating coverage with 20p target

We initiate coverage of BlueJay Mining PLC (JAY) with a 20p target using a DCF-based SOTP. JAY's flagship asset is the Dundas Ilmenite Project in Greenland. Despite its remote location, Dundas has significant further resource growth potential and, we believe, enjoys a more straightforward path to commercialisation than many of its junior mineral sands peers, with strategic interest from Rio Tinto (RIO) and recent support from Greenlandic and Danish sovereign-backed funds. We see upside to the shares as milestones are reached over the coming months, including the expected receipt of a mining licence in 2020. Aside from Dundas, JAY holds attractive base metal exploration at Disko, Kangerluarsuk and in Finland, adding further value, in our view.

A world class TiO2 feedstock resource

Dundas has a Resource of 117Mt at an ilmenite grade of 6.1%, placing the project as one of the highest grade TiO2 deposits in the world. Test work has shown the ore to be easily upgradeable to a premium ilmenite product, suitable for direct use in sulphate pigment production or for conversion to intermediate TiO2 slag which could be used in either the sulphate or chloride process. Even without zircon or rutile by-products, Dundas' revenue-to-cost ratio is expected to be ~2x, amongst the highest globally. Based on Exploration Targets provided by SRK and RSC Global, Dundas' Resource has the potential to reach in excess of 700Mt of ore.

Opportunities to optimise PFS economics

JAY released a summary of its Dundas PFS in Jun'19, which, in our view, was completed primarily to progress the permitting process in Greenland, rather than to attract capital. As such, we see significant scope for improvement in project economics as the company optimises the mine-plan, and receives firmer estimates of capital and operating costs through the BFS phase. Indeed, the PFS was based on a Dec'18 Resource, and did not include the 15% increase in Resource announced in May'19, nor any consideration of further expansion potential. Capex savings could include a significant cut in the construction cost for ship loading facilities, after the successful sealift of a 42kt ore sample in Sep'19 showed the viability of a simpler plan, while a cheaper ore-handling solution and removing contingencies could drive down opex estimates.

Interest from Rio Tinto shows strategic value

JAY's Environmental and Social Impact Assessments (ESIA) have progressed smoothly, with final documents submitted to the Mining Ministry alongside the Dundas mining licence application in Sep'19. Greenlandic and Danish state bodies have shown support, with recent investments in JAY from Greenland Venture and Vaekstfonden. JAY also struck a deal with RIO in 2019 to provide a smelter test sample from Dundas to its TiO2 slag plant at Sorel-Tracy in Quebec. Test results will dictate RIO's next steps during 2020, while half of the bulk sample has been kept aside by JAY and is expected to be sent to other potential customers in N America, keeping tension in the marketing process.

Valuation - sensitivity to price upside

We have assumed an ilmenite price of US\$200/t and a WACC of 8%, more conservative than the PFS inputs of US\$232/t and 5%. However, based on the potential size of the Resource, we have modelled 17 years of production beyond the 9-year PFS Reserve. We have also stripped US\$45m from the capex budget and assume 12% lower unit operating costs in real terms. On this basis we reach an NPV of US\$253m for Dundas, to which we apply a 0.8x multiple. We then add US\$40m for Disko and Kangerluarsuk (vs ~US\$100m historical spend), and US\$20m for JAY's Finnish assets. Adjusting for working capital and G&A, we derive a total Dec'20E SOTP of ~US\$254m or 20p/sh, implying 126% upside to the share price. Furthermore, we note for every US\$10/t delta in ilmenite we would see a ~US\$40m change (~16%) in our Dundas NPV, equivalent to a ~2.6p change in SOTP; marking-to-market for current ilmenite prices of ~US\$230/t, this would imply ~40% further upside to our PT.

GICS Sector	Materials
Ticker	LN:JAY
Market cap 15-Jan-20 (US\$m)	109
Share price 15-Jan-20 (GBp)	8.66
Target price 31-Dec-20 (GBp)	20

+131%

Upside from current share price to our 20p/sh target

>700Mt

Potential ilmenite resource at Dundas



H&P Advisory Ltd is Corporate Broker to BlueJay Mining Plc. The cost of producing this material has been covered by SolGold as part of a contractual engagement with H&P; this report should therefore be considered an "acceptable minor nonmonetary benefit" under the MiFID II Directive.

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Key Charts

Shareholder Structure

Source: Company reports

Ilmenite tonnage shipped and recovery rate



Source: Company reports, H&P estimates.



Source: Company reports, H&P estimates.

Ore excavated vs Grade 10.0 10.0% to 2048E 8.0 8.0% 6.0% 6.0 4.0% 4.0 2.0% 2.0 0.0 0.0% 2022E 2025E 2028E 2029E 2031E 2023E 2026E 2027E 2030E 2032E 2033E 2034E 2035E 2024E 2036E Ore excavated - assumed LoM extension (Mt, lhs) Ore excavated - PFS Reserves (Mt, lhs)

Source: Company reports, H&P estimates.

Ilmenite grade (%, rhs)

Unit cost of finished product vs RoM ilmenite grade



Source: Company reports, H&P estimates.

Price target derivation (GBp per share)



Source: H&P estimates, *PT rounded to nearest 1p.

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Executive Summary

We initiate coverage of BlueJay Mining Plc with a 20p target, implying 131% upside from the current share price.

The company's flagship asset is the Dundas Ilmenite Project on the North Western coast of Greenland, and is one of the highest-grade ilmenite resources in the world. Despite its remote location, we believe Dundas enjoys a more straightforward route to commercialisation than many of its junior mineral sands peers and retains significant further resource expansion potential, while BlueJay has other assets which could be monetised to offset external funding requirements. An optimised pre-feasibility study, released in Q2'19, provided the first independent assessment of Dundas' economics, and allowed the company to submit its Social and Environmental Impact Assessments to the Greenlandic government. As the company moves through the BFS phase, we see scope for significant upside to the shares as milestones are hit over the coming months.

A world class TiO2 feedstock resource; upside from Iterlak & offshore

Dundas is one of the highest-grade mineral sand ilmenite projects globally, with massive resource upside potential beyond the ~117Mt of ore in resource grading 6.1% ilmenite (in situ), as estimated by SRK Exploration Services Ltd ("SRK"). The Resource is contained within just 17% of the raised beach area, which extends along more than 30km of coastline over a width of ~1km. The majority (~79%) is derived from the Moriusaq area only, with work on large swathes of the license area still to be incorporated.



Dundas Ilmenite Project map showing current Reserves and potential new areas

Source: Company presentation

SRK has already outlined a conservative "exploration target" of a further 20-60Mt at 6-10% ilmenite in the Iterlak delta area, while additional material from the shallow marine offshore area could also ultimately be included in a fully optimised project. RSC Global Pty Ltd ("RSC") estimated an offshore exploration target of 300-530Mty to 0.4-4.8% ilmenite in-situ in this zone, which would also be suited to cheaper dredge-mining methods. As such, we believe a key attraction for investors is the enormous scope for expansion to the scale of the eventual operation. Importantly the Resource sits at or virtually at surface, and is homogeneous, with low impurities, giving it favourable processing characteristics.

Low cost mining & processing to produce high-quality, 'clean' ilmenite

The Dundas PFS published in June 2019 envisaged mining the raised beach zones using continuous surface miners with rotating cutter-heads, meaning no drilling or blasting is required. The mined sand is then expected to be transported to the wet gravity processing plant using a fleet of trucks, although there may be scope for costs to be reduced through the use modern conveyor technologies.

The Dundas' concentrator is expected to employ simple, proven technologies, with an initial upgrading phase using wet gravity separation (spirals) to produce a heavy mineral concentrate ("HMC"). The HMC will then be dried and passed through a dry magnetic circuit capable of producing a "premium" feedstock product containing >99% pure ilmenite content.

Metallurgical test work has shown the ore to be easily upgradeable to a premium ilmenite feedstock product, containing very few deleterious elements (such as uranium or thorium). The company expects Dundas' output to be suitable for direct use in sulphate pigment production or for conversion to intermediate TiO2 slag products which could be used in either the sulphate or chloride process. Even without any zircon or rutile by-products in its mineral assemblage, Dundas' revenue-to-cost ratio is expected to be ~2x, amongst the most attractive globally.

Potential strategic value to RIO

Dundas occupies a strategically-advantageous location close to the US and Europe, providing multiple routes to market. While shipping costs to China appear prohibitively high, at this stage, the technical feasibility of bulk shipping over the Northwest Passage has been demonstrated and could open an additional marketing option.

In particular, Rio Tinto, which requires TiO2 feedstock for the Sorel-Tracy TiO2 slag smelter in Quebec, has shown interest in the project. Rio Tinto Iron & Titanium (RTIT) has struck an agreement with BlueJay to analyse ilmenite production from Dundas, including a smelter test. A 42kt bulk sample of ore was shipped to Canada for this purpose in late August. While the smelter test results are still pending, the shipment in itself provided evidence of the viability of loading and shipping bulk vessels from the project.

RTIT and BlueJay also agreed to work together to review and improve the technical work at Dundas completed to date. This is a strong validation of Dundas' potential strategic value, in our view. While there is no guarantee of a longer-term transaction within the agreement, we see multiple potential outcomes of this deal, including Rio becoming an offtake partner or even taking an equity interest in Dundas.

With the very clean composition of Dundas ore, we believe the project could provide an ideal ilmenite feedstock for Rio's TiO2 slag furnaces in Quebec – both in terms of quality and proximity. Rio has shown commitment to its Canadian

TiO2 business, with a rebuild in H1'19 of two idled furnaces in Quebec. A potential participation in the development of Dundas could offset Rio's future capital and operating costs associated with sourcing ilmenite feedstocks for the smelter Dundas' high-grade material also offers good fit with Rio's stated focus on maximising productivity from operating furnaces, in our view.

Positive outlook for TiO2 pigment and feedstock markets

Industry participants have provided increasingly positive commentary on TiO2 feedstock markets over the course of 2019. Strong downstream demand is driving high TiO2 pigment plant utilisation, which is in turn boosting demand for feedstocks (i.e. TiO2 slag, ilmenite, rutile etc). Rio expects growth in emerging economies to support "solid" long-term demand growth of "3% per year", while noting: "supply of high-grade mineral sands (titanium dioxide and zircon) remained tight due to a combination of grade decline and production disruptions – and this has underpinned robust prices."

Kenmare Resources also saw a tightening ilmenite market in H2'19, driven by purchases destined for upgrading into high grade chloride-slag feedstocks, for which Chinese domestic ilmenite is unsuitable. KMR believes demand for highquality ilmenite currently exceeds the available supply, as exports from historically important players such as India and Vietnam remain depressed. This boosted prices in H2 2019 over those achieved in H1, and further price increases have been agreed with customers for Q1'20.

Supply tightness has translated into a broad-based improvement in global ilmenite benchmarks, with prices for imported Chinese ilmenite (the main spot market) up by over 20% since August.



Recent moves in global ilmenite price benchmarks (US\$/t)

Source: Bloomberg.

Opportunities to optimise PFS economics

BlueJay released a summary of its Dundas PFS in June 2019. The study envisaged a ~9-year mine-life processing ~7.4Mtpa of ore on average, to produce ~440ktpa

of end product. Capex was estimated at ~US\$245m, including ~US\$22m of contingencies and ~US\$30m in costs relating to construction of a jetty for the loading of ilmenite on to bulk carriers.

We believe the PFS was mainly prepared to accelerate the permitting process in Greenland, rather than with a specific focus on optimising IRR and NPV to attract capital to the project. As such, the resulting capex budget estimate was overly conservative, in our view. Indeed, as part of the process of shipping a bulk sample to RIO in September, the BlueJay team constructed a jetty in the space of ~2 weeks at a considerably lower cost. We see ample scope for capex reductions as the company moves through the BFS phase; therefore, we base our model on an initial budget of ~US\$200m, ~18% below the PFS estimate.

We also note the PFS was based on a Dec'18 Resource statement, and did not include the 15% increase in Resource announced in May'19; nor does it include any value for the additional Iterlak delta exploration target of 20-60Mt at 6-10% ilmenite prepared by SRK, and the offshore exploration target of 300-530Mt at 0.4-4.8% ilmenite as prepared by RSC. We have, therefore, added 17 years to our modelled mine life at Dundas – equivalent to an additional ~139Mt of ore on top of the 67Mt reserve included in the PFS – to account for the clear further potential upside to the Resource.

With Dundas now benefitting from Rio Tinto's technical capability, we believe these optimisations can be delivered, while the BlueJay team can also increase focus on value-delivery at the exciting Disko and Kangerluarsluk polymetallic exploration projects.

Risks of Arctic operations overstated

Dundas' remote location and extreme Arctic climate are often quoted as risk factors for the project, particularly with regards to environmental protection and the logistical challenge of only having a window of a few months each year to ship out ilmenite due to sea ice.

However, year-round operations are achievable at the mine, and the company anticipates using a covered stockpile to store finished product through the seasons until the shipping window opens for four months each summer.

BlueJay's confidence in the technical feasibility of shipping ~440ktpa was backed up by the successful loading of a 42kt bulk sample of ore in September 2019. This proved that only ~10-12 Supramax vessels would be required to ship the entirety of Dundas' expected annual output of ilmenite, equivalent to two or three ships per month during the June-October shipping season. It is expected that four additional ships will be required to supply the operation with fuel and other supplies during the shipping window.

It should also be noted that the US Air Force has had a base at Thule, less than 40km away as the crow flies, since 1943, showing that the region is habitable year-round and can support significant infrastructure.

Granting of Exploitation Licence could be key catalyst in early 2020

BlueJay has made significant progress towards securing an Exploitation Licence for Dundas from the Government of Greenland. Alongside completion of the Prefeasibility Study, the company submitted Environmental and Social Impact Assessments in Q2'19. With individual modules having been accepted by the relevant authorities as and when they were completed over the last two years, it is expected that the final Mining Licence Application, submitted in September 2019, will provide all the information required for the Government to make a relatively quick and straightforward decision. Once the Ministry of Mines deems the application compliant, expected in early 2020, the EIA and SIA will be subject to a public consultation period of approximately eight weeks.

Feedback from the public-hearing process will be compiled into a "White-Book", created jointly by the Government and the Company, and an "Impact Benefit Agreement" will be agreed between the Government, Municipality and BlueJay. It should be noted that in support of this process, BlueJay has already initiated cooperative programmes with various stakeholders to ensure mutually beneficial impacts for Greenlandic society and the mine operation. The company maintains a strong relationship and a constructive dialogue with the Municipality around Dundas. Government-level relations also appear to be strong, with BlueJay having been awarded "Prospector and Developer of the Year 2017".

Once the White-Book and Impact Benefit Agreement are complete, the Government will make a decision on the granting of the Exploitation Licence. Understandably, BlueJay themselves are reluctant to commit to a timeline for completion of the process, as certain elements are out of the company's control. However, based on our understanding, we believe the Licence could be received by Q2'20, marking a significant milestone and positive catalyst for the company. Removal of licensing risk should materially improve Dundas' attractiveness to potential funding partners, in our view.

Value in early-stage portfolio

Aside from Dundas, BlueJay holds a wider portfolio of exciting early-stage exploration targets in Greenland and Finland. In particular, the Disko-Nuussuaq ("Disko") and Kangerluarsuk licences on the west coast of Greenland (~850km SSE of Dundas) appear highly prospective.

Extensive fieldwork has been conducted at Disko over the last three summers, including geological mapping, rockchip sampling, geochemical soil sampling, and an EU-funded, drone-based magnetic, photogrammetric and hyperspectral imaging programme. Multiple outcrops of polymetallic sulphide mineralisation have been discovered, with massive-sulphide boulder assays including 6.9% nickel, 3.7% copper, 0.6% cobalt and 2g/t PGMs. The results to date continue to support BlueJay's initial hypothesis that Disko shows many similarities to the Norilsk-Talnakh Magmatic Massive Sulphide (MMS) deposit, the largest known sulphide nickel resource in the world, with significant copper and PGM coproducts. The company has identified a total of 28 drill-ready targets, and believes the commencement of drilling in 2020 will begin to define a globally significant, nickel-copper-PGM-cobalt project. Underlining the prospectivity of the Disko licence area, we note Anglo American recently staked concessions nearby in the West Greenland region, also looking for polymetallic magmatic sulphides.

Meanwhile at Kangerluarsuk, BlueJay lodged an application for an expansion of its exploration licence in October 2019, to cover an area of 692km². Fieldwork during 2019 has helped to outline a 6-hole maiden drilling programme to be conducted in early 2020. Historic surface sampling has shown very high-grade polymetallic zinc-lead-copper mineralisation, grading ~41% Zn, ~9% Pb, 1.3% Cu and 596g/t Ag – i.e. over 50% combined metal content. BlueJay's planned diamond drilling programme in 2020 will benefit from the proximity of Kangerluarsuk to Disko, allowing their chosen drilling contractor (yet to be determined) to share equipment across both sites. The programme, targeting depths of 350-1200m, will be the first drilling at Kangerluarsuk. However, the

regional geology is promising, with BlueJay's licences sitting within ~20km of the former Black Angel zinc mine, which was operated by Cominco from 1973–1986 and Boliden from 1986–1990. Black Angel historically produced ~11Mt of ore at a grade of 12.6% Zn, 4.1% Pb and 2.9g/t Ag. BlueJay has commenced dialogue with potential drilling contractors with the required capability and experience ahead of the 2020 exploration season.

With Resources still to be defined, we have placed nominal values of US\$30m on Disko and US\$10m on Kangerluarsuk in our SOTP for BlueJay. We justify these figures in more detail in the valuation section below. We anticipate that BlueJay will spend up to \sim £3m in total on drilling programmes at these projects in 2020.

Beyond Greenland, BlueJay is the largest licence holder in Finland. The company holds three early-stage exploration licences; the Hammaslahti (copper-zinc), Enonkoski (nickel-copper) and Outokumpu (copper-nickel) projects. While these assets have not been considered "core" to BlueJay's investment case in recent years, we believe there is potential to derive value from the assets. We carry them at US\$20m value in our SOTP and note that they could be a source of upside if BlueJay can divest the assets as a package or bring in funding partners to move the exploration forwards.

Greenland emerging as attractive jurisdiction for mining investment

Greenland is part of the Kingdom of Denmark and is subject to the Danish Constitution, but has had autonomous status since 1979. As the world's largest island, but with a population of just 55,000, the country's exports are dominated by fish and fish products (91% in 2015).

Greenland was granted further autonomy in 2009 following a referendum, giving the Greenlandic government control of legislation on mineral resources. Currently, there are only six valid exploitation licenses in Greenland: a gold mine in south Greenland, an iron ore deposit, a gemstone deposit, a lead and zinc mine and an anorthosite mine in west Greenland, and a lead and zinc mine in northern Greenland. However, just two of these are in active production – a gemstone mine run by Greenland Ruby and the White Mountain anorthosite mine run by Hudson Resources.

As such, Greenland is only just emerging as a destination for mining investment. Nonetheless, the Government of Greenland has ambitions to grow the mineral resources sector (as evidenced by its unprecedented "Greenland Day" promotional push at the 2019 PDAC conference in Toronto). Stable geopolitics, established legal system and clear permitting processes all weigh in Greenland's favour; and while a 30% corporate tax rate is broadly in-line with global averages, there is no requirement for local ownership or local management, and the state royalty is relatively low at ~2.5% of sales for most minerals.

RIO's interest in Dundas further underlines the attractive investment environment in Greenland, in our view, both in terms of prospectivity and regulatory stability, which has emerged in recent years.

While President Donald Trump's suggestion in August 2019 that the US could "buy Greenland" was greeted with ridicule in many corners, it underlined the strategic importance of this huge North Atlantic territory to the global superpowers. Mr Trump's comments were followed by a <u>visit in October</u> of a high-level delegation from the US State Department to the capital Nuuk, including meetings with Greenlandic government ministers. The visit has been interpreted as an effort to strengthen ties with Greenland and increase the US' influence on

the territory, including cooperation on trade, investment in infrastructure and education.



Greenland's Geological Environments and Selected Mineral Occurrences

Source: Government of Greenland presentation at "Greenland Day", PDAC 2019

Valuation: a sum-of-the-parts approach

Dundas - DCF

We have assumed a long-term ilmenite price of US\$200/t (real) and a WACC of 8%, more conservative than the inputs used in the PFS of US\$232/t and 5%. However, based on the potential size of the Resource and conversion to Reserves, we have added 17 years of production to our DCF beyond the 9-year PFS estimate. This includes two years to account for Measured and Indicated Resources published in May 2019 which have not yet been included in the Reserve, and an assumed 15 years of additional material (or ~120Mt) from Inferred Resources and Dundas' extensive exploration targets. We have stripped ~US\$45m in contingencies and infrastructure costs (mainly relating to ship loading facilities) from our modelled capex budget to assume US\$200m instead of the PFS estimate of US\$245m. We have also assumed that BlueJay will ultimately be capable of achieving LoM unit operating costs of ~US\$100/t in real terms, 12% below the PFS estimate of US\$113/t, again on the basis of stripping out contingencies and assuming more efficient mining and ore transportation using Rail-Veyor® technology.

On this basis we reach an unlevered NPV8 of US\$253m for Dundas, measured as of December 2020E, to which we apply a P/NPV multiple of 0.8x to account for the project's early stage. This gives a contribution to our SOTP from Dundas of ~US\$203m or ~16p per share. Our cash flow projections imply a post-tax IRR for the project of ~18%.

We caution that these estimates are not directly comparable with the base case IRR 32.8% and NPV5 of US\$83.1m presented in the PFS summary in June – not only because of our different modelling assumptions and extended mine life – but also as these figures were flattered by the fact that they were presented on a post-finance (i.e. levered) basis, instead of the industry norm of presenting unlevered project economics. Still, it is worth noting that the company estimates the addition of an extra 2 years to the 9-year life-of-mine assumed in the PFS (easily achievable based on the latest Resource) would add US\$47.6m to the NPV5 and boost the IRR to 34%.



Dundas DCF waterfall (US\$m)



Source: H&P estimates.

Source: H&P estimates.

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Disko & Kangerluarsuk – value assessment based on listed peers To our DCF-based valuation for Dundas, we add nominal values of US\$30m and US\$10m for the highly prospective Disko nickel and Kangerluarsuk zincpolymetallic exploration licences, also in Greenland, which compares to over \$100m of historical exploration spending. To put these valuations in context, we calculate listed pure-play nickel explorers and developers currently trade on an average EV/Resource multiple of US\$34 per tonne of contained nickel equivalent. Based on this metric, a US\$30m valuation for Disko would be justified by a contained resource of ~870kt nickel equivalent – a relatively conservative sum in comparison to the size of other sulphide nickel projects globally, and notably other MMS-style deposits such as Norilsk which still contains in excess of ~15Mt of nickel.

Looking at the listed early-stage zinc peer group, we calculate an average EV/resource of ~US\$21/t. On a similar basis to that described above, this would mean a contained resource of ~480kt zinc equivalent would be required at Kangerluarsuk to justify our assumed US\$10m valuation. Again, this appears adequately conservative based on the size of similar projects globally.

Early stage nickel peers EV/Resource (US\$/t contained nickel equivalent)



Source: H&P estimates, SNL, CapIQ, Company websites.





Source: H&P estimates, SNL, CapIQ, Company websites.

Finland - potential source of valuation upside

We have included only US\$20m in value for JAY's assets in Finland – which comprise of past producing base metal mines at Hammaslahti (copper-zinc), Enonkoski (nickel-copper) and Outokumpu (copper-nickel), as well as earlier stage exploration in the Kainuu Schist Belt (nickel-zinc) – despite the potential for significant commercial value beyond this level. JAY provides relatively little information on these assets. However, we understand restarting the shuttered underground mines could be capital-intensive and therefore see them as suitable for restructuring into a JVs or earn-in agreements alongside a new partner. Nevertheless, this multi-commodity portfolio has been structured to be costsustainable whilst determining the best plan for future development or value realisation, and could at some point provide upside to our SOTP.

We have taken a similar approach to valuing the Finnish assets as that applied to Disko and Kangerluarsuk above. Our assumed valuation of US\$20m, equivalent to ~2p per share, would require a resource of ~590kt of contained nickel. There is already a combined resource of c. 310kt contained nickel equivalent in the Kainuu

Schist Belt consisting of the Rautavaara JORC compliant (inferred + indicated) resource of 109kt NiEq and the Paltamo non-JORC compliant resource of approximately 200kt NiEq. Using an EV/tonne of US\$34/t puts a valuation of ~US\$10m on this part of JAY's Finnish assets. It is, therefore, not a stretch to reach the US\$20m valuation we assigned to the Finnish assets as a whole.

Funding position

171 L' /D'

We estimate BlueJay had ~US\$20m in net cash as of the end of 2019, including ~£11m in net proceeds from a share placing completed in December. To calculate our Dec'20E SOTP we then deduct estimated capex and G&A in 2020E of US\$29m, although this spending is clearly contingent upon receipt of a mining licence, completion of a BFS and a subsequent decision to execute the project. Development funding would also be required in order to stick to the timeline we have modelled (with first production from late 2021E) although we note there could be some flexibility to reschedule capex without causing a material delay.

Overall this gives a total December 2020 SOTP valuation of US\$254m or a price target of 20p, implying 131% upside to the current share price.

valuation/Thee Target Derivation - Dec 20E				
	Value - \$m	Multiple	Risked value - \$m	PT - GBp/share
Dundas - DCF discounted to Dec'20E	253	0.8	203	16
Disko - est. value	30	1.0	30	2
Kangerluarsuk - est. value	10	1.0	10	1
Finland – est. value	20	1.0	20	2
Total asset value	313		263	21
Net Debt/ Cash - Dec'19E	20	1.0	20	2
Less 2020E capex & G&A	(29)	1.0	(29)	(2)
Total equity SOTP - Dec'20E	305		254	20
Current share price				8.66
Upside/ downside from current share price - %				131

Source: H&P estimates, Company reports, CapitalIQ.





Source: H&P estimates, Company reports, CapitalIQ.

DCF Sensitivity Analysis

Ilmenite prices and WACC

The sensitivity analysis below shows the most important lever on valuation for BlueJay is the long-term ilmenite price outlook. Assuming a real long-term ilmenite price of US\$200/dmt, our base case SOTP is US\$254m. If we were to use a US\$232/dmt selling price, as used in the Company's PFS, and 8% WACC at Dundas, we would achieve an SOTP of US\$355m (rising to US\$538m using a 5% WACC).

Sensitivity of Dec '20E SOTP in US\$m to ilmenite prices and WACC NPV sensitivity Ilmenite (\$/dmt) **5% 6%** 7% WACC 8% **o%** 10%

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Source: H&P estimates

11%

Capex budget and Operating Costs

Our base case model includes a capex of US\$200m which differs from the US\$245m estimate the Company stated in the PFS. Our more optimistic capex is due to the expectation of significant improvements being achievable. If we were to use the US\$245m capex estimate, as used in the PFS, we generate a NPV8 of US\$226 (NPV5 US\$363m). In terms of operating costs, our model is based on average unit costs of ~US\$100/t in real terms over a ~26 year life (9 year reserve & 17 assumed mine life extension), 12% below the US\$113/t unit cost estimates used in the PFS (over a 9 year life).

Sensitivity of Dec '20E SOTP in US\$m to capex budget and opex

SOTP sens	sitivity				-	· · · · ·		
	Capex (\$m)	140	160	180	200	220	240	260
	-30%	388	376	364	352	339	327	315
	-20%	355	343	331	319	307	294	282
	-10%	323	311	299	286	274	262	249
Opex	0%	291	278	266	254	241	229	216
	+10%	258	246	234	221	209	196	183
	+20%	226	213	201	188	176	163	150
	+30%	193	181	168	155	143	130	117

Source: H&P estimates

Dundas vs comparable projects

BlueJay compares favourably in terms of capital intensity and resource grades in relation to its peers. Dundas' capex budget of ~US\$200m implies a capital intensity of ~US\$450 per tonne of annual ilmenite output, placing it in-line with the global average (in ilmenite equivalent terms). Meanwhile, Dundas' expected grade is one of the highest globally in terms of ilmenite alone and is in the top three projects on an ilmenite equivalent basis (i.e. when we adjust for other

projects' rutile and zircon content). Combined with, in our view, a relatively favourable jurisdiction for potential capital providers in terms of fiscal terms, geopolitics and social risks, this makes Dundas an attractive investment and, we believe, a more viable commercial prospect than many comparable projects.





Source: SNL CapIQ

As shown in the table below, about 50% of potential supply consists of junior developers at various stages of pre-production, with a largely uncertain outlook in terms of funding. Furthermore, many of the expansion projects mooted by major producers look set to replace declining production elsewhere in their portfolios, rather than driving incremental supply. This places JAY in a relatively strong position to meet increasing demand in North America, China and other markets globally, in our view.

Potential sources	of new supply of TiO2 fee	-	-	-		-	
	Owner and Project	Location	Stage of Evaluation	Potential Start Date	Production of contained TiO₂ (ktpa)	Production of Zircon (ktpa)	Capex US\$m (if available)
	Iluka - Sierra Rutile expansions	Sierra Leone	In operation - Expansion	2020	~120	11.2	~180-270
	Iluka - Cataby	Australia	In operation	2019	~200	~12	250-275
	Iluka - Balranald	Australia	Pre-execute	2022-24	TBC	TBC	TBC
Major Producers	Kenmare - Moma	Mozambique	WCP B move and WCP C development	2020	~100	~40	TBC
	Rio Tinto - Zulti South	South Africa	Pre-execute	2021	350	90	463
	Tronox - Atlas / Campaspe	Australia	Pre-execute	TBC	125	35	152
	Tronox - Dongara	Australia	Pre-execute	2019	70	20	220
Swing Production	Vietnam (ilmenite)	Vietnam	Swing producer	In operation	Up to 500 TiO2 (Sulfate ilmenite)	0	TBC
	BlueJay - Dundas	Greenland	Awaiting exploitation licence	2021	~220	0	200-245
	Nordic Mining - Engebø	Norway	PFS complete	2021	~25	0	207
	Strandline Resources - Fungoni	Tanzania	DFS complete, product offtakes secured, final project approvals pending	2020	~15	~6	35
	Savannah Resources' - Mutamba JV with RIO	Mozambique	Progressing towards first production	2020	~230	TBC	226
	Group DF - Motronovsk	Ukraine	Under development	TBC	90	14	TBC
Junior developers	Astron - Donald	Australia	FS expected H2'19	2019	135	75	TBC
at various stages of	Astron - Niafarang	Senegal	Pre-FS	TBC	TBC	TBC	TBC
and financing	Base Resources - Toliara	Madagascar	Advanced	TBC	212	31	300
	Anhui Foreign Economic Construction Group - Chibuto	Mozambique	Pre-execute	TBC	500	35	TBC
	Diatreme - Cyclone	Australia	PFS complete	TBC	34	40	93
	Image - Atlas / Boonanarring	Australia		TBC	65	32	40
	Kalbar - Fingerboards	Australia	Advanced	2019	55	75	130
	Sheffield - Thunderbird	Australia	Advanced	2019	224	119	265
	Strandline - Coburn	Australia	Advanced	2020	~55	~55	177
	Trimex - Bhavanapadu	India	Advanced	In operation	155	7	385
	Median			-	~3.6Mtpa	~0.7Mtpa	
	BlueJay vs median						

Source: H&P estimates, SNL, Company Reports.

Catalysts

Key upcoming events which could be significant drivers of BlueJay share price over the next 12 months include:

- Application compliance certification: BlueJay submitted the final Mining Licence Application in September 2019 and the Environmental and Social Impact Assessments in Q2'19. Once the Ministry of Mines deems the application compliant, the EIA and SIA will be subject to a public consultation period of approximately eight weeks.
- Release of the "White-Book" and the "Impact Benefit Agreement": Feedback from the public-hearing process for the EIA and SIA will be compiled into a "White-Book", created jointly by the Government and the Company, and an "Impact Benefit Agreement" will be agreed between the Government, Municipality and BlueJay. One the White-Book and Impact Benefit Agreement are complete, the Government will make a decision on the granting of the Exploitation Licence.
- Receipt of a Mining/Exploitation Licence for the Dundas Ilmenite Project from the Greenlandic Government. While the company has understandably decided not to provide guidance on when it will receive this key licence, we believe it could be granted by Q2'20, based on our understanding of the application process.
- Exploration results: Drilling programmes have been planned for 2020 at Disko and on the existing Kangerluarsuk licence. With over US\$100m in exploration expenditure under previous owners (some looking for oil), the geological understanding of the licence areas is relatively high for a pre-drill target. Previous sampling and geophysical surveys have helped to define drilling programmes on both assets in 2020. We expect first result from these programmes in H2'20 could provide a positive catalyst for JAY shares. BlueJay has also applied for an additional Exploration Licence to expand the company's existing licence area at the Kangerluarsuk Zinc-Lead-Silver Project, which would allow BlueJay to commence a programme of stream sediment, scree sediment and rock sampling on the expanded area. (Application announced 21 Oct'19)
- Processing and delivery of first batches of HMC bulk sample to Rio Tinto: once RIO has received ilmenite from the bulk sample sent to Canada for processing earlier this year, they will produce a TiO2 slag from their furnaces at Sorel-Tracy. This slag will then have to be tested for quality and assessed for commercialty by RTIT's customers in the pigment industry. Results from this bulk testing process will help to determine the value-in-use of BlueJay's ilmenite for RIO's TiO2 business, and will therefore define RIO's future strategy with regards to Dundas, in our view. News flow on this front is unlikely to be released as the results will most probably form the basis of confidential negotiations between RIO and BlueJay over their level of involvement in the project.
- Dundas will move into the BFS phase in 2020 and we would expect the results of this study to be announced around the end of the year. The BFS could be run in parallel with the company's efforts to secure offtake agreements and potential funding partners to spread the cost of developing the project.

Risks to valuation

Upside/downside risks to our valuation include:

- Ilmenite prices exceeding/undershooting our assumptions.
- Lower/higher than expected development costs and capital expenditures.
- Better/worse than expected working capital management impacting cash flows.
- Access to/lack of capital to build the project
- Capital and operating costs undershooting/overshooting our forecasts.
- Failure to obtain, sustain or renew requisite rights, licenses, and permits and regulatory approvals from the authorities.
- Other general environmental risks associated with mining and processing operations.
- Weaker/stronger than assumed Danish Krone compared to US dollar.
- Sensitive supply chain with limited shipping window during the summer.
- Higher/lower yield of Ilmenite yield compared to our assumptions.
- Global demand for premium ilmenite products outstrips/does not match supply, impacting sales volumes and/or JAY's ability to secure offtake agreements for Dundas' product.
- Faster/slower than expected development of the Dundas mine.

Company Overview

BlueJay Mining PLC is listed on London's AIM market (JAY) and the Frankfurt Stock Exchange. The company started life as BlueJay Mining Limited in 2011, when it reversed into a listed shell on AIM and started an exploration in NW Greenland. BlueJay Mining Limited was acquired by FinnAust Mining, another AIM-listed group, in 2015, bringing Finnish assets into the combined entity. The company subsequently took on the name to BlueJay Mining PLC and acquired further licences on the west coast of Greenland through the acquisition of Avannaa Exploration for \pounds 500k.

Summary of key assets

The Company's primary focus is the development of the Dundas Ilmenite project (previously known as Pituffik), located on the Steensby Land Peninsula in NW Greenland. Current total Resources stand at 117 million tonnes at 6.1% ilmenite, placing it amongst the highest-grade ilmenite projects globally. A pre-feasibility study was completed in H1'19, in which a 9-year life-of-mine was defined, producing 440ktpa of ilmenite end-product. Environmental and Social Impact Studies have already been submitted, with the process of securing an Exploitation Licence from the Greenlandic Government well underway. The timeline to further develop the project is somewhat dependent upon receipt of this licence, as well as simultaneous negotiations currently being advanced with potential strategic offtake and funding partners.

BlueJay Mining's Projects Overview



Source: Company report

Beyond Dundas, BlueJay has two highly prospective exploration projects in Greenland – the 2,776sq km Disko-Nuussuaq ('Disko') Magmatic Massive Sulphide ('MMS') nickel-copper-platinum project ('Ni-Cu-PGM') and the 692sq km Kangerluarsuk Sed-Ex lead-zinc-silver project ('Kangerluarsuk'). The assets have had in excess of US\$100m in exploration spending under previous owners (some looking for oil). This historic work, along with BlueJay's own early stage surface sampling programmes have shown the potential for Disko to host mineralisation similar to the world's largest nickel/copper sulphide deposit, Norilsk-Talnakh in Russia. At Kangerluarsuk, historical surface programmes have recovered grades of 41% zinc, 9.3% lead and 596 g/t silver. BlueJay intends to conduct drilling programmes at both Disko and Kangerluarsuk in 2020, which are in relatively close proximity on the west coast of Greenland. Outside Greenland, BlueJay has a 100% interest in a portfolio of copper, zinc and nickel projects in Finland – Hammaslahti, Enonkoski and Outokumpu. While these past-producing mines may still have commercial value, we understand their rehabilitation could be capital intensive and therefore see them being suitable for a JV or earn in agreement with partners who will bring in funding for further exploration. This multi-commodity portfolio has been restructured to be cost-sustainable whilst determining the best plan for future development or value realisation.

Dundas Ilmenite Project

The Company's flagship asset is the Dundas Ilmenite project (previously known as the Pituffik Titanium Project) in Greenland. With a JORC-compliant resource of 117Mt at 6.1% ilmenite, Dundas is one of the highest-grade mineral sand ilmenite projects globally. A PFS completed in H1'19 defined a Reserve of 67.1Mt at 3.45%, giving a 9-year mine-life with 440ktpa of annual ilmenite output. While the PFS estimated a levered IRR of 33%, this was on a post-finance basis and assumed a relatively high long-term realised ilmenite price of US\$232/t. BlueJay is now working to further optimise the project to solidify its attractiveness to potential funding partners.

We believe BlueJay is on track to complete a BFS at Dundas during 2020, although this timeline is somewhat conditional upon the outcome of Rio Tinto's test work on the bulk sample shipped in H2'19. This 42kt bulk sample of ore was successfully mined and shipped in August 2019 and will be refined at BlueJay's pilot facility in Canada into ~10kt of heavy mineral concentrate containing ~90% ilmenite. Roughly half will be sent to Rio Tinto's Sorel-Tracy Plant in Quebec for smelter testing to confirm its long-term commerciality. The other half is available for BlueJay to test with alternative customers.







Having proven the potential quality of the Dundas ilmenite product, we believe there is significant scope to add value to Dundas by reducing initial capex requirements, extending the life of the mine and/or increasing annual output, thereby lowering the capital intensity of the project. Indeed, the PFS was itself based on the Dec'18 Resource statement, and did not include a 15% increase in Resource announced in May'19. The company estimates the addition of an extra 2 years to the 9-year life-of-mine assumed in the PFS would add US\$47.6m to the NPV5 and boost the IRR to 34%. Crucially, the defined resource has significant room for growth, with exploration targets provided by SRK and RSC Global suggesting the ultimate resource potential could be in excess of 700Mt, including the mining of offshore marine material as well as the onshore raised beaches from which the PFS mine plan was derived. BlueJay has over 40km of coastline within the Dundas licence area, including raised beach, offshore and the Iterlak Delta domains. The tested zone from which the Resource has been defined covers just 17% of the total landholding.

It should be noted that the process of mineral separation at Dundas will not use any chemicals and has no tailings, using simple physical methods (gravity and magnetic separation). The Government of Greenland has expressed support for the mining sector and BlueJay recently received a further positive endorsement with a £4m investment from Greenlandic and Danish Government-backed institutions (Greenland Ventures A/S and Vaekstfonden, respectively).

Location & Geological setting

The Dundas license is located along a 40km stretch of coastline in NW Greenland, surrounding the abandoned fishing settlement of Moriusaq on the Steensby Land Peninsula, at the northern end of Baffin Bay. The nearest significant settlement is approximately 80km to the north at Qaanaaq, which currently has around 600 inhabitants, and has an airport with regular services on Air Greenland. The project site can then be accessed by helicopter or boat from Qaanaaq. Alternatively, the United State's Air Force's Thule Air Base, established in the 1950s, is located approximately 30km SE at Pituffik, offering some potential for infrastructure sharing. The site itself is currently accessed by helicopter or boat from Qaanaaq or Thule.

Project location on the NW coast of Greenland





Source: Google Maps.

Source: Google Maps.

The Geological Survey of Denmark and Greenland ("GEUS") has estimated that 10 billion tonnes of ilmenite exist in the original rock within the entire Thule region, with a further 7 billion tonnes of ilmenite present in the form of placer ilmenite. The "black sand" ilmenite deposits along this south-facing stretch of coastline on Greenland's Steensby Land peninsula are quite unusual in that they remain relatively proximal to the original source rock in the raised hinterland. It is likely that a combination of glacial and fluvial erosion has deposited the heavy minerals at the coast, where the action of the waves and changing sea-levels along with the high specific gravity of the material has over time led to more concentrated ilmenite-bearing deposits.

Other heavy minerals in the black sand in the Dundas project area include magnetite (iron-oxide mineral), pyroxene and amphibole (silicate minerals). Additionally, the black sands in the project area also contain a high proportion of lighter coloured and less dense 'normal sand' minerals such as quartz, feldspars and micas. All sand minerals in the Dundas project area are non-harmful, not toxic, and do not contain radioactive isotopes.

Exploration & Mineral Resource development

The mineralised zones at Dundas broadly cover four types of terrain:

- **Raised Beaches:** refers to the dunes up to the base of the escarpment, containing ilmenite accumulations over widths of more than 1km, of unknown depths, along more than 30km of coastline.
- Active Beaches: refers to the area seaward of the frontal dunes, including the beach, tidal zones and surf zone
- **Drowned Beaches:** refers to the areas seaward of active beaches, i.e. submerged mineral sand deposits on the seabed.
- **Iterlak Delta:** refers to deltaic heavy mineral deposits discovered in the Iterlak estuary area.

Dundas Project Map



Source: Company report

Mineral Resource Estimate

The initial focus of Resource development drilling has been on the Raised and Active beaches. Exploration programmes conducted by SRK during 2016, 2017 and 2018 led to the publication of a ~24Mt Maiden Resource Estimate in April 2017. The Resource was increased in several steps to reach ~101Mt at 7.1% ilmenite by December 2018 (which formed the basis of the Dundas pre-feasibility study published in Q2'19). The Resource was subsequently increased further in May 2019 to its current level of 117Mt at 6.1% ilmenite.

Mineral Resource	Estimate							
Classification	Location	Tonnes (kt)	>5mm (%)	>2mm (%)	<63µm (%)	THM (%)	In-Situ TiO ₂ (%)	Implied In-Situ Ilmenite* (%)
	Moriusaq	88000	27.5%	36.1%	4.2%	27.0%	3.1%	6.5%
Indicated	Iterlak East	19500	15.3%	24.0%	12.8%	22.2%	2.2%	4.6%
Indicated	Iterlak West	4800	23.2%	32.4%	13.8%	11.9%	1.0%	2.1%
	Total	112300	25.2%	33.9%	6.1%	25.5%	2.8%	5.9%
Ta farma d	Moriusaq	5000	15.7%	23.0%	5.7%	34.2%	4.4%	9.2%
Inferred	Total	5000	15.7%	23.0%	5.7%	34.2%	4.4%	9.2%
Total		117300	24.8%	33.4%	6.1%	25.9%	2.9%	6.1%

Source: Company reports. *Note: % TiO_2 In-situ assumes that all TiO_2 is within ilmenite and that the ilmenite contains 47.65% TiO_2 , based on historical exploration data.

To date, the defined Resources have been derived only from the Raised Beach terrain, across three zones – Moriusaq Bay, Iterlak West and Iterlak East:

Moriusaq Bay -

- Indicated Mineral Resource equal to 88 million tonnes at 6.5% ilmenite (in- situ), with 5 million tonnes inferred at 9.2% ilmenite.
- Inferred Mineral Resource of 5 million tonnes at 9.2% ilmenite (in-situ)
- This raised beach area was the focus of the PFS published in June 2019

Iterlak West & East -

- Raised beaches west & east of the Iterlak Delta, SSW of Moriusaq.
- 19.5 million tonnes at 4.6% ilmenite (in situ) at Iterlak East.
- 4.8 million tonnes at 2.1% ilmenite (in situ) at Iterlak West.

Iterlak Exploration Map



Source: Company Reports

Exploration Targets

Beyond the Resources defined on the Raised Beach areas, BlueJay has delineated JORC-compliant Exploration Targets at the Iterlak Delta and the offshore shallow marine area (Drowned Beaches):

- **Iterlak Delta** Exploration Target of between 20Mt and 60Mt at between 6% and 10% ilmenite defined by SRK
- **Drowned Beaches** offshore shallow marine exploration target of 300-530Mt at 0.2-2.3% TiO2 (or ~0.4-4.8% ilmenite) defined by RSC, a mining and mineral exploration company.

JORC Exploration Targets

Location	Tonnage (Mt)	In-Situ TiO2 (%)	In-Situ Ilmenite (%)	Consultant Geologist
Iterlak Delta	20-60	2.9-4.8%	6-10%	SRK
Offshore	300-530	0.2-2.3%	0.4-4.8%	RSC

Source: Company reports.

The Company has also identified an area, further east along the beach from Interlak East (see purple box in map below), that has the potential to further add to the resource.

Reserve and Resources Map



Source: Company Reports



Iterlak Delta Exploration Map

Source: Company Reports.

Offshore Shallow Marine Geological Model



Source: Company Reports.

Mining Reserves & assumed mineral inventory

Within the summary of Pre-Feasibility Study ('PFS') for the Dundas Ilmenite project, released on 27th June 2019, BlueJay published a JORC-compliant Mineral Reserve of 67.1Mt at 3.45% TiO2 (equivalent to ~7% ilmenite in-situ). This Reserve tonnage was derived from the 88Mt of Indicated Resources at Moriusaq as of the Dec'18 Resource Statement, and did not include any of the ~24Mt in new Indicated material at Iterlak East and West that was announced in the latest May'19 Resource.

This was highlighted as a source of potential upside in the PFS summary. The company estimated that these additional Indicated Resources would (conservatively) convert into an extra two years of mine-life, extending it to 11 years from the PFS Reserve of 9 years. It was estimated that these additional years would add ~US\$48m to the NPV of the project based on BlueJay's macro assumptions and a 5% WACC.

Given the size of the exploration targets outlined by BlueJay's consultant geologists and the scale of Dundas' licence area yet to be properly drilled and assayed, we have assumed in our DCF model that a further ~15 years of material on top of the May'19 Resource will ultimately be brought into the life-of-mine plan (i.e. we have assumed a total of 17 years of additional life on top of the 9 years used in the PFS). We have also assumed the grade of this material will be similar to the existing Reserve grade, based on the ability to enrich the Resource grades through a simple front-end oversize screening step. The table below summarises the Reserve tonnes and assumed additional mineral inventory which we have included in our DCF analysis.

Ore Reserves & Assumed Mineral Inventory

Category	LoM	Tonnes (Mt)	Ilmenite head grade (%)
Probable Reserves	Years 1 - 9	67.1	7.4%
May'19 Indicated Resource converted to Reserves	Years 10 - 11	16.0	7.0%
Assumed Additional Mineral Inventory	Years 12 - 27	122.6	7.0%

Source: Company reports, H&P estimates.

Mining & Processing

BlueJay expects to mine the ore (which is essentially black sand) using automated continuous surface miners that harvest the sand with rotating cutter-heads. Drilling and blasting should not be required. The PFS is based on the assumption that a fleet of trucks will then be used to transport the mined ore to the wet processing plant; one option which could be investigated as part of the BFS would be to instead use a semi-mobile Rail-Veyor[®] system. These appear to be suited to the topography (i.e. a flat, straight beach) and could be more cost effective than trucks over longer distances.

Nonetheless, based on continuous miners and truck haulage, the PFS estimates a relatively conservative mining cost of US\$2.63 per tonne of run-of-mine ore.



Source: Company Reports, H&P Estimates.

Once transported to the processing plant, raw mined material will be screened to remove the largest particles and heated in a rotary kiln for de-icing. The screens and rotary kiln would be mobile to ensure they can be moved to new positions (relocation every 2-3 years) and follow the operational area for the continuous surface miners.



Source: Company Reports.

The mined, screened sand will then be separated in the wet plant into two fractions – heavy minerals (~10% by volume) and light minerals (~90%) - through two types of gravity separation: the first phase consists of two stages of spirals circuits; and the second phase will use an upward current classifier, a technique often used in the sorting of sands.

It is expected that the gravity separation will be able to use seawater, with no adverse impact on the quality of the final product and no freshwater required. No crushing or grinding will be necessary to liberate the minerals and no chemical reagents will be used to separate the desired elements. Seawater used in the gravity separation will be pumped back to the sea after use.

The rejected material from the gravity circuits – i.e. the light minerals – will be transported back to be combined with mining waste and oversized screened material, and will then be backfilled into the mine cuttings. The backfilled raised beach areas will be rehabilitated with the previously removed organic-bearing

top-soil material. The company expects there to be no discernible impact to the original environment after the final layer of topsoil is replaced and the area remediated back to its natural state.

Gravity circuit (aka Wet Concentrator Plant) consisting of two stages of spirals followed by upward current classifier



Source: Company Reports.

After the wet plant, the heavy mineral concentrate (consisting of ~88% ilmenite with the remaining 12% being composed mainly of magnetite and other heavy minerals) will be transported to the mineral separation plant (also referred to as the "MSP" or "dry plant"). This is expected to be in a fixed location, close to the established storage and port facilities. Before entering the MSP, the HMC will be dried to ensure all moisture is removed.

The heavy minerals will be refined into >99% clean 'premium ilmenite product' through magnetic separation methods. The overall metallurgical recovery rate is expected to be just under 80% to produce ~440ktpa of ilmenite end product.



Source: Company Reports.

As the chart below demonstrates, we have assumed in our model that the limiting factor on production is the capacity of the mineral separation plant. In effect we assume that ore excavation and the rate of ore feed to the gravity circuits can be varied in inverse proportion to grade, in order to maintain a consistent rate of end-product output from the MSP.



Annual ilmenite end-product output & metallurgical recovery rate

Source: Company Reports, H&P Estimates.

In terms of processing costs, the use of seawater, the fact that no chemicals are required, and the ability to backfill oversize and rejected light minerals has a beneficial impact on the environmental impact as well as the capex and opex required to execute the project. The PFS estimates processing costs at ~US\$1.82/t of run-of-mine ore, equivalent to US\$31/t of ilmenite output.

Logistics - shipping and storage

Ilmenite end products are expected to be stored in a large storage facility at the mining site itself. The company believes shipping with bulk carriers should be possible during a ~4 month window each year from the end of June to October. Approximately 10-12 return trips, equivalent to <1 loading per week during the ice-free window, are expected to be required to move the anticipated 440ktpa of end product with vessels of the type 42,000 DWT Supramax or similar.

While the challenges of loading bulk carriers at his latitude should not be underestimated, this shipping schedule appears realistic, in our view, especially in light of the successful sealift of a bulk sample from Dundas completed in September 2019.

The bulk sample was transported to the Port of Contrecour in Canada, where it is currently stockpiled in preparation for processing through a pilot plant to produce heavy mineral concentrate. This will then be further processed into a ~4.5kt sample of ilmenite to send to Rio Tinto's Sorel-Tracy smelter in Quebec.

The sealift was conducted by Nordic Bulk Carriers, a subsidiary of Pangea Logistics, who have extensive experience in Arctic bulk shipping and are pioneers in shipping through the <u>Northwest Passage</u>. Once in full operation, it is expected that material from Dundas will be shipped by bulk carriers either directly to customers or to a storage location at a port with open-water all year round, where it can be stockpiled before being taken to end customers in the international market, based on long-term agreements.

The most easily accessible market for BlueJay is North America and hence the natural choice for this storage location is likely to be on Canada's St Lawrence Seaway. However, a second storage facility in Europe could also be considered if a

European customer base is developed. The technical feasibility of shipping through the Northwest Passage to China has also been shown in recent years although this route would likely incur higher freight costs and therefore lower FOB prices.

Greenland occupies a strategically advantageous position with access to N American and European markets



Source: Company Reports.

Ilmenite product marketing

The ilmenite at Dundas is un-oxidised, homogeneous and very low in impurity. These three key characteristics mean there is interest from all angles of the market, including potential end users, refiners and off-take customers (see below for further details on the potential for an off-take agreement with Rio Tinto).

The Company had previously envisaged selling both a "Standard" and a "Premium" ilmenite product that, if required, could be blended to meet consumer needs. The Standard ilmenite product had a composition that comparable with other similar high FeO ilmenite products with a TiO2 content of 46%, FeO content >38%, low levels of Cr2O3 and V2O5 impurities and radioactive elements below detection limits; the Premium Ilmenite product had the same composition as the standard product plus favourable MgO and CaO content that ensured suitability for chloride slag production. Typical key composition shown below:

Key Composition		
	Typical	Range
TiO ₂	46.5%	45-47%
FeO	39.2%	>38%
Fe ₂ O ₃	11.4%	10-12%
Al_2O_3	0.09%	<0.2%
SiO ₂	0.71%	<1.0%
Cr_2O_3	0.06%	0.06%
ZrO_2	0.12%	0.12%
CaO	0.15%	<0.2%
MgO	0.78%	<1.0%
MnO	0.52%	0.50-0.57%
Nb ₂ O ₅	0.03%	0.03%
P ₂ O ₅	0.002%	<0.01%
V_2O_5	0.35%	<0.40%
U	<10ppm	<10ppm
Th	<10ppm	<10ppm

Source: Company Reports.

We expect the majority of the project's ilmenite product to fall into the premium category, we have simply assumed a blended price of US\$200/dmt. The precise mix may also depend on customer demand and there could be a trade-off between volume and quality; indeed, after further analysis and customer feedback, we believe it will be possible for the entirety of Dundas' output to be produced to one set of specifications, meeting many of the premium-quality characteristics, with no need for subdivision into two product-streams.

Potential offtake engagement with Rio Tinto

BlueJay announced an agreement with Rio Tinto Iron and Titanium Canada, a subsidiary of Rio Tinto Plc ("Rio") on 28th May 2019, to analyse ilmenite from its 100% owned Dundas Ilmenite Project in Greenland, including the testing of sample material at Rio's Sorel-Tracy TiO2 slag smelter in Quebec, Canada. Rio and BlueJay will also continue to work together to assess and improve on technical work conducted to date.

Validation of Dundas: the announcement was a strong endorsement of the potential quality of Dundas' ilmenite product, its suitability for slag production, the scale and deliverability of the mine, and the favourable environment for

mining investment in Greenland. While the terms of the contract are confidential, and the statement made clear that there is no guarantee of any long-term transaction between the two parties, we believe possible outcomes could include an offtake deal or Rio Tinto taking an equity stake in Dundas, subject to positive results. As we outlined above, this could prove to be one of multiple significant catalysts driving further upside in BlueJay's shares in 2020.

Future tie-up could be mutually beneficial, in our view – opportunity to scale up from PFS: With the benefit of Rio Tinto's deep technical expertise, we expect this deal will allow BlueJay to maximise the value of Dundas by considering expansion options beyond the 440ktpa of ilmenite output which was assessed in the 2019 pre-feasibility study. Aside from its financial clout, we view Rio as an excellent and logical partner for BlueJay at Dundas. Metallurgical test work to date has shown the project will produce an ideal ilmenite feed for Rio's slag operations, with a high TiO2 content of 46%; low Fe2O3 content, which boosts value-in-use in the chloride pigment production process; and low sulphur, which improves the quality of by-product pig iron from slag furnaces. Furthermore, being in close proximity to Greenland, Rio's TiO2 slagging operations in Quebec are ideally located, in our opinion, to mitigate some of the logistical challenges of operating in high latitudes.

Potential for significant, high-grade resource upside: aside from its proximal location and high-quality product, we believe the key attraction of Dundas for RIO is its combination of high grades and scalability. Dundas is the highest-grade mineral sand ilmenite project globally, with impressive resource upside potential beyond the ~117Mt of ore in Resource grading 6.1% ilmenite (in situ). The majority (~79%) of the current JORC resource is derived from the Moriusaq area only, with work on large swathes of the license area still to be incorporated. SRK has already outlined a conservative "exploration target" of a further 20-60Mt at 6-10% ilmenite in the Iterlak delta area, while additional material from the shallow marine offshore area, where RSC defined a further 300-520Mt exploration target at 0.4-4.8% ilmenite in 2019, could drive further upside. Both could ultimately be included in a fully optimised project. As such, we believe a significant driver of the agreement between JAY and RTIT was the enormous scope for expansion of the eventual operation. Importantly the Resources sit at or virtually at surface, and are homogeneous, with low impurities, giving it favourable processing characteristics.

Rio's commitment to TiO2 sector confirmed: Rio and other market participants continue to provide generally positive commentary on the state of the TiO2 pigment market. Strong downstream demand is driving high TiO2 pigment plant utilisation, which is in turn boosting demand for feedstocks (i.e. TiO2 slag, ilmenite, rutile etc). Rio expects growth in emerging economies to support "solid" long-term demand growth of "3% per year", while noting: "supply of high-grade mineral sands (titanium dioxide and zircon) remained tight due to a combination of grade decline and production disruptions - and this has underpinned robust prices." Rio is also showed its confidence in the sector with the rebuilding of two idled furnaces at the Sorel-Tracy smelter in Quebec during H1'19. A potential participation in the development of Dundas could offset Rio's future capital and operating costs associated with sourcing ilmenite feedstocks for the smelter; Dundas' high-grade, high-quality product could also help achieve Rio's stated aim of maximising productivity from the furnaces in operation. According to RIO's H1'19 Results, eight of the company's nine furnaces in Quebec are currently in operation, with the decision to restart the ninth dependent on a "value over volume" strategy.

Elsewhere in Rio's portfolio we note the company has approved \$463m in capex for construction of the Zulti South mineral sands project at Richards Bay Minerals, after completion of a feasibility study. First production was expected in late 2021. However, this should have little impact on Sorel-Tracy as ilmenite from Zulti South will likely be entirely consumed by RBM's smelting operations in South Africa. In any case, after an escalation of violence in the communities around RBM, the operations were temporarily closed in December 2019 to ensure the safety of RIO employees. The construction of Zulti South was also suspended. While operations are expected to resume in January, work on the project will remain under review until operations have been normalised.

In our view, this unrest and delay in the project could feed into market concerns around the long-term supply of TiO2 feedstocks, further supporting recent positive ilmenite price momentum. Furthermore, within RIO, we believe the difficult operating environment at RBM may put further emphasis on maximising the company's Canadian TiO2 business, which could have positive implications for Dundas.

Test work likely to dictate Rio's next steps: as we have mentioned above, BlueJay is currently in the process of producing a sample of refined ilmenite endproduct at its pilot facility in Canada, using ore shipped from Dundas in September. We expect this to be delivered to RIO in batches during the course of 2020; the quality of the resulting TiO2 slag produced will then be assessed in order to determine the value to RTIT of Dundas' ilmenite as a blending feed at Sorel-Tracy. Notwithstanding this testing, we note BlueJay will retain half of the ore sample and expect this could be sent to other prospective customers in the region, offering another potential avenue to market Dundas' product.

Positive implications for other prospective assets in BlueJay portfolio:

in our view, this partnership should help to de-risk any near term working capital required to advance Dundas to a full bankable feasibility study. We note BlueJay CEO Rod McIlree's comment that management will now be able to focus more attention on the company's other earlier stage assets in Greenland at Disko and Kangerluarsuk. The ability to focus more attention and, potentially, deploy more exploration and development expenditure to these projects could allow them to accelerate up the value curve, offering further upside for investors. The opportunity also remains to monetise the value of the company's legacy Finnish exploration holdings.

Development timeline and capex budget

The PFS highlights a Capex requirement of ~US\$245m which is inclusive of mining, processing, storage of dried finished product and a near shore direct ship loading facility capable of handling 440ktpa+ of ilmenite production, as well as a working capital buffer to account for shipping windows. According to the PFS, the Dundas project site construction work is expected to commence in June 2020 with mining and processing of the ore likely to begin in Q3 '21. We model the first shipment of ilmenite from Dundas to occuring in late 2021 or early 2022.

PFS - direct capex budget breakdown						
Cost Category	Mining (US\$m)	Processing (US\$m)	Infrastructure (US\$m)			
Earthworks & General Services	0.36	6.22	2.45			
Civils & Buildings		15.07	15.26			
Structural		8.47	3.78			
Platework		1.74	2.30			
Mechanical	24.00	13.88	22.10			
Electrical & Instrumentation		3.95	7.59			
Piping & Valves		2.81	2.81			
First Fills & Spares		-	0.12			
Vendor Representatives		0.18	0.08			
Contingency	1.10	1.20	2.18			
Total	24.36	57.70	60.97			

Source: Company reports.

Overall the budget includes ~US\$25m in contingencies for cost overruns and, we understand, a further ~US\$30m in costs associated with the construction of ship loading facilities (spread across several cost categories). As demonstrated by the successful sealift in September, we believe this is a conservative estimate and anticipate the bill for this capital item could be reduced by as much as US\$20m once the full BFS has been completed. We have also stripped the US\$25m in contingencies from our model as, in our view, there is already adequate conservatism reflected in the PFS estimates in general. This leaves us with a total US\$200m capex budget assumption in our DCF analysis.

PFS - indirect capex budget breakdown					
Cost Category	(US\$M)	(% of Total Direct Cost)			
Owner's costs	3.71	2.6			
Engineering & Procurement	9.72	6.8			
Construction Management Costs	5.50	3.8			
Vendor Reps, Spares & First Fills	5.24	3.7			
Indirect Construction Costs	18.16	12.7			
Indirect Contractors Costs	3.48	2.4			
Freight, Duty & Taxes	19.46	13.6			
Insurances	1.36	1.0			
Contingency & Escalation	20.71	14.5			
Total	87.33	61.1			

Source: Company reports.

Operating cost estimates

The table below shows a breakdown of operating costs, in real terms, as stated in JAY's PFS. In our model we use a total operating cost of US\$100/t compared to the Company's estimate of US\$113/t which it notes as being highly conservative having been inflated to account for an additional 20% of the current total operating cost. Our estimate, 12% below the value used in the PFS and roughly at the mid-point between the Company's baseline and conservative estimates, is due to our belief that cost reductions are achievable. We envisage a material reduction of the current mining cost through the implementation of a Rail-Veyor® system to replace trucking. Furthermore, while we have modelled a 17 year mine life extension, the geological potential of the resource could support a much larger operation driving economies of scale and reducing operating costs.

Operating Cost Estimates in PFS			
	Total Cost (US\$M)	Cost (US\$) per tonne of ROM	Cost (US\$) per tonne of Ilmenite
Mining	24.36	2.63	44.45
Processing	57.7	1.82	30.80
Infrastructure, Services and G&A	60.9	2.23	37.56
Total	143.0	6.68	112.81

Source: Company reports

Below is graph of opex per tonne of finished ilmenite product in nominal terms using a 2.5% per annum inflator as used in our model. There is (roughly) an even split between the three main operating costs, with cost reductions, we believe, most achievable within the mining and infrastructure sections.



Source: H&P estimates
DCF model summary

The table on the following page summarises our DCF model resulting from the assumptions we have described above. Overall, we derive an IRR and NPV8 of 18% and US\$208m, respectively, when discounting to end'19E, and 21% and US\$253m when discounting to end'20E. We have modelled in nominal terms, using a 2.5% underlying annual inflation rate. Other key modelling assumptions include a real long-term ilmenite price input of US\$200/t (FOB).

	-	-	_	_	-	-	-	-	-	-	-	-	-	-
Dundas Ilmenite Project model summary														Average
Year end December		FY19E	FY20E	FY21E	FY22E	FY23E	FY24E	FY25E	FY26E	FY27E	FY28E	FY29E	FY30E	FY31-48E
Pricing, production & shipments														
Realised Ilmenite price (nominal)	\$/dmt	180.0	189.6	210.1	215.4	220.8	226.3	231.9	237.7	243.7	249.8	256.0	262.4	334.5
Ilmenite production	ooodmt	-	-	-	144.5	439.5	439.6	440.8	439.6	439.6	439.6	440.8	439.6	446.3
Ilmenite shipped	ooodmt	-	-	-	71.1	439.5	439.6	440.8	439.6	439.6	439.6	440.8	439.6	450.4
Finished Ilmenite stockpile	ooodmt	-	-	-	73.4	73.4	73.4	73.4	73.4	73.4	73.4	73.4	73.4	34.7
Revenue														
Total FOB revenue	\$m	-	-	-	15.3	97.0	99.5	102.2	104.5	107.1	109.8	112.8	115.4	150.7
Cost of Production														
Cash unit opex/t of finished product (nominal)	\$/dmt	-	-	-	117.8	105.6	97.5	101.9	112.0	105.7	133.9	128.2	149.6	166.2
Cash cost of production	\$m	(1.9)	(2.0)	(2.0)	(17.0)	(46.4)	(42.8)	(44.9)	(49.3)	(46.5)	(58.9)	(56.5)	(65.8)	(74.1)
P&L cost adjusted for inventory moves	\$m	(1.9)	(2.0)	(2.0)	(8.4)	(47.3)	(43.4)	(44.6)	(48.5)	(46.9)	(56.8)	(56.9)	(64.2)	(75.2)
Profit and Loss														
EBITDA	\$m	(1.9)	(2.0)	(2.0)	6.9	49. 7	56.0	57.6	56.0	60.2	53.0	55.9	51.2	75.4
D&A	\$m	-	-	-	(9.4)	(26.5)	(26.4)	(29.7)	(32.6)	(30.8)	(39.0)	(37.4)	(43.5)	(1.4)
Royalties paid	\$m	-	-	-	(0.4)	(2.4)	(2.5)	(2.6)	(2.6)	(2.7)	(2.7)	(2.8)	(2.9)	(3.8)
Tax expenses		-	-	-	-	-	-	-	(1.2)	(17.2)	(15.1)	(15.9)	(14.5)	(21.5)
Net profit/loss after tax	\$m	(1.9)	(2.0)	(2.0)	(2.9)	20. 7	27.2	25.3	19.5	9.5	(3.8)	(0.2)	(9.7)	48.8
Capital Expenditure														
Sustaining capex	\$m	-	-	-	(0.3)	(0.9)	(0.9)	(1.0)	(1.1)	(1.0)	(1.3)	(1.2)	(9.0)	(1.4)
Growth capex	\$m	(5.9)	(26.6)	(133.4)	(40.0)	-	-	-	-	-	-	-	-	-
Capital expenditure	\$m	(5.9)	(26.6)	(133.4)	(40.3)	(0.9)	(0.9)	(1.0)	(1.1)	(1.0)	(1.3)	(1.2)	(9.0)	(1.4)
FCF & DCF														
EBITDA	\$m	(1.9)	(2.0)	(2.0)	6.9	49.7	56.0	57.6	56.0	60.2	53.0	55.9	51.2	75.4
Movement in working capital	\$m	-	-	(1.0)	(8.3)	(1.5)	0.0	(0.4)	(0.5)	0.1	(1.3)	0.2	(1.0)	0.5
Capex	\$m	(5.9)	(26.6)	(133.4)	(40.3)	(0.9)	(0.9)	(1.0)	(1.1)	(1.0)	(1.3)	(1.2)	(9.0)	(1.4)
Taxes & royalties paid	\$m	-	-	-	(0.4)	(2.4)	(2.5)	(2.6)	(3.9)	(19.9)	(17.8)	(18.8)	(17.4)	(25.3)
Free cash flow	\$m	(7.8)	(28.6)	(136.4)	(42.0)	44.9	52. 7	53. 7	50.5	39.3	32.6	36.1	23.8	49.3
IRR		18%	21%											
Discounted cash flow @8% WACC	\$m	208.2	253.4											

Source: H&P estimates, Company reports.

Disko (Greenland)

Description

Located on the south-west coast of Greenland, Disko is a Magmatic Massive Sulphide ('MMS') Ni-Cu-Pt-Co project that hosts mineralisation similar to Norilsk-Talnakh in Siberia, the world's largest nickel/copper sulphide mine. Disko has been the subject of more than US\$50 million of exploration work over the last 60 years by international mining companies including Cominco, Falconbridge, Vismand and Cairn energy Plc.

A surface sampling programme in 2017, carried out by BlueJay, confirmed a working sulphide system at Disko with initial chemical assays in oxidised surface material returning 2.02% nickel, 0.8% copper and 0.2% cobalt, with seven anomalies identified for drill testing. MMS occurrences have been identified in the Disko licence area with the largest being a 28t boulder that assayed 6.9% nickel ('Ni'), 3.7% copper ('Cu'), 0.6% cobalt ('Co') and 2 g/t PGM's.

In 2019 the company underwent a work program of reprocessing and validating historical data as well as the acquisition of new geophysical and geochemical data. The results from this added seven newly defined drill-ready targets, the largest of which is twelve kilometres long and approximately two kilometres wide; total defined drill ready targets now stand at twenty-eight, up from twenty-one in 2018. Three new outcropping sulphide occurrences were discovered in the North-Eastern part of Disko island.

Мар

At Disko the company has license areas covering 2,776km²; the two main target areas are the Kugg Project on the Nuussuaq peninsula and the Illug Project on Disko island.

BlueJay's licence areas on Disko Island and Nuussuaq Penisula.



Source: Company reports

The Kugg and Illug Projects



Source: Company reports

Area 1 - The Kugg Project, Nuussuaq peninsula

Surface sampling confirmed a sulphide system with initial chemical assays in oxidised surface material returning 2.02 % nickel, 0.8% copper, 0.2% cobalt. Handheld XRF sampling on fresh, polished material returned values averaging between 4.6%-9.3% nickel & 1.5 - 2.8% copper, with fresh samples taken from outcrops show characteristics indicative of large scale Ni-Cu-Co-PGE sulphide segregation.

Area 2 - The Illug Project, Disko island

Data compilation and interpretation has identified numerous additional targets, as well as confirming historically identified anomalies – work is ongoing. Additional large coincident gravity, magnetic and conductor anomalies have been identified.



Drill ready, large-scale MMS targets in Area 2.



Source: Company reports

Source: Company reports

Geology

In 2019, Geological mapping including detailed structural measurements, boulder tracing & data interpretation were all completed over the boulder discovery zone at Disko Island, where a 28-tonne massive sulphide boulder that assayed 6.9% nickel, 3.7% copper, 0.6% cobalt and 2g/t PGM was located. Importantly the Company is now happy that it has discovered the source of this boulder and will include this location in its drilling plans.

Three new strongly mineralised outcrops were found (see map below). The first discovery, 'Delta Mineralisation', is characterised by several rusty, mineralised outcrops approximately 5km SE of Qullissat and mainly located between the historical Falconbridge drill holes, FP-94-5 & FP-94-6. The mineralised rock is a mafic, fine grained intrusive with pyrrhotite (primary mineral for nickel) and chalcopyrite (primary mineral for copper) disseminated throughout the rock.



2019 field activities on the Disko island and Nuussuaq peninsula

Source: Company reports

Notably, the aforementioned mafic sill contains an intersection of gold-bearing iron-cumulates, yielding historical assays of 32 g/t gold in a concentrate. The basal contact of the sill was never penetrated by Falconbridge, but the iron cumulates and sulphides at surface point to the potential for much larger sulphide accumulations at the base of these magmatic bodies.

The 'Ujarassuit mineralisation' was found near the eastern base of Ujarassuit boulder field, approximately 15km SE of the former coal-mining town of Qullissat. The mineralised rocks encountered here are malachite stained and carry high concentrations of sulphides. The third finding, the 'Mudstone Zone', consists of a strongly weathered bed of siltstone/mudstone on the base of a rusty, mafic, fine grained intrusion approximately 3.5km NW of Qullissat.

Although the geological work conducted in 2019 primarily focused on wellexposed rock sequences along the northern coast of Disko, the observations further support analogies with the Noril'sk-Talnakh nickel district in Siberia. The work also testified that the Kuug and Illug valleys, which carry some of the largest identified drillable targets, represent large-scale faults that have acted as the most pronounced magma conduit-feeder systems in the region. Critically, erosion within these valleys into these conduit-feeder systems has allowed exploration into the underlying rock sequences that elsewhere are concealed by the overlying lava successions (up to several thousand metres).

Potential Value

We have assigned a nominal US\$30m value to Disko based on the prospectivity across BlueJay's large licence area, a lot of which has yet to be tested. Based on an EV/NiEq Resource multiple of US\$34 per tonne metric, a US\$30m valuation for Disko would be justified by a contained resource of ~870kt nickel equivalent – a relatively conservative sum in comparison to the size of other sulphide nickel projects globally.

Kangerluarsuk SedEx (Greenland)

Description

Kangerluarsuk is a Pb-Zn-Ag project, covering 107 sq km, is located approximately 100km NE of Disko and is situated 20km north of the Black Angel Pb-Zn mine. It was originally discovered and later drilled by Cominco with further work undertaken by Rio Tinto Zinc ('RTZ'). Historical results include 41% zinc, 9.3% lead and 596 g/t silver.

The Company acquired the Kangerluarsuk Project in January 2017 when it purchased Avannaa Exploration ('Avannaa') and its exploration assets in an all share transaction with Cairn Energy Plc. Between 2011 and 2013, Avannaa had carried out an aggressive campaign to advance the Project. Detailed geological and structural mapping were completed, and a series of intense geochemical anomalies were discovered within a 15km long NE-SW trending lineament based on MMI (Mobile Metal Ion) and SGH (Soil Gas Hydrocarbon), and bulk soil geochemistry surveys. The SGH study defined a signature highly consistent with a deeply buried (>500m) base metal deposit.

New Licence Area

BlueJay's new Licence area currently under application, totalling 586km², surrounds the Company's existing Exploration Licence (MEL 2011/31) and is focused on the peninsulas of Alfred Wagener Halvø and Qiioqi (see map below).

The area was selected based upon:

1. Proximity to known mineralisation within the existing Licence;

2. Stream sediment and heavy mineral concentrates ('HMC') that are highly anomalous in Zn, Pb, Cu and Ag, suggesting the presence of poly-metallic mineralisation, supported by elevated pathfinder elements such as Cd, As and Cs;

3. The mapped distribution of the Nûkavsak Formation, on the premise that all known mineralisation is located at the base of this unit within the Qaarsukassak Formation, close to the unconformable contact with basement gneisses;

4. The presence of strongly mineralised rock samples.





Source: Company reports

Geology

The Kangerluarsuk Zn-Pb-Ag Project is located within the Karrat Group, a major Palaeoproterozoic sedimentary basin that formed in an epicratonic rift and sag setting within the larger Rinkian mobile belt, which extends into the Foxe Belt in NE Canada. The Karrat Group contains abundant Zn-Pb-Ag showings and hosts the former Black Angel Zn-Pb-Ag mine, which produced 11 Mt at 12.6 % Zn, 4.1 % Pb and 29 g/t Ag during operation by Cominco (1973–1986) and subsequently Boliden (1986–1990).

The Company's existing 106 km2 Exploration Licence (MEL 2011/31) at Kangerluarsuk is acknowledged as the strongest cluster of stream sediment zinc anomalies in Greenland, with samples up to 2,200 ppm Zn. Cominco reported zinc mineralised float within the Licence area. Later prospecting in 1992 under a Joint Venture between RTZ and Platinova revealed several locations with outcropping high-grade mineralisation up to 41% Zn, 9.3% Pb, 1.2% Cu and 596 g/t Ag at the edges of the Kangerluarsuk sub-basin. The 'discovery' outcrops consist of massive coarse-grained sphalerite (zinc ore mineral) and galena (lead ore mineral), whereas the Kangerluarsuup Glacier mineralisation to the south consists of finely laminated sphalerite-galena ore.

The known Zn-Pb-Ag (± Cu) mineralisation is hosted by ferruginous horizons in graphitic schist within the Qaarsukassak Formation (a newly defined informal unit). Mineralisation generally occurs within tens of metres of the basement contact. The Archaean basement gneisses in the Kangerluarsuk area were heavily incised during the Palaeoproterozoic creating palaeo-valleys which were in-filled by siliciclastic and carbonate rocks of the Qaarsukassak Formation. This formation correlates well with the Mârmorilik Formation to the south that hosts the former Black Angel mine.

2020 Work Programme

Logistical planning is now underway to prepare for a maiden diamond drill programme at Kangerluarsuk which has been scheduled for summer 2020. This will test several high-priority drill targets at depths of 350 to 1200 metres (see map below). Significantly, this will be the first time that the property has been drill-tested.

Drilling Kangerluarsuk will be a low-cost conventional programme that is planned to be executed in conjunction with drilling Disko. This will provide cost savings across both projects given their relatively close proximity with the planned use of the same equipment.



Kangerluarsuk large-scale drill ready targets

Source: Company reports

The Company is currently in dialogue with drilling contractors who have both the helicopter portable diamond drill rigs and operational experience required to successfully execute this programme. The Company is also in dialogue with a consultancy specialising in structural modelling to refine the existing model for the depth of the basement contact throughout the Licence area.

Subject to successful granting of the new Licence area, the wider Zn-Pb-Ag (\pm Cu) potential of the area will be tested through a focused campaign of stream sediment, scree sediment and HMC geochemistry and rock sampling.

Potential Value

We have assigned a nominal value of US\$10m for the prospective Kangerluarsuk zinc-polymetallic exploration licences that are proximal to a historical high-grade mine and have strong historical results from Cominco and RTZ. Based on an EV/ZnEq Resource multiple of US\$21 per tonne metric, a US\$10m valuation for Disko would be justified by a contained resource of ~470kt zinc equivalent – a relatively conservative sum in comparison to the size of other zinc projects globally.

Finland

Description

Recent years have seen a renewed interest in base metal exploration in Finland, a country rich in base and battery metals. The country's proximity to the European automotive market as well as a skilled workforce and safe jurisdiction make it attractive for explorers; in 2018 Canadian policy think-tank Fraser Institute named Finland as the most attractive jurisdiction in the world for mining investment.

BlueJay is the largest licence holder in Finland and owns three high-grade, multielement base metal deposits: Hammaslahti Copper Project, Enonkoski Nickel-Copper Project, Outokumpu Copper Project. All three deposits were within licences owned by Centurion Resources Plc and came into the BlueJay portfolio through FinnAust Mining Plc who had executed a reverse takeover of Centurion in 2013.

The Company is focusing exploration on the historic Hammaslahti and Enonkoski mines where near-mine exploration efforts have been very limited. The Company has also identified exploration targets in its Outokumpu project areas and is evaluating two low-grade Ni-Zn-Cu-Au resources at Rautavaara (JORC compliant) and Paltamo in the Kainuu Schist Belt.



Locations of the key location of the Company's Finnish assets

Source: FinnAust Mining CPR report, 2012.

Hammaslahti Cu-mine

The highest priority target is the historical Hammaslahti VMS-hosted Cu-mine located in Eastern Finland. The mine, operated by Outokumpu Oy, produced 7Mt of ore at 1.1% Cu. Recent drilling has confirmed the potential to establish new Cu-Zn-Ag-Au resources/reserves to re-open the mine.

In 2012 a diamond drilling campaign was carried out by FinnAust Mining Finland Oy (FAMF) to test the down-plunge, southern extension of the main Cu-sulphide zone. The three holes confirmed extension of the zone with a highlight intercept of 15m at 3.05% Cu, 0.13%, 14.4 g/t Ag and 0.77 g/t Au from 536m. The mineralised zone, that the old mine exploited, remains open down plunge to the south and down dip to the west.

In 2017 and 2018, FAMF drilled two deep step-out holes south of the 2012 drill section. Although no high-grade Cu mineralisation was intersected, DHEM (downhole electromagnetic) and two ground EM surveys to the west of the mine highlighted a potential conductor that has never been drilled (see below). A preliminary drilling program has been prepared for this Hammaslahti West target to test the possible western limb of the open synform close to the surface.



FLEM (fixed loop electromagnetic) survey interpretation

Another exploration target, the E-lode, located north east of the Hammaslahti mine was discovered in 2014. This new zone of Cu-Zn-Ag-Au mineralisation lies on the eastern flank of the hypothesised synformal structure and returned an intercept of 8.65m at 2.15% Cu, 1.97% Zn, 47.5 g/t Ag, 0.5 g/t Au from 194m in the discovery hole.

Enonkoski project area

The second high-priority project area is the Enonkoski belt with two historical differentiated gabbro-intrusion hosted Ni-Cu-Co mines, Enonkoski and Hälvälä. Enonkoski, mined by Outokumpu OY between 1984 and 1994, produced 7Mt at an average grade of 0.78% Ni and 0.22% Cu. Historical intercepts from the massive ore in the mines include 32.9m at 4.09% Ni, 0.56% Cu, 0.17% Co and 19.7m at 6.12% Ni, 1.94% Cu, 0.29% Co. The 2300 hectare project area covers the area between the historical Ni-Cu-mines (see map below). However, the Laukunkangas mining concession (Enonkoski mine area) is still held by Outokumpu Mining Oy.

Image of the Enonkoski belt showing the locations of the high priority targets and the historical mines



Source: Company reports

Source: Company reports

A 2012 EM survey survey confirmed extensions and repeats of high grade nickel, copper and PGM mineralization 2 km south east of the old Enonkoski Mine.

Drilling at Laukunkampi and Kolvosenjarvi intercepted low-grade fine disseminated sulphides. A new, narrow zone with massive sulphide drops/droplets was intersected near the NE contact of the Laukunlampi intrusion, but no thicker zone of massive sulphides was found. The Company has noted that additional geophysical surveys are needed prior to the next drilling program to locate the high-grade massive sulphides.

Outokumpu Area

The Outokumpu belt is one of the world's most prolific geological belts, which hosts multiple high-grade mines including the world famous Outokumpu copper mine. Two old mines, Outokumpu-Keretti and Vuonos, have produced a total of approximately 34.4 Mt of ore at average grades of 3.6% copper, 1.2% zinc, 0.22% cobalt and 0.1% nickel between 1914 and 1988. Currently only the Kylylahti mine, that commenced production in 2012, is in operation in the area. The total historical and current ore reserves and resources of the Outokumpu belt are approximately 44Mt at 3.1% Cu, 1.1% Zn, 0.2% Co and 0.1% Ni (including the Kylylahti resources in 2012). The reserves and resources contain also significant amounts of Au and Ag.



Outokumpu licence areas (blue polygons) and priority targets.

Source: Company reports

There have been several FAMF drilling campaigns at the target areas none of which yielded significant Cu-sulphide mineralisation. However the limited nature of these campaigns warrants further investigation in and around the target areas.

Kainuu Schist Belt

The Rautavaara and Paltamo projects, located north of Outokumpu in the Kainuu Schist Belt, have low grade Ni-Zn resources of Talvivaara type.

The Rautavaara resource is a JORC-compliant Indicated+Inferred resource:

34Mt at 0.19% Ni, 0.37% Zn, 0.1% Cu, 0.01% Co.

The Paltamo resource is a preliminary one (not JORC-compliant):

64Mt at 0.19% Ni, 0.34% Zn, 0.09% Cu, 0.01% Co

Using our estimate EV/NiEq Resource of US\$34 per tonne metric, based on the comparison of other nickel projects, would imply values of US\$4m for Rautavaara and US\$7m Paltamo.

Untapped value in Finland

Overall we have assigned a value of US\$20m for the Company's Finnish assets based on the future potential in the Hammaslahti and Enonkoski areas and the current in situ value at Rautavaara and Paltamo.

Summary Financials & Valuation

Income statement							
Year end December		2019E	2020E	2021E	2022E	2023E	2024E
Revenue	£m	-	-	-	11.8	74.6	76.5
Cost of Sales	£m	-	-	-	(4.3)	(30.8)	(28.4)
Depreciation	£m	-	-	-	(7.2)	(20.4)	(20.3)
Gross profit/(loss)	£m	-	-	-	7.5	43.8	48.1
Other operating costs	£m	(1.5)	(1.5)	(1.5)	(2.2)	(5.5)	(5.0)
Operating profit/(loss)	£m	(1.5)	(1.5)	(1.5)	5.3	38.2	43.1
Finance income	£m	-	-	-	-	-	-
Finance Costs	£m	-	-	-	-	-	-
FX gains/losses	£m	-	-	-	-	-	-
Other gains/(losses)	£m	-	-	-	(0.3)	(1.9)	(1.9)
Profit/(Loss) before tax	£m	(1.5)	(1.5)	(1.5)	(2.2)	16.0	20.9
Tax credit/(expense)	£m	-	-	-	-	-	-
Net profit/(loss)	£m	(1.5)	(1.5)	(1.5)	(2.2)	16.0	20.9
EBITDA	£m	(1.5)	(1.5)	(1.5)	5.3	38.2	43.1

Year end December		2019E	2020E	2021E	2022E	2023E	2024E
Profit/(loss) before tax	£m	(1.5)	(1.5)	(1.5)	(2.2)	16.0	20.9
Depreciation	£m	-	-	-	(7.2)	(20.4)	(20.3)
Other non-cash items/adjustments	£m	(0.3)	-	-	14.5	40.8	40.6
Operating cash inflow/(outflow) £m	(1.8)	(1.5)	(1.5)	5.0	36.4	41.2
Working capital change	£m	-	-	(0.8)	(6.4)	(1.2)	0.0
Net interest (paid)/received	£m	-	-	-	-	-	-
Tax (paid)/received	£m	-	-	-	-	-	-
CFO	£m	(1.8)	(1.5)	(2.3)	(1.3)	35.2	41.2
Additions to PPE	£m	(0.6)	(20.5)	(102.6)	(31.0)	(0.7)	(0.7)
Other	£m	(4.0)	-	-	-	-	-
CFI	£m	(4.6)	(20.5)	(102.6)	(31.0)	(0.7)	(0.7)
Minimum debt repayments	£m	-	-	-	-	-	-
Other movement in net debt	£m	-	-	-	-	-	-
New equity issued	£m	11.9	-	-	-	-	-
Other	£m	(0.5)	-	-	-	-	-
CFF	£m	11.4	-	-	-	-	-
Net change in cash	£m	6.0	(22.0)	(104.9)	(32.3)	34.5	40.5
FX impact on cash & equivalents	£m	-	-	-	-	-	-
Beginning cash & equivalents	£m	8.8	14.8	(7.1)	(112.0)	(144.3)	(109.8)
Ending cash & equivalents	£m	14.8	(7.1)	(112.0)	(144.3)	(109.8)	(69.3)

Balance sheet							
Year end December		2019E	2020E	2021E	2022E	2023E	2024E
Cash balance/(funding shortfall)	£m	14.8	(7.1)	(112.0)	(144.3)	(109.8)	(69.3)
Receivables	£m	0.8	0.8	0.8	1.0	6.1	6.3
Inventory	£m	-	-	-	6.7	6.0	5.5
Other	£m	0.3	0.3	0.3	0.3	0.3	0.3
Current Assets	£m	15.9	(6.0)	(110.9)	(136.4)	(97.4)	(57.2)
PPE	£m	3.4	23.9	126.5	150.3	130.6	110.9
Other	£m	18.8	18.8	18.8	18.8	18.8	18.8
Fixed Assets	£m	22.2	42.7	145.3	169.1	149.3	129.7
Payables	£m	0.8	0.8	-	0.5	3.8	3.5
Short Term Debt	£m	-	-	-	-	-	-
Other	£m	-	-	-	-	-	-
Current Liabilities	£m	0.8	0.8	-	0.5	3.8	3.5
Long term debt	£m	-	-	-	-	-	-
Other	£m	0.5	0.5	0.5	0.5	0.5	0.5
Non Current Liabilities	£m	0.5	0.5	0.5	0.5	0.5	0.5
Total Equity	£m	28.2	26.7	24.4	22.7	52.0	72.5

Ratios and per share data							
Year end December		2019E	2020E	2021E	2022E	2023E	2024E
Wtd average shares in issue	m	860.0	970.0	970.0	970.0	970.0	970.0
Revenue growth	%			0%	0%	533%	3%
EBITDA margin	%				45%	51%	56%
ROCE	%	-7%	-3%	-1%	-1%	11%	16%
ROE	%	-4%	-4%	-4%	-7%	33%	30%
EPS	£p/sh	(0.2)	(0.2)	(0.2)	(0.2)	1.6	2.2
Free cash flow	£m	(6.1)	(22.0)	(104.9)	(32.3)	34.5	40.5
FCF/share	£m/sh	(0.01)	(0.02)	(0.11)	(0.03)	0.04	0.04
Net debt/equity	%	-40%	20%	331%	455%	230%	101%
EV/EBITDA	x	(62.7)	(78.7)	(148.6)	47.8	5.8	4.2
EV/Sales	х				21.7	3.0	2.4

Production volumes							
Year end December		2019E	2020E	2021E	2022E	2023E	2024E
Ilmenite	kt	-	-	-	145	440	440

Shipment volumes							
Year end December		2019E	2020E	2021E	2022E	2023E	2024E
Ilmenite	kt	-	-	-	71	440	440

Mineral sands price assumption	ıs (nominal)						
Year end December		2019E	2020E	2021E	2022E	2023E	2024E
Ilmenite - spot	US\$/tonne		190	210	215	221	226
Ilmenite - realised	US\$/tonne				213	218	224

Cash Costs							
Year end December		2019E	2020E	2021E	2022E	2023E	2024E
Cash costs/t finished product	US\$/tonne	-	-	-	118	106	97
Total Cash Cost	US\$m	(2)	(2)	(2)	(17)	(46)	(43)
Cost of sales (P&L)	US\$m	-	-	-	(15)	(67)	(63)

Market cap, net debt & enterpris	se value						
Year end December		2019E	2020E	2021E	2022E	2023E	2024E
Market Cap	£m	110.9	110.9	110.9	110.9	110.9	110.9
Net Cash/(Debt)	£m	14.8	(7.1)	(112.0)	(144.3)	(109.8)	(69.3)
Rolling EV	£m	96.1	118.1	222.9	255.3	220.7	180.2

Valuation/ Price Target Derivat	ion - Dec'19E			
Year end December		Value	Multiple	Risked NAV
Dundas Ilmenite project	US\$m	253.4	0.8	202.7
Other projects	US\$m	60.0	1.0	60.0
Net Debt/ Cash	US\$m	19.7		19.7
Total Value	US\$m	304.5		253.9
Shares outstanding	m			970.0
NPV/ Target Price per share	US cents			26.2
USD/GBP FX	\$/£			1.30
NPV/ Target Price per share*	GBp			20
Current share price	GBp			8.6
Upside from current share price	%			132%

*Rounded to nearest 1p

Source: H&P estimates, Company Reports.

Appendices Corporate Overview

Major Shareholders

BlueJay Mining's major shareholders (January 2020)



Source: Company website

Sandgrove Capital is a London-based asset manager focusing on alternative investments. It was founded by Simon Davies in 2014, and it employs a traditional, European events driven strategy. It is the largest institutional investor of BlueJay Mining, with a stake of 18%.

Prudential Plc is a British multinational company focusing on financial services and life insurance. It invests customer's savings to help them meet their longterm needs after retirements.

Mr. Roderick McIllree is the managing director of BlueJay Mining and has over 20 years of experience in both the financial and the resource sectors. He was formerly a key member of several successful mining companies including Medusa Mining, Anvil Mining, Kingsrose Mining etc.

Mr. Gregory Kuenzel is the CFO at Georgian Mining Corporation, an AIM-listed copper and gold exploration and resource development company. He has over 20 years of experience in providing accounting, corporate and financial services in mining and resource development companies. He is the third largest individual shareholder, with a stake of 4%.

Mr. Shaun Bunn is the former COO of Greenland Minerals & Energy. He also serves as a board member at Precious Metals Australia Ltd, and Shaun Bunn and Assoc Pty Ltd. He currently holds 3% of BlueJay Mining's shares.

Key Management and Board of Directors

Name	Title	Tenure	Profile	
Michael Hutchinson	Non-Executive Chairman	2.4 year	•	Mr. Hutchinson began his career at Metallgesellschaft where he worked for 25 years, and become the MD in 1985 Previously served as Chairman at Metalloyd and Wogan PLC, Non-Executive Chairman of Greenland Minerals and Energy between 2011-2014 Served as Director of London Metals Exchange (LME) between 1986-2008
Rod McIllree	Chief Executive Officer	4.1 years	•	Founder of Greenland Gas & Oil, Founding Manager Director of Greenland Minerals and Energy and managed the licencing of Jameson on behalf of the company Served as Managing Director of Greenland Minerals Mr. McIllree is a geologist and holds a B.Sc. (Mineral Exploration and Mining Geology), as well as a Post- Graduate Diploma in Mineral Economics at Curtin University's Kalgoorlie School of Mines
Peter Waugh	Non-Executive Director	2.6 years	•	Chairman of the Remuneration Committee and member of the AIM Compliance Committee Consultant to BlueJay assisting with market entry strategies, development of the product offers as well as timely metallurgical management and advice Has more than 30 years' experience in the global titanium dioxide industry, including 24 years with Tioxide Group, followed by Huntsman Pigments
Ian Henderson	Non-Executive Director	1.4 years	• • • •	Chairman of the Audit Committee and member of the Remuneration Committee Non-executive Director of BMO Capital Markets in London Served as a fund manager at JP Morgan, and managing UK Global Financials Fund and the firm's Natural Resources funds with assets approaching US\$10hn at JP Morgan Served as Director and Chief Investment Officer of Wardley Investment Services International for 9 years International portfolio manager in London and New York for Morgan Grenfell & Co. for 5 years Mr. Henderson is a qualified accountant and graduated from Edinburgh University with an MA in Philosophy & Politics and an LLB in Scots Law
Dr. Bo Møller Stensgaard	Executive Director	1.3 years	•	Worked as senior research scientist at the Danish state survey and has advised multiple European federal and commercial entities in the field of commodity development Has extensive experience in economic geology and resource assessment, managing large complex international research projects, mapping and assessing of mineral potential throughout Greenland Holds a Ph.D. from the University of Aarhus, Denmark at the Department of Economic Geology at the Geological Survey of Denmark and Greenland (GEUS)
Thomas Levin	Chief Operating Officer (Finland)	1 year	•	A geologist with more than 15 years of experience in exploration and project management. Spent 9 years in the Magnus Minerals Oy and Western Areas Ltd joint venture team which later became FinnAust Mining Finland Oy, a company that is now part of BlueJay mining Plc. Holds Master's degree from Abo Akademi University, Finland, in Geology and Minerology
Hans Jensen	Managing Director (Dundas Titanium A/S)	3 years	•	Has more than 30 years of experience managing and operating a variety of large logistical and supply chain operations in Greenland as well as international explorations Previously served as CEO of ISS, a large facility service company in Greenland Held senior roles in the largest transportation and logistics companies in Greenland such as Royal Arctic

			 Line A/S and Leonhard Nilsen, served as Marketing Manager & Vice-President in charge of Projects and Transportation at Sønner A/S Mr. Jensen is also experienced in permitting regulations required by the various Ministries of Greenland regarding these types of activities
Eric Sondergaard	Geology Manager	3 years	 Has more than 10 years of on-ground exploration and operational experience in remote locations Holds a degree from the University of Calgary in Canada, and is a registered Professional Geoscientist (P.Geo). Previously managed the exploration team that discovered the super-giant Kvanefjeld Rare Earth project in Greenland. Mr Sondergaard has experience in permitting regulations required by the various Ministries in Greenland.

BlueJay Mining PLC – History

Past Events

- **2011:** BlueJay Mining Limited was founded by taking over a confectionery company listed on AIM and traded as Sweet China Ltd since 2005
- **2011:** BlueJay began a titanium exploration project in Greenland called the Pituffik titanium project
- **2012:** The company acquired an 80% interest in the Mitterberg Copper Exploration Licence
- 2012: The Company went public on 11th December 2012
- **2013:** FinnAust Mining, an exploration company established in 2010, 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
- **2015:** FinnAust Mining completed successful acquisition of the Pituffik Titanium Project ('Pituffik' or the 'Project') in Greenland through the acquisition of a 60% interest in BlueJay Mining in December 2015
- **Sep 2016:** The Company strengthened its position in Greenland by acquisition of 100% of Avannaa Exploration for a price of £500k
- **Dec 2016:** FinnAust successfully raised £8.5m from the issue of ~76.4m new ordinary shares and the placing of 45m existing ordinary shares of the Company
- **Mar 2017:** FinnAust Mining Plc changed its name to BlueJay Mining Plc in March 2017
- **Jun 2017:** BlueJay raised a total of £3.5m (before expenses) by the placing ~29.2m new ordinary shares of the Company
- **Feb 2018:** BlueJay announced that it conditionally raised £17m (US\$ 24m) via a placing of 77.2m new ordinary shares
- **Feb 2018:** Prudential Plc increased its stake in the Company from 9.8% to 12.2%
- **Mar 2018:** BlueJay notified the issuance of ~43.8m shares for proceeds of £10.63m to ING Group, Netherlands at a price of £24.30/sh, representing an equity interest of 5.16%

Recent Updates

- **2016:** BlueJay announced that the Greenland Mineral and Safety Authority has granted approval for a Social Impact Assessment Programme ("SIA") as well as the associated Term of Reference ("TOR") for Dundas
- **2016:** FinnAust was granted an extension of its existing licence to include all minerals within the shallow marine environment at its Pituffik Titanium Project. This is the first marine based exploration licence for minerals granted by the Self Rule Government of Greenland
- **2017:** Unearthed "world's purest ilmenite deposit" in Greenland
- **2017:** BlueJay is set to bring into production the world's highest-grade ilmenite project in 2019, being the Dundas Ilmenite Project 'Dundas' or 'the Project') in north-west Greenland
- **2nd Feb 2018:** BlueJay announced that it conditionally raised £17m (US\$ 24m) via a placing of 77.2m new ordinary shares at a placing price of £22/sh
 - Announced that the funds raised would primarily support BlueJay in its rapid advancement of the Dundas Ilmenite Project in Greenland, as it commences to fast track the Project into production
- **23rd Apr 2018:** The firm announced a 400% increase in resources to 96Mt at 6.9% ilmenite
 - Reported indicated Mineral Resources of 81Mt of 6.1% ilmenite at Moriusaq
 - Also announced assessment of the shallow marine area is underway, where potential for additional resources is being evaluated
 - Announced that the management expects an opportunity to upgrade the in-situ grade by up to 30% via a simple oversize separation step prior to processing, further enhancing run of mine (ROM) grade and project economics
- **2nd May 2018:** Announced that it has further increased its land package for the Disko-Nuussuaq Magmatic Massive Sulphide ('MMS') Nickel-Copper-Platinum Project in south-west Greenland by an additional 1,616sq. km
 - The Project now comprises a total of 2,586sq. km
- **22nd May 2018:** Provided an update on activities at the Dundas Ilmenite Project in Greenland and outline its plans for 2018 as it continues to advance the Project towards the commencement of mining
 - Announced that resource expansion at Iterlak is the primary focus with plans to significantly increase resources there based on internal estimates, the Company plans to define resources in excess of 100Mt
 - Also reported 2018 exploration programme to refine targets further in expanded licence area at Disko-Nuussuaq
 - Reported a cash balance of >£15m
- **24th May 2018:** Announced that it is proposed to issue 97,835 new Ordinary Shares at a price of £0.23/sh. Also announced that as per the Joint Broker agreement with Hannam & Partners, announced on 18th October 2017, the Company agreed that certain fees would be payable in new ordinary shares of GBp0.01/sh
- **6th Jun 2018:** Announced the appointment of Mr. Garth Palmer as Non-Executive Director
- **5th Sep 2018:** Announced the appointment of Dr. Bo Møller Stensgaard as General Manager of BlueJay Mining, a non-board role
- **12th Sep 2018:** Provided an Operational Update on the 2018 field programme at its Dundas Ilmenite Project in Greenland as it prepares the site for the commencement of mining
 - Reported 10kt of bulk sampling has been completed at the site and additional samples have, and will continue to be, dispatched in the coming weeks to several key groups for the

purpose of testing and supporting ongoing discussions regarding offtakes for up to the entire 450kt of planned annual ilmenite production

- Also reported that extensive drilling and trenching programme has been performed on raised beaches at Iterlak Delta, east of Iterlak Delta and at the foreland west of Iterlak Delta
- In total, 68 holes have been drilled with the intention of enhancing the Project resource with ilmenite-rich sediments encountered in all new holes so far
- Updated that alongside work to determine the resource expansion potential at known target areas, regional exploration for ilmenite sediment and sources has been completed over the full extent of the licence area
- 27th Sep 2018: Announced its interim results for H1 '18
 - Reported total resources at the Dundas Ilmenite Project stand at 96Mt at 6.9% ilmenite (in situ) - an increase of some 400% on the maiden resource announced in April 2017
 - Also announced offtake discussions with major players continued to advance for up to the entire planned initial annual ilmenite production from Dundas
 - Reported that Pre-Feasibility Study now re-scoped to include optimisations, would result in an updated timeline for the final PFS report, individual modules of the PFS would be released as they are completed starting November 2018 with final report to be released to market by Q1 '19
- **2nd Oct 2018:** Announced that it has received option holders to exercise options over 1m new ordinary shares of GBp0.01/sh at GBp10/sh
- **5th Oct 2018:** Announced that Mr. Peter Waugh, a NED of the company, purchased 33,742 ordinary shares at 0.01 pence each. Mr. Roderick McIllree, CEO, purchased 100k ordinary shares and Mr. Garth Palmer, NED, purchased 74,941 ordinary shares
- **22nd Nov 2018:** provided a permitting update on the Dundas Ilmenite Project:
 - Environmental Impact Assessment ('EIA') three-year field work studies are now complete
 - Social Impact Assessment ('SIA') data collection and collation to be completed January 2019 – high degree of support received to date from all stakeholders
 - Optimised Pre-Feasibility Study ('PFS') continues and is on track for completion Q1 '19
- 17th **Dec 2018:** provided an updated Mineral Resource Statement for the Dundas Ilmenite Project:
 - New updated JORC Compliant Mineral Resource of 101Mt at 7.1% ilmenite (in-situ)
 - New resource includes higher grade portions at various cut off grades of:
 - o 2Mt at 10.7% Ilmenite in-situ (using a 3.5% cut-off)
 - o 16Mt at 12.9% ilmenite in-situ (using a 4.5% cut-off)
- **25th Jan 2019:** announced that it received notification from warrant holders to exercise warrants over 2,461,615 new ordinary shares at GBp0.01/sh at a price of GBp7/sh for 1,461,615 shares and GBp6/sh for 1,000,000 shares
- **3rd May 2019:** announced that it has received notification from option holders to exercise options over 300,000 new ordinary shares of GBp0.01/sh at a price of GBp10/sh
- **10th May 2019:** announced the submission of the Social Impact Assessment. Key findings of the study concluded:
 - Dundas judged to have a net positive impact on local communities
 - Substantial public support for Dundas' development demonstrated across the Qaanaaq region as well as throughout Greenland with national stakeholders

- The new mine is expected to bring significant employment opportunities and economic development to the region and to Greenland in general
- **13th May 2019:** provided an update on the local engagement activities for the Dundas Ilmenite Project, including the provision of training of local workforce, the participation in the Baume Construction and Mining Machinery trade fair, and the participation in Future Greenland-Greenland's largest business conference
- **30th May 2019:** released the annual preliminary results for the year ended 31 December 2018:
 - BlueJay had £8.8m of cash and cash equivalents at 31st December 2018;
 - Exploration costs during the year were £6.3m compared to £4.6m for the previous financial year;
 - The Company expects to report a loss of £10.8 million for the year (which includes an £8.9m impairment referred to below) compared to a loss of £2.7m for the previous year;
 - Administration expenses for the year were £1.8 million, split between Greenland (£0.5m), Finland (£0.1m) and the UK (£1.2m);
 - The Company expects to impair £8.9m of intangible assets in relation to the Company's Finnish exploration assets
- **3rd Jun 2019:** announced its final results for the year ended 31st December 2018:
 - Excellent progress made across the Dundas Ilmenite Project including resource increase, further delineation and the submission of social and economic studies
 - SIA key findings were highly positive:
 - Pre-Feasibility Study for Dundas is currently at a final draft stage
 - Advancing Dundas towards the granting of an exploitation licence to facilitate production – last remaining components are the mineral reserve, mine plan and impact benefit agreement
 - $\circ \quad \text{Current cash position of \pounds7.2m}$
- **6th Jun 2019:** announced the submission of the Pre-feasibility study for its Dundas Ilmenite Project in Greenland.
- **18th Jun 2019:** provided an update on Dundas Work Programme:
 - Focus on preparing bulk smelter sample for shipment to Rio Tinto Iron and Titanium Canada Sorel-Tracy plant in Quebec, Canada
 - Construction of 2,400t per week ROM demonstration plant for processing of ilmenite-bearing sand sample into a heavy mineral concentrate
 - Completion of the final year of the shallow-marine Environmental Base-Line Study
 - Continue with onsite infrastructure development
 - Lodgement of mining licence application
- 27th Jun 2019: provided an update and summary of the PFS:
 - 32.8% IRR on base case post tax and post finance NPV of US\$83.1m
 - US\$153.1m undiscounted net profit over initial 9-year LOM
 - 34% IRR on upside case, post tax, post finance NPV of US\$130.7m
 - US\$247.2m undiscounted net profit if LOM extended by further two years to include additional indicated resources identified after 2017
- **2nd July 2019:** provided an update on its Nickel-Copper-Platinum Disko project:
 - >20 large-scale drill ready targets identified on licence holdings recently expanded following further exploration from 2,556 km² to 2,776 km²

- Grab samples from the historical Igdlukunguaq Gossan assayed 1.9% Cu, 3.3% Ni, and 1.1% Cu, 2.8% Ni
- **12th August 2019:** provided an update on the activities at its Dundas Ilmenite Project in Greenland:
 - received an export permit from the Government of Greenland for the shipment of the 42kt ROM bulk sample material which is to be processed at the Company's pilot processing plant in Quebec, Canada
 - appointed MID-SHIP Group to head a selection process with the aim of identifying potential Arctic water operators with sufficient ability and experience to fulfill and support a loading operation without established infrastructure
- **13th August 2019:** appointed Dr. Bo Møller Stensgaard as Executive Director to the Company. Dr. Stensgaard joined BlueJay in September 2018 as General Manager (Non-Board) and joined the Company's subsidiary Boards as Executive Director of Dundas Titanium A/S and Disko Exploration
- **9th September 2019:** announced the departure of the 42kt bulk sample from its Dundas Ilmenite Project, from Greenland destined for the Port of Contrecoeur in Canada
- **17th September 2019:** announced the formal lodgement of its exploitation licence application for the Dundas Ilmenite Project to the Mineral Licence and Safety Authority, Greenland
 - The Exploitation Licence covers the onshore portion of Dundas and once approved will allow the Company to take the next important step toward annualised production of 440ktpa.
 - Currently, the defined mineral resource at Dundas stands at 117Mt at 6.1% ilmenite (in situ) at a 0% cut-off grade, as well as a maiden offshore exploration target of between 300Mt and 530Mt of ilmenite at an average expected grade range of 0.4 to 4.8% ilmenite in-situ
- **30th September 2019:** announced its interim results for the six months ended 30th June 2019
 - The Company reported a loss before taxation of the group for the six months ended 30th June 2019 amounted to £203k
 - The net cash balance as at 30^{th} June 2019 was £6.5m
- **14th October 2019:** provided an update on the extensive field work programme completed at its Disko-Nuussuaq nickel-copper-cobalt-platinum group elements project in West Greenland
 - Seven additional newly defined drill ready targets identified, the largest of which is 12kms long and ~2kms wide
 - Three new outcropping sulphide occurrences discovered in the North-Eastern part of Disko island
- **21**st **October 2019:** lodged an application to the Mineral Licence and Safety Authority, Greenland for a new mineral exploration licence surrounding the existing Kangerluarsuk licence area in central west Greenland. Together, these areas returned historic surface samples of 41% Zn, 9.3% Pb, 1.2% Cu and 596 g/t Ag, combined, more than 50% metal
- **12th November 2019:** appointed Mr. Joshua Hughes as Greenland Exploration Manager. Mr. Hughes will manage multiple interrelated exploration programmes in Greenland as BlueJay moves to advance its two large scale base metal projects, Disko-Nuussuaq and Kangerluarsuk

- **20th November 2019:** conditionally raised £11.5m by way of an issue of 115m new ordinary shares of GBp0.01/sh at the issue price of GBp10/sh
 - The proceeds will be used to continue the development of the Dundas Ilmenite Project through the Mining Licence approval process and towards commencement of production; maiden drilling campaigns in 2020 at the Disko-Nuussuaq Project and the Kangerluarsuk Project; and the ongoing project generation in Greenland as well as working capital

Mineral Sands Primer

For informational purposes, we reproduce below our primer on the Mineral Sands sector and downstream TiO2 industry, first published in <u>October 2017</u> within our Kenmare Resources initiation report.

What are Mineral Sands?

The term "mineral sands" refers to beach sand deposits which contain useful concentrations of "heavy minerals" such as ilmenite, rutile and zircon. These minerals originally form as crystals within igneous rocks (e.g. basalt or granite). As the rocks are weathered and eroded, the minerals are washed down to the coast via rivers or glaciers.

Heavy minerals have a relative density of between 4 and 5.5, compared to ~2.65 for quartz (which forms the majority of ordinary beach sand). Consequently, over millions of years, waves and wind carry away the lighter quartz particles, leaving behind the useful heavy minerals.

Some beach sand deposits are amenable to dredge mining – wherein an area of the sand is flooded and excavated using dredges – or dry mining techniques (which are often used where there are higher levels of clay). The heavier particles can then be separated from the lighter sands using gravity separation, producing a "heavy mineral concentrate" (HMC).

Dundas Ilmenite Project



Source: BlueJay Mining

The HMC is then further subdivided, often using magnetic and electrostatic separation, into various saleable mineral products: ilmenite, rutile and leucoxene, which contain titanium dioxide; zircon, a form of zirconium silicate; and monazite, a phosphate mineral containing oxides of rare earth metals and thorium.

Properties of minerals of titanium								
Name	Formula	% TiO 2	Colour	Density (g/cm3)	Crystal form	Transparency		
Ilmenite	FeTiO3	52.6%	Black	4.50-5.00	Hexagonal	Opaque		
Perovskite	CaTiO3	58.0%	Black, brown, reddish-brown, yellow	4.26-4.48	Monoclinic			
Rutile				4.23-5.50	Tetragonal			
Anatase	TìO2	95.0%	Reddish-brown, red, yellowish, black	3.82-3.97	Tetragonal	Opaque or sub-transparent		
Brookite				4.08-4.18	Orthorhombic			
Titanite	CaTiSiO5	35-40%	Brown, green, grey, yellow, black		Monoclinic	Transparent to opaque		

End Uses of Ilmenite & Rutile: TiO2 Pigment & Titanium Metal

The heavy minerals ilmenite, rutile and leucoxene contain titanium dioxide and are collectively known as titanium dioxide (TiO_2) feedstocks. TiO_2 is a non-toxic inert product with a very high refractive index, which gives it a superior ability to disperse light and create a brilliant white colour. Titanium dioxide pigments account for ~90% of demand (in terms of contained TiO₂ by weight). The pigments are used in the manufacture mainly of paints, but also other coatings, papermaking, plastics and cosmetics. TiO_2 pigment can have one of two crystalline forms - "anatase" or "rutile", each with slightly different properties determining their suitability for the various end-uses.

Titanium metal production accounts for ~6% of the end-use of TiO_2 units by weight. Titanium has a very high strength to weight ratio, a high melting point and is very resistant to corrosion. This makes it a preferred metal for many applications including in jet engines, power and desalination plants and many medical and electronic uses. Rutile is also used in welding electrodes, accounting for the remaining ~4% of demand for TiO_2 units.

TiO₂ feedstocks: 90% of demand for TiO₂ units is from TiO₂ pigments

TiO₂ pigment: 58% of TiO₂ pigment is used in coatings (paint) Coatings/paint: Mainly architectural (43%) & general industrial (28%) uses





Source: PPG Presentation

Mineral Sands Value Chain

Ilmenite, rutile and leucoxene can, broadly speaking, follow one of two processing paths to produce pigment, known as the "sulphate process" or "chloride process".

The sulphate process employs simpler technology and can handle lower grade ores (hence lower grade ilmenites are often referred to as "sulphate ilmenites" and higher grade as "chloride ilmenites"). However, the sulphate process is generally costlier on a unit opex basis, and can be more capital intensive depending on the plant set up required. The chloride process, first commercialised by Du Pont in the 1950s, was developed later than the sulphate process, and offers waste disposal, energy and quality advantages.

Often, in both the sulphate and chloride processes, lower grade ilmenite needs to first be upgraded using a smelting process to remove the iron content (which can be sold separately as a pig iron by-product). The smelter slag is known as "sulphate slag" or "chloride slag" depending on the pigment production process for which the slag is destined to be used. "Sulphate slag" generally contains around 72-85% TiO₂, whereas "chloride slag" contains ~85-87%.



From Raw Material to End Use - Mineral Sand Processing Routes

Source: Kenmare Resources

Sulphate Process

In the sulphate process, a blend of feedstocks (including slag and ilmenites) is "digested" using concentrated sulphuric acid. The acid reacts with the unwanted iron to produce iron sulphate which can be separated from the dissolved titanium dioxide.

The three key chemical reactions in the sulphate process are shown below:

1. FeTiO₃ + 2H₂SO₄ \rightarrow TiOSO₄ + FeSO₄ + H₂O (Dissolution of raw material)

2. TiOSO4 + H2O \rightarrow TiO2n.H2O + H2SO4 (TiO2 precipitation)

3. TiO₂n·H₂O \rightarrow TiO₂+ nH₂O (TiO₂ calcination and conditioning)

The sulphate process accounts for approximately 40-45% of total TiO₂ pigment output. The process employs simpler technology than the chloride process, and consequently has seen significant growth in recent decades due to the rapid expansion of the Chinese pigment industry. However, the use of lower grade feedstocks leads to larger quantities of iron sulphate waste products, while the pigment end-product is in the form of "anatase" TiO₂, which is more suitable for use in paper, ceramics and inks, but is considered lower-quality for most other applications.

Chloride Process

The chloride process generally requires a higher TiO_2 grade in the feedstock input blend, and therefore normally uses a significant proportion of rutile or synthetic rutile (90-95% TiO_2) along with higher grade chloride ilmenites and slags. The TiO_2 content is first "reduced" in a fluid bed reactor using coke (i.e. carbon) as a reducing agent along with gaseous chlorine at a temperature of 900-1000°C. This produces a gas stream containing oxides of carbon and titanium tetrachloride [TiCl4] (as well as chlorides of iron and other metals depending on the impurities in the feedstock). As the gas is cooled, the other metal chlorides can be separated out by condensation. The TiCl4 is cooled further to produce a pure liquid; this can then be oxidised at a high temperature (>1500°C) to produce TiO_2 and chlorine gas which is reused at the beginning of the process.

The main chemical reactions of the chloride route are as follows:

- 1. $2\text{TiO}_2 + 3\text{C} + 4\text{Cl}_2 \rightarrow 2\text{TiCl}_4 + 2\text{CO} + \text{CO}_2$
- 2. $TiCl_2$ (impure gas) \rightarrow $TiCl_2$ (pure liquid)
- 3. $TiCl_2 + O_2 \rightarrow TiO_2 + 2Cl_2$

Although the chlorine associated with the titanium tetrachloride is recycled in the process, the chlorine associated with the metal impurities (usually iron) is not recovered. Overall chlorine consumption therefore relates to the level of impurity in the feedstock: on average, approximately one tonne of chlorine is required to produce 5-6 tonnes of TiO₂.

The chloride process is considered environmentally safer and is less labour intensive than the sulphate process. It also allows tighter quality control and produces TiO₂ pigment in the "rutile" crystalline form, making it more suited to higher value application such as automotive paint and manufactured goods.

Currently the chloride process accounts for ~55-60% of global pigment output. Although chloride pigment supply growth has been slower than sulphate in recent decades due to the development of the Chinese industry, in 2013 this trend began to reverse with the commissioning of several fluidised-bed plants. Environmental concerns, as well as, potentially, a more recent reduction in sulphate ilmenite supplied as a by-product of domestic Chinese iron ore mining, could also have contributed to the reversal in the trend toward sulphate pigment capacity. Furthermore, even though China is a large net exporter of pigment in overall terms, these are made up mostly of lower-grade sulphate pigment products; the expansion of chloride pigment facilities is an effort to reduce China's ongoing reliance on imports of higher-quality pigment.

Pigment Demand Outlook Strongly Correlated to GDP

With many of the end-applications of TiO_2 pigment strongly associated with improving standards of living – paint, plastics etc. – it is perhaps unsurprising that demand growth has shown a strong link to GDP (albeit with greater swings during times of economic recession and recovery due to the impact of inventory cycles.)

Global per capita TiO₂ pigment demand growth versus GDP – inventory cycles have caused exaggerated swings in demand in recent years...

15.0% 10.0% 5.0% 0.0% -5.0% -10.0% -15.0% -20.0% 2019E 2020E 2001A 2002A 2009A 2010A 2012A 2013A 2016E 2003A 2004 2005 2006 2011 2014 2015A 2017E 2007/ 2008/ Global TiO2 pigment consumption/capita - %YoY Global GDP/capita (USD, real 2005 prices) - %YoY

...but longer-term correlation of pigment demand with GDP per capita is relatively high



Source: H&P estimates, Bloomberg

A "Later-Cycle" Product: China Still Only 25% of Demand

In comparison to many other commodities, TiO_2 is often considered a "latercycle" product, with demand growth remaining strong into the later-stages of economic development due to pigment's greater use in consumer products. Indeed, China still only represents ~25% of global demand, versus over 50% for iron ore, aluminium and copper.



Source: H&P estimates, Bloomberg

China's relatively low share of global demand is all the more surprising given the "offshoring" of consumer goods' supply chains from the developed to the developing world. From 2000-2015 Chinese TiO_2 pigment demand grew at a CAGR of ~10% pa, while N American demand shrank at a rate of 1.5% and Europe (including CIS) grew at just 0.5%.

Despite significant room for further expansion, when plotted against GDP growth, per capita TiO_2 usage in China has arguably outpaced the normal trend for

developing economies. We therefore assume the pace of Chinese demand growth is likely to moderate in coming years, albeit this could be offset by faster growth in other Asian economies and South America as Brazil comes out of recession.



TiO2 pigment use vs GDP per capita

Source: H&P estimates, Bloomberg, Company reports

Pigment Demand Forecasts

Global pigment demand has grown at a CAGR of around 2% over the last decade, with China accounting for the overwhelming majority of demand growth (at a CAGR of c. 10%). The demand growth trend has been punctuated by several short, sharp downward adjustments, most notably during the global financial crisis in 2008-09, as well as a severe destocking cycle in 2012. In 2015 a less severe slowdown in demand occurred on the back of a cooling Chinese economy and recessions in South America.

TiO₂ pigment demand by region: we expect ~2% CAGR in demand to continue, primarily driven by APAC





APAC's share of global pigment demand has increased in the last two decades, displacing N America & Europe

Source: H&P estimates

Source: H&P estimates

Paint Remains a Relatively Fragmented Industry

The split of global pigment demand broadly reflects the end-demand for paint and coatings, with just over 40% of coatings demand coming from APAC and just under 50% from EMEA and N America. PPG estimates the global coatings market at around \$130bn; based on 2016 revenues, Sherwin-Williams (which recently merged with Valspar) is the largest coatings player, with around 12% market share. While certain niches may be more concentrated, coatings, in general, appears to be a relatively fragmented industry, with the top five players representing just 37% of the global market, on our estimates. It remains to be seen whether this picture will change significantly in the coming years if the recent wave of consolidation continues in the paints and chemicals industry more widely. While PPG's attempts to acquire Akzo Nobel were rebuffed, Sherwin-Williams successfully completed the acquisition of Valspar in June 2017.

Global paint demand by region: split is broadly in-line with the regional split of demand for TiO₂ pigment

Paint industry market share by sales (assuming ~\$130bn total market size); top 5 players under 40% of market



Source: PPG company presentations

Source: Bloomberg, PPG, H&P estimates

The paint industry is seeking to sustain margins which have been on an improving trend for several years but have come under pressure in 2017 as raw material prices have recovered. If paint producers are unable to push prices higher, pressure may come back on to raw material suppliers such as TiO_2 pigment producers. However, any pressure on TiO_2 pigment prices is likely to be mitigated by the fact that TiO_2 is still only ~15-25% of the coating producers' cost base, as shown below right. Furthermore, despite recent mergers in paints and coatings, we note pigment production remains a more concentrated industry, with the top five producers now supplying nearly 70% of the market post the Tronox-Cristal merger. Particularly outside China, where pigment plant utilisation rates are healthy, we believe the balance of power is in favour of the pigment suppliers.

Median paint producer EBITDA margins Q3'06–Q3'18: recent margin pressure follows multi-year upturn



Source: Bloomberg, *Median of publicly available quarterly EBITDA margins reported by PPG Industries Inc, Sherwin-Williams, Axalta Coating Systems, RPM International, Ferro Corp, Asian Paints, Nippon Paint, Kansai Paint, Akzo Nobel, Valspar.



Illustrative cost base for architectural and industrial coatings – $\rm TiO_2$ pigment is only 15-25% of cost base

Source: PPG company presentations; H&P estimates

Pigment Supply: Ample Capacity in China, Tightness Ex China

In spite of a relatively supportive demand outlook, it should be noted that global pigment production capacity appears more than sufficient to feed consumption in the short to medium-term, with utilisation likely to hover around the ~70% level for the foreseeable future. This is for the most part a legacy of China's rapid buildout of sulphate pigment facilities in the last 10-15 years, with the trend only recently shifting towards chloride capacity.

While this over-supply of sulphate pigment capacity should have no direct consequences on TiO_2 feedstock demand, it does, in our view, mean the pigment market is likely to remain susceptible to deep inventory cycles, in turn sending waves through the feedstock market.

It should be noted that the under-utilisation is, unsurprisingly, most acute in the sulphate pigment industry, particularly in China. Looking forwards, as China seeks to redress the balance between chloride and sulphate - potentially even closing capacity - this should provide a relative advantage to feedstock suppliers, such as Kenmare and BlueJay, whose product can be used in both the sulphate and chloride pigment production processes.

Outside China, industry participants have reported high pigment capacity utilisation rates, with limited spare capacity to fill any supply gaps as a result of Chinese shutdowns. It is therefore expected that the inventory cycle should remain on a tightening trend in the short to medium-term, supporting pigment producer margins.



Demand for TiO₂ from pigments, metal and other, & implied global pigment plant utilisation rate -2010-20E

Split of sulphate and chloride pigment capacity: China predominantly sulphate, vs chloride in rest of world



Despite accounting for around 40% of capacity, we believe China's share of global TiO2 pigment output was only around 28% in 2015 - testament to the level of underutilisation in the Chinese industry. Within China's share, the largest player is Lomon Billions (a merger between Sichuan Lomon Titanium and Henan Billions) at around 8-9% of global supply.

Ex-China, the key suppliers are: Chemours (formerly DuPont's pigment division which was spun off prior to DuPont's merger with Dow Chemicals), with around 19% global market share; Cristal Global with around 11% share, which has agreed a merger with Tronox (on 7%) to form the second largest player; Venator, formerly Huntsman's pigments and additives division before its IPO in August 2017, on 13% share; and Kronos on 9%.



Major TiO₂ pigment producers – supply more consolidated than the paint industry



Median pigment producer* EBITDA margins Q1'11-Q3'18: recent upturn

Median of publicly available quarterly EBITDA margins reported by Chemours, Tronox Ltd, Cristal Pigmentos do Brasil amd Kronos Worldwide Inc.

HANNAM&PARTNERS

Source: H&P estimates

Source: Bloomberg
TiO2 Feedstock Demand

TiO₂ feedstock demand is effectively a function of TiO₂ pigment production, which in turn is a function of end demand for pigment. However, how end demand for pigment feeds through to differing demand growth rates for the various types of TiO₂ feedstocks depends on several factors, including:

- Pigment & feedstock inventory cycles: apparent demand for pigments can undershoot real end demand during pigment destocking cycles (and vice versa), reducing required pigment production and in turn impacting on feedstock demand. Similarly, apparent demand for feedstocks can undershoot pigment production during feedstock destocking cycles. Definitive data on pigment and feedstock inventory levels is difficult to source and compile; market observers are therefore reliant upon commentary from industry players to judge the current impact of inventory movements on demand.
- The relative economics/popularity of the chloride vs sulphate process: China is shifting to the chloride process, increasing reliance on imported ilmenite. Over the last two decades the rapid expansion in Chinese pigment capacity has almost exclusively focused on the less technologically complex sulphate production route. However, since 2012, China has begun to add chloride pigment capacity – both for environmental reasons and to improve self-sufficiency in higher quality pigments. Very little of China's domestic feedstock supply – most of which is mined in inland provinces in Southwest China – is appropriate for direct use in the chloride process due to low grades. New chloride capacity is therefore predominantly being built in coastal provinces and will rely more heavily on imported feedstocks; this in turn is positive for producers of higher grade TiO₂ feedstock products such as rutile and synthetic rutile, as well as producers such as KMR with the ability to supply ilmenite directly to the chloride process.
- Pigment plant utilisation rates and relative feedstock price levels: when pigment plant utilisation rates are low, pigment producers' first response to an increase in demand is to increase the volume of cheaper, lower grade feedstock material processed, favouring direct-feed ilmenite feedstock products. Ilmenite demand and pricing therefore tends to react first during periods of recovering pigment demand. As plant utilisation rates increase, further increases in pigment output require higher-grade feedstocks such as slag, synthetic rutile or rutile, shifting demand growth in favour of these products - especially if ilmenite prices have already recovered strongly. Once this point has been reached, further increases in ilmenite demand stem more from increases in slag output. As with inventory levels, independent data on current pigment plant utilisation rates is difficult to source; however, industry sources suggest European and North American pigment plants are currently running at close to full utilisation, as noted by Venator in its recent IPO prospectus.

TiO2 Feedstock Supply

The supply dynamics for titanium dioxide feedstock are somewhat complicated by the wide variety of feedstock qualities and the multiple different processing routes to produce TiO₂ pigment. Ilmenite and rutile should, in our view, be seen more as chemical feedstocks than true commodities:

• By-product output skews cost curves: As different deposits contain different relative concentrations of the various heavy minerals mineral

sands miners often have one main product with the other minerals only produced as by-products of the process. (e.g. zircon is a by-product of KMR's ilmenite production; rutile is a by-product of Iluka's zircon production, etc.). Ilmenite is also found in hard rock deposits and as a by-product of magnetite iron ore mining. The significant contribution of by-products in the mineral sands industry can have the effect of reducing the elasticity of supply, as low prices do not necessarily dis-incentivise output (and vice versa).

- Not all ilmenite is created equal: The picture is further complicated by the number of different processing routes raw minerals to end products; ilmenite is often, but not always, upgraded to titanium slag, an intermediate product before the pigment production phase. Some ilmenite is also consumed in the production of synthetic rutile. Pigment is manufactured using either the sulphate or chloride processes, and not all ilmenite is appropriate for use in each process (and hence a distinction is often made between "sulphate ilmenite" and "chloride ilmenite").
- Vertical integration reduces elasticity of feedstock demand in strong markets and elasticity of supply in weak markets: Vertical integration is a common feature of the industry, with pigment producers often also owning slag plants and mining assets. Pigment production plants are often configured to rely on a certain blend of input material, usually from a combination of their own captive sources and trusted third-party suppliers under long-term volume contracts. Pigment plants' ability to switch to cheaper feedstock sources at short notice in response to higher prices is limited. In weaker markets, some vertically integrated producers reduce their own feedstock consumption and divert feedstock supply to the open market. This can make mineral sands a more volatile market than would be expected as added supply can enter the market with lower price requirements at the wrong time in the cycle.



Typical TiO₂ feedstock product specifications

	TiO2	FeO	Fe ₂ O ₃	FeO: Fe2O3	Cr2O 3
Premium Indian Ilmenite	52%	34%	13%	2.6	0.04%
East Australian Ilmenite	51%	25-29%	16-19%	1.5	0.30%
East African Ilmenite	48%	26%	20%	1.3	0.09%
Southeast African Ilmenite	52%	21%	28%	0.8	0.09%
West African Ilmenite	53%	19%	23%	0.8	0.16%
Premium Rutile	95%		5%		
Standard Rutile	92%		8%		
Leucoxene	90-91%				
Synthetic Rutile	88-95%				
Sulphate slag	70-90%				
Chloride slag	85-87%				
Upgraded slag (UGS)	95%				

Source: H&P estimates. *In terms of TiO₂ content arriving at pigment plant.

Source Sheffield Resources, Iluka Resources, Materials Sciences and Applications: "A Review of the Production Cycle of Titanium Dioxide Pigment", May 2014 (http://file.scirp.org/Html/1-7701335_46456.htm)

Key Feedstock Suppliers

Kenmare is the third largest titanium feedstock supplier behind Rio Tinto (in Madagascar, South Africa & Canada) and Tronox (South Africa and Australia), soon to be merged with Cristal.

There are a few large producers in China and many smaller producers in India, Ukraine, Russia and Vietnam. They are generally higher cost, being small scale with the Chinese production often a by-product of high-cost iron ore mines.





Source: H&P estimates. *In terms of TiO2 content; e.g. for Kenmare with an average 53% TiO2 content, production is 0.903Mt*0.53

Source: Bloomberg, *Median of publicly available semi-annual EBITDA margins reported by Kenmare Resources, Iluka Resources, Base Resources, and Sierra Rutile Ltd.

In comparison to the TiO_2 feedstock supply-side, specific types of feedstock show varying degrees of concentration. For instance, the sulphate ilmenite market (i.e. lower grade ilmenites which are more suited to the sulphate pigment process) is relatively fragmented, reflecting the abundance of lower grade material available in China, India and elsewhere. In contrast, the chloride ilmenite market (i.e. slightly higher TiO_2 grade ilmenites with fewer deleterious elements, which can be fed directly into chloride pigment plants) is more concentrated, with Kenmare and Iluka representing more than half of supply.



Source: H&P estimates

Source: H&P estimates

Supply Unlikely to Balance Demand at Current Prices

There is no geological scarcity of potential titanium dioxide supply, in our view. However, existing capacity is insufficient to meet future demand, and we believe feedstock prices would need to remain at current prices or higher for a sustained period to incentivise new projects. We see several key swing factors to consider on the supply side:

China: domestic Chinese ilmenite production has increased as a by-product of Chinese iron ore mining, particularly in inland provinces such as Sichuan; China currently supplies ~17% of global TiO₂ feedstock by TiO₂ content, of which nearly 70% comes from Sichuan. Approximately 80% of Chinese ilmenite supply is a by-product of magnetite iron ore mining. Counterintuitively, despite the prolonged slump in iron ore prices from 2014 to late 2015, and a faltering recovery thereafter, official Chinese iron ore output data has been consistent in recent years. There is therefore little evidence of a significant overhang of potentially price-insensitive Chinese ilmenite supply waiting to return to the market as iron ore and ilmenite prices recover.



Source: Bloomberg

- Rio Tinto: Production results are due out on evening of January 16th and are expected to give 2020 guidance. The group previously said that TiO2 slag production for 2019 would come in at the lower end of guidance of 1.2 to 1.4 Mt keeping supply pressure on TiO2 units. After unrest in December 2019 a phased restart is now in progress across the RBM operation, with a return to full operations expected in early January. While operations are expected to resume in January, work on the Zulti South project will remain under review until operations have been normalised. Any delay in the commissioning for Zulti South, expected in late 2021, could benefit ilmenite.
- Cristal Jazan smelter: in 2012, Cristal, the world's 2nd largest pigment producer, announced the construction of a smelter at Jazan in Saudi Arabia in a JV with Tasnee, a Saudi industrial conglomerate. The smelter is to have a design capacity of ~500ktpa of chloride slag. After a troublesome commissioning phase, and repeated delays, Tasnee announced in December 2019 that Furnace 1 is expected to restart in H2'20. At full capacity, we estimate Jazan would represent a ~40% increase in global chloride slag output. Jazan coming online, we believe, will go some way to offset the impact of the new ilmenite supply from Zulti South which, although likely to be entirely consumed in the RBM smelters, may displace some of RBM's current demand for traded ilmenite.

- Iluka: in H1'19, the world's largest zircon producer recorded 160kt of Zircon and 163 kt of Rutile output from its Jacinth-Ambrosia and Cataby mines in Australia and operation in Sierra Leone. At Balranald, a project to replace mining capacity in the Murray Basin, Iluka is completing a final field trial in 2020 to prove underground mining and backfilling technology; assuming the project goes ahead, Iluka does not expect commercial quantities of HMC to be produced until 2021. The Gangama Expansion in Sierra Leone was commissioned and ramped up H1'20.
- Kenmare Resources: For FY19 output declined and expected to decline further in 2020 as processing facilities are moved and commissioned. A move to higher grade zone should increase output in 2021.
- A compression in "swing" producers in India and Vietnam due to government restrictions as well as declining production from major producing countries, such as Australia and Kenya, due to declining orebodies, are likely to add to ilmenite supply constraints into 2020.

	2013A	2014A	2015A	2016E	2017E	2018E	2019E	2020E
DEMAND								
Feedstock demand from pigment production	5,339	5,640	5,530	5,920	5,971	5,954	6,046	6,166
Feedstock demand from titanium metal & other	855	898	1,050	1,071	1,092	1,092	1,120	1,176
Total underlying feedstock demand	6,194	6,538	6,580	6,991	7,063	7,046	7,165	7,342
% YoY	-5%	6%	1%	6%	1%	0%	2%	2%
Increase/(decrease) in feedstock inventory at consumers	-50	-50	-50	0	150	50	-50	-25
Total apparent feedstock demand	6,144	6,488	6,530	6,991	7,213	7,096	7,115	7,317
% YoY	-8%	6%	1%	7%	3%	-2%	0%	3%
SUPPLY								
Total feedstock output	6,740	6,980	6,585	6,270	6,630	7,080	7,065	6,755
% YoY	-6%	4%	-6%	-5%	6%	7%	0%	-4%
Decrease/(increase) in feedstock inventory at suppliers	-596	-492	-55	721	300	-100	0	100
Total feedstock shipments	6,144	6,488	6,530	6,991	6,930	6,980	7,065	6,855
% YoY	-8%	6%	1%	7%	-1%	1%	1%	-3%
Notional balance - surplus/(deficit)	ο	0	0	0	-283	-116	-50	-462

Supply/Demand of TiO2 Feedstocks (kt TiO2 units)

Source: H&P estimates

Longer-term, we believe structural demand growth of ~2% pa and uncertainty around new supply will lead to widening notional deficits by the end of the decade, requiring prices to remain healthy to incentivise production.



Source: H&P estimates

Mining in Greenland

Greenland: Key Facts

GDP	 GDP \$2.714bn (2018) GDP per capita: \$48,295 (2016) GDP growth rate: 0.99% (2017)
GDP Composition	 Agriculture: 15.9% Industry: 10.1% Services: 73.9%
Population	 Population: 56,025 (2018) Urbanisation: 86.8% (2018) Unemployment rate: 9.1% Literacy rate: 100%
Exports and Imports	 Imports: \$783.5m Primarily machinery and transport equipment, manufactured goods, food and Petroleum Exports - \$401.7m Primarily fish and fish products

Source: IMF, CIA World Factbook

Greenland is the world's largest island, and it is part of the Kingdom of Denmark. Although its exports are dominated by fish and fish products (91% in 2015), the government of Greenland is ambitious towards the development of mineral resources. At present, there are six exploitation licenses in Greenland: a gold mine in south Greenland, an iron ore deposit, a gemstone deposit, a lead and zinc mine and an anorthosite mine in west Greenland, and a lead and zinc mine in northern Greenland for which licences covering iron, gem stones, anorthosite and one of the lead and zinc mines.

The main law governing Greenland's mining industry is the Greenland Parliament 2009 and it was last amended in 2016. An updated Standard Terms of Exploration Licences for Minerals (excluding Hydrocarbons) was issued in June 2013 regulating the fixed terms applied to all granted licenses. The Mineral Licence and Safety Authority administrates the mineral resources, and the Environmental Agency for the resource area is responsible for the environmental matters. In addition, Greenland is a supportive member of the Extractive Industries Transparency Initiative Standard, which is the global standard for the good governance of sectors including Oil, gas and mineral resources. (Source: Lexology)

https://www.lexology.com/library/detail.aspx?g=4f55d3ae-c021-4867-a366db82a74a3c05

Greenland Tax Code	
Mining Royalties	 2.5% for minerals other than rare earth elements (REE), Uranium or Gemstones 5% for REE and Uranium 5.5% for Gemstones
Other Tax	 Income tax 30% for mining companies, lower than other companies Dividend tax 36%, lower than 42%-44% for other companies

Source: Global Legal Group Limited

https://iclg.com/practice-areas/mining-laws-and-regulations/greenland

As Greenland has a relatively low tax rate, especially low Royalties at a global standard, it could potentially be an attractive investment destination. For example, the royalties in other countries include Australia's 30%, Brazil's 30%, Canada's 25%, and China's 10% (Source: PwC).

https://www.pwc.com/gx/en/energy-utilities-mining/publications/pdf/pwc-gx-mining-taxes-and-royalties.pdf

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