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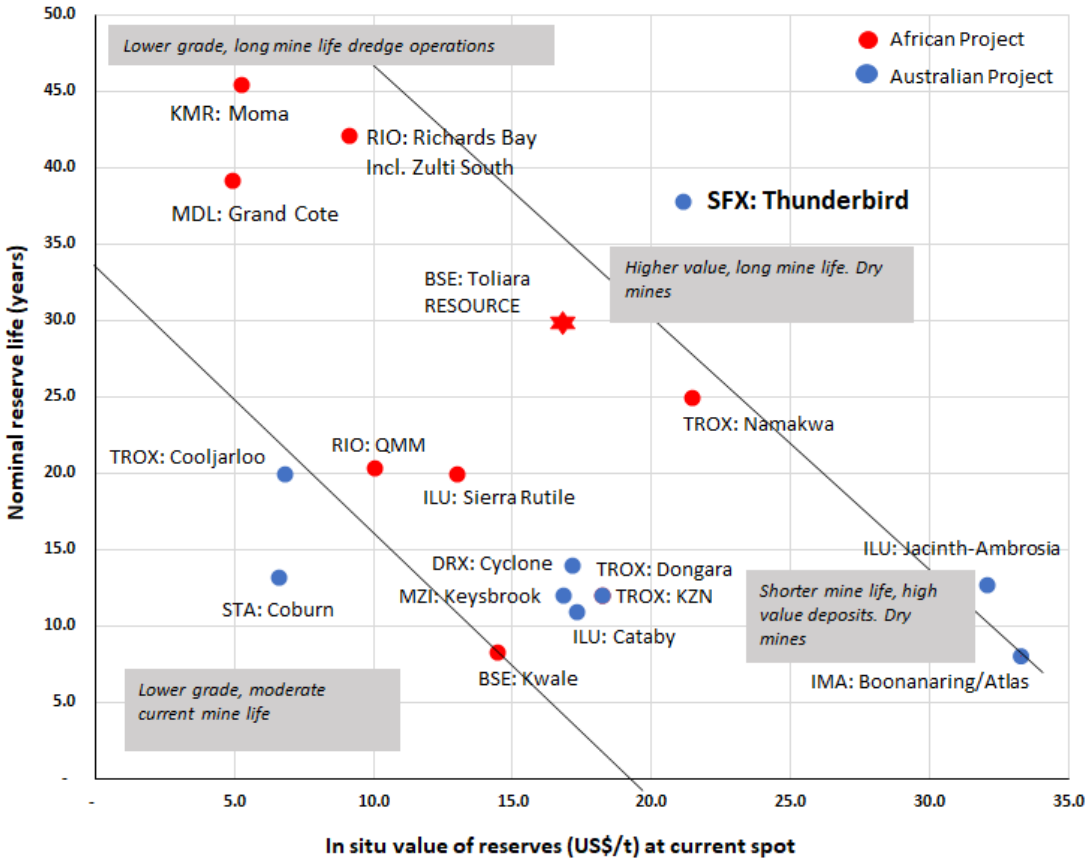
SHEFFIELD RESOURCES LTD (SFX AU, $0.74)

Zircon supply squeeze continues. RBM calls force majeure on TiO_2 exports. Positive tailwinds for Thunderbird, a Tier 1 zircon/ilmenite project

- 2018 has started positively for the zircon producers. Tronox increased its premium zircon reference price by around 9.5% to US$1425-1445/t (CIF basis). Iluka's reference price has been pushed from US$1230 to $1410/t from 2Q18.
- Market traders have suggested to us that the spot market is now in the range US$1450-1600 (CIF), with the potential see prices move to over US$1600 and perhaps as high as $2000/t over the next 2 years.
- In recent days we have seen major South African mineral sands producer Richards Bay Mining call force majeure on titanium slag exports. It is not yet known whether this will impact zircon production and sales.
- This is providing an increasingly positive backdrop for SFX's 100% owned Thunderbird project. We retain our view that Thunderbird is one of the very few Tier 1 mineral sand assets available for development. Based on our conservative commodity price assumptions we generate an after-tax IRR of 27%.
- The grant of a mining lease is likely in a month or two. SFX must also be close to the finalisation of the Taurus debt facility which will be a significant positive. We have retained our long term premium zircon price assumptions of US$1400/t (CIF), which delivers an A$1.84/share valuation for SFX.



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Investment Summary

Commodity overview

- Major zircon producer, Tronox, increased premium zircon prices by around 9.5% to a range of US$1425-1445/t (CIF) from 1 January 2018. In February, Iluka increased its own reference price from US$1250/t to $1410/t, applicable from 2Q18. These actions are reflective of a continuing tight supply/demand outlook for the commodity.
- We have heard recently of significant labour disruption at the Richards Bay mineral sands operations 76% owned and operated by Rio Tinto. This has resulted in the declaration of force majeur on TiO2 deliveries, just one month after a roaster failure caused a halt in slag production.
- Spot zircon prices we understand have touched US$1600/t (CIF) into China. Market commentators are now suggesting prices might breach US$2000/t within 18 months.
- On the demand side, there is a general view emerging that zircon intensity of use in the ceramic industries is increasing. We forecast demand growth of 2.8% per year.
- Our modelling of recent mine restarts (especially the Jacinth – Ambrosia mine of Iluka) and declines in producer inventory confirms the view presented by Iluka that the current supply deficit will continue to magnify. This may translate into further price strength for zircon over the next 12-24 months.
- We have re-examined our supply/demand estimates for zircon, and see a supply deficit extending out past 2020, largely driven by the future of Richards Bay Minerals. Our long-term commodity price assumptions for zircon at US$1400/t and premium sulphate ilmenite of US$220/t are unchanged. We believe our zircon price assumptions are conservative.
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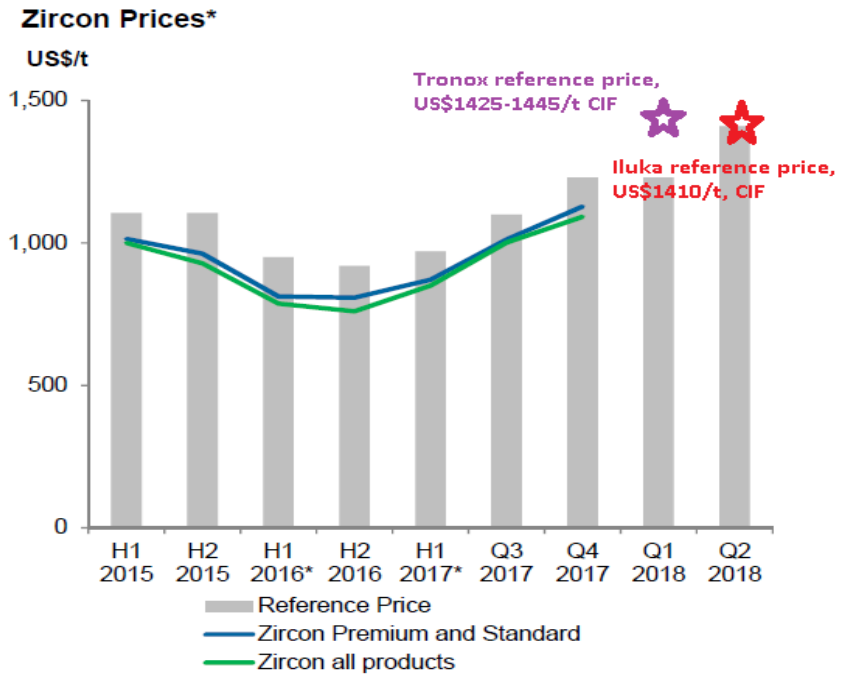

* Notes:
'Premium and Standard' and 'All products' prices are weighted average received price, FOB.
'Reference Price' is based on a 2 tonne bag of Zircon Premium, DAT, ex-China warehouse.
During 1H 2016 reference price decreased from US$1050/t to US$950/t. In February 2017 the reference price was increased US$50/t.

Source: Base figure from Iluka investor presentation, March 2018

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Sheffield/Thunderbird update

- SFX has been able to accelerate activities at its 100%-owned Thunderbird project following an A$32m equity raise in late 2017 and the establishment of a US$175-200m project debt facility with Taurus.
- Early works on the mine site have commenced, with access roads and an employee's camp under construction and initial bore field completed.
- Despite issues with Native Title and bureaucratic delays in delivering environmental approvals, we believe SFX will be in a position to start construction of Thunderbird in mid-2018, with first commissioning in late 2019 or early 2020.
- A second appeal to the Federal Court in December was upheld. The case has been returned to the National Native Title Tribunal (NNTT) for a final judgement likely in Q2 2018.
- WA State Government environmental approvals remain on the critical path. Final approvals are now expected in May. It then requires sign-off by the Federal Department of Environment and Energy.
- Some 60% of Stage 1's revenues are now covered with binding sales contracts.

Sheffield valuation

- Our valuation (NPV10) for SFX is now A$1.84/share. This is based on unchanged commodity price assumptions, a USD exchange rate of 0.75 and a debt/equity ratio of 60% at the project level.
- Therefore, critical to the project's viability is finalisation of the Taurus debt package. This is likely to be reliant on product offtake contracts and grant of a mining lease.
- We also see the potential for a sell-down of the project to an end-user to assist with financing, but this is no longer our base case.

Rerating of Sheffield

- A positive medium-term outlook for the mineral sands commodity cycle provides an attractive backdrop to the sector.
- We envisage on-going rerating of SFX as the current Native Title issue is resolved and environmental permits are completed, all of which will lead to the granting of the mining lease. The company will then move into final funding and the construction and production phase of Thunderbird.

Sheffield Resources Ltd (SFX AU)		
Share price	A$	$0.74
Number of shares (fpo)	m	228.3
Market capitalisation	A$m	$168.94
Share options (av 45c)	m	15.8
Cash (at 12/17)	A$m	$31.60
Debt	A$m	$0.00
Top 50 shareholders, appr.		50%
Insitutional holding, appr.		28%

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The Thunderbird project, an emerging Tier 1 Mineral Sands producer

The Thunderbird BFS released in April 2017 confirmed our view that the project is of Tier 1 quality offering strong project economics. The project is dominated by zircon (appr. 54% of total revenues in the first 10 years, 35% sulphate ilmenite and 11% HiTi88 and titanomagnetite, based on our commodity price assumptions).

What defines a Tier 1 project? In an interesting article in MiningNews.net (25/5/16) journalist Gareth Treway interviews commodity specialists and mining executives and draws the following conclusions.

Tier 1 mining assets it their view are likely to have the following attributes:

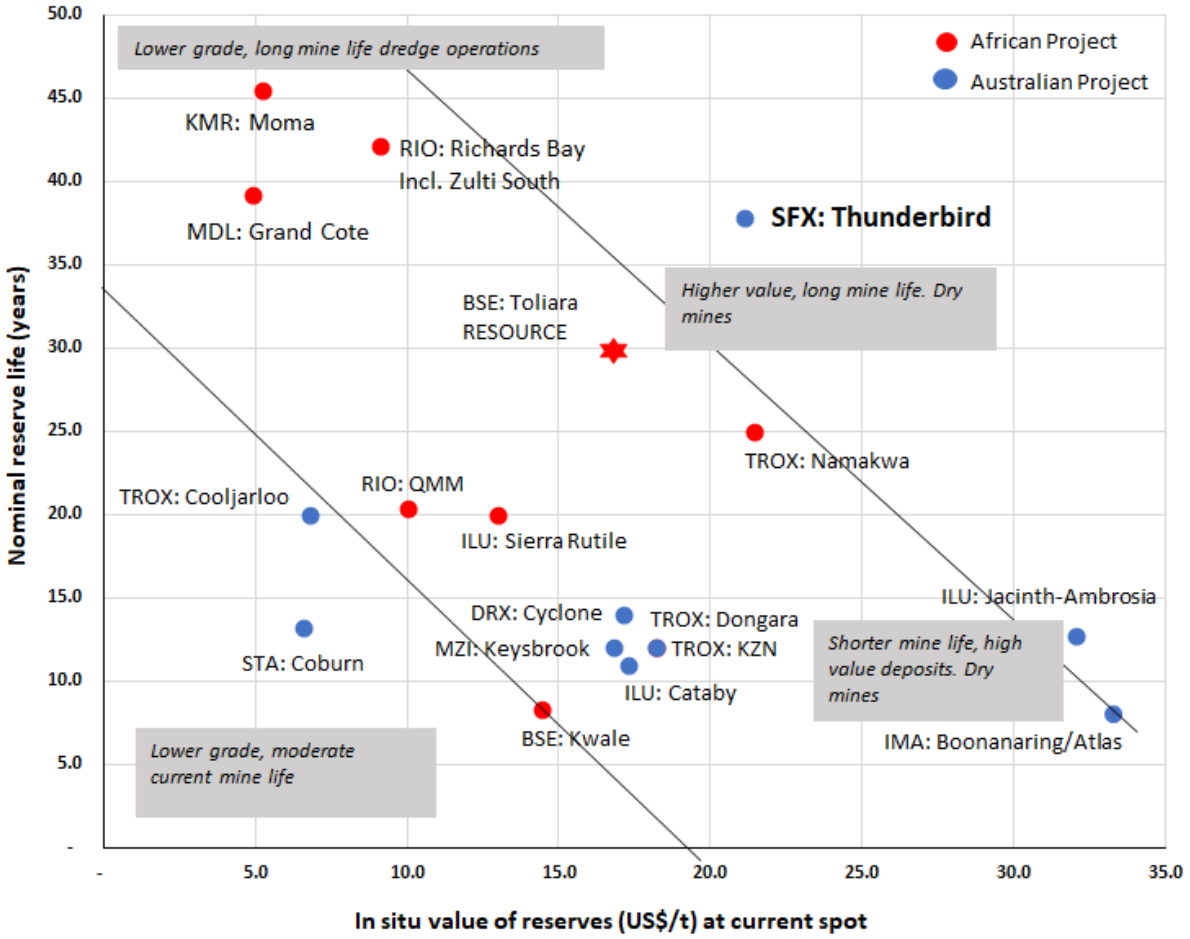
- High quality projects which are able to generate positive free cashflow throughout the cycle.
- Positioning in the bottom quartile of the present-day cost curve is desirable, but not essential if the outlook for that specific commodity is toward declining global production.
- High barriers to entry, such as access to transport.
- Multiple expansion opportunities.
- Long mine life, enabling the asset to participate in multiple future commodity price upcycles.
- Low sovereign risk.
- Good labour availability.

We believe Thunderbird is a Tier 1 asset, on the following grounds:

- It is one of the largest deposits found in the last 30 years. 3-4 times larger than the Jacinth-Ambrosia discovery of Iluka in 2004 for roughly the same in situ value per tonne of ore.
- Thunderbird will provide new supply in an environment of declining production globally.
- It can offer a long mine life of +40 years. Additional resource potential is evident (eg Night Train).
- High grade. Significantly higher grades than many of its peers.
- Low cash costs driven by a low strip ratio and high grades which on our trough commodity price assumptions should deliver positive cashflow through the cycle.
- Large resource base may allow multiple expansion phases going forward.
- Good access to road and port infrastructure.
- Located in Western Australia, the world's most attractive mining jurisdiction.
- Good labour availability from the towns of Broome and Derby.

We have looked at two key "tier 1" attributes for Thunderbird and its peers, deposits both in production and those at project level. These are:

- The in-situ value of the stated reserves calculated with approximate spot commodity prices (eg zircon at US$1500/t and ilmenite at US$220/t). This is certainly simplistic as not all ilmenites (for example) will achieve premium pricing and in several cases zircon will be sold in concentrate form, at a discount to premium pricing). As well, it does not include metallurgical losses.
- The nominal mine life delivered by the current reserve base. This is defined by reserve life divided by the current (or designed) plant throughput. Again, this is simplistic but does provide a level field for comparison.



Source: Company reports

This chart does highlight how Thunderbird stands out from the crowd. It holds a high average value of mineral in-situ, and demonstrates a long mine life. This is not to damn the lower grade dredge projects, such as MDL's Grand Cote, Kenmare's Moma and RBM's Richards Bay. These can be high returning projects, but need low operating costs, consistent production levels (and/or high commodity prices) to achieve high margins. Note that the RBM numbers above are skewed with the inclusion of Zulti South in the reserves. Without Zulti South RBM's mine life is significantly shorter (?10-15 years at most, perhaps less).

Iluka's Jacinth-Ambrosia operations in the Eucla basin of South Australia remain highly attractive, with high grades, but with a rapidly depleting mine life. Image resources recently sanctioned Boonanaring/Atlas project is also very attractive, but it is of relatively short mine life.

Following the acquisition by Base Resources acquisition we have included resource numbers from the Madagascan Toliara/Ranobe project on this chart. As the project is about to embark on its pre-feasibility study, we would not expect reserve numbers until 2019. It is likely to be a long mine life project, perhaps over 30 years.

We are of the view that Base paid a full price for Toliara, but the acquisition seems to make sense from a project development standpoint, given BSE's African experience. And Toliara was for sale. It does appear to be quite an attractive project, but less attractive than Thunderbird.

This comparative confirms that Sheffield must be on the M&A radar screens of the global mineral sand miners and consumers.

Moving Thunderbird forward towards production

The Thunderbird deposit is geologically unique. Most mineral sand deposits are not very far from their origins, an active coastal fringe, where wave action produces a concentration of the higher density minerals, such as rutile, ilmenite and zircon, within their less dense host (typically quartz sand). Older shorelines have also been responsive for world class despots. Examples would include those of the Perth Basin, Eucla and Murray Basins (perhaps 2-40 million years old) located in Australia and the old coastal deposits of the eastern US. These deposits are well explored, and mature. All have seen the best deposits extracted over the past 10-30 years.

We believe the Thunderbird deposit is unusual because of its age. It is hosted by the lower Cretaceous sediments of the Canning Basin and very much older than its Perth Basin neighbours: likely around 140 million years.

Enclosed within the so-called Thunderbird Formation is a continuous, very-high grade (>7.5% HM) zone named the GT Zone. This Zone is up to 43 m thick (average 15 m) over an area at least 7.5 km × 4 km, strikes approximately north-south, follows the dip of the Thunderbird Formation and is open along strike. The GT Zone extends from surface to a maximum modelled depth of 126 m, the average depth to its top is 35 m and the average mineralised thickness is 16 m.

This high-grade zone is interpreted to represent an internal structure to the mineralisation. The higher grades are not associated with unit thickening or a change in grainsize, and are therefore interpreted to result from deposition in higher wave energy shoals off-shore influenced by inflow directions of heavy minerals source (e.g. rivers, floodplains). There is some thought that Thunderbird was formed in a similar fashion to the WIM150 deposits of the Murray Basin in Victoria.

The heavy minerals in the Thunderbird deposit are comprised of altered ilmenite, ilmenite, pseudo-rutile, haematite, goethite, leucoxene, zircon, rutile, anatase, and monazite. At a median diameter of 57–75 microns, the valuable heavy minerals are finer-grained than most other Western Australian HM deposits.

The rocks themselves are deeply weathered, with the some of the ilmenite having broken down to leucoxene and anatase with the remnant iron precipitated as the various types of hydrated iron oxides. This along with oxidised titanomagnetite contributes to the high proportion of iron in the HM suite, and the need to separate this lower value material from the higher value product. This does result in some areas of re-precipitated iron oxide, but these are typically narrow and should represent few challenges to the miners. The weathering of the ilmenite has concentrated titanium at the expense of iron, enabling the production of higher grade, and therefore more valuable ilmenite.

Thunderbird is materially large. At a low cut-off grade (3% HM), the deposit contains some 223 million tonnes of heavy minerals, within a total resource of over 3 billion tonnes. Within this is a higher grade resource of 92 million tonnes (7.5% HM cut-off grade), largely of zircon and ilmenite.

Sheffield presents the following chart to highlight the quality of Thunderbird compared with its peers. It is comparable in in situ TiO2 grade to deposits of the Perth Basin (Iluka) and Tronox's Namakwa and Fairbreeze mines. But the in-situ zircon grade is significantly higher.

The rather unique nature of the Thunderbird deposit delivered some technical challenges for project development. However, a comprehensive BFS was able to deal with the challenges. Attention is draw to Appendix 1 in this report which summarises key technical issues and their solutions from our post-BFS review last year. They include:

- The partially indurated nature of the Thunderbird sands. A comprehensive geotechnical study and large-scale trenching has eliminated this risk.
- Fine grain size. Met testing has delivered zircon recoveries of over 90% and TiO2 recoveries of around 84% using conventional spiral technology.

- The Thunderbird sands have a 15-17% slimes content, much of which is silts (rather than clay). This should be easily manageable.
- The presence of hard ironstone. This material can be removed by screening.
- High proportion of iron in the heavy mineral concentrate. Sheffield's consultants have employed a low temperature roast (LTR) to remove iron oxides from the concentrate by converting them to titanomagnetite. As a by-product benefit, roasting delivers a significant value-in-use benefit to the upgraded ilmenite while also producing a titanomagnetite by-product.

The Thunderbird Project – results from the BFS

- In mid-March 2017, management announced the release of the Hatch-led bankable feasibility study, 15 months in its preparation. Hatch is a highly credentialed speciality engineering that has undertaken mineral sands projects for the majors including Rio Tinto.
- Key outcomes from the BFS are as follows:
    - **A two phase project enabling the staging of capex**. A$348m is needed for phase 1. (We have assumed A$360m in our evaluation). Total capex for the 2 phase project is A$543m (excluding sustaining capital), with A$195m required to double plant capacity from year 5. This is around 20% higher than our earlier estimates, and 17% higher than the revised PFS number.
    - **Higher capex has driven significantly higher ilmenite production levels than we had expected from our earlier work.** Peak production in years 5 – 10 is now estimated at 516ktpa low temperature roast (LTR) ilmenite and around 133ktpa zircon.
    - **What is comforting is that the project is not particularly sensitive to capex**. A 10% rise is capex results in only a 7% decline in NPV(10). This is supported by (1) very strong early cashflows and (2) the very long mine life.
- The production profile is illustrated in the following chart from the BFS.

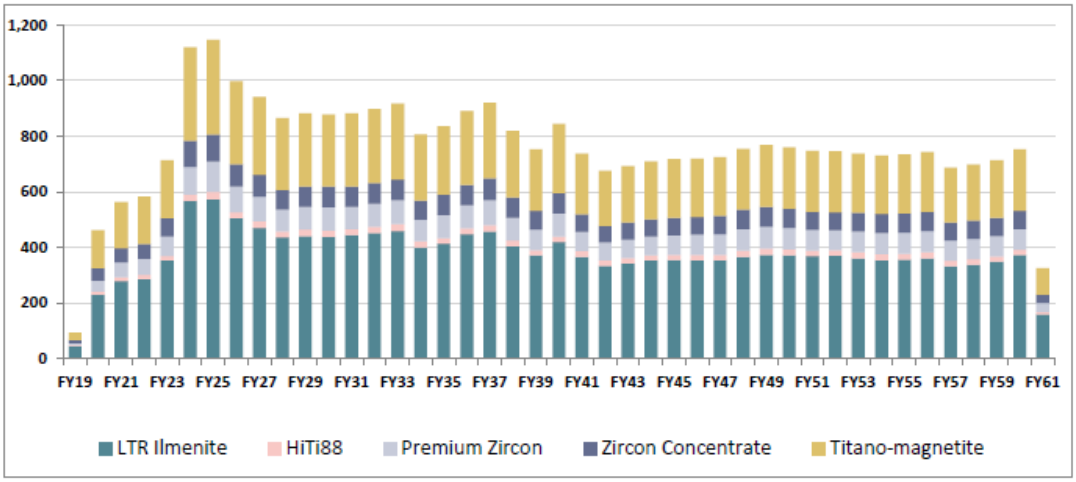


Figure 3: Annualised production of Final Products over Life of Mine (Kt)

Source: Sheffield Resources, March 2017

- **Favourable cash costs.** SFX commissioned TZMI to prepare a cost curve (using the Iluka revenue to cost methodology). Thunderbird is favourably positioned, located at the top of the 2nd highest margin quartile. This is not unexpected from our earlier work.

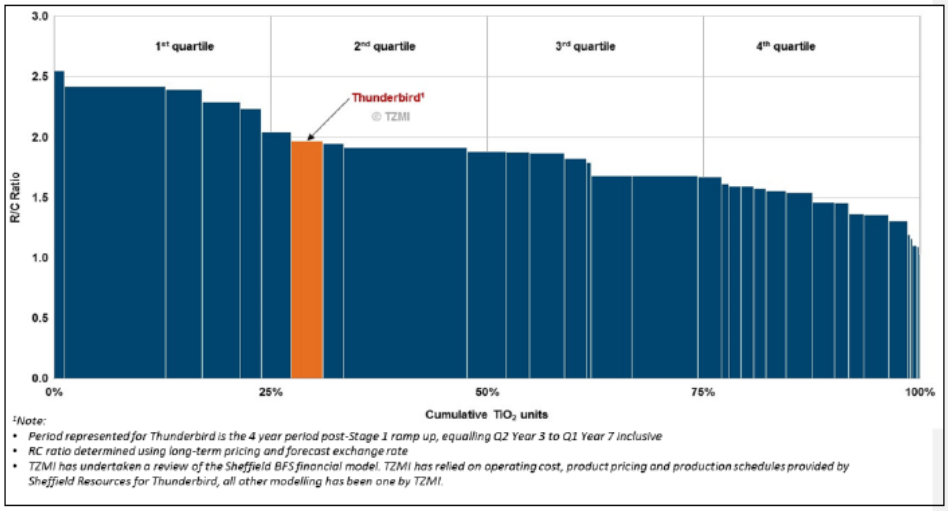


Figure 2: TZMI 2020 Industry Revenue to Cash Cost Curve

Source Sheffield Resources BFS support documents, March 2017

- Comparing with the PFS, the headline Revenue/Op cost measure are the same: 2 to 1, at much the same commodity price assumptions.
- **The mine life?** JORC reserves of 42 years at the proposed mining rate.
  With our increase in long-term zircon price assumptions at the end of 2017, our valuation of Thunderbird is now A$843m (pre-tax) with an estimated pre-tax IRR of 29%, with first production likely in late 2019, or perhaps early 2020. A summary of our economic evaluation of the Thunderbird project is summarised below.

The Taurus debt package – made to measure

On 18 October 2017 Sheffield announced the finalisation of a US$200m debt package, arranged and underwritten by the Taurus Mining Finance Fund. We consider the Taurus debt package to be attractive. Key terms of the facility include:

- A US$175m (ca.A$230m) facility with a US$25m contingent instrument facility to cover bonds. (Tranche A is US$100m).
- Of this US$75m is priced at USD Libor plus 4.5% (around 5.8%) with US$100m priced at 8.5% (Tranche B)
- Overriding royalties of 0.5% for years 1-4 and 0.75% for years 5 to 22.5).
- The loan facility will be interest only for the first 3.5 years. Tranche A is repayable between years 3.5 and 7 and Tranche B is repayable in year 7.
- Conditions precedent don't look onerous, and appear limited to the usual issues, such as permitting, offtake agreements and an agreed equity spend before debt drawdown.
- There is a provision for a cash sweep "in certain circumstances". We would assume this to be the case during periods of very high commodity prices.
- Note that there is no hedging of commodity prices (which would have been very difficult as mineral sand commodities do not offer a forward market) nor of currency.

The overriding royalty, based on our commodity price estimates adds to the cost of debt capital. Assuming no repayment of the debt until 2023, a total interest bill of approximately $108m (discounted into the future at 10%) is inflated by around $20m (PV).

This is our interpretation of the cost of Taurus debt for the duration of the 7 year facility, assuming Thunderbird is geared at 60% (which will require a drawdown of some A$210m of the $230 available):

		Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7
Debt	A$m	$ 210.00	$ 210.00	$ 210.00	$ 210.00	$ 210.00	$ 210.00	$ 210.00
Tranche A	A$m	$ 100.00	$ 100.00	$ 100.00	$ 100.00	$ 100.00	$ 100.00	$ 100.00
Libor	%	1.30%	1.30%	1.30%	1.30%	1.30%	1.30%	1.30%
Tranche A, Libor plus	%	4.50%	4.50%	4.50%	4.50%	4.50%	4.50%	4.50%
Tranche A interest	A$m	$ 5.80	$ 5.80	$ 5.80	$ 5.80	$ 5.80	$ 5.80	$ 5.80
Tranche B		$ 110.00	$ 110.00	$ 110.00	$ 110.00	$ 110.00	$ 110.00	$ 110.00
Tranche B rate	%	8.50%	8.50%	8.50%	8.50%	8.50%	8.50%	8.50%
Tranche B interest	A$m	9.35	9.35	9.35	9.35	9.35	9.35	9.35
Total interest	A$m	$ 15.15	$ 15.15	$ 15.15	$ 15.15	$ 15.15	$ 15.15	$ 15.15
Taurus royalty rate	%	0.5%	0.5%	0.5%	0.5%	0.8%	0.8%	0.8%
Royalties to Taurus	A$m	$ 0.21	$ 1.10	$ 1.27	$ 1.32	$ 2.45	$ 3.62	$ 3.76
Effective interest rate, ex royalties	%	7.21%	7.21%	7.21%	7.21%	7.21%	7.21%	7.21%
Effective interest rate, incl. royalties	%	7.31%	7.74%	7.82%	7.84%	8.38%	8.94%	9.01%
EBIT/interest	x	- 1.30	4.80	6.14	7.88	9.36	13.00	13.86

Under this scenario, effective interest rates peak at a little over 9%, which is when we have revenues peaking (driven by the coincidence of high grades and the Stage 2 upgrade). However, during the early years, where cashflow is critical the effective rate, including royalties is 7 to 8%. Over the duration of the 7 year facility the EBIT/interest ratio is very comfortable.

In the event that the debt is refinanced to another debt provider in year 7, we assume Taurus will continue to enjoy the royalty stream into year 23, with its present value of $20m amortised over a much lower interest payment (PV of around $65m). No question that this is attractive for Taurus, but the package is highly attractive to Sheffield for in the following ways:

- The debt + royalty carries quite a low headline interest rate, especially over the early years where cashflow risk is high.
- There will be no principle repayment for 3.5 years to allow the accumulation of capital to assist with the funding of Stage 2 from 2022. We estimate surplus cashflows of over A$100m to be available to SFX in the first 3.5 years of the project. On our numbers we see no need for further equity to fund Stage 2.

On balance we consider the Taurus package to be attractive for a small company such as Sheffield.

The absence of hedging means shareholders are exposed to the full upside (and downside of course) of commodity prices and currency.

Summary economics

Pricing, long term		SFX	Bridge Street
Premium zircon	US$/t, CIF	1387	1400
Zircon concentrate	US$/t, CIF	677	700
Ilmenite	US$/t, CIF	183	220
Hi Ti 88	US$/t, CIF	500	600
Titanomagnetite	US$/t, CIF	48	48
A$/US$		0.75	0.75
Production (LOM, average)			
Premium zircon	ktpa	76	77
Zircon concentrate	ktpa	69	68
Ilmenite	ktpa	388	392
Hi Ti 88	ktpa	20	19
Titanomagnetite	ktpa	230	247
Mine life	Years	42	42
Pre-production capital	A$m	348	360
LOM capital (excl. sustaining)	A$m	543	555
LOM unit revenue	A$/t	19.9	21.2
LOM site costs (ex G&A)	A$/t	11.4	11.6
LOM cost (zircon equivalent basis)	A$/t zircon	1053	1020
Revenue to cost ratio (years 1-10)		2.0	1.9
NPV10 (pre-tax)		A$676m	$842
IRR (pre-tax)		25%	32%

Our higher estimate of NPV and IRR compared with the BFS is almost entirely driven by higher commodity price assumptions. Under the BFS commodity price assumptions, our pre-tax NPV drops to A$649m.

Valuation of Thunderbird –$1.84/share

Our valuation for SFX is A$1.84/share. This is based on the following assumptions:

- Critical commodity price assumptions of US$1400/t for premium zircon and US$220/t for sulphate ilmenite.
- A$/US$ of 0.75.
- Stage 1 capex of A$360m, with LOM capex of A$555m (excluding sustaining capex).
- Project level gearing of 60%. We had previously assumed 50%, but we believe that nature of the Taurus facility will allow the project to take on higher gearing levels
- No sell-down at the project level. We have changed our base case to assume that SFX will retain 100% of the project. A sell-down remains a possibility, but it will be contingent on price achieved.
- A final equity raise of around A$120m. Here we have assumed 100% of the equity raise will be issued at A$0.70/share, in line with the 2017 raising.

Thunderbird (NPV10), post tax	A$m	$ 553.8	
Add back capex	A$m	$ 350.0	
Less working capital		-$ 20.0	
Thunderbird (NPV10)	A$m	$ 883.8	Unfunded NPV
Mine site exploration	A$m	$ 10.0	Notional
Equity NPV	A$m	$ 893.8	
Project debt	A$m	-$ 210.0	50% debt/equity
NPV less debt	A$m	$ 683.8	
Ownership by SFX	A$m	100%	
Implied SFX equity	A$m	$ 683.8	
Cash	A$m	$ 31.6	Current
PV of corporate costs	A$m	-$ 100.0	Estimate
Other exploration	A$m	$ -	
Corporate NAV	A$m	$ 615.4	
Number of shares, current	m	228.3	
New equity required	A$m	$ 120.0	Estimate
Number of new shares	m	171.4	
Total number of shares	m	399.7	
NAV adding new cash	A$m	$ 735.4	
NAV/share	A$	$ 1.84	

Sensitivities

It is possible to evaluate SFX's valuation under a variety of commodity price assumptions. However, zircon delivers over 50% of Thunderbird's revenue, and in our view offers the greatest upside potential.

		Project		Corporate	
Zircon price (premium, US$/t CIF)		NPV(10), A$m	IRR (%)	Fully funded NPV (A$)	
Base case	$1,400	842	32	1.84	per share
+10%	$1,540	998	36	2.13	per share
+20%	$1,680	1154	39	2.43	per share
-10%	$1,260	686	29	1.55	per share
-20%	$1,120	529	25	1.25	per share

Where to for Sheffield after project 'go-ahead?

We see a number of opportunities for ongoing value enhancement for Sheffield following the commencement of construction. These include:

- Finalisation of product offtake agreements.
- Further optimisation of the Thunderbird project including the possibility of bringing forward the Stage 2 expansion. Recall that the BFS was conducted using now very conservative commodity price assumptions (zircon at US$1250 and ilmenite US$183/t). The cashflow impact at higher commodity

prices is dramatic and could pave the way for a financial decision to proceed with Phase 2 earlier than has been proposed.

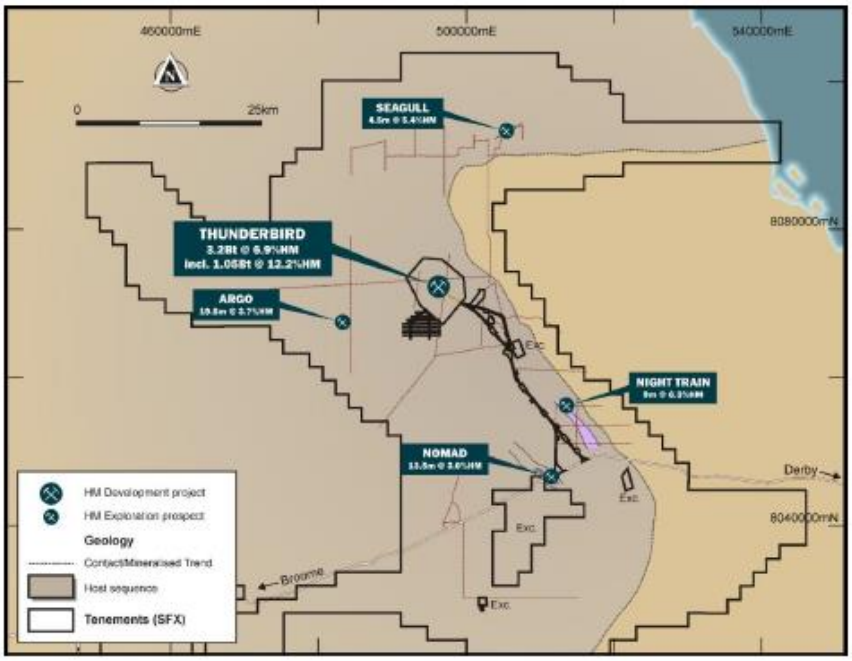
The following table presents sensitivities, with 10 to 30% increases in product pricing in 2021.

		Project EBITDA, 2021e
Product price (premium, US$/t CIF)		A$m
Base case	$1,400	140.8
+10%	$1,540	163.2
Change from base		22.4
+20%	$1,680	184.5
Change from base		43.7
+30%	$1,820	206.1
Change from base		65.3

Admittedly a bullish case, but a 30% in commodity prices could generate significant incremental cashflow, potentially justifying the acceleration of the Stage 2 project, which currently has a A$195m price tag.

- Incremental resource and reserve tonnage. Thunderbird is already a very large orebody, which will ultimately justify a number of expansions as market conditions and commodity prices dictate. What could be useful in the short to medium term is even higher grade material to feed the proposed plant.

  Located just 3km from the proposed Thunderbird is the Night Train discovery. Here initial exploration has defined good widths (9 to 24m) at depths of less than 50 metres, with good grades of heavy minerals, with much lower levels of trash. Importantly initial work suggests that the zircon grades are even higher than Thunderbird (15% of HM at Night Train against 8.3% for Thunderbird). We'd be surprised if SFX doesn't recommence exploration at this and other regional opportunities during 2018.



Developments in the global zircon markets

Tronox starts the ball rolling with a 9.5% increase in 2018

The current market tightness has seen reference prices from roughly 50% of zircon supply (Tronox and Iluka) move to over US$1400/t (CIF).

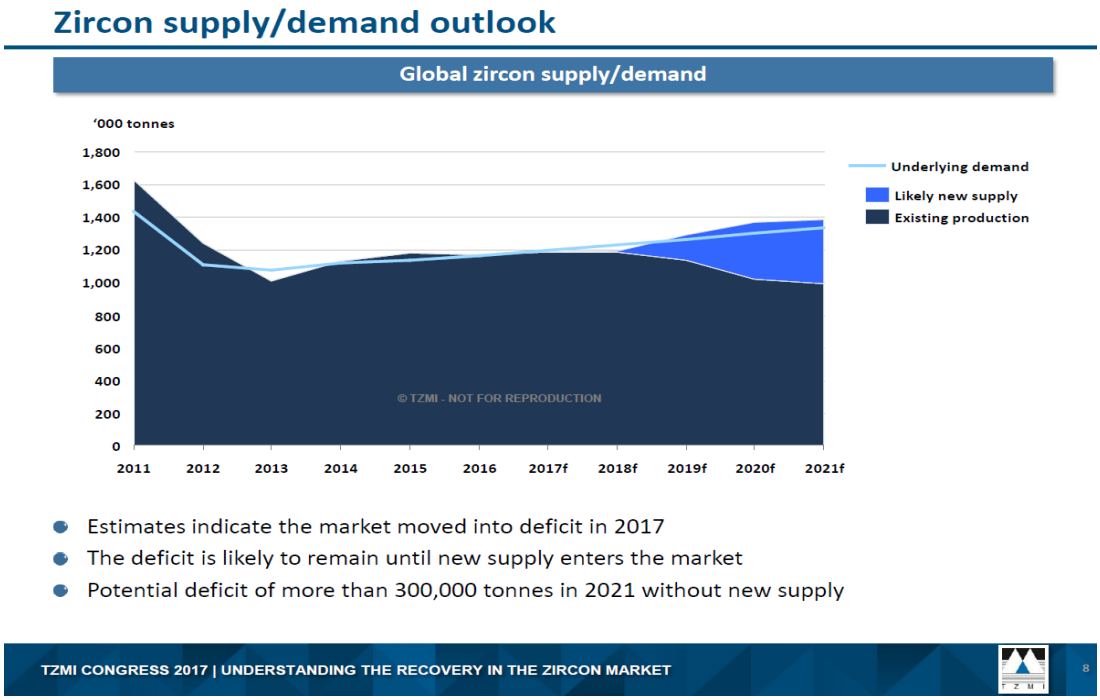
We have heard recently of significant labour disruption at the Richards Bay mineral sands operations 76% owned and operated by Rio Tinto. This has resulted in the declaration of 'force majeure' on TiO2 deliveries, just one month after a roaster failure caused a halt in slag production. It is uncertain whether this dispute will flow upstream into the concentrators, but the risk must be quite high.

Spot zircon prices we understand have touched US$1600/t (CIF) into China. See commentary below regarding our thoughts on pricing.

Key points from the 2017 TZMI Conference, November 2017, Hong Kong

- TZMI reported that they believed zircon moved into supply deficit during 2017. This deficit could move to over 300,000 tonnes by 2021 (some 25-30% of demand) without new supply.
- TZMI are forecasting a return to demand growth following 5-6 years of static demand, largely driven by thrifting by the ceramic manufacturers. Demand is expected to grow by 2.8% per year into 2021 with specialty end-users above trend, ceramics on trend and refractory and foundry end users below tend.
- China is forecast to remain the dominant consuming region, but with high rates of growth out of India. TZMI concedes that substitution concerns are real, but innovation and high-quality applications are seeing increased zircon usage. This is echoed by market-leader Iluka (see below)
- TZMI concluded with the statement that the zircon market is at "an interesting turning point".

We concur with these views but would argue that the deficit was starting to appear as early as 2016, as Iluka's J-A and Murray Basin mines and Rio Tinto's RBM all delivered declining production. It really was only high producer inventory levels which kept the supply balance in place.



Source: TZMI Congress 2017. Understanding the recovery in the Zircon Market. Gavin Diener

Iluka's view in November 2017: "Significant supply deficit from 2019"

Demand

- At their annual presentation in November 2017, Iluka presented a stronger demand estimate compared to TZMI (by around 50kt pa).
- ILU state that there is currently no inventory build in zircon and that there has been an inability from producers to respond, generating favourable pricing conditions. This has been confirmed in informal discussions with industry participants.
- Iluka presented detail regarding substitution of zircon for other compounds. In summary:
  - ~ They see only 2% of the zircon market where substitution risk is real (in sand castings). In other words, much of the easy substitution has already occurred.
  - ~ In around 50% of applications (mainly ceramics) is there a medium to low risk of substitution.
  - ~ In the balance (48%, mainly chemicals) there is negligible risk of substitution.
- Iluka believe that substitution of zircon has reached its technical limit.
- The rise of digital printing in the production of high quality ceramic tiles is supporting an increased intensity of use in tile-making.
- Increasingly, architects are employing large zircon-rich, porcelain tiles for high-end decorative use. These larger tiles are demanding higher intensity of zircon use to ensure strength and rigidity in the kiln.

Supply

- ILU confirmed information from other market sources: that the artisanal producers in Kalimantan are providing swing production, in response to the recent price surge. ILU believe they have the capacity to generate around 2000 tonnes per month.
- Iluka can see a limited number of high quality zircon and rutile projects globally. Those that exist are generally in higher sovereign risk locations and are likely to deliver higher unit costs due to grade and distance to infrastructure.
- Otherwise, the ILU/TZMI sourced tabulation of new sources of supply contained few new entrants that we hadn't already factored into our estimates.
- The restart of the Eucla Basin operations by ILU has always been in our numbers but not at the levels suggested in ILU's recent release. In theory, even without the 30% concentrator upgrade and without high-grading, the J-A operations could be producing at over 160ktpa (on a pure zircon basis) for perhaps 3 years. We have used a more cautious number for 2018 and 2019, and have not applied the concentrator upgrade until 2020. Note that this upgrade has still not been sanctioned.
- Image Resources in late 2017 delivered a favourable BFS for its Atlas/Boonanaring project, which is now moving to production. Production forecasts are surprisingly high with over 60kt zircon (as zircon-in-concentrate) expected in 2019 and over 80kt in 2020.
- As shown in the accompanying table, we now have the zircon supply/demand balance remaining severely undersupplied out until 2020. This is despite new production from Image, Sheffield and perhaps the start of production from Kalbar in Victoria. Note that we have assumed RBM's Zulti South project does not provide ore to the concentrators until after 2020.

Our view of the zircon supply/demand balance out to 2020

Zircon forecast supply (pure zircon equivalent basis)			2016e	2017e	2018e	2019e	2020e
Country	Location	Company					
Australia	Eucla Basin	Iluka	0	0	140	160	180
S.Africa	Richards Bay	Rio Tinto	185	210	190	171	154
S.Africa	Namakwa	Tronox	120	121	121	121	121
Mozambique	Mozambique	Kenmare Resources	52	80	80	80	80
Australia	Boonanaring	Image Resources	0	0	5	60	80
Senegal	Grande Cote	TiZir (Eramet/MDM JV)	50	60	70	70	70
Australia	Thunderbird	Sheffield	0	0	0	20	70
USA	Florida	Chemours	65	65	65	65	65
Australia	Western/Eastern Aust.	Cristal Mining	60	60	60	60	60
S.Africa	Fairbreeze	Tronox	30	46	46	50	55
Australia	Fingerboards	Kalbar	0	0	0	5	50
Australia	Perth Basin	Iluka	130	75	40	30	30
Australia	Western Australia	Tronox	22	34	30	30	30
Kenya	Kwale	Base Resources	30	38	35	30	25
S.Africa	Tormin	Mineral Commodities Ltd	32	25	25	25	25
Brazil	Mataraca, Paraiba	Millennium Inorganic Chemicals	25	25	25	25	25
Australia	Murray Basin,NSW	Cristal Mining	20	20	25	25	25
Indonesia	Various	Various	-	5	24	24	24
Madagascar	Port Dauphin	QMM	20	20	20	20	20
India	Tamil Nadu	Tata Steel	20	20	20	20	20
		Total	**1,345**	**1,186**	**1,134**	**1,201**	**1,226**
		Growth in supply	*11.3%*	*-11.8%*	*-4.4%*	*5.9%*	*2.1%*
		Growth in demand		*13.6%*	*2.8%*	*2.8%*	*2.8%*
		Surplus/deficit		-13	-99	-66	-77

Note: forecast production of >20ktpa in 2020 included in the table.

The elephant in the room is the Rio Tinto/Richards Bay project, Zulti South. We still have no clarity on the future of this project, but it is unlikely to be in production until 2021 even if it is given the go-ahead tomorrow. Our assumptions above – little more than guesswork due to the lack of transparency of RBM – provides for declining zircon production as reserves continue to deplete.

At the 2018 Indaba conference, the South African Mines Minister (recently a victim of the Zuma clean-out) stated he had met with RIO and had discussed plans to push ahead with the project (source: Financial Times 5/2/18). In the same article RIO stated that an investment decision would go to the board in 2018 In our view, RBM needs Zulti South to avoid significant value destruction of this once grand asset.

Social unrest at Richards Bay does not seem to be settling down. As recently as January 2018, the local Press (Zululand Observer, 22/1/18) reports on road blockades around the Richards Bay operations. As we mention above, RBM has in recent days declared force majeure on TiO2 shipments due to industrial unrest.

Given recent events in South Africa and the highly unpredictable behaviour of sovereign governments in Africa as a whole, it is hardly surprising that RIO is not making a hasty decision. Our estimate of 91ktpa from 2020 is guesswork, but coincidently it is of the same quantum estimated by Iluka. The days of RBM producing over 200ktpa of zircon appear to be long gone.

Outlook for zircon prices

Discussions with market participants over the past few weeks suggests that our medium to long term estimates for zircon pricing of US$1400/t (CIF basis) are conservative. One trader, with over 30 years in the zircon market believes that current spot prices are in the range US$1450-1550/t (CIF). Furthermore, he believes we will exit 2018 with prices over US$1600/t and in 2019 prices could move to above US$2000/t.

These views were formed before the recent strike action at Richards Bay (RBM). Richards Bay (with QMM) have supplied up to 20-25% of global zircon. We believe (but can't confirm that this is now around 200kt (or 16%) of global supply.

From our informal channel checks we see no evidence of inventory build, which says to us that demand remains robust and ILU's J-A production has yet to hit the market in any great volume.

The great uncertainty remains from swing production from the artisanal miners in Indonesia, Vietnam and China.

We will remain with our $1400/t estimate and provide valuation sensitivities for SFX further on in the report.

Sheffield Resources' off-take agreements – 93% of premium zircon and 100% of ZIC now under binding agreement

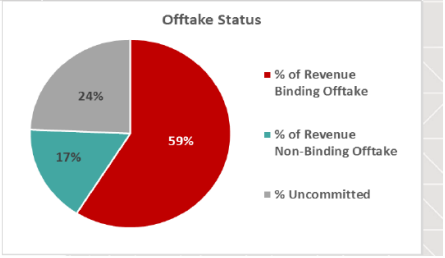
The following slide from SFX's recent presentation confirms that ca. 60% of projected revenue from Stage one is now covered by binding agreements. This will facilitate sign-off by the lenders.

OFFTAKE AND MARKET STATUS

Sheffield Resources

Product & (% BFS Revenue Contribution)	Non Binding Agreement Stage 1 Volume	Binding Agreement Stage 1 Volume	Offtake Parties
Premium Zircon (43%)	7%	93%	Sukaso, Ruby Ceramics, RZI, Qingyuan Jinsheng, Minchem, CFM, Chilches
Zircon Concentrate (19%)	0%	100%	Hainan Wensheng, RZI
LTR Ilmenite (29%)	47%	In Progress	CHTi
HiTi-88 (5%)	In Progress		
Titano-magnetite (4%)	In Progress		

- The concluded agreements boosts Sheffield's total forecast revenue from Thunderbird under binding agreement to over 60% of Stage 1 production.
- Remaining binding off-take agreement discussions will continue in parallel with the funding process.
- Thunderbird will deliver a secure supply of high quality products from a low risk jurisdiction over a 42 year mine life.



Note that these contracts are volume based. Pricing will be negotiated on a regular basis as we see amongst the other producers. The 'headline' numbers from the likes of Tronox and Iluka will provide the best guidance.

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Appendix 1

Key technical and marketing issues addressed in the BFS

The following commentary is from our April 2017 report which discussed the key findings from the BFS.

✓ ***The sandstone host rock is indurated (cemented) and may create difficulties in mining. Is this an issue?***

We continue to hear stories of indurated rock (or so-called coffee rock) within the Thunderbird resource. In our minds, the BFS has put that issue to bed.

As we know, Thunderbird is an unusual mineral sand deposit, hosted in very weathered rocks of the Canning Basin. In the near-surface environment where mineralisation comes close to the surface a weakly indurated crust can occur. But below the crust the ore becomes increasingly weathered and softer with depth. As well, typically on the periphery of the deposit are outcrops of the Melligo Sandstone, which is variably indurated.

Hatch's consultants have undertaken a detailed review of the hardness of the deposit and associated overburden and concluded that the indurated crust can be dealt with by the proposed earth moving equipment. A detailed review of geotechnical information obtained from drilling and from the three 9 metre deep trenches bulldozed last year, have generated the following data:

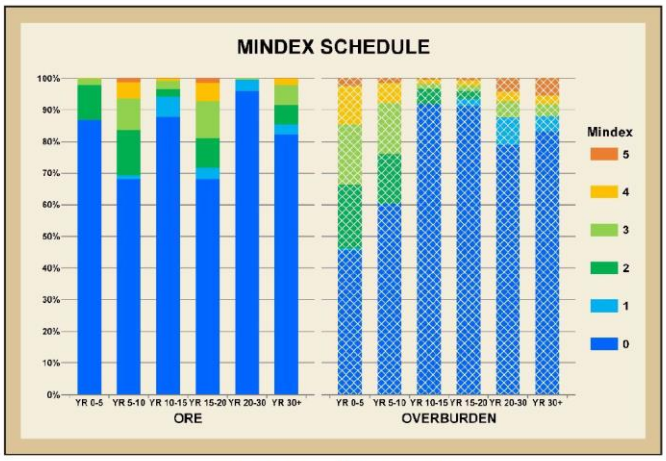

Figure 14-14: MINDEX Schedule

Table 14-8: Description of MINDEX Indicators, and Relative Proportions of Each in the Resource Model

MINDEX Indicator	Excavatability	Mining Oversize	Model Proportions		
		Probability	Waste	Ore	All
0	Easy Dig or Push	Very Low	82.3%	83.0%	82.7%
1	Easy Dig or Push	Very Low	4.7%	3.2%	3.8%
2	Hard Dig or Push	Very Low	2.3%	5.9%	4.3%
3	Easy Rip, Dig or Push	Low	4.5%	5.3%	5.0%
4	Easy-Hard Rip, Dig or Push	Moderate	2.9%	2.2%	2.5%
5	Hard Rip, Dig or Push	High	3.3%	0.4%	1.7%

Source Sheffield Resources BFS support documents, March 2017

There is no "coffee rock" as is conventionally recognised in the mineral sands industry. Coffee rock is an extremely indurated iron-bearing pisolitic laterite, typically associated with the weathering of coastal or dune sands. It is often an issue for dredge mining of mineral sand deposits, where the dredge is not configured to deal with hard rock.

At Thunderbird, induration seems to be associated with the local weathering profile where slightly increased iron cementation occurs in the near surface weathered sandstone ore horizon. All materials appear to be amenable to ripping by 'dozers, and the induration decreases with depth as the ore horizon becomes increasingly weathered. In total under 2% of waste plus ore are "hard rip, dig or push". And over 80% is "easy dig or push".

The early years of overburden removal will be the most expensive, with around 15% of the overburden requiring ripping.

We believe the BFS has adequately addressed the indurated overburden issue and built in the additional costs for ripping of indurated material near surface.

✓ ***The metallurgy of Thunderbird appears still to be the largest concern. What are the issues?***

It seems to us that much of the criticism of Thunderbird's metallurgy is based on a lack of understanding of the proposed metallurgical circuit. We have spent time discussing specific issues with metallurgical consultants. (All discussions were around publicly available information). Those contracted by Hatch and Sheffield are some of the best in the world: Hatch and Robbins are unquestionably 'best in class'. And given the current malaise in the mining sector, SFX have employed the "A Team" from both groups.

It's fair to say that Thunderbird is not like the iconic rutile and zircon deposits of the East Coast of Australia. But nothing is anymore. Those reserves have already been mined out. Thunderbird is part of the new generation of mineral sand deposits. Metallurgical issues were identified early in the exploration of the deposit.

The following issues still appear to be worrying investors:

- ***The grain size of the orebody is fine which may cause problems in the wet concentrate plant (WCP). Is this the case?***

  IHC Robbins (and Hatch) have been able to select appropriate spiral technology to ensure good performance from the wet concentrating plant. Overall heavy mineral recovery is quoted at 68.3%, with zircon recoveries a remarkable 90.6% and TiO2 recovery of 83.8%. The established producers never report met recoveries, so it is difficult to compare. But we would be surprised if Thunderbird's recoveries are much lower than industry average. ***The fine size of Thunderbird's product has been addressed with appropriate equipment selection.***

- ***Thunderbird has a high proportion of slimes (clay) which could result is tailings disposal issues.***

  We had heard that the slimes levels (less than 38 micron) was as moderately high. In fact, the average slimes content in the Ore Reserve is 15.7% which is typical of this style of deposit and much less than some currently being mined (ie Kwale at 26%). Testing of bulk samples has delivered a

7.5% slimes content, with comments that the slimes can be easily thickened, and will therefore be suitable for co-disposal in the mining void. Furthermore the clay proportion of the slimes is relatively low. ***We believe that slimes will not be an issue at Thunderbird.***

- ***50-60% of the heavy minerals assemblage is trash. How does that make Thunderbird a viable project?***

  Early in the history of the project it was simply too hard to produce an economic concentrate. Put simply, the heavily weathered nature of the mineral assemblage has liberated a variety of iron oxide minerals which are largely worthless, and are difficult to separate from the valuable heavy mineral assemblage. Zircon could be recovered, but ilmenite at an economic grade could not.

  Met consultant Robbins and its associates, who had been working on Thunderbird's metallurgy, were quick to deliver an outcome. Interestingly the solution was simple, and was actually beneficial to the mineral assemblage.

  The use of low temperature roasting (LTR) is a means by which the iron oxides can be separated from the valuable heavy minerals. This enables the production of a high TiO2 ilmenite, which has excellent acid solubility characteristics, and may command a price premium from sulphate pigment producers. Moreover, the iron oxides are converted by the LTR process to a saleable product (titanomagnetite). More comments on both issues are in the section on Markets which follows.

  All this comes with additional capital for the roaster, and operating cost, but this is partly offset by the delivery of more marketable products earlier in the project's life**.**

  In summary, we believe the issue of high levels of trash have been comprehensively addressed in the BFS and the LTR circuit enables the production of ilmenite with highly suitable characteristics for the sulphate pigment producers.

  > ***Not all ilmenites are the same.*** *The sulphate pigment producers in China have a particular requirement of a high iron II to iron III ratio which increases the reactivity of the ilmenite in sulphuric acid, which in turn encourages the solubility if the contained titanium. The higher the titanium content the better. Low temperature roasting of Thunderbird ilmenite produces just such a product. Furthermore the levels of impurities such as Cr and Al are well within quality guidelines. As well Ca and Mg contents are low, which could make Thunderbird ilmenite suitable for the chloride pigment route. Thorium levels are higher than competing slag products, but they fall within limits for transportation.*

- ***What about the hard ironstone in the plant?*** It has been established that the coarse ironstone can be effectively screened at 2mm while delivering recoveries of over 98% of both ZrO2 and TiO2.

✓ ***Capex, it's $53m higher than the revised PFS number. Why?*** Perhaps disappointingly the capex is significantly higher than the revised PFS estimates. The bulk of the A$53m increase is attributed to the wet concentrate plant ($8m) and low temperature roaster ($25m). If there were to be any surprises it will have been the plant. **It should be noted that the roaster has been designed to incorporate volumes from Phase 2.**

- ✓ ***What are the key environmental issues***? The project's PEA was lodged later than we expected and was opened up for public comment in January 2017. Since then 52 submissions have been lodged, and are overwhelmingly positive. The sole issue of any significance is to do with the Greater Bilby, a potentially at risk marsupial species, for which management plans will be put in place.

- ✓ ***Is the market ready for a new, large mineral sands project?*** Below is a discussion of the outlook for zircon and ilmenite. Suffice to say here that we are greatly comforted that it is now proposed to ramp up Thunderbird's production more slowly than it was proposed in the PFS. ***This ramp-up will allow a progressive entry into the 1-1.2mtpa global zircon market, without disrupting supply (and therefore pricing) too much.***

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