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Mining

Source: Thomson Reuters

Market data

EPIC/TKR	TNG
Price (A¢)	14.5
12m High (A¢)	29.0
12m Low (A¢)	9.7
Shares (m)	714.5
Mkt Cap (A$m)	103.6
EV (A$m)	100.1
Market	ASX

Description

Large vanadium-titanium-iron mine in advanced development with a patented hydrometallurgical process and base metals exploration programs in the Northern Territory of Australia

Company information

CEO	Paul Burton
CFO	S Rauschenberger
Chairman	Vacancy

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Key shareholders

Directors	3.94%
WWB Investments	11.11%
Aosu Inv & Dev Co Pty Ltd	7.88%
Ao-Zhong Interntional Mineral Resources Pty Ltd	5.33%
Paul Burton	1.85%
Todd Brouwer	1.40%

Next event

End April	1Q report
End July	2Q report
End October	3Q report

Analysts

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TNG Ltd

TNG's Metals of the Future get place in S&P Index

TNG's progress towards production continues with two out of three product offtakes now in place, a binding agreement for the refinery design, potential for international processing plant sales or licensing, an MoU for mine/refinery building and mine operation, and recognition by S&P through its inclusion in the ASX All Ordinaries Index.

- **Strategy**: Primary asset is the Mount Peake Vanadium-Titanium-Iron Mine project around 230km north of Alice Springs with an associated refinery located in Darwin's new East Port. The current feasibility study covers an initial 17-year mine life. Mine and refinery construction are expected to take two years, with production starting in 2018.

- **Strategy Part 2:** In addition to mine development TNG has other base-metals assets at earlier stages of development. The intention is for the majority of non-ferrous assets to be spun out as a new company, Todd River Resources, when market conditions permit. Holders of TNG stock will receive an in specie distribution of equity in Todd River Resources.

- **Valuation:** Using mining parameters from the company's feasibility study and Hardman & Co commodities price estimates, once financed and permitted, the project supports a Fair Market Value for 100% of the project, not including tax or interest, of A$4.63/sh on a fully diluted issue of 723m shares (see note published in Dec 2015 for full description of the model).

- **Risks**: There are low political and technical risks but moderately high project development and global commodity price risks. The company has secured life-of-mine off-takes for a minimum of 60% of both its vanadium and its pig iron products. Negotiations for project finance are on-going, but construction and operational agreements have been signed. A long-term agreement to cover sales of the pigment grade titanium dioxide product remains to be signed. Inclusion in the S&P ASX All Ordinaries Index should raise the company's institutional profile.

- **Investment summary:** The main potential for rapid growth is the start of production of three high-value mineral products from a long-lived mine. On the current schedule this is due in 2018 with a production step up four years later. Project delivery has been significantly de-risked, with additional binding agreements continuing that improving trend, but project finance has not been finalised and dilution of current holdings is expected.

Financial summary and valuation

Year-end July (A$000)	2011	2012	2013	2014	2015	2016E
Sales	4	129	35	50	69	N/A
Operating Profit/(Loss)	-2,289	-3.623	-4,620	-3,668	-4,942	N/A
Net Interest	0	0	0	-13	-8	N/A
Profit Before Tax	-2,760	-4,114	-4,618	-3,670	-5,021	N/A
Profit After Tax	-2,148	-3,430	-4,618	-3,670	-5,021	N/A
Earnings per share (A¢)	-0.81	-1.08	-1.10	-0.71	-0.83	N/A
Net (debt)/cash	3,210	10,230	2,595	4,002	5,157	N/A
Shares issued	8,207	33,518	14,350	71,020	50,019	N/A

Source: Hardman & Co Research

Recent activity

TNG Ltd has been developing the Mount Peake Vanadium-Titanium-Iron project since its discovery in 2006. A positive Preliminary Feasibility Study (PFS) was delivered in 2012, after which Mount Peake became the focus for building a significant international coalition to help deliver what has become a strategically important mine and refinery project.

- **2013** – Mount Peake project advances on positive PFS results, DFS starts and the managed separation of non-core projects begins. SMS Siemag and CSIRO brought in to help optimise TiVAN™. Asian sales campaign starts in earnest.
- **2014** – Development, finance and sales partners found in Woojin, Hyundai Steel, POSCO, Gunvor Group, GPP Group. Successful capital raisings and continued technical progress at Mount Peake as the project is given Major Project Status by the NT government. First firm off-take – for magnetite concentrate.
- **2015** – Technical studies continue on site as development MoUs start to be signed. Local rail and port access, local engineering contractors, environmental and community liaison all progressed. DFS delivered August. Binding offtake for 60%+ of produced vanadium signed with Woojin. Central Land Council Sacred Site Clearance Certificate gained for mine site and infrastructure. Environmental Impact Statement released for public comment. Caterpillar Financial confirmed as project partner. A$1.9m R&D rebate for TiVAN™ development and A$4m raised through option uptake.
- **H1 2016** – Binding term sheet covering 60%+ of all iron products signed with Gunvor (Singapore). Binding agreement signed with SMS Seimag for refinery design and offsite fabrication (with possible finance support through the German export bank). An additional agreement with SMS Seimag opens the pathway to taking advantage of the TiVAN™ patents through licensing and export assistance. An MoU signed with Downer EDI to build the refinery onsite, build and operate the Mount Peake mine and its associated support infrastructure. Inclusion in S&P ASX All Ordinaries Index.

Binding agreements so far

- A minimum of 60% of all vanadium products, with a price floor of 20% over spot price. Agreement valid for the life of the Mount Peake mine.
- A minimum of 60% of all iron products, to be sold on a fixed commission basis (Free on Board at Darwin). The agreement is valid for the life of the Mount Peake Mine.
- A life of mine technology transfer agreement to allow for the production of ferrovanadium products at the Darwin refinery site.

Outstanding:

- A long-term agreement to cover a significant proportion of the titanium dioxide product.
- Finance package

Commercialising TiVAN™ and developing its global market

Readers will remember that TNG applied for international patents during the development phase of its innovative hydrometallurgical process. The most recent news; that it had agreed with SMS Group (the parent of SMS Seimag, DEMAG and other well-known suppliers to the heavy industry) to explore the best means of rolling out TiVAN™ on a global basis, is a logical progression of the original impulse to protect valuable Intellectual Property.

Agreement between TNG and SMS Group sets the scene for global licensing of TiVAN™ and building of the Darwin-based metals refinery to support the Mount Peake project

Initially at least this agreement dissolves the barrier between TNG's R&D and the IP developed by SMS Group's specialist in designing mineral processing technologies, SMS Seimag, in order to implement TiVAN™ in an optimal manner. But 'simple' engineering is just the first step.

The two companies are directly addressing the international potential of technology partnership. As we understand it there is no settled approach just yet, but SMS Group's global reputation, capacity and linkages with Germany's export agencies mean that it is very well positioned to act in almost any role to advance the case for TiVAN™.

There are many reasons, both commercial and political, why SMS Group might want to invest time, money and influence in changing the market fundamentals for two metals that TNG will produce at Mount Peake, vanadium and titanium.

SMS Group move aligns it with German/EU policy on critical minerals supply and findings by German academics

Vanadium carries the 5th highest supply risk assessment by the British Geological Survey out of 41 economically important elements[1], mainly due to the concentration of vanadium processing capacity in China. While the titanium supply chain is much less at risk, due to its supply chain's distribution through friendly western nations, its association with advanced aerospace, defence technologies and increasing use in premium marque automobiles mean that manufacturing economies like Germany, are moving to protect their supplies or find new deposits within their boundaries[2].

Having immediate access to a technology that derisks both vanadium and titanium supply chains simultaneously is something that EU-based manufacturing companies and governments alike are surely seeking. As Viebahn et al state in their 2015 paper, part-funded by German Federal Ministry for Economic Affairs and Energy, "… in addition to achieving closer cooperation with companies and governments of supplier countries, increasing resource efficiency and recyclability should be key elements of technology development to secure Germany's raw material supply"[3]

So apart from a 'simple' export deal for a single processing plant that offers a step change in resource efficiency to be sited in Northern Australia, it seems highly likely that a major global exporter, such as SMS Group, could see the systemic potential for reshaping two global supply chains to its own and Germany's advantage.

[1] http://www.bgs.ac.uk/mineralsuk/statistics/risklist.html

[2] http://www.bgr.bund.de/EN/Themen/Min_rohstoffe/Rohstoffverfuegbarkeit/rohstoffverfuegbarkeit_node_en.html

[3] P. Viebahn et al. Renewable and Sustainable Energy Reviews 49 (2015) 655–671

Evolving Steel Markets

UK and EU steel industry in similar situation to US steel in the 1970s but against a backdrop of technology with 40 years further development

In the past we have looked closely at advanced and future uses of vanadium and titanium, such as the energy sector and aerospace. In this note, and given the current state of agitation regarding UK and EU industry, we'll look more closely at the biggest consumer of vanadium in the world, steel production.

The UK is not alone in being wracked by a crisis of conscience over its domestic steel production capacity, and more specifically about its ability to produce virgin steel from its raw constituents; iron ore, coke, limestone and fluxing agents. This is no real surprise and many will recall the global steel glut of the 1970s, when energy prices and global recession led to oversupply at the low tech, virgin end of the market and that saw the development of the mini-mill using Electric Arc Furnaces (EAFs) and higher proportions of recycled steel.

The situation is slightly different this time around with 40 years of technological development to take into account, so we should briefly look at how current steel market movements may impact TNG's product lines.

Let's take each product as a separate case.

Vanadium

Vanadium use in steel is increasing as lower quality steels are legislated out of use in some high volume applications such as Chinese rebar

Vanadium is included in steel-making, both primary and recycled, through ferrovanadium, the main product covered by TNG's binding agreements with Woojin of South Korea.

The cost of including vanadium in relatively low quality steels, as a means to increase their quality, is largely offset by the decrease in total tonnage of steel needed to achieve the same engineering performance. As a result, the intensity of vanadium use in steel is rising globally (at 8% CAGR 2006-14 according to Largo Resources) as part of the wider trend for increasing materials quality.

Moreover, as the efficiency of recycling streams increase we expect to see more up-cycling of secondary steels through the addition of vanadium and other alloying elements, rather than the current downgrading of functional parameters that is largely due to feedstock quality.

While the overall tonnage of steel including vanadium as an alloying agent has fallen in recent months as a direct result of a drop in primary steel production volumes, the total tonnage of vanadium being used has risen annually since the crash and is still rising year-on-year. We, and many other commentators, expect this trend for increased steel quality to continue, especially as China continues to move towards more advanced engineering.

Titanium

Titanium use is increasing as transport systems are 'light-weighted' and ferrotitanium is used to cleanse recycled steel while molten before reuse

Ferrotitanium (FeTi) is used as a scavenging agent in steel production, acting to combine with impurities and form a slag that can then be skimmed off the surface of molten steel. Although relatively small volumes of FeTi are used in steel recycling, they perform a vital technical function in controlling product quality.

The addition of FeTi as an alloying agent (over and above its cleansing function) is a means to adjust the grain size in finished steels of both primary and recycled origin, and by doing so alter their physical properties. Finer grain structures are associated

with decreased rejects in steel casting and increased reliability of the finished cast parts.

While TNG doesn't currently have any direct interest in ferrotitanium or its production, increased demand for elemental titanium through increased need for recycled steel cleansing is certainly possible, putting an upwards pressure on the wider titanium market, albeit slight and indirect.

Of more direct interest may be the replacement of some steel auto parts with metallic titanium in higher end auto marques (or aluminium-titanium alloys in mid-range marques) and the legislated recyclability of all new European-built cars. This will eventually (after maybe two decades) reduce the volume of steel available for recycling from that sector and put the onus on low energy, high purity sources of elemental iron. The reduction or removal of copper wiring looms in the auto recycling process will also have an impact by increasing secondary steel feedstock quality, so as light weighting and electrification advance across the world's automobile fleet the picture is quite complex.

Pig Iron

Pig iron is the steel recycler's diluting agent of choice to control the concentration of impurities in recycled steel

Pig iron is both the primary and the secondary steel industry's source of choice for new 'elemental' iron. Direct Reduced Iron (DRI or sponge iron) tends to be expensive and can be difficult to handle. Pelletized iron is only used by primary steel producers and is an inflexible, capital intense product that is usually tailored to specific manufactories.

TNG's decision to produce pig iron rather than iron oxides, DRI or iron pellets is, in part, a response to the long-term growth of steel recycling with its focus on short supply chains, smaller production units and lower energy costs. However, growth in the secondary steel market doesn't prevent the use of the pig iron product by any other kind of iron or steel producer. There are many reasons why pig iron is still the trader's choice, but ultimately its convenience and flexibility are probably the key factors.

Comment

We are now in an era of smaller miners and entering an era of smaller, more innovative mines

Several years ago, just after the crash, we stated that the world was "entering an era of smaller miners and smaller mines". Time has proven the first half of that statement true with almost every major miner having undertaken significant divestment of active and development projects. Just this month AngloAmerican divested its niobium and phosphate assets. The second half, predicting smaller mines, is dependent on the mining industry increasing its internal productivity through innovation and cost control, but also on the geology of critical and strategic minerals, some of which simply do not occur in large, bulk mineable deposits.

The sale of its Brazilian niobium mine by Anglo-American to China Molybdenum demonstrates the potential in this space, where steel additives such as niobium, molybdenum and vanadium become the core of specialist mining and metals businesses rather than a small appendix to a larger corporate body.

Agile, transparent mining houses with profitable mines designed for this era will not need to support 'diplomatic overhead'

A 6Mt per annum mine, such as Mount Peake at full production, is still an industrial scale minerals operation and will benefit from the efficiencies provided by large mechanised plant, but it doesn't require its own dedicated rail network or port. Its operations don't need a cadre of apparatchiks engaged in pseudo-diplomatic negotiations that try to define national economies for decades. That kind of

infrastructure and diplomatic overhead is expensive, and in the new era of supply chain transparency[4] could carry both real and perceived risks.

TNG's Mount Peake can make a good profit without having to dominate on a global scale and it can do so through its fundamental innovation and forward-looking product lines.

We note with some interest that recent reports by both E&Y[5] and Deloitte[6] now recognize the pressures on miners to structure operations at a scale where bureaucracy is minimised and innovation can be pursued more aggressively.

Conclusion

Some miners are 'old school, pile it high and sell it cheap' by design, but others are very much plays for the future. Robust multi-product mines, with innovation at their core, can be profitable at very much smaller scales than the previous era's mega mines, but we must see past innovation risk in this conservative industry and find aspects within mines, metal refineries and recycling streams, that benefit from high tech agility.

In the UK's context, mining is no longer synonymous with coal mining and we can start to see the endeavour for what it now is; a modern, global industry at the cutting edge of technology. You are now as likely to meet a Professor of Virtual Reality or Robotics in the mining departments of UK universities as one specialising in coal extraction.

Recycling is only a threat to incumbent mineral producers whose business models are predicated on fresh material use only, but most recycling streams have consumable resource requirements, even if they are only in terms of additional energy supply. Seeing recycling as an opportunity for new business models rather than simply as a threat will see a new generation of agile miners succeed.

To be blunt, substitution risk (the chance that the ore being mined will stop being needed within the lifetime of a mine) is something that miners who just dig can't do much about. However mineral processors and metal refiners can develop new processes and products if they understand the innovation landscapes they inhabit. Only three mined resources have ever really gone out of mass use, flint, asbestos and arsenic, with mercury now starting its slow exit from industrial systems thanks to a global treaty.

TNG is positioned to provide for both sides of the evolving steel-making equation; ferrovanadium and pig iron for easy use in Electric Arc Furnaces that fit in more flexibly with local and distributed energy systems, and vanadium pentoxide to help that next generation of energy infrastructure operate at maximum efficiency. Its remaining product, titanium dioxide, may be used in lightweight vehicles, solar cells

[4] http://www.minister.industry.gov.au/ministers/frydenberg/media-releases/increasing-transparency global-resources-sector

[5] http://www.ey.com/GL/en/Industries/Mining---Metals/EY-productivity-in-mining-now-comes-the-hard-part

[6] http://www2.deloitte.com/global/en/pages/energy-and-resources/articles/key-issues-facing-mining-sector.html

or reflective paints, but until the agreements to cover its sale are signed we can't know.

Fundamentally the Mount Peake project is being built as forward-looking and innovative, to provide strategic metals to key growth industries and open the way for new technologies waiting in the wings. TNG's TiVAN™ processing technology has advantages in cost, energy consumption and waste disposal when weighed against the incumbent sources of three vital metals, so the recent agreements with one of the world's leading processing plant designers and builders, SMS Group, opens the door for those advantages to be leveraged around the world. Partnership with the European engineer brings with it the potential for might and expertise of the German export bank to support a wider global roll-out of the technology, so long as the plants themselves are designed and pre-fabricated in Germany of course.

These are really tough times for steel makers around the world, but whatever the political choices made by Western governments regarding specific native steel production capacity, in the end steel production is a growth industry that TNG should benefit from, even if some countries decide to let their blast furnaces go cold. Asia's blast furnaces will undoubtedly be the destination for much, if not most, of Mount Peake's vanadium but we shouldn't discount secondary steel production as a consumer of its pig iron and a positive force within the markets of both titanium and vanadium.

In the future the potential for steel upcycling, through the addition of alloying materials, and energy storage, via flow battery technology, strongly suggest demand growth for two of Mount Peake's product lines (vanadium and iron) and potential upwards price pressure on its third (titanium dioxide).

TNG's rise into the S&P ASX All Ordinaries should bring it into the cross hairs of a more varied range of institutions. Its steady progress towards finance and then production continue against the tide in the mining world, but tides turn.

Notes

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