BNP EQUITIES PRIVATE (AUSTRALIA) LIMITED

(INCORPORATING ABS WHITE & CO)

ACN 003 307 873

Austpac Resources N.L (APG)

Buy

$0.13

Risk: High

APG achieves technological breakthrough in the treatment of ilmenites

Tuesday, 21 March 2000
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Issued Shares	**320m**
Market Cap	**$41.6m**
Cash	**$0.5m**
Debt	**nil**

- ***Austpac Resources (APG) is set to commercialise its technological breakthrough in the mineral sands market.***
- ***Licences have already been granted to leading mineral sands players, Iscor. APG is set to advance its own project in India.***
- ***Low projected operating and capital costs could leave APG's technology as the preferred route.***
- ***We expect APG's technology will be successfully commercialised. With a market capitalisation of $41m APG offers substantial upside over the medium term.***
- ***Buy: We recommend APG as a Buy, but recognise this investment is high risk.***

APG patented ERMS process can create synthetic rutile feedstock from previously unusable or sub-economic deposits of ilmenite

APG's principal aim is to rapidly progress the commercialisation of its patented Enhanced Roasting and Magnetic Separation (ERMS) process and Enhanced Acid Regeneration System (EARS). ERMS roasting and leaching process enables the upgrading of a wide range of ilmenite types (including current sub-economic resources) to produce high grade synthetic rutile feedstocks for use in chloride plants to produce titanium dioxide (TiO_2) pigments and metal. TiO_2 pigment is the brilliant white pigment used in the paint and plastic industries.

An emerging significant synthetic rutile producer in the making using its proven ERMS technology

- **Opinion:** APG has successfully treated over 60 types of ilmenite using its patented ERMS technology to produce high quality synthetic rutile. The company has successfully entered into licence agreements with Iscor Limited of South Africa to use APG's ERMS and EARS technology. In August 1999, APG and Indian Rare Earths (IRE) reached an agreement on the commercial parameters for the development and operation of a 10ktpa start-up plant adjacent to the existing Orissa Sands Complex (OSCOM) facilities. If successful a 100ktpa processing facility is expected to be constructed. The potential for APG to exploit mineral sands resources in India and elsewhere is significant. We regard this investment as speculative but the company has demonstrated at its pilot plant in Newcastle that it can produce high grade synthetic rutile from ilmenite samples using its ERMS technology and have no reason to believe it will not be successful on a commercial scale.

Enormous potential exists to exploit mineral sands resources in India

Titanium dioxide market

- Titanium occurs as an oxide in a number of minerals, the most commercially important of which are ilmenite and rutile. These minerals are used to produce titanium metal and titanium pigment.
- The primary use of titanium is in the oxide form, TiO_2. The value of the TiO_2 market is currently US$7.0 billion per year and grows on average by 3%pa. The paint industry is the largest user accounting for roughly 55% of the world TiO_2 pigment production. The paper and plastics industries account for approximately 25% and 15% respectively.

The paint industry consumes 55% of TiO_2 pigment production

TiO_2 production methods

- There are two commercial methods used to produce TiO_2; the sulphate and chloride routes.

Two methods are used produce TiO_2

- The chloride route was commercialised in 1958 and now accounts for 60% of world production of TiO_2 and is expected to reach 70% by 2010.

The Chloride route now accounts for 60% of production

- Feedstock for the chloride process must already have a high level of TiO_2 in excess of 85%, have low levels of silica, alkaline earth oxides and only trace amounts of heavy metals such as chromium and vanadium.

Feedstocks for the chloride route require high levels of TiO_2 to produce high grade TiO_2 pigments

Chloride route- feedstocks

- Natural rutile which contains 92%-97% TiO_2,
- Synthetic rutile containing 88%-95% TiO_2, which is produced from ilmenite using either the Becher or Benilite process, and
- Titania slags which contain 80%-86% TiO_2, which are produced from ilmenite by electro-smelting

- Substantial resources of ilmenite are available worldwide. However, ilmenite concentrates produced from heavy mineral deposits have historically not been suitable for synthetic rutile production because they are chrome-rich or have high levels of silica and other impurities.

Substantial resources of ilmenite are available but a large proportion are sub-economic

- APG's ERMS technology can produce suitable feedstock from many of these sub-economic deposits of ilmenite.

ERMS technology a potential break through

Ilmenite upgrade technologies

- Titania slag production is limited to countries with low energy costs. Slags contain 80%-86% TiO_2.
- The Becher process reduces ilmenite by roasting at high temperatures (>1100^{o}C) to metallise the iron, which is removed by oxidising in dilute ammonium chloride solution. The leached product is further purified with a sulphuric acid wash to produce a synthetic rutile containing 90%-93% TiO_2. This process is used to treat ilmenite produced by Ticor (TOR) and Iluka Resources (ILU) in WA.

Both ILU and TOR use the Becher process to upgrade ilmenite to synthetic rutile

- The Benilite process subjects ilmenite to a six hour reduction roast in a rotary kiln at 800^{o}C, followed by a multi-stage hydrochloric acid leach under pressure with a cycle of 12 hours or more. The leached product is calcined to produce a synthetic rutile containing 90%-95% TiO_2. The

Malaysian Titanium Corporation use the Benelite process

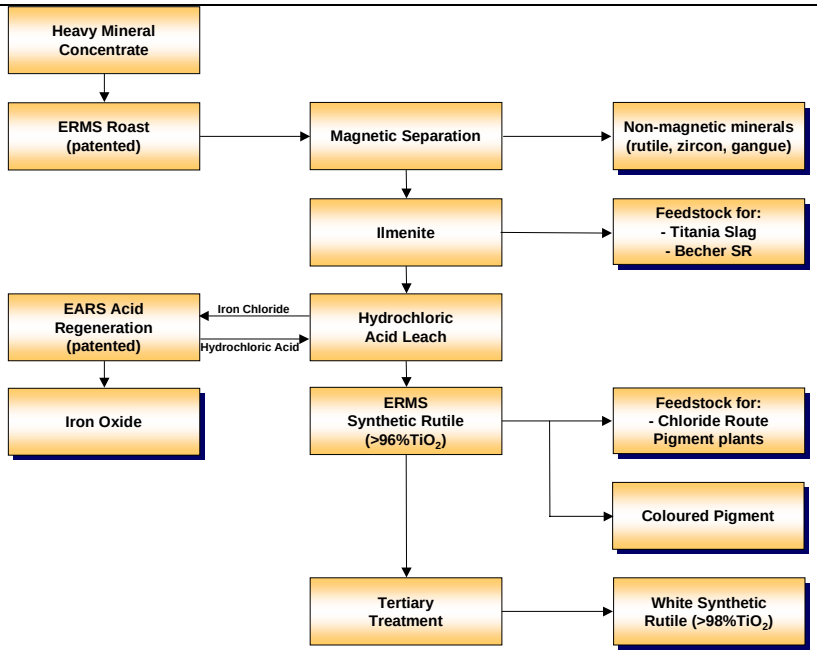
Benilite process is used by Malaysian Titanium Corporation at Ipoh in Malaysia.

Austpac's ERMS process

APG has successfully developed the ERMS and EARS technology to upgrade ilmenite to high grade synthetic rutile

- APG has successfully developed new mineral processing technology enabling the upgrade of ilmenite to a high grade synthetic rutile (96%-98% TiO_2) feedstock ideal for the manufacture of TiO_2 pigment. The technology processes used are Enhanced Roasting & Magnetic Separation (ERMS) and Enhanced Acid Regeneration System (EARS). The technologies which have been developed and patented by APG have tremendous potential.
- Chart 1 below shows the ERMS process flowsheet incorporating the EARS technology.

Chart 1: ERMS & EARS process flowsheet



Source: APG prospectus (30 March 1999)

Low cost acid re-generation crucial

- The key to the economic viability of acid leach synthetic rutile processes, such as ERMS, is low cost acid regeneration.

Comparative advantage of ERMS

ERMS pilot plant work has produced high grade synthetic rutile from over 60 different ilmenities

- The Newcastle ERMS pilot plant has demonstrated that high grade synthetic rutile feedstocks for use in chloride plants can be produced from a wide range of ilmenites. The company has tested over 60 ilmenites over a wide range of quality and in all cases has produced a good synthetic rutile (TiO_2 of >96%).
- The ERMS process has the following advantages over alternative methods of beneficiating ilmenite:
  - High recoveries of ilmenite,
  - efficient separation from contaminant minerals,

- ERMS does not require elevated roasting temperatures or pressures in the leaching process,
- the process is environmentally friendly and end-products are free of radioactivity associated with some alternative process,
- synthetic rutile produced has a grade >96% TiO_2, which is higher than the Becher (88%-93% TiO_2) or Benilite (90%-95% TiO_2) processes, and
- comparative capital and operating cost advantages (see table 1)

Table 1: Competitive advantage

Process	TiO_2 content (%)	Capital cost[1] (US$/t)	Operating cost[2] (US$/t)
Becher[3]	88-93	400	110-140
Benilite[4]	90-95	620	180
ERMS	96-98	400	120

Source: APG prospectus(30 March 1999)

[1]US$/t of installed synthetic rutile capacity (on 100ktpa plant)

[2]US$/t cost to produce synthetic rutile, including acid regeneration but excluding ilmenite costs

[3]Requires ilmenite grade >57% TiO_2 and Collie WA coal

[4]No Benilite plants have been built in the last ten years

- The ERMS process is very competitive with the Becher process on capital and operating cost basis. The advantage with ERMS is that it can treat ilmenite with TiO_2 grades <57%.

ERMS technology very competitive against other processes

Austpac's EARS process

- The manufacture of synthetic rutile by leaching requires large volumes of Hydrochloric acid (HCl). A by-product of this process is large quantities of iron chloride which can be regenerated to produce HCl. Current commercial regeneration processes require iron chloride solution to be heated to 800°C in a pyrohydrolysis reactor, so regenerating HCl acid. Large amounts of energy are required to superheat a reactor to remove water from the chloride solution. The cost of acid is crucial to the synthetic rutile process economics. Cheap sources of acid are essential to the economics of producing synthetic rutile.

Significant quantities of HCl acid are required to produce synthetic rutile

Cost of acid is crucial to process economics

- The EARS process is based on evaporating the waste solutions at low temperatures to form iron chloride pellets, which are fed into the pyrohydrolysis reactor to regenerate HCl. The EARS system uses simple low temperature pelletising equipment in conjunction with a much smaller reactor. Pilot testing of the technology at the Newcastle plant indicates that this technology could potentially halve the capital cost significantly reduce the operating cost of acid re-generation.

APG's acid re-generation technology EARS could potentially halve capital and operating costs compared to similar systems

Business development opportunities

- The company is moving expeditiously to commercialise these technologies. To date the company has two major initiatives in place to commercialise its technology. These include:

Rapidly moving to commercialise ERMS and EARS

South Africa

- In 1998 the company signed two licence agreements with Iscor, a steel and mineral sands producer. The licences are for both the ERMS and EARS technologies. The licence agreements followed extensive testing over the past two years by Iscor.

Licence agreements signed with Iscor to use ERMS and EARS

- The technologies will be used in conjunction with Iscor's US$300m Heavy Minerals project which includes a mine, mineral separation plant and a 250ktpa titania slag smelter at Empangeni, near Richards bay in KwaZulu-Natal province, South Africa.

Technologies to be used in conjunction with Iscor's heavy minerals project nears Richards Bay in South Africa

India

- India's mineral resources are among the largest and least exploited in the world today. The country has a resource base of 278m tonnes of ilmenite or 20% of the world's known ilmenite. It is believed that half of these resources are available for mining and that the deposits contain 20%-30% heavy minerals. Ilmenite constitutes up to 50% of the heavy minerals.

India's mineral sands deposits are among the largest and least exploited in the world

- Over 80% of India's ilmenite occurs along the east coast in Tamil Nadu, Andhra Pradesh and Orissa states. Ilmenite contained in these deposits grades 50%-53% TiO_2 which is suitable feedstock for upgrading by acid leach but are uneconomic for the Becher process used by ILU and TOR.

Significant proportion of India's ilmenite resources are unsuitable for the Becher process

- The ERMS process is ideal for treating Indian ilmenite.

ERMS is ideal process

- The Indian Government mineral sands policy is to value add. This requires that ilmenite be upgraded to either synthetic rutile or TiO_2 pigment. The Government would like to develop a world class TiO_2 industry based on its vast resource base.

Indian government requires mineral sands to be valued added

Commercial agreement

- Indian Rare Earths (IRE) is the government owned agency which controls most of the mineral sands operations in India. IRE became interested in the ERMS process in 1997 when it was demonstrated the technology could produce high grade synthetic rutile from ilmenite from three very large deposits controlled by IRE on the east coast of India. The deposits have an aggregate resource base of 120mt of ilmenite, or 8% of the world's known ilmenite.

IRE became interested in ERMS in 1997 when it was demonstrated the ERMS technology could produce high grade synthetic rutile

- In mid 1998 Austpac and IRE agreed to investigate the feasibility of establishing an ERMS 10ktpa synthetic rutile plant in India using the existing ilmenite acid regeneration facilities at OSCOM.

IRE investigate the possibility of developing a 10ktpa plant

- By April 1999, Austpac and IRE had reached agreement on the commercial parameters for the development and operation of a 10ktpa start-up plant adjacent to the existing OSCOM facilities. If the start-up plant is successful, then a 100ktpa plant is expected to be constructed.

APG and IRE reach agreement on the commercial parameters to develop 10ktpa start-up plant

- In August 1999, a definitive joint venture agreement with APG and IRE was signed called AusRutile India Pvte Ltd. Equity is split APG 74% and IRE 26%. AusRutile will construct and manage the plant.

Definitive joint venture agreement signed with APG and IRE

Stage I: 10ktpa ERMS synthetic rutile plant at Orissa India

- This operation is expected to use existing ilmenite production and acid regeneration facilities at OSCOM to support the operation.

Stage I to use acid regeneration facilities at OSCOM

- Construction of the plant is expected from mid-2000 subject to finance. The capital cost of the project is estimated at US$5.3m. Production is expected to commence by mid 2001. Table 1 shows a summary of operating parameters.

Plant construction expected to commence mid 2000

Table 1: Stage 1 economics

Capital Cost incl working capital	US$5.3m
Operating costs	US$360/t
Synthetic Rutile	US$500/t
Revenue after commissioning (US$m)	5.0
Operating costs (US$m)	3.6
Depreciation (US$m)	0.3
EBIT (US$m)	1.1
APG share (74%)	0.8
EBIT Margin (%)	22
Tax 35% after year 6 (US$m)	0.4
NPAT (US$m)	0.7
APG's share (74%)	0.5
Ungeared IRR	18%

Source: BNPP & APG

- APG will need to raise approximately US$5.3m for project development and working capital.

$5.3m required to develop Stage I

- EBIT margin even on this small operation is 22%. IRR has been estimated at 18%.

EBIT margin strong at 18%

Stage 2: 100ktpa ERMS and EARS plant

- Project economics improve substantially with a plant 10 times the size. Engineering studies have indicated that a small 10ktpa greenfields ERMS plant & EARS acid regeneration facility, would not be financially attractive in the long term. Production capacity of at least 25ktpa would be required to be economic. Table 2 summaries the operating parameters for the full scale operation.

Project economics improve significantly with large plant incorporating acid regeneration EARS technology

Table 2: Stage 2 economics

Capital Cost incl working capital	US$50m
Operating costs	US$282/t
Synthetic Rutile	US$500/t
Revenue after commissioning (US$m)	50.0
Operating costs (US$m)	28.2
Other costs (US$m)	1.5
Depreciation (US$m)	3.0
EBIT (US$m)	17.3
APG's share (74%)	12.8
EBIT Margin (%)	35
Tax 35% after year 6 (US$m)	6.1
NPAT (US$m)	11.2
APG's share (74%)	8.3
Ungeared IRR	40%

Source: BNPP & APG

EBIT margins of 35% possible compared to 22% for Stage I

- The economics of this project are far superior. The project generates EBIT margins of 35% compared to 22% for the Stage I project. Profits could be forecast at US$11.2m before financing costs.
- Project IRR is very robust at 40%.

Other projects

Murray Basin

Potential to utilise ERMS in Murray Basin

- A number of companies including ILU have discovered heavy mineral sands deposits in the Murray Basin in Australia. The "strand line" of coarser grained deposits contain valuable heavy minerals, rutile and zircon as well as high-grade ilmenite >60% TiO_2. Test work at continuous pilot plant scale has demonstrated that, using the ERMS process, high grade low ilmenite can be produced from chrome-rich high TiO_2 ilmenite concentrate. APG is well placed to possibly participate in the development of these assets.

Corporate

Funds required for Stage I which is well advanced

- APG has completed a number of placements over the past couple months raising $1.45m. The current cash position of the company is around $0.5m. Further capital will be required to sustain operations of the company. We understand funding for the AusRutile Stage I project is well advanced.

Recommendation

Speculative Buy

- The company is progressing well with development and commercialisation of its patented ERMS and EARS technologies to treat ilmenite. The recent signing of an agreement with IRE is a major breakthrough and opens enormous potential for the company to treat vast ilmenite resources in India. This investment is speculative but we recommend purchase for exposure to an emerging mineral sands producer in India using demonstrated new ERMS and EARS technology.

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