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Memo to: Angela Lorrigan
Principal Geologist, Zinifex Australia Limited

From: Gerald Purvis
Consultant Geologist, JG Purvis & Associates Pty. Limited

Date: 19th December 2004

Re: ***REVIEW OF MAIN CREEK MAGNESITE DEPOSITS NEAR SAVAGE RIVER, TASMANIA - INTERIM REPORT***

Angela,

KEY CONCLUSIONS

1. The **55 million tonne** magnesite resource at Main and Bowry creeks is **high grade (+43% MgO)** and of **high purity** by world standards.

2. No work is needed in the immediate future to clarify or upgrade the **40% Indicated 60% Inferred** status of the resource. In excess of 10,000m of core drilling has determined there is **sufficient magnesite in sight to feed an 80,000 tpa magnesium smelter for 100 years.**

3. **No impediments to underground mining** are evident. Economic transport of magnesite from minesite to a port or smelter could be more of a problem. The existing Savage River pipeline to Port Latta may become available.

4. MRT's verbal threat to **resume the tenements** covering the resource needs to be clarified officially by Zinifex management as soon as possible.

5. The world magnesium market is dominated by **rising exports of cheap metal from China** which produces 50% of world total. This dominance has depressed prices and put a sharp brake on major Western magnesium producers and new developments world-wide. **How long China can maintain cheap production in the face of rising energy prices is a critical question.**

6. Overall, **magnesium use is rising** because it is lighter and stronger than aluminium, with which it is commonly alloyed. Use in vehicle manufacture is an important area of growth.

7. **It is concluded exploitation of the Main Creek magnesite is almost wholly dependant on the viability of the associated smelting operation and/or the cost of transporting magnesite from the minesite.**

KEY TECHNICAL POINTS:

- The Main Creek (north) and Bowry Creek (south) deposits lie 1000m apart along strike within a 200-400m wide Carbonate Sequence. The Savage River Mine (magnetite) is in the hangingwall stratigraphy 6 km to the NE.

- The magnesite occurs as stacked near-vertical lenses within the Carbonate Sequence. Resource figures are based on lenses with 10m minimum horizontal width, >40% MgO and <3% CaO. There are 4 main lens positions within a thick envelope of variably-dolomitic magnesite.

- The resource totals at least 55 million tonnes to 300m depth below a 10-20m weathered zone. Golden Triangle's drill-based figures are as follows:

  Indicated:
  Main Creek 23.76 mmt @ 44.03% MgO, 2.33% CaO, 1.80% SiO2, 1.36% Fe2O3

  Inferred:
  Bowry Creek 23.1 mmt @ 42.64% MgO, 2.24% CaO, 2.93% SiO2, 2.32% Fe2O3

  Total: **46.86 mmt @ 43.34% MgO, 2.29% CaO, 2.36% SiO2, 1.83% Fe2O3**

  To this can be added my tonnage calculations of potential resource extensions in zones identified by Golden Triangle, to 300m depth:

  Inferred:
  Main Creek 9.1 mmt @ 43-45% MgO

- This is sufficient to supply an 80,000 tpa magnesium smelter for 100 years.

  (Such a smelter requires 400,000t of high grade magnesite feed annually. The calculation assumes 80% extraction of the Indicated resource and 60% of the Inferred, as allowed for by Golden Triangle).

- The magnesite is high grade, averaging in excess of 43% MgO (pure magnesite is 47.8% MgO). It is low in important impurities: CaO (2.3%), SiO2 (2.3%) and Fe2O3 (1.8%).

- Testwork in Canada showed trace element impurities (B, Ni, Cr, Al, S, Zn, Cu) are also low to very low, and that the magnesite is an attractive feedstock for the normal Alcan smelting process.

- Golden Triangle spent over $2 million and their work is of a high standard. However, checks on the data plotting and ore block interpretations are suggested if the project is taken further as some discrepancies were noted.

- More drilling and some underground development would be required before a final mining feasibility study could be undertaken.

- The minimum 10m horizontal width of the magnesite lenses makes them suitable for bulk mechanized cut and fill underground mining. Golden Triangle concluded ground conditions would be generally good. Water inflows could be expected and occasional solution cavities in the upper 100m. The upper 10-20m (maximum 40m) of magnesite is weathered to Fe-rich clays.

- The resource lies in rugged forested country cut by sizeable creeks and served by 4WD tracks. Rainfall is 2 metres pa. There is an unsealed public road <1.5km to east and the Savage River Mine infrastructure (sealed road, town, pipeline, power), 5km to the NE. The Savage River pipeline to Port Latta on the NW Coast may be available to transport magnesite, especially if the Savage River Mine closes in the next few years as is possible.

- Studies by Golden Triangle and others have shown that a new magnesium smelter is a huge complex project costing between A$500 million and A$1 billion. Equally important as a large high-grade quality Mg source to such a smelter are factors such as cheap bulk power supply, gas supply, port and proximity to an aluminium smelter (molten aluminium is used in the process and to make Mg-Al alloys on site). Bell Bay is the obvious site in Tasmania.

KEY NON-TECHNICAL FACTORS

Tenure

- Mineral Resources Tasmania are presently considering whether to grant the request by Savage Resources/Pasminco for the six Mining Leases covering the magnesite to be amalgamated into single consolidated ML 4/2004 of 647 ha. The term and conditions of a consolidated ML have not been decided.

- The ML's are partially flanked north, west and south by Pasminco's Retention Licence 2/1988 of 4 sq km. Part of the Main Creek Indicated resource lies on the RL.

- Initially I was told by MRT that the amalgamation process was held up pending transfer and lodgement of the performance bond. They were pleased there was going to be some action on the tenements.

- However, later their line hardened and I was informed verbally by the Mining Registrar, Dennis Burgess, that the amalgamation was in limbo as the Department considered its options and that amalgamation was unlikely to be

recommended. I was told the Director, Tony Brown, was taking a hard line on the matter and it was *"very possible"* they will resume the ML's and put the resource out to tender.

- The magnesite resource lies within the Tarkine Wilderness Area Application to the Australian Heritage Commission for listing on the Register of the National Estate (Federal Government jurisdiction). According to Dennis Burgess this does not change anything or make a mine less likely to be approved as such approval is a State Government responsibility. The State regards it as Conservation Area in which mining is allowed (and currently takes place).

- In the Tarkine Wilderness Application specific mention is made of karst development in magnesite: "the magnesite karst in the Savage River area is a very rare formation on a global scale". Most of this occurs in the Lyons and Arthur River deposits, north of Savage River. The known karst areas at Main Creek are very small and only one (<1000 sq m) is within the resource area. It would probably not be affected by underground mine development.

  The Tarkine Application injects a small note of caution into the tenure situation at the magnesite resource.

Gerald Purvis.

Consultant Geologist

Launceston, 19th December 2004

(5 appendicies and letter attached)

APPENDIX 1

WORLD MAGNESIUM INDUSTRY[1]

Useage

Magnesium's main uses are in aluminium alloys (36%), die-castings (41%), and as a deoxidizing and desulphurizing agent in iron and steel manufacture (14%) (2002 figures). The die castings are increasingly used in vehicle manufacture due to weight savings of 33% compared to aluminium. Because of magnesium's superior stiffness and other properties these weight savings can be achieved without compromising strength. In vehicles however, magnesium still faces stiff competition from aluminium, steel and plastics. Chemical applications of magnesium include in pharmaceuticals, perfumes and pyrotechnics.

There is active research taking place into alloy development which is expected to increase the use of magnesium.

Price

Overall, the demand for magnesium is rising and the price falling. Between 1996 and 2002 the spot price fell from US$4,120/t to US$2,550/t. The major factor in the price fall has been rapidly rising exports of cheap magnesium from China – their export price at the end of 2002 was US$1,320/t, compared to the free market price of US$1,930/t.

Production (Primary)

With the exception of Canada, the rise of Chinese production has put a sharp brake on major non-Chinese magnesium producers and new developments world-wide. Several Western producers closed in 2002.

Country	*1995*	*Rank*	*2002*	*Rank*
USA	142,000t	1	35,000t	4
China	60,000t	2	234,700t	1
Russia	51,000t	3	52,000t	3
Canada	42,000t	4	86,000t	2
World Total	372,000t		470,700t	

About 77% (180,000t) of Chinese production was exported in 2002. China produces magnesium from the silicothermic Pidgeon process, in which calcined dolomite is mixed with ferrosilicon and briquetted. This is then smelted in a coal-fired furnace to release magnesium vapour which is condensed to the metal. The method is considered obsolete by Western standards as it is very labour intensive.

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[1] Much of the information in this section is taken from (i) Brown, R. (2003): Magnesium. *Mining Annual Review 2000*. (ii) Wagner, W. (2000): Magnesium. 1999 Summary of Canadian Production and Forecast. *Natural Resources Canada, December 2000.*

However, the capital costs per tonne of installed capacity in China are apparently 10% or less of those of Western plants, and the operating costs (US$0.55 - $0.65/lb) comparable with lowest-quartile Western plants. The largest Chinese facilities have a capacity of 20,000tpa compared to 60-80,000tpa for the larger Western ones. A weak link in the Chinese method is that ferrosilicon production is power-intensive.

In 2002 total Chinese production *capacity* was estimated at 500,000tpa of which up to 350,000tpa was considered likely to be very cost competitive.

Sources

Outside China magnesium is produced from a variety of feedstocks. These include brines, which in 2002 accounted for 100% of USA (35,000t) and Israeli (34,000t) production, serpentinite and magnesite. *In 2002 less than 500,000t of magnesite was used to make magnesium worldwide*. Of this, 200,000t fed Norsk Hydro's Canadian plant with the high-purity natural magnesite coming from China (50%), Spain and Australia (the QMAG project at Kunwarara in Queensland).

Future

How long the Chinese can maintain cheap production in the face of rising energy prices would seem to be a critical factor for the future of the magnesium market. In late 2002 the rising cost of Chinese production was starting to become apparent with a slight increase in Chinese prices.

APPENDIX 2

WORLD MAGNESITE & MAGNESIA PRODUCTION[2]

In 2002 world production of natural magnesite (MgCO3) was 20 million tonnes, with 10 million tonnes from China. Australia was ranked 7th with 540,000t. China exported 98,000t of magnesite to the Norsk Hydro Mg smelter in Canada.

Over 98% of world magnesite production is converted to magnesia (MgO). In 2002 MgO production totalled 7.85 mmt of which 6.85 mmt came from magnesite (natural magnesia) and 1 mmt from brines/seawater (synthetic magnesia). China produced 3.6 mmt MgO from 10 mmt of magnesite. In 2002 less than 500,000t of raw magnesite was used to make magnesium metal worldwide.

75% of magnesia is used in refractories for furnace linings in the iron/steel, non-ferrous metals, cement and glass industries. The remaining 25% is used in agriculture, insulation and water purification. MgO prices depend on purity. May 2003 prices ranged from US$240/t for first-grade dead-burned magnesia to US$650/t for top-grade electrofused magnesia.

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[2] This data largely from Coope, B. 2003: Magnesite/Magnesia. Mining Annual Review 2003

APPENDIX 3

AUSTRALIAN MAGNESITE / MAGNESIUM INDUSTRY

In the mid to late 1990's there was a flurry of interest in magnesium production in Australia with no less than *"nine magnesium projects in some form of study or development at the start of 2001"* (Brown, 2003). These included:

- **QMAG Project, Stanwell, Qld** – 97,000 tpa smelter & mine, based on the Kunwarara magnesite resource (400 mmt Indicated contained magnesite).

  Status: *Smelter project terminated June 2003 after construction, because of low Mg metal prices. Mine still producing beneficiated magnesite at 450,000tpa, some for export for Mg metal production in Canada.*

- **SAMAG Project, Port Pirie, SA** – 52,500 tpa smelter & mine, based on magnesite deposits at Leigh Creek (Hutton/Mt Playfair: 100 mmt @ 42.8% MgO, Measured reserve 32 mmt. Total Inferred resource 474 mmt).

  Status: *Project written off July 2004 before development.*

- **Woodsreef, NSW.** Pacific Magnesium (formerly Golden Triangle). Based on serpentinite tailings at the old asbestos mine (70 mmt @ 38% MgO), suitable to supply 80,000 tpa smelter.

  Status: *No development planned. PM out of funds.*

- **LaTrobe Magnesium, Vic.** 100,000 tpa smelter using brown coal fly-ash produced from existing power generation in Latrobe Valley, Gippsland.

  Status: *Unknown. Production wasn't planned until 2008.*

- **Arthur-Lyons River, Tas.** Crest Resources (now Indcor). 90,000 tpa smelter at Bell Bay & mine based on Indicated Resource of 29 mmt @ +40% $MgCO_3$, 5% SiO_2, in deposits NE of Savage River. [3]

  Status: *Project collapsed in 1999-2000 with withdrawal of major financial backers. Resource currently under option to Mineral Holdings.*

Around 2000 some experts were predicting Australia could be producing 800,000 tpa of magnesium by 2020. They obviously didn't ask the Chinese! *None* of the grandiose plans for Australian magnesium production have come to fruition nor appear likely to in the short term.

[3] Note silica impurity level over twice as high as that at Main / Bowry Creek resource.

APPENDIX 4

PIGMENTS (Savox Project)

80% of the data held at Rosebery relates to Savage Resources' Savox Pigment Project from the 1990's.

Savage sought to produce coloured pigments (yellow, red, brown) from small surficial umber and ochre deposits (one each) in the 10-40m deep paleo-weathering profile of the magnesite, as well as black pigment from the adjacent Long Plains magnetite deposit.

The Savox Project was tiny: estimated capital cost was $4.2 million and pre-tax profit calculated at less than $2 million pa over the 20 year life. Return on investment was estimated at 23%.

The open-pittable resources, as defined by auger drilling and costeaning, are:

Ochre	*47,000t recoverable*
Umber	*11,500t recoverable*
Black Pigment	*122,600t* (magnetite fines ex Long Plains deposit)

Given the project size, the effort Savage put into trying to make it fly is utterly remarkable and seems out of all proportion to the potential reward. *It is a pity they didn't give the magnesite resource the same sort of attention.* The Rosebery boxes are full of countless testwork results and approaches to just about every pigment laboratory, producer, supplier and expert on the planet. In 1993 Savage even sought and got permission from local authorities to run an on-site pigment operation.

Such specialty industrial minerals/products can be notoriously difficult to produce and market. The responses to Savage's enquiries from established players in pigments both in Australia and overseas, made it clear it is a well-supplied industry heavily influenced by synthetic product, with exacting requirements and expert buyers. Natural products such as those intended to be produced by Savox generally suffer from being coarser, harder and of more variable purity than synthetics. Some expert firms warned Savage that their natural product would have trouble matching the competition and could be restricted in its use and price.

Despite their best endeavours Savage couldn't get the project up or sell the concept to established producers. In 1999 Golden Triangle offered just $6,000 for the 3 MLs then covering the ochre, umber and Long Plains magnetite.

If the upper part of the magnesite resources were mined by opencut, it is probable the ochre and umber could be removed and separately stockpiled for on-selling as raw material to a specialist producer. Care would be necessary to avoid contamination of the material. Underground mining of the magnesite would not affect the potential for the ochre and umber to be removed as the material is soft and doesn't require blasting. Care would still be needed to avoid compromising the crown pillar in the magnesite mine. The improved infrastructure might make such ochre/umber removal attractive to a pigment producer.

APPENDIX 5

LONG PLAINS MAGNETITE

This drill-defined magnetite resource also occurs on the Savage Resources/Pasminco ML's in the Main Creek area. The Long Plains resource totals 9.48 mmt @ 44.6% DTR (Davis Tube Recoverable iron oxide), yielding 4.23 mmt of magnetite concentrate. This includes 6.5 mmt @ 51.7% DTR (3.4 mmt magnetite concentrate).

The Long Plains magnetite occurs on a ridge in the hangingwall of the Bowry Creek magnesite resource and in close proximity to it. The magnetite has an easterly dip around 75º and an opencut to mine it would possibly cut into the top of the magnesite.

The Long Plains magnetite lens is the largest known magnetite resource in Tasmania outside the Savage River Mine. It has the same characteristics as the Savage River Mine Central deposit (now mined out).

Savage looked at Long Plains as a source of black pigment for their Savox Project, but realistically the resource only has value if it is treated at the Savage River Mine. It lies 9km SW of the Savage River mill (14 km by road). Australian Bulk Minerals, the owners of Savage River, were approached by Savage Resources in 1997 and later by Pasminco regarding an option, but negotiations collapsed. In 1998 Savage Resources calculated Long Plains would have yielded a $65 million pre-tax profit if it was mined by ABM.

Further drilling would be required to accurately define the Long Plains resource before it could be exploited.

JGP.

Launceston
19th December 2004