

TANTALUM



Provenance and established miners

BY ULRIC SCHWELA

OVER half the world's tantalite production comes from Australia, with Brazil, eastern Canada, China, Ethiopia and central and southern Africa making up the rest. Other significant sources include tin slags from Malaysia and Thailand, as well as recycling of tantalum.

Sons of Gwalia Ltd in Western Australia has been in administration since 2004 and the purchase of the company by Resource Capital Fund IV LP was approved in June 2007. The tantalum resources became part of the newly-formed company Talison Minerals Pty Ltd in August 2007 and continue to be the world's main source of tantalum.

For Ethiopia, tantalum has become the second-most important mineral export earner for the country, and the operator is Ethiopian Mineral Development Sh Co (EMDSC).

The US Defense Logistics Agency (DLA) offered further tantalum materials for sale from the Defense National Stockpile from November 2006, and announced that it had depleted the inventory of tantalum minerals with the sales from that month. The only remaining DLA tantalum stock is understood to be 4,000 lb of tantalum carbide.

PROSPECTIVE MINERS

Tertiary Minerals plc continues development of the Ghurayyah deposit in western Saudi Arabia. After about six months of voluntary share suspension, the company resumed its AIM listing in July 2007.

In Egypt at Abu Dabbab, Gippsland Minerals Ltd has continued work and the mine's scheduled start-up is now set for 2010. The Abu Dabbab project is

Gippsland Minerals at work: Preparing the laydown area on the 440RL at the Abu Dabbab mine in Egypt



TANTALUM: HISTORY

One of the denser natural elements, tantalum is related to niobium and vanadium, and shares many of niobium's chemical and physical characteristics.

Discovered in Sweden over 200 years ago, tantalum was not isolated until 182, and then only as an impure metal.

It was not until 1905 that a pure metal suitable for working was achieved. Its strengths are a high electrical capacitance per unit mass, a high melting point and excellent resistance to chemical attack.

More than 130 species of tantalum/niobium minerals exist, only some of which – tantalite, microlite, wodginite, euxenite, polycrase – are so far being used by the tantalum industry as raw materials. Tantalite, in the form of $(Fe,Mn)(Ta,Nb)_2O_6$, is the most important mineral for tantalum extraction.

expected to produce an average of 650,000 lb/y of tantalum pentoxide (Ta_2O_5) over the first 13 years of an estimated 20-year mine life, placing it in the top tier of tantalum miners in terms of volume.

Angus & Ross plc has two main tantalum projects: Motzfeldt, in southern Greenland; and Caiçara, in Brazil. It also has a number of smaller projects in other parts of Brazil and in Australia.

Noventa has several tantalum projects in Mozambique, of

which the Marropino development began production

this year. The Morrua development is anticipated to begin production in 2009.

Commerce Resources Corp is heavily involved in developing a mining project near Blue River in British Columbia, Canada, including expansion of the Upper Fir carbonatite exploration. A series of drilling programmes indicates a contiguous system accessible from

CONTENTS

Overview	2-3
Map	6-7
Facts about tantalum	11

Profiles:

Angus & Ross plc	4
Commerce Resources Corp	5
Gippsland Minerals Ltd	8
Noventa	9
Talison Minerals Pty Ltd	10

Cover image: Various tantalum projects and properties around the world *Design: T Peters*

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“Tantalum demand appears to have levelled off in 2005-06, after showing a steady rise for the preceding five years”

the surface. In April 2007, the company announced an expanded exploration programme in the area. There are two defined resources but a third recently-discovered resource could prove to be significantly richer than the other two.

In the US, Wasser LLC is looking to develop and mine a tantalum resource in Alabama within the next five years.

In Australia, Queensland Gold and Minerals Ltd has been examining the tantalum mining potential of its Georgetown area, and another Australian company, Magnum Mining and Exploration Ltd has acquired the Tantalite Val-

ley mine in southern Namibia. Haddington Resources Ltd has put its tantalum activities on hold until such time as operating conditions might change.

RAW-MATERIAL BUYERS

The two main tantalum buyers and processors are H C Starck GmbH (with sites in Germany, Thailand, the US and Japan) and Cabot Corp (US and Japan). Other processors include those located in China (Ningxia

MAIN ACTIVE MINES

Name	Country	Owner	Yearly capacity (lb Ta_2O_5)
Wodgina	Australia	Sons of Gwalia – Talison Minerals	1,300,000
Pitinga	Brazil	Parapanema SA	200,000
Tanco	Canada	Cabot Corp	n/a
Yichun, Jiangxi	China	China Minmetals, SASAC	127,000
Kenticha	Ethiopia	EMDSC	120,000
Nanping, Fujian	China	China Minmetals, SASAC	116,000
Mibra	Brazil	Metallurg Group	100,000

PROSPECTIVE MINES

Name	Country	Owner	Reserves* (Mlb Ta ₂ O ₅)
Ghurayyah	Saudi Arabia	Tertiary Minerals	212.00
Nuweibi	Egypt	Gippsland	30.80
Abu Dabbab	Egypt	Gippsland	**7.25, 15.00
Motzfeldt	Greenland	Angus & Ross	16.50
Suzhou, Jiangxi	China		14.80
Xianghualing, Hunan	China		12.20
Boluo, Guangdong	China		12.00
Morrúa	Mozambique	Noventa	7.90
Jinzhunong, Hunan	China		6.80
Hengfeng, Jiangxi	China		6.60
Marropino	Mozambique	Noventa	5.70
Fir	Canada	Commerce Resources	5.50
Limu Shuiximao, Guangxi	China		4.80
Mt Deans	Australia	Haddington Resources	4.30
Keketuohai, Xinjiang	China		2.30
Verity	Canada	Commerce Resources	1.50
McAllister, Alabama	US	Wasser LLC	1.20
Aletai, Xinjiang	China		0.66
Rosendal	Finland	Tertiary Minerals	0.59
Binneringie	Australia	Haddington Resources	0.50
Bald Hill	Australia	Haddington Resources	0.24
Limu Naofudou, Guangxi	China		0.22
Caiçara	Brazil	Angus & Ross	**0.16

* Indicated, inferred or preliminary, unless otherwise noted. ** Measured or proven



Geologist sampling at Commerce Resources' Fir property

Non-ferrous Metals Import and Export Corp, Jiujiang Tanbre Smelter, Jiujiang Jinxin Non-ferrous Metals Co Ltd and others), Estonia (AS Silmet), Japan (Mitsui Mining & Smelting Co Ltd), Kazakhstan (NAC Kazatom-prom) and Russia (Solikamsk Magnesium Works).

Most tantalum-bearing raw materials are sold on long-term contracts and some spot market activity exists in addition to this. Prices are a matter of negotiation between buyer and seller and are not made public. There are no official or published prices, as tantalum is not traded on any metal exchange.

This year, Kazatomprom resumed production of tantalum after a period of inactivity in that sector and aims to concentrate on materials for the manufacture of capacitors.

In February 2007, the process of H C Starck being sold by its parent company, Bayer, was completed: two investment companies, Advent International and The Carlyle Group, took over H C Starck.

USES

About half of the tantalum consumed each year is used in the electronics industry, mainly as powder and wire for capacitors, owing to tantalum's particular ability to store and release electrical energy. This allows components to be exceptionally small and they are therefore favoured in space-sensitive high-end applications in telecommunications, data storage and implantable medical devices such as auto-defibrillators and cochlear implants. Tantalum is also used for electronic sound filters and as a barrier against copper diffusion in semi-conductors. Tantalum carbide's hardness makes it ideal for cutting tools.



View of the pit at Noventa's Marropino mine

TANTALUM PRIMARY PRODUCTION*

Category	2002	2003	2004	2005	2006
Tin slag	350	353	549	504	475
Ta concentrate	2,796	2,703	3,106	3,004	1,692
Other concentrates (columbite, struverite)	310	244	189	221	384
Total	3,456	3,300	3,844	3,729	2,551

* ('000 lb Ta₂O₅ contained)

“About half of the tantalum consumed each year is used in the electronics industry”

Tantalum is highly biocompatible. Its low mechanical strength means it is generally used as a coating on stronger substrates, such as stainless steel.

Applications range from stents supporting blood vessels to plates, bone replacements, suture clips and wire.

Tantalum also goes into the manufacture of superalloys, imparting strength and high-temperature resistance against cracking, for use in aerospace and

energy generation. The use of noble metals in the aircraft industry is assured for the foreseeable future as they cannot easily be substituted once they are engineered and tested in to the designs. Its corrosion resistance makes tantalum useful in the chemical industry, generally as a lining to pipes, tanks and vessels.

Tantalum oxide increases the refractive index in lens glasses. There is a wealth of uses for this metal.

SUMMARY

The recent closure of the underground mine at Greenbushes in Australia has affected the primary Ta concentrate production figure for 2006.

Tantalum supply remains sufficient to satisfy demand owing to a number of factors, including the continuing stocks held by downstream industries and by some processors supplementing their supply by sourcing material directly from smaller producers.

Tantalum demand appears to have levelled off in 2005-06, after showing a steady rise for the preceding five years. This can chiefly be attributed

to the traditional long-term contracts between producers and processors being discontinued and the processors seeking to reduce their stock levels.

Demand for capacitor-grade tantalum powder continues to rise slowly and it reached an all-time high of over 2 Mlb of Ta₂O₅ contained in 2006, yet this only represents 37% of the total consumption of tantalum, the lowest level for the past five years. The greatest increase has been shown by mill products of tantalum, now more than double the amount in 2002 and a high of 20% of the total.

Angus & Ross explores for tantalum on three continents

The company is in discussion with third parties regarding the development of its Motzfeldt Complex prospect in Greenland



Sample preparation

ANGUS & Ross plc, formed in 1999 and accepted on to London's AIM market in 2001, originally targeted tantalum exploration and development in Ireland and Greenland.

While, today, the company is focused on reopening the Black Angel zinc-lead mine in Greenland and gold exploration in Brazil, it does retain an interesting portfolio of tantalum prospects.

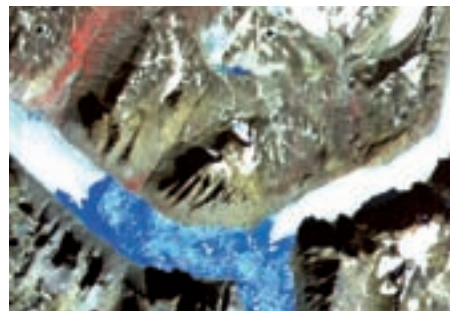
The company has the advantage over other tantalum-exploration companies in that US-based Cabot Corp, the world's leading tantalum processor, is a significant shareholder.

The largest, potential resource in Angus & Ross' portfolio remains the niobium-tantalum deposit at the Motzfeldt Complex in southern Greenland. Originally discovered in 1984 by the Greenland Geological Survey, it was subsequently estimated to contain a resource of 500 Mt, grading 250 g/t Ta₂O₅ and 700 ppm Nb₂O₅.

In 2000, the company was awarded the licence for the deposit, which was the subject of an extensive exploration programme in 2001 and 2002, including 1,622 m of diamond drilling. Independent consultants Behre Dolbear concluded, within the relatively small portion of the deposit investigated, "a 'preliminary' resource of 15 Mt, with an average grade in excess of 500 ppm Ta₂O₅, and 6,000 ppm Nb₂O₅ is a wholly realistic target that is likely to be achieved".

This resource target is the equivalent of about 17 Mlb of Ta₂O₅. For comparison, in 2005, it was reported that the world's largest resource, Greenbushes in Australia, contained 60 Mlb, but at a grade of only 157 g/t, while the Abu Dabbab project in Egypt contained some 22 Mlb at a grade of 252 g/t.

More recently, Angus & Ross' geological team, along



Satellite image of the Motzfeldt complex

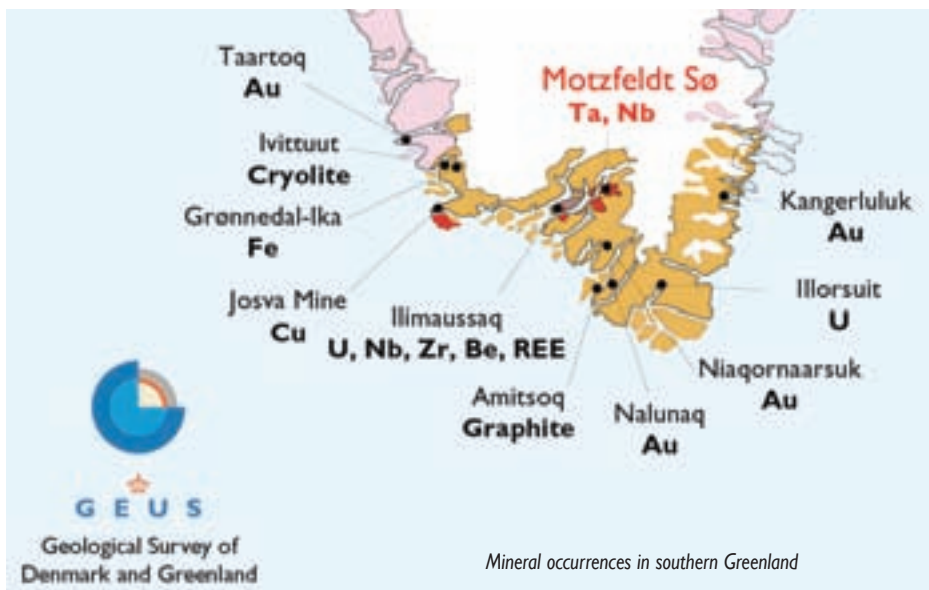
with geologists from St Andrews University, have been carrying out mineralogical research, to understand the genesis of this syenite-based ring deposit and map other parts of the licence area. Angus & Ross is currently in discussion with various interested third-parties regarding further joint development of this interesting prospect.

PROJECT PORTFOLIO

The company retains an 81% interest in UK-based St Andrews Mining Ltd (SAM), which has a portfolio of tantalum and gold projects in Brazil via its wholly-owned Brazilian subsidiary. SAM owns the small Caiçara project in Rio Grande do Norte state. It was bought two years ago, based on a reserve estimate (to Canadian NI 43-101), developed by Canadian Junior First Choice Industries, of 0.17 Mt, grading 432 g/t Ta₂O₅.

Angus & Ross has carried out further exploration and a Brazilian-based consulting company has confirmed the robustness of the project. Angus & Ross also owns several other small pegmatites in the vicinity and intends to increase its resource base prior to reaching a decision, probably within the next year, on whether to develop Caiçara.

Australian-listed Queensland Gold & Minerals, in which Angus & Ross holds a 28% shareholding, continues to explore the Grant's Gully and Buchanan's Creek tenements for tantalum and associated minerals, the latter having recently been the subject of a joint venture agreement with TSX listed Mega Uranium Ltd.



Mineral occurrences in southern Greenland

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Angus
& Ross

Commerce leaps forward

COMMERCE Resources Corp is focused on the exploration and development of an expansive, 100%-owned, 1,000 km² land package in central British Columbia, Canada. Known as the Blue River Tantalum-Niobium project, the results of exploration have catapulted the project's development in support of commercialising a low-cost, prospectively lucrative mining operation.

Commerce Resources has defined resources on three deposits: the Verity, Fir and Upper Fir. The importance of finding new sources of raw materials of tantalum and niobium cannot be overstated. Tantalum is so sought after that any meaningful new discoveries are welcomed with open arms by tantalum-dependent end-users, namely the global hi-tech industry.

STRATEGIC ADVANTAGE

The prospect of commercialising a tantalum mine in a politically-stable environment such as Canada gives Commerce a key strategic advantage. Specifically, Canada's renowned legal framework, and minimal political and currency risk, would support the viability of any long-term supply contracts that the firm enters into with domestic or foreign tantalum processors.

It is important to note that the world's small handful of tantalum processors typically refrain from doing business with mining companies that cannot guarantee the uninterrupted delivery of tantalum over the duration of long-term contracts. Therein lies the considerable appeal to processors of having access to a new, untapped supply of tantalum from a politically stable country, as is Canada.

LOCATION AND LOGISTICS

The Blue River Tantalum-Niobium project takes its name from the nearby town of Blue River, which lies to the south of the Upper Fir deposit. The project benefits from excellent infrastructure; a key logistical factor as the ready availability of water, power and paved roads can go a long way towards containing a mine's operating costs.

The Yellowhead Highway, Canadian National Railway and BC Hydro power lines actually cross Commerce's property. Such infrastructure can contribute to making the Blue River project a low-cost producer. To this end, the firm benefits from the convergence of a number of compelling dynamics, which paint a favourable logistical picture in support of a profitable mining venture.

UPPER FIR DEPOSIT

The Upper Fir deposit was first drilled in October 2005 and three drill holes returned significant intersections of carbonatite near the surface, supporting the hypothesis that this deposit could be mined with the lowest costs in an open-pit operation.

In 2006, 17 holes were drilled and on July 16, 2007, the NI-43-101 report was released on the Upper Fir deposit, reporting a resource of 8.6 Mt indicated and 5.5 Mt inferred, grading 208 g/t tantalum and 1,372 g/t niobium. Beginning in June 2007, 18 more drill holes were completed on the Upper Fir deposit. Finally, the deposit is still open to the south and east.

With over C\$38 million in working capital, the company is well-financed for its development plans

UNIQUE HOST ROCK

Tantalum-bearing minerals are typically found in pegmatitic ores. The Blue River Tantalum-Niobium project is an expansive, carbonatite system, (which makes it more comparable to world-class deposits of niobium), albeit with a unique anomaly of high-grade tantalum.

The carbonatite is a relatively soft, host rock and it is significant in that the crushing of this ore leaves the tantalum and niobium minerals largely intact, translating into a higher rate of recovery than for the tantalum projects hosted in pegmatites.

Furthermore, metallurgical testing for the Fir carbonatite – conducted by an independent, technical research consultancy firm – indicated that a gravity concentrate can be produced with higher recoveries of the contained tantalum and niobium minerals than the industry norm.

Additionally, Commerce's project enjoys very large grain sizes. The world's largest pyrochlore – the tetra

or octahedral quartz-like crystal in which the tantalum and niobium is contained – is from the original specimen pit of Commerce's Verity deposit, which is on display at the University of British Columbia. The large grain size is another factor that contributes to an overall, higher recovery rate than the industry standard.

MAJOR BOOST

Commerce recently completed a C\$33 million (€24 million) financing. Now, with over C\$38 million in working capital, the company is well-financed

for its development plans. Shareholders in the company now include an array of North American and European investment funds.

OTHER CARBONATITES

The Blue River Tantalum-Niobium project is surrounded by geologically-fertile mineral claims that are also wholly-owned by Commerce. In fact, earlier exploration at the project identified a number of other distinct tantalum/niobium-bearing carbonatites. These include the Switch Creek, Bone Creek, Gum Creek, Paradise, Serpentine and Mill. The possibility that these carbonatites may outline the parameters of a large, mineralised structure is expected to be investigated during upcoming exploration seasons.



President David Hodge talks with analysts and shareholders at Blue River property visit



Geologist Sasha Blinova displays drill core showing large tantalum-niobium bearing pyrochlore

HIGHLIGHTS

- Independent, metallurgical test results have initially demonstrated higher than industry average rates of recovery.
- Commerce has 100% ownership of the Blue River Tantalum-Niobium project. The properties are not subject to any royalties, back-in payments or other agreements.
- Exploration to date at the Upper Fir deposit has identified a significant resource of tantalum and niobium.
- The pressing need to develop new, global supplies of tantalum in a politically-stable nation like Canada makes Commerce's deposits very attractive to the tantalum industry.
- The Blue River Tantalum-Niobium project benefits from excellent infrastructure.
- Demand for tantalum is rising steadily, as is its price. In this demand-driven resource-hungry industry, Commerce could become a prime takeover target for a major producer or tantalum/niobium processor.

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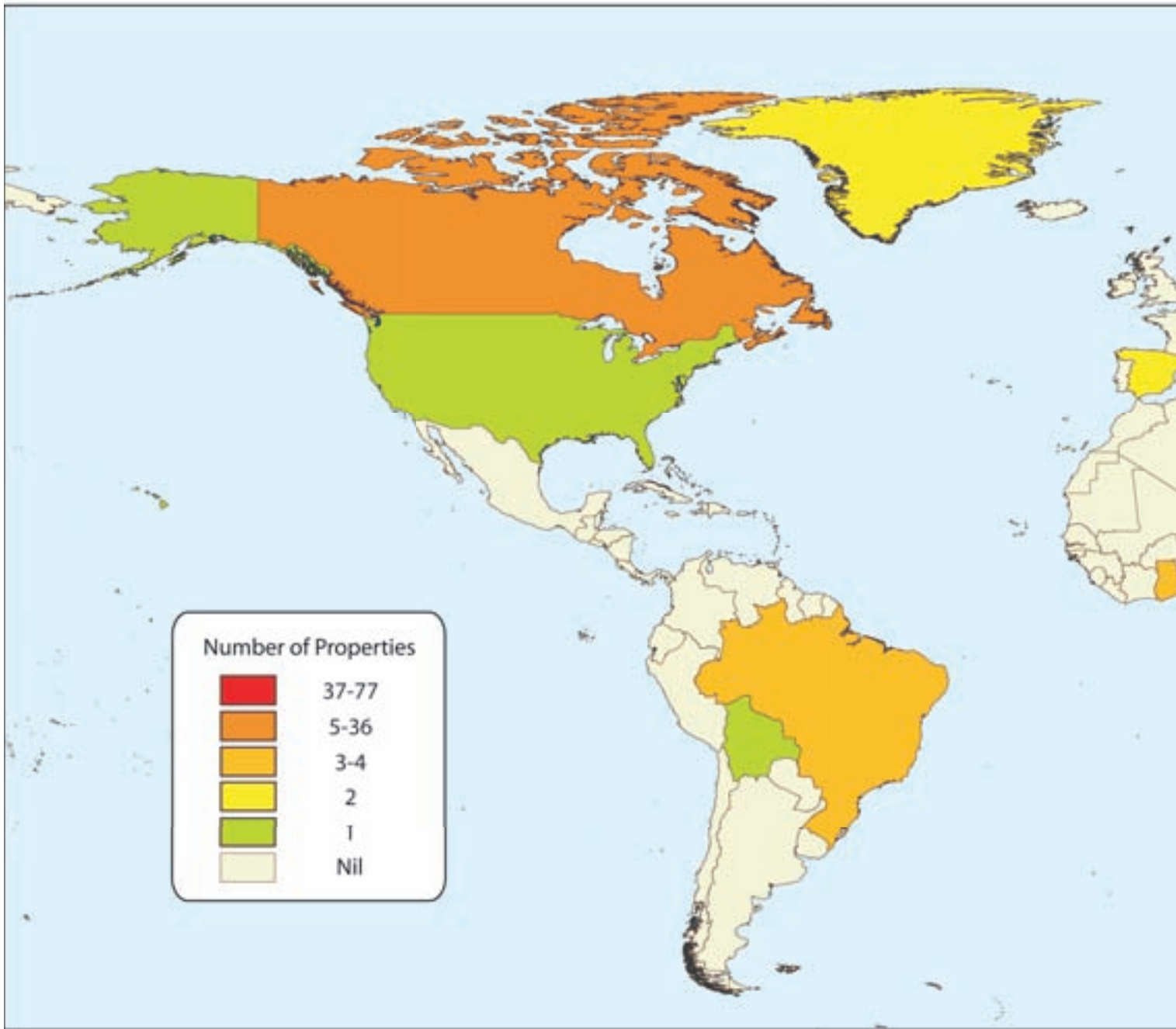
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COMMERCE RESOURCES CORP.

Tantalum projects reported to global financial markets as at October 2007



This map depicts the number of Tantalum projects reported to the North American, Australian, South African and London markets as at October 2007.

Projects range from grass roots exploration plays through to operating and mothballed mines. 'Relinquished' projects are included.

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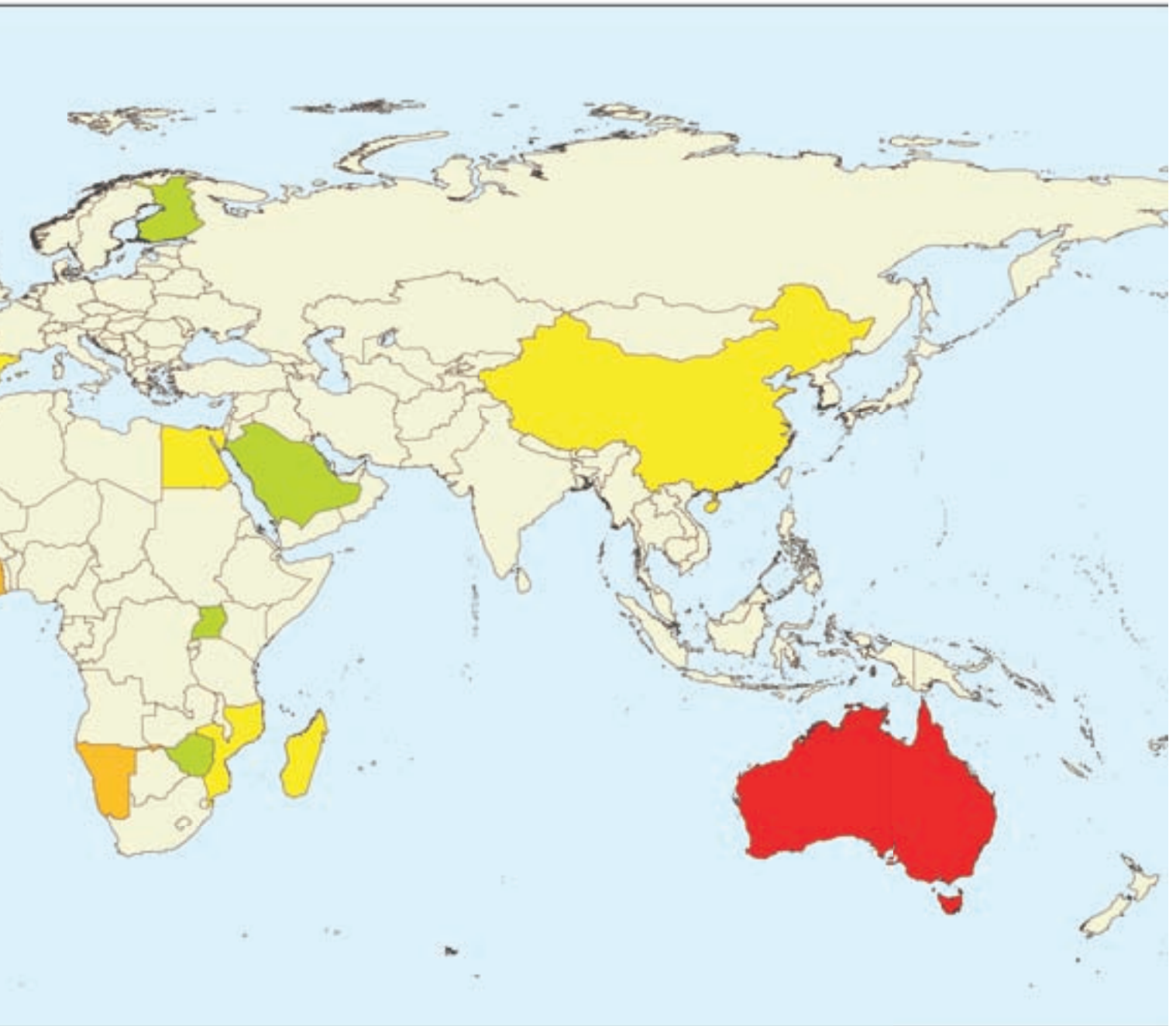
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MAPPING



COUNTRY	TOTAL	Egypt	2	Namibia	4
Australia	77	Finland	1	Saudi Arabia	1
Bolivia	1	Ghana	4	Spain	2
Brazil	4	Greenland	2	Uganda	1
Canada	36	Madagascar	2	United States	1
China	2	Mozambique	2	Zimbabwe	1

Western Australia possesses some 90% of the world's known Tantalum resources, and produces some 50-60% of world production. Other major producers are Brazil, Mozambique, Canada and Ethiopia. Total annual world production is just over 1,000 tonnes per year, with the main use being in the electronics industry. Tantalite, the main ore mineral of Tantalum, mainly occurs with niobium in granite hosted pegmatite veins and in carbonatites and as a by product of tin mining.

Gippsland emerges as a major tantalum force

GIPPSLAND Ltd, an Australian-based international resource company, is focused on the development of its major tantalum and tin deposits in Egypt. The firm's prime assets are world-class tantalum-tin projects in the Central Eastern Desert of Egypt, adjacent to the western shore of the Red Sea. These projects include the 40 Mt Abu Dabbab deposit, scheduled to be brought into production in 2010, and the 98 Mt Nuweibi deposit, situated about 20 km southeast of Abu Dabbab.

Listed on the Australian Stock Exchange, the London Stock Exchange AIM and the UK Plus Markets, Gippsland has developed a solid infrastructure and a highly-supportive commercial relationship with the Egyptian government. With a low-cost production base, favourable commercial environment and key, logistical advantages, Gippsland is poised to become one of the world's largest tantalum suppliers and capitalise on the growing demand for the metal.

ABU DABBAB – ON TRACK

A bankable feasibility study (BFS) has determined that the Abu Dabbab project alone is capable of producing 650,000 lb/y of tantalum pentoxide. The project, which has an expected mine life of 20 years, will become the world's second-largest tantalum supplier. In excess of 1,500 t/y of tin metal will be produced as a co-product to the tantalum-pentoxide production.

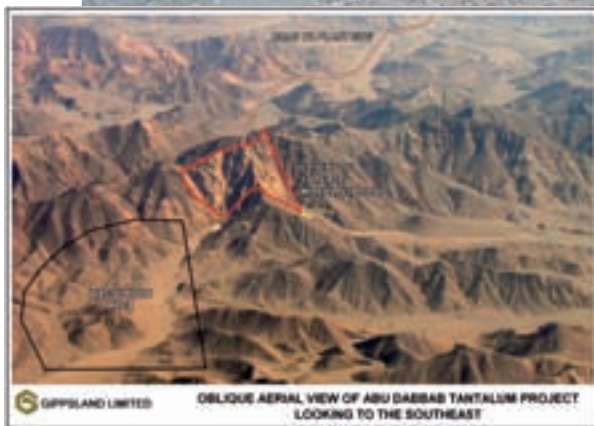
The project is being developed by Tantalum Egypt JSC, a company incorporated in Egypt, which is 50%-owned by the Egyptian government via the Egyptian Mineral Resources Authority (EMRA) and 50% by Tantalum International Pty Ltd, which is a 100%-owned subsidiary of Gippsland Ltd.

Gippsland maintains board and management control of the joint-venture company, Tantalum Egypt JSC, for the life of the project. The Abu Dabbab scheme has the major advantage of being in its own Free Trade Zone, which provides relief from Egyptian taxation, import/export licensing and customs import duties.

Key features of the project include:

- 2 Mt/y initial mill-feed rate; producing more than 650,000 lb/y of tantalum pentoxide and 1,530 t/y of LME-grade tin metal as a co-product.
- Ten-year tantalum offtake-agreement in place with world's largest consumer, HC Starck GmbH, of Germany, for 600,000 lb/y.
- Project-specific Free Trade Zone – zero taxation, no import-export licensing, and no customs import duties for machinery and project consumables.
- Environmental studies completed to World Bank standards.
- All project-permitting requirements completed.
- Potential for the production of 1.5 Mt/y of ceramic-grade feldspar.

The company is poised to become one of the world's largest tantalum suppliers



The capital cost for the project, including financing during construction, is estimated at US\$125 million, which is expected to be provided on an attractive 80%-debt and 20%-equity basis. The estimated time to complete the engineering design and construction of the plant at Abu Dabbab is two years, with production due to start in March 2010.

MARKETING AND FINANCE

An agreement has been reached with a leading consumer of tantalum pentoxide for the supply of 6 Mlb of the product to HC Starck over the initial ten years of production. The confidential pricing mechanism contained in the offtake agreement provides protection against production-cost increases and it underpins the viability of the project by reducing the long-term market risk. Based on the present price of tin, the revenue from this London Metals Exchange (LME)-grade material is likely to generate revenue of over US\$25 million per year. Projected tantalum sales are expected to exceed US\$28 million annually.

Gippsland is currently in negotiations with a number of German banks, and discussions are well advanced to arrange project finance for Abu Dabbab. It is anticipated that Gippsland's tantalum offtake agreement will enable a special form of German government debt-funding support.

NUWEIBI – PHASED OUTPUT

Nuweibi is located 17 km south of the Abu Dabbab deposit and 30 km inland from the Red Sea. The project has indicated and inferred resources of 98 Mt of 0.0143% tantalum pentoxide. Like the Abu Dabbab deposit, Nuweibi has the potential to yield high-quality, pre-milled ceramic-grade feldspar for markets in Europe and South East Asia.

The resource presents an opportunity to substantially increase production, leveraging the Abu

Dabbab process plant for several decades beyond the initial, projected 20-year mine life.

FELDSPAR OUTPUT

Abu Dabbab and the nearby Nuweibi deposits are strategically located to supply up to 1.5 Mt of pre-milled, ceramic-grade feldspar, as a by-product to tantalum and tin production, for sale to European and South East Asian producers of ceramic tiles and sanitary wear. Following in-plant testwork in Italy, the firm secured a Heads of Agreement with a major Italian feldspar consumer for the supply of 2.65 Mt, spread over an initial, five-year period.

The Abu Dabbab BFS did not take into account any potential revenue derived from the sale of feldspar. This will be considered in detail immediately after the start of tantalum and tin production. The production of feldspar would result in the sale of about 80% of all material mined at Abu Dabbab and Nuweibi. At current market prices, this would generate additional income in excess of US\$20 million per year.

SUMMARY

Abu Dabbab is poised to become the second-largest producer of tantalum; a strategic metal essential for the production of numerous electronic devices, such as cell phones, laptops and video cameras. The metal is also crucial in the fabrication of turbine blades for stationary and jet engines, while its resistance against acid corrosion makes it an important material in the fabrication of specialised chemical plant and equipment. Abu Dabbab will operate in a most favourable commercial environment, which will ensure low-cost production for several decades. With only modest expansion in production rates, Abu Dabbab has the potential to become the world's largest producer of tantalum pentoxide.

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Noventa looks to fill supply shortfall

Aerial view of the Morrua mine

Set to become one of the largest, lowest-cost suppliers of tantalum concentrate

THE group, formed in 2001 and listed on London's Alternative Investment Market in March 2007, has two key mining projects in northeastern Mozambique: the Marropino tantalum mine and processing plant; and the fast-track development of its Morrua concession.

The new plant at Marropino was commissioned this year and production is being ramped up and expected to reach an annualised run rate of more than 420,000 lb of tantalum concentrate by early 2008. The next mine being developed is Morrua, which is at the advanced engineering stage. Noventa expects the first production from Morrua, which will have a similar capacity to Marropino, in early 2009.

Noventa intends to use its large tantalum deposits and its low cost base to take advantage of the current supply shortfall and growing global demand for tantalum. Once the Morrua mine starts operation in 2009, the group will be the second-largest primary producer of tantalum in the world, with a 20% market share based on current global output projections.

A further benefit for Noventa at the Marropino mine is that commercial quantities of morganite, a rare pink gemstone, are also recovered while mining tantalum. The size of the morganite deposit at Marropino is significantly larger than any other known deposit in the world.

CURRENT OPERATIONS

Noventa's assets include mining permits and exploration licences covering an area of 21,000 ha, located in the world-renowned Alto Ligonha pegmatite province of northeastern Mozambique.

Commercial mining of these mineralised pegmatites started in the 1930s, mainly for muscovite

and beryl. Exploitation of tantalite was sporadic through the 1950s and 1960s, with a significant amount of geological and geophysical studies being carried out during the 1980s by Russian, East German and United Nations teams. Past open-pit mining by the Portuguese and Eastern Bloc countries took place mainly in the weathered zone, which was more easily worked, leaving the hard rock for present-day mining.

Current reserves/resources at four of the 12 concessions held by Noventa total 29 Mt containing about 19 Mlb of Ta₂O₅ at an average grade of 296 ppm, with exploration projects expected to add to this base over time.

MARROPINO

The Marropino mine is the only industrial-scale tantalum mine in operation in Mozambique. It lies 350 km northeast of the provincial capital, Quelimane, and is an open pit.

The optimised pit contains 7.8 Mt of ore with an average grade of 288 ppm tantalum. At the current feed rate of 108,000 t/mth, Marropino has a remaining life-of-mine in excess of six years.

Considerable enhancements have been made to the processing plant over the past six months. Production is planned to be 420,000-550,000 lb/y of tantalum.

A government electrification programme to provide grid power to Marropino and Morrua has also been initiated and is targeted for completion by mid-2008, which will further lower the company's cost of production, already estimated to be one of the lowest in the world for an industrial-scale producer.

Noventa employs 350 people at the mine, drawn mostly from the surrounding community. As the company is the only significant provider of formal employment within 300 km of the mine, it plays a crucial role in the continued development of the local community.

The company has just finished building the first school in the area and a medical clinic is due to be completed early next year. Employees and their

families, in emergencies, have access to the on-site paramedic and benefit from the malaria monitoring and treatment programme run at the mine. Additionally, boreholes have been drilled to provide fresh, running water to the local village near the mine.

MORRUA

The Morrua mine, just 40 km from Marropino, is currently being developed, and production is expected to begin in 2009. A conventional open-pit operation is proposed and a plant will be built to produce more than 450,000 lb/y of tantalum concentrate over the estimated 13-year mine life.

EXPLORATION

The company is also actively engaged in the exploration and evaluation of its other Mozambican properties. At Mutala, further pitting, trenching and sampling are under way. This will be supported by a drilling programme in due course following the imminent arrival of the drill rig.

This work will materially assist in the firming up of the currently-known ore resource and allow the development of this property to be fast-tracked. Evaluation work is also in the planning stages for both the Ginama and Gile projects, where a similar programme to Mutala is envisaged.

These activities, along with the ongoing evaluation of new properties, should result in a continuing pipeline of projects, which will ensure Noventa's long-term engagement in the tantalum business.

MOZAMBIQUE

Mozambique has experienced one of the world's fastest-growing economies over the past five years, with its real GDP growth averaging more than 8% over the past decade, decreasing inflation and sustained political stability. Growth has been driven primarily by foreign-financed 'mega-projects' in mining, energy and infrastructure, such as BHP Billiton's Mozal aluminium project, CVRD's Moatize coal project and Kenmare Resources plc's Moma mineral-sands operation.

A new mining law was introduced in 2002, further strengthening the holder's security of tenure and setting the royalty payable on tantalum at 3%. Mozambique strongly promotes foreign direct investment in its mining industry by offering a favourable fiscal regime as part of the mining contract concluded with the government. As a result, Marropino is benefiting from a 50% reduction in the corporate tax rate until 2012 and exemption from withholding taxes and import duties.

With the tantalum market now in deficit, annual consumption forecast to continue growing strongly, and the lengthy lead time for new projects to come on stream, Noventa is in an advantageous position to help meet the supply shortfall.

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Loading a dump truck at the Marropino mine



Talison, the world's largest supplier of tantalum concentrate



Mine locations

The company has secure, high-quality, long-life resources and established efficient operations

TALISON Minerals Pty Ltd was formed in August 2007 following the sale of Sons of Gwalia's Advanced Minerals Division to a consortium of investors led by the Denver-based mining specialist Resource Capital Fund. All the company's assets are in Western Australia and include the Wodgina tantalum mine, the Greenbushes lithium, tantalum and tin mine, as well as a number of highly prospective exploration tenements near Wodgina.

Talison is the world's largest producer of tantalite (Ta_2O_5) concentrate, providing between a quarter and a third of the global supply from the Wodgina operation alone. Tantalum operations at the Greenbushes mine are on care and maintenance, but if reactivated, Talison's two mines could produce up to 50% of the world's tantalite concentrate supply. Each of Talison's operations has mineral resources of approximately 70 Mlb of contained Ta_2O_5 .

WODGINA

Wodgina, the world's largest tantalum mine, is 1,500 km north of Perth and 120 km southeast of Port Hedland in the Pilbara region of Western Australia. Mining at Wodgina was first recorded in 1904 and the area has a history of consistently replacing its extensive resource base. Due to the remoteness of the site, the workforce operates on a fly-in fly-out roster with most personnel commuting from Perth.

Ore from the Mt Cassiterite and Mt Tinstone pits is extracted using conventional open-pit mining methods. The ore is crushed and processed at a rate of 3.2 Mt/y to produce a primary concentrate which is bagged and transported by road to the Greenbushes operation for secondary processing.

Annual production is 1.3-1.4 Mlb Ta_2O_5 .

GREENBUSHES

Greenbushes was discovered in 1886. Mining starting two years later, making it the oldest continuously-operating mine in Western Australia. The mine is 210 km

Greenbushes mine



Wodgina processing plant

south of Perth in the southwest region of Western Australia.

The operation comprises open-pit and underground mines, a primary and secondary tantalum-processing plant, tin smelter and a lithium plant. The primary tantalum plant, with the capacity to process 3.5 Mt/y of ore, was placed on care and maintenance in 2006 to reduce inventory build-up in the tantalum supply chain. The 1 Mlb/y tantalum operation can be reactivated rapidly in response to changes in the economics of the tantalum market.

All of Wodgina's primary concentrate is upgraded to final product at Greenbushes' secondary plant, which comprises various gravity, magnetic and electrostatic separation, and roasting and smelting metallurgical processes.

SOCIAL RESPONSIBILITY AND THE ENVIRONMENT

Pro-active programmes ensure Talison's operations continue to have the least possible impact on the environment and local community.

In 2006, Greenbushes was awarded Western Australia's highest environmental award for industry: the Golden Gecko Award for Environmental Excellence.

TECHNICAL COMPETENCE

The mining and processing of tantalite ores is technically challenging and capital intensive. Selective mining to avoid contamination of ore with waste requires close geological supervision. Process flowsheets designed to minimise overgrinding of minerals are essential to maximise the recovery of tantalum to concentrate. For these reasons, metallurgical recovery from tantalum operations is often as low as 50-60%. Talison leads the industry in its technical capability in tantalum concentrate production and in research and development regarding product upgrading, all of which enhances value to its customers.

Due to the nature of the hardrock mining operation, the technical complexities of processing and

Talison's long-term commitment to the health and safety of employees and environmental and community welfare, operating costs are significantly higher than achieved by intermittent production by artisanal miners in Africa and South America. There are also major cost pressures imposed on the company's operations from the booming resources industry in Western Australia, and a tightening ocean freight market, particularly for materials like tantalite concentrates, which must comply with stringent export/import legislation.

In response to the strong influence of ore grade on unit costs, Talison maintains a strong exploration programme focused on the delineation of high-grade tantalum resources. Of particular interest are the Mt Francisco and Pilgangoora projects near the Wodgina mine where encouraging results have been achieved from preliminary exploration work. Both have the potential to provide future high-grade ore sources for the Wodgina processing plant.

COMPETITIVE ADVANTAGE

Talison is the world's largest supplier of tantalum concentrate. The company has secure, high-quality, long-life resources, established efficient operations and is in a politically stable, world-class mining province. For its customers, and just as importantly theirs, this means reliable long-term supply, consistency of quality and surety of delivery on contracts.

Recommissioning the Greenbushes tantalum operation can significantly increase Talison's current production. This latent capacity provides comfort throughout the tantalum supply chain that future supply shortfalls can be met by the company.

With new and supportive owners, Talison now has the opportunity to further develop the business. Given the future outlook for the tantalum industry, Talison is well positioned to further its role as the leading producer in this market.

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Extraction and refining

THE extraction and refining of tantalum, including the separation

from niobium in these various tantalum-containing mineral concentrates, is generally accomplished by treating the ores with a mixture of hydrofluoric and sulphuric acids at elevated temperatures.

This causes the tantalum and niobium values to dissolve as complex fluorides, and numerous impurities that were present also dissolve. Other elements such as silicon, iron, manganese, titanium, zirconium, uranium, thorium, rare earths, etc. are generally present. The filtration of the digestion slurry, and further processing via solvent extraction using methyl isobutyl ketone (MIBK) or liquid ion exchange using an amine extractant in kerosene, produces highly-purified solutions of tantalum and niobium.

Generally, the tantalum values in solution are converted into potassium tantalum fluoride (K_2TaF_7) or tantalum oxide (Ta_2O_5). The niobium is recovered as niobium oxide (Nb_2O_5) by neutralising the niobium fluoride complex with ammonia to form the hydroxide, followed by calcination to the oxide.

The primary tantalum chemicals of industrial significance, in addition to K_2TaF_7 and Ta_2O_5 , are tantalum carbide (TaC), tantalum chloride ($TaCl_5$), and lithium tantalate ($LiTaO_3$).

Tantalum metal powder is generally produced by the sodium reduction of the potassium tantalum fluoride in a molten salt system at high temperature. The metal can also be produced by the carbon or aluminium reduction of the oxide or the hydrogen or alkaline earth reduction of tantalum chloride. Capacitor-grade powder is produced by the sodium reduction of potassium tantalum fluoride. The choice of process is based on the specific application and whether the resultant tantalum will be further consolidated by processing into ingot, sheet, rod, tubing, wire, and other fabricated articles.

Capacitor-grade tantalum powder provides about 60% of the market use of all tantalum shipments. Additional quantities are consumed by tantalum wire for the anode lead as well as for heating elements, shielding, and sintering tray assemblies in anode sintering furnaces.

The consolidation of metal powder for ingot and processing into various metallurgical products begins with either vacuum arc melting or electron beam melting of metal feedstocks, comprising powder or high-purity scrap, where the elements with boiling points greater than tantalum are not present.

Double- and triple-melt ingots achieve a very high level of purification with regard to metallics and interstitials. Ingots are used to produce the various metallurgical products named earlier. Ingot stock is also used for producing such alloys as tantalum-10% tungsten. Ingot and pure tantalum scrap are used in the production of land and air-based turbine alloys.

Tantalum applications include: X-ray film, laptop computers, Playstation gaming consoles and camera lenses

Photos: Bloomberg News

Information supplied by the Tantalum-Niobium International Study Centre

APPLICATIONS FOR TANTALUM

Tantalum product

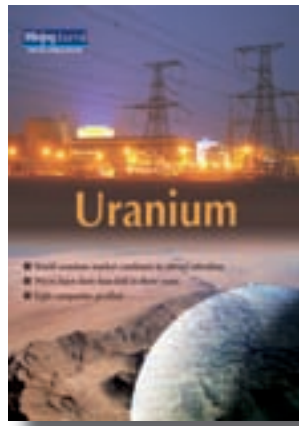
- Tantalum carbide:
- Tantalum oxide:
- Tantalum powder:

- Tantalum fabricated sheets, plates, rods, wires:

Application

- Cutting tools.
- Camera lenses, X-ray film, ink jet printers.
- Tantalum capacitors for electronic circuits in medical appliances such as hearing aids, pacemakers, also in airbag protection systems, ignition and motor control modules, GPS, ABS systems in automobiles, laptop computers, cellular phones, Playstation, video cameras, digital still cameras.
- Sputtering targets.
- Chemical process equipment.
- Cathodic protection systems for steel structures such as bridges and water tanks.
- Prosthetic devices for humans – hips, plates in the skull, also mesh to repair bone removed after damage by cancer.
- Suture clips.
- Corrosion-resistant fasteners, screws, nuts, bolts.
- High-temperature furnace parts.
- High-temperature alloys for air- and land-based turbines (eg jet engines).





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