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ANNUAL REPORT FOR RL8802; CML46M/90 AND ML2M/99

FOR THE PERIOD ENDING 22 MAY 1999

by

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for

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20 October 2000

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Annual Report for RL8801, CML 46M/90 and
ML2M/99 for Period Ending 22 May 1999.
Golden Triangle Resources NL*
Laughton, C.A. 2M/1999; 46M/1990; R

Abstract

The work recorded and referenced to in this report follows on from the Annual Report for the period ended 22 May 1998. The principal objective of the investigations carried out by Golden Triangle Resources NL has been to determine the extent and quality of previously identified magnesite occurrences in RL8802 and CML46M/90, with a view to the identification of a resource for refining and production of magnesium metal and alloys.

Following completion of a core drilling program on the Main Creek and Bowry Creek magnesite deposits, an inferred resource was calculated for the magnesite deposits of 47.4 million tonnes at 43.36% MgO. It is described and illustrated in report N3 dated 10 June 1998 by consulting geologist L. Newnham (1998, N3).

Recommendations for the follow-up drilling program to upgrade the resource category according to JORC requirements were also provided by L. Newnham (1998, N9).

During the period January to May 1999 that second round of drilling was carried out to further define the Main Creek magnesite deposit to that of an indicated resource.

Other pertinent activities relating to the quality assessment of the magnesite deposits as a whole included preliminary testwork by Oretest on magnesite samples for flotation and magnesium chloride recovery. The results were very satisfactory and are documented in two reports (1998, O2 and O3). Tests were carried out on two composite samples, with composite #1 from the Main Creek deposit, and composite #2 from the Bowry Creek deposit. Important differences were evident and provided the reasoning for focusing the drilling on the Main Creek deposit in the second round of drilling. Follow-on metallurgical testwork carried out during the period under review by Lakefield Research Limited of Canada is also discussed in the report.

A conceptual mine planning study by Barrett Fuller & Partners (1998, B10) also suggested that the resource was potentially suitable for extraction by environmentally friendly underground methods.

The major component to the whole magnesite to magnesium project is the refinery. However, as this cannot be located on the tenements, and the preferred site identified by Sinclair Knight Merz (1998, S46) is 60 km away, the only impact is on the transportation of the feedstock from the selected mine site out of the tenement area.

During the period under review, an environmental issues report was commissioned from NSR Environmental Consultants, which covers the Project Concept, Environmental Setting and Issues, Approvals and Permitting Process, Future Work Program, and Schedule (1998, N6). It covers both the Main Creek and Bowry Creek magnesite deposit areas.

The recommendations were to continue with all phases of the project following the preliminary assessment of the excellent quality, metallurgical recoveries and available quantities of readily mineable magnesite.

CONTENTS

1. Introduction

Previous activity within the area of the tenements in northwest Tasmania (Fig.1) was principally directed at the assessment of the magnesite as a potential source of magnesia. Many reports, held by Mineral Resources Tasmania, resulted from the magnesia project in the 1980's, including among them work done by the holders, Savage Resources Limited (SRL), and by CSIRO. Other potential resources were also investigated, as well as the use of magnesite as a paper filler. However, Golden Triangle Resources NL (GTR) had identified magnesium metal as a potential product with a strong growth potential for the future due to its combination of light weight and strength that surpassed that of aluminium in many uses.

Previous investigations in the Main Creek area had suggested that potential existed for a deposit that could maintain a substantial production of magnesium metal, in the order of 60,000 to 100,000 tonnes per year for 100 years with a requirement of only 400,000 tpa of magnesite. However, the quality requirements of the magnesite feed would be critical to the success of the project and different for those as a source of magnesia.

Hence, GTR negotiated rights to explore the deposits within the tenements with SRL to test the potential viability of the project at the end of 1997. The tenements comprised RL8802 and CML46M/90, located approximately 6km south-southwest of the Savage River iron ore mine (Fig.2). Towards the end of the period Savage Resources Limited, the tenements holder, applied to replace CML46M/90 with four new Mining Leases, 2M/99 the "Magnesite Lease", 3M/99 the "Ochre Lease", 4M/99 the "Umber Lease", and 5M/99 the "Magnetite Lease" (Fig.3). This was approved by the Director of Mines, Mineral Resources Tasmania on 10 March 1999, and granted to Savage Resources Limited by the Minister on 25 March 1999, towards the end of this reporting period of 23 May 1998 to 22 May 1999.

The work carried out by GTR on the tenements was done so under an Option Deed between Savage Resources Limited and Golden Triangle Resources NL dated 4 December 1997, and Deed of Variation dated 18 December 1997, effective to 30 June 1998, which was extended to 30 September 1998. The Option Deed and the variation were approved by the Minister and noted in the Register on 24 June 1998. A Second Deed of Variation dated 28 September 1999 was executed and the Notice of Exercise of the Option signed on the same day. The Second Deed of Variation was approved by the Minister and noted in the Register on 13 January 1999. Draft Applications for tenement licence changes to give effect to the provisions of the Option Deed, as amended, were submitted to the Registrar of Mines by Savage Resources in February 1999, and as noted above granted on 25 March 1999.

2. Review of previous work

2(a) Prior to current tenements

The presence of magnesite south of the Savage River iron ore mine was first recognised in 1963, and followed by some mapping of the outcrops, which are largely restricted to the river banks, in 1966 (Urquhart). The Main Creek magnesite deposits occur in the Bowry Formation within the Arthur Metamorphic Complex. The Bowry formation consists of pelitic schists and amphibolites and hosts magnetite-pyrite deposits at Savage River and Long Plains (Turner, 1990) magnesite at Main Creek (Frost, 1982) and Bowry Creek, secondary ochre and

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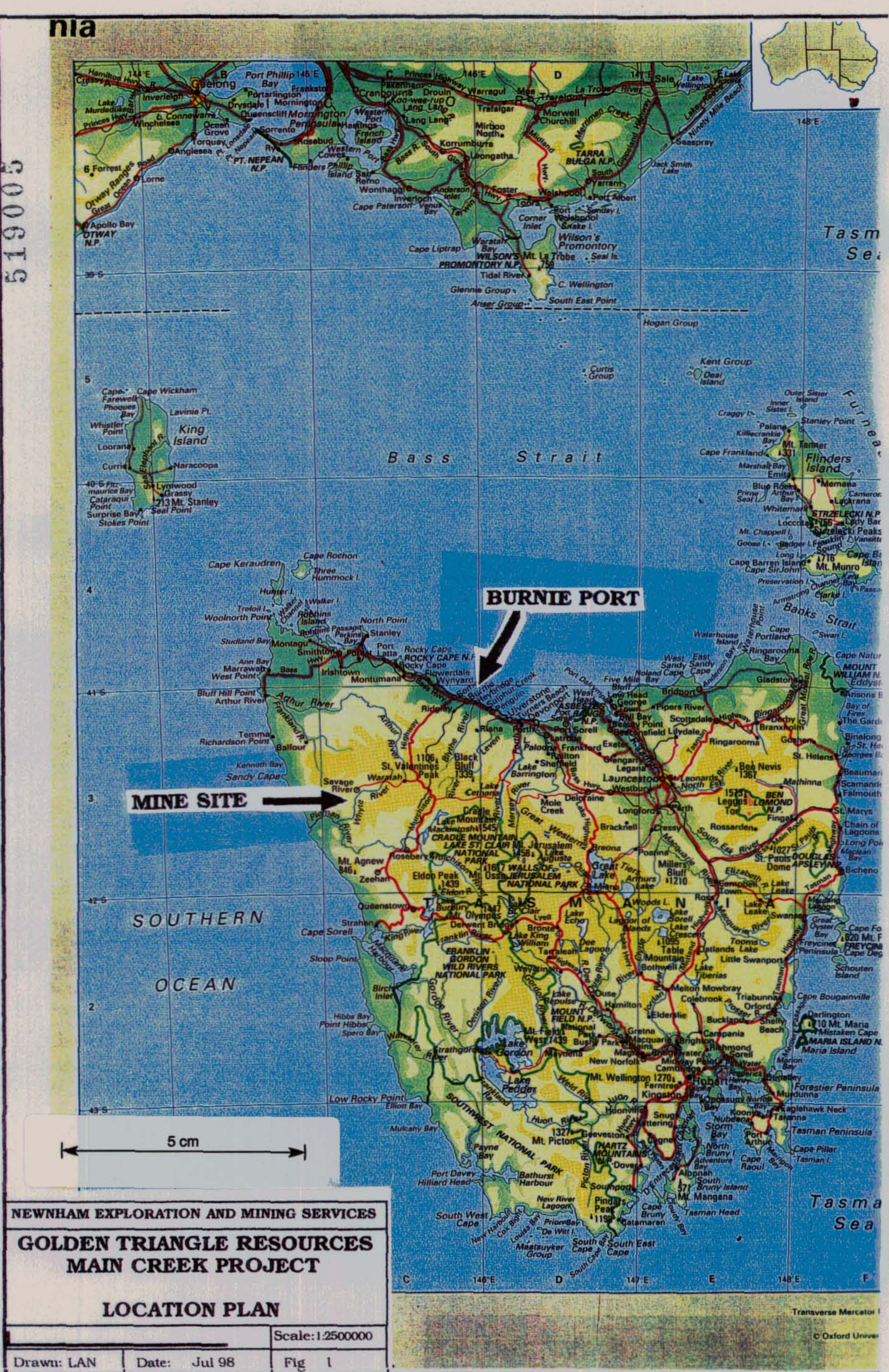

NEWNHAM EXPLORATION AND MINING SERVICES

GOLDEN TRIANGLE RESOURCES
MAIN CREEK PROJECT

LOCATION PLAN

Scale: 1:2500000

Drawn: LAN | Date: Jul 98 | Fig 1

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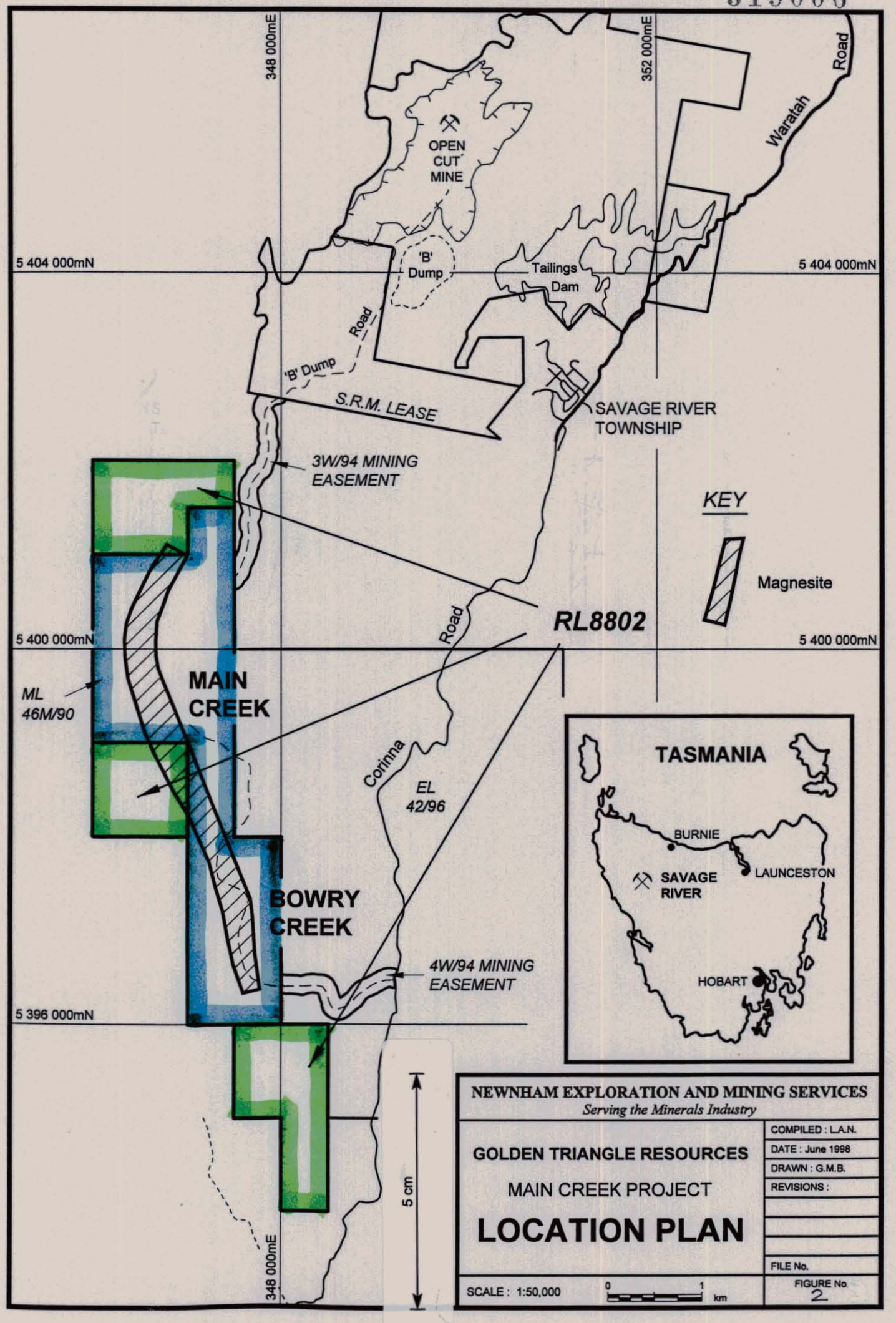


NEWNHAM EXPLORATION AND MINING SERVICES
Serving the Minerals Industry

GOLDEN TRIANGLE RESOURCES

MAIN CREEK PROJECT

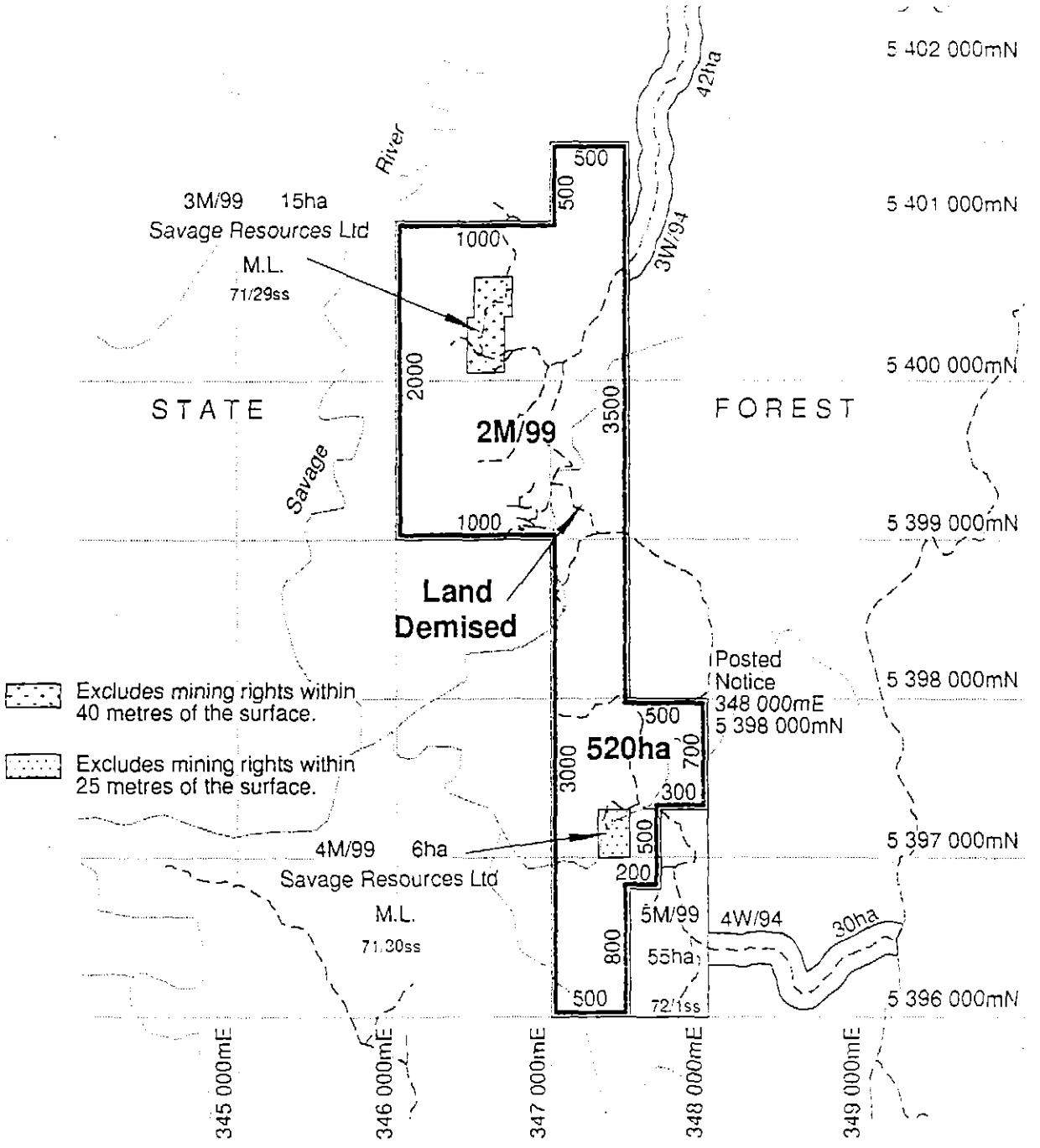
LOCATION PLAN

COMPILED : L.A.N.
DATE : June 1998
DRAWN : G.M.B.
REVISIONS :
FILE No.

SCALE : 1:50,000 (0 — 1 km)

FIGURE No. 2

PLAN-SUBJECT TO SURVEY



LAND DISTRICT RUSSELL		VICINITY BOWRY CREEK, SAVAGE RIVER	
MUNICIPALITY WARATAH/WYNYARD	MAP CORINNA 1:50000	SCALE 1:40000	
APPLICATION NO. 2M/99	AREA 520ha	MINERAL RESOURCES TASMANIA	
APPLICANT SAVAGE RESOURCES LTD			
5 cm			
DRAWN *A. Ploughman*	EXAMINED	DATE 10-3-99	Tasmania
APPROVED	DIRECTOR OF MINES	DATE 10-3-99	VOL. 1 FOLIO 23

MINERAL RESOURCES TASMANIA - DATA MANAGEMENT GROUP FIG: 3

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umber, and silica deposits. The Main Creek – Bowry Creek magnesite deposits occur near the base of the Bowry Formation.

Urquart (1966) and Frost (1981) suggested that the deposits within Exploration Licence 4/61 are the products of magnesium metasomatism of dolomites, although Frost recognised from petrographic evidence that they might have been a primary ocean floor sediment of chemical origin.

Investigations into the economic potential of the magnesite began with the drilling of two core holes by Industrial and Mining Investigations (MC1 and MC2). The interest was in the magnesia potential, which John Canterford of the CSIRO Division of Mineral Chemistry began to investigate in 1979. By 1982, a patent had been applied for covering the production of high-purity magnesium oxide via calcination/carbon dioxide leaching, and iron removal by the addition of aluminium sulphate. In 1984, Malcolm Frost and others of the CSIRO reported an estimated reserve in the Main Creek magnesite deposit of between 130 and 260 million tonnes based on four cored holes (MC1, MC2, MC27 and MC28) for a total of 1,166 metres drilled.

Two years later in 1986 further work was carried out on Exploration Licence 4/61 by Savage Resources Limited "with the object of defining the magnesite deposit to retention area status, with the long term refractory use in mind" (Annett, R W, Shannon, C H C and Vanzino, L, 1986).

2(b) During current tenements

The Annual Report for RL 8802 and CML 46M/90 for the period 1 October 1993 to 23 May 1994 highlights the refocus, including marketing studies, of Savage Resources Limited's emphasis from magnesia to the potential for pigment production based on ochre, umber and black magnetite based pigments. The first two are weathering products of the magnesite. This had commenced in RL8802 with preliminary investigations of the ochre bearing sediments as pigments in 1988/89 (Hosking & Shannon, 1989), and continued through to 1997 (Annett, 1997), following their initial recognition under the tenure of EL 4/61 in 1987.

In the first half of 1998, Golden Triangle Resources began an investigation of the potential of the magnesite to produce magnesium metal with a nine-hole core-drilling program for 3,381 metres.

3. Exploration completed during the report period

GTR's exploration drilling program, referred to in the previous section, was completed in the previous report period. However, the magnesite resource estimation report (Newnham, 1998, N3) with all derived data was not completed until the current period. This showed that the inferred resource for the Main Creek and Bowry Creek deposits was 47.4 million tonnes at 43.36% MgO, with substantial potential to increase the resources of the defined lenses both along strike to the north and south, and up-dip and down-dip. It was considered that the two magnesite lenses in the Bowry Creek section might be more amenable to open-cut mining than the three in the Main Creek deposit.

The geology, drilling and data management, resource estimate methodology, and the resource estimate are described in the report (N3), followed by the conclusions and recommendations.

Separate recommendations for a follow-up drilling program were provided by Newnham Exploration & Mining Services (N9), and the second round of drilling carried out from June to May 1999. The results of that program will be reported on in the succeeding Annual Report for the period 23 May 1999 to 22 May 2000, when the report on the program was completed and compiled as a 'Report on drilling program and magnesite resource potential'.

4. Other activities carried out during the report period

4(a) Metallurgical testwork programs

Oretest Pty Ltd carried out the initial metallurgical testwork in Perth. It covered flotation of the magnesite (Oretest, 1998, O2) as a guide to pre-leaching beneficiation requirements for the ore in the envisaged hydrometallurgical-electrowinning process, and magnesium chloride recoveries (Oretest, 1998, O3).

The testwork was carried out on two composite samples, one each from the drill cores obtained from the Main Creek and the Bowry Creek deposits respectively. The samples were composited from the cores to reflect as closely as possible the average composition in each of the deposits. In the first stage of the program completed in July 1998, the samples were analysed by ICP, and a mineralogical examination performed on each, followed by grinding and screening. Silica was successfully removed during a quartz prefloat, but attempts to upgrade the magnesia content gave unacceptably high losses. The magnesite concentrates from a bulk float were analysed by ICP. The report (O2) contains all the detailed test data following descriptions of the samples, sample preparation, testwork procedures and results, and are not therefore repeated here.

The second stage of the program to investigate the recovery of magnesium as magnesium chloride was completed in August 1998. The objectives included characterisation of the samples, which were the upgraded flotation product from composite 1 used in the flotation work, and the –2mm screen product from composite 1; chemical analysis and DTA/TG measurements. Second, was determination of the optimum conditions for calcination of the samples and the generation of magnesia products. Third, the establishment of optimum conditions over a given range of temperature, time and % acid stoichiometry for leaching with concentrated hydrochloric acid. Fourth, measurement of the element concentrations in the filtered solutions following calcine neutralisation of the leach liquors; and fifth, determination of the purity of the magnesium chloride recovered from the neutralised solutions following crystallisation. These objectives were all achieved and the details fully documented in the report (O3), which includes the detailed test results.

Following the successful preliminary metallurgical program at Oretest, flow sheet development testwork was continued at Lakefield Research Limited's laboratories in Ontario, Canada. The results of this work are fully documented in four progress reports produced during the period 23 March 1999 to 6 April 1999, and contained within the Final Report (Lakefield Research Ltd, 1999, L20). The principal

objectives "were firstly to confirm the findings of the previous testwork and secondly to experimentally develop a preliminary practical flowsheet, which comprises the operations of leaching, neutralisation, purification, filtration, brine evaporation and magnesium chloride crystal dehydration to $MgCl_2,1.2H_2O$. Laboratory testing of the proposed flow sheet has yielded two fully dehydrated magnesium chloride products for preliminary characterisation as feedstock for the production of magnesium metal in high efficiency electrolysis cells." (L20, p.2).

Two composite samples of diamond drill core were taken from holes MC32 and MC36 in the central areas of the Bowry Creek and Main Creek magnesite deposits respectively. The locations of the holes are shown on figure 2 from report N3. These were used in the first, or leaching stage of the testwork program, described in Progress Report No. 1 (Lakefield Research Limited, 1999, L18). The majority of the hydrochloric acid leach tests were performed on sample MC36, although 94% magnesium extraction was achieved on that sample and 97% for MC32.

The analyses of the two samples were as shown in the table below:-

Sample	Assay (%)	Assay (%)	Assay (%)	Assay (%)
	Mg	Ca	Si	Fe
MC32	26.2	1.51	0.95	1.62
MC36	26.9	1.48	1.11	0.65

Full details of the testwork are described and discussed in the report.

The second Progress Report (Lakefield Research Limited, 1999, L19) dealt with the process development of the leach liquor purification stage. The objectives were to confirm prior testwork carried out by Oretest Pty Ltd, to test three proposed purification routes and to develop a simplified flow sheet for the leach slurry neutralisation, purification and filtration operations of a future process. It was determined that a direct neutralisation and oxidising precipitation of impurities scheme, coupled with known methods for calcium and sulphur elimination provided the preferred neutralisation and purification flow sheet. The report provides full test details of the work.

Progress Report #3 (Appendix A3 of L20) includes a review of eight existing dehydration technologies, recommendations to GTR for scoping experiments and a final determination, following preliminary experimentation, that the Alcan technology (ADT) was the most suitable. This experimental work resulted in the production of anhydrous $MgCl_2$ and $MgCl_2,6NH_3$.

The Final Report (L20) presents a proposed preliminary process flow sheet, a summary of the overall project results and the conclusions and recommendations of LRL for further flow sheet development by GTR. These are summarised in the form of process flow sheet diagrams showing some of the alternatives that were tried.

4(b) Conceptual mine planning

Following the results of the first round of drilling, a conceptual mine planning study was undertaken by BFP Consultants Pty Ltd (1998, B10) to identify the most cost effective and environmentally friendly option, based on a 400,000tpa operation. This suggested that an open pit would be the least desirable option, while several technically possible options were examined for underground mining on the Bowry Creek deposit due to its higher elevation. The final operating cost would depend on the method of stoping chosen and the source of backfill, if required, with a likely operating cost of $18-24/tonne of ore produced. Open pit mining costs were estimated at around $10/tonne, but would have limited life. The report includes cost breakdowns for the open pit and underground options, as well as production schedules.

4(c) Refinery siting study

Sinclair Knight Merz were commissioned by the Tasmanian Department of State Development to extend the study carried out for Crest Magnesium NL to include areas of potential interest to GTR for the magnesium refinery, but to exclude the Bell Bay sites, chosen by Crest as their preferred sites. This study (Sinclair Knight Merz, 1998, S46) showed that the nearest suitable land to the tenements reviewed in this report lay 2 kilometres to the south, but that the best site was at Hampshire 60 km to the northeast. No further discussion of the likely refinery site is therefore considered necessary in the context of this report, other than the recognition of the need to transport the magnesite ore in suitable form out of the tenement area.

5. Discussion of results

A systematic diamond core drilling program confirmed the presence of a substantial magnesite resource in the Main Creek - Bowry Creek area of northwest Tasmania, that had only previously been tested with four cored holes of any significance. Systematic chemical analysis of the magnesite, which occurs in lenses, showed the presence of an open ended resource that is more than adequate in quantity to meet the needs of a magnesium refinery for a hundred years at an output of 100,000 tpa magnesium metal.

Laboratory bench-scale testing of the quality of the magnesite, for effective recovery of the magnesium through the hydrometallurgical/electrowinning technology at two laboratories gave every encouragement that a high purity product could be achieved.

A preliminary mine planning study, recognising the competency of the main ore lenses, the nature of the hanging wall and foot wall lithologies, and the nature of the terrain, suggested that underground mining would be the better option although at higher monetary cost initially than open pit mining. The latter would also be likely to be limited to a small part of the resource, while the former would have a minimal footprint and impact on the environment.

6. Conclusions

The preliminary scoping work, continued from the previous period, on the potential of the magnesite deposits in the Main Creek - Bowry Creek area to provide the feedstock for a magnesium metal producing refinery, confirmed the likely success of the project. Further drilling was recommended to upgrade the resource category, while the focus of the metallurgical testwork program would be on the development of the dehydration stage and optimisation of the pre-dehydration stages of the process flow sheet. It seemed unlikely that any beneficiation of the magnesite would be required other than crushing for transport to the refinery, and crushing and grinding to the optimal grain size for tank leaching at the refinery site.

7. Environment

The tenements lie within a RFA land classification area designated 'State Forest – Multiple Use Forest Land' and outside the Tarkine Wilderness.

NSR Environmental Consultants Pty Ltd were commissioned to provide a report (1998, N6) on a preliminary environmental assessment of the Main Creek magnesite project in relation to the mining of the magnesite, together with requirements and indicative costings for a full DPEMP. The report includes a review of the project concept, and addresses the following issues:- 'Environmental setting and issues; Approvals and permitting process; Future work program; Schedule; Cost estimate; and contains a reference list. Two relevant environmental references not included, as they post-date the report, are "Magnesite karst in northwest Tasmania" (Houshold et al, 1999, T23) and "Report on the geoconservation values of the magnesite karst in northwest Tasmania" (Williams, 1998, W2). The former is a well-researched, 163 page study, covering geological, geomorphological and hydrological aspects, including examples from Brazil, California, Czechoslovakia as well as Australia. In Tasmania it includes the main areas of the Arthur-Lyons River as well as the Main Creek-Bowry Creek location. Its assessment of potentially significant sites includes two mentions of Bowry Creek, (section 6.2, p.105) but none for Main Creek.

Unfortunately, the 9 page Williams' document, is prone to exaggeration with regard to the size of the Tasmanian magnesite deposits, "on a world scale the Tasmanian resource is amongst the largest known" (Williams, 1998, p.7), with no mention of Chinese magnesite deposits that are an order of magnitude larger! This then flows into the Houshold report (p.105, T23). Thus the first conclusion from Williams "5.1 The magnesite deposits of northwest Tasmania are of international significance for their size and rarity" is not correct. The second conclusion, 5.2, is that the only surface expression worthy of conservation is the 'pinnacled' terrain in the Arthur River area. 5.4 states that "The biota of both the cool and warm groundwater systems could be important for their rarity and consequently merit investigation." Whilst, "5.5 A hydrogeological survey will be required in each magnesite lens before any geo-hydrological values can be fully assessed." The last will also be a necessity before any mining could occur as the major parts of the magnesite resources are below river levels.

Some environmental baseline data collection began from existing resources for the proposed mine location towards the end of the first quarter of 1999.

Expenditure

CATEGORY	EXPENDITURE	SUB-TOTAL	TOTAL
Geology	153931	153931	
Geochemistry	157243	157243	
Geophysics – air	0	0	
Geophysics – ground	0	0	
Metallurgy	142612	142612	
Feasibility studies	112473	112473	
Rehabilitation	0	0	
Drilling	511725	511725	
Gridding	12041	12041	
Other			
Field office	8975		
Government fees	1364		
Legal fees	22518		
Superannuation	6023		
Travel expenses	18977		
		57857	
			1147882
Overhead – 10%			114788
Total expenditure			1262670

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*Reports already provided to MRT as per letter of 24 March 1999 (file 097/060.1)

Keywords

Standard mineral names:- (Magnesia), magnesite, magnesium, magnetite, ochre, pigment, umber.
Standard mine/deposit names:- Bowry Ck, Main Ck, Savage R
Standard keywords:- Arthur Metamorphic Complex, Beneficiation, Bowry Formation, Carbonate hosted mineralisation, dolomite, (core drilling, dehydration, electrowinning, environment), flotation, (geology), hydrology, hydrometallurgy, (karst, leaching), metasomatism, mining: open pit, mining: underground, resource estimation,