

J.J. McDONALD & SONS MINING PTY LTD

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EXPLORATION LICENCE NO. 17/98

MAYDENA, TASMANIA

ANNUAL REPORT

TO

04 September 2003

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ABSTRACT

University research indicates that low temperature (<200°C), relatively saline solutions potentially related to a granite intrusion at depth provided the silica for replacement of dolomite to form the host rock for the silica sand/flour deposit at Pine Hill. A number of similarities with the Corinna silica flour deposit, western Tasmania have been recognised.

Check assays verified areas ear-marked for possible future bulk testing while reconnaissance was completed to select areas for relinquishment.

Investigations into process optimisation and availability of bulk testing facilities continued. Ongoing marketing efforts provided some indications of possible product off-take in a medium to long term time frame.

Keywords:

Maydena; Pine Hill
Silica flour; Origin:
Dolomite; Bulk Testing;
Marketing.

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1. INTRODUCTION

This report details activities by J.J. McDonald & Sons Mining Pty. Ltd. relating to Exploration Licence 17/1998 during the fifth year of tenure ended 04.09.2003.

Exploration licence tenure over an area of 7 sq. km was granted to J.J. McDonald & Sons Mining Pty. Ltd. for a period of five years from 04.09.1998.

E.L. 17/1998 surrounds and extends to the east of Pine Hill, located just south of the sealed Gordon River road approximately 4 km west south west of Maydena and about 90 km by road from Hobart (Fig.1). There is good access to and within the prospect area. Power, water, housing and basic facilities are readily available from within a short radius of the prospect. The rail-line from New Norfolk to Maydena is being progressively upgraded for passenger traffic. A 700m long gravel airstrip is located 3 km north west of the silica sand deposit.

The primary target for investigation and assessment is the deposit of silica sand located largely to the west of the Eastern Quarry, about 1 km south east of Pine Hill (Fig.2).

The overall aim of the investigations is to determine if a commercially viable operation can be established, based on products derived from the silica sand resource in the tenement.

The main objectives of this year's activities towards this aim were:

- completion of the CODES research project
- completion of a preliminary, internet-based market investigation
- to find an independent bulktesting/pilot plant facility
- continuation of product upgrade investigations
- on-going marketing efforts for silica flour and co/by-products

2. PREVIOUS WORK

Exploration by Pioneer Silicon Industries Pty. Ltd. in 1988/89 identified a lag deposit of hard silica rock at the Western Quarry containing a small resource of material deemed suitable for the manufacture of silicon. From this, approximately 19,000 tonnes of crushed, screened silica rock was produced in 1991 and 1992 for shipment. 10,000 tonnes were consigned to Pioneer's silicon smelter at Electrona and about 9,500 tonnes went to Temco's Bell Bay ferrosilicon plant. Extraction, by Duggans Pty. Ltd. under M.L. 1396 P/M, virtually ceased upon closure of the Electrona smelter in 1992, although a small parcel of 850 tonnes of silica rock is reported to have been mined in 1995. Towards the end of the earlier exploration work, a deposit of white silica sand was located between Pine Hill and the Styx Road in an area now known as the Eastern Quarry Area. Pioneer investigated this deposit in the vicinity of the Eastern Quarry by 23 shallow RC drill holes. Preliminary estimates suggested a resource in the order of some 0.75 - 1.5 million cu. m. of mostly low iron silica sand containing about 10% of high grade lump silica.

Assay results from a number of subsequent, excavator generated pit samples by the North West Bay Co. Pty. Ltd. supported the high quality of the resource and, together with sizing determinations on a bulk sample, indicated that the sand might be suitable for the manufacture of table ware glass.

In the first year of tenure of E.L. 17/1998 JJ. McDonald & Sons Pty. Ltd., using the air-core drill sampling method, extended the sampling into the western segment of the deposit along more widely-spaced drill centres. 23 drill holes totalling 294m were completed which demonstrated that the deposit is more variable, complex and higher in iron oxides than previous data suggested.

The area around the Eastern Quarry was shown generally to have a matrix of fine grained sand, but with elevated levels of iron, titanium and alumina.

Laboratory sizing determinations indicated that the deposit is a possible source of silica flour as well as glass sand, while geological mapping pointed to a small resource potential for silica rock as well.

Bench-scale acid wash tests on a sample of the glass size fraction sand aimed at the removal of iron oxides showed that the material could easily be upgraded to a high quality product containing less than 50 ppm iron without major environmental impact, with levels of iron below 10ppm a possibility.

The second year's activities by JJ. McDonald & Sons Pty. Ltd. contributed to a better understanding of the geological setting of the silica sand deposit and identified a possible source of good grade limestone for use in acid neutralisation in relative proximity to the east of the silica sand deposit.

Marketing activities provided some encouragement for potential demand for the area's products, with particular interest and enquiries directed at the silica flour component and other fine fraction material.

The main outcomes in the third year of operation were the completion of the first-pass drill coverage of the Pine Hill silica sand deposit which outlined broadly its complex quality and textural characteristics and the identification of silica flour as potentially its economically most important component.

During the fourth year of tenure a resource estimate and bench-scale tests led to a scoping study on processing options for the production of high quality silica flour. This also provided "order of magnitude" capex/opex estimates for a conceptual 25,000 t.p.a. operation. Encouraging outcomes of limited bulk sample processing tests helped underpin further marketing efforts.

In parallel, a university-based research project was initiated to characterise the deposit and its origins geologically.

The fifth year's activities continued to build on previous work and the results are described below.

3. ACTIVITIES FOR PERIOD

During the period under review most of the effort was again related to matters dealing with the Eastern Quarry silica sand deposit.

However, some attention was devoted to the silica and dolomite potential in the tenement due to several market enquiries.

Ground relinquishment and flow-on tenure were also addressed.

3.1 Work Done:

This included:

- completion of a research project by a CODES honours student on the origin of the silica flour deposit and bedrock silicification and to characterise aspects of the deposit
- planning and costing of a low-level air-borne EM-mag-radiometric survey over E.L. 17/1998 and adjacent E.L. 17/2002
- preliminary review of the silica bedrock and dolomite potential of the tenement
- selection of ground for retention licence application and for relinquishment; applications, with respective reports, submitted
- preliminary, internet-based market investigation completed
- on-going discussions with suppliers of processing plant
- on-going search Australia-wide for suitable, independent bulk sample processing or pilot plant facilities
- completion of the annual report for 2003

3.2 Statistical Summary:

No .of samples	:	76
No. of determinations	:	1002
Acid neutralization value determinations	:	1

3.3 Expenditure:

Expenditure - this period (9 months, Oct '02-June '03)	:	\$ 21,642
Cumulative expenditure to 30/06/2003	:	\$ 225,412

4. RESULTS

4.1 Geology - CODES Project:

This project, undertaken by S. Osterloh as her honours degree research assignment at the Geology Department, University of Tasmania, was completed at year-end 2002, with the final report submitted in early 2003.

It attempted to characterise the Pine Hill silica sand/flour deposit with particular reference to the deposit's geological setting, its geochemistry, impurities and the physico-chemical environment of bedrock silicification. This information was needed to compare it with a similar deposit located at Corinna, NW Tasmania.

An extract from the thesis, which summarises the main research outcomes is presented in Appendix 3.

Of special interest to product quality enhancement efforts is the newly identified presence of chrome spinels, rutile inclusions in quartz and, in particular, dark, micron-sized impurities along primary growth zones in vein quartz cutting the silicified dolomite bedrock. These particles are thought to be iron oxides and/or sulphides, but accurate identification is necessary.

The presence of this fine, dark material may in part explain the increase in iron levels in the -20 micron size fraction.

These enclosed particles would also be inaccessible to the mild chemical reagents, which would account for the reason why acid washing of final product to remove iron has only been partially successful.

Thin section examination of some of the dolomite protolith shows that much of it is very fine grained and assists towards an understanding of silica flour formation if dolomite replacement by silica occurred on a grain by-grain basis.

4.2 Resource Quality Verification:

Prior to selection of further test sites for bulk sampling it was deemed prudent to verify the quality of the raw material in the target area. The latter is comprised of resource blocks AB, AC and AD (Krummei, 2003).

In the initial resource estimate, quality was calculated using assay data from every alternate 1m drill sample.

The latest attempt to check this estimate used drill chip assays from every previously untested 1m interval.

These results were then combined with the previous assays on a hole-by-hole basis to give continuous data over 1m intervals down each of the holes selected.

These holes were (Fig. 3):

<u>BLOCK</u>	<u>HOLES</u>
AB	93, 94, 101
AC	91, 102
AD	72, 83, 90, 104

This latest suite of samples was also checked for levels of K₂O, Na₂O, Co and LOI in response to a market enquiry.

Recalculating the resource quality over the same drill intercepts showed:

<u>BLOCK</u>	<u>Al₂O₃</u>	<u>Fe₂O₃</u>	<u>TiO₂</u>	<u>Comments</u>
AB+AC+AD	232	461	149	All combined
<i>Compared with</i> AB+AC+AD	237	429	148	1999 & 2001 results only

These results reflect:

Al ₂ O ₃	2% decrease
Fe ₂ O ₃	7.5% increase
TiO ₂	0.7% increase

and also show the effects of arithmetic smoothing since variations in the results, especially for iron, for individual holes are often greater than this summary suggests.

Of particular note in this context is hole 101 where the amount of iron almost doubled from a previous 178 ppm to 344 ppm Fe₂O₃, even though Al₂O₃ and TiO₂ remained almost unchanged at 186 and 163 ppm respectively.

This underlines the need to treat all raw material assay results from this deposit, especially those for iron, with considerable caution.

Levels of K_2O and Na_2O were generally low. K_2O was predominantly in the range of 20-10 ppm or below, with similar values for Na_2O . Spot highs were few and did not exceed 210 ppm K_2O and 620 ppm Na_2O . Co levels were mostly below 1 ppm, rarely rising to 1 ppm.

LOI values ranged from 0.31 - 0.11% and averaged an acceptable 0.15-0.17% (Appendix 1).

4.3 Dolomite:

In response to an enquiry about a possible supply of dolomite for the use in the manufacture of magnesium, a 10m channel sample of this bedrock type was collected at the south-central edge of the silica sand deposit and assayed (sample location: 5263655 mN 465800 mE)

Results obtained were CaO: 30.62%, MgO: 20.16%, Fe_2O_3 : 0.12% and SiO_2 : 2.61%, LOI: 46.21 (Appendix 2).

CaO and MgO values are acceptable, but SiO_2 is high when compared with the specified maximum level of 0.15%.

The acid neutralization value for the sample is a satisfactory 103.2.

However, dolomite assays for two samples by Osterloh (2002) gave improved SiO_2 values and showed:

	<u>CaO%</u>	<u>MgO%</u>	<u>SiO₂%</u>	<u>LOI%</u>
Sample A	31.01	20.71	0.32	46.14
Sample B	30.92	20.76	1.40	45.95

These results suggest that the material is marginal/sub-marginal with respect to specifications, but it may be adequate for agricultural purposes.

4.4 Relinquishment Areas Geology:

Several areas were selected for relinquishment in line with statutory requirements. The geology of these areas was reviewed, ground-checked where required during the course of the E.L. tenure and is described briefly below.

4.4.1 Part 1 – Northern Part (Fig 2)

Inspection of 1:10,000 aerial photographs gave no obvious indications of extensive occurrences of silica sand similar to the Pine Hill deposit in the areas to be relinquished. A conspicuous vegetation anomaly approx. 1.5 km, E-W x 0.3 Km N-S extending down the flanks of the Pine Hill ridge to the Gordon River road represents thinner scrubby growth in contrast to the more lush forest growth to the south. Small cuttings just south of the Gordon River Road in this area indicated the presence of white material, possibly silica sands.

Ground check showed this to be scree of largely coarse silica gravel and rock boulders. The proportion of finer fractions was too small to justify further investigation. Assays of several grab samples of this material collected previously by Ellis (in Jones, 1988) showed:

<u>Sample</u>	<u>Al₂O₃</u>	<u>Fe₂O₃</u>	<u>TiO₂</u>	<u>CaO</u>
PH 39	0.86	0.072	0.071	0.011
PH 53	1.2	1.5	0.066	0.014?
PH 69	0.53	0.046	0.19	0.004
PH 70	0.82	0.14	0.033	0.013
PH 71	0.40	0.26	0.042	0.010
PH 88	0.56	0.018	0.062	0.010
PH 90	1.2	0.031	0.14	0.013
PH 99	0.82	0.41	0.042	0.011

Note: Results in %

CaO value in these samples are low, but the high levels of Al₂O₃, TiO₂ and, to certain extent Fe₂O₃, rendered this material unattractive to Pioneer Silicon Industries for the production of silicon.

It remains so for the purposes of this investigation.

4.4.2 Part 2 - Eastern Part:

Most of this segment is underlain by units of the Ordovician Gordon Limestone Group, with a dip of around 35-40° to the NE.

These units were mapped by Calver and Forsyth (1999) and designated the Karmberg Limestone at the base of the sequence, followed by the Cashions Creek Limestone with the Benjamin Limestone at the top.

Further investigations of these units by Calver (1992) and Wrigley (1992 & 1993) as a possible source of high quality limestone for the Risdon Smelter was successful in outlining a drill indicated resource of some 1 million tonnes of suitable limestone in the Cashions Creek Limestone averaging around 94.5% CaCO₃ and 0.38% MgO in an area just to the SE of E.L. 17/1998.

As this unit traverses the NE corner of the tenement some limited check assaying of some of the MRT-generated drill cuttings was undertaken to confirm the quality of the material and to test for acid neutralization capacity.

The results confirmed the high quality of the material, indicated only very low levels or absence of undesirable contaminants and indicated satisfactory acid neutralization values of around 96.9.

Further investigations into this material were discontinued when it became apparent that the required, relatively small, amounts of limestone could be sourced more cheaply elsewhere.

4.4.3 Part 3 - Southern Part

This segment, traversed by Maynes and Styx Road, occupies a 3 km long section along the lower slopes of the Maydena Range.

Most of this area contains lithologies at the base of the Permo-Triassic Parmeener Group, represented here by soft "pebble" mudstones overlain by dark grey mudstone, dipping at very low angles to the south.

These beds are downfaulted against steeply-dipping, north-west trending sequences of probable Lower Cambrian age.

Spot checks revealed no significant deposits of silica sand or flour associated with the rocks in this area.

4.5 Beneficiation

4.5.1 Batch/Bulk Sample Processing:

Efforts to locate a suitable, independent batch or bulk processing facility for test samples have been unsuccessful to date. Problems revolve around contamination, availability of suitable equipment and cost.

One Melbourne-based facility no longer processes silica due to health risks associated with fine silica dust.

Exploratory discussions and plant inspection at AMDEL's site in Adelaide highlighted contamination issues with the proposed plant during processing at this site and the probable high cost to minimise or eliminate them.

In connection with these enquiries the flint pebble deposits around Port Macdonnell, S.E. South Australia, were examined for pebbles and boulders suitable for use as a grinding medium to reduce the coarse Pine Hill sand material to flour.

The occurrence of the flint deposits was somewhat localised and patchy over a distance of some 30 km of coast line. The pebble and boulder shapes were found to be highly irregular and generally unsuitable for use in a ball mill setting. A literature search revealed an undesirably high iron content. These two negative factors eliminate the pebbles from the proposed use.

IMDEX Minerals, Perth, when contacted, was in the process of re-organisation and re-structuring. It does appear, however, that this company may have at least some suitable equipment available to process small batches of silica flour. Contacts with the company are to be resumed when future corporate directions have been determined.

Preliminary discussions were initiated with Mineral Technologies, Gold Coast, particularly in regard to the suitability and use of spirals in the proposed processing circuit to size and upgrade the Pine Hill feed stock. This initial contact was promising, with further discussions and a visit to the company's research facility planned.

In a similar vein, arrangements have been made to inspect and assess the Stratoplex and Turboplex air classifier systems at the Hosokawa-Alpine research facility in Augsburg, Germany, later this year.

4.6 Marketing:

4.6.1 Market Survey:

A limited, internet-based, preliminary market survey was undertaken, with the aim of improving our level of knowledge of the silica flour market. The scope of this work was curtailed by the fact that virtually all the information accessed on the net related to producers rather than end users of silica sand and flour products. Information on production levels and product prices was minimal to nil. This precluded an estimate,

of whatever accuracy, of the size of the regional and world market for silica flour and pricing information must be obtained by other means.

However, some useful outcomes were achieved.

An important point to arise from this survey is that INDEX silica flour is very close to the highest purity material currently being sold in the world by a very large margin for many of its products.

Equally important is that the Pine Hill silica flour, as produced in batch tests by INDEX, compares quite well with the equivalent INDEX material.

There appears to be a significant competitive advantage as none of the other manufacturers produce silica flour with less than 0.02% Fe₂O₃, most averaging around 0.04%. The attractiveness of the Pine Hill products would be further enhanced by their low levels of T10₂ and A1₂O₃.

Among the main conclusions drawn from this survey are (quote):

- The main point that has emerged from this search is the relatively poor quality of the majority of silica flours when compared with INDEX production and potentially the production from Pine Hill.
- The results are encouraging and indicate that there could be room for another producer besides INDEX of high purity silica flour, and that Pine Hill could make such material.

4.6.2 Glasstec 2002:

A visit to this very large trade exhibition, held biennially in Dusseldorf, Germany, identified several off-take possibilities and led to direct contact with Quarzwerke, one of Germany's largest producers of silica sand and silica flour.

4.6.3 Quarzwerke:

The results of verification procedure by this company on a small demonstration sample of each of the -75 micron and -250 micron bands processed Pine Hill product submitted are comparable with J.J. McDonald data.

A minor exception was the slightly coarser nature of the -75 micron fraction, as determined by Quarzwerke.

The company advised that deposits of similar quality are now beginning to be exploited in Europe and that the products from Tasmania would most likely be uncompetitive in Europe due to shipping and increasing European ground transport costs.

4.6.4 Pilkington (UK):

This company advised that it has no need for silica flour sourced from Tasmania.

4.6.5 Pilkington Australia:

This company, a subsidiary of the above entity, currently uses about 15,000 t.p.a. of silica flour at its Alexandria, Sydney, plant for the production of glass used in the manufacture of solar panels.

Current specifications for this application are 0.010% Fe_2O_3 maximum and 98% SiO_2 minimum. These are now under review, but the Pine Hill material seems well placed to meet these basic quality requirements.

However, the estimated landed cost, Sydney plant, renders the product uncompetitive relative to the company's current suppliers.

Nevertheless, this steady requirement represents a medium to long term off take opportunity and contact is being maintained with the company on this and related matters.

In this context, the Resource Processing and Energy Unit of the Department of Economic Development, Tasmania, compiled an in-house "Summary Investment Brief - Silica Flour Processing for Glass Manufacture". Amongst other topics, this report addressed the comparative advantage of the manufacture of high quality float glass in Tasmania.

It lists factors which point out that Tasmania presents "an excellent commercial opportunity to establish and end-to-end high quality float glass manufacturing plant."

4.6.6 Index Mineral Processors ("INDEX")

The company advised that further product testing and marketing efforts based on Pine Hill silica flour products are continuing.

The company also flagged interest in sourcing some material from the Pine Hill deposit, subject to very stringent quality specifications across a range of elements. Some of these, especially K_2O , Na_2O , Co and LOI were checked out as part of the drill chip assay programme described in section 4.2 above.

In the light of these specifications, iron levels in the Pine Hill products remain a beneficiation challenge.

4.6.7 Unimin:

This company is an associate of Quarzwerke.

Submission of a test sample to the company's Melbourne office elicited concerns about transport costs ex Tasmania, which dampened further interest in the product for local use.

4.6.8 Sumitomo, Japan:

Introductory sample submitted for inspection and check tests. Feed-back is awaited.

4.6.9 Trachem, Korea:

Introductory sample submitted for inspection and tests. Feed-back is awaited.

4.6.10 Osthandel Chemie GmbH:

OHC's interest in sourcing high quality lump silica from the Pine Hill deposits for silicon producer ELKEM of Norway was negated when the latter company was taken over by one of the large US aluminium producers.

However, OHC continues to seek out markets for the Pine Hill silica flour.

4.6.11 Australian Silicon Limited

ASL investigated the possibility of establishing a silicon production plant in Tasmania, with the intention of sourcing at least part of its lump silica requirements from Pine Hill.

Inability to achieve a long term, low-cost electricity supply coupled with market competition and threat of oversupply, led to major shareholder disillusionment, resulting in the abandonment of the project.

4.6.12 Magnesium Production:

A recent enquiry was aimed at sourcing lump silica from the Pine Hill deposit for the production of ferro-silicon which is said to be a step in the production of magnesium using dolomite as feed-stock.

News of developments in this proposed project are awaited.

4.7 Rehabilitation:

As field activities this year were non-intrusive, no rehabilitation was required.

5. CONCLUSIONS

5.1 The Pine Hill silica flour deposit compares well in many aspects with its counterpart at Corinna, Western Tasmania and could be competitive in several product lines.

5.2 Further beneficiation and testing of larger parcels of Pine Hill material is desirable to assure both producer and consumers that a set of end products of a consistent quality can be achieved on a regular basis from raw material sourced from different parts of the deposit.

5.3 Marketing efforts, supported by product development and product sample availability now need to be stepped up.

There is increasing awareness in the market place of the potential for lump silica availability from the deposit.

However, transport costs and emerging "green" issues are becoming matters for some concern as they seem to colour the market's perception of the advantages to source material from Tasmania.

5.4 A retention licence including the deposits of silica sand, silica bedrock and a possible processing site is required to allow marketing, product development and product improvement activities to continue in anticipation of entering production.

6. PROPOSED FUTURE ACTIVITIES

- Application for a retention licence of 4 sq km to be submitted.
- Surplus ground to be relinquished; a relinquishment report to be written.
- Continue with on-going beneficiation investigations aimed at developing product range and improving end product quality and consistency.
- Marketing:
 - continue to generate product awareness and to identify customers world-wide
 - maintain contact and information exchange with interested parties
 - secure take-off arrangements
 - monitor developments on lump silica requirements

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APPENDIX 1

DRILL HOLE ASSAYS

CERTIFICATE OF ANALYSIS



ALS Chemex

Batch: ST38446
Sub Batch: 0

CONTACT: MR GERHARD KRUMMEI
CLIENT: JJ MCDONALD & SONS MINING P/L
ADDRESS: SUITE 28
487 ST KILDA ROAD
MELBOURNE VICTORIA 3004

LABORATORY: BRISBANE
DATE RECEIVED: 02/06/2003
DATE COMPLETED: 26/06/2003
SAMPLE TYPE: SILICA
No. of SAMPLES: 75

ORDER No.: FAX
PROJECT:

COMMENTS

NOTES

This is the Final Report and supersedes any preliminary reports with this batch number.
Results apply to sample(s) as submitted. All pages of this report have been checked and approved for release.

ISSUING LABORATORY: BRISBANE

Address
32 Shand Street
Stafford QLD 4053
Australia

Phone: 61-7-3243 7222
Fax: 61-7-3243 7254
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Signatory

LABORATORIES

AUSTRALIA

Brisbane Orange
Alice Springs Perth
Kalgoorlie Townsville

NORTH AMERICA

Vancouver Fairbanks Thunder Bay
Chihuahua Guadalajara Toronto
Elko Reno

SOUTH AMERICA

Santiago Calama Mendoza
Antofagasta Copiapo Quito
Arequipa Lima

AFRICA

Mwanza

Batch: ST38446
 Sub Batch: 0
 Date of Issue: 26/06/2003
 Client: JJ McDONALD & SONS MINING P/L
 Client Reference:

CERTIFICATE OF ANALYSIS



SAMPLE	Element Unit Method	Al2O3 %	Fe2O3 %	TiO2 %	Cr2O3 ppm	CaO %	MgO %	MnO %	V2O5 %	K2O %	Na2O %	Cu ppm	Ni ppm
	LOR	M289-1	M289-1	M289-1	M289-1	M289-1	M289-1	M289-1	M289-1	M289-1	M289-1	M289-1	M289-1
70370R	DH 72 2-3 m	0.157	0.036	0.034	2	0.011	0.009	<0.001	<0.001	0.021	0.005	17	<1
70371R	4-5	0.055	0.026	0.018	1	0.014	0.007	<0.001	<0.001	0.006	0.003	2	<1
70372R	DH 82 2-3 m	0.063	0.064	0.030	3	0.014	0.008	<0.001	<0.001	0.006	0.003	10	1
70373R	4-5	0.023	0.029	0.020	<1	0.012	0.006	<0.001	<0.001	0.003	0.002	4	<1
70374R	6-7	0.017	0.018	0.015	<1	0.011	0.005	<0.001	<0.001	0.002	0.002	2	<1
70375R	8-9	0.015	0.022	0.021	<1	0.011	0.005	<0.001	<0.001	0.001	0.002	2	1
70376R	10-11	0.031	0.091	0.069	3	0.020	0.009	<0.001	<0.001	0.003	0.003	2	1
70377R	DH 83 2-3m	0.050	0.050	0.017	1	0.014	0.006	<0.001	<0.001	0.003	0.002	1	1
70378R	4-5	0.026	0.024	0.044	1	0.015	0.005	<0.001	<0.001	0.002	0.003	<1	<1
70379R	6-7	0.039	0.033	0.035	2	0.024	0.008	<0.001	<0.001	0.002	0.002	1	<1
70380R	8-9	0.015	0.014	0.013	<1	0.020	0.006	<0.001	<0.001	0.001	0.002	<1	<1
70381R	10-11	0.158	0.150	0.109	6	0.036	0.016	<0.001	<0.001	0.005	0.018	5	2
70382R	DH 84 2-3m	0.023	0.053	0.035	<1	0.013	0.005	<0.001	<0.001	0.001	0.003	1	<1
70383R	4-5	0.033	0.081	0.026	<1	0.015	0.006	<0.001	<0.001	0.002	0.004	3	<1
70384R	6-7	0.020	0.068	0.034	1	0.026	0.012	<0.001	<0.001	0.002	0.006	2	<1
70385R	8-9	0.021	0.052	0.034	<1	0.022	0.011	<0.001	<0.001	0.001	0.002	1	1
70386R	10-11	0.042	0.089	0.051	2	0.036	0.017	<0.001	<0.001	0.002	0.005	2	<1
70387R	12-13	0.028	0.041	0.031	<1	0.022	0.011	<0.001	<0.001	0.002	0.002	<1	1
70388R	14-15	0.022	0.024	0.018	<1	0.025	0.014	<0.001	<0.001	0.002	0.003	<1	<1
70389R	16-17	0.030	0.033	0.020	<1	0.047	0.027	<0.001	<0.001	0.002	0.002	<1	1
70390R	DH 90 2-3 m	0.019	0.018	0.007	<1	0.026	0.004	<0.001	<0.001	0.002	0.001	<1	<1
70391R	4-5	0.017	0.015	0.006	<1	0.027	0.004	<0.001	<0.001	0.001	<0.001	1	<1
70392R	6-7	0.016	0.045	0.013	<1	0.016	0.003	<0.001	<0.001	0.002	<0.001	1	1
70393R	8-9	0.014	0.028	0.008	<1	0.029	0.010	<0.001	<0.001	0.001	0.001	1	<1
70394R	10-11	0.019	0.020	0.008	<1	0.019	0.009	<0.001	<0.001	0.002	<0.001	<1	<1
70395R	12-13	0.018	0.156	0.034	5	0.038	0.016	0.002	<0.001	0.002	0.062	6	2
70396R	14-15	0.019	0.132	0.020	3	0.082	0.046	0.001	<0.001	0.002	0.019	10	1
70397R	DH 91 2-3 m	0.011	0.016	0.015	<1	0.014	0.004	<0.001	<0.001	0.002	0.002	<1	<1
70398R	4-5	0.009	0.018	0.014	<1	0.008	0.004	<0.001	<0.001	0.002	0.001	<1	<1

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SAMPLE	Element Unit Method	Al2O3 % M289-1	Fe2O3 % M289-1	TiO2 % M289-1	Cr2O3 ppm M289-1	CaO % M289-1	MgO % M289-1	MnO % M289-1	V2O5 % M289-1	K2O % M289-1	Na2O % M289-1	Cu ppm M289-1	Ni ppm M289-1
70399R	DH 91 6-7 m	0.011	0.074	0.031	1	0.017	0.008	<0.001	<0.001	0.002	0.002	<1	1
70400R	8-9	0.010	0.039	0.020	1	0.029	0.004	<0.001	<0.001	0.002	0.002	1	<1
70401R	10-11	0.008	0.072	0.022	2	0.038	0.006	<0.001	<0.001	0.002	0.002	<1	<1
70402R	DH 93 1-2 m	0.017	0.050	0.010	1	0.032	0.006	<0.001	<0.001	0.002	0.002	2	1
70403R	3-4	0.012	0.068	0.013	1	0.033	0.007	<0.001	<0.001	0.001	0.002	2	<1
70404R	5-6	0.011	0.037	0.015	<1	0.068	0.031	<0.001	<0.001	<0.001	0.002	1	1
70405R	7-8	0.013	0.033	0.021	<1	0.029	0.010	<0.001	<0.001	<0.001	0.001	<1	<1
70406R	9-10	0.009	0.066	0.019	<1	0.036	0.005	<0.001	<0.001	0.001	<0.001	<1	<1
70407R	11-12	0.014	0.056	0.015	2	0.039	0.009	<0.001	<0.001	0.001	0.001	2	<1
70408R	DH 94 4-5 m	0.039	0.028	0.009	1	0.043	0.011	<0.001	<0.001	<0.001	0.001	<1	<1
70409R	6-7	0.020	0.024	0.007	<1	0.043	0.009	<0.001	<0.001	<0.001	<0.001	<1	<1
70410R	8-9	0.024	0.025	0.019	<1	0.048	0.007	<0.001	<0.001	0.001	<0.001	<1	<1
70411R	DH 101 2-3 m	0.014	0.024	0.013	<1	0.025	0.008	<0.001	<0.001	0.002	0.001	<1	<1
70412R	4-5	0.018	0.055	0.026	<1	0.017	0.005	<0.001	<0.001	<0.001	0.002	<1	2
70413R	6-7	0.014	0.077	0.017	<1	0.021	0.006	<0.001	<0.001	<0.001	0.002	<1	<1
70414R	8-9	0.010	0.045	0.013	<1	0.026	0.007	<0.001	<0.001	<0.001	0.002	1	<1
70415R	10-11	0.007	0.018	0.006	<1	0.032	0.008	<0.001	<0.001	<0.001	0.001	<1	<1
70416R	12-13	0.032	0.068	0.006	1	0.029	0.012	<0.001	<0.001	0.001	0.002	<1	1
70417R	14-15	0.022	0.196	0.009	1	0.024	0.009	0.001	<0.001	0.001	0.002	<1	1
70418R	DH 102 2-3 m	0.015	0.040	0.008	<1	0.022	0.008	<0.001	<0.001	<0.001	0.002	<1	<1
70419R	4-5	0.016	0.082	0.009	1	0.021	0.007	<0.001	<0.001	<0.001	0.002	1	<1
70420R	10-11	0.023	0.141	0.012	4	0.023	0.007	<0.001	<0.001	0.001	<0.001	<1	<1
70421R	12-13	0.013	0.077	0.010	2	0.019	0.005	<0.001	<0.001	<0.001	0.001	<1	<1
70422R	14-15	0.013	0.121	0.010	2	0.029	0.004	<0.001	<0.001	<0.001	0.001	1	<1
70423R	16-17	0.013	0.058	0.011	<1	0.045	0.009	<0.001	<0.001	<0.001	0.001	<1	<1
70424R	18-19	0.009	0.116	0.012	3	0.033	0.006	<0.001	<0.001	<0.001	<0.001	<1	2
70425R	20-21	0.006	0.126	0.019	3	0.031	0.004	<0.001	<0.001	<0.001	<0.001	<1	<1
70426R	22-23	0.009	0.043	0.010	<1	0.025	0.005	<0.001	<0.001	<0.001	<0.001	1	<1
70427R	24-25	0.009	0.089	0.015	3	0.035	0.004	<0.001	<0.001	0.001	<0.001	2	<1

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 Client: JJ McDONALD & SONS MINING P/L
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SAMPLE	Element Unit Method	Al2O3 % M289-1	Fe2O3 % M289-1	TiO2 % M289-1	Cr2O3 ppm M289-1	CaO % M289-1	MgO % M289-1	MnO % M289-1	V2O5 % M289-1	K2O % M289-1	Na2O % M289-1	Cu ppm M289-1	Ni ppm M289-1
70428R	DH102 26-27m	0.009	0.132	0.010	3	0.030	0.004	<0.001	<0.001	<0.001	<0.001	<1	1
70429R	28-29	0.010	0.036	0.007	<1	0.029	0.008	<0.001	<0.001	<0.001	<0.001	<1	<1
70430R	30-31	0.010	0.082	0.014	3	0.032	0.016	<0.001	<0.001	<0.001	<0.001	1	<1
70431R	32-33	0.008	0.066	0.006	3	0.015	0.007	<0.001	<0.001	<0.001	0.001	<1	<1
70432R	DH103 2-3 in	0.015	0.058	0.009	2	0.027	0.013	<0.001	<0.001	<0.001	0.001	2	1
70433R	4-5	0.035	0.035	0.015	<1	0.023	0.012	<0.001	<0.001	0.001	<0.001	<1	1
70434R	6-7	0.014	0.075	0.012	1	0.019	0.007	<0.001	<0.001	<0.001	<0.001	<1	<1
70435R	8-9	0.011	0.016	0.006	<1	0.019	0.007	<0.001	<0.001	<0.001	0.001	<1	<1
70436R	10-11	0.010	0.040	0.010	1	0.017	0.008	<0.001	<0.001	<0.001	0.002	<1	<1
70437R	12-13	0.021	0.071	0.018	2	0.024	0.011	<0.001	<0.001	0.001	0.002	<1	2
70438R	DH104 2-3 m	0.023	0.088	0.017	3	0.019	0.007	<0.001	<0.001	<0.001	<0.001	<1	<1
70439R	4-5	0.015	0.031	0.018	<1	0.017	0.004	<0.001	<0.001	<0.001	<0.001	<1	<1
70440R	6-7	0.015	0.059	0.015	1	0.017	0.003	<0.001	<0.001	<0.001	<0.001	<1	<1
70441R	8-9	0.011	0.021	0.011	<1	0.017	0.004	<0.001	<0.001	<0.001	<0.001	<1	1
70442R	10-11	0.007	0.031	0.014	<1	0.015	0.003	<0.001	<0.001	<0.001	<0.001	<1	<1
70443R	12-13	0.010	0.054	0.020	2	0.018	0.005	<0.001	<0.001	<0.001	<0.001	<1	<1
70445R	4-5mm composite	0.022	0.007	0.031	<1	0.011	0.004	<0.001	<0.001	0.002	0.003	<1	<1

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SAMPLE	Element Unit Method	Co ppm M289-1	LOI % OA-GRA05																		
70370R	LOR	<1	0.01																		
70371R		<1																			
70372R		<1																			
70373R		<1																			
70374R		<1	0.16																		
70375R		<1																			
70376R		1																			
70377R		<1																			
70378R		<1																			
70379R		<1	0.31																		
70380R		<1																			
70381R		1																			
70382R		<1																			
70383R		<1																			
70384R		1	0.26																		
70385R		<1																			
70386R		1																			
70387R		<1																			
70388R		1																			
70389R		<1	0.20																		
70390R		<1																			
70391R		<1																			
70392R		<1																			
70393R		<1																			
70394R		<1	0.19																		
70395R		<1																			
70396R		2																			
70397R		<1																			
70398R		<1																			

Batch: ST38446
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SAMPLE	Element Unit Method	Co ppm M289-1	LOI % OA-GRA05																
70399R	LOR	<1	0.01																
70400R		<1	0.14																
70401R		<1																	
70402R		<1																	
70403R		<1																	
70404R		<1	0.17																
70405R		<1																	
70406R		<1																	
70407R		<1																	
70408R		<1																	
70409R		<1	0.18																
70410R		1																	
70411R		<1																	
70412R		<1																	
70413R		<1																	
70414R		<1	0.15																
70415R		<1																	
70416R		<1																	
70417R		<1																	
70418R		<1																	
70419R		<1	0.13																
70420R		<1																	
70421R		<1																	
70422R		<1																	
70423R		<1																	
70424R		<1	0.11																
70425R		<1																	
70426R		<1																	
70427R		<1																	

Batch:
Sub Batch:
Date of Issue:
Client:
Client Reference:

ST38446
0
26/06/2003
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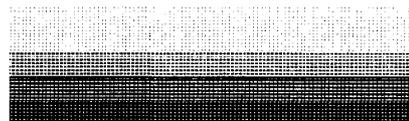


SAMPLE	Element Unit Method LOR	Co ppm M289-1	LOI % OA-GRA05																		
70428R		<1	0.01																		
70429R		<1	0.13																		
70430R		<1																			
70431R		<1																			
70432R		<1																			
70433R		<1																			
70434R		<1	0.15																		
70435R		<1																			
70436R		<1																			
70437R		<1																			
70438R		<1																			
70439R		<1	0.14																		
70440R		<1																			
70441R		<1																			
70442R		<1																			
70443R		<1																			
70445R		<1	0.14																		

APPENDIX 2

DOLOMITE ASSAYS

ST38188-1



**AUSTRALIAN
LABORATORY
SERVICES P/L**

A.C.N. 009 936 029
32 Shand Street
Stafford QLD 4053
Ph: 61-7-3243 7222
Fax: 61-7-3243 7216

**TO: JJ MCDONALD & SONS MINING P/L
SUITE 28
487 ST KILDA ROAD
MELBOURNE VICTORIA 3004**

ATTENTION: MR GERHARD KRUMMEI

SUBJECT: Analytical results.

BATCH: ST38188-1

DATE: 16/05/03

Dolomite



DOLomite

JJ MCDONALD & SONS MINING P/L

STAFFORD

Page-no: 1

Attention: MR GERHARD KRUMMEI
YourOrder: FAX
SampleType: DOLOMITE
Project:

Batch-no: 38188
Sub-batch: 1
No-samples: 1
Received: 29/04/03
Checked:

Element Unit Method	SiO2 %	Al2O3 %	Fe2O3 %	CaO %	MgO %	Na2O %	K2O %	TiO2 %
	ME-ICP85	ME-ICP85	ME-ICP85	ME-ICP85	ME-ICP85	ME-ICP85	ME-ICP85	ME-ICP85
70444	2.61	0.15	0.12	30.62	20.16	<0.05	<0.05	<0.01

X

✓

✓

✓

Limit of Detection 0.01 0.01 0.01 0.01 0.01 0.05 0.05 0.01



JJ McDONALD & SONS MINING P/L

STAFFORD

Page-no: 2

Attention: MR GERHARD KRUMMEI
YourOrder: FAX
SampleType: DOLOMITE
Project:

Batch-no: 38188
Sub-batch: 1
No-samples: 1
Received: 29/04/03
Checked:

Element Unit Method	MnO %	P2O5 %	SiO %	LOI %	NV %
	ME-ICP85	ME-ICP85	ME-ICP85	ME-ICP85	OA-VOL07
70444	0.01	0.1	0.01	46.21	103.2

✓

Limit of Detection	0.01	0.1	0.01	0.01	0.5
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APPENDIX 3

THESIS EXTRACT

Origin of the Maydena Silica Flour and Bedrock Silicification, Tasmania.

Sophie Osterloh (B.Sc)



UNIVERSITY
OF TASMANIA



CODES SRC
Centre for Ore Deposit Research

**A Thesis submitted in partial fulfilment of the requirements of the degree
of Bachelor of Science with Honours.**

**Centre for Ore Deposit Research Studies (CODES)
School of Earth Sciences, University of Tasmania.**

November, 2002.

CHAPTER 7 SYNTHESIS AND CONCLUSIONS

7.1 INTRODUCTION

This final synthesis evaluates the results presented in this thesis and presents a model of formation for the silica flour and origin of the source fluid based on extensive discussions in individual chapters. A comparison has been made with the Corinna Silica Flour Deposit, western Tasmania.

7.2 TEMPERATURE, SALINITY AND SOURCE OF THE SILICEOUS FLUID

The fluid responsible for the silicification of the host rock was a low temperature fluid with a homogenisation temperature range of 160-170°C. Salinities of primary fluid inclusions range between 1 and 22 wt % NaCl. There is a wide range of salinities in secondary inclusions. Some first ice melting temperatures are as low as -55°C and this indicates that salts, possibly hydrohalites with higher salinities than NaCl were present in the fluid. High salinity fluid inclusions and the presence of CH₄ and carbon species in the fluid do not rule out the additional sedimentary brine component of the system. CH₄ and carbon species may have leached from host rock into magmatic fluid cooling systems. The oxygen isotope quartz-fluid fractionation value for the fluid is $\delta^{18}\text{O}$ 7.12‰

7.3 SOURCE OF IMPURITIES WITHIN SILICA FLOUR

Chrome spinels are present throughout the silica flour prospect and represent the tectonic provenance of source rocks. Magnetite, haematite, goethite, zircon, pyroxene, talc, mica, Mg-chlorite and chlorite were impurities found in addition to chrome spinels. The distinctive group formed by chrome spinels in silica flour is distinguished by Cr # vs Mg # ratios which appears to indicate different magmatic origins for the two common populations. The Adamsfield Ultramafic chrome spinels display similar low TiO₂ and low Al₂O₃. The average Al₂O₃ value for spinels in the silica flour is 6.71 wt %

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compared with 9.6 wt % in Adamsfield spinels and 5.73 wt % for Cambrian Boninite spinels. Chrome spinels from the silica flour display similar petrological characteristics to chrome spinels from the Cambrian aged Adamsfield Ultramafics. The chrome spinels may have been placed in the silica flour through one of two processes: (1) spinel grains were already present in host rocks prior to silicification, and were already within the protolith rock from an earlier depositional cycle. In this instance, *if* the protolith rock was dolomite, the age of the dolomite would be Cambrian or younger; (2) spinel grains may have been transported through the depositional cycle, either by meteoric fluids or sedimentation. The fact that the base of drill hole 88 is richer in spinels and magnetite is indication that the majority of the impurities are sourced from the protolith.

7.4 WHOLE ROCK GEOCHEMISTRY

Ti and Zr ratios indicate that the genetic origin of the host rock was a Cambrian Dolomite. Ti/Zr ratios are ~ 20-40 typical of andesites. This value could equally be a mixture of sedimentary detrital components. Down hole drill data indicates that there is no change in mobile elements Ca and Mg with depth. An important observation is that the quartz vein has essentially 'zero' Ti and Zr. This is consistent with the notion that Ti and Zr were immobile and not transported within the fluids and not deposited within veins. This doesn't prove that they were immobile however, it is consistent with their immobility.

Low assays were returned for gold. There was <10 ppb returned for dolomite and <5 ppb returned for the silica flour, which indicates that although there is low gold, it may have been consolidated in the red plant carbon rich clay layer which forms a contact between the silica flour and the dolomite. This would be possible if there had been mass loss of dolomite material during transition to silica flour.

7.5 PREVIOUS GENETIC CONCEPTS FOR SILICA FLOUR DEPOSITS

The Maydena silica flour and bedrock silicification can be compared with the silica flour deposit in the Corinna district in Western Tasmania. Cominex discovered the site in 1984 within the exploration licence area 37/82. Longworth and MacKenzie Pty.Ltd identified 732,000 tonnes at greater than 99.9% SiO₂ with grainsize <106 microns. However the contractors did not mention the origin of the deposits and referred to the origin and genesis as unknown (Piaszczyk, 1989).

In a report for Cominex produced by Large (1987) the following points summarised the origin and genesis of the Corinna silica flour.

- 1) The Corinna silica flour deposits formed in recent times on a bedrock of dolomite and are overlain by Tertiary gravels.
- 2) Study of the silica flour using a scanning electron microscope indicated that the flour developed in-situ by a process of dolomite silicification followed by disaggregation and was not the result of a Tertiary alluvial system.
- 3) The dolomites formed as part of the Sigma Group, a sequence of Upper Proterozoic dolomites and mafic volcanics. Two high purity dolomite formations are present in the area; the Savage dolomite is below the Bernafai Volcanics, and the Corinna Dolomite is above the volcanics.
- 4) Petrographic studies of the dolomites and silicified dolomites suggest that a silicification event was probably post Tabberabberan deformation produced crustiform quartz veining.
- 5) Exploration criteria for the silica flour combine mapped or interpreted areas of the Sigma Group with aeromagnetic lows.

Piaszczyk (1989) added further findings:

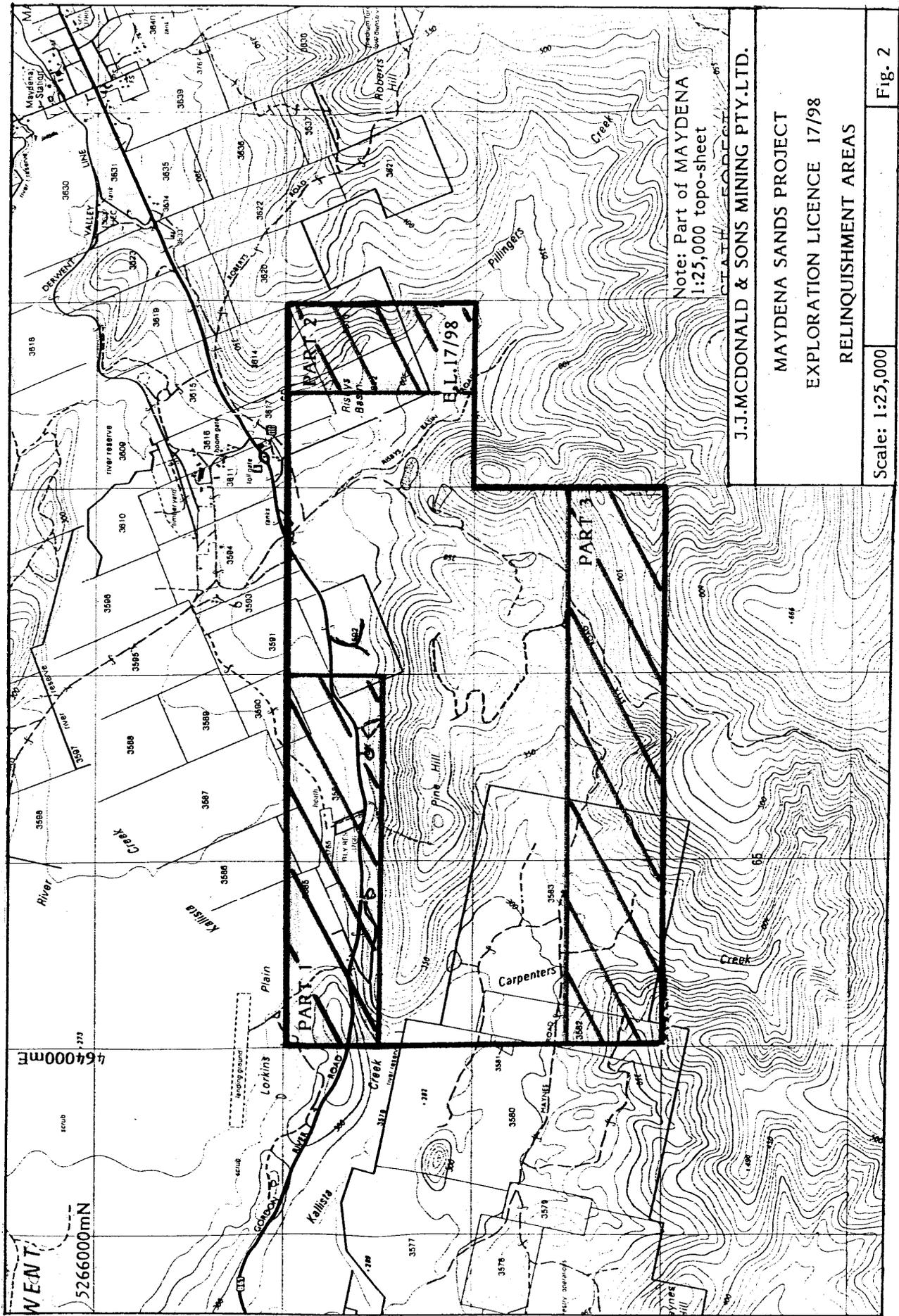
- 1) The silica flour is fine grained (90% in the 30 to -200 micron category) and the silica flour is high purity (99.99% silica).

- 2) The Corinna and Savage Dolomites, are technically dolomicrites, and were deposited in a peritidal regime from a mixed marine source fluid. The dolomites have a grain size similar to that of the silica flour.
- 3) The silica flour deposits are situated on hard bedrock consisting of dolomicrite. The silica flour is granular and unconsolidated containing larger boulder material forming lineation in pods in various stages of decomposition. Tertiary gravels cover deposits of high purity
- 4) Three types of boulder material were found in the deposits: lacy agate, silicified dolomicrite, and re-agglomerated type. The lacy agate boulders have colloform banding and are the most common type of boulder. The silicified dolomicrite boulders show remnant textures of the original dolomicrite but are now 99.99% silica. Re-agglomerated boulders indicate recent cementing of the flour.
- 5) Fluid inclusions gave an average homogenisation temperature of 125.5°C and a salinity of 10.5 to 12.7 wt % NaCl equivalent.
- 6) Oxygen isotope values for $\delta^{18}\text{O}$ fluid value was 6.26‰.
- 7) Using the temperature, salinity and $\delta^{18}\text{O}$ values range between 25.8 and 27.1, the fluid conditions during dolomite replacement were fluid temperature below 200°C, of near neutral pH, only slight supersaturation of silica and slow cooling near equilibrium conditions.
- 8) Silicification fluids for the deposits were derived from a magmatic or a metamorphic source and were potentially mixed with meteoric waters.
- 9) Disaggregation of the silica flour occurred after the Tertiary due to weathering processes that were assisted by earlier metamorphism.

7.6 ORIGIN OF THE SILICA FLOUR AT MAYDNA

- Petrographic and stratigraphical relationships support that the Maydna Silica Flour Prospect formed from the replacement of a carbonate host by siliceous fluid. Subsequent disaggregation of the silicified matrix resulted in the formation of fine-grained silica flour.
- Fluid inclusions indicate that the temperature of the siliceous fluid was approximately $< 200^{\circ}\text{C}$. Oxygen isotope values indicate that average fluid composition was 7.12‰ . This fluid is potentially sourced from a granite intrusion at depth and represents a low temperature hydrothermal intrusion.

MAPS



Note: Part of MAYDEN
 1:25,000 topo-sheet

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MAYDEN SANDS PROJECT
 EXPLORATION LICENCE 17/98
 RELINQUISHMENT AREAS

Scale: 1:25,000

Fig. 2



466000mE

5264000mN

AREA B

AREA A

Quarry

AD

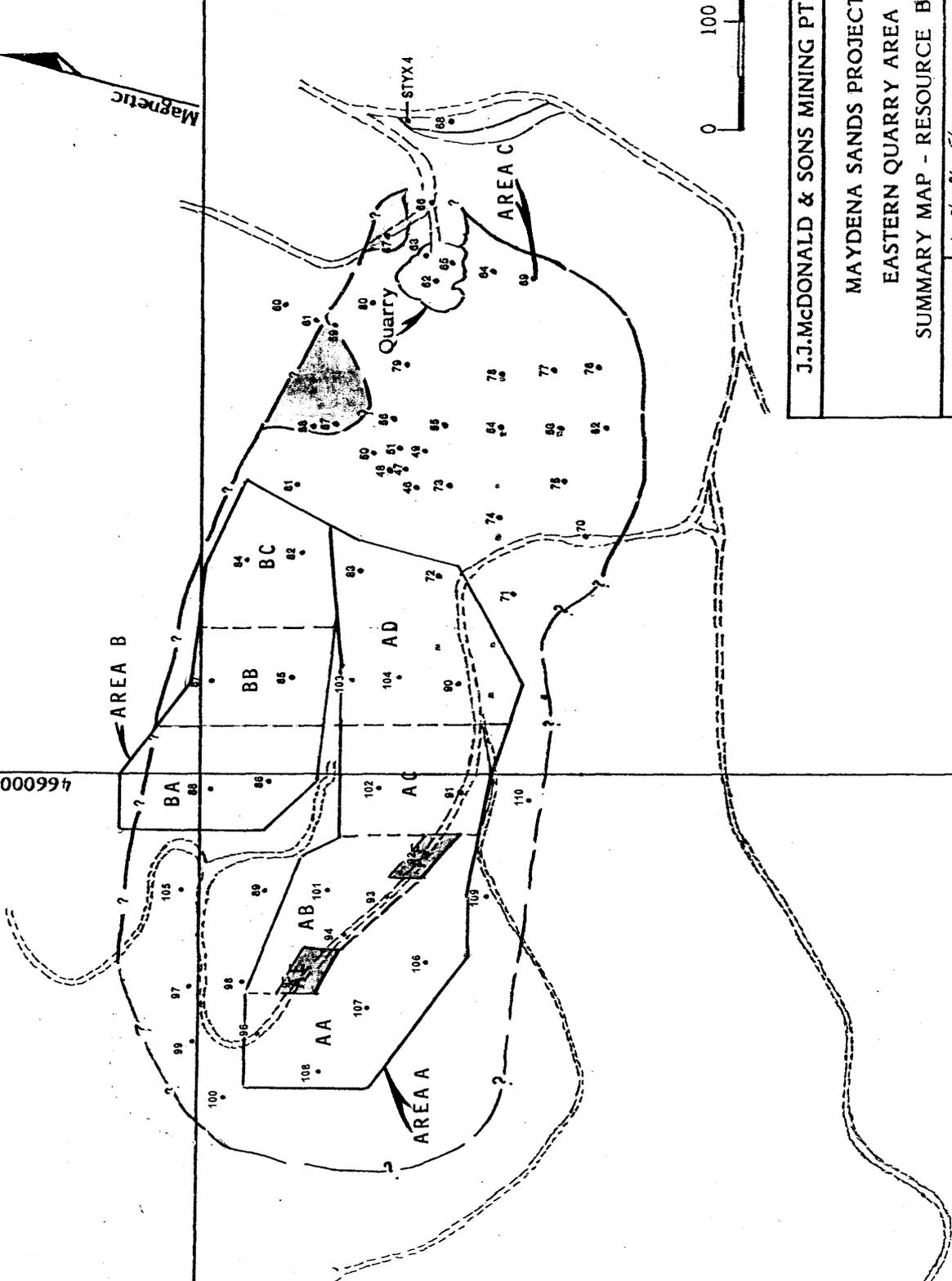
AA

AB

BC

AREA C

STYX 4



J.J. McDONALD & SONS MINING PTY. LTD.	
MAYDNA SANDS PROJECT	
EASTERN QUARRY AREA	
SUMMARY MAP - RESOURCE BLOCKS	
Scale: 1:5,000	1/11, 8/10, 9/10, 5/10, 1/02,
Fig. 3	