642001

00 4441

J.J. McDONALD & SONS MINING PTY LTD

ACN 051 399 261

EXPLORATION LICENCE NO. 17/98

MAYDENA, TASMANIA

ANNUAL REPORT

TO

END SEPTEMBER, 1999

GERHARD K. KRUMMEI

OCTOBER 1999

ABSTRACT

Previous investigations in the Eastern Quarry segment of the Pine Hill Area west of Maydena pointed to the possibility of a small resource of potentially saleable product consisting mainly of high purity, fine silica sand suitable for the manufacture of table-ware glass.

This year's exploration programme by J.J. McDonald & Sons Mining provided further information about the extent, variability and quality of this resource.

Preliminary sizing and beneficiation tests to upgrade the quality of the product indicate positive results.

Overall, the technical outcomes of investigations to-date justify continuing with the project.

642003

CONTENTS

APPENDICES

ILLUSTRATIONS

1. SUMMARY

An active first year programme focused almost exclusively on the silica sand resource around the Eastern Quarry area of the tenement. Activities commenced with the preparation of an accurate topo base map and check mapping, followed by the completion of 23 RC/Air-core holes for a total of 294m drilled, sample assays, sizing determinations, mineralogy and beneficiation tests.

Although in part "due dilligence" to confirm prior information, the programme was mainly aimed at expanding the data base on the size potential, character and variability of the silica sand deposit, providing some indications of possible product range and to investigate if the silica sands can be upgraded to high purity, low Fe/Ti product which commands a price premium in the market place.

The picture emerging to date is that of a rather more complex silica sand deposit than earlier results might have suggested.

Although not yet closed off fully to the west and south, it seems unlikely at this stage that the amount of easily accessible and treatable silica sand within the deposit will significantly exceed about 3.5 million tonnes. Below a leached horizon extending to about 8m from the surface there appears to be a marked deterioration in the quality of the sand as shown by a rise in the iron and clay content. Sizing tests suggest that about 43% of the material across the area tested so far falls within the size range suitable for the manufacture of glass. However, the particle size distribution tends to favour the finer end of the range and highlights the need to assess the silica flour production potential of the deposit.

Impurity levels, particularly iron, were found to be higher than previously reported. Variations between individual samples and drill holes can be quite large.

On average, in the light of available results, the western two thirds of the deposit are emerging being of better quality and coarser than the remaining area of the prospect where the Eastern Quarry is located.

Bench-scale magnetic separation tests confirm that about half of the iron contamination can be removed using WHIMS. Preliminary acid washing tests indicate that the remaining material could be upgraded relatively easily to a high quality product containing less than 50 ppm and possibly only 2 ppm Fe without major environmental impact.

All up, the results to date are deemed to be sufficiently encouraging to continue with the investigations of the deposit with cautious optimisim.

2. INTRODUCTION

The area was brought to the attention of J.J. McDonald & Sons Mining Pty. Ltd. via the Tasxplorer notice system of Mineral Resources Tasmania. This advertised the availablity of ETA 483 (formerly R.L. 9042 held by the Northwest Bay Co. Pty. Ltd.) in the early months of 1998.

A brief visit to the district and inspection of the silica sands in the Eastern Quarry prompted a decision to apply for a small exploration licence over an area surrounding the main deposits of silica sand and silica rock (Fig.1).

Further encouragement was derived from positive, preliminary discussions with the Office of Major Projects Tasmania and Tasrail, the latter signalling proposals to re-open the narrow gauge rail line to Maydena.

3.TENURE

Application for an exploration licence of 7 sq km (including R.L. 9042) around Pine Hill approximately 3 km south west of Maydena was submitted on the 26th of May 1998.

Ministerial consent for the licence was obtained on 10.10.1998, effective for 5 years to 04.09.2003.

The tenement comprises:

State Forest - Multiple use forest land

Private Property

Crown Land - Subject to DELM approval

One Heritage Site

These land use areas are shown in Fig.2.

4. INFRASTRUCTURE

In a direct line, the silica sand prospect is located about 60 km west north west of Hobart. By road it is about 90 km and 1½ hours' driving time from the city centre by sealed road for all but the last 1.5 km, which are part of a well formed and maintained gravel road.

Basic facilities, including housing, are available in the small township of Maydena and surrounding district (Fig.1).

Refurbishment of the narrow gauge, single track rail line from Bridgewater to the Mt. Field National Park for passenger traffic has commenced. The remaining 12 km to Maydena may be upgraded at a later date, if warranted.. This line extends a further 2 km to the west of Maydena to a former timber yard, now privately owned and about 2 km by gravel track from the silica sand prospect.

A 700 m long, fair-weather, east-west orientated gravel landing strip is located 3 km north west of the prospect.

A single strand power-line extends from Maydena to within 1 km of the prospect and the Gordon River power transmission line passes 2.5 km to the south. Water supply opportunities in the area are plentiful.

5. TARGETS AND OBJECTIVES

The primary target for exploration and assessment is the deposit of silica sand located mainly to the west of the Eastern Quarry about 1 km south east of Pine Hill.

Product quality and markets outside Tasmania are the key to the commercial viability of this resource.

In this context, the main project objectives this year were to further characterise the deposit and gain product knowledge by:

* obtaining further information on the geological setting of the silica sand deposit, its size and extent, quality, composition and variability
* undertaking preliminary beneficiation tests to determine if the saleable material can be upgraded to a more valuable product by the removal of contaminants
* "low key" marketing efforts, pending more accurate definition of product range and quality

Familiarisation with the tenement geology and other hard-rock silica occurrences in the licence area were subsidiary aims.

6. PREVIOUS EXPLORATION

Although the Pine Hill area was part of BHP's EL 13/65 and EL 8/79and later also embraced within Amoco's EL 14/84, neither company undertook any work in that segment of their tenements.

The area gained some prominence when Pioneer Silicon Industries took out EL 14/88 of 81 sq. km to search for high quality silica rock deposits possibly associated with Pre-Cambrian quartzites. Attention focused quickly on the Pine Hill area where, between September and November 1988, a lag deposit of approximately 180,000 tonnes of variable quality silicified quartzite gravel were outlined by 45 shallow percussion holes at the Western Quarry locality. A further 23 shallow percussion holes were drilled to test the white silica sands at, and in the vicinity of, a site designated as the Eastern Quarry.

Many of the holes in the latter area reported encouragingly low iron and alumina contamination over significant widths. Although sampling procedures were described, there is no information on assay procedure.

Preliminary resource estimates for the Eastern Quarry area suggested a range of 0.75 - 1.5 million cu. m of fine silica sand containing 75 - 150,000 cu.m of high grade lump silica, with suggested end uses being production of optical glass and silicon respectively.

The details of this work are given by Ellis (1988) in his technical report appended to the annual tenement report by Jones (1989).

Subsequently, a trial parcel of 1034 tonnes of lump silica extracted from the Western Quarry was delivered to Pioneer's Electrona plant for tests. Smelting results indicated that "the material was thermally stable and gave quartz efficiencies between 81 and 89%, with power consumption less than 13,000 Kw hours per tonne of silicon" (Patterson, 1991).

The exploration effort for high grade silica rock was terminated during August 1991, when Pioneer abandoned its plans for silicon production at Electrona, south of Hobart, ostensibly because of poor market outlook for the product.

With the reduction of EL 14/88 to 25 sq. km and transfer to the Northwest Bay Co. Pty. Ltd. (NWBCo.) on 13.04.1992 exploration for lump silica was abandoned and refocused on limestone, dolomite and high grade silica sand.

This effort was successful in discovering an outcrop of dolomite at Kallista Hill where subsequent testing by a small programme of shallow air-track drilling and trenching by hydraulic excavator outlined an open-ended resource of some 350,000 tonnes of dolomite averaging about 20% MgO and 30% CaO.

Samples of silica sand from 10 tests pits (the location of some of which is uncertain, despite co-ordinate references) in the Eastern Quarry area were screened to the +75 to -600 micron fraction by ACI Industrial Minerals. These averaged 99.93% silica, 0.004% Fe2O3, less than 0.01% TiO2 and 0.01% Al2O3 (Forster, 1992). Assaying was presumably also by ACI Industrial Minerals.

Separate sizing analyses by ACI for MWBCo. suggested that the +75 to -600 micron fraction constituted between 48.5% (dry screened) and 56.7% (wet screened, after wash) of the total volume of silica sand. These results are significantly better than those from tests by Duggans Pty. Ltd. which showed only 32% of the material in the above size band, plus 45% fines below 75 microns.

NWBCo. concluded that these assays and gradings obtained would meet the ACI Purchase Acceptance Standard for glass table-ware (Forster,1992).

At about this time, in the early 1990s, the Tasmania Department of Mines completed a 57m vertical diamond drill hole in the Eastern Quarry area, which is reported to have penetrated some 55m of silica sand before entering dolomitic bedrock at 55m (C.Calver, pers. comm.).

Little, if any, work appears to have been carried out in the tenement after 1994 when the principal of NWBCo. became indisposed and a retention licence 9042 of 2 sq. km was granted to that company over the silica resource. Early in 1998 RL 9042 was relinquished and the availability of the area for exploration tenders under ETA 483 came to the notice of J.J. McDonald &Sons Mining Pty. Ltd. through the exploration tender system of Mineral Resources Tasmania.

7. CURRENT ACTIVITIES

After initial area familiarization and orientation reconnaissance to verify the gross geology of the tenement area activities concentrated on the silica sands of the Eastern Quarry prospect area.

7.1 Work Done:

* Aerial photography and preparation of topographic base maps using a 2m contour interval
* Confirmatory geological mapping of the Eastern Quarry silica sand prospect at 1 : 1000 scale
* Completion of a shallow RC/air core drilling programme of 23 holes totalling 294m
* Accurate survey of drill hole collars
* Submission of 219 drill samples for individual assays comprising Fe_2O_3, Al_2O_3, MgO, CaO, TiO_2, Cr_2O_3, MnO and V_2O_5.
* Make-up of samples for sizing determinations
* Sizing determiantions on:

Head samples	:	27	analyses for contaminants as above
Sizings	:	27	analyses for contaminants as above

* Scoping bench scale magnetic separation tests
* Mineralogy on 9 magnetic, 2 non-magnetic and 1 untreated sample
* Assay of 14 composites of the +75 to -600 micron fraction from select drill samples, after wet magnetic separation, for contaminants as above
* Preliminary indicative laboratory bench scale acid leach tests for Fe_2O_3 removal and sizings
* More definitive laboratory scale acid wash tests on one drill sample composite
* Data analysis - progressive
* Removal of about 400 cu. m of sand from Eastern Quarry by a contractor for emergency road works under a Forest Produce Licence
* Securing entrance to quarry by logs and earth mounds to prevent unauthorised entry and removal of material
* Clean-up and rehabilitation of drill sites; drainage grips on tracks; aerial re-seeding by timber concession holder
* Preliminary marketing enquiries
* Data compilation and preparation of annual report
* On-going liaison with state authorities, timber concession holders, local service providers

7.2 Statistical Summary:

Aerial photography	:	2 sq km approx.
Topo-contour map	:	0.4 sq. km approx.
Prospect mapping - geology	:	0.3 sq. km approx.
Drill holes completed	:	23 by Diamond Drilling Tasmania, Zeehan
Rig Type	:	UDR RC/Air-core unit, track mounted 80mm diam. hole
Total drilled	:	294m (Average : 12.8m; range: 5 - 30m)
No. of drill samples collected	:	291
No. of drill samples assayed	:	158 (incl. duplicates & standards)
No of determinations	:	1264
No. of samples-sizing determinations	:	27
Assays - heads	:	27
sizings	:	27
standards	:	2
Total	:	56
Total determinations	:	366
Trial magnetic separation	:	2 samples (by ERIEZ, Melbourne)
Mineralogy on drill samples	:	12 samples
No. of samples-mag-cleaned sizings	:	14
No. of determinations	:	112
Gold assays on +600 micron fraction	:	14
Preliminary acid leach tests	:	3 samples
Acid wash tests	:	1 sample
Total expenditure for year reviewed	:	$ 52,518

8. RESULTS

8.1 Base Map Generation:

The choice of air-photography and photogrammetry with surveyed ground control points provided a rapid, trouble free, flexible and cost effective way of producing the accurate topographic base plans essential for the ensuing exploration activites and planning at the prospect.

Contour accuracy was further enhanced by clear-felling activities over a large part of the prospect area shortly before flying began.

The survey data is stored in digitised format and can be manipulated to produce a range of purpose-specific maps at a scale of the user's choice.

Topographic base map sheets are available at 1:1000 and 1:500 scale.

An added bonus is a suite of colour air photographs at a scale of 1:7500.

8.2 Geology:

Reconnaissance checks along roads, tracks, clearings and short, off-track traverses support the broad regional lithological framework for the exploration licence and the Pine Hill area as presented by Calver & Forsyth (1999) and Ellis (1988) respectively. The general strike of the Cambrian and Ordovician sediments underlying the tenement is easterly, swinging to south east, with dips subvertical to steep northerly.

A wedge of Cambrian basalts in the south central part of the tenement may be the source of the particulate iron, titanium and chromium contamination of the silica sands.

The Ordovician carbonate beds along Pillinger Creek in Risbys Basin in the extreme north east of the tenement have a more pronounced south easterly strike with shallower dips in the order of 35° to the north east.

In the prospect area, the silica sand deposit is flanked to the north, east and south east by highly weathered, reddish to yellowish brown muddy shales and clays. There is a good contact exposure between the silica sands and the underlying, weathered bedrock in the cutting of the logging road about 70m north of the Eastern Quarry,clearly showing a southerly dip of about 40°. A southerly dipping contact can also be seen in a timber haulage road cutting near the north western extremity of the deposit. The northern contact of the main silica sand deposit can be delineated to within an accuracy of about 25m , while the eastern and south eastern limits are well defined.

A 100m gap containing reddish brown and khaki-yellow clays with fragments of weathered sediment separates the main deposit from a small "outlier" of coarser, "dirty" siliceous gravel at the eastern extremity of the prospect underlying a small segment of the Styx Road.

Drilling results on either side of this gap suggest the tantalising possibility that the silica sands may extend beneath this cover.

The main silica sand deposit is in the order of 300m wide and at least 800m long in an east-west direction. The western contact has not yet been defined and may lie 100 - 200m west of the last known sand exposure.

Similarly, the position of the south western contact has not yet been delineated accurately. The possibility exists that the deposit width in that segment could be increased by 50 -100m.

The upper surface of the deposit is eroded, irregular and covered by a layer of peaty and humic soils up to 50cm thick. This surface rises from a height of 380m a.s.l. at the top of the Eastern Quarry to a peak formed by a small silica rock outcrop at about 424m a.s.l.on a ridge-like feature near the western end of the prospect.

The surface is disected by a number of creeks and gullies, suggesting the removal, by erosion, of appreciable volumes of silica sand.

Drilling indicates that the topography of the bedrock surface on which the sands rest is also uneven. The depth of sand ranges from 3m in hole 71 through +18m in hole 84 to +30m in hole 88 to possibly 55m above dolomite in Styx 4, a Mineral Resources Tasmania diamond drill hole collared somewhere in the Eastern Quarry area (Calver,1999, pers. comm).

The arithmetic average depth of sand, before reaching clay, clayey sand or quartz?bedrock in in the order of 12m. However, not all of this sand interval is of commercial purity or sizing range. The depth range of leached, relatively iron-free sand appears to be in the order of 6-10m, averaging about 8m, with occasional deeper pockets of acceptable quality material. Below that depth, there is often a sudden, marked increase in iron and, to a lesser extent, alumina.

The outcrop at the topographic peak is one of off-white, softish quartz, possibly weathered, leached, silicified dolomite in the midst of an easterly striking zone about 300 m long and 50m wide containing scattered boulders of similar material.

The sand grains, fragments and boulders which make up the deposit are sharp, angular and show only little or no sign of abrasion or transport.

The impression gained is that the sand and gravel deposits may have formed by weathering and erosion of a bed, or beds of brecciated, silicified dolomite, with angular sand and boulders accummulating in situ or in near-by hollows, depressions and channels.

These accummulations are being eroded, disected, depleted and re-deposited by the present-day erosion cycle.

8.3. Drilling and Assays:

The position of all drill holes completed at the prospect to-date is shown on Fig. 10.

Holes numbered 46 - 68 were drilled by Pioneer Silicon Industries in 1988 using an Atlas Copco 712 hydraulic rotary air-blast rig. All of these holes were drilled within a 200m radius of the Eastern Quarry. Samples were collected over 1m intervals. Only white, clean-looking material was analysed using sub-samples from every second 1m intercept. Intervals showing possible or obvious iron contamination were only selectively analysed to confirm poor quality.

Presumably all analyses for iron, alumina, titania and lime were undertaken at PSI's Electrona plant. Many of the samples showed iron levels below 0.01% with a number of them around 0.005% or less iron oxide and alumina below 0.02%.

In contrast to the previous operator, J.J. McDonald & Sons Mining Pty.Ltd. used an air-core recovery system in an attempt to preserve sample integrity with respect to grain size and grading. Drill coverage extended to as far as 600m west of the Eastern Quarry. Samples were collected and logged at 1m intervals (Appendix 1).
Every second sample in each drill hole was cone-and-quartered and one quarter removed to be assayed for Al_2O_3, Fe_2O_3, CaO, MgO, TiO_2, MnO, Cr_2O_3 and V_2O_5 (Appendix 2).

The assay results did not match those obtained for its drill samples by PSI or those for the bulk samples collected by NWBCo. which presumably used ACI as its assayer.

Impurity levels, particularly for alumina, iron and titania in the clean-looking material were much higher than expected from the PSI and NWBCo. data.

No sample from the current drilling recorded Fe2O3 below 100ppm (0.01%), with only a few readings below 200ppm (0.02%). TiO2 levels varied from 976ppm to 37ppm, with most values falling into the 100-300ppm range. Alumina ranged from 1.2% to 83ppm. Levels of MnO and V2O5 over the sections of interest (i.e. those with relatively lower iron content) were at a satisfactory low of -10ppm (Figs. 5 - 7).

Cr2O3 concentrations over the latter intervals were generally in the relatively low range of 1-5ppm, though elsewhere they were higher and more erratic.

There was also a clear indication from the current drilling that results west of a line joining holes 71 and 81 were better than for the area to the east.

The cause of some of the unexpectedly high iron contamination was revealed by a mineralogical examination of a number of magnetic fractions extracted from several samples (Appendix 4).

This work showed that some of the iron contamination in the drill samples could be attributed to flakes and slivers of steel, rust and weld globules derived from the drilling equipment by the abrasive action of the sand return during drilling. This contamination appears to be pervasive and is evident in the earlier, as well as the later holes of the current drilling programme, despite an attempt to clean the drilling equipment at the start of the programme by sinking a couple of holes in the quarry floor.

Furthermore, it was shown that part of the metallic contamination was present in the form of small single or composite particles easily removable by magnetic separation methods.

To test this notion, a suite of 14 composites was made up from the drill samples form a number of holes with various levels of iron contamination. The +75 to -600 micron fraction was extracted from these samples and "cleaned" of paramagnetic materials by high intensity wet magnetic separation and assayed for the requisite suite of elements.

The outcome was a significant improvement on previous results as represented by the arithmetic averages of the contaminants in the individual samples which made up the composites.

Iron contamination in most cases was reduced by 50% or more, with a commensurate reduction in TiO2 and Cr2O3. However, no sample reported less than 100ppm Fe2O3, the lowest reading being 131ppm from hole 91, (Appendix 3).

Levels of Al2O3, CaO and MgO were also lowered, possibly due to screening (more clay impurities to fines) and washing during the WHIMS treatment.

Check analyses for gold were undertaken on the coarse (+600 micron) fraction of these samples, but all results were below 0.001 ppm.

One of the important outcomes of this work is the realization that future drill samples will have to undergo WHIMS treatment prior to routine analysis in order to overcome contamination by iron during the drilling process. This procedure may have to be extended to other sampling methods using plant and equipment made of iron and steel.

8.4 Grain Size Distribution:

Grain size distribution determinations were carried out on composites made up for each drill hole. The purpose was to gauge the proportion, by weight, of of the +75 to -600 micron glass sand fraction in the bulk of the material of the deposit.

This size band is referred to as the "prescribed" fraction in the attached Esker report which provides details of procedures and results (Appendix 5).

The weight% of material in the prescribed size fraction varied from a low 19.3% in hole 89 (near an outcrop of soft quartz) to as high as 66.5% in hole number 72 and averaged out at 42.6%.
The proportion of -75 micron fraction is spread over a similar range, with an average of 38.6%.

When plotted on a map, the results show a pattern suggesting that the eastern third of the prospect consists mainly of finer material. The coarser fraction appears to be located largely in the western two thirds (Fig. 8).

The prescribed fraction in the deposit as a whole broadly reflects a distribution pattern similar to the above (Fig.9). It amounts to less than 40% of the total material in the eastern third of the deposit and exceeds, with a couple of exceptions, that proportion in the western part. These exceptions are pockets of predominantly finer material around holes 87 and 90, while results from hole 86 are questionable due to its position close to a silica outcrop.

It is worth noting that the line which divides the above two main areas is approximately the same which separates areas of higher and lower purity.

Assays of feed samples showed results which were of the same order, but numerically somewhat higher than the averages calculated for the same sample interval using the individual drill sample assays.

The +75 to -600 micron "size" fractions derived from the feed samples show significant reductions in the levels of impurities, particularly Fe_2O_3, TiO_2 and Al_2O_3 as compared to the original "head" (or "feed") samples (Appendix 6). Encouragingly, reductions in excess of 40% with respect to iron oxides and 60% with respect to titania were achieved in a number of these samples.

The results also suggest that more than half of the contamination could reside in the -75 micron fraction.

Detailed analytical data for this stage of work feature in Appendix 6.

8.5 Beneficiation Tests:

It was recognised right from the outset that the effective removal iron contamiantion and the removal of other deleterious materials would be crucial to the successful development and economic viability of a business based on the silica sands in the Eastern Quarry area.

At the start of the project, a preliminary test was commissioned with CSIRO, Melbourne, using three samples from the Eastern Quarry. These were to provide some pointers on the relationship between iron content and sample colour and indications as whether or not iron contamination could be reduced or removed by acid leaching/washing.

The procedures adopted and results are set out in detail in Appendix 7.

The outcome of this work was somewhat ambiguous and sobering, underlining the need for caution in this project.

It was shown that the white colour of the sand may not necessarily reflect high purity.

Secondly, acid leaching to remove iron using hydrochloric and/or sulphuric acids, under energetic conditions, was only partially successful and failed to bring iron content down to below 30 ppm. Such a result could only be achieved under severe conditions using hydrofluoric acid - a process unlikely to be be applied successfully to treatment of bulk volume materials.

However, the work raised the possibility that weaker acids may perform better, if some of the iron could be removed by pre-treatment.

The ability to remove particulate iron compounds and composites as well as some quartz grains coated with limonite/hematite was subsequently confirmed by bench scale tests using both dry magnetic separation and WHIMS at the ERIEZ laboratory, Melbourne. Of the two methods, WHIMS appeared to produce the better results.

An ICP scan of the three samples also showed that, other than Fe, Ti, Al and Na, only Ca occured in significant amounts above background levels.

The second phase of acid wash tests was undertaken at the University of Tasmania Chemistry Department, Hobart, by Osleach Pty. Ltd. This company was recommended as having some expertise in acid washing processes.

On the suggestion of these consultants, the investigations were, at this stage, confined to the best (whitest) +75 to -600 micron fraction of one of a batch of six samples submitted. This was a composite of material taken off each alternate 1m drill sample interval down to 12 m in hole 90.

Though slightly higher, the head assay of 180 ppm Fe compares favourably with the average of the iron content calculated over the same sample interval from the initial drill sample assays (see Appendix 2).

The amount of prescribed material in this sample was some 10% greater than in the sample used for sizing tests (see Appendix 5) Esker.

The test work and results are set out in the report by Osleach attached as Appendix 8.

In summary, it was determined that:

* A combination of wet screening, gravity separation and mild leaching with dilute sulphuric acid is capable of extracting the required size range and of reducing the iron content of the product to at least -10ppm, and probably as low as 5ppm
* Other process options exist, including production of a material in the required size range containing less than 50ppm Fe without the need for acid leaching
* More comprehensive testwork would almost certainly lead to a simplification of the process circuit, with commensurate lowering of capital and operating costs
* Plant operation at any level of production would not present any serious environmental difficulties
* Treatment plant capital and operating costs would be in the order of $250,000 - $330,000 for a production of 4,200 to 25,000 t.p.a. of saleable product

* Plant operating costs are estimated at $50/t of product at 4,200 t.p.a. to around $20/t at 25,000 t.p.a of product
* Revenue enhancement could be derived from sales of sections of the -75 micron fraction. Upgrading the purity of such a product would not seem to present undue difficulty.

Overall, the results of this testwork are regarded as encouraging in so far as they indicate:

* an upgrade to high purity silica sand with low iron content is technically feasible and could be achievable commercially
* a minimum output/ sales horizon of around 25,000 t.p.a. of product to reach a competitive production cost structure
* areas and steps for process fine-tuning
* the possibility of producing high purity silica flour.

9. CONCLUSIONS

9.1 Investigations to-date suggest a resource potential in the order of some 3.5 million tonnes silica sand at the prospect, of which about 43% (c. 1.6 mil. tonnes) falls into the +75 to -600 micron size range acceptable for glass manufacture.

This represents about 16 years' production at a rate of 100,000 t.p.a of marketable product

9.2 There is currently little evidence in support of a substantial increase in the total resource potential at the prospect beyond the above estimate.

9.3 Impurity levels in the deposit, as indicated by drill sample assays, would appear to be higher than those reported by prior tenement holders.

It is encouraging that these impurity levels, particularly iron, titanium and chromium can be significantly reduced or almost removed altogether by a combination of wet screening, magnetic and gravity separation and mild leaching with dilute sulphuric acid.

9.4 Plant operation at any foreseeable rate of production would not cause serious environmental difficulties.

9.5 Reduction of capital and operating costs are possible at least for the beneficiation plant, depending on production rates and process options adopted.

9.6 Apart from high quality glass sands, there is scope for other product options, such as high purity silica flour, high purity silica powder and possibly coarse feed for a silicon smelter. These options need further investigation.

9.7 Overall, the results of the first year's work provide some grounds for cautious optimism and justify the continuation of investigations and testing aimed at reserve definition and product upgrade to secure premium prices in the market place.

10. RECOMMENDATIONS

10.1 Exploration:

* Complete 1st-pass resource drilling and assessment with a view to establishing an improved resource outline and estimate and to identify sub-areas for more detailed investigations to help establish a preliminary extraction plan

* investigate near-by occurences and sources of limestone for eventual use in acid neutralisation.

10.2 Beneficiation:

* continue with product improvement investigations, with more attention to the silica flour component of the deposit

10.3 Marketing:

* Commence a marketing study to identify a saleable product range and a potential customer base, with a focus on overseas markets.

11. PROPOSED FUTURE ACTIVITIES

11.1 Exploration:

* add-on aerial photography/topo base map production with focus on the western and southern segments of the deposit
* drilling of about 25 RC/air-core holes totalling some 300m , mainly in the western and southern segments of the deposit
* drill collar survey
* assaying and sizing determinations, as per the first year's programme
* mineralogy, if required

The timing of the above work will be dependent on the next round of timber harvesting activity over this segment of the prospect by the timber concession holders. Current indications are that the latter may commence towards the end of the second year of tenure.

* The applicability and cost effectiveness of shallow seismic and/or shallow ground penetrating radar surveys to delineate bedrock topography will be investigated as a guide to drillsite location and an aid to more accurate resource calculation.

* Reconnaissance for limestone in the eastern part of the tenement and familiarisation with past limestone investigations in adjacent areas.

11.2 Beneficiation:

* continuation of investigations on product up-grade relating to both the glass size and silica flour components of the deposit

11.3 Marketing:

* Initiate a comprehensive market survey and customer identification programme with emphasis on export sales.

12. REFERENCES

Calver, C.R, & Forsyth, S.M.,1999	Maydena, Tasmania; Digital Geological Atlas, 1:25 000 Series; Tasmanian Geological Survey.
Ellis, P.D., 1988	Interim Report - Pioneer Silicon Industries Pty. Ltd.
Jones, P.A., 1989	Exploration Licence No. 14/88 - Maydena Progress Report on Exploration Activity 5 August 1988 to 5 July 1989
Paterson, W., 1990	Exploration Licence 14/88 - Maydena Annual Report on Exploration Activity 6th July 1989 to 4th August 1990
Forster, M.C., 1992	EL 14/88 Maydena, Annual Report - Year 4
Forster, M.C., 1993	EL 14/88 - Maydena, Annual Report - Year 5 05.08.92 to 04.08.93
Forster, M.C., 1994	Maydena - Tasmania, Pine Hill High Grade Silica, June 1994

APPENDIX 1
DRILL HOLE LOGS

DRILL HOLE LOG

642022

AREA: Eastern Quarry Area, Pine Hill, Maydena

MAP SHEET: 4626 Maydena

DRILLER: Diamond Drilling Tasmania Pty. Ltd.

DRILL HOLE: 69

METHOD: Air Core

AMG CO-ORDS: 5263693mN 466474mE

DATE: 27.03.1999

ANGLE: Vertical

LOGGED BY: G.K.

FINAL DEPTH: 11m

FROM	TO	DESCRIPTION	SAMPLE NUMBER
0	1	Light brown, sandy clay	70100
1	2	Buff, fine sand; coarse frags. ca. 20%	70101
2	3	Off-white, gravelly sand; coarse frags. ca.20%	70102
3	4	Light brown, clayey sand; coarse fraction ca. 10%	70103
4	5	Buff, fine sand; coarse fraction ca. 5-10%	
5	6	Light buff, fine sand; coarse fraction ca. 5%	70104
6	7	Light buff, very fine sand; clayey; coarse fraction ca. 5%	
7	8	As above	70105
8	9	As above; minor clay: coarse fraction 5%	
9	10	Buff-yellowish, fine sand; coarse fraction ca. 10-15%	70106
10	11	Buff fine sand; coarse fraction ca. 5%	70107

Hole stopped on quartz boulder/?quartz bedrock.

DRILL HOLE LOG

642023

AREA: Eastern Quarry Area, Pine Hill, Maydena

MAP SHEET: 4626 Maydena

DRILLER: Diamond Drilling Tasmania Pty. Ltd.

DRILL HOLE: 70

METHOD: Air Core

AMG CO-ORDS: 5263645mN 466231mE

DATE: 27.03.1999

ANGLE: Vertical

LOGGED BY: G.K.

FINAL DEPTH: 6m

FROM	TO	DESCRIPTION	SAMPLE NUMBER
0	1	Buff, fine sand; coarse fraction ca. 5%	
1	2	Buff-yellowish sand; coarse fraction ca. 5-10%	70108
2	3	Pale yellowish, coarser sand; coarse fraction ca. 10-20%	
3	4	Buff sand; some brown clay and pebbles; coarse fraction ca. 20%	70109
4	5	Brown sand; coarse with brown clay	
5	6	Dark, chocolate brown, sandy soil	

Note: Drill hole collar on side of road, ca. 4m below top of cutting through coarse, greyish sand.

DRILL HOLE LOG

642024

AREA: Eastern Quarry Area, Pine Hill, Maydena

MAP SHEET: 4626 Maydena

DRILLER: Diamond Drilling Tasmania Pty. Ltd.

DRILL HOLE: 71

METHOD: Air Core

AMG CO-ORDS: 5263710mN 466175mE

DATE: 27.03.1999

ANGLE: Vertical

LOGGED BY: G.K.

FINAL DEPTH: 5m

FROM	TO	DESCRIPTION	SAMPLE NUMBER
0	1	Dark brown, fine, clayey sand; ?organic soil; coarse fraction ca. 5%	70110
1	2	Brown clayey sand: ?organic soil; coarse fraction ca 5%	
2	3	As above; coarse fraction less than 5%	70111
3	4	Dark brown sand; clayey; coarse fraction ca. 10%	
4	5	Dark brown clay; organic soil. edge of creek Note: brown clay starts from ca. 3.75m	

642025

DRILL HOLE LOG

AREA: Eastern Quarry Area, Pine Hill, Maydena

MAP SHEET: 4626 Maydena

DRILLER: Diamond Drilling Tasmania Pty. Ltd.

DRILL HOLE: 72

METHOD: Air Core

AMG CO-ORDS: 5263780mN 466191mE

DATE: 27.03.1999

ANGLE: Vertical

LOGGED BY: G.K.

FINAL DEPTH: 6m

FROM	TO	DESCRIPTION	SAMPLE NUMBER
0	1	Brown sand with some dark brown clay balls	
1	2	Brown sand; coarse fraction ca. -1%	70112
2	3	Brown, coarse sand with dark brown clay: coarse fraction ca. 2%	
3	4	Light brown sand; coarser; with balls of brown clay; coarse fraction ca. -1%	70113
4	5	As above; somewhat finer; coarse fraction ca. -1%	
5	6	Buff fine sand; coarse fraction ca. 2%	70114

Hole stopped on rock

DRILL HOLE LOG

AREA: Eastern Quarry Area, Pine Hill, Maydena

MAP SHEET: 4626 Maydena

DRILLER: Diamond Drilling Tasmania Pty. Ltd.

DRILL HOLE: 73

METHOD: Air Core

AMG CO-ORDS: 526377mN 466281mE

DATE: 27.03.1999

ANGLE: Vertical

LOGGED BY: G.K.

FINAL DEPTH: 23m

FROM	TO	DESCRIPTION	SAMPLE NUMBER
0	1	Brown clayey sand: coarse fraction ca. 5%	
1	2	Brown sand, coarse: coarse fraction ca. 20%	70115
2	3	Minor brown sand; white clay balls	
3	4	Pale/white clay; minor, very fine clayey sand	70116 (not submitted)
4	5	White/grey clay; mostly in balls	
5	6	Buff/white clay; mostly in balls	70117 (not submitted)
6	7	Brown and red-brown clay; gritty	
7	8	Brown/ red-brown clay with coarse red-brown sand at base; coarse fraction ca. 5-10%	70118 (not submitted)
8	9	Buff red-brown sand, trace clay; coarse fraction ca. 10%	70119
9	10	Red-brown sand; coarse fraction ca. 10-15%	
10	11	Light red-brown sand; finer; coarse fraction ca. 5-10%	70120
11	12	As above; coarse fraction ca 10%	
12	13	As above; cf ca. 10%	70121
13	14	Pale red-brown, tending to cream-yellow, fine sand; coarse fraction ca. 10%	
14	15	Pale buff, medium-fine sand; cf ca. 10%	70122
15	16	Pale orange, fine-medium sand; cf ca. 20%	
16	17	As above	70123
17	18	Dark orange-brown, medium sand; cf ca. 30%	
18	19	As above; cf ca. 20%	70124
19	20	As above; cf ca. 10%	
20	21	As above; cf ca. 10%	70125
21	22	Dark orange-brown fine sand; cf ca. 5-10%	
22	23	As above; cf ca. 10%	70126

Hole discontinued; poor quality material.

642027

DRILL HOLE LOG

AREA: Eastern Quarry Area, Pine Hill, Maydena

MAP SHEET: 4626 Maydena

DRILLER: Diamond Drilling Tasmania Pty. Ltd.

DRILL HOLE: 74

METHOD: Air Core

AMG CO-ORDS: 5263723mN 466247mE

DATE: 27.03.1999

ANGLE: Vertical

LOGGED BY: G.K.

FINAL DEPTH: 9m

FROM	TO	DESCRIPTION	SAMPLE NUMBER
0	1	Light brown, fine, clayey sand; balling of organic clay; coarse fraction ca. 5%	
1	2	Pale buff, fine-medium sand; cf ca. 10%	70127
2	3	Whitish fine sand; coarse fraction ca. -5%	
3	4	White fine sand; clayey; cf ca. -5%	70128
4	5	As above, but no clay; cf ca. -5%	
5	6	Dark buff to light brown clayey sand; coarse fraction ca. -5%	70129
6	7	Brown and white clay; minor very fine white sand	
7	8	Dark, chocolate-brown clay/soil	no sample
8	9	Brown clay and water	

DRILL HOLE LOG

642023

AREA: Eastern Quarry Area, Pine Hill, Maydena

MAP SHEET: 4626 Maydena

DRILLER: Diamond Drilling Tasmania Pty. Ltd.

DRILL HOLE: 75

METHOD: Air Core

AMG CO-ORDS: 5263663mN 466282mE

DATE: 27.03.1999

ANGLE: Vertical

LOGGED BY: G.K.

FINAL DEPTH: 21m

FROM	TO	DESCRIPTION	SAMPLE NUMBER
0	1	Dirty brown, coarse, somewhat clayey sand	
1	2	Pale orange-brown, medium sand; coarse fraction ca. 5-10%	70130
2	3	Pale orange-brown, fine to medium sand: coarse fraction 10-20%	
3	4	As above: cf ca. 5-10%	70131
4	5	Pale buff fine sand; coarse fraction ca. 5-10%	
5	6	As above; coarse fraction ca. -5%	70132
6	7	As above;	
7	8	Pale buff fine-very fine sand; cf ca. -5%	70133
8	9	Pale buff very fine sand; cf ca. -5%	
9	10	Greyish-white fine sand;coarse fraction ca.-5%	70134
10	11	Dark buff fine sand; coarse fraction ca. -5%	
11	12	As above;	70135
12	13	Dark buff fine-medium sand; cf ca. 5-10%	
13	14	As above;	70136
14	15	Dark buff fine sand; coarse fraction ca. 5-10%	
15	16	Buff fine sand; somewhat clayey; cf ca. -1%	70137
16	17	As above, but coarse fraction ca. 10-20%	
17	18	Dark buff fine sand; cf ca. 10-20%	70138
18	19	Light brown medium sand; pebbly; coarse fraction ca. 10-20%	
19	20	Dark red-brown medium-coarse sand; pebbly; coarse fraction ca. 30%	70139
20	21	Dark orange brown, medium sand cf ca. 20-30% becoming clayey	

Hole stopped due to apparent high Fe in sample returns.

DRILL HOLE LOG

642029

AREA: Eastern Quarry Area, Pine Hill, Maydena

MAP SHEET: 4626 Maydena

DRILLER: Diamond Drilling Tasmania Pty. Ltd.

DRILL HOLE: 76

METHOD: Air Core

AMG CO-ORDS: 5263632mN 466390mE

DATE: 27 & 28.03.1999

ANGLE: Vertical

LOGGED BY: G.K.

FINAL DEPTH: 22m

FROM	TO	DESCRIPTION	SAMPLE NUMBER
0	1	Dark brown clay (soil)	
1	2	Buff-white fine-medium sand; cf ca. 10%	70140
2	3	Pale buff/white fine sand; cf ca. 5-10%	
3	4	Pale buff/white fine sand; slightly clayey; coarse fraction ca. 10-20%	70141
4	5	Pale buff/white fine sand; coarse fraction ca. 10-15%	
5	6	As above; slightly clayey; cf ca. 10%	70142
6	7	Dark buff - yellowish fine sand; cf ca. 10%	
7	8	Pale buff/white fine sand; cf ca. 5%	70143
8	9	As above	
9	10	As above; coarse fraction ca. -5%	70144
10	11	As above.	
11	12	As above; slightly darker.	70145
12	13	Buff/white fine sand; coarse fraction ca. 1%	
13	14	As above	70146
14	15	As above	
15	16	As above	70147
16	17	As above; slightly darker	
17	18	White fine sand; coarse fraction ca 1%	70148
18	19	As above	
19	20	White very fine sand; coarse fraction ca. 1%	70149
20	21	White fine sand; coarse fraction ca. 5%	
21	22	White very fine sand with red-brown streaks; coarse fraction ca. 1-5%	70150

Hole stopped due to difficult drilling on hard rock at base of hole.

DRILL HOLE LOG

642030

AREA: Eastern Quarry Area, Pine Hill, Maydena

MAP SHEET: 4626 Maydena

DRILLER: Diamond Drilling Tasmania Pty. Ltd.

DRILL HOLE: 77

METHOD: Air Core

AMG CO-ORDS: 5263672mN 466385mE

DATE: 28.03.1999

ANGLE: Vertical

LOGGED BY: G.K.

FINAL DEPTH: 12m

FROM	TO	DESCRIPTION	SAMPLE NUMBER
0	1	Grey-white fine sand; coarse fraction ca. 20%; (very small sample)	
1	2	Grey-white fine sand with some white and red-brown clay; coarse fraction ca. 5% (small sample)	70151
2	3	White medium sand; coarse fraction ca. 20-30%	
3	4	White fine-medium sand; streaks of pale orange sand; coarse fraction ca. 10%	70152
4	5	Pale orange brown fine-medium sand; streaks of white sand; coarse fraction ca. 20%	70153
5	6	Dark orange-brown fine-medium sand; coarse fraction ca. 20%	70154
6	7	Orange brown and white fine sand; coarse fraction ca. 10%	
7	8	Light orange, fine sand; minor brown clay;	70157
8	9	Pale orange-brown, fine sand; coarse fraction ca. 5-10%	
9	10	As above	70156
10	11	Pale orange-brown fine-medium sand; coarse fraction ca. 20%	
11	12	Orange-brown fine-medium sand: coarse fraction ca. 20%	70157

Hole stopped on siliceous rock

DRILL HOLE LOG

642031

AREA: Eastern Quarry Area, Pine Hill, Maydena

MAP SHEET: 4626 Maydena

DRILLER: Diamond Drilling Tasmania Pty. Ltd.

DRILL HOLE: 78

METHOD: Air Core

AMG CO-ORDS: 5263723mN 466380mE

DATE: 28.03.1999

ANGLE: Vertical

LOGGED BY: G.K.

FINAL DEPTH: 8m

FROM	TO	DESCRIPTION	SAMPLE NUMBER
0	1	Light grey-brown, fine-medium sand; coarse fraction ca. 10%	
1	2	Pale buff fine-medium sand; coarse fraction ca. 10%	70158
2	3	As above	
3	4	White fine - (medium) sand;coarse fraction ca. 5-10%	70159
4	5	As above; coarse fraction ca. 10%	
5	6	As above	70160
6	7	As above	
7	8	As above	70161

Hole stopped on hard rock/?bedrock

DRILL HOLE LOG

AREA: Eastern Quarry Area, Pine Hill, Maydena

MAP SHEET: 4626 Maydena

DRILLER: Diamond Drilling Tasmania Pty. Ltd.

DRILL HOLE: 79

METHOD: Air Core

AMG CO-ORDS: 5263812mN 466392mE

DATE: 28.03.1999

ANGLE: Vertical

LOGGED BY: G.K.

FINAL DEPTH: 12m

FROM	TO	DESCRIPTION	SAMPLE NUMBER
0	1	Light grey-brown, fine sand; slightly clayey; coarse fraction ca. -5%	
1	2	White fine sand; coarse fraction ca. 1%	70162
2	3	As above	
3	4	As above; coarse fraction ca. 5%	70163
4	5	As above; coarse fraction ca. 1-5%	
5	6	As above; coarse fraction ca. 1%	70164
6	7	As above; coarse fraction ca. 5%	
7	8	As above; coarse fraction ca. 1%	70165
8	9	As above; coarse fraction ca. 1-5%	
9	10	White and brown fine sand; somewhat gritty; coarse fraction ca. 10%	70166
10	11	Brown sandy clay; coarse fraction ca. 10%	
11	12	Brown loam	No sample

Hole stopped in brown clay.

DRILL HOLE LOG

642033

AREA: Eastern Quarry Area, Pine Hill, Maydena

MAP SHEET: 4626 Maydena

DRILLER: Diamond Drilling Tasmania Pty. Ltd.

DRILL HOLE: 80

METHOD: Air Core

AMG CO-ORDS: 5263842mN 466448mE

DATE: 28.03.1999

ANGLE: Vertical

LOGGED BY: G.K.

FINAL DEPTH: 15m

FROM	TO	DESCRIPTION	SAMPLE NUMBER
0	1	Pale orange-yellow/buff fine sand;coarse fraction ca. 1%	
1	2	White fine sand; cf ca. 1%	70167
2	3	As above	
3	4	As above	70168
4	5	As above	
5	6	White and red-brown fine sand; minor red-brown clay; coarse fraction ca. 1%	70169
6	7	Pale orange/red-brown fine sand; cf ca. 10%	
7	8	Light orange-yellow fine sand; cf ca. 5%	70170
8	9	As above: slightly paler; cf ca. 5%	
9	10	As above; slightly more yellowish; cf ca. 5%	70171
10	11	As above	
11	12	As above	70172
12	13	As above	
13	14	As above; coarse fraction ca. 1%	70173
14	15	Pale buff/white very clayey , very fine sand	

Hole not bottomed?

DRILL HOLE LOG

642034

AREA: Eastern Quarry Area, Pine Hill, Maydena

MAP SHEET: 4626 Maydena

DRILLER: Diamond Drilling Tasmania Pty. Ltd.

DRILL HOLE: 81

METHOD: Air Core

AMG CO-ORDS: 5263911mN 466277mE

DATE: 29.03 1999

ANGLE: Vertical

LOGGED BY: G.K.

FINAL DEPTH: 8m

FROM	TO	DESCRIPTION	SAMPLE NUMBER
0	1	Greyish-white fine-medium sand; coarse fraction ca. 10%	
1	2	Pale yellowish-white, fine to medium sand; coarse fraction ca. 10%	70174
2	3	Pale yellowish-white, medium sand; coarse fraction ca. 20%	
3	4	Off-white, medium-coarse sand; coarse fraction ca. 20-30%	70175
4	5	Off-white medium sand; coarse fraction ca. 10-15%	
5	6	Off-white medium-coarse sand; coarse fraction ca. 5%	70176
6	7	Dark coarse sand; coarse fraction ca. 10-15% wet sample	
7	8	Pale brown coarse, gravelly sand; coarse fraction ca. 30-40%	70177

Struck water; no sample return. Hole not bottomed.

DRILL HOLE LOG

642035

AREA: Eastern Quarry Area, Pine Hill, Maydena

MAP SHEET: 4626 Maydena

DRILLER: Diamond Drilling Tasmania Pty. Ltd.

DRILL HOLE: 82

METHOD: Air Core

AMG CO-ORDS: 5263905mN 466215mE

DATE: 29.03.1999

ANGLE: Vertical

LOGGED BY: G.K.

FINAL DEPTH: 14m

FROM	TO	DESCRIPTION	SAMPLE NUMBER
0	1	No sample	
1	2	Dirty grey-white coarse sand; oversize ca 5%	70178
2	3	Dirty grey-brown coarse sand; oversize ca. 5%	
3	4	Dirty-white, medium-coarse sand; coarse fraction ca. 5%	70179
4	5	White-brown medium-coarse sand; cf. ca. 10%	
5	6	Whitish-buff medium-coarse sand; cf.ca. 10%; good quality sand	70180
6	7	White medium sand; coarse fraction ca. 10%; good quality sand	
7	8	As above; coarse fraction ca. 5%	70181
8	9	White medium-coarse sand; Coarse fraction ca 10%	
9	10	As above	70182
10	11	Greyish-white, fine-medium sand; clayey; coarse fraction ca. 10%; wet sample	
11	12	White, medium-coarse, pebbly sand; coarse fraction ca. 20-30%	70183
12	13	Dirty, grey-brown fine-medium sand somewhat clayey; cf. ca. 10%	
13	14	Dark chocolate brown, sandy clay; wet sample	no sample

Hole stopped in wet ground and poor material.

DRILL HOLE LOG

642036

AREA: Eastern Quarry Area, Pine Hill, Maydena

MAP SHEET: 4626 Maydena

DRILLER: Diamond Drilling Tasmania Pty. Ltd.

DRILL HOLE: 83

METHOD: Air Core

AMG CO-ORDS: 5263852mN 466196mE

DATE: 29.03.1999

ANGLE: Vertical

LOGGED BY: G.K.

FINAL DEPTH: 11m

FROM	TO	DESCRIPTION	SAMPLE NUMBER
0	1	Dark-brown to black organic sandy soil	
1	2	Browm medium sand; coarse fraction ca. 5%	70184
2	3	Light brown medium sand; coarse fraction ca. 5%	
3	4	As above	70185
4	5	Greyish-white, fine to medium sand; coarse fraction ca. 1%	
5	6	White fine sand; coarse fraction ca. 1%	70186
6	7	As above	
7	8	As above	70187
8	9	White fine-medium sand; coarse fraction ca. 10%	
9	10	Pale buff-white fine sand	70188
10	11	Buff, very fine sand with clay; cf. ca. -1%	
		Clay blocking return; no return; hole stopped.	

DRILL HOLE LOG

642037

AREA: Eastern Quarry Area, Pine Hill, Maydena

MAP SHEET: 4626 Maydena

DRILLER: Diamond Drilling Tasmania Pty. Ltd.

DRILL HOLE: 84

METHOD: Air Core

AMG CO-ORDS: 5263959mN 466203mE

DATE: 29.03.1999

ANGLE: Vertical

LOGGED BY: G.K.

FINAL DEPTH: 18m

FROM	TO	DESCRIPTION	SAMPLE NUMBER
0	1	Dirty, off-white, fine sand; coarse fraction ca. 1%	
1	2	White, fine-medium sand; coarse fraction ca.1-5%	70189
2	3	As above	
3	4	As above; cf ca. 10%: somewhat clayey	70190
4	5	As above; cf. ca. 10%	
5	6	As above	70191
6	7	White, finer , slightly clayey sand; coarse fraction ca. 10%	
7	8	As above	70192
8	9	As above	
9	10	As above, but somewhat coarser; cf. ca. 10%	70193
10	11	Buff, fine clayey sand; coarse fraction ca. 1%	
11	12	White medium sand with minor clay; coarse fraction ca. 5%	70194
12	13	White, coarse sands, minor clay; cf. ca. 20%	
13	14	As aboove; cf. ca. 30-40%	70195
14	15	As above; cf. ca. 30%	
15	16	Buff-brown, fine clayey sand; cf. ca. 10%	70196
16	17	As above; cf. ca. 5%	
17	18	Brown coarse sand; somewhat clayey; damp; coarse fraction ca. 30%	70197

Hole bottomed in clayey sand due to balling and poor, wet return.

DRILL HOLE LOG

642038

AREA: Eastern Quarry Area, Pine Hill, Maydena

MAP SHEET: 4626 Maydena

DRILLER: Diamond Drilling Tasmania Pty. Ltd.

DRILL HOLE: 85

METHOD: Air Core

AMG CO-ORDS: 5263915mN 466093mE

DATE: 29.03.1999

ANGLE: Vertical

LOGGED BY: G.K.

FINAL DEPTH: 4m

FROM	TO	DESCRIPTION	SAMPLE NUMBER
0	1	Brown, coarse sand; coarse fraction ca. 10%	
1	2	Buff-brown, medium sand; cf. ca. 10%	70198
2	3	Somewhat lighter, buff-brown medium sand; coarse fraction ca. 20%	
3	4	As above, but with orange tinge; cf. ca. 20%	70199

Hole stopped on quartz and siliceous bedrock.

DRILL HOLE LOG

642039

AREA: Eastern Quarry Area, Pine Hill, Maydena

MAP SHEET: 4626 Maydena

DRILLER: Diamond Drilling Tasmania Pty. Ltd.

DRILL HOLE: 86

METHOD: Air Core

AMG CO-ORDS: 5263936mN 465992mE

DATE: 29.03.1999

ANGLE: Vertical

LOGGED BY: G.K.

FINAL DEPTH: 13m

FROM	TO	DESCRIPTION	SAMPLE NUMBER
0	1	Light brown to buff, medium-coarse sand; coarse fraction ca. 15%	
1	2	Buff/white medium sand; cf. ca. 10%	70200
2	3	Buff medium sand; coarse fraction ca. 5%	
3	4	White, medium sand; coarse fraction ca. 5%	70201
4	5	White, medium-fine sand; cf. ca. 1-5%	
5	6	As above; cf. ca. 1%	70202
6	7	As above	
7	8	As above; somewhat finer	70203
8	9	As above	
9	10	White, fine-medium sand; cf ca. 1%	70204
10	11	As above	
11	12	As above	70205
12	13	As above	

Hole stopped on hard, siliceous breccia

DRILL HOLE LOG

642040

AREA: Eastern Quarry Area, Pine Hill, Maydena

MAP SHEET: 4626 Maydena

DRILLER: Diamond Drilling Tasmania Pty. Ltd.

DRILL HOLE: 87

METHOD: Air Core

AMG CO-ORDS: 5363992mN 466092mE

DATE: 29.03.1999

ANGLE: Vertical

LOGGED BY: G.K.

FINAL DEPTH: 12m

FROM	TO	DESCRIPTION	SAMPLE NUMBER
0	1	Light brown/whitish, fine sand; cf. ca. 5%	
1	2	Light brown fine-medium sand; cf.ca. 1-2%	70206
2	3	White, medium-fine sand; cf. ca. 2%	
3	4	As above; but finer; cf.ca. 2%	70207
4	5	As above; somewhat clayey; cf. ca. 1%	
5	6	As above	70208
6	7	White, fine sand; somewhat clayey; cf. ca. 1%	
7	8	White, fine-medium sand; cf. ca. 1%	70209
8	9	Buff, fine-medium sand; cf. ca. 1%	
9	10	Pale orange white fine sand; cf. ca. 1%	70210
10	11	Light brown, fine sand; cf. ca. 2-5%	
11	12	Brown sandy loam/clay; cf. ca. 5%	70211

Hole bottomed in brown clay.

DRILL HOLE LOG

642041

AREA: Eastern Quarry Area, Pine Hill, Maydena

MAP SHEET: 4626 Maydena

DRILLER: Diamond Drilling Tasmania Pty. Ltd.

DRILL HOLE: 88

METHOD: Air Core

AMG CO-ORDS: 5263992mN 465985mE

DATE: 29.03.1999

ANGLE: Vertical

LOGGED BY: G.K.

FINAL DEPTH: 30m

FROM	TO	DESCRIPTION	SAMPLE NUMBER
0	1	Brown clayey soil; coarse fraction ca. 5%	
1	2	Brown clayey sand; cf. ca. 5%	70212
2	3	Light brown, medium-fine sand, slightly clayey; coarse fraction ca. 10%	
3	4	As above	70213
4	5	As above; to pale buff; cf. ca. 5-10%	
5	6	As above; slightly lighter; with balls of dark brown clay; coarse fraction ca. 5-10%	70214
6	7	As above; sparse balls of dark brown clay	
7	8	Pale buff, fine-medium sand; cf. ca. 10%	70215
8	9	Pale buff fine clayey sand; clay balls; coarse fraction ca. 5-10%	
9	10	As above	70216
10	11	As above; medium-fine	
11	12	White/pale buff medium grained sand;cf.ca. 15%	70217
12	13	As above; somewhat clayey; cf.ca. 15%	
13	14	White/buff, medium-coarse sand; clayey; coarse fraction ca. 15%; damp sample	70218
14	15	White, medium-coarse sand; gravelly; coarse fraction ca. 20%	
15	16	White, medium-coarse sand; cf. ca. 15%	70219
16	17	As above	
17	18	As above	70220
18	19	As above	
19	20	White, medium-fine sand; coarse fraction ca 10%	70221
20	21	White, fine-medium sand; coarse fraction ca. 5%	
21	22	As above	70222
22	23	White to pale buff, medium- fine sand; coarse fraction ca. 10%	
23	24	White to pale buff, fine-medium sand; coarse fraction ca.10%	70223

DRILL HOLE LOG

612042

DRILL HOLE: 88

FROM	TO	DESCRIPTION	SAMPLE NUMBER
24	25	As above	
25	26	Whitish, medium-fine grained sand; coarse fraction ca. 10%	70224
26	27	Whitish, fine-medium sand; coarse fraction ca. 5%	
27	28	Pale brown, fine -medium sand; coarse fraction ca. 5%	70225
28	29	Pale buff-white, fine-medium sand; coarse fraction ca. 5-10%	
29	30	As above	70226

Hole not bottomed; insufficient rods.

DRILL HOLE LOG

642043

AREA: Eastern Quarry Area, Pine Hill, Maydena

MAP SHEET: 4626 Maydena

DRILLER: Diamond Drilling Tasmania Pty. Ltd.

DRILL HOLE: 89

METHOD: Air Core

AMG CO-ORDS: 5263940mN 465891mE

DATE: 29.03.1999

ANGLE: Vertical

LOGGED BY: G.K.

FINAL DEPTH: 6.5m

FROM	TO	DESCRIPTION	SAMPLE NUMBER
0	1	Grey-white fine, somewhat clayey sand; coarse fraction ca. 5%	
1	2	White,fine sand; cf. ca. 5%	70227
2	3	As above; cf. ca. 10%	
3	4	As above	70228
4	5	White, fine-medium-grained sand; coarse fraction ca. 5-10%	
5	6	White, fine sand; coarse fraction ca. 20-25%	70229
6	6.5	As above; cf. ca. 10-15%	

Hole stopped on hard silica bedrock.

642044

DRILL HOLE LOG

AREA: Eastern Quarry Area, Pine Hill, Maydena

MAP SHEET: 4626 Maydena

DRILLER: Diamond Drilling Tasmania Pty. Ltd.

DRILL HOLE: 90

METHOD: Air Core

AMG CO-ORDS: 5263766mN 466087mE

DATE: 29.03.1999

ANGLE: Vertical

LOGGED BY: G.K.

FINAL DEPTH: 15m

FROM	TO	DESCRIPTION	SAMPLE NUMBER
0	1	Buff grey-white medium-fine sand; coarse fraction ca. 5%	
1	2	White fine sand; coarse fraction ca. 1%	70230
2	3	White fine-medium sand; cf. ca 2-5%	
3	4	As above	70231
4	5	As above	
5	6	As above	70232
6	7	White fine sand; coarse fraction ca. 1%	
7	8	As above; somewhat gritty; cf. ca. 1%	70233
8	9	As above	
9	10	As above	70234
10	11	As above; coarse fraction ca. 5%	
11	12	As above	70235
12	13	White medium-grained, pebbly sand; coarse fraction ca. 15%; wet sample	
13	14	Greyish-white, fine clayey sand; coarse fraction ca. 20%	70236
15	16	Greyish-white fine clayey sand; abundant clay balls	

From 12m sample clogging. Hole stopped at 15m as no return. Need water injection to clear. ?Hole not bottomed?

DRILL HOLE LOG

642045

AREA: Eastern Quarry Area, Pine Hill, Maydena

MAP SHEET: 4626 Maydena

DRILLER: Diamond Drilling Tasmania Pty. Ltd.

DRILL HOLE: 91

METHOD: Air Core

AMG CO-ORDS: 5263757mN 465983mE

DATE: 29.03.1999

ANGLE: Vertical

LOGGED BY: G.K.

FINAL DEPTH: 13m

FROM	TO	DESCRIPTION	SAMPLE NUMBER
0	1	Greyish-white medium grained clayey sand; coarse fraction ca. 5%	
1	2	White to light brown medium sand; coarse fraction ca. 5%	70237
2	3	As above	
3	4	Whitish/buff fine-medium sand; coarse fraction ca. 1%	70238
4	5	Whitish fine-medium sand	
5	6	As above	70239
6	7	As above	
7	8	As above	70240
8	9	White fine sand; coarse fraction ca. 1%	
9	10	As above	70241
10	11	As above	
11	12	As above	70242
12	13	White very fine sand; cf. ca. -1%	

Hole not bottomed. (ran out of sample bags).

642046

APPENDIX 2

ASSAYS - DRILL HOLE SAMPLES

AUSTRALIAN LABORATORY SERVICES P/L
A.C.N. 009 936 029

ANALYTICAL REPORT

642047

LABORATORY: STAFFORD
BATCH NUMBER: ST26056
SUB BATCH: 0
No. OF SAMPLES: 97
DATE RECEIVED: 13/04/99
DATE COMPLETED: 04/05/99

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

ORDER No.:
SAMPLE TYPE: AIR CORE
PROJECT:

SAMPLE NUMBER	ELEMENT / UNIT / METHOD / L.O.R.	Al2O3 ppm M289 10	Fe2O3 ppm M289 10	CaO ppm M289 10	MgO ppm M289 10	TiO2 ppm M289 10	MnO ppm M289 10
Hole 69:	0-1 70100	1620	2640	193	732	289	19
	1-2 70101	747	729	181	234	343	<10
	2-3 70102	345	223	159	133	169	<10
	3-4 70103	792	692	228	299	185	<10
	5-6 70104	483	795	342	157	130	<10
	7-8 70105	440	1010	244	175	111	<10
	9-10 70106	511	1360	224	283	99	13
	10-11 70107	717	1150	306	294	183	<10
Hole 70:	1-2 70108	295	1010	141	169	53	<10
	3-4 70109	383	445	174	94	98	<10
Hole 71:	0-1 70110	1100	358	232	83	236	<10
	2-3 70111	1190	562	239	73	243	<10
Hole 72:	1-2 70112	1510	519	102	142	179	<10
	3-4 70113	1070	304	109	101	252	<10
	5-6 70114	454	223	133	70	166	<10
Hole 73:	1-2 70115	7640	1300	277	549	970	<10
	8-9 70119	7520	3020	205	403	278	<10
	10-11 70120	1510	1690	302	129	101	<10
	12-13 70121	2410	3350	279	218	154	<10
	14-15 70122	874	1080	299	166	63	<10
	16-17 70123	572	1490	284	226	49	<10
	18-19 70124	1310	1330	229	209	87	<10
	20-21 70125	3590	2250	1220	268	191	<10
	22-23 70126	5230	3910	3990	342	217	12
Hole 74:	1-2 70127	1010	979	390	101	96	<10
	3-4 70128	426	387	300	141	126	<10
	5-6 70129	1190	944	357	183	172	<10
Hole 75:	1-2 70130	1360	281	103	85	73	<10
	3-4 70131	863	391	194	85	76	<10
	5-6 70132	763	298	192	72	73	<10

COMMENTS:

Method suitable for very high purity silica sands.
Many of these samples are considered low purity.
Results may bias low.

• This is the Final Report which supersedes any preliminary reports with this batch number.
• Results apply to sample(s) as submitted by client.

All pages of this report have been checked and approved for release.

Alice Springs Laboratory
Phone: (08) 8952 6020 Fax: (08) 8952 6028
Bendigo Laboratory
Phone: (03) 5446 1390 Fax: (03) 5446 1389
Brisbane Laboratory
Phone: (07) 3243 7222 Fax: (07) 3243 7218
Charters Towers Laboratory
Cloncurry Laboratory
Phone: (077) 42 1323 Fax: (077) 42 1685
Kalgoorlie Laboratory
Phone: (08) 9021 1457 Fax: (08) 9021 6253
New Zealand Laboratory
Phone: (07) 575 7654 Fax: (07) 575 7641
Perth Laboratory
Phone: (08) 9249 2988 Fax: (08) 9249 2942
Townsville Laboratory
Phone: (077) 79 9155 Fax: (077) 79 9729

AUSTRALIAN LABORATORY SERVICES P/L
A.C.N. 009 936 029

[redacted]

ANALYTICAL REPORT

642048

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

LABORATORY: STAFFORD
BATCH NUMBER: ST26056
SUB BATCH: 0
No. OF SAMPLES: 97
DATE RECEIVED: 13/04/99
DATE COMPLETED: 04/05/99

ORDER No.: SAMPLE TYPE: AIR CORE PROJECT:

SAMPLE NUMBER	ELEMENT / UNIT / METHOD / L.O.R.	Al2O3 ppm M289 10	Fe2O3 ppm M289 10	CaO ppm M289 10	MgO ppm M289 10	TiO2 ppm M289 10	MnO ppm M289 10
Hole 75:	7-8 70133	790	570	193	83	85	<10
	9-10 70134	1300	2110	227	162	170	13
	11-12 70135	1080	1570	164	117	161	<10
	13-14 70136	858	1280	265	126	130	<10
	15-16 70137	1500	2580	312	330	214	16
	17-18 70138	1820	3080	419	215	310	16
	19-20 70139	8500	1190	552	187	159	<10
Hole 76:	1-2 70140	4670	788	299	123	304	<10
	3-4 70141	2300	494	242	120	393	<10
	5-6 70142	1480	631	279	106	430	<10
	7-8 70143	2480	1740	308	101	405	<10
	9-10 70144	2750	1570	249	104	212	<10
	11-12 70145	2290	3260	216	102	277	12
	13-14 70146	2350	3580	383	223	194	11
	15-16 70147	1620	4280	281	210	126	14
	17-18 70148	423	5120	300	138	107	21
	19-20 70149	953	4630	235	166	65	16
	21-22 70150	2360	5660	275	173	70	19
Hole 77:	1-2 70151	1.20%	8190	316	812	501	36
	3-4 70152	203	2230	196	100	184	<10
	4-5 70153	293	4580	209	92	174	<10
	5-6 70154	3030	7910	257	143	408	<10
	7-8 70155	9530	7750	223	126	379	<10
	9-10 70156	4070	4230	221	112	298	<10
	11-12 70157	1300	2350	136	60	253	<10
Hole 78:	1-2 70158	1160	1460	129	79	513	<10
	3-4 70159	821	1190	137	59	356	<10
	5-6 70160	681	1170	149	65	256	<10
	7-8 70161	731	1580	173	67	293	<10
Hole 79:	1-2 70162	316	825	239	40	251	<10

COMMENTS:

This is the Final Report which supersedes any preliminary reports with this batch number. • Results apply to sample(s) as submitted by client.

AUSTRALIAN LABORATORY
SERVICES P/L
A.C.N. 009 936 029

ANALYTICAL REPORT

642049

LABORATORY: STAFFORD
BATCH NUMBER: ST26056
SUB BATCH: 0
No. OF SAMPLES: 97
DATE RECEIVED: 13/04/99
DATE COMPLETED: 04/05/99

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

ORDER No.:
SAMPLE TYPE: AIR CORE
PROJECT:

SAMPLE NUMBER		ELEMENT UNIT METHOD L.O.R.	Al2O3 ppm M289 10	Fe2O3 ppm M289 10	CaO ppm M289 10	MgO ppm M289 10	TiO2 ppm M289 10	MnO ppm M289 10
Hole 79	3-4	70163	397	897	256	90	276	<10
	5-6	70164	235	727	232	77	214	<10
	7-8	70165	397	1110	191	70	313	<10
	9-10	70166	860	1070	225	96	375	<10
Hole 80:	1-2	70167	447	440	186	56	222	<10
	3-4	70168	360	511	185	78	234	<10
	5-6	70169	9660	8870	218	480	922	<10
	7-8	70170	3250	2400	371	202	289	<10
	9-10	70171	1700	2040	563	145	239	<10
	11-12	70172	1630	2070	293	157	290	<10
	13-14	70173	1090	1750	365	177	227	<10
Hole 81:	1-2	70174	1310	2160	160	124	360	<10
	3-4	70175	660	998	198	135	258	<10
	5-6	70176	132	199	276	149	85	<10
	7-8	70177	368	768	231	134	159	<10
Hole 82:	1-2	70178	330	408	106	70	104	<10
	3-4	70179	243	329	128	68	136	<10
	5-6	70180	161	263	101	51	125	<10
	7-8	70181	141	242	103	57	141	<10
	9-10	70182	109	216	108	54	122	<10
	11-12	70183	134	250	131	75	174	<10
Hole 83:	1-2	70184	768	775	111	74	164	<10
	3-4	70185	313	403	122	56	252	<10
	5-6	70186	167	171	205	66	273	<10
	7-8	70187	154	141	201	78	144	<10
	9-10	70188	157	183	167	82	110	<10
Hole 84:	1-2	70189	162	206	109	52	129	<10
	3-4	70190	191	651	145	65	310	<10
	5-6	70191	248	1470	159	83	274	<10
	7-8	70192	211	554	219	120	259	<10

COMMENTS:

· This is the Final Report which supersedes any preliminary reports with this batch number.

• Results apply to sample(s) as submitted by client.

AUSTRALIAN LABORATORY SERVICES P/L
A.C.N. 009 936 029

ANALYTICAL REPORT

642050

LABORATORY: STAFFORD
BATCH NUMBER: ST26056
SUB BATCH: 0
No. OF SAMPLES: 97
DATE RECEIVED: 13/04/99
DATE COMPLETED: 04/05/99

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

ORDER No.:
SAMPLE TYPE: AIR CORE .
PROJECT:

SAMPLE NUMBER	ELEMENT / UNIT / METHOD / L.O.R.	Al2O3 ppm M289 10	Fe2O3 ppm M289 10	CaO ppm M289 10	MgO ppm M289 10	TiO2 ppm M289 10	MnO ppm M289 10
Hole 84 9-10	70193	166	272	232	144	126	<10
11-12	70194 A	126	181	199	117	145	<10
	70194 B	190	393	239	139	228	<10
15-16	70196	597	656	454	287	221	<10
17-18	70197	943	541	421	301	364	<10
Hole 85: 1-2	70198	139	204	133	69	37	<10
3-4	70199	355	517	130	78	102	<10

COMMENTS:

This is the Final Report which supersedes any preliminary reports with this batch number. • Results apply to sample(s) as submitted by client.

lice Springs Laboratory
hone: (08) 8952 6020 Fax: (08) 8952 6028
endigo Laboratory
hone: (03) 5446 1390 Fax: (03) 5446 1389
risbane Laboratory
hone: (07) 3243 7222 Fax: (07) 3243 7218
harters Towers Laboratory
Cloncurry Laboratory
Phone: (077) 42 1323 Fax: (077) 42 1685
Kalgoorlie Laboratory
Phone: (08) 9021 1457 Fax: (08) 9021 6253
New Zealand Laboratory
Phone: (07) 575 7654 Fax: (07) 575 7641
Orange Laboratory
Perth Laboratory
Phone: (08) 9249 2988 Fax: (08) 9249 2942
Townsville Laboratory
Phone: (077) 79 9155 Fax: (077) 79 9729

AUSTRALIAN LABORATORY
SERVICES P/L
A.C.N. 009 936 029

ANALYTICAL REPORT

642051

LABORATORY: STAFFORD
BATCH NUMBER: ST26056
SUB BATCH: 0
No. OF SAMPLES: 97
DATE RECEIVED: 13/04/99
DATE COMPLETED: 04/05/99

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

ORDER No.: SAMPLE TYPE: AIR CORE PROJECT:

SAMPLE NUMBER	ELEMENT UNIT METHOD L.O.R.	Cr2O3 ppm M289 1	V2O5 ppm M289 10
Hole 69: 0-1	70100	44	<10
1-2	70101	13	<10
2-3	70102	4	<10
3-4	70103	10	<10
5-6	70104	5	<10
7-8	70105	5	<10
9-10	70106	9	<10
10-11	70107	9	<10
Hole 70: 1-2	70108	10	<10
3-4	70109	2	<10
Hole 71: 0-1	70110	4	<10
2-3	70111	5	<10
Hole 72: 1-2	70112	4	<10
3-4	70113	2	<10
5-6	70114	2	<10
Hole 73: 1-2	70115	16	15
8-9	70119	12	11
10-11	70120	5	<10
12-13	70121	9	<10
14-15	70122	3	<10
16-17	70123	6	<10
18-19	70124	6	<10
20-21	70125	10	<10
22-23	70126	13	<10
Hole 74: 1-2	70127	3	<10
3-4	70128	2	<10
5-6	70129	4	<10
Hole 75: 1-2	70130	2	<10
3-4	70131	2	<10
5-6	70132	2	<10

COMMENTS:

· This is the Final Report which supersedes any preliminary reports with this batch number. • Results apply to sample(s) as submitted by client.

Alice Springs Laboratory
Phone: (08) 8952 6020 Fax: (08) 8952 6028
Bendigo Laboratory
Phone: (03) 5446 1390 Fax: (03) 5446 1389
Brisbane Laboratory
Phone: (07) 3243 7222 Fax: (07) 3243 7218
Charters Towers Laboratory
Cloncurry Laboratory
Phone: (077) 42 1323 Fax: (077) 42 1685
Kalgoorlie Laboratory
Phone: (08) 9021 1457 Fax: (08) 9021 6253
New Zealand Laboratory
Phone: (07) 575 7654 Fax: (07) 575 7641
Perth Laboratory
Phone: (08) 9249 2988 Fax: (08) 9249 2942
Townsville Laboratory
Phone: (077) 79 9155 Fax: (077) 79 9729

AUSTRALIAN LABORATORY SERVICES P/L
A.C.N. 009 936 029

ANALYTICAL REPORT

642052

LABORATORY: STAFFORD
BATCH NUMBER: ST26056
SUB BATCH: 0
No. OF SAMPLES: 97
DATE RECEIVED: 13/04/99
DATE COMPLETED: 04/05/99

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

ORDER No.: SAMPLE TYPE: AIR CORE PROJECT:

SAMPLE NUMBER	ELEMENT UNIT METHOD L.O.R.	Cr2O3 ppm M289 1	V2O5 ppm M289 10
Hole 75: 7-8	70133	2	<10
9-10	70134	7	<10
11-12	70135	4	<10
13-14	70136	3	<10
15-16	70137	10	<10
17-18	70138	7	<10
19-20	70139	11	<10
Hole 76: 1-2	70140	7	<10
3-4	70141	5	<10
5-6	70142	3	<10
7-8	70143	6	<10
9-10	70144	7	<10
11-12	70145	8	<10
13-14	70146	6	<10
15-16	70147	8	<10
17-18	70148	8	<10
19-20	70149	6	<10
21-22	70150	9	<10
Hole 77: 1-2	70151	37	19
3-4	70152	3	<10
4-5	70153	3	<10
5-6	70154	8	15
7-8	70155	15	13
9-10	70156	7	<10
11-12	70157	4	<10
Hole 78: 1-2	70158	3	<10
3-4	70159	2	<10
5-6	70160	2	<10
7-8	70161	2	<10
Hole 79: 1-2	70162	1	<10

COMMENTS:

• This is the Final Report which supersedes any preliminary reports with this batch number.
• Results apply to sample(s) as submitted by client.

AUSTRALIAN LABORATORY SERVICES P/L
A.C.N. 009 936 029

ANALYTICAL REPORT

642053

LABORATORY: STAFFORD
BATCH NUMBER: ST26056
SUB BATCH: 0
No. OF SAMPLES: 97
DATE RECEIVED: 13/04/99
DATE COMPLETED: 04/05/99

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

ORDER No.:
SAMPLE TYPE: AIR CORE
PROJECT:

SAMPLE NUMBER	ELEMENT / UNIT / METHOD / L.O.R.	Cr2O3 ppm M289 1	V2O5 ppm M289 10
Hole 79: 3-4	70163	2	<10
5-6	70164	1	<10
7-8	70165	2	<10
9-10	70166	2	<10
Hole 80: 1-2	70167	2	<10
3-4	70168	2	<10
5-6	70169	11	30
7-8	70170	5	<10
9-10	70171	3	<10
11-12	70172	3	<10
13-14	70173	2	<10
Hole 81: 1-2	70174	5	<10
3-4	70175	3	<10
5-6	70176	1	<10
7-8	70177	2	<10
Hole 82: 1-2	70178	1	<10
3-4	70179	1	<10
5-6	70180	2	<10
7-8	70181	1	<10
9-10	70182	1	<10
11-12	70183	1	<10
Hole 83: 1-2	70184	2	<10
3-4	70185	2	<10
5-6	70186	2	<10
7-8	70187	1	<10
9-10	70188	1	<10
Hole 84: 1-2	70189	1	<10
3-4	70190	2	<10
5-6	70191	2	<10
7-8	70192	1	<10

COMMENTS:

• This is the Final Report which supersedes any preliminary reports with this batch number.
• Results apply to sample(s) as submitted by client.

AUSTRALIAN LABORATORY SERVICES P/L
A.C.N. 009 936 029

[redacted]

642054

ANALYTICAL REPORT

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

LABORATORY: STAFFORD
BATCH NUMBER: ST26056
SUB BATCH: 0
No. OF SAMPLES: 97
DATE RECEIVED: 13/04/99
DATE COMPLETED: 04/05/99

ORDER No.: SAMPLE TYPE: AIR CORE PROJECT:

SAMPLE NUMBER	ELEMENT / UNIT / METHOD / L.O.R.	Cr2O3 ppm M289 1	V2O5 ppm M289 10
Hole 84: 9-10 70193		<1	<10
11-12 70194 A		<1	<10
70194 B		1	<10
15-16 70196		2	<10
17-18 70197		2	<10
Hole 85: 1-2 70198		1	<10
3-4 70199		2	<10

COMMENTS:

This is the Final Report which supersedes any preliminary reports with this batch number. • Results apply to sample(s) as submitted by client.

Alice Springs Laboratory
Phone: (08) 8952 6020 Fax: (08) 8952 6028
Bendigo Laboratory
Phone: (03) 5446 1390 Fax: (03) 5446 1389
Brisbane Laboratory
Phone: (07) 3243 7222 Fax: (07) 3243 7218
Charters Towers Laboratory
Cloncurry Laboratory
Phone: (077) 42 1323 Fax: (077) 42 1685
Kalgoorlie Laboratory
Phone: (08) 9021 1457 Fax: (08) 9021 6253
New Zealand Laboratory
Phone: (07) 575 7654 Fax: (07) 575 7641
Orange Laboratory
Perth Laboratory
Phone: (08) 9249 2988 Fax: (08) 9249 2942
Townsville Laboratory
Phone: (077) 79 9155 Fax: (077) 79 9729

AUSTRALIAN LABORATORY SERVICES P/L
A.C.N. 009 936 029

ANALYTICAL REPORT

642055

LABORATORY: STAFFORD
BATCH NUMBER: ST26056
SUB BATCH: 0
No. OF SAMPLES: 97
DATE RECEIVED: 13/04/99
DATE COMPLETED: 04/05/99

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

ORDER No.: SAMPLE TYPE: DUPLICATES PROJECT:

SAMPLE NUMBER	ELEMENT UNIT METHOD L.O.R.	Al2O3 ppm M289 10	Fe2O3 ppm M289 10	CaO ppm M289 10	MgO ppm M289 10	TiO2 ppm M289 10	MnO ppm M289 10
*** 70108		309	987	141	169	55	<10
Original Result		295	1010	141	169	53	<10
*** 70121		2370	3270	294	214	156	<10
Original Result		2410	3350	279	218	154	<10
*** 70131		873	368	196	87	81	<10
Original Result		863	391	194	85	76	<10
*** 70155		1.03%	8230	228	127	391	<10
Original Result		9530	7750	223	126	379	<10
*** 70165		418	1140	199	73	314	<10
Original Result		397	1110	191	70	313	<10
*** 70175		664	943	195	132	237	<10
Original Result		660	998	198	135	258	<10
*** 70191		270	1470	154	82	258	<10
Original Result		248	1470	159	83	274	<10

COMMENTS:

Results which appear on this report are for laboratory QUALITY CONTROL purposes.

• This is the Final Report which supersedes any preliminary reports with this batch number. • Results apply to sample(s) as submitted by client.

Alice Springs Laboratory
Phone: (08) 8952 6020 Fax: (08) 8952 6028
Bendigo Laboratory
Phone: (03) 5446 1390 Fax: (03) 5446 1389
Brisbane Laboratory
Phone: (07) 3243 7222 Fax: (07) 3243 7218
Charters Towers Laboratory
Cloncurry Laboratory
Phone: (077) 42 1323 Fax: (077) 42 1685
Kalgoorlie Laboratory
Phone: (08) 9021 1457 Fax: (08) 9021 6253
New Zealand Laboratory
Phone: (07) 575 7654 Fax: (07) 575 7641
Perth Laboratory
Phone: (08) 9249 2988 Fax: (08) 9249 2942
Townsville Laboratory
Phone: (077) 79 9155 Fax: (077) 79 9729

AUSTRALIAN LABORATORY SERVICES P/L
A.C.N. 009 936 029

ANALYTICAL REPORT

LABORATORY: STAFFORD
BATCH NUMBER: ST26056
SUB BATCH: 0
No. OF SAMPLES: 97
DATE RECEIVED: 13/04/99
DATE COMPLETED: 04/05/99

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

ORDER No.: SAMPLE TYPE: DUPLICATES PROJECT:

SAMPLE NUMBER	ELEMENT / UNIT / METHOD / L.O.R.	Cr203 ppm M289 1	V205 ppm M289 10
*** 70108		9	<10
Original Result		10	<10
*** 70121		8	<10
Original Result		9	<10
*** 70131		2	<10
Original Result		2	<10
*** 70155		16	14
Original Result		15	13
*** 70165		3	<10
Original Result		2	<10
*** 70175		2	<10
Original Result		3	<10
*** 70191		2	<10
Original Result		2	<10

COMMENTS:

• This is the Final Report which supersedes any preliminary reports with this batch number. • Results apply to sample(s) as submitted by client.

Alice Springs Laboratory
Phone: (08) 8952 6020 Fax: (08) 8952 6028
Bendigo Laboratory
Phone: (03) 5446 1390 Fax: (03) 5446 1389
Brisbane Laboratory
Phone: (07) 3243 7222 Fax: (07) 3243 7218
Charters Towers Laboratory
Cloncurry Laboratory
Phone: (077) 42 1323 Fax: (077) 42 1685
Kalgoorlie Laboratory
Phone: (08) 9021 1457 Fax: (08) 9021 6253
New Zealand Laboratory
Phone: (07) 575 7654 Fax: (07) 575 7641
Perth Laboratory
Phone: (08) 9249 2988 Fax: (08) 9249 2942
Townsville Laboratory
Phone: (077) 79 9155 Fax: (077) 79 9729

AUSTRALIAN LABORATORY
SERVICES P/L
A.C.N. 009 936 029

[redacted]

642057

ANALYTICAL REPORT

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

LABORATORY: STAFFORD
BATCH NUMBER: ST26056
SUB BATCH: 1
No. OF SAMPLES: 6
DATE RECEIVED: 13/04/99
DATE COMPLETED: 04/05/99

ORDER No.:
SAMPLE TYPE: AIR CORE
PROJECT:

SAMPLE NUMBER	ELEMENT / UNIT / METHOD / L.O.R.	Al2O3 ppm M289 10	Fe2O3 ppm M289 10	CaO ppm M289 10	MgO ppm M289 10	TiO2 ppm M289 10	MnO ppm M289 10
BCS313-1 A		325	118	66	13	106	<10
BCS313-1 B		333	123	67	13	93	<10
BCS313-1 C		368	125	64	12	106	<10
BCS 267 A		6970	6550	1.31%	389	1460	1270
BCS 267 B		6830	6780	1.37%	395	1250	1390
BCS 267 C		7620	6990	1.41%	406	1470	1400

COMMENTS:

• This is the Final Report which supersedes any preliminary reports with this batch number.
• Results apply to sample(s) as submitted by client.

Alice Springs Laboratory
Phone: (08) 8952 6020 Fax: (08) 8952 6028
Bendigo Laboratory
Phone: (03) 5446 1390 Fax: (03) 5446 1389
Brisbane Laboratory
Phone: (07) 3243 7222 Fax: (07) 3243 7218
Cloncurry Laboratory
Phone: (077) 42 1323 Fax: (077) 42 1685
Kalgoorlie Laboratory
Phone: (08) 9021 1457 Fax: (08) 9021 6253
New Zealand Laboratory
Phone: (07) 575 7654 Fax: (07) 575 7641
Perth Laboratory
Phone: (08) 9249 2988 Fax: (08) 9249 2942
Townsville Laboratory
Phone: (077) 79 9155 Fax: (077) 79 9729

All pages of this report have been checked and approved for release.

AUSTRALIAN LABORATORY SERVICES P/L
A.C.N. 009 936 029

ANALYTICAL REPORT

642058

LABORATORY: STAFFORD
BATCH NUMBER: ST26056
SUB BATCH: 1
No. OF SAMPLES: 6
DATE RECEIVED: 13/04/99
DATE COMPLETED: 04/05/99

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

ORDER No.:
SAMPLE TYPE: AIR CORE
PROJECT:

SAMPLE NUMBER	ELEMENT / UNIT / METHOD / L.O.R.	Cr2O3 ppm M289 1	V2O5 ppm M289 10				
BCS313-1 A		1	<10				
BCS313-1 B		1	<10				
BCS313-1 C		1	<10				
BCS 267 A		127	14				
BCS 267 B		141	14				
BCS 267 C		130	14				

COMMENTS:

• This is the Final Report which supersedes any preliminary reports with this batch number. • Results apply to sample(s) as submitted by client.

Alice Springs Laboratory
Phone: (08) 8952 6020 Fax: (08) 8952 6028
Bendigo Laboratory
Phone: (03) 5446 1390 Fax: (03) 5446 1389
Brisbane Laboratory
Phone: (07) 3243 7222 Fax: (07) 3243 7218
Charters Towers Laboratory
Cloncurry Laboratory
Phone: (077) 42 1323 Fax: (077) 42 1685
Kalgoorlie Laboratory
Phone: (08) 9021 1457 Fax: (08) 9021 6253
New Zealand Laboratory
Phone: (07) 575 7654 Fax: (07) 575 7641
Perth Laboratory
Phone: (08) 9249 2988 Fax: (08) 9249 2942
Townsville Laboratory
Phone: (077) 79 9155 Fax: (077) 79 9729

BUREAU OF ANALYSED SAMPLES LTD.

Directors (1979-89):-
P.D. RIDSDALE, *B.Sc., C.Eng., M.I.M.*, (Managing)
B. BAGSHAWE, *A.Met., C.Eng., F.I.M.*
R.P. MEERES, *B.A.*, (Oxon)
W.F. WILSON

BRITISH CHEMICAL STANDARD CERTIFIED REFERENCE MATERIAL

CERTIFICATE OF ANALYSIS

BCS-CRM No. 313/1
HIGH PURITY SILICA

Prepared under rigorous laboratory conditions and, AFTER CERTIFICATION ANALYSIS IN GREAT BRITAIN, issued by the Bureau of Analysed Samples Ltd.

The Material for this CRM was supplied by Pilkington Brothers plc, St. Helens. It was graded to pass a 125 micrometre (120 mesh) sieve and the sieved material was passed over a magnetic separator.

CO-OPERATING ANALYSTS AND FIRMS

INDEPENDENT ANALYSTS

1. OLIVER, G.J., *B.Sc., Ph.D., C.Chem., M.R.S.C., M.I.Ceram.*, British Ceramic Research Ltd., Stoke-on-Trent.
2. PAGE-GIBSON, J.E., *B.Sc., C.Chem., M.R.S.C.*, Ridsdale and Co. Ltd., Middlesbrough.

ANALYSTS representing MANUFACTURERS and USERS

3. BREW, *M.C., C.Chem., M.R.S.C.*, United Glass Containers, St. Albans.
4. BUTLER, A.S., *C.Chem., M.R.S.C.*, Tilcon Ltd., Knaresborough
5. CARLYLE, Miss S.P., *L.R.S.C.*, Rockware Glass Ltd., Knottingley.
6. CLIFFE, F.J., *C.Chem., F.R.S.C.*, Pilkington Brothers plc., Ormskirk
7. PROCTER, R.G., *L.R.S.C., L.I.Ceram.*, Watts Blake Bearne & Co. plc., Newton Abbot
8. WATKINS, P., *B.Sc., M.Sc., Ph.D.*, British Industrial Sand Ltd., Kendal
9. WILLEY, P.G., *A.Met.*, ECC International Ltd., St. Austell.

ANALYSES

Mean values — mass content in %. All results relate to the dried (110°C) sample

Analyst No.	SiO_2	Al_2O_3	TiO_2	Fe_2O_3	MnO	CaO	MgO	Na_2O	K_2O	Cr_2O_3	Li_2O	*Loss on Ignition*
1	99.69	0.040	0.012	0.012	0.00010	0.006	0.0013	0.004	0.005	*<0.0001*	*0.0008*	*0.12*
2	99.70	0.039	0.016	0.012	0.00017	0.006	0.0014	0.003	0.004	*0.0002*	*0.0004*	*0.09*
3	99.72	0.042	0.022	0.012	...	0.006	...	...	0.003	*0.0001*	...	*0.09*
4	...	0.037	0.014	0.010	...	0.005	0.0014	0.002	0.006	...	...	*0.07*
5	99.82	0.031	0.016	0.012	0.00012	...	...	0.003	...	*0.0002*	*0.0002*	*0.04*
6	99.86	0.038	0.017	0.011	0.00012	0.006	0.0015	0.004	0.006	*<0.0001*	*0.0009*	*0.07*
7	99.84	0.035	...	...	...	0.008	...	...	...	...	...	*0.11*
8	99.76	0.033	0.020	0.012	0.00010	0.007	0.0013	0.002	0.004	*0.0002*	*0.0004*	*0.12*
9	99.83	0.031	0.018	0.012	0.00015	0.007	0.0010	0.004	0.005	*<0.0001*	...	*0.05*
M_M	**99.78**	**0.036**	**0.017**	**0.012**	**0.00013**	**0.006**	**0.0013**	**0.003**	**0.005**	...	...	...
s_M	0.07	0.004	0.003	0.001	0.00003	0.001	0.0002	0.001	0.002			

M_M: Mean of the intralaboratory means. s_M: Standard deviation of the intralaboratory means.

The above figures are those which each analyst has decided upon after careful verification.

Figures in bold type certified, figures in small italic type only approximate

MAIN EDITION.

British Chemical Standards

issued by

Bureau of Analysed Samples, Ltd.

Certificate of Analyses

OF

B.C.S. No. 267, SILICA BRICK

Prepared under rigorous laboratory conditions, and AFTER STANDARDIZATION BY ANALYSTS IN GREAT BRITAIN, issued by the Bureau of Analysed Samples, Ltd.

The material for this standard was specially selected and was kindly supplied by the Oughtibridge Silica Firebrick Co. Ltd., Sheffield. It was crushed by Messrs Murex Ltd., Rainham, Essex, to pass a 120 mesh B.S. sieve.

CO-OPERATING ANALYSTS AND FIRMS.

Referee Analysts—Independent.

1. British Iron & Steel Research Association, Metallurgy Division, Sheffield. (per K. SPEIGHT *A.Met.*, *A.I.M.*).
2. British Ceramic Research Association, Stoke-on-Trent, (per A. T. GREEN, *O.B.E.*, *D.Sc.*, *F.R.I.C.*).
3. BURNEY, E., *B.A.*, *B.Sc.*, Ridsdale & Co. Ltd., Middlesbrough.
4. University of Sheffield (per H. MOORE, *D.Sc.*, *A.R.C.S.*, *F.Inst.P.*) Department of Glass Technology, Sheffield.

Analysts Representing Manufacturers and Users.

5. BAGSHAWE, B., *A.Met.*, *F.I.M.*, *M.Inst.F.*, The Brown-Firth Research Laboratories, Sheffield.
6. CHIRNSIDE, R. C., *F.R.I.C.*, The General Electric Company Ltd., Research Laboratories, Wembley.
7. CUMMINGS, G. T., *B.Sc.*, and SINGLETON, F. H., *B.Sc.*, *A.R.I.C.*, Woodall-Duckham Construction Company Ltd. London, S.W. 3.
8. NICHOLSON, A., The Oughtibridge Silica Firebrick Co. Ltd., Oughtibridge, Nr. Sheffield.
9. SPEIGHT, G. E., *B.Sc.*, *F.I.M.* *F.R.I.C.*, and PADGET, G., *A.Met.*, The United Steel Companies Ltd., Research and Development Department, Rotherham.

ANALYSES (Sample dried @ 110°/120°C)

Analyst No.	SiO_2 %	Al_2O_3 %	Total Fe* expressed as Fe_2O_3 %	TiO_2 %	Total Mn* expressed as MnO %	CaO %	MgO %	Na_2O %	K_2O %	Total %
1.	95·9	0·86	0·77	0·18	0·15	1·80	0·08	0·07	0·17	
2.	96·0	0·85	0·79	0·18	0·13	1·80	0·02	0·06	0·12	
3.	96·2	0·88	0·79	0·17	0·16	1·75	0·06	0·06	0·12	
4.	95·7	0·85	0·78	0·18	0·16	1·79	...	0·06	0·15	
5.	95·9	0·83	0·75	0·17	0·16	1·68	0·06	0·06	0·14	
6.	96·0	0·83	0·80	0·15	0·16	1·81	<0·10	0·05	...	
7.	95·8	0·85	0·77	0·17	0·13	1·75	0·09	...	...	
8.	95·8	0·84	0·83	0·18	0·12	1·67	0·07	0·06	0·18	
9.	96·1	0·85	0·81	0·17	0·18	1·66	0·04	0·06	0·12	
Average	95·9	0·85	0·79	0·17	0·15	1·75	0·06	0·06	0·14	99·8₇

The above figures are those which each Analyst has decided upon after careful verification.

* About 0·08% Fe and 0·10% Mn exist in the metallic form.

[P.T.O.

AUSTRALIAN LABORATORY
SERVICES P/L
A.C.N. 009 936 029

ANALYTICAL REPORT

G22061

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

LABORATORY: STAFFORD
BATCH NUMBER: ST26692
SUB BATCH: 0
No. OF SAMPLES: 43
DATE RECEIVED: 15/06/99
DATE COMPLETED: 25/06/99

ORDER No.: SAMPLE TYPE: AIR CORE PROJECT:

SAMPLE NUMBER		ELEMENT UNIT METHOD L.O.R.	Al2O3 ppm M289 10	Fe2O3 ppm M289 10	CaO ppm M289 10	MgO ppm M289 10	TiO2 ppm M289 10	MnO ppm M289 10
Hole 86:	1-2	70200	231	306	162	100	182	<10
	3-4	70201	157	349	189	105	66	<10
	5-6	70202	134	238	146	77	73	<10
	7-8	70203	170	668	233	121	124	<10
	9-10	70204	119	965	193	106	144	<10
	10-11	70205	137	638	450	184	103	<10
Hole 87:	1-2	70206	230	576	197	115	212	<10
	3-4	70207	200	421	184	91	188	<10
	5-6	70208	151	447	416	85	160	<10
	7-8	70209	192	638	260	126	198	<10
	9-10	70210	1050	2470	365	169	276	<10
	11-12	70211	5740	3190	417	386	976	<10
Hole 88:	1-2	70212	2680	2260	354	279	555	11
	3-4	70213	420	559	285	184	104	<10
	5-6	70214	1260	1720	468	294	337	<10
	7-8	70215	270	570	323	206	86	<10
	9-10	70216	204	894	282	166	89	<10
	11-12	70217	237	808	301	176	108	<10
	13-14	70218	246	867	389	235	121	<10
	15-16	70219	161	949	384	234	74	<10
	17-18	70220	132	639	332	189	48	<10
	19-20	70221	161	1140	323	180	77	<10
	21-22	70222	156	1250	341	188	59	<10
	23-24	70223	203	1500	369	183	75	<10
	25-26	70224	182	807	542	362	43	<10
	27-28	70225	4620	2.13%	576	1.76%	137	240
	29-30	70226	232	1890	423	302	100	<10
Hole 89:	1-2	70227	248	1230	258	172	319	<10
	3-4	70228	199	2290	325	190	225	11
	5-6	70229	136	1500	253	156	245	<10

COMMENTS:

This is the Final Report which supersedes any preliminary reports with this batch number. • Results apply to sample(s) as submitted by client.

All pages of this report have been checked and approved for release.

Alice Springs Laboratory
Phone: (08) 8952 6020 Fax: (08) 8952 6028
Bendigo Laboratory
Phone: (03) 5446 1390 Fax: (03) 5446 1389
Brisbane Laboratory
Phone: (07) 3243 7222 Fax: (07) 3243 7218
Charters Towers Laboratory
Cloncurry Laboratory
Phone: (077) 42 1323 Fax: (077) 42 1685
Kalgoorlie Laboratory
Phone: (08) 9021 1457 Fax: (08) 9021 6253
New Zealand Laboratory
Phone: (07) 575 7654 Fax: (07) 575 7641
Perth Laboratory
Phone: (08) 9249 2988 Fax: (08) 9249 2942
Townsville Laboratory
Phone: (077) 79 9155 Fax: (077) 79 9729

AUSTRALIAN LABORATORY
SERVICES P/L
A.C.N. 009 936 029

ANALYTICAL REPORT

642062

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

LABORATORY: STAFFORD
BATCH NUMBER: ST26692
SUB BATCH: 0
No. OF SAMPLES: 43
DATE RECEIVED: 15/06/99
DATE COMPLETED: 25/06/99

ORDER No.: SAMPLE TYPE: AIR CORE PROJECT:

SAMPLE NUMBER	ELEMENT UNIT METHOD L.O.R.	Al2O3 ppm M289 10	Fe2O3 ppm M289 10	CaO ppm M289 10	MgO ppm M289 10	TiO2 ppm M289 10	MnO ppm M289 10
Hole 90: 1-2	70230	208	155	277	56	100	<10
3-4	70231	162	168	326	46	43	<10
5-6	70232	198	231	345	33	107	<10
7-8	70233	118	274	412	137	54	<10
9-10	70234	128	288	223	105	60	<10
11-12	70235	166	179	268	147	49	<10
13-14	70236	231	1160	696	488	353	<10
Hole 91: 1-2	70237	124	175	171	73	121	<10
3-4	70238	130	298	130	82	237	<10
5-6	70239	91	287	150	74	209	<10
7-8	70240	105	414	111	60	241	<10
9-10	70241	100	533	250	85	191	<10
11-12	70242	83	846	354	77	194	<10

COMMENTS:

• This is the Final Report which supersedes any preliminary reports with this batch number.
• Results apply to sample(s) as submitted by client.

Alice Springs Laboratory
Phone: (08) 8952 6020 Fax: (08) 8952 6028
Bendigo Laboratory
Phone: (03) 5446 1390 Fax: (03) 5446 1389
Brisbane Laboratory
Phone: (07) 3243 7222 Fax: (07) 3243 7218
Cloncurry Laboratory
Phone: (077) 42 1323 Fax: (077) 42 1685
Kalgoorlie Laboratory
Phone: (08) 9021 1457 Fax: (08) 9021 6253
New Zealand Laboratory
Phone: (07) 575 7654 Fax: (07) 575 7641
Perth Laboratory
Phone: (08) 9249 2988 Fax: (08) 9249 2942
Townsville Laboratory
Phone: (077) 79 9155 Fax: (077) 79 9729

AUSTRALIAN LABORATORY SERVICES P/L
A.C.N. 009 936 029

ANALYTICAL REPORT

642063

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

LABORATORY: STAFFORD
BATCH NUMBER: ST26692
SUB BATCH: 0
No. OF SAMPLES: 43
DATE RECEIVED: 15/06/99
DATE COMPLETED: 25/06/99

ORDER No.: SAMPLE TYPE: AIR CORE PROJECT:

SAMPLE NUMBER	ELEMENT UNIT METHOD L.O.R.	Cr2O3 ppm M289 1	V2O5 ppm M289 10
Hole 86: 1-2	70200	<1	<10
3-4	70201	<1	<10
5-6	70202	<1	<10
7-8	70203	<1	<10
9-10	70204	<1	<10
10-11	70205	<1	<10
Hole 87: 1-2	70206	<1	<10
3-4	70207	<1	<10
5-6	70208	<1	<10
7-8	70209	<1	<10
9-10	70210	3	<10
11-12	70211	11	19
Hole 88: 1-2	70212	7	<10
3-4	70213	<1	<10
5-6	70214	3	<10
7-8	70215	<1	<10
9-10	70216	<1	<10
11-12	70217	<1	<10
13-14	70218	<1	<10
15-16	70219	<1	<10
17-18	70220	1	<10
19-20	70221	<1	<10
21-22	70222	<1	<10
23-24	70223	1	<10
25-26	70224	<1	<10
27-28	70225	186	<10
29-30	70226	3	<10
Hole 89: 1-2	70227	2	<10
3-4	70228	<1	<10
5-6	70229	1	<10

COMMENTS:

This is the Final Report which supersedes any preliminary reports with this batch number. • Results apply to sample(s) as submitted by client.

Alice Springs Laboratory
Phone: (08) 8952 6020 Fax: (08) 8952 6028
Bendigo Laboratory
Phone: (03) 5446 1390 Fax: (03) 5446 1389
Brisbane Laboratory
Phone: (07) 3243 7222 Fax: (07) 3243 7218
Charters Towers Laboratory
Cloncurry Laboratory
Phone: (077) 42 1323 Fax: (077) 42 1685
Kalgoorlie Laboratory
Phone: (08) 9021 1457 Fax: (08) 9021 6253
New Zealand Laboratory
Phone: (07) 575 7654 Fax: (07) 575 7641
Perth Laboratory
Phone: (08) 9249 2988 Fax: (08) 9249 2942
Townsville Laboratory
Phone: (077) 79 9155 Fax: (077) 79 9729

AUSTRALIAN LABORATORY SERVICES P/L
A.C.N. 009 936 029

ANALYTICAL REPORT

64206A

LABORATORY: STAFFORD
BATCH NUMBER: ST26692
SUB BATCH: 0
No. OF SAMPLES: 43
DATE RECEIVED: 15/06/99
DATE COMPLETED: 25/06/99

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

ORDER No.: SAMPLE TYPE: AIR CORE PROJECT:

SAMPLE NUMBER	ELEMENT UNIT METHOD L.O.R.	Cr2O3 ppm M289 1	V2O5 ppm M289 10				
Hole 90: 1-2	70230	<1	<10				
3-4	70231	<1	<10				
5-6	70232	<1	<10				
7-8	70233	<1	<10				
9-10	70234	<1	<10				
11-12	70235	<1	<10				
13-14	70236	2	<10				
Hole 91: 1-2	70237	<1	<10				
3-4	70238	<1	<10				
5-6	70239	<1	<10				
7-8	70240	<1	<10				
9-10	70241	<1	<10				
11-12	70242	<1	<10				

COMMENTS:

This is the Final Report which supersedes any preliminary reports with this batch number. • Results apply to sample(s) as submitted by client.

AUSTRALIAN LABORATORY
SERVICES P/L
A.C.N. 009 936 029

642065

ANALYTICAL REPORT

LABORATORY: STAFFORD
BATCH NUMBER: ST26692
SUB BATCH: 0
No. OF SAMPLES: 43
DATE RECEIVED: 15/06/99
DATE COMPLETED: 25/06/99

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

ORDER No.:
SAMPLE TYPE: DUPLICATES
PROJECT:

SAMPLE NUMBER	ELEMENT / UNIT / METHOD / L.O.R.	Al2O3 ppm M289 10	Fe2O3 ppm M289 10	CaO ppm M289 10	MgO ppm M289 10	TiO2 ppm M289 10	MnO ppm M289 10
*** 70208		158	501	436	88	166	<10
Original Result		151	447	416	85	160	<10
*** 70218		251	858	398	244	123	<10
Original Result		246	867	389	235	121	<10
*** 70228		197	2360	328	195	220	11
Original Result		199	2290	325	190	225	11

COMMENTS:

Results which appear on this report are for laboratory QUALITY CONTROL purposes.

This is the Final Report which supersedes any preliminary reports with this batch number. • Results apply to sample(s) as submitted by client.

Alice Springs Laboratory
Phone: (08) 8952 6020 Fax: (08) 8952 6028
Bendigo Laboratory
Phone: (03) 5448 1390 Fax: (03) 5448 1389
Brisbane Laboratory
Phone: (07) 3243 7222 Fax: (07) 3243 7218
Charters Towers Laboratory
Cloncurry Laboratory
Phone: (077) 42 1323 Fax: (077) 42 1685
Kalgoorlie Laboratory
Phone: (08) 9021 1457 Fax: (08) 9021 6253
New Zealand Laboratory
Phone: (07) 575 7654 Fax: (07) 575 7641
Perth Laboratory
Phone: (08) 9249 2988 Fax: (08) 9249 2942
Townsville Laboratory
Phone: (077) 79 9155 Fax: (077) 79 9729

AUSTRALIAN LABORATORY SERVICES P/L
A.C.N. 009 936 029

642066

ANALYTICAL REPORT

LABORATORY: STAFFORD
BATCH NUMBER: ST26692
SUB BATCH: 0
No. OF SAMPLES: 43
DATE RECEIVED: 15/06/99
DATE COMPLETED: 25/06/99

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

ORDER No.: SAMPLE TYPE: DUPLICATES PROJECT:

SAMPLE NUMBER	ELEMENT / UNIT / METHOD / L.O.R.	Cr2O3 ppm M289 1	V2O5 ppm M289 10				
*** 70208		<1	<10				
Original Result		<1	<10				
*** 70218		<1	<10				
Original Result		<1	<10				
*** 70228		2	<10				
Original Result		<1	<10				

COMMENTS:

• This is the Final Report which supersedes any preliminary reports with this batch number. • Results apply to sample(s) as submitted by client.

Alice Springs Laboratory
Phone: (08) 8952 6020 Fax: (08) 8952 6028
Bendigo Laboratory
Phone: (03) 5446 1390 Fax: (03) 5446 1389
Brisbane Laboratory
Phone: (07) 3243 7222 Fax: (07) 3243 7218
Cloncurry Laboratory
Phone: (077) 42 1323 Fax: (077) 42 1685
Kalgoorlie Laboratory
Phone: (08) 9021 1457 Fax: (08) 9021 6253
New Zealand Laboratory
Phone: (07) 575 7654 Fax: (07) 575 7641
Perth Laboratory
Phone: (08) 9249 2988 Fax: (08) 9249 2942
Townsville Laboratory
Phone: (077) 79 9155 Fax: (077) 79 9729

AUSTRALIAN LABORATORY SERVICES P/L
A.C.N. 009 936 029

642067

ANALYTICAL REPORT

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

LABORATORY: STAFFORD
BATCH NUMBER: ST26692
SUB BATCH: 1
No. OF SAMPLES: 2
DATE RECEIVED: 15/06/99
DATE COMPLETED: 25/06/99

ORDER No.: SAMPLE TYPE: AIR CORE PROJECT:

SAMPLE NUMBER	ELEMENT / UNIT / METHOD / L.O.R.	Al2O3 ppm M289 10	Fe2O3 ppm M289 10	CaO ppm M289 10	MgO ppm M289 10	TiO2 ppm M289 10	MnO ppm M289 10
BCS313-1		377	108	67	16	149	<10
BCS267-A		7950	7040	1.63%	478	1490	1440

COMMENTS:

• This is the Final Report which supersedes any preliminary reports with this batch number.

• Results apply to sample(s) as submitted by client.

All pages of this report have been checked and approved for release.

Alice Springs Laboratory
Phone: (08) 8952 6020 Fax: (08) 8952 6028
Bendigo Laboratory
Phone: (03) 5446 1390 Fax: (03) 5446 1389
Brisbane Laboratory
Phone: (07) 3243 7222 Fax: (07) 3243 7218
Charters Towers Laborat

Cloncurry Laboratory
Phone: (077) 42 1323 Fax: (077) 42 1685
Kalgoorlie Laboratory
Phone: (08) 9021 1457 Fax: (08) 9021 6253
New Zealand Laboratory
Phone: (07) 575 7654 Fax: (07) 575 7641

Perth Laboratory
Phone: (08) 9249 2988 Fax: (08) 9249 2942
Townsville Laboratory
Phone: (077) 79 9155 Fax: (077) 79 9729

AUSTRALIAN LABORATORY SERVICES P/L
A.C.N. 009 936 029

[redacted]

642063

ANALYTICAL REPORT

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

LABORATORY: STAFFORD
BATCH NUMBER: ST26692
SUB BATCH: 1
No. OF SAMPLES: 2
DATE RECEIVED: 15/06/99
DATE COMPLETED: 25/06/99

ORDER No.: SAMPLE TYPE: AIR CORE PROJECT:

SAMPLE NUMBER	ELEMENT / UNIT / METHOD / L.O.R.	Cr2O3 ppm M289 1	V2O5 ppm M289 10				
BCS313-1		<1	<10				
BCS267-A		152	16				

COMMENTS:

• This is the Final Report which supersedes any preliminary reports with this batch number. • Results apply to sample(s) as submitted by client.

Alice Springs Laboratory
Phone: (08) 8952 6020 Fax: (08) 8952 6028
Bendigo Laboratory
Phone: (03) 5446 1390 Fax: (03) 5446 1389
Brisbane Laboratory
Phone: (07) 3243 7222 Fax: (07) 3243 7218
Charters Towers Laboratory
Cloncurry Laboratory
Phone: (077) 42 1323 Fax: (077) 42 1685
Kalgoorlie Laboratory
Phone: (08) 9021 1457 Fax: (08) 9021 6253
New Zealand Laboratory
Phone: (07) 575 7654 Fax: (07) 575 7641
Perth Laboratory
Phone: (08) 9249 2988 Fax: (08) 9249 2942
Townsville Laboratory
Phone: (077) 79 9155 Fax: (077) 79 9729

APPENDIX 3

ASSAYS - SELECT SIZED COMPOSITES

642070

GERHARD K. KRUMMEI
SUITE 28, 487 ST. KILDA ROAD, MELBOURNE. 3004. AUSTRALIA
TELEPHONE /FAX – (03)9820 2595 MOBILE – 0412 512 320

FACSIMILE TRANSMISSION

To	:	Shaun Kenny, ALS; Fax: 07 3243 7254
FROM	:	Gerhard K. Krummei, Fax: 03 9820 2595
DATE	:	12th August 1999
PAGES	:	Four
SUBJECT	:	SILICA SAND ASSAYS - REF: QUOTE BR/016/99

Following our discussions over the last few weeks, I confirm that some further definitive work is required on some of the samples held in Brisbane under batch numbers ST 26056 and ST 26692.

The purpose is to determine the impurity levels of the +75 to -600 micron size fraction of homogenised and processed sample composites made up of individual drill intercepts.

The numbers of the samples to be composited, with the new identity number of their composites, are listed on the attached pages.

There are 14 composites in all.

Assay procedures and determinations as set out in the ALS Quote BR/016/99 of 23.02.99 apply to the +75 to -600 micron fraction. Gold assays are required for the coarse fraction by method PM209.

Please adopt the following sample preparation procedure prior to assay:

1. "Middlings":

* riffle split each sample once	retain ½
* combine other halves by groupings as indicated. These make up the composites.	see attached sheets
* allocate new sample number to each composite: Total 14 samples	M - series
* isolate the +75 to -600 micron fraction by sieving - (the "middlings")	retain over and under size fractions separately
* remove magnetic fraction from "middlings" by WHIMS at MD Research (suggested field strength: at least 15K, preferably 20K gauss)	retain magnetic fraction
* thoroughly homogenise non-mag fraction	
* select portion for assay and dry	retain remainder
* assay as per quotation BR/016/99	

2. Coarse fraction:

* select sample from oversize (+600 microns)	
* label sample using C prefix for corresponding M-series numbers	(i.e. M101 becomes C101)
* grind/pulverise and assay for gold by method PM 209	

SAMPLE SCHEDULE

642071

Current Sample Number	New Composite Sample Number	Fe expectations (ppm)
70101		med.- low; below 300
102		
103	M101	
104		
70105		
106	M102	med.+: below 600
107		
70110		
111	M103	med.-low; below 200
70140		
141	M104	med.- low; below 300
142		
70143		
144	M105	med.- high; around 1000
145		
146		
70158		
159	M106	med.; around 500
160		
161		
70162		
163	M107	med.- low: below 200
164		
70167		
168	M108	low: below 200
70170		
171	M109	med.- high; around 1000
172		
173		
70178		
179		
180	M110	low; below 100
181		
182		
183		
70200		
201		
202	M111	low; below 200
203		
204		
205		

Current Sample Number	New Composite Sample Number	Fe expectations (ppm)
70206		
207	M112	low; below 200
208		
209		
70227		
228	M113	?med.- high; around 1000 or less
229		
70237		
238		
239	M114	low; below 200
240		
241		
242		

AUSTRALIAN LABORATORY SERVICES P/L

A.C.N. 009 936 029

642073

ANALYTICAL REPORT

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

LABORATORY: STAFFORD
BATCH NUMBER: ST27476
SUB BATCH: 0
No. OF SAMPLES: 14
DATE RECEIVED: 02/09/99
DATE COMPLETED: 12/10/99

ORDER No.: SAMPLE TYPE: -600+75 PROJECT:

SAMPLE NUMBER	ELEMENT / UNIT / METHOD / L.O.R.	Al2O3 ppm M289 10	Fe2O3 ppm M289 10	CaO ppm M289 10	MgO ppm M289 10	TiO2 ppm M289 10	MnO ppm M289 10
	M101	372	169	200	111	104	<10
	M102	229	230	181	111	44	<10
	M103	597	186	170	60	164	<10
	M104	1420	248	187	95	237	<10
	M105	792	398	129	67	80	<10
	M106	379	337	92	55	149	<10
	M107	172	244	176	61	77	<10
	M108	223	182	120	55	105	<10
	M109	421	377	243	95	54	<10
	M110	168	152	100	65	77	<10
	M111	91	146	118	73	43	<10
	M112	129	162	118	60	65	<10
	M113	70	238	132	82	91	<10
	M114	74	131	70	41	62	<10

COMMENTS:

M102 was composite of 70105 and 70106 as sample 70107 was destroyed.
Other bags of individual samples in composites M101 to M104 were damaged but contamination not suspected.

• This is the Final Report which supersedes any preliminary reports with this batch number.

• Results apply to sample(s) as submitted by client.

All pages of this report have been checked and approved for release.

Alice Springs Laboratory
Phone: (08) 8952 6020 Fax: (08) 8952 6028
Bendigo Laboratory
Phone: (03) 5446 1390 Fax: (03) 5446 1389
Brisbane Laboratory
Phone: (07) 3243 7222 Fax: (07) 3243 7218
Charters Towers Laboratory
Phone: (07) 4787 4155 Fax: (07) 4787 4220
Cloncurry Laboratory
Phone: (07) 4742 1323 Fax: (07) 4742 1685
Kalgoorlie Laboratory
Phone: (08) 9021 1457 Fax: (08) 9021 6253
Orange Laboratory
Phone: (02) 6363 1722 Fax: (02) 6363 1189
Perth Laboratory
Phone: (08) 9249 2988 Fax: (08) 9249 2942
Townsville Laboratory
Phone: (07) 4779 9155 Fax: (07) 4779 9729

AUSTRALIAN LABORATORY SERVICES P/L
A.C.N. 009 936 029

642074

ANALYTICAL REPORT

[redacted]

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

LABORATORY: STAFFORD
BATCH NUMBER: ST27476
SUB BATCH: 0
No. OF SAMPLES: 14
DATE RECEIVED: 02/09/99
DATE COMPLETED: 12/10/99

ORDER No.: SAMPLE TYPE: -600+75 PROJECT:

SAMPLE NUMBER	ELEMENT UNIT METHOD L.O.R.	Cr2O3 ppm M289 1	V2O5 ppm M289 10				
M101		2	<10				
M102		1	<10				
M103		1	<10				
M104		2	<10				
M105		1	<10				
M106		<1	<10				
M107		<1	<10				
M108		<1	<10				
M109		1	<10				
M110		2	<10				
M111		<1	<10				
M112		<1	<10				
M113		1	<10				
M114		1	<10				

COMMENTS:

• This is the Final Report which supersedes any preliminary reports with this batch number. • Results apply to sample(s) as submitted by client.

AUSTRALIAN LABORATORY SERVICES P/L
A.C.N. 009 936 029

[redacted]

642073

ANALYTICAL REPORT

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

LABORATORY: STAFFORD
BATCH NUMBER: ST27476
SUB BATCH: 2
No. OF SAMPLES: 2
DATE RECEIVED: 02/09/99
DATE COMPLETED: 12/10/99

ORDER No.: SAMPLE TYPE: STANDARDS PROJECT:

SAMPLE NUMBER	ELEMENT	Al2O3	Fe2O3	CaO	MgO	TiO2	MnO
	UNIT	ppm	ppm	ppm	ppm	ppm	ppm
	METHOD	M289	M289	M289	M289	M289	M289
	L.O.R.	10	10	10	10	10	10
BCS 313-1		8700	7800	1.76%	470	1580	1580
BCS 267		1570	240	69	43	184	<10

COMMENTS:

• This is the Final Report which supersedes any preliminary reports with this batch number.
• Results apply to sample(s) as submitted by client.

All pages of this report have been checked and approved for release.

Alice Springs Laboratory
Phone: (08) 8952 5020 Fax: (08) 8952 6028
Bendigo Laboratory
Phone: (03) 5446 1390 Fax: (03) 5446 1389
Brisbane Laboratory
Phone: (07) 3243 7222 Fax: (07) 3243 7218
Charters Towers Laboratory
Phone: (07) 4787 4155 Fax: (07) 4787 4220
Cloncurry Laboratory
Phone: (07) 4742 1323 Fax: (07) 4742 1685
Kalgoorlie Laboratory
Phone: (08) 9021 1457 Fax: (08) 9021 6253
Orange Laboratory
Phone: (02) 6363 1722 Fax: (02) 6363 1189
Perth Laboratory
Phone: (08) 9249 2988 Fax: (08) 9249 2942
Townsville Laboratory
Phone: (07) 4779 9155 Fax: (07) 4779 9729

AUSTRALIAN LABORATORY SERVICES P/L
A.C.N. 009 936 029

642076

ANALYTICAL REPORT

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

LABORATORY: STAFFORD
BATCH NUMBER: ST27476
SUB BATCH: 2
No. OF SAMPLES: 2
DATE RECEIVED: 02/09/99
DATE COMPLETED: 12/10/99

ORDER No.: SAMPLE TYPE: STANDARDS PROJECT:

SAMPLE NUMBER	ELEMENT UNIT METHOD L.O.R.	Cr2O3 ppm M289 1	V2O5 ppm M289 10				
BCS 313-1		124	16				
BCS 267		1	<10				

COMMENTS:

• This is the Final Report which supersedes any preliminary reports with this batch number. • Results apply to sample(s) as submitted by client.

Alice Springs Laboratory
Phone: (08) 8952 6020 Fax: (08) 8952 6028
Bendigo Laboratory
Phone: (03) 5446 1390 Fax: (03) 5446 1389
Brisbane Laboratory
Phone: (07) 3243 7222 Fax: (07) 3243 7218
Charters Towers Laboratory
Phone: (07) 4787 4155 Fax: (07) 4787 4220
Cloncurry Laboratory
Phone: (07) 4742 1323 Fax: (07) 4742 1685
Kalgoorlie Laboratory
Phone: (08) 9021 1457 Fax: (08) 9021 6253
Orange Laboratory
Phone: (02) 6363 1722 Fax: (02) 6363 1189
Perth Laboratory
Phone: (08) 9249 2988 Fax: (08) 9249 2942
Townsville Laboratory
Phone: (07) 4779 9155 Fax: (07) 4779 9729

AUSTRALIAN LABORATORY SERVICES P/L
A.C.N. 009 936 029

[redacted]

612077

ANALYTICAL REPORT

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

LABORATORY: STAFFORD
BATCH NUMBER: ST27476
SUB BATCH: 1
No. OF SAMPLES: 14
DATE RECEIVED: 02/09/99
DATE COMPLETED: 12/10/99

ORDER No.: SAMPLE TYPE: +600UM PROJECT:

SAMPLE NUMBER	ELEMENT UNIT METHOD L.O.R.	Au ppm PM219 0.001	Au PM219 ppm CHECKS 0.001				
	C101	<0.001	<0.001				
	C102	<0.001					
	C103	<0.001					
	C104	<0.001	<0.001				
	C105	<0.001					
	C106	<0.001					
	C107	<0.001					
	C108	<0.001	<0.001				
	C109	<0.001					
	C110	<0.001					
	C111	<0.001	<0.001				
	C112	<0.001					
	C113	<0.001					
	C114	<0.001	<0.001				

COMMENTS:

• This is the Final Report which supersedes any preliminary reports with this batch number.

• Results apply to sample(s) as submitted by client.

All pages of this report have been checked and approved for release.

Alice Springs Laboratory
Phone: (08) 8952 6020 Fax: (08) 8952 6028
Bendigo Laboratory
Phone: (03) 5446 1390 Fax: (03) 5446 1389
Brisbane Laboratory
Phone: (07) 3243 7222 Fax: (07) 3243 7218
Charters Towers Laboratory
Phone: (07) 4787 4155 Fax: (07) 4787 4220
Cloncurry Laboratory
Phone: (07) 4742 1323 Fax: (07) 4742 1685
Kalgoorlie Laboratory
Phone: (08) 9021 1457 Fax: (08) 9021 6253
Orange Laboratory
Phone: (02) 6363 1722 Fax: (02) 6363 1189
Perth Laboratory
Phone: (08) 9249 2988 Fax: (08) 9249 2942
Townsville Laboratory
Phone: (07) 4779 9155 Fax: (07) 4779 9729

APPENDIX 4

MINERALOGY OF SILICA SAND SAMPLES

642079

Central Mineralogical Services

8 Bradshaw Avenue, Crafers. S.A. 5152
Telephone (08) 8370 9779 Fax (08) 8370 9788
International: Telephone + 618 8370 9779 Fax + 618 8370 9788

30 July 1999

Mr G. Krummei
Suite 28
487 St Kilda Road
MELBOURNE VIC 3004

REPORT CMS 99/7/9

YOUR REFERENCE:	Letter 20 July 1999
DATE RECEIVED:	26 July 1999
SAMPLE NO'S:	73, 85, 90
SUBMITTED BY:	G. Krummei
WORK REQUESTED:	Mineralogy

H.W. Fander

H.W. Fander, M.Sc.

REPORT CMS 99/7/9

MINERALOGY OF SILICA SANDS SAMPLES

Twelve samples were received for mineralogical examination, comprising the following:

Hole 73: 1 Non-magnetic fraction, 6 magnetic fractions
Hole 85: 1 unprocessed sample
Hole 90: 1 Non-magnetic fraction, 3 magnetic fractions

PROCEDURE

All the samples were examined as grain mounts, and opaque minerals were identified in polished sections (of which seven were prepared); selected photomicrographs were prepared to augment the descriptions.

The grain mounts were examined under the stereobinocular microscope (in oblique incident light) and under a petrological microscope by transmitted light – giving complementary results.

GENERAL COMMENTS

All the samples (***85, 90/1KG, 73/1KG***) contained ferrous metal shavings, turnings and slivers of artificial origin, probably from the drilling/sampling equipment; for ***85*** this was the dominant or sole source of Fe, and a major source for the other samples, and must be taken into account in the assays; elimination of this source of contamination should significantly reduce Fe in ***85*** and ***90***.

Sample **73** is a different case because another major source of Fe is naturally-occurring goethite impregnating and coating quartz grains, particularly aggregates of silt-sized grains.

Other opaque grains identified include rust (magnetic Fe oxides), hematite, magnetite, goethite, chromite, weld "globules", and black organic matter (some as coatings on quartz and impregnations in quartz aggregates). Goethite forms thin coatings on quartz and only penetrates single grains (ie mono-crystalline grains) when these are microfractured. Traces of native copper occur in some samples and are probably artificial contaminants.

The quartz in all samples consists chiefly of mono-crystalline grains with a small proportion of microcrystalline chert-like aggregates and porous clusters of silt-sized grains; the mono-crystalline grains have a cloudy or milky appearance due to numerous submicroscopic fluid inclusions and the aggregates are whitish (except in ***73***, where they are stained).

Coatings, where present on quartz grains, are mostly "limonite" or ferruginous clay, but some coatings are carbonaceous, ie black.

RESULTS

Sample 85 This consists of >99% quartz, with a few dark opaque and metallic (magnetic) grains, and shreds of wood.

The quartz is principally (95-97%) mono-crystalline, angular to subangular, with 3-5% white microcrystalline aggregates; it is milky, cloudy with a translucent whitish colour (this appears brown in transmitted, polarised light!). A few grains have 3μ - 120μ carbonate inclusions, and there are rare ?brookite (TiO_2) inclusions. Occasional grains have weak goethite spots or partial coatings.

Some of the opaque grains were hand-picked and polished; most were black organic matter, generally impregnating quartz; some were bright, strongly magnetic metal slivers. ***(photo 11)***

Sample 90

Non-Magnetic >99% quartz, almost entirely as mono-crystalline, subangular to angular cloudy grains containing numerous submicroscopic fluid inclusions often with zonal distribution; some contain carbonate inclusions up to 20μ. There are white microcrystalline quartz aggregates (<1%) and a few black organic grains. ***(photo 12)***

90/1KG 20-25% magnetic grains (metal slivers 5μ - 250μ; rust 20μ - 500μ, rare magnetite and magnetite/quartz); 75-80% clean, cloudy quartz.

90/3KG 5-10% magnetics (metal slivers, rust) and a trace of metallic Cu. 90-95% quartz, almost all clean, cloudy; a few with weakly limonite-coated surfaces.

90/10+20KG 2-3% free hematite, as 10μ - 200μ grains, rarely as composites with quartz; a trace of metallic Cu as 10μ - 100x300μ grains, and 1-2% goethite. About 95% clean, cloudy quartz.

Sample 73

73NM 1-2% limonite-stained microcrystalline quartz aggregates, about 10% lightly limonite-coated quartz; the remainder (about 88%) very lightly limonite-stained mono-crystalline quartz, with some carbonaceous staining. ***(photo 9)***

Acid-Treated NM (50% HCl, 5 minutes, hot). Most limonite coatings removed from the mono-crystalline quartz, but with only limited effect on microcrystalline aggregates in that time ***(photo 10)***. Carbonaceous films not removed.

73/1KG About 60% magnetics (ferrous metal, magnetite, rust, hematite, chromite with magnetite rims and veins, goethite, weld globules). There are two types of magnetite – one is more titaniferous and contains hematite exsolution lamellae, the other is plain; grainsizes are 50µ - 300µ. Some magnetite has rims of a white clay-group mineral. ***(photos 1-4)*** The other 40% is limonite-stained quartz.

73/3KG About 25% magnetics (as above, 65-70% strongly limonite-stained quartz, about 5% brown, oxidised chlorite, 5% ferruginous clay/earthy limonite. Rare zircon, garnet.

73/5KG About 85% limonite-stained mono-crystalline, subangular to subrounded quartz grains; staining is superficial except where grains are microfractured. About 10% goethite-cemented quartz (?microbreccia), and 5% limonite-stained microcrystalline aggregates. There are traces of free hematite, ultrafine ferrous metal slivers and metallic Cu. ***(photos 5,6)***

73/10KG About 15% limonite-stained microcrystalline aggregates, 50% heavily-stained quartz, 35% lightly to very lightly-stained quartz.

73/15KG About 50% of the mono-crystalline quartz is moderately Fe-stained, 30-35% is lightly-stained, 5% is heavily-stained, and 10% consists of limonite-stained aggregates. There are traces of hematite and of limonite-stained clay aggregates. ***(photos 7,8)***

73/20KG About 50% is moderately-stained quartz, 40% is lightly-stained quartz, with about 10% limonite-stained aggregates (microcrystalline quartz and clusters of silt-sized grains).

REPORT CMS 99/7/9
PHOTOMICROGRAPHS

Photo No.

1 **73/1KG** Magnification 270x
Chromite grain with magnetite veins.

2 **73/1KG** Magnification 270x
Chromite (C) and Magnetite (M).

3 **73/1KG** Magnification 270x
Metal and rust particles.

4 **73/1KG** Magnification 270x
Ti-Magnetite with hematite lamellae and magnetite with a clay rim.

5 **73/5KG** Magnification 135x
Quartz-goethite aggregate and goethite-cemented quartz.

6 **73/5KG** Magnification 270x
Quartz-goethite aggregate.

7 **73/15KG** Magnification 270x
Goethite-impregnated quartz.

8 **73/15KG** Magnification 270x
Quartz with goethite rim.

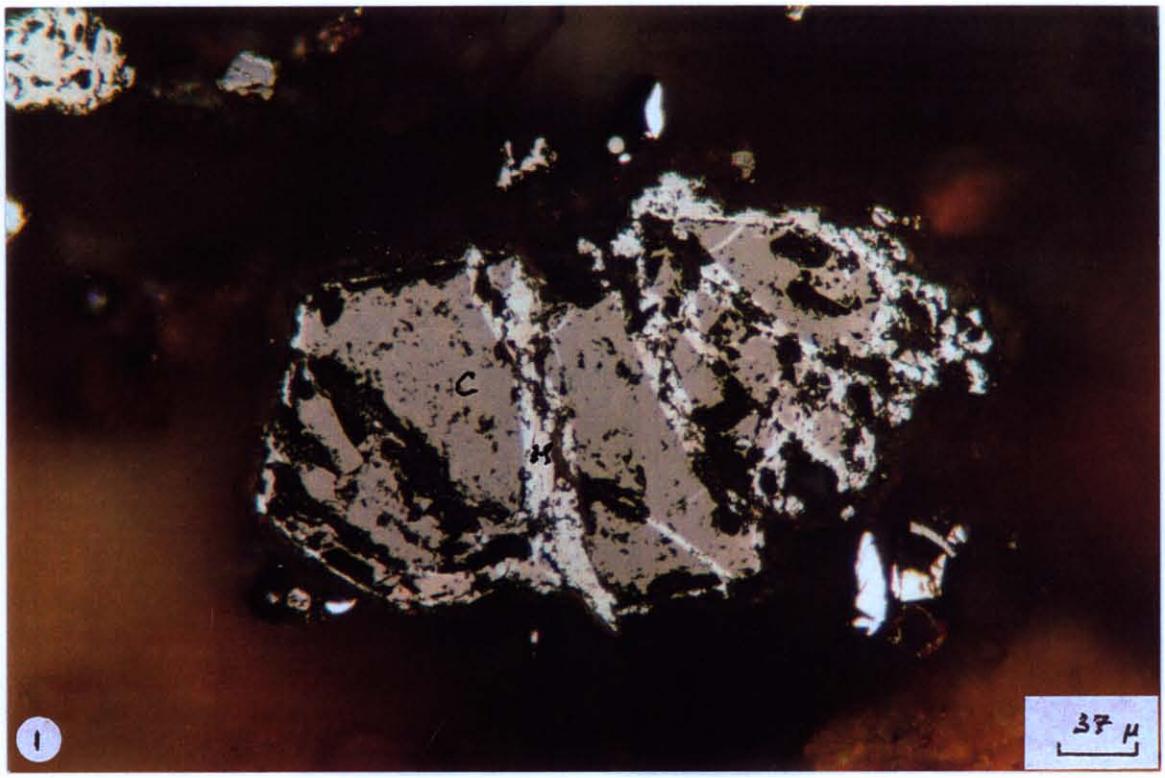
9 **73/NM** Magnification 40x
General view of this fraction showing Fe-staining, limonite-impregnated aggregate (A).

10 **73NM Acid-treated** Magnification 40x
Aggregates (A) have retained some limonite.

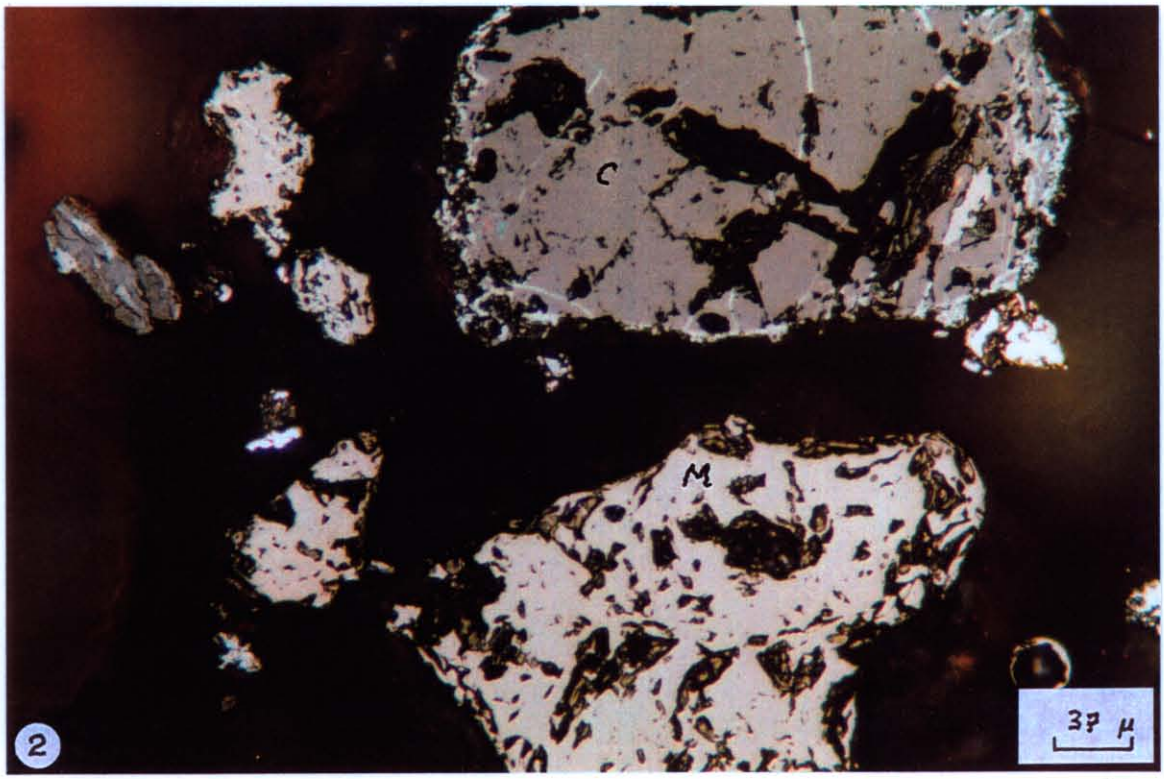
11 **85** Magnification 40x
General view of sample. The milky quartz grains always appear brownish in transmitted light; this is an optical phenomenon unrelated to Fe-staining.

12 **90NM** Magnification 40x
General view of sample.

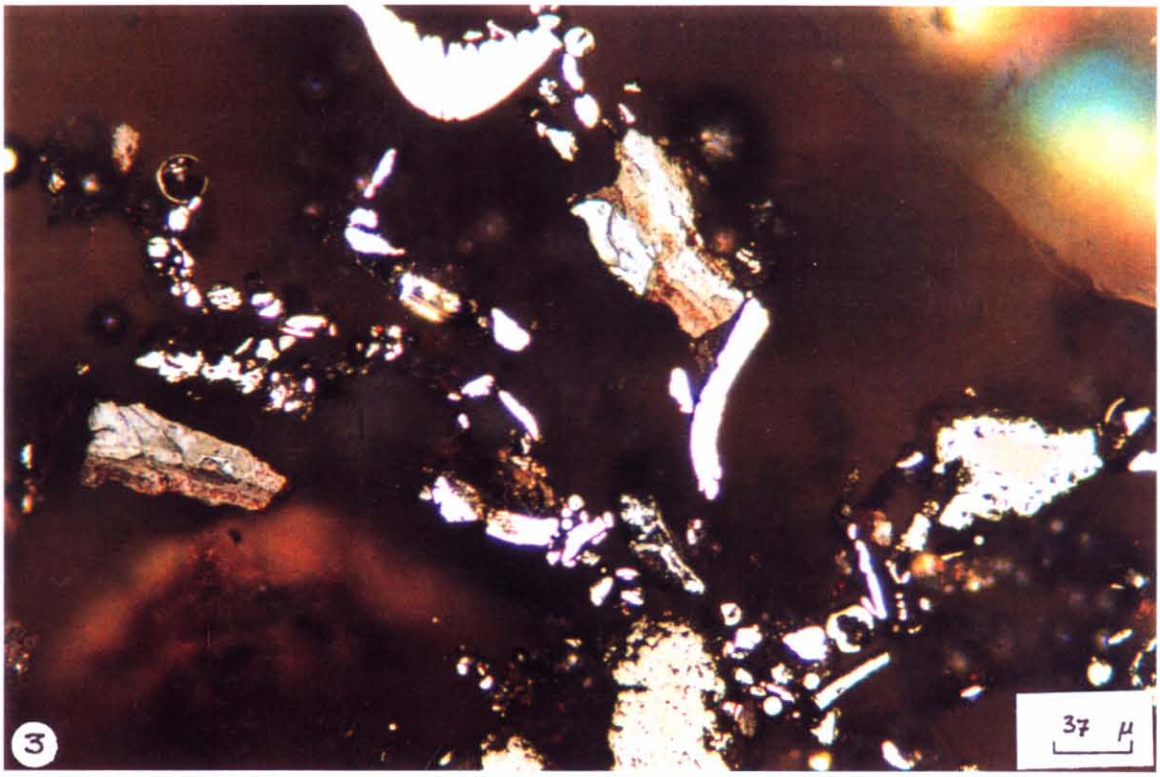
642084

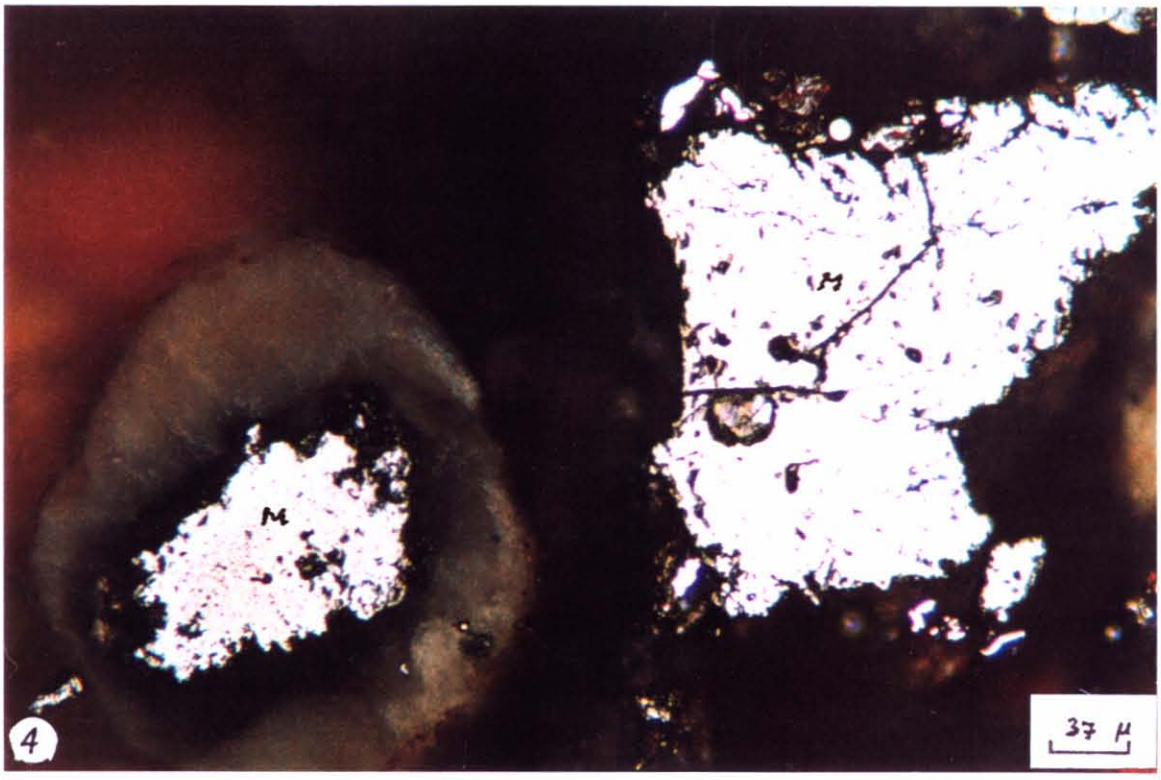


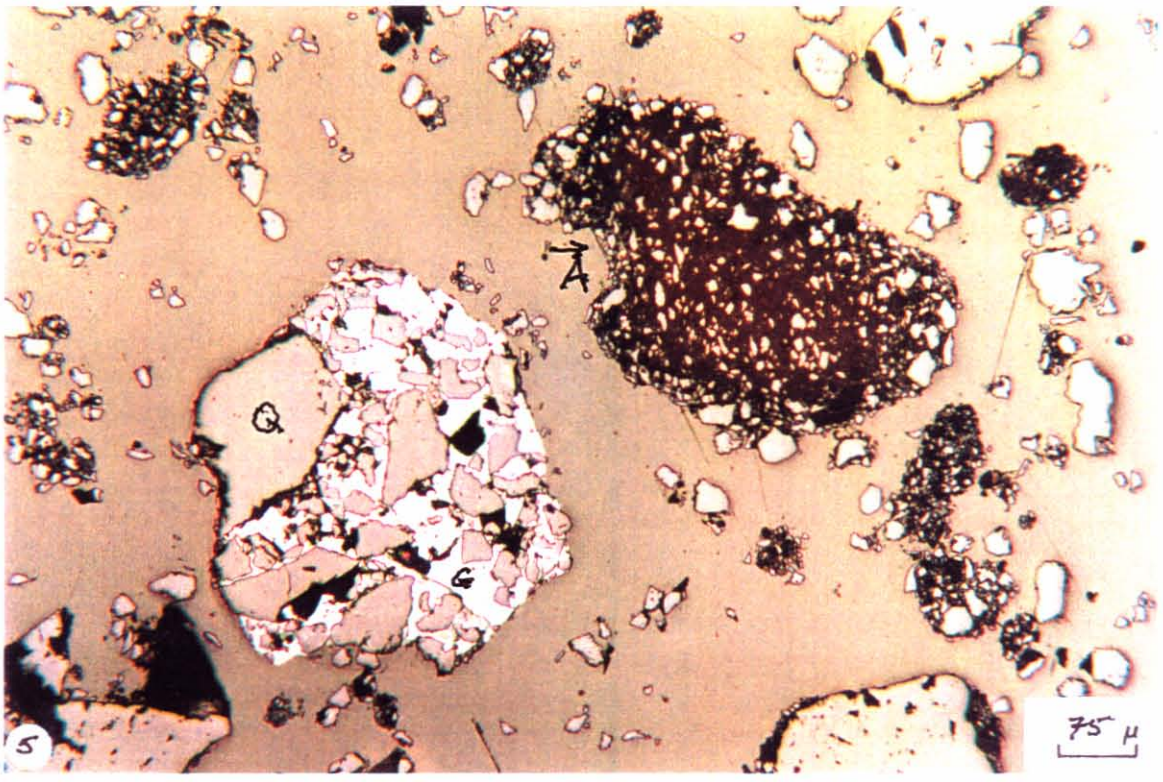
1

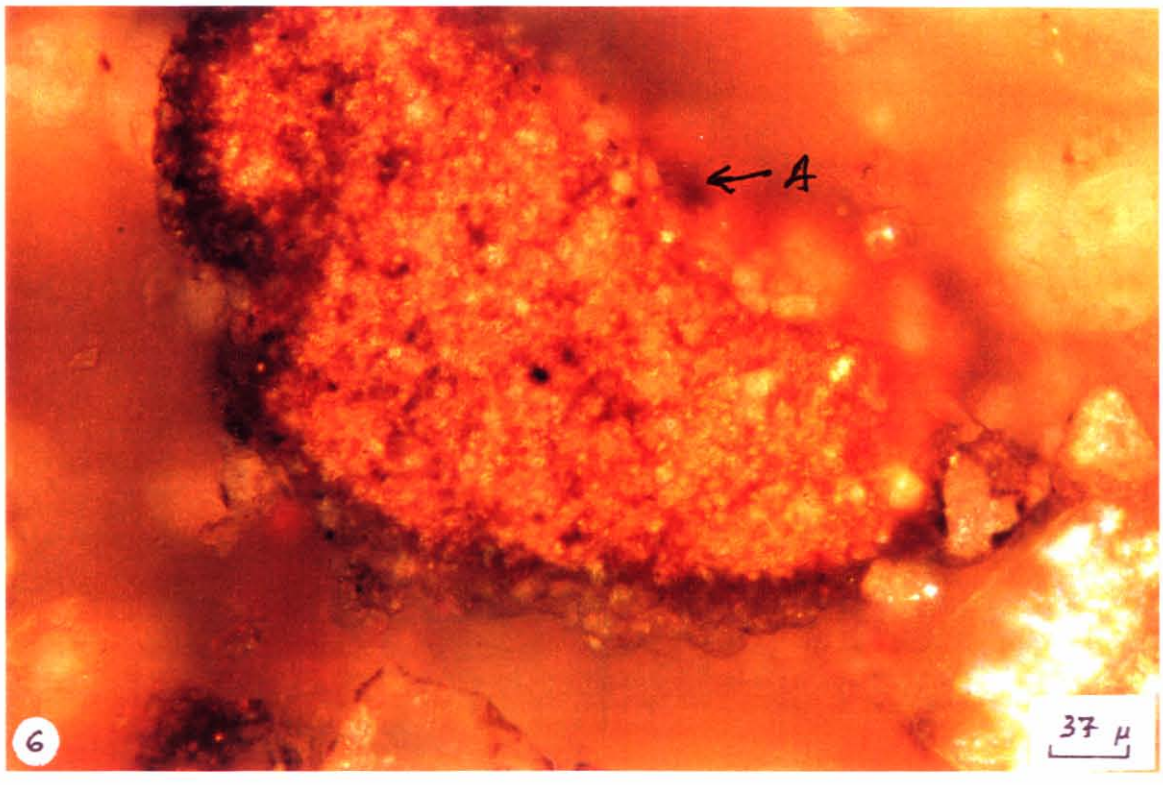


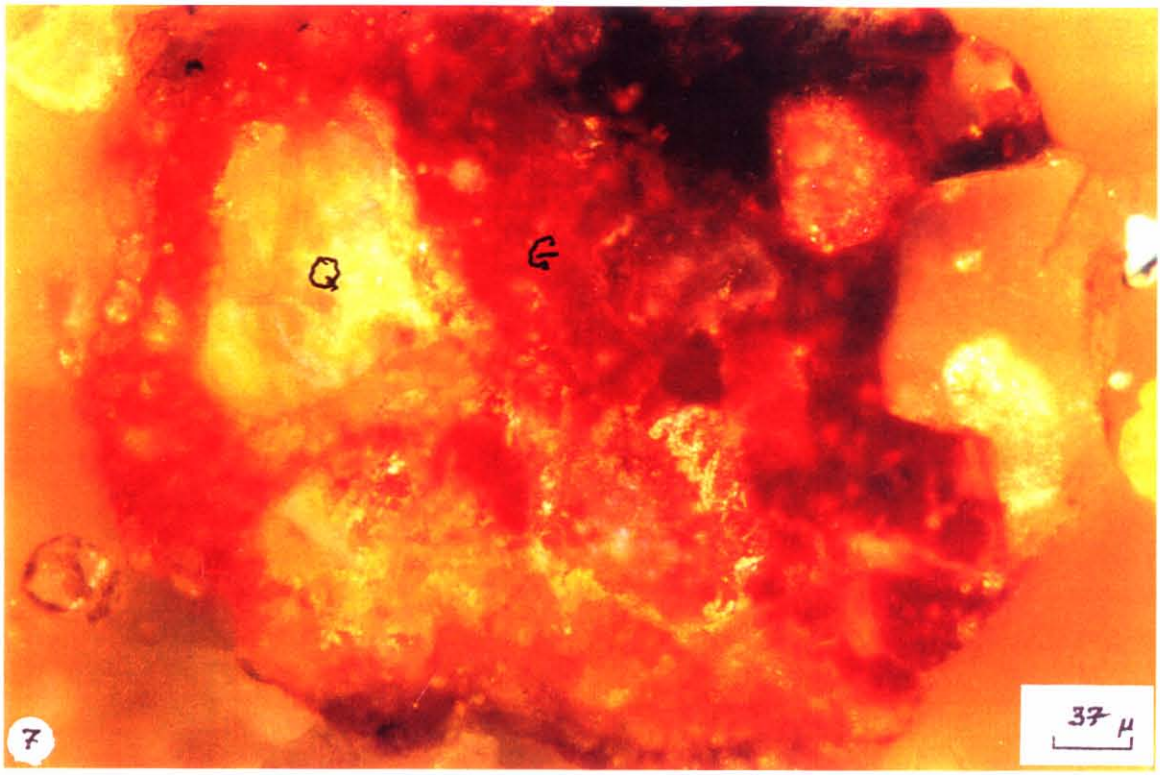
2

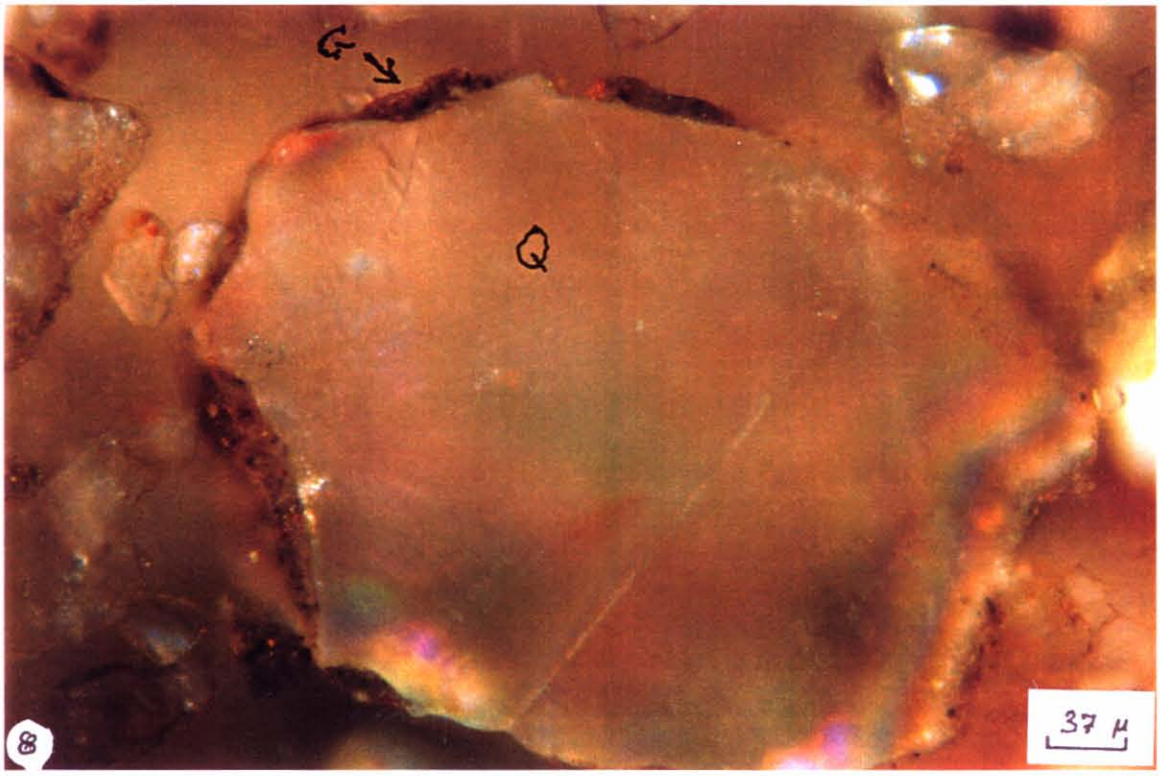


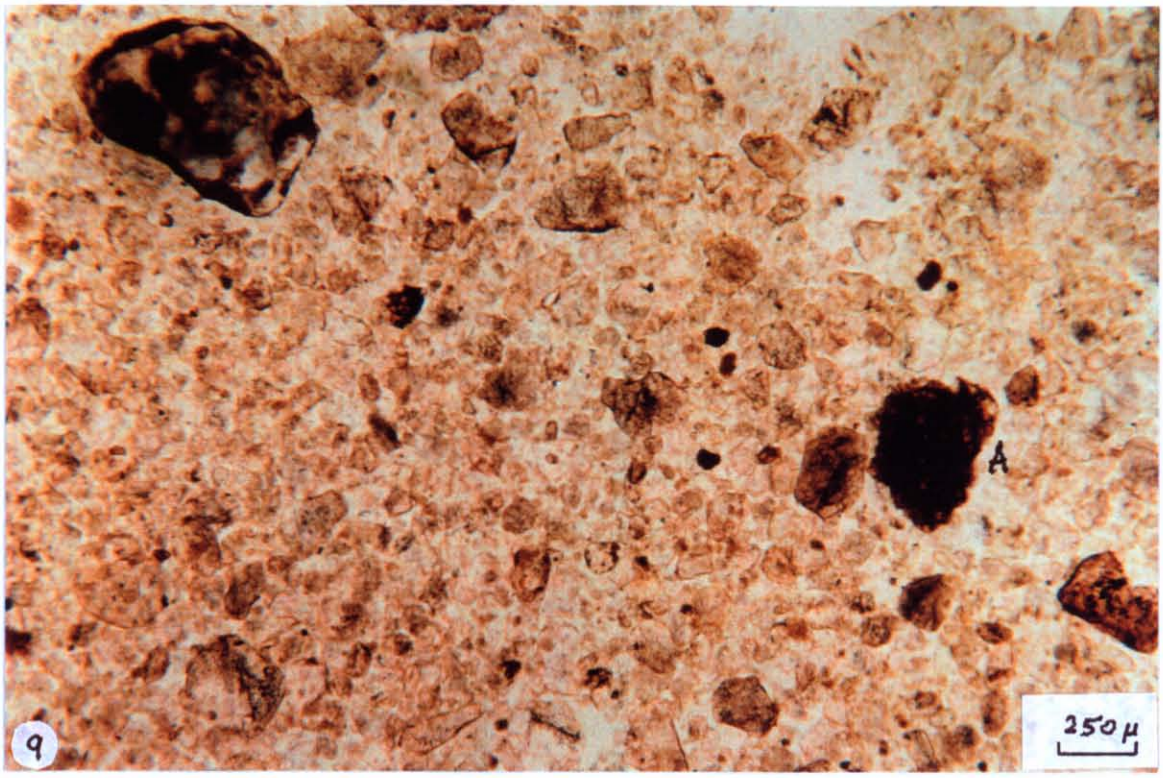


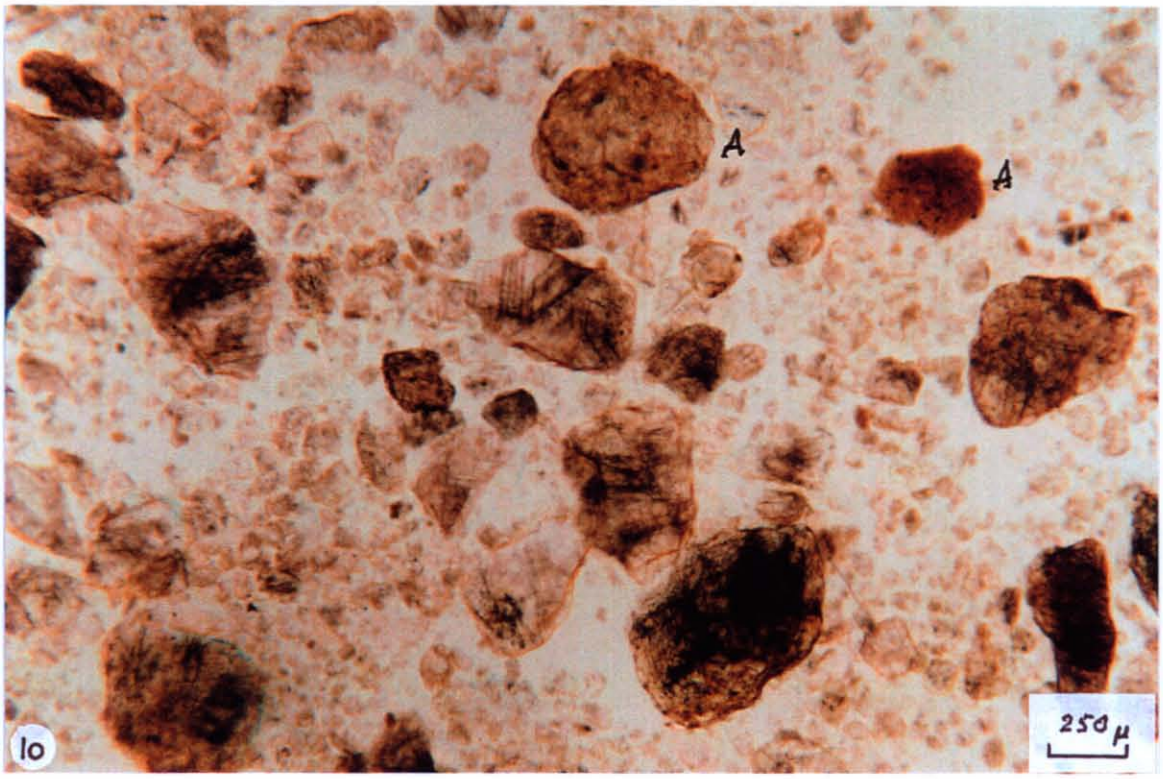




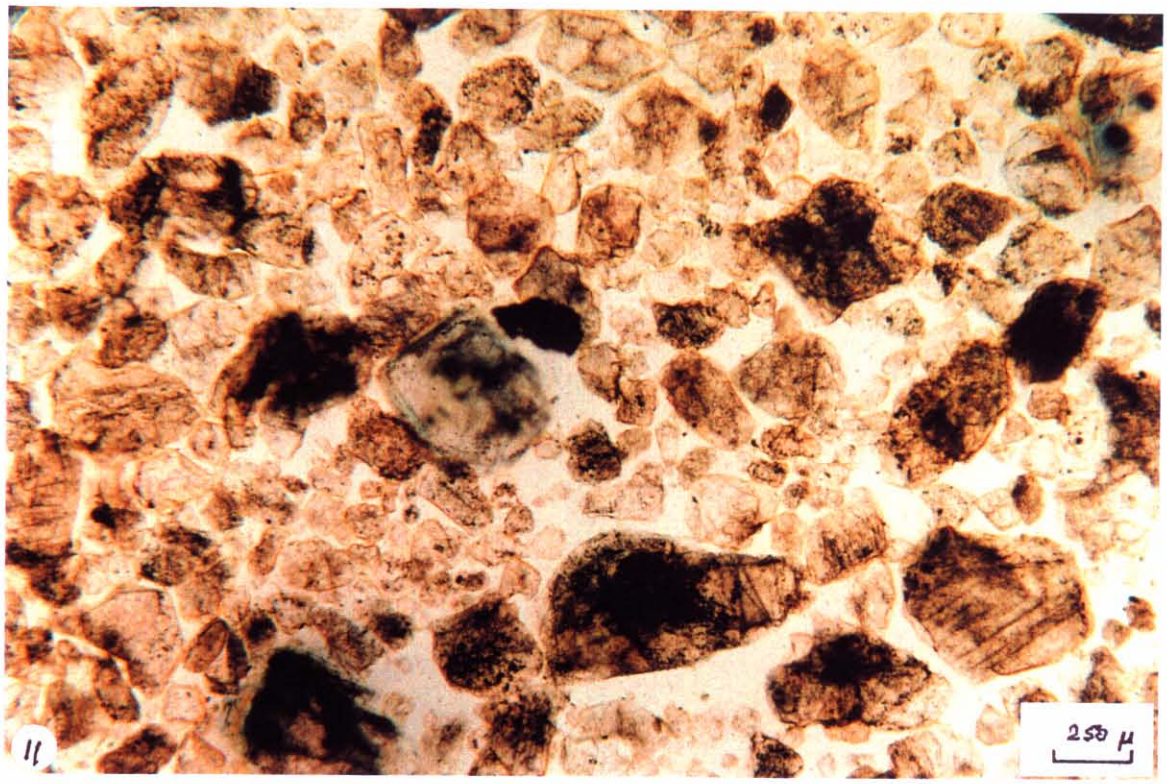


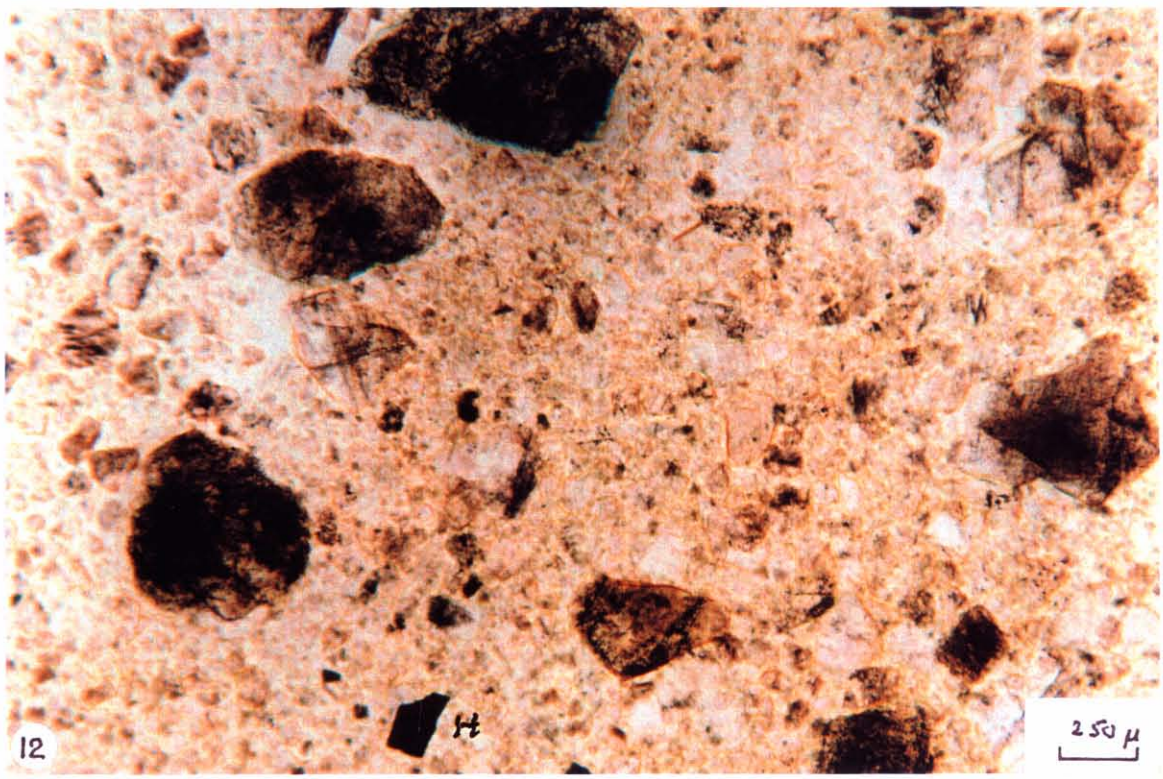



A
250 μ
9


A
A
250 μ
10

642089





APPENDIX 5

REPORT - GRAIN SIZE DETERMINATIONS ON SILICA SANDS

ESKER

642091

Grain Size Determination

on

Silica Sands

from

Pine Hill, Maydena

00_4441A

642092

ESKER Milling and Processing Pty Ltd

(ACN 009 566 750)
Registered Office:
c/- McDougall Johnstone Pty
147 Davey Street, Hobart, Tasmania, 7000

5 Wentworth Street
SOUTH HOBART
Tasmania
Australia, 7004

Telephone & Fax: 03 6223 3502

Report:	Grain Size Determination and Visual Observation of High Grade Silica Sands from Pine Hill, Maydena.
To:	Gerhard Krummei J.J. McDonald & Sons Mining Pty Ltd.
Authority:	Verbal instruction from Gerhard Krummie
Subject:	To determine the weight distribution of silica sands within the 600μm to 75μm fractions at Pine Hill. Assay samples were taken from these fractions to establish Fe, Al, Ti, Cu and CaO content.
Date:	27 MAY 1999
Officers Involved:	Ian House - Chemist/Technical Nick Moony - Esker

Summary

In May 1999 twenty seven samples, from a silica sands deposit at Pine Hill near Maydena, were sized at Western Metals laboratory in Burnie in order to gauge weight distribution and measure the disposition of sand between 600μm and 75μm (the prescribed band). Assay samples were cut from each head and sent for analysis. Results show that 42.6% of the weight reports within the prescribed band on average and is somewhat independent of whether the sample sized is coarse or fine. There was considerable colour variance between drill holes. Some of this was caused by surface staining and contamination from peat/loam. Mineralogical and elemental analysis will determine if this colour variance effects sample purity.

Contents

Introduction

A drilling program was carried out on the silica deposit at Pine Hill near Maydena in south west Tasmania in March 1999. On the 4 April Mr Krummie delivered 27 samples to me in Hobart. These samples were then taken to Western Metals laboratory in Burnie at the end of April and processed under conditions that reduced iron contamination. Results show that this silica sand is fine with 42.6% of the material reporting within the prescribed band of -600μm +75μm. This weight distribution did not vary greatly even when the D_{50} (the average where 50% is retained and 50% passes a mesh size) fluctuated greatly. There was a considerable variance in sample colour, varying from off white to loamy brown/ black. Some 56 samples were sent for analysis. Each sample will be assayed for Fe_2O_3 , CaO, Al_2O_3 , CrO, TiO_2 & possibly organic C.

Preparation

In late April 27 samples were received at Western Metals laboratories in Burnie and weighed between 5 and 15 kilograms. All samples were dried as follows.

- Large aluminium trays were washed, dried, then lined with foil.
- Samples were then placed in the trays, covered with foil and placed in an oven at a temperature of 120C^0.
- The dried samples were then returned to heavy duty plastic bags as soon as they had cooled. No other samples were handled during this process.
- Due to iron contamination in the sample room most samples had to be mixed and sampled from the plastic bags. This was done by rolling the bags externally to break up lumps within the sample bags. Assay and sizing samples were cut by scooping several fractions and re-mixing and re-rolling between each cut.
- It is accepted that this method does not conform to Gy's methods but a compromise had to be made between accuracy and contamination.
- About 3kg was cut out as a head sample.

Sizing

Two sizings and an assay feed sample were generated from each sample received and processed as follows.

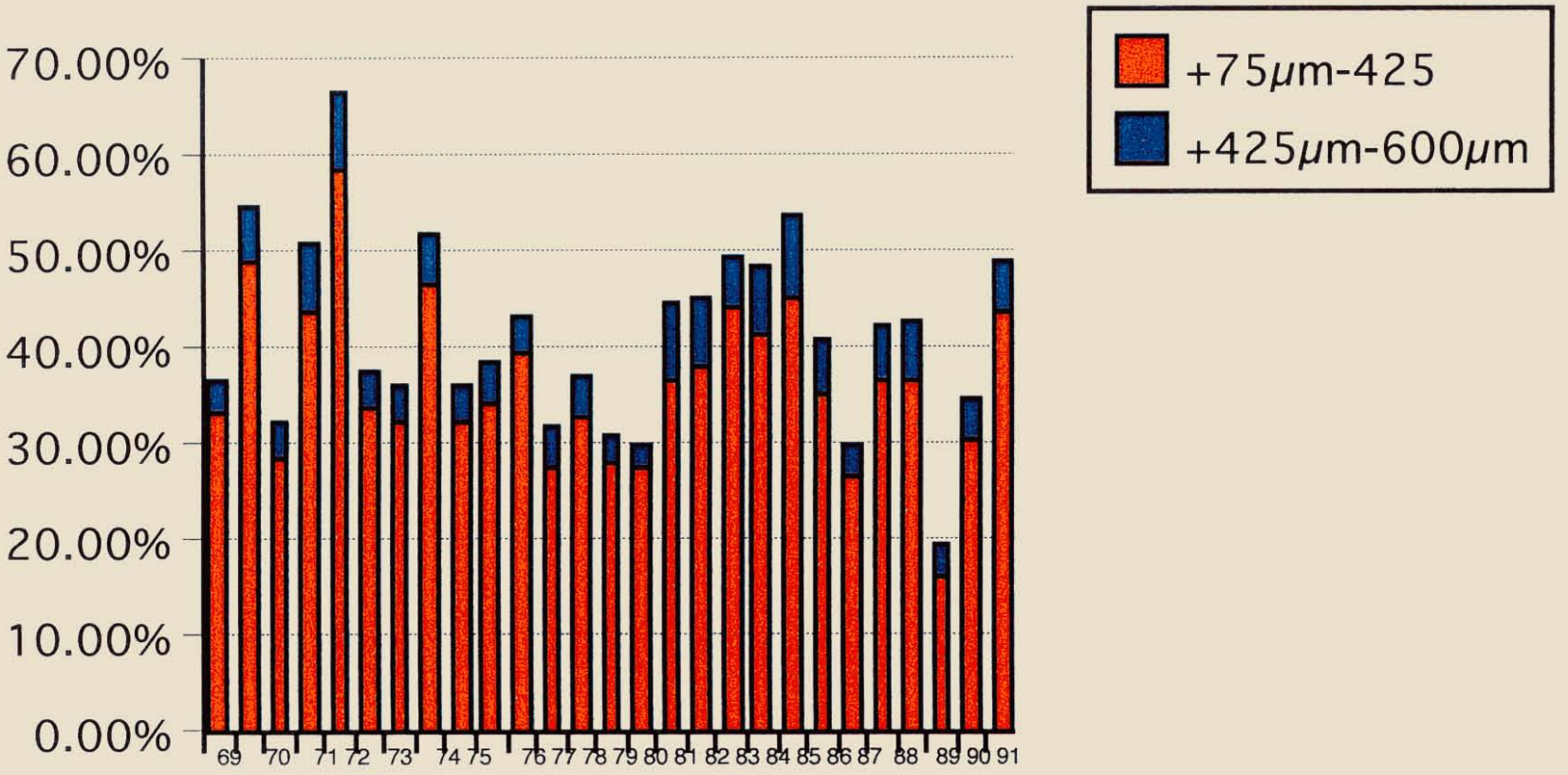
- The assay feed samples were sent to Analabs, Burnie.

- Each sample was screened at:
  +75μm
  +106μm
  +150μm
  +212μm
  +300μm
  +425μm
  +600μm

  Samples were first wet screened at 75μm, dried and then screened on a Rotap for 15 minutes. The fractions were weighed and then discarded.

- Each assay sample was pulverized at Analabs in a tungsten carbide bowel pulverizer. Considerable effort was made to ensure that iron contamination was kept to a minimum.

- Each sample will be assayed for Fe_2O_3 , CaO, Al_2O_3 , CrO, Cu,TiO_2 and possibly organic C. Two reference samples were included; these samples came from the Corinna deposit. They were designated 7/250 and 30/75. This means that they assayed 7ppm and 30ppm Fe respectively and were 90% passing 250μm and75μm. In total 56 samples were submitted for assay.



DRILL CORE 69 to 91

FIGURE ONE

Discussion of results

On average 42% of the material reported within the prescribed range of 600μm and 75μm which is summarized in Table one below.

Table One

Pine Hill Silica

Wt% Reporting Within The Prescribed Range

Variance Between Drill Holes Reporting Within 600μm to 75μm Band	Wt% reporting between 600μm & 75μm
ONE (DH89)	<20%
ONE (DH87)	20% to 30%
ELEVEN (DH69,70b,73a,73b, 75,76a,77,78,) (79,80,&90)	30% to 40%
NINE (DH77,81,82,83,84,86, 88a,88b & 91)	40% to 50%
FOUR (DH70a,71, 75 &85)	50% to 60%
ONE (DH72)	>60%
AVERAGE (27 samples)	42.6%

Full sizing details of each hole are given in Tables 2 and3 attached. Variability of the -600μm +75μm band is visually illustrated in Figure 1 opposite. The distribution of the -75μm fraction is shown below in figure 2.

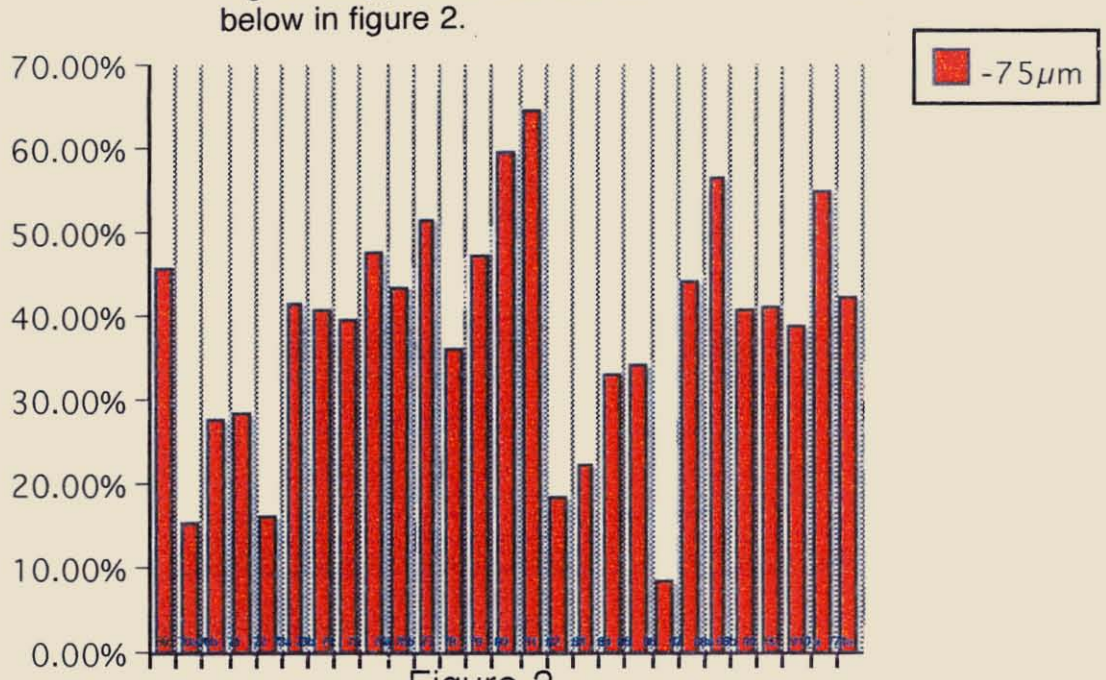


Figure 2

Distribution of - 75μm Fraction

DH69 to DH91

Samples can be divided into categories, ie: coarse=C (D_{50} >200μm), medium= M (D_{50} >110μm <200μm), and fine= F (D_{50} <110μm). Refer table 4 below and figures 13 to 17 for the detailed analysis. In Figure 3, shown opposite, it can be seen that generally the percentage of material reporting within the 600μm to 75μm band tends to be constant irrespective of the D_{50} . There is an increase in fineness from DH69 to DH79 and a small decrease in the 600μm to 75μm band. The same tendency is again evident from DH85 to DH91. This is elucidated in more detail in figures 5 to 12 attached and illustrated as an example in figure 4 opposite.

TABLE 4

Drill Hole	Wt% O/S	Wt% in the -600μm+75μm	D_{50}	Ore Category
89	42.0	19.3	220μm	C
87	13.3	29.8	65μm	VF
80	5.5	30.1	<50μm	VF
79	9.4	30.8	<50μm	VF
77	32.2	31.8	170μm	M
70b	39.6	32.6	320μm	C
90	10.4	34.6	65μm	VF
73b	22.9	36.2	106μm	F
75	15.9	36.3	106μm	F
		(+600μm)	Band	
69	17.4	36.9	70μm	F
78	15.2	37.3	80μm	F
73a	20.7	37.8	106μm	F
76a	18.0	38.4	106μm	F
86	15.0	40.9	100μm	F
88b	16.1	42.7	110μm	M-F
88a	16.6	42.8	110μm	M-F
76b	4.9	43.4	106μm	VF
81	36.5	44.9	270μm	C
82	32.7	45.1	370μm	C
84	17.1	48.6	160μm	M
91	8.3	49.2	101μm	F
83	17.7	49.4	140μm	M
71	20.5	50.9	180μm	M
74	8.6	51.9	106μm	F
85	37.8	53.9	360μm	C
70	29.7	54.8	280μm	C
72	17.3	66.5	206μm	C

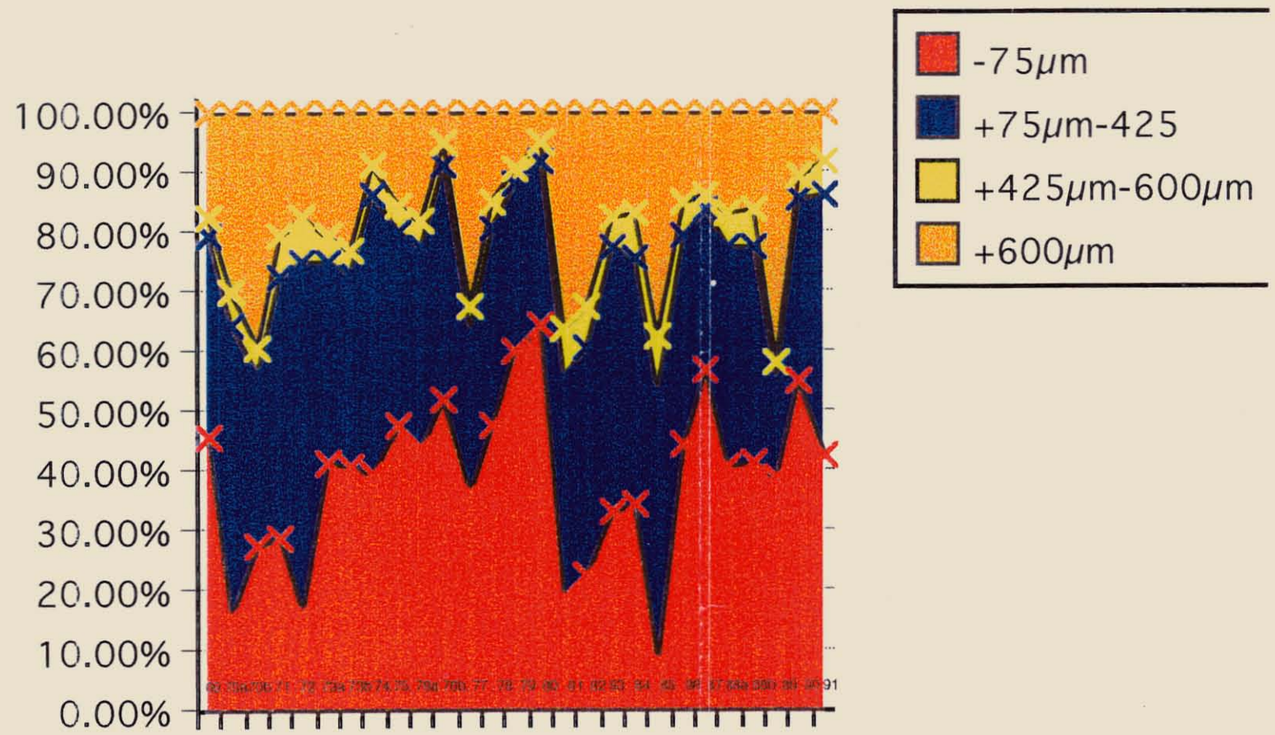


Figure 3

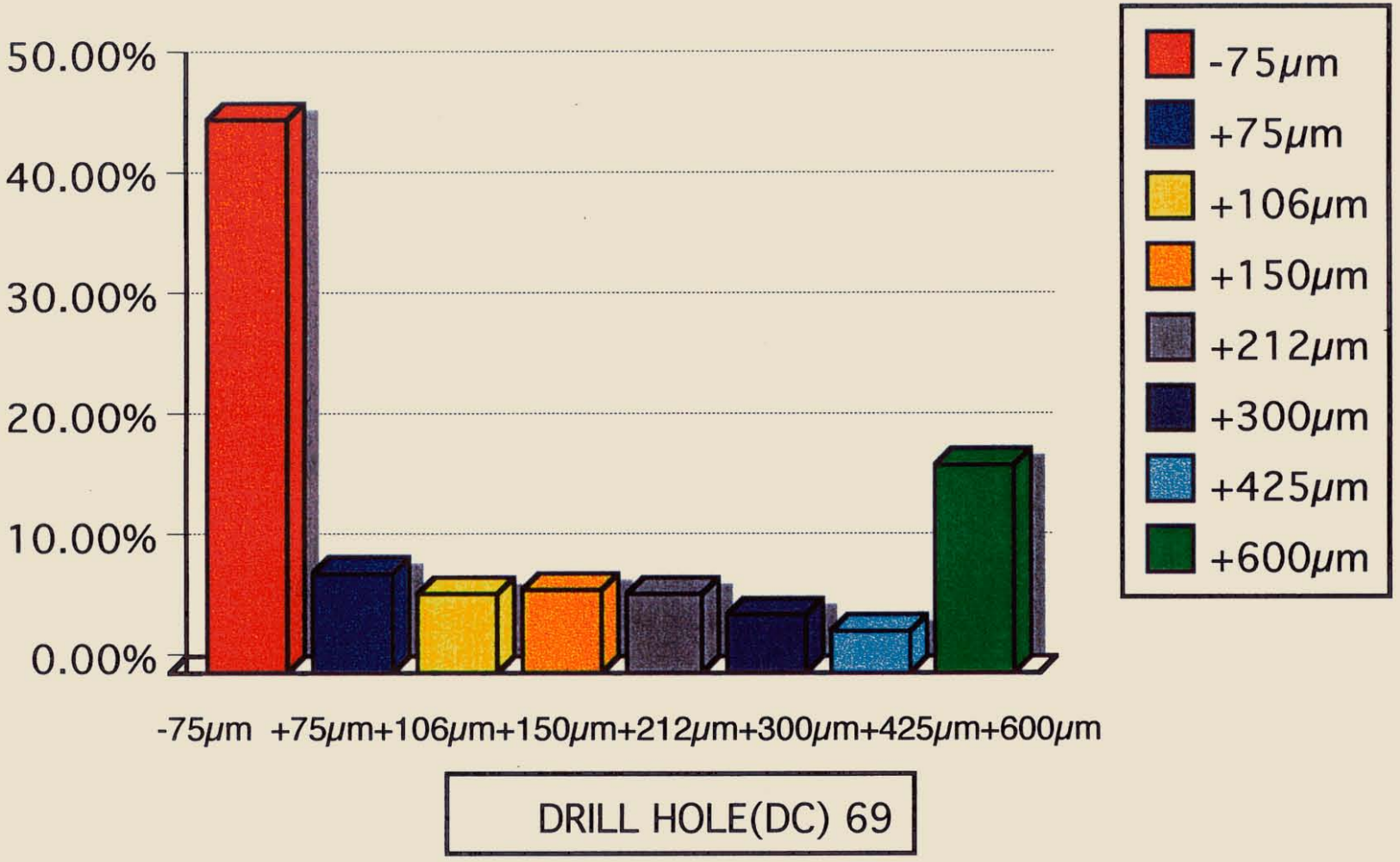


Figure 4

Table 5
Visual Observation of
Ore Brightness

DH90
DH86
DH89
DH84
DH91
DH87
DH79
DH78
DH88b
DH74
DH88a
DH80
DH81
DH83 **DARKER**
DH75
DH69
DH82
DH70a

DH77 Step change
DH76b in colour at
DH76a DH77
DH73b
DH73a
DH85
DH72 **DARKER**
DH71
DH70b very dark & loamy

Sample Observation

Each hole is very briefly discussed below and shown in Table 5, opposite, where drill holes are assembled or ranked in order of "brightness".

DH69 0m-11m Off white, light gray in colour, little O/S(+600μm) or pebbles(+3.35mm) observed.
DH70a 0m-3m Dirty off white, grayer than DH69,coarse pebbles present some of which have dark staining.
DH70b 4m-6m Very dark brown loamy intersection, with considerable coarse cemented O/S.
DH71 0m -4m Slightly Lighter than DH70b, this is a brown quartzy sand with some fine O/S pebbles.
DH72 0m-6m This core is lighter than DH71 and could be said to have a gray/brown texture with stained pebbles and few fines.
DH73a 0m-8m: Dark creamy to light brown/gray, with some stained O/S.
DH73b 9m-23m: Similar to DH73a, but much less O/S and pebbles not observed.
DH740m-6m: Cleaner than any of the previous drill holes, off white, fine & sandy.
DH75 0m-21m: Brown with dark specks, not as clean as DH74, more pebbles present.
DH76a 1.0m-11m: Light brown but darker than DH74, stained pebbles observed and cemented loam.
DH76b 12m-23m: Very fine, light gray, not as clean as DH74, lack of O/S material clearly observed, loam absent.
DH77 0m-12m: Brown with dark specks, considerable quantity of pebbles seen. Darker than DH74
DH 78 0m-8m: Clean, slightly off white, this core is cleaner than DH74 and has a fine texture. Some O/S and pebbles are present but these tend to be clean with little staining.
DH79 0m-10m: Clean and very slightly off white. Cleaner than DH78 but very fine, no pebbles observed and little O/S seen.
DH80 0m-15m: Creamy, with cemented loam or clay present as specks in most fractions. Some stained O/S and pebbles observed. this core is cleaner than DH74 but not as clean as DH78.
DH81 0m -8m : Coarse and light gray in colour with a considerable quantity of stained O/S and pebbles present. This core is just a tad darker than DH74.
DH82 1m-10m: Very coarse with distinctive pinkish gray colour, a few cemented loam pebbles that tend to break down when dry.

DH83 1m-10m: Slightly finer and lighter than DH82 but darker than DH74. Specks of loam observed in most fractions.
DH84 0m-18m: Coarser and cleaner than DH78. Some stained O/S and a few loam specks observed in the coarser fractions.
DH85 0m-4m: "Dirty" brown/gray to pink and very coarse.

DH86 0m-13m : Very clean, slightly creamy, brighter and whiter than DH84. O/S is also clean with little staining.
DH87 0m-11m: Cleaner than DH78 but not quite as unblemished as DH86 or DH84, with a few dark specks observed in the coarser fractions.
DH88 1m-15m: Darker than DH74.
DH88b 16m-30m: Lighter than DH88a and very close to DH87 in texture but somewhat coarser.
DH89n 1m-7m: Very slightly grayer than DH90 and, as the sizing shows, this hole has very little material in the 600μm-75μm range, but can be considered to have a clean colour for this deposit.
DH90 0m-15m: The whitest and cleanest core observed, not as creamy as DH86, not as coarse as DH89, a few dark specks observed in the coarser fractions. This is good quality silica.
DH91 0m-13m: Clean and very similar to DH89. This core is grayer than DH90.

Conclusions

- There is considerable variability in colour between samples. This may only be cosmetic and its importance will depend on assay results. The cleanest samples have a slightly cream/gray tinge.
- Loam specks occurred in some samples and substantial surface staining was observed.
- Cursory observation indicates that silica particles are sharp and angular.
- These samples indicate this the natural grain size of this deposit is fine with a D_{50} of around 120μm varying from 370μm to 50μm.
- The weight distribution within the prescribed range of 600μm to 75μm was surprisingly constant at an average of 42.6% with only six samples having less than 35% weight distributed within this band.
- Great care was taken to minimize iron contamination even at the expense of correct sampling procedures.

Recommendations

- No recommendations can be made until assay results are obtained.

APPENDIX I

Tables 2 and 3

642103

PINE HILL - Silica Sands. Sizings

MICRONS	Wt%	Wt%	Wt%	Wt%	Wt%	Wt%	Wt%	Wt%
+75-600	36.90%	54.80%	32.60%	50.90%	66.50%	37.80%	36.20%	51.90%
+75-425	33.40%	48.90%	28.70%	43.90%	58.50%	33.70%	32.20%	46.80%
DRILL HOLE	69	70	70	71	72	73	73	74
METRES-DEPTH	0-11	0-3	4-6	0-4	0-6	0-8	8-23	0-6
-75µm	45.70%	15.50%	27.80%	28.60%	16.20%	41.50%	40.90%	39.60%
+75µm-425	33.40%	48.90%	28.70%	43.90%	58.50%	33.70%	32.20%	46.80%
+425µm-600µm	3.50%	5.90%	3.90%	7.00%	8.00%	4.10%	4.00%	5.10%
+600µm	17.40%	29.70%	39.60%	20.50%	17.30%	20.70%	22.90%	8.60%
-75µm								
+75µm	45.70%	15.50%	27.80%	28.60%	16.20%	41.50%	40.50%	39.60%
+106µm	54.10%	22.60%	33.20%	37.60%	22.00%	50.30%	49.20%	49.90%
+150µm	60.80%	31.30%	37.90%	46.20%	38.20%	57.20%	55.70%	59.10%
+212µm	67.70%	42.90%	42.90%	55.60%	51.60%	63.90%	62.20%	69.10%
+300µm	74.40%	55.60%	48.20%	64.20%	63.70%	69.50%	68.40%	79.10%
+425µm	79.10%	64.40%	56.50%	72.50%	74.80%	75.20%	73.20%	86.30%
+600µm	82.60%	70.30%	60.40%	79.50%	82.70%	79.30%	77.10%	91.40%
DRILL HOLE	69	70	70	71	72	73	73	74
METRES-DEPTH	0-11	0-3	4-6	0-4	0-6	0-8	8-23	0-6
-75µm	45.70%	15.50%	27.80%	28.60%	16.20%	41.50%	40.90%	39.60%
+75µm	8.40%	7.10%	5.40%	9.00%	10.60%	8.80%	8.30%	10.30%
+106µm	6.70%	8.70%	4.70%	8.60%	11.00%	6.90%	6.50%	9.20%
+150µm	6.90%	11.60%	5.00%	9.40%	13.40%	6.70%	6.50%	10.00%
+212µm	6.70%	12.70%	5.30%	8.60%	12.10%	5.60%	6.20%	10.00%
+300µm	4.70%	8.80%	8.30%	8.30%	11.00%	5.70%	4.47%	7.20%
+425µm	3.50%	5.90%	3.90%	7.00%	8.00%	4.10%	4.00%	5.10%
+600µm	17.40%	29.70%	39.60%	20.50%	17.30%	20.70%	22.90%	8.60%

X

MICRONS	Wt%	Wt%	Wt%	Wt%	Wt%	Wt%	Wt%	Wt%
+75-600	30.10%	44.90%	45.10%	49.40%	48.60%	53.90%	40.90%	29.80%
+75-425	27.40%	36.90%	38.20%	44.50%	41.40%	45.10%	35.30%	26.80%
DRILL HOLE	80	81	82	83	84	85	86	87
METRES-DEPTH	0-15	0-8	1-13	1-10	0-18	0-4	0-13	1-13
-75µm	64.60%	18.60%	22.20%	32.90%	34.30%	8.30%	44.10%	56.70%
+75µm-425	27.40%	36.90%	38.20%	44.50%	41.40%	45.10%	35.30%	26.80%
+425µm-600µm	2.70%	8.00%	6.90%	4.90%	7.20%	8.80%	5.60%	3.00%
+600µm	5.50%	36.50%	32.70%	17.70%	17.10%	37.80%	15.00%	13.30%
-75µm								
+75µm	64.40%	18.60%	22.20%	32.90%	34.30%	8.30%	44.10%	56.90%
+106µm	73.10%	24.10%	28.80%	43.90%	41.20%	14.20%	52.10%	64.50%
+150µm	78.60%	29.90%	35.50%	53.00%	48.70%	21.70%	58.70%	70.20%
+212µm	83.70%	37.60%	43.60%	62.30%	57.60%	31.20%	65.80%	75.50%
+300µm	88.40%	47.10%	52.70%	71.00%	67.50%	42.30%	73.30%	80.20%
+425µm	91.80%	55.50%	60.40%	77.40%	75.70%	53.40%	79.40%	83.70%
+600µm	94.50%	63.50%	67.30%	82.30%	82.90%	62.20%	85.00%	86.70%
DRILL HOLE	80	81	82	83	84	85	86	87
METRES-DEPTH	0-15	0-8	1-13	1-10	0-18	0-4	0-13	1-13
-75µm	64.40%	18.60%	22.20%	32.90%	34.30%	8.30%	44.10%	56.90%
+75µm	8.70%	5.50%	6.60%	11.00%	7.40%	5.90%	8.00%	7.60%
+106µm	5.50%	5.80%	6.70%	9.10%	7.20%	7.50%	6.60%	5.70%
+150µm	5.10%	7.70%	8.10%	9.30%	8.70%	9.90%	7.10%	5.30%
+212µm	4.70%	9.50%	9.10%	8.70%	9.90%	10.70%	7.50%	4.70%
+300µm	3.40%	8.40%	7.70%	6.40%	8.20%	11.10%	6.10%	3.50%
+425µm	2.70%	8.00%	6.90%	4.90%	7.20%	8.80%	5.60%	3.00%
+600µm	5.50%	36.50%	32.70%	17.70%	17.10%	37.80%	15.00%	13.30%

Wt%	Wt%	Wt%	Wt%	Wt%	Wt%
36.30%	38.40%	43.40%	31.80%	37.30%	30.80%
32.40%	34.10%	39.70%	27.40%	32.90%	28.30%
75	76	76	77	78	79
0-21	1-11	12-22	0-12	0-8	0-10
47.80%	43.50%	51.70%	36.00%	47.50%	59.80%
32.40%	34.10%	39.70%	27.40%	32.90%	28.30%
3.90%	4.30%	3.70%	4.40%	4.40%	2.50%
15.90%	18.00%	4.90%	32.20%	15.20%	9.40%
47.80%	43.50%	51.70%	36.00%	47.50%	59.80%
50.90%	51.50%	61.30%	42.50%	53.50%	68.10%
58.60%	58.10%	69.70%	47.50%	60.10%	74.00%
67.10%	65.20%	78.30%	52.90%	67.40%	79.60%
73.60%	72.30%	86.10%	58.60%	74.60%	84.60%
80.20%	77.70%	91.40%	63.40%	80.40%	88.10%
84.10%	82.00%	95.10%	67.80%	84.80%	90.60%
75	76	76	77	78	79
0-21	1-11	12-22	0-12	0-8	0-10
47.80%	43.50%	51.70%	36.00%	47.50%	59.80%
3.10%	8.00%	9.60%	6.50%	5.90%	8.30%
7.70%	6.60%	8.40%	5.00%	6.70%	5.90%
8.50%	7.10%	8.60%	5.40%	7.30%	5.60%
6.50%	7.10%	7.80%	5.70%	7.20%	5.00%
6.60%	5.40%	5.30%	4.80%	5.80%	3.50%
3.90%	4.30%	3.70%	4.40%	4.40%	2.50%
15.90%	18.00%	4.90%	32.20%	15.20%	9.40%

Wt%	Wt%	Wt%	Wt%	Wt%
42.80%	42.10%	19.30%	34.60%	49.20%
36.70%	36.50%	16.30%	30.50%	44.00%
88	88	89	90	91
1-15	16-30	1-7	0-15	0-13
40.80%	41.20%	38.70%	55.00%	42.50%
36.70%	36.50%	16.30%	30.50%	44.00%
5.90%	6.20%	3.00%	4.10%	5.20%
16.60%	16.10%	42.00%	10.40%	8.30%
40.80%	41.20%	38.70%	55.00%	42.50%
48.20%	48.60%	42.80%	63.20%	52.30%
55.00%	55.20%	45.90%	68.70%	61.00%
62.70%	62.70%	48.90%	74.40%	70.40%
70.90%	70.90%	52.10%	80.50%	79.70%
77.50%	77.70%	55.00%	85.50%	86.50%
83.40%	83.90%	58.00%	89.60%	91.70%
88	88	89	90	91
1-15	16-30	1-7	0-15	0-13
40.80%	41.20%	38.70%	55.00%	42.50%
7.40%	7.40%	4.10%	8.20%	5.20%
6.80%	6.60%	3.10%	5.50%	6.80%
7.70%	7.50%	3.00%	5.70%	9.40%
8.20%	8.20%	3.20%	6.10%	9.30%
6.60%	6.80%	2.90%	5.00%	6.80%
5.90%	6.20%	3.00%	4.10%	5.30%
16.60%	16.10%	42.00%	10.40%	8.30%

APPENDIX II

Figures 5 to 11

DC70 - DC91
Histograms

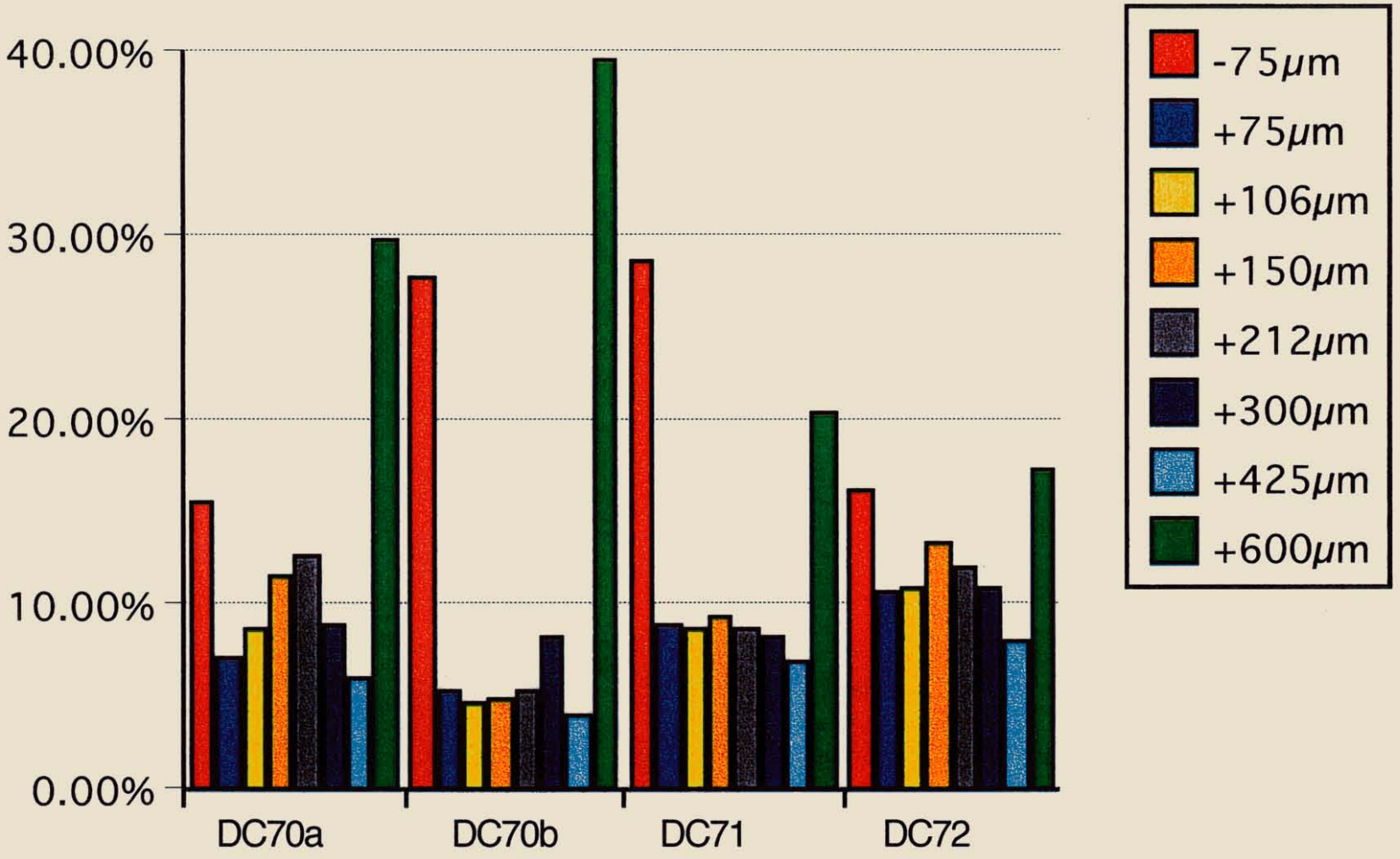


Figure 5

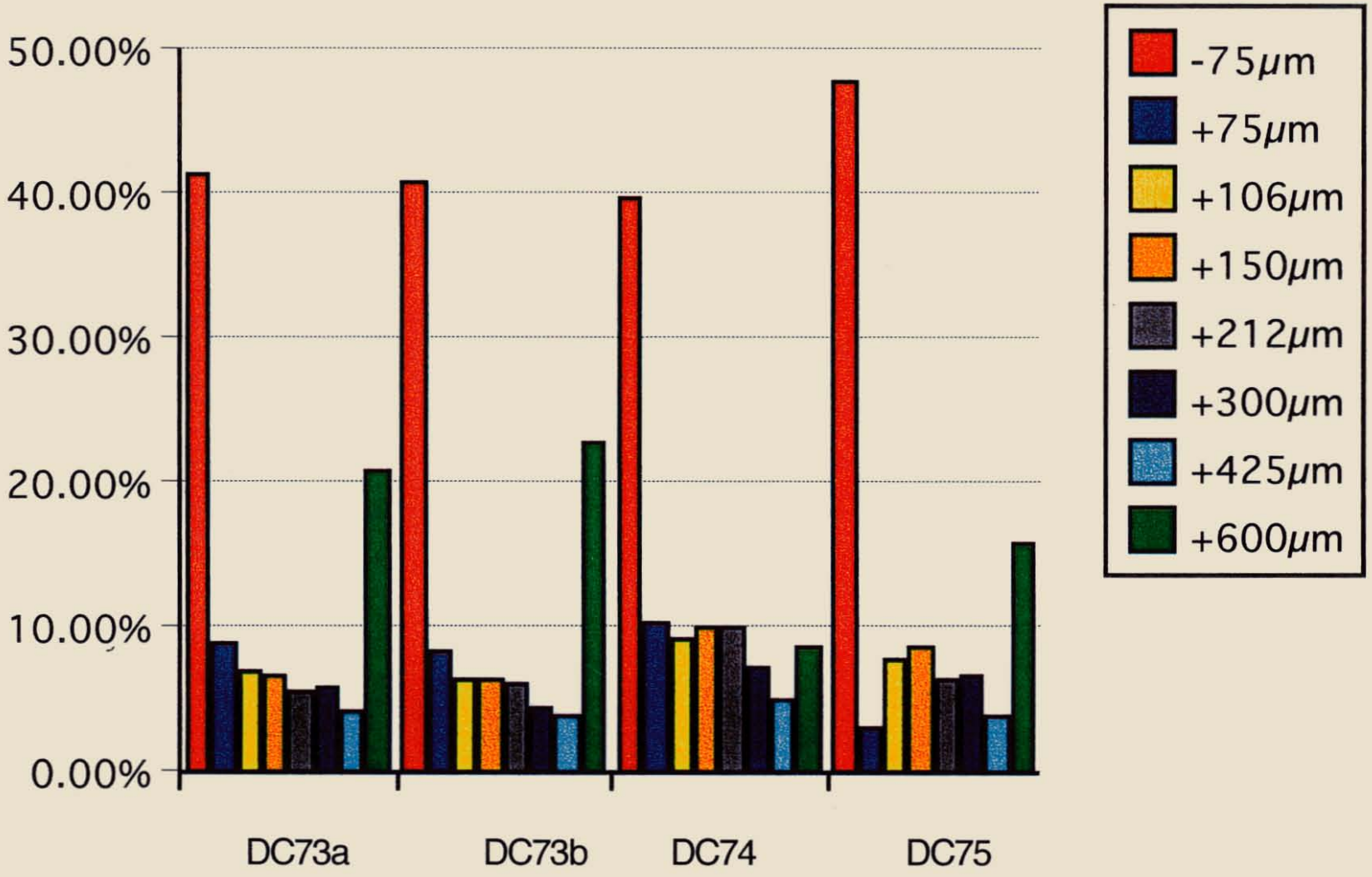


Figure 6

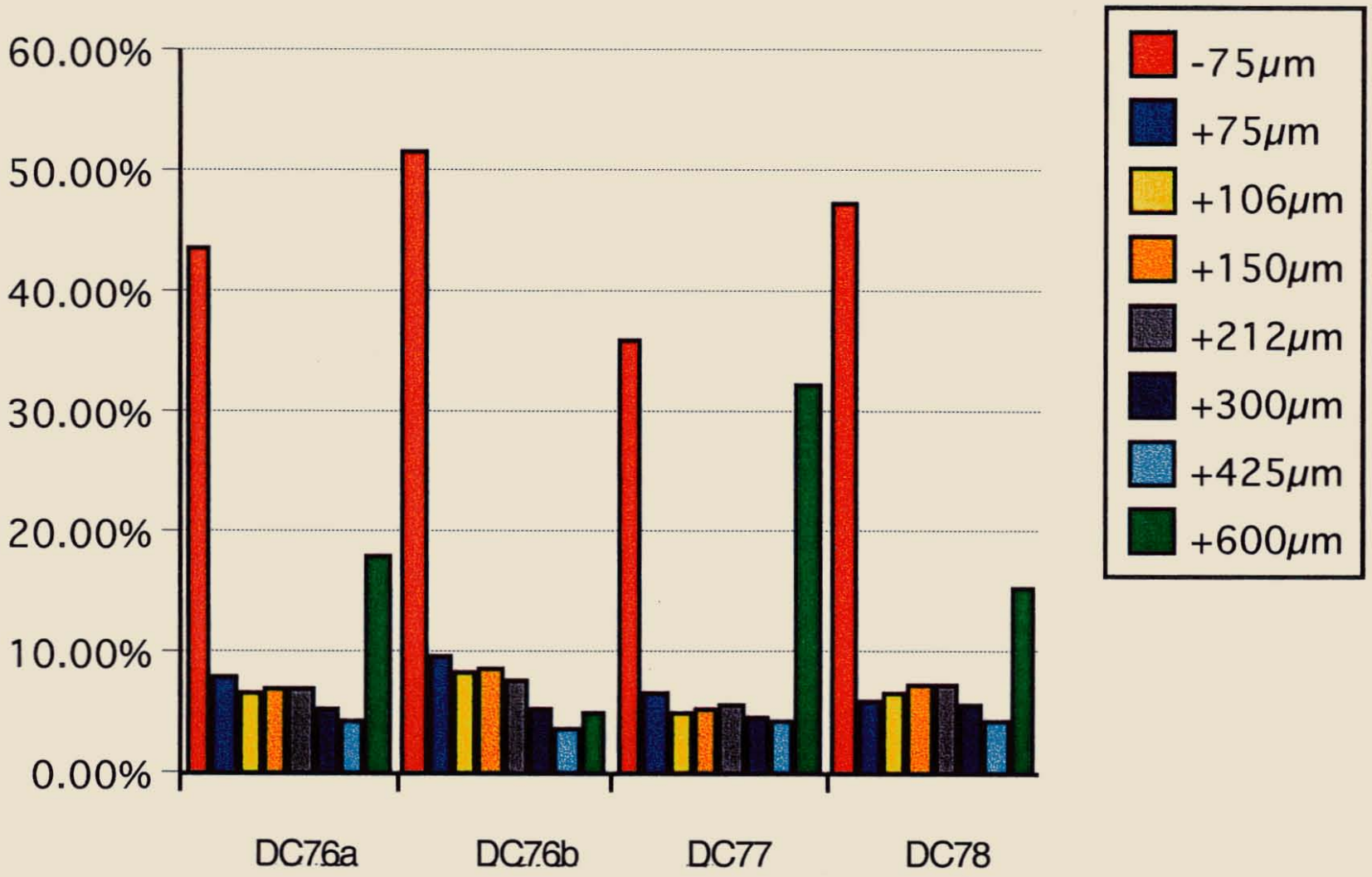


Figure 7

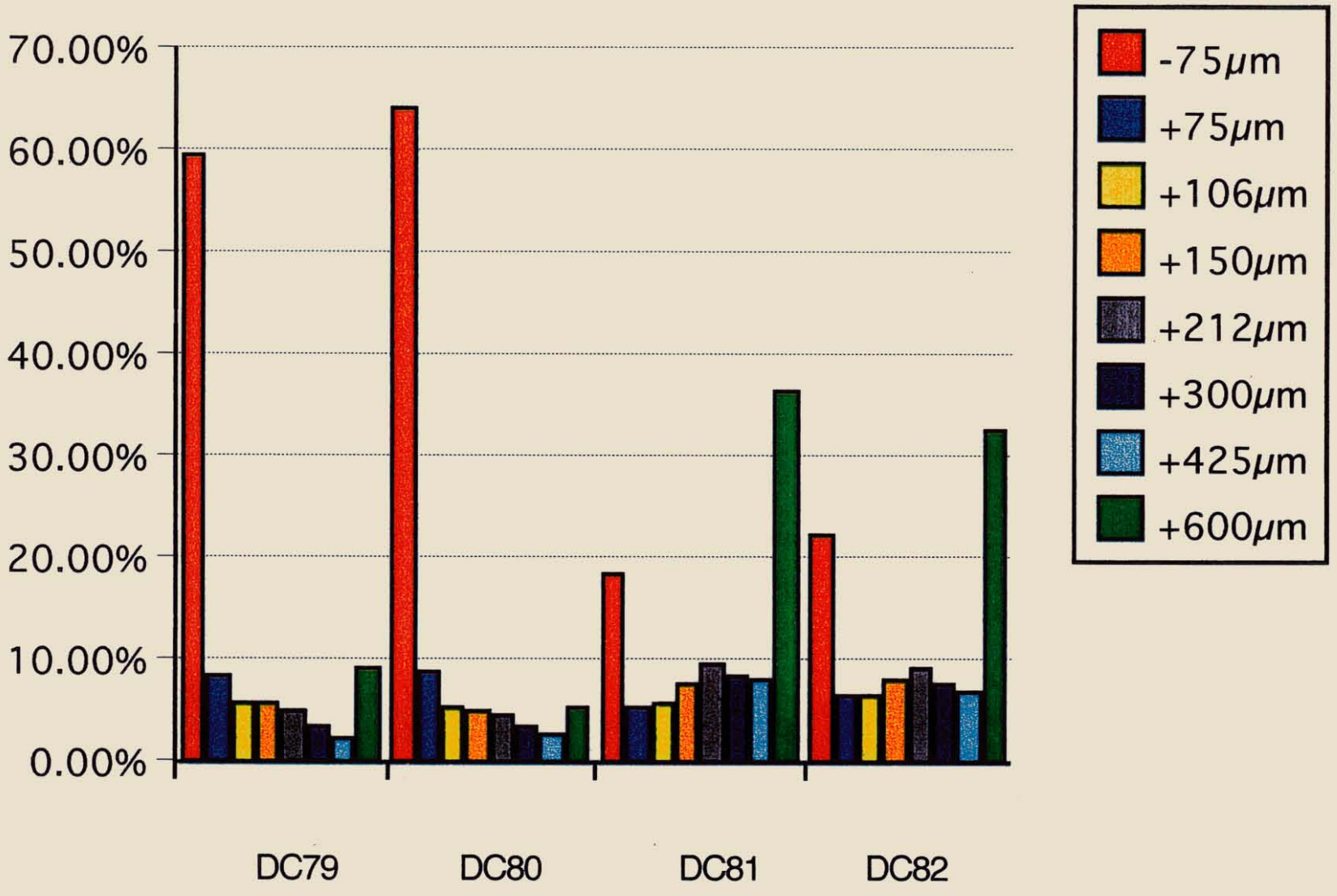


Figure 8

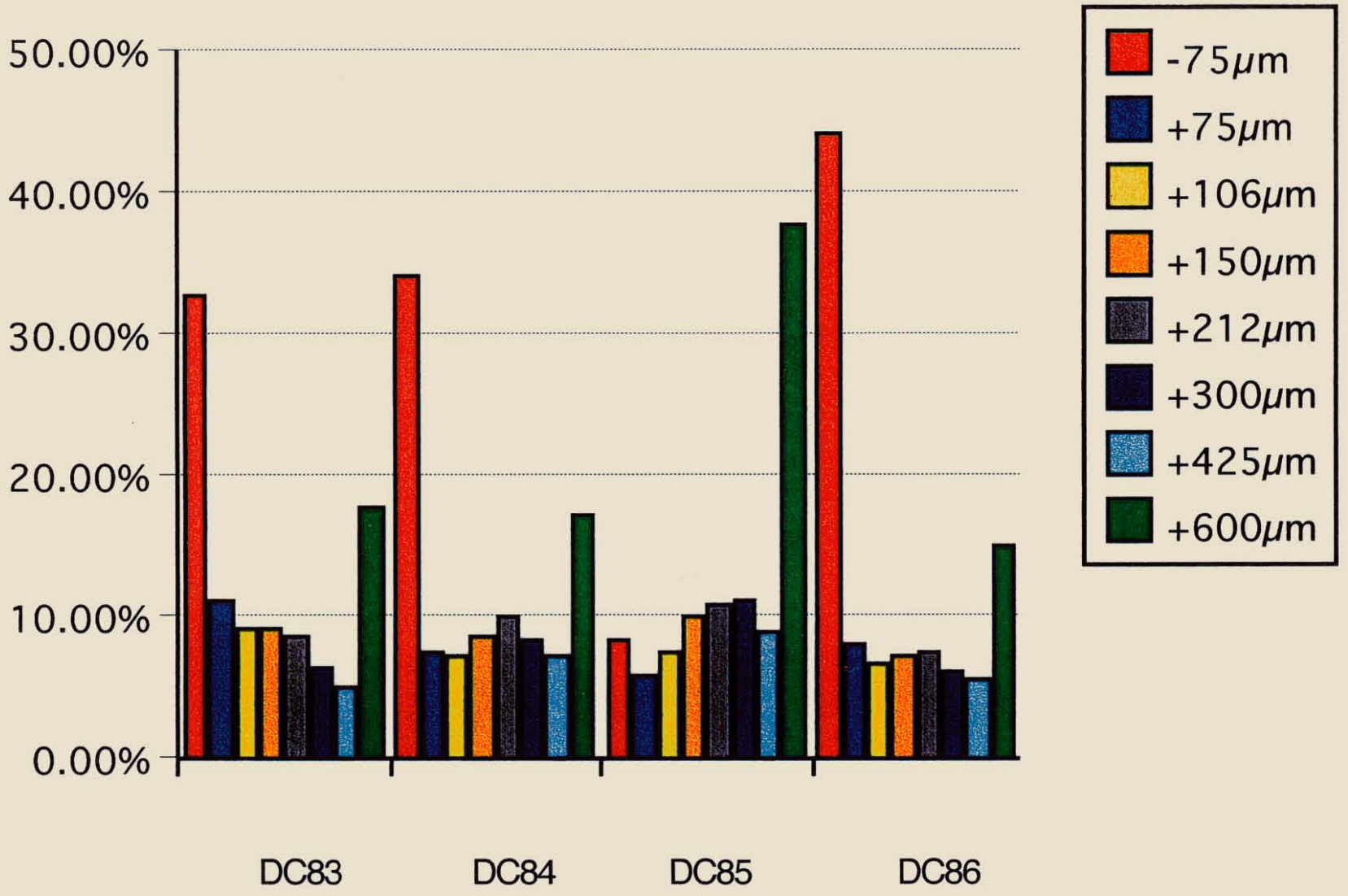


Figure 9

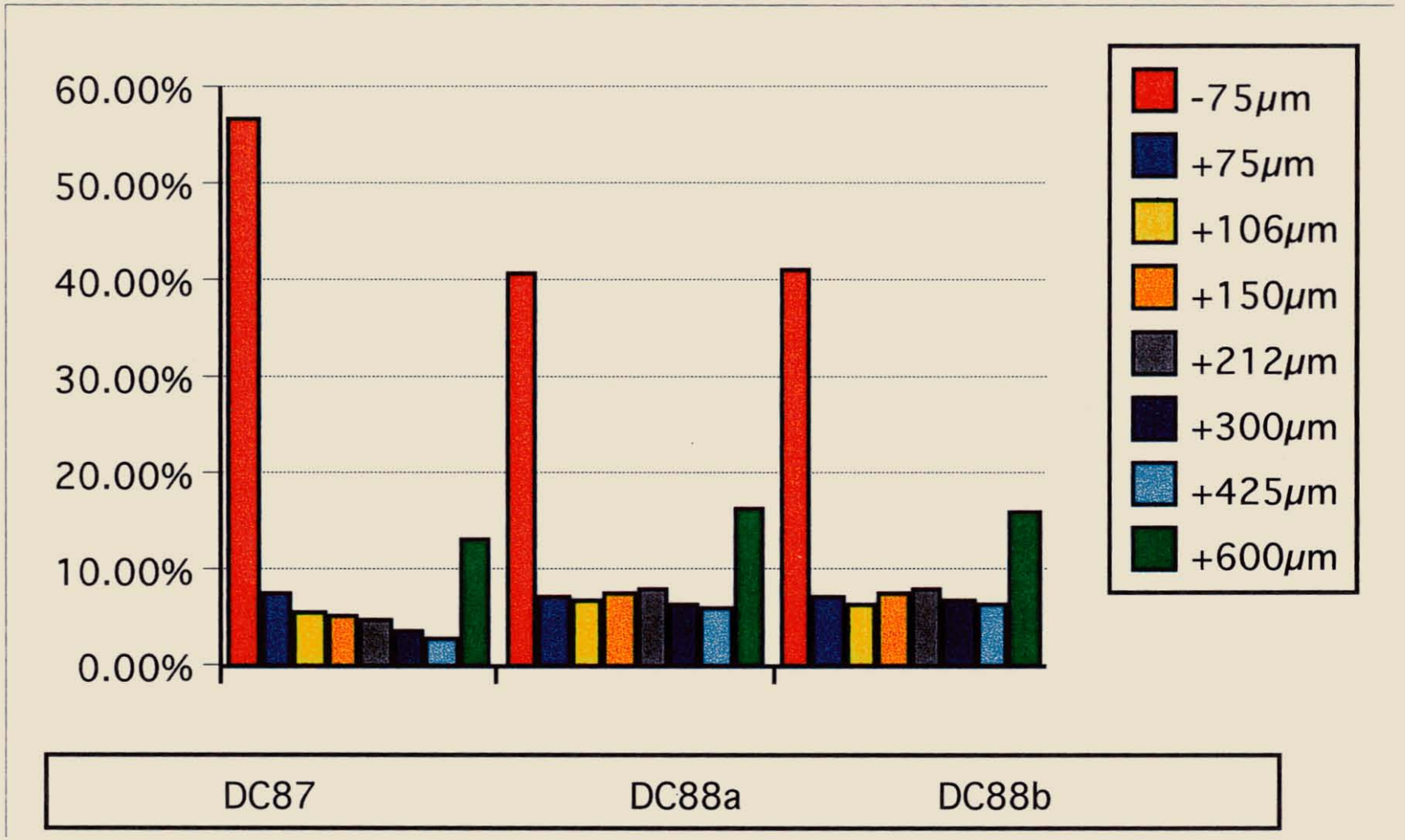


Figure 10

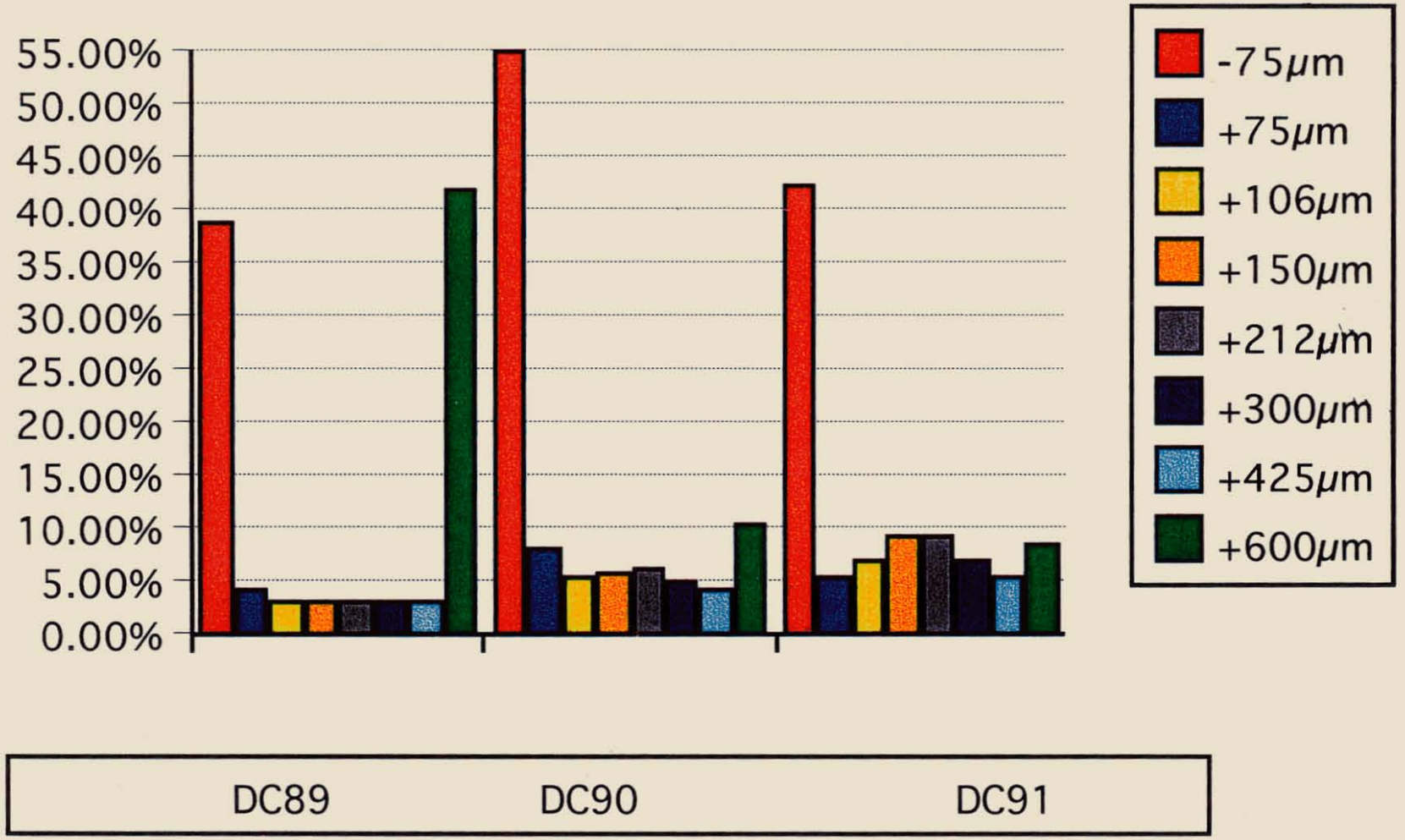


Figure 11

APPENDIX III

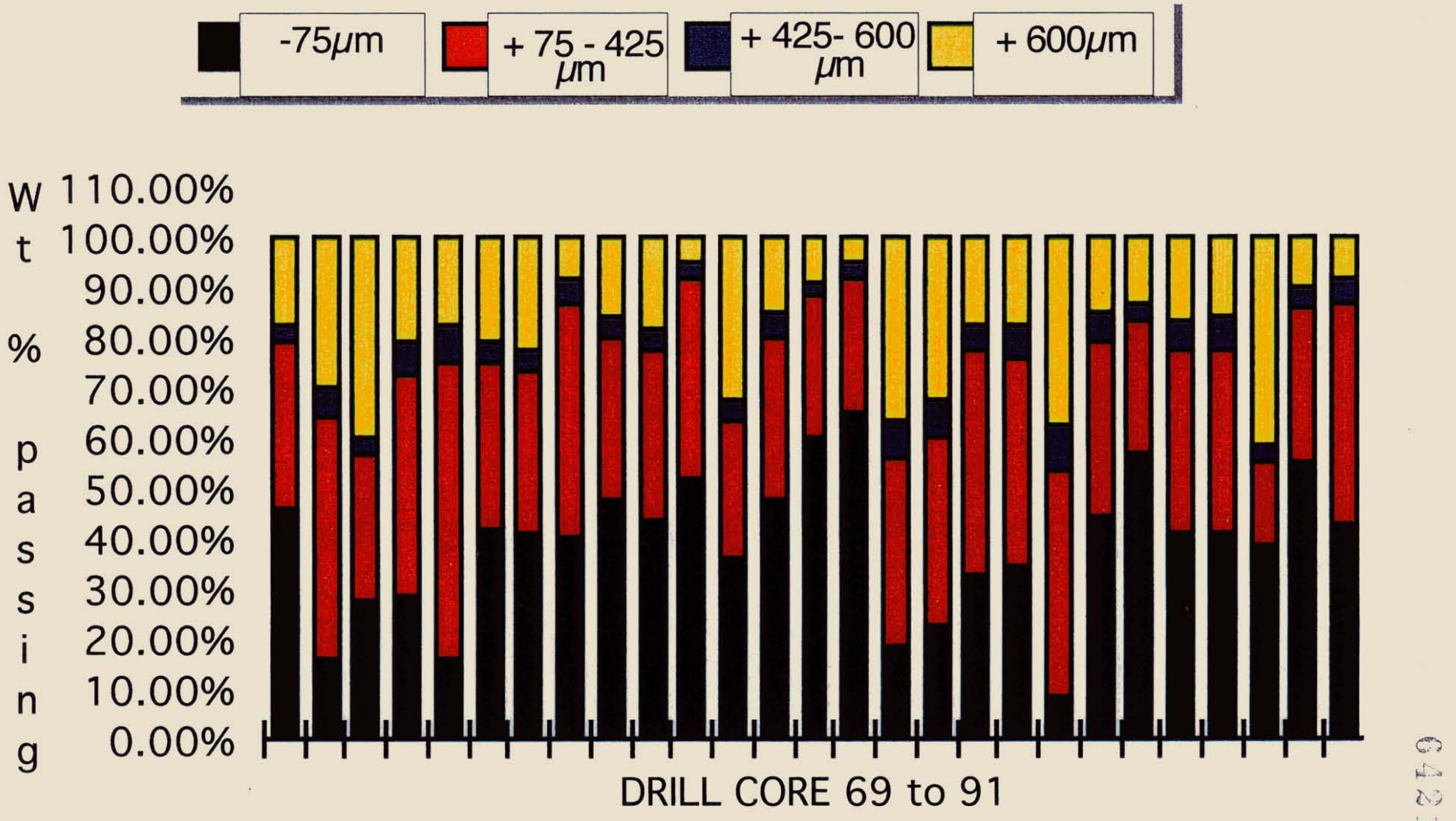


Figure 12

APPENDIX IV

Figures 13 to 17

642122

Cumulative Weight Passing
DC69 to DC91

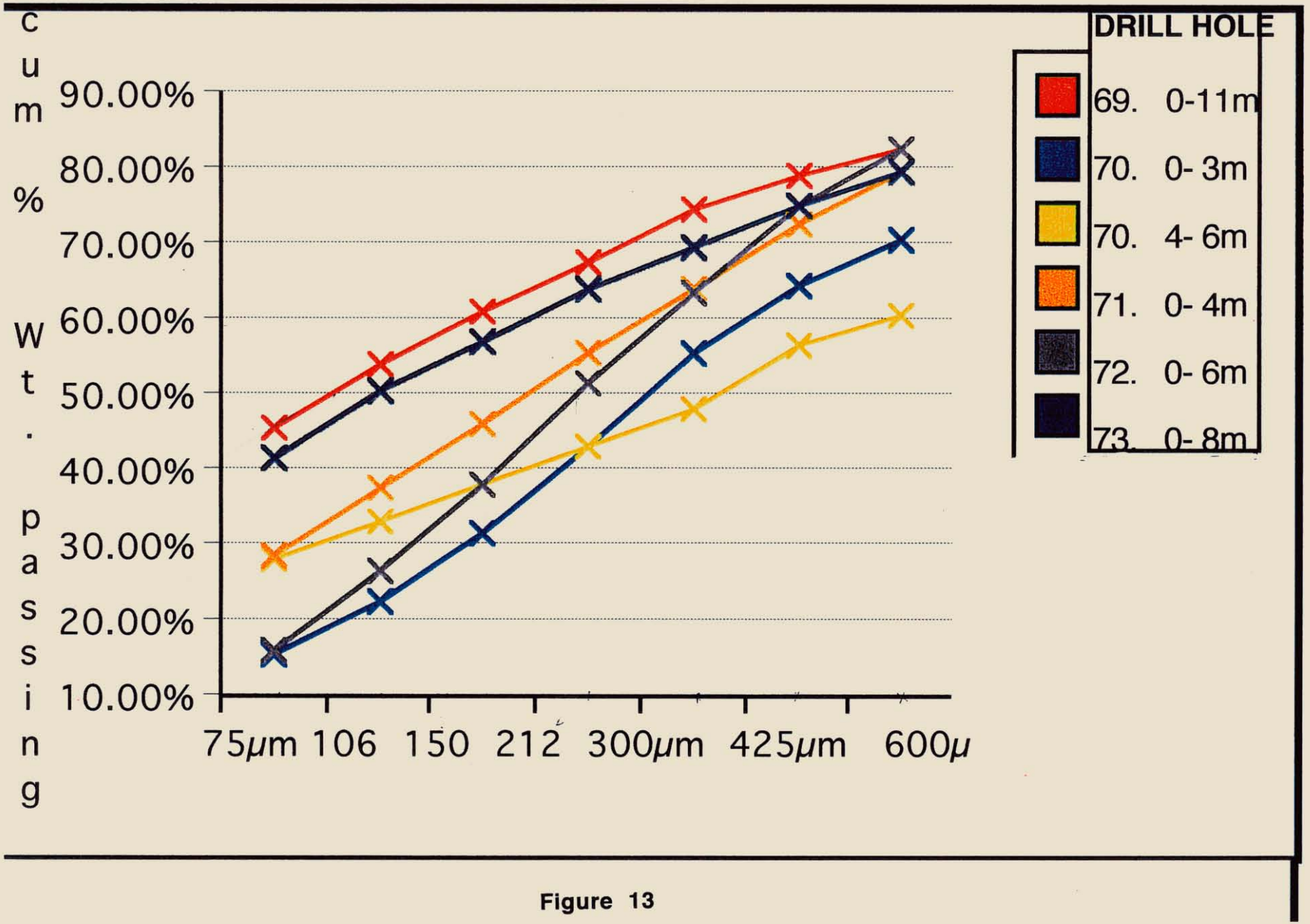
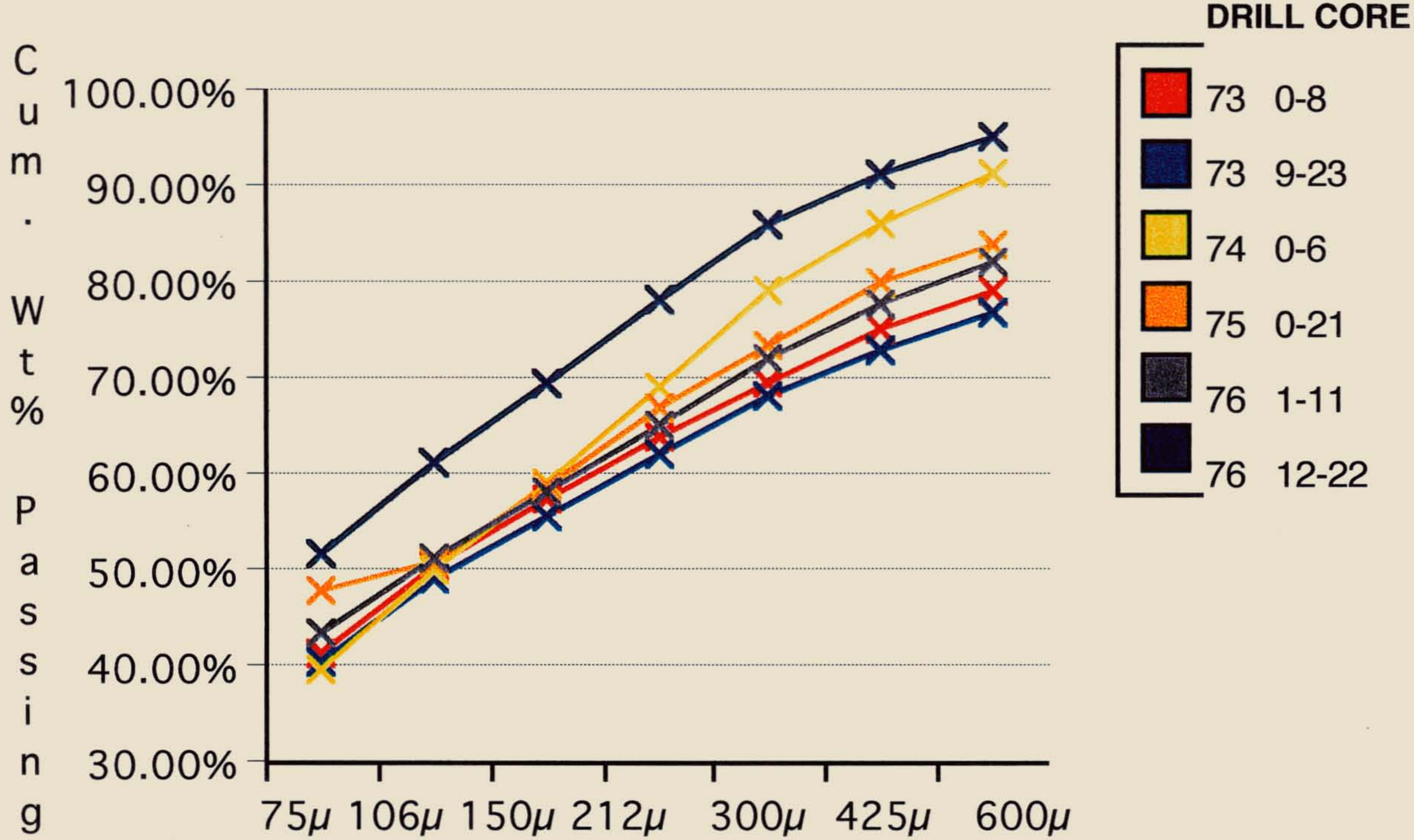


Figure 13



642124

Figure 14

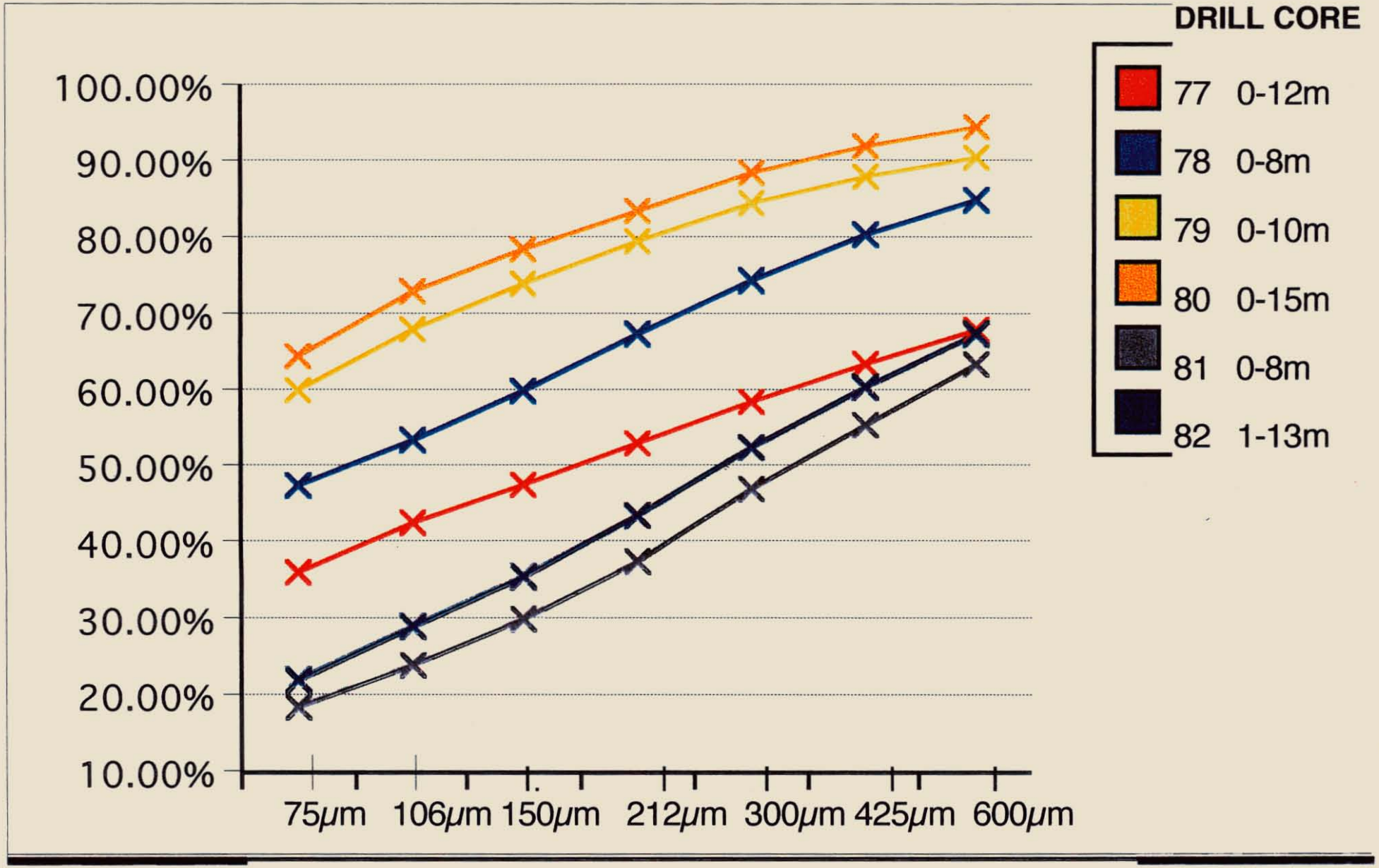


Figure 15

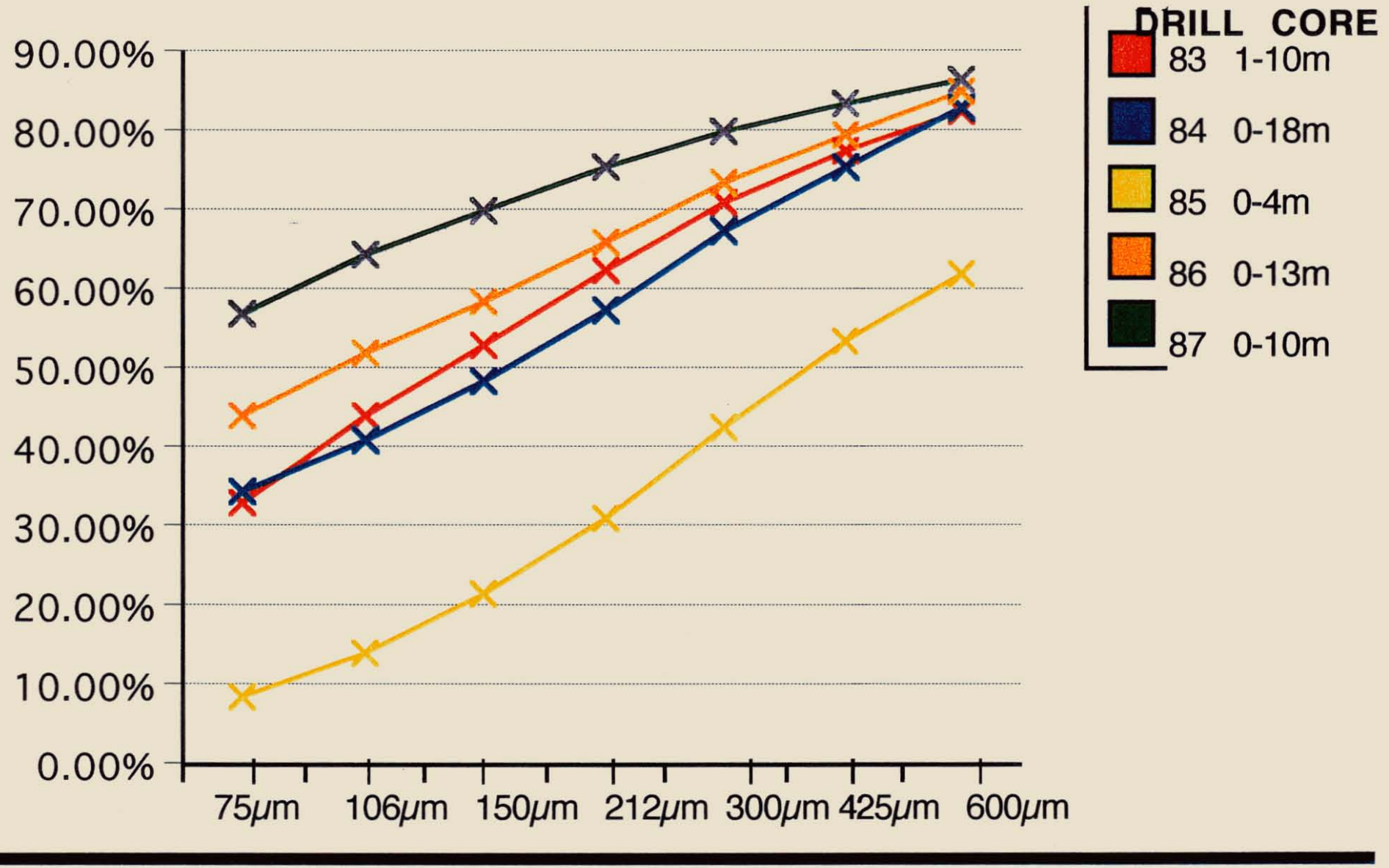


Figure 16

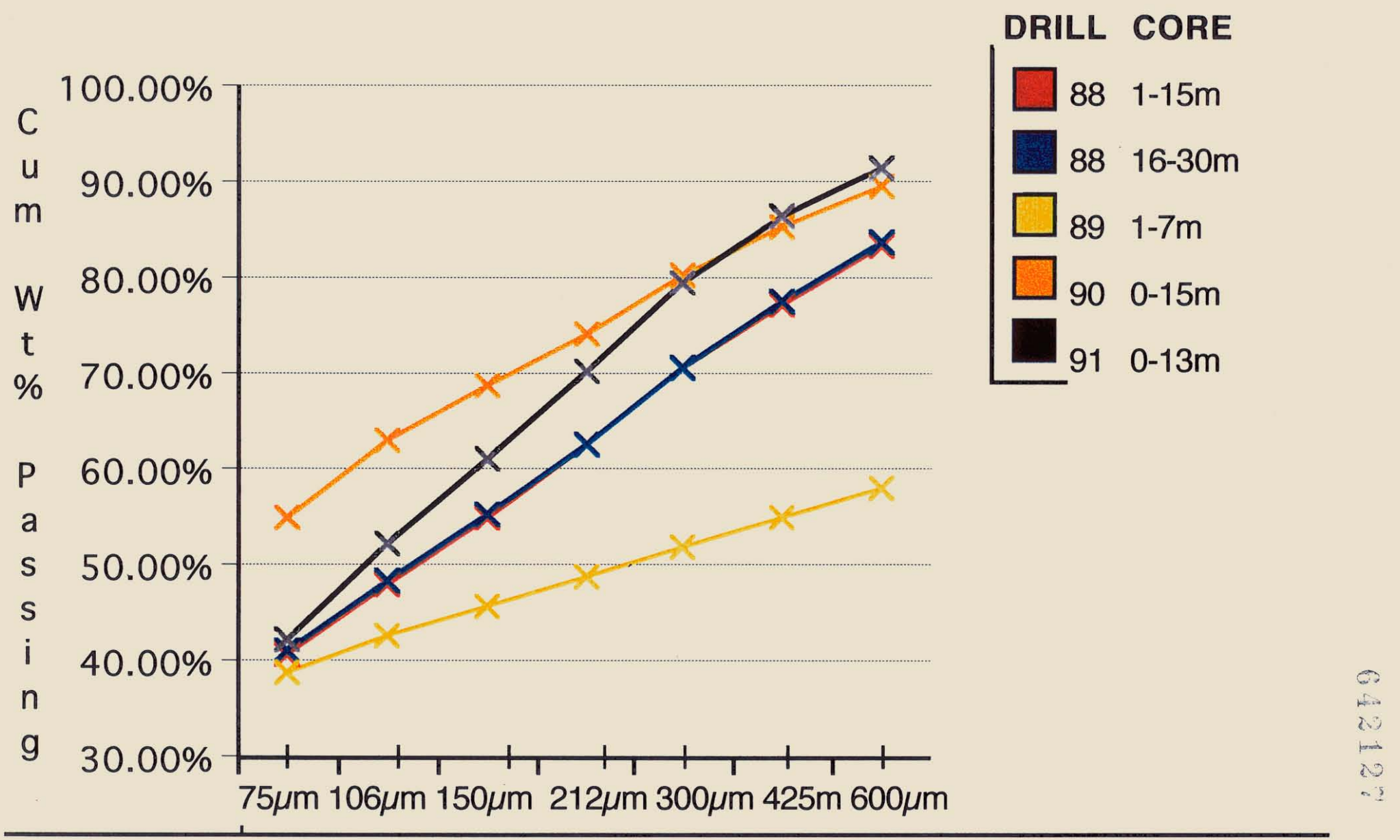


Figure 17

APPENDIX 6

ASSAYS - SIZE DETERMINATIONS: FEED & SIZE

642129

ANALABS

Our reference : BU016308
Your reference :
Project code : Silica Sands
Report date : 02/06/99
Report status : Final
Page : 1 of 6

Analabs Pty. Ltd.
ACN 004 591 664
14 Thirkell St, Burnie
Tasmania 7320
Telephone : (03) 6431 6837
Facsimile : (03) 6431 8890

ANALYTICAL DATA

Sample	CaO	Fe2O3	MnO	TiO2	Al2O3	Cr2O3
FEED DH69 0-11	400	1140	<13	340	820	<15
FEED DH70 0-3	240	760	<13	180	520	<15
FEED DH70 4-6	1670	1420	<13	350	1.17%	<15
FEED DH71 0-4	380	740	<13	610	2030	<15
FEED DH72 0-6	350	660	<13	520	2520	<15
FEED DH73 0-8	1040	3810	16	180	3490	20
FEED DH73 8-23	1270	4490	18	230	4880	22
FEED DH74 0-6	630	1140	<13	170	1440	<15
FEED DH75 0-21	680	1830	16	210	2890	<15
FEED DH76 1-11	450	1760	<13	600	3980	<15
FEED DH76 12-12	460	5800	26	210	2050	<15
FEED DH77 0-12	320	8740	<13	380	4750	<15
FEED DH78 0-8	240	1670	<13	580	1180	<15
FEED DH79 0-10	350	1540	<13	550	890	<15
FEED DH80 0-15	630	4320	<13	560	5570	<15
FEED DH81 0-8	300	980	<13	430	750	<15
FEED DH82 1-13	240	540	<13	445	370	<15
FEED DH83 1-10	270	430	<13	380	470	<15
FEED DH84 0-18	400	760	<13	345	510	<15
FEED DH85 0-4	240	420	<13	140	380	<15
FEED DH86 0-13	270	590	<13	150	250	<15
FEED DH87	320	1330	<13	270	920	<15
FEED DH88 1-15	490	1160	<13	180	730	<15
FEED DH88 16-30	510	3170	30	98	860	<15
FEED DH89 1-7	370	1670	<13	500	330	<15
FEED DH90 0-15	530	660	<13	155	290	<15
FEED DH91 0-13	320	730	<13	265	<189	<15
SIZE DH69 0-11	320	740	<13	84	510	<15
SIZE DH70 0-3	200	700	<13	40	360	<15
SIZE DH70 4-6	980	1090	<13	235	6100	<15
SIZE DH71 0-4	330	520	<13	470	1630	<15
SIZE DH72 0-6	190	330	<13	170	1080	<15
SIZE DH73 0-8	780	3820	22	105	2570	48
SIZE DH73 8-23	740	3370	18	105	2240	30
SIZE DH74 0-6	360	620	<13	66	740	<15
SIZE DH75 0-21	300	1150	<13	68	1540	<15
SIZE DH76 1-11	320	820	<13	245	2540	<15
SIZE DH76 12-12	270	1280	<13	50	670	<15
SIZE DH77 0-12	290	5410	<13	235	4400	<15
SIZE DH78 0-8	180	810	<13	205	700	<15
SIZE DH79 0-10	240	770	<13	150	600	<15
SIZE DH80 0-15	410	1130	<13	120	1140	<15
SIZE DH81 0-8	320	580	<13	96	400	<15
SIZE DH82 1-13	210	310	<13	94	270	<15
SIZE DH83 1-10	220	280	<13	120	380	<15
SIZE DH84 0-18	340	430	<13	130	300	<15
SIZE DH85 0-4	260	490	<13	52	740	<15
SIZE DH86 0-13	210	300	<13	42	220	<15
SIZE DH87	250	730	<13	100	540	<15
SIZE DH88 1-15	430	700	<13	64	350	<15
Method	I104	I104	I104	I104	I104	I104
Units	ppm	ppm	ppm	ppm	ppm	ppm
Detection Limit	70	143	13	17	189	15

Notes: N.A. = not analysed, -- = element not determined, I.S. = insufficient sample, L.N.R. = listed not received

642130

ANALABS

Our reference : BU016308
Your reference :
Project code : Silica Sands
Report date : 02/06/99
Report status : Final
Page : 2 of 6

Analabs Pty. Ltd.
ACN 004 591 664
14 Thirkell St, Burnie
Tasmania 7320
Telephone : (03) 6431 6837
Facsimile : (03) 6431 8890

ANALYTICAL DATA

Sample	CaO	Fe2O3	MnO	TiO2	Al2O3	Cr2O3
SIZE DH88 16-30	370	2440	30	32	710	<15
SIZE DH89 1-7	470	1580	14	115	400	<15
SIZE DH90 0-15	380	460	<13	48	240	<15
SIZE DH91 0-13	200	440	<13	82	250	<15
REF 30/75	240	<143	<13	<17	<189	<15
REF 7/250	220	<143	<13	<17	<189	<15
Method	I104	I104	I104	I104	I104	I104
Units	ppm	ppm	ppm	ppm	ppm	ppm
Detection Limit	70	143	13	17	189	15

Notes: N.A. = not analysed, -- = element not determined, I.S. = insufficient sample, L.N.R. = listed not received

APPENDIX 7

REPORT - PRELIMINARY ACID LEACH TESTS
CSIRO

642132

CSIRO

CSIRO Minerals
Head Office: Bayview Avenue, Clayton
Box 312, Clayton South, Victoria 3169, Australia
Telephone: (61-3) 9545 8500 Fax: (61-3) 9562 8919

FACSIMILE

To:	Mr Gerhard Krummei	**From:**	Graham Sparrow
Company:	J.J. McDonald and Sons Mining Pty Ltd	**Date:**	10/12/98
Fax No:	9820 2595	**File No:**	
		No of Pages:	(including this one) 4

Dear Mr Krummei

Following are the results of the work undertaken for Quotation BM77K of 7 August and for Quotation BM77P of 13 November with the sand samples supplied.

The samples supplied were;
a white sand labelled May 1 (CSIRO number 9808A);
a pale brown coloured sand labelled May 2 (CSIRO number 9808B), and
another pale brown coloured sand labelled May 3 (CSIRO number 9808C).

First of all the May 1 sample as received, and a -106µm fraction of the May 2 sample were analysed. Three leaches were carried out with the -106µm fraction of the May 2 sample. They were with hydrochloric acid, sulphuric acid containing sodium fluoride, and sodium hydroxide followed by hydrochloric acid. The final leach for this work was with hydrofluoric acid. A coarser sand fraction (-425+106µm) was used for this leach because the finer fraction dissolved too rapidly. All the leaches were at 10 wt% solids. The results are given in Table 1.

The iron assay value for the 'white' May 1 sample was 30 ppm Fe, while two assays for the 'pale brown' -106µm fraction of the May 2 sample were 450 and 550 ppm Fe.

Leaching the -106µm fraction of the May 2 sample with hydrochloric or sulphuric acids increased the iron assay values of the sample, presumably as a result of dissolving something else. A two step leach with sodium hydroxide followed by hydrochloric acid did remove about 50% of the iron and gave a product with 270 ppm Fe. The improvement with the caustic/acid leach may be a result of a partial attack by the NaOH on the silica.

/-2

Table 1. Iron analytical data for the sand samples and leach products.

Sample	Leach conditions	Fe assay (ppm)
May 1, as received	——	30
May 2, -106µm	——	450, 550
May 2, -106µm	1:1 (v/v) HCl at boiling point for 4 hours	630
May 2, -106µm	1:1 (v/v) H_2SO_4 + 0.1M NaF at boiling point for 4 hours,	620
May 2, -106µm	8M NaOH at at boiling point for 2 hours and then conc. HCl at boiling point for 2 hours	270
May 2, -425 +106µm	1:1 (v/v) HF at 90-100°C for 15 minutes	30

Since none of the initial leaches gave a product with less than the target level of 10 ppm Fe, a final leach with hydrofluoric acid was carried out. The leach product from the coarse fraction of the May 2 sample contained 30 ppm Fe, which was the same as the level in the May 1 sample. The weight loss in this leach was 34% consistent with the acid dissolving an appreciable amount of the sand. The amount of silica dissolved in the hydrofluoric acid leach depended on the particle size of the sand, the acid concentration, and the reaction time and temperature.

The colour of the leached samples reflected their iron assay values. They were less coloured the greater the amount of iron removed. However, examination under a binocular microscope of the two samples with 30 ppm Fe indicated they still had iron stains on their surfaces. Material with lower iron levels might be obtained by leaching the May 1 sample, or by further leaching of the May 2 sample.

In summary, the results of the leaching work indicate that the iron content of your sand can be reduced significantly by leaching with dilute hydrofluoric acid. However, it is doubtful that a commercial process based on hydrofluoric acid leaching would be practicable, although there is some scope to optimise the leach conditions used in this brief study. Weaker acids, while not effective here, may perform better if the initial iron levels are first lowered by some other physical pre-treatments.

In the second phase of this work the May 1 and May 3 samples were screened into three size fractions; +600µm, -600+75µm and -75µm. (All the May 2 sample was used in the leaching test work.) The finer two size fractions were analysed for iron, sodium, aluminium and titanium. As well, the solutions prepared for the ICP analyses were scanned for the presence of any other elements that might be present. The results are summarised in Tables 2 and 3 for the May 1 and May 3 samples, respectively.

/-3

Table 2. Analytical data for the size fractions from the May 1 sample.

Size Fraction	Wt %	Assay data (ppm)*				
		Fe	Na	Al	Ti	Ca
+600µm	18.5	n.d.	n.d.	n.d.	n.d.	n.d.
-600 +75µm	40.0	345, 349	19	83,84	414, 424	82, 83
-75µm	41.5	92, 85	20	129, 122	62, 52	230, 224

* The limits of detection for Fe, Na, Al, Ti and Ca in the solids were 1ppm.
n.d. = not determined

Table 3. Analytical data for the size fractions from the May 3 sample.

Size Fraction	Wt %	Assay data (ppm)				
		Fe	Na	Al	Ti	Ca
+600µm	16.3	n.d.	n.d.	n.d.	n.d.	n.d.
-600 +75µm	40.4	375, 389	18	71, 74	196, 199	90, 95
-75µm	43.3	716, 719	20	96, 98	70, 64	217, 223

* The limits of detection for Fe, Na, Al, Ti and Ca in the solids were 1ppm.
n.d. = not determined

The ICP scan indicated that other than the elements requested for analysis, only calcium was present at levels significantly higher than the background levels. Analysis values are also given for calcium in Tables 2 and 3.

While the May 3 iron assay values are consistent with the previous results for the May 2 sample, those for the May 1 sample are higher than expected since, when previously analysed, the whole sample assayed only 30ppm Fe. It is also interesting to note that the titanium assay values are similar to the iron assay values in the May 1 fractions. Also, while the two fractions of the May 1 sample were both white, the -600+75µm fraction of May 3 was still a pale brown, even though it assayed with a similar iron content as the May 1 sample.

/-4

In this work the assays were by ICP AES on a solution prepared by dissolution of the sample in hydrofluoric acid. In preparation for the analyses, the -600+75µm samples were ground in a titanium carbide mill with titanium carbide balls for 5min to give material of less than 2µm. The -75µm samples were not ground. Grinding of the two coarser samples gave them a greyish tinge.

The grinding mill was cleaned with quartz sand before the coarser May 1 and May 3 size fractions were ground. However, it is possible that the samples may have been contaminated with material previously ground in the mill since the mill is usually used for grinding ilmenite. This might be consistent with the high titanium assays in the -600 +75µm fractions, although the -75µm fraction of the May 1 sample, that was not ground for analysis, also had a titanium assay similar to the iron assay. There were small black specs in the samples that presumably contain iron that may be responsible for these higher iron assays for the May 1 samples. There is no doubt that a more representative sample was obtained for the analyses given in Table 2 than was the case when the bulk sample was analysed (Table 1).

The assay results for the size fractions indicate that the finer fraction of the May 3 sample contains more iron than does the coarser fraction, while the opposite result was obtained for the May 1 sample. However, there is some doubt about the iron levels in the size fractions of the white May 1 samples and further analyses of a fresh sample may be required to resolve this problem.

I look forward to any comments you might have on these results.

Graham Sparrow

Graham Sparrow
(Manager – Industrial Minerals)

APPENDIX 8

PRELIMINARY ACID WASH TESTS - INTERIM REPORT

GLASS SAND PROJECT

PRELIMINARY ACID WASH TESTS

INTERIM REPORT

C.J.BROWNE
OSLEACH P/L
March 2000

TABLE OF CONTENTS

SUMMARY

An initial study into the possibility of extracting a product suitable for certain applications in the Fine Glass industry from samples supplied has been carried out. A number of samples were supplied, and the initial study was confined to the best sample supplied, on the presumption that if a suitable product could not be obtained from that sample, then it would be unlikely to be obtainable from the other samples.

For the material to be suitable for the application, the main requirements to be met were that the material have a particle size range of >75<600 micron (Note:- In body of report micron = #), and that the iron level be as low as possible, preferably below 10 ppm.

The sample was found to contain 180 ppm Fe and approximately 44% of the material was in the desired size range.

Testwork indicates that a combination of wet screening, gravity separation and mild leaching with dilute sulphuric acid, is capable of extracting this size range, and of reducing the iron content of the product to at least <10 ppm, and probably as low as 5ppm.

It has been estimated that the capital cost of a plant capable of treating 10,000 dry tonnes per annum of this material, would be in the order of $250,000, and that such a plant would be expected to produce a minimum of around 4,200 tonnes per annum of dry product on an 8 hour day/ 5 day week basis.

It is estimated operating costs at this production rate would be around $50.00/tonne of product.

Operating costs can only be significantly reduced if throughput is increased, i.e. more markets for the product can be established.

For example, increasing the operating hours (7 day week, 12 hours/day) to yield higher outputs of 6,000 -12,000 tpa, would reduce operating costs from this plant to as low as $35/tonne of product without increasing capital costs.

The capacity of the plant could be doubled for around an extra 30% in capital; costs. This would allow production to increase to 12,000-25,000 tpa. Operating costs would then level out at around $20/tonne.

Other process options exist, including producion of a material in the required size range which contains <50 ppm Fe, without the need for acid leaching. Also more comprehensive testwork would almost certainly lead to a simplification of the process circuit, and hence lower capital and operating costs.

Plant operation at any level of production would not present any serious environmental difficulties.

1. INTRODUCTION

The following is an interim report on the initial phase of an investigation into the applicability of a particular sand deposit to the production of high grade sand feedstock to the glass industry.

This project has been initiated by GERHARD KRUMMEl on behalf of J.J.McDONALD & SONS MINING PTY. LTD.

Several raw samples were supplied and these were to be investigated to determine:-
(1). Methods of obtaining a suitable product,
(2). Develop an initial commercial process to produce this product,
(3). Prepare some preliminary cost estimates.

2. TECHNICAL CONSIDERATIONS.

Premium prices are obtainable at the more sophisticated end of the international Glass Industry for the supply of silica feedstock which falls within the following specifications:-

(1). Very high silica levels (>99.9%.)
(2). Iron levels below 50 ppm, and particularly below 10 ppm.
(3). Particle Size >75 < 600 micron.
(4). Minimal levels of other metals, particularly Cr, Ti, V, Mn and silicates (Ca, Mg, Al etc.).

Natural grains are preferred, so the particle size specification cannot be met by grinding.

As a general rule such material is not commonly found, and a high premium is payable for material in the correct particle size range, with moisture, iron and other silicate levels as close as possible to zero.

3. DESCRIPTION OF FEEDSTOCK SAMPLES.

Several samples were supplied, all damp, and with a range of particle size (generally between 1 micron to 20mm) and colour, and with varying Fe, Cr, Ti, V, Mn, and "other silicate" content. All were contaminated with minor amounts of material of vegetable origin. The samples were labelled 75A, 75B, 83, 88, 90 and QF1.

One sample (Sample 90) was superior in several aspects, notably of lighter colour, and with lower iron content. It was decided as a cost control over the evaluation, that initial testwork be based on this sample, on the basis that if this sample was not suitable, then it would be unlikely that the remainder would be suitable.

The results of evaluation on this sample would then be reviewed, and a decision taken as to further testwork based on these results.

4. BASIS OF TESTWORK.

4.1 Basis of Testwork Program.

Initial testwork was confined to sample 90, which had the whitest natural colour.

The emphasis of this test programme was to establish the proportion of the sample which fell into the specified particle size range, and to then determine what process or processes would be required to reduce the iron level of the material to as close as possible to zero ppm.

4.2 Approach to Problem of Iron Removal.

Previous tests conducted on the material indicated that the iron was present as both oxides and more complex compounds such as ilmenite, chromite, magnetite, etc. These contaminants were present as free particles, and as surface coatings on sand grains. Whether any of these compounds were present within the crystal structure of the silica, or deeply imbeded in cracks in the sand grains was not known.

4.2.1 Chemical Leaching.

Initially it was suggested that the iron be removed by chemical leaching. In the case of iron, this implies acid leaching. While simple leach mechanisms using economically feasible reagents such as sulphuric, hydrochloric and nitric acid can be expected to effectively dissolve a range of iron oxides, their application for this purpose is not as simple as may appear.

High temperatures and complex materials of construction can be required, and effluent disposal can be very difficult. Sulphuric acid is by far the cheapest acid, even on a stoichiometric basis, and presents the least problems in materials of construction and effluent control. It is however generally less effective in dissolving higher iron oxides and requires very severe conditions to attack minerals such as ilmenite.

Furthermore chemical leaching can be expected to be ineffective in removal of iron included in the crystal structure or in fine cracks in sand particles.

4.2.2 Wet Magnetic Separation.

The writer has had considerable experience over many years in the development and application of both Readings Dry Magnetic Separators and Readings WHIMS (Wet High Intensity Magnetic Separators) in the removal of iron compounds such as hematite, magnetite, chromite and ilmenite in the beach sands industry, and is of the opinion that these machines are by far the most effective available for removal of these compounds from sands.

The fine end of the particle size range required in this case would not be ideal for Dry Magnetic Separation, but the material would be ideally suited to WHIMS, particularly as the material is initially wet.

In this case it was felt that WHIMS should be capable of removal to a high efficiency of any ilmenite, magnetite or similar iron bearing materials of medium to high magnetic susceptibility, whether present as free particles, composites, surface coatings or as inclusions in grains.

Compounds of lower magnetic susceptibility such as hematite would be removed at lower efficiencies, dependent on such factors as particle size, degree of oxidation, and degree of inclusion in grains.

However it is these materials which are easiest to remove by chemical leaching, particularly by sulphuric acid which is the cheapest acid available.

4.3. Suggested Approach.

It was decided that a preferred approach would be to extract the relevant size fraction from the sample by simple wet sceening. The relevant size fraction of the sample would then be subjected to WHIMS, and the resultant magnetics, middlings and non-magnetic fractions collected and dried.

All fractions (i.e. Head sample, desired size fraction, magnetics, middlings and non-magnetics) would be weighed, sampled and analysed, primarily to obtain a mass balance and iron distribution.

The non-magnetic fraction would then be investigated for iron removal by chemical leaching, based on sulphuric, hydrochloric and nitric acids.

The only test rig available for WHIMS is located at Readings of Lismore, and is located at Lismore (NSW). Therefore the initial magnetic separation was conducted at Lismore, under supervision of the writer.

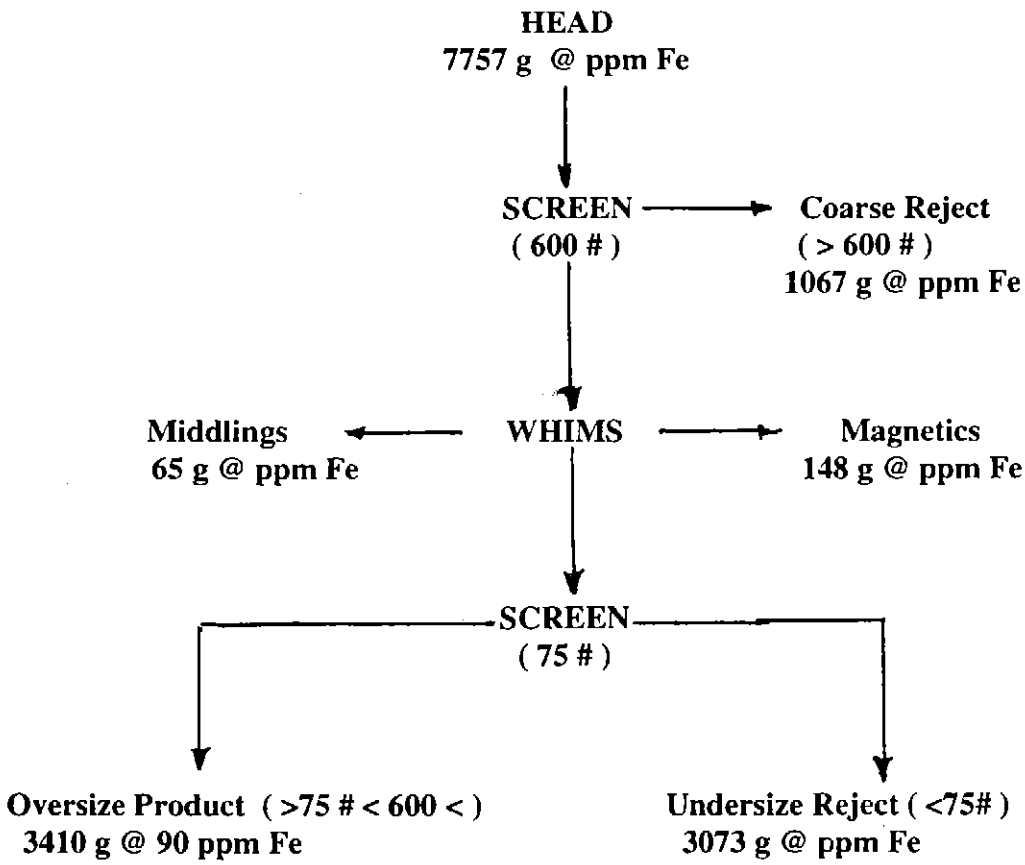
The products would then returned to Hobart for further work.

5. TESTWORK AND RESULTS.

5.1. Magnetic Separation.

The nature of the test rig resulted in a modification of the above procedure. The rig consists of one pole of a commercial 16-pole machine, and to obtain meaningful results the feed must be passed through this pole at commercial rates (1 tonne dry solids equivalent/hr/pole). Due to the small sample weight, and the inability of the machine to cope with a particle size > 2mm, a compromise was reached, in that the sample was wet screened at 600 micron, and only the <600 micron fraction was passed through the machine.

The mass balance and Iron analysis are ashown schematically as follows:-



The total mass and iron distributions with reference to the total sample were as follows:-

	Mass		Fe	
	(gram)	Dist (%)	ppm	Dist (%)
Oversize Reject >600 #	**1067**	**13.7**	**155**	**11.8**
WHIMS Middling	**65**	**0.8**	**380**	**1.8**
WHIMS Magnetics	**148**	**1.9**	**4424**	**46.9**
Non Magnetics:-				
Product >75<600 #	**3410**	**44.0**	**90**	**21.9**
Undersize Reject <75#	**3073**	**39.6**	**80**	**17.6**
HEAD	**7757**	**100.0**	**180**	**100.0**

The mass and iron balances with respect to the <600 # fraction only, were:-

	Mass		Fe	
	(gram)	Dist (%)	ppm	Dist (%)
Total <600 # Fraction	**6690**	**100.0**	**184**	**100.0**
WHIMS Middling	**65**	**1.0**	**380**	**2.0**
WHIMS Magnetics	**148**	**2.2**	**4424**	**53.2**
Non Magnetics:-				
Product >75<600 #	**3410**	**51.0**	**90**	**24.9**
Undersize Reject <75#	**3073**	**39.6**	**80**	**19.9**

These results indicate that WHIMS achieved a removal of 48.7% of the iron from the total sample, by removal of 1.7% of the total sample mass. Alternatively, 55.2% of the iron was removed from the <600 # fraction, in 3.2% of the mass.

The effect was to reduce the iron content of the <600 # fraction from 184 ppm to 90 ppm. It was presumed that this was achieved by removal of all free particles of minerals of high-medium magnetic susceptibility (such as ilmenite, magnetite and hematite) along with sand grains containing occlusions or heavy coatings of these minerals. Reprocessing of the magnetic and middling fractions would no doubt increase the efficiency of separation in terms of iron removed/mass removed, but the low quantity of material lost suggests that this may not be worth the effort.

5.2 Effect of Magnetic Separation on Iron Leachability

The <600 # Non-Magnetic fraction obtained should contain easily leached material of low magnetic susceptibility as surface coatings, free particles, or as occlusions. It was considered chemically unlikely that such minerals, which should be heavily oxidised, could occur as occlusions.

It would therefore appear logical to conclude that the only impediments to easy removal of the remaining iron by simple leaching would be:-

A. Presence of otherwise easily leachable material in deep cracks in sand grains, and, or
B. Inefficiencies in the magnetic separation step.

Since magnetic separation efficiency for a given mineral in WHIMS is inversely proportional to particle size, but proportional to magnetic susceptiblity, WHIMS inefficiency would reflect itself as coarse particles of higher magnetic material such as ilmenite and magnetite, or as coarser sand grains with minimal occlusion.

5.3. Leaching Tests.

All leaching tests were confined to the >75<600 # non-magnetic fraction obtained from the WHIMS test run, which comprised 44% of the total sample.

The sample was split into a series of 100 g samples, and leach tests were conducted on individual 100 g samples, using sulphuric acid, hydrochloric acid , nitric acid and aqua regia, at various strengths and at various temperatures and for various periods.

To minimise any contamination, all leach tests were conducted using AR grade acids and distilled water. Tests were conducted in glass beakers covered with glass watchglasses, using agitation provided by glass coated magnetic stirrer bars and externally powered magnetic stirring devices.

Analysis for iron was conducted both internally, and for certain key samples,by Australian Laboratory Services in Brisbane.

The results are summarised overleaf.

NOTE:- The head solids contained 90 ppm Fe in all cases. Results are expressed as ppm removed.

5.3.1. Sulphuric Acid.

Conditions Used		Fe Removed (ppm)					Final Solids Fe (ppm)
Acid Strength (%)	Temperature (C)	30 min	60 min	120 min	300 min	24 hr	
5	15	22	30	36	38	40	50
5	30	25	35	38	40	40	50
5	60	30	40	50	50	50	40
10	15	25	35	37	40	40	50
10	30	30	40	48	50	50	40
10	60	40	50	50	50	50	40
25	15	25	35	38	40	45	45
25	30	48	50	50	50	50	40
25	60	50	50	50	50	50	40

5.3.2. Hydrochloric Acid.

Conditions Used		Fe Removed (ppm)					Final Solids Fe (ppm)
Acid Strength (%)	Temperature (C)	30 min	60 min	120 min	300 min	24 hr	
5	15	22	30	36	38	40	50
5	30	25	35	38	40	40	50
5	60	30	40	40	40	40	50
10	15	25	35	37	40	40	50
10	30	30	40	40	40	40	50
10	60	40	40	40	40	40	50

5.3.3. Nitric Acid.

Conditions Used		Fe Removed (ppm)					Final Solids Fe (ppm)
Acid Strength (%)	Temperature (C)	30 min	60 min	120 min	300 min	24 hr	
5	15	22	30	36	38	40	50
5	30	25	35	38	40	40	50
5	60	30	40	40	40	40	50
10	15	25	35	37	40	40	50
10	30	30	40	40	40	40	50
10	60	40	45	45	50	50	40

5.3.4. Aqua Regia.

Conditions Used		Fe Removed (ppm)					Final Solids Fe (ppm)
Acid Strength (%)	Temperature (C)	30 min	60 min	120 min	300 min	24 hr	
5	15	22	30	36	38	40	50
10	30	25	35	38	40	40	50
20	60	40	40	40	50	50	40
100 (conc.)	100	85	88	88			2

The results indicated that a barrier existed at 40-50 ppm residual iron in the sample. i.e. only 44-55 % of the iron was easily leached with even the severest conditions, using conventional acid solutions.

Sulphuric acid, even at moderate conditions, gave the best result (40 ppm residual Fe), which was only achieved with nitric acid at high temperatures and concentration.

It was noted that aqua regia was unable to remove any more iron than sulphuric acid, in moderately dilute solution, but removed substantially all iron (2 ppm residual) as concentrated solution at boiling.

6. DISCUSSION OF TESTWORK RESULTS.

The results presented a conundrum in that all attempts to remove the iron from the >75<600 # fraction using acids under practical conditions were only partly successful, as outlined above.

This would tend to suggest that 44-55 % of the iron was either occluded inside individual sand grains, and/or deeply imbeded in cracks in the grains.

However the fact that hot aqua regia removed almost all iron (98 %) negates this conclusion.

The other possibility which would fit with the results obtained, is that 40-50 % of the iron is contained in the blackish apparently organic material present in the sample

Since this material would inevitably require removal from any commercial product, it was decided that this material should be closely examined, both in terms of its iron content, and methods for its removal.

7. EXAMINATION OF BLACK PARTICULATE CONTAMINANT.

Choices for removal of the black particular matter included calcination prior to leaching, flotation, and gravity separation.

Since calcination and flotation introduce complications to the process in terms of extra steps and expensive equipment, it was decided to concentrate on finding means of removal by gravity separation, and to attempt to define the iron content of the balck matter.

A 200 g sample of the >75<600 # material was carefully panned using a new plastic panning dish. It was found that most of the black matter could be floated off easily, along with around 3% of the initial sample. This could no doubt be more efficient in practice, using either spiral separators, or wet tables.

The floated light fraction, containing almost all of the black matter was calcined and digested in hot aqua regia. The solution was analysed for Fe, and it was established that the iron content of the light fraction was 1500 ppm.

The panning was repeated on a second 200 g fraction, and the float was again around 3% of the sample. This sample was direct aqua regia digested, and analysed for Fe. The result indicated the light fraction was 1400 ppm Fe.

When related to the head , which was established as 90 ppm, and using the average of the above results, this fraction therefore contributed 0.03 x 1450 = 43.5 ppm of the total iron in the head. This represents almost all of the apparently non-leachable iron established in the acid leaching grid tests above.

The panning was not 100% effective, so it could be interpreted that the black matter does indeed contain the balance of the iron not removable by acid leaching, locked up insome way in an organic matrix which requires destruction by strong oxidising conditions (hot Aqua Regia) before it can be removed.

Unfortunately all of the sample of the >75<600 # fraction had been consumed at this point.

8. CONCLUSIONS FROM CURRENT TESWORK

It appears that the results indicate that, at least on the sample supplied, the following conclusions can be drawn:-

1. Around 45% of the material is in the desired size range (>75<600 #).

2. Magnetic separation using WHIMS reduces the Fe content of this fraction to 90 ppm.

3. Around half of the remaining iron in this fraction is easily removed by sulphuric acid leaching at moderate conditions.

4. Almost all of the remaing iron is contained in a black, light, apparently organic contaminant in the material.

5. This contaminant can be removed to high efficiency by gravity separation.

6. A combination of wet screening, WHIMS, moderate acid leaching, and gravity separation is likely to yield approximately 40 % of the head as a product with a size range of >75<600 # with an iron content of less than 10 ppm, and more likely 2-5 ppm.

9. PROCESS IMPLICATIONS.

After a great deal of consideration of several available process options, I have boiled the procees stream down to into a simple circuit, designed to minimise the process steps involved, to utilise inexpensive equipment where possible, and to minimise the size and hence cost of the most expensive piece of operating equipment (WHIMS).

9.1. Basis For Calculations.

The basis for all calculations is as follows:-

Throughput Required:-	10,000 tonnes raw feed per annum (Dry Basis).
Operating Mode:-	52 weeks/annum, 5 day week, 8 hour/day operation, with 90% availability.
Final Product:-	100% >75<600 #, ,<10 ppm Fe, <0.2 % moisture, in bulka bags.

9.2. Circuit

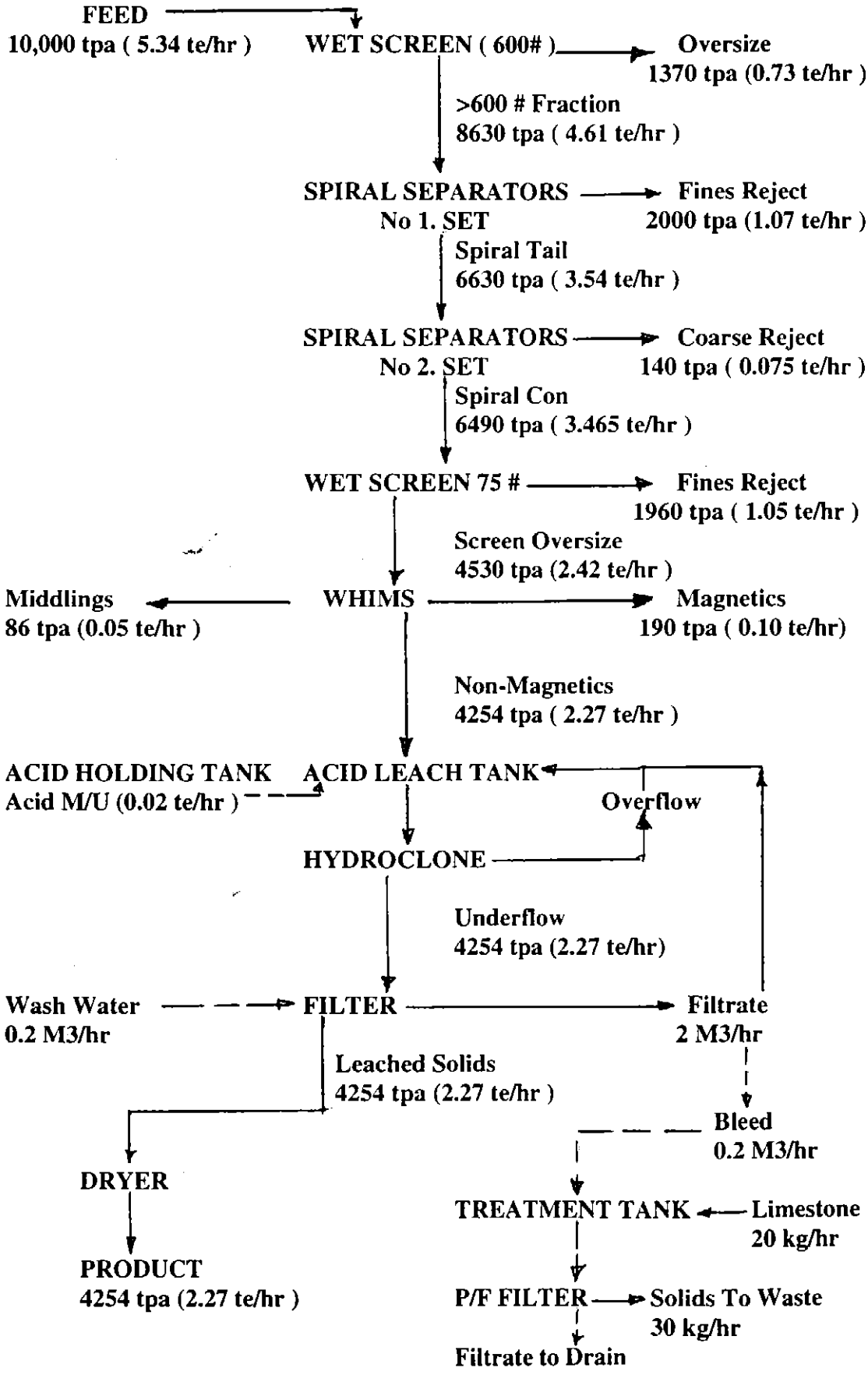
9.2.1. Circuit Diagram.

The suggested circuit is shown diagramatically overleaf.

9.2.2. Capital Cost Estimate.

Capital cost estimates and equipment sizes for this circuit are calculated on a preliminary basis as follows:-

Item	Equipment Size	Estmated Cost $
1. Wet Screens	600 # Screen 3m x 1 m	6000
	75 # Screen 3m x 1 m	6000
2. Spiral Separators	Set No.1 5 pairs standard Reichert S/H	6000
	Set No.2 4 pairs standard Reichert S/H	4000
3. WHIMS	4 Pole Unit S/H	25,000
4. Acid Leach Tank	10 M3 Stainless Steel	5,000
5. Hydroclone		2,000
6. Filter	2m x 1m Rotary Vacuum S/H	20,000
7. Acid Storage Tank	2 M3	2,000
8. Bleed Treatment Tank	2 m3	2,000
9. P/F Filter	Polythene	4,000
10. Dryer	6m x1m Stainless Steel Rotary	10,000
11. Product Hoppers		10,000
12. Pumps, lines, valves, etc		30,000
13. Electrical		50,000
14. Buildings, bunds etc.		50,000
15. Contingency	(10 %)	23,000
TOTAL CAPITAL COST		**255,000**


FEED
10,000 tpa (5.34 te/hr)
WET SCREEN (600#)
Oversize
1370 tpa (0.73 te/hr)
>600 # Fraction
8630 tpa (4.61 te/hr)
SPIRAL SEPARATORS
No 1. SET
Fines Reject
2000 tpa (1.07 te/hr)
Spiral Tail
6630 tpa (3.54 te/hr)
SPIRAL SEPARATORS
No 2. SET
Coarse Reject
140 tpa (0.075 te/hr)
Spiral Con
6490 tpa (3.465 te/hr)
WET SCREEN 75 #
Fines Reject
1960 tpa (1.05 te/hr)
Screen Oversize
4530 tpa (2.42 te/hr)
Middlings
86 tpa (0.05 te/hr)
WHIMS
Magnetics
190 tpa (0.10 te/hr)
Non-Magnetics
4254 tpa (2.27 te/hr)
ACID HOLDING TANK
Acid M/U (0.02 te/hr)
ACID LEACH TANK
Overflow
HYDROCLONE
Underflow
4254 tpa (2.27 te/hr)
Wash Water
0.2 M3/hr
FILTER
Filtrate
2 M3/hr
Leached Solids
4254 tpa (2.27 te/hr)
Bleed
0.2 M3/hr
DRYER
TREATMENT TANK
Limestone
20 kg/hr
PRODUCT
4254 tpa (2.27 te/hr)
P/F FILTER
Solids To Waste
30 kg/hr
Filtrate to Drain

9.2.3 Operating Cost Estimate.

The equipment sizes chosen for the plant circuit outlined above are in most cases the smallest unit size available. There is probably considerable reserve capacity in these units. This would allow higher throughput to be attained in the plant than shown, with the same operating time, if desired.

Further increases in throughput could also be attained by operating for longer periods.

For estimating purposes it is assumed that up to 6000 tpa of product could be obtained over the 8hr/day 5 day week basis used in mass balances shown in the circuit diagram.

Operation on an 8 hour/day 7 day week basis would increase maximum production from the plant shown to 8,400 tpa.

Operation on a 12 hour/day 5 day/week basis would further increase maximum production to 12,600 tpa.

This gives a range of operating costs, depending on the degree of plant utilisation and hours operated.

This range of operating costs is summarised overleaf.

It is assumed that the operation is run by 2 men, with a supervisor, for the 5 days/week operations, and by 4 men with a supervisor for 7 days/week operations. It is also assumed that any mobile equipment required is leased.

OPERATING COSTS/TONNE

ITEM		COST ($) Production Rate /annum 4200	6000	8000	12,600
Fixed costs/tonne					
Sulphuric Acid	0.007 t/t @ $200	5880	8400	11200	17640
Limestone	0.007 t/t @ $ 30	880	1260	1680	2646
Fuel for Drying	$3/t	12600	18000	24000	37800
Power	88 kwhr/t @ $0.06	22170	31680	42240	66528
Total Fixed Costs		**41530**	**59340**	**79120**	**124614**
Total Fixed Costs/t		**$9.89**	**$9.89**	**$ 9.89**	**$ 9.89**
Variable Costs/tonne					
Labour	$45,000 / man	90,000	90,000	180,000	180,000
Supervision		35,000	35,000	40,000	45,000
Maintenance Costs		25,000	30,000	35,000	45,000
Overheads	10% of Capital	25,000	25,000	30,000	40,000
Total Variable Costs		**175,000**	**180,000**	**285,000**	**310,000**
Total Variable Costs/t		**41.67**	**30.00**	**35.62**	**24.60**
TOTAL OPERATING COSTS PER TONNE PRODUCT		**51.56**	**39.89**	**45.51**	**34.49**

Batch: ST27881
Sub Batch: 0
Date of Issue: 14/03/2000
Client:
Client Reference:

CERTIFICATE OF ANALYSIS

SAMPLE	Element	Fe2O3
	Unit	%
	Method	M269
	LOR	0.001
HEAD		0.018
-600 + 75MM STD		0.009
CONC SAND H2SO4 WASHED		0.004
MIDS -75#		0.038
S8B		0.005
CALCINED A/LEACHED		0.005

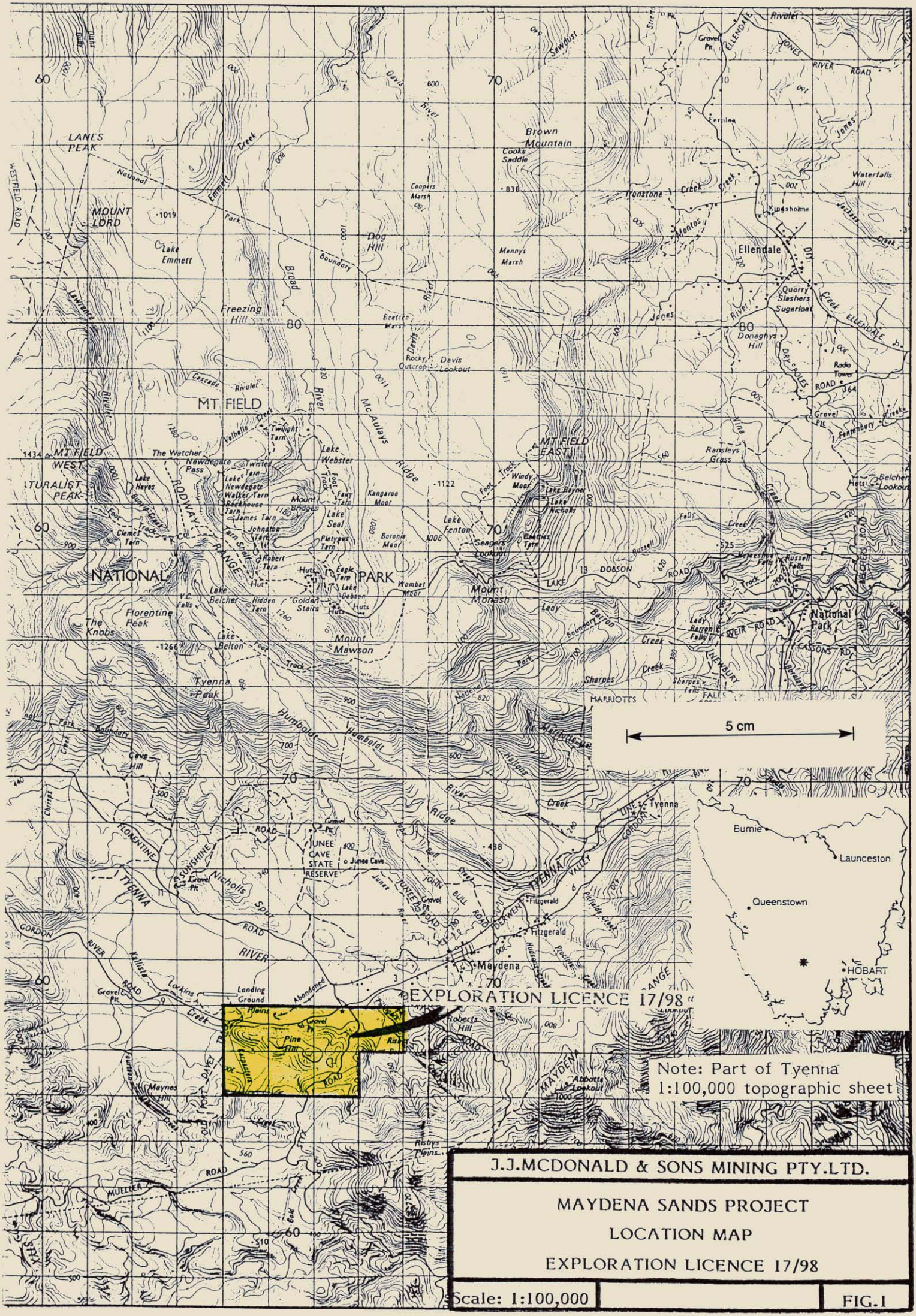
14-MAR-00 16:46

P.03

Batch: ST27254
Sub Batch: 0
Date of Issue: 14/03/2000
Client:
Client Reference:

CERTIFICATE OF ANALYSIS

SAMPLE	Element	Fe2O3
	Unit	%
	Method	M289
	LOR	0.001
S1 AL		0.006
S2 AL		0.005
S3 AL		0.005
S3 +75#		0.008
S4 AL		0.004



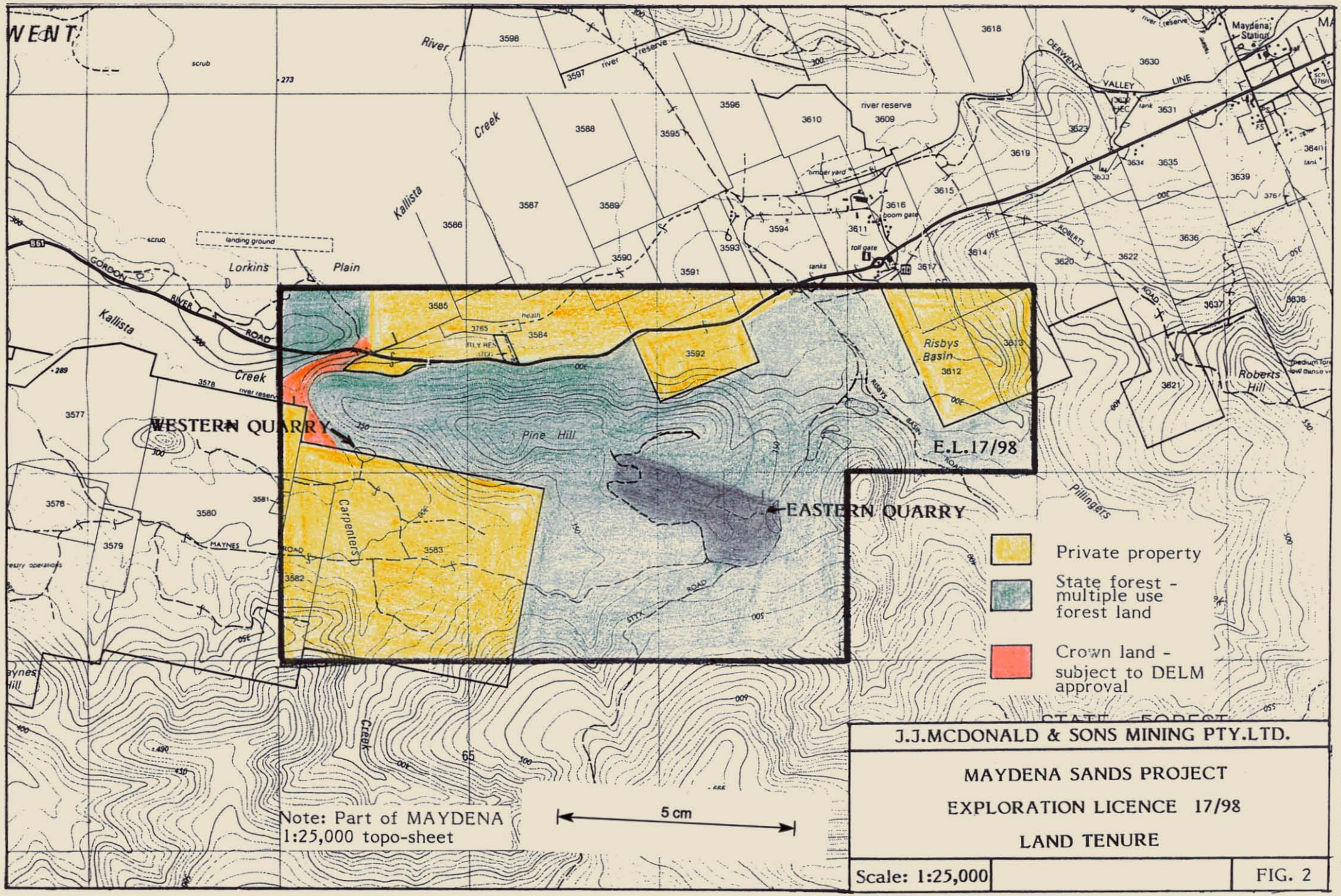
J.J.MCDONALD & SONS MINING PTY.LTD.

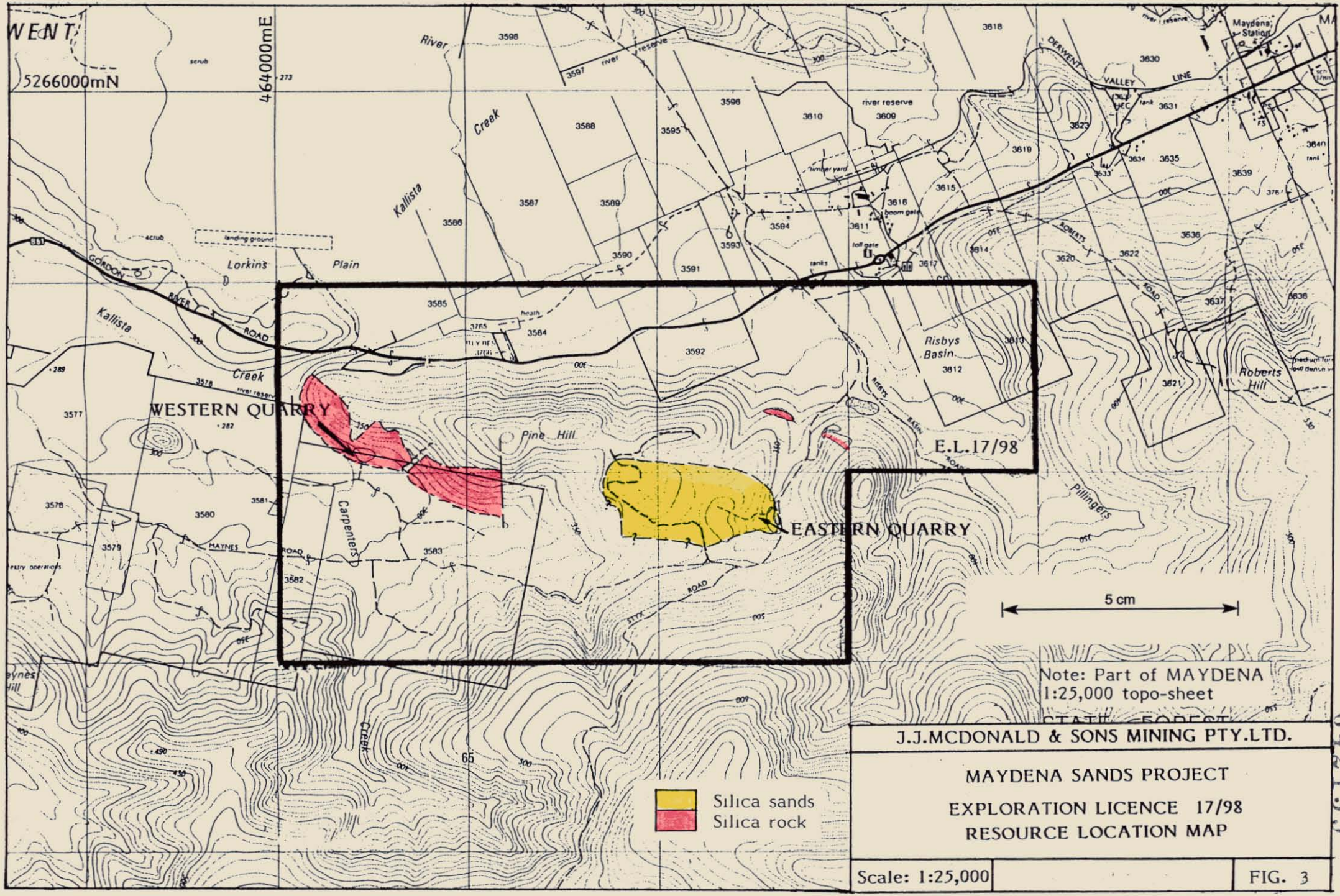
MAYDENA SANDS PROJECT

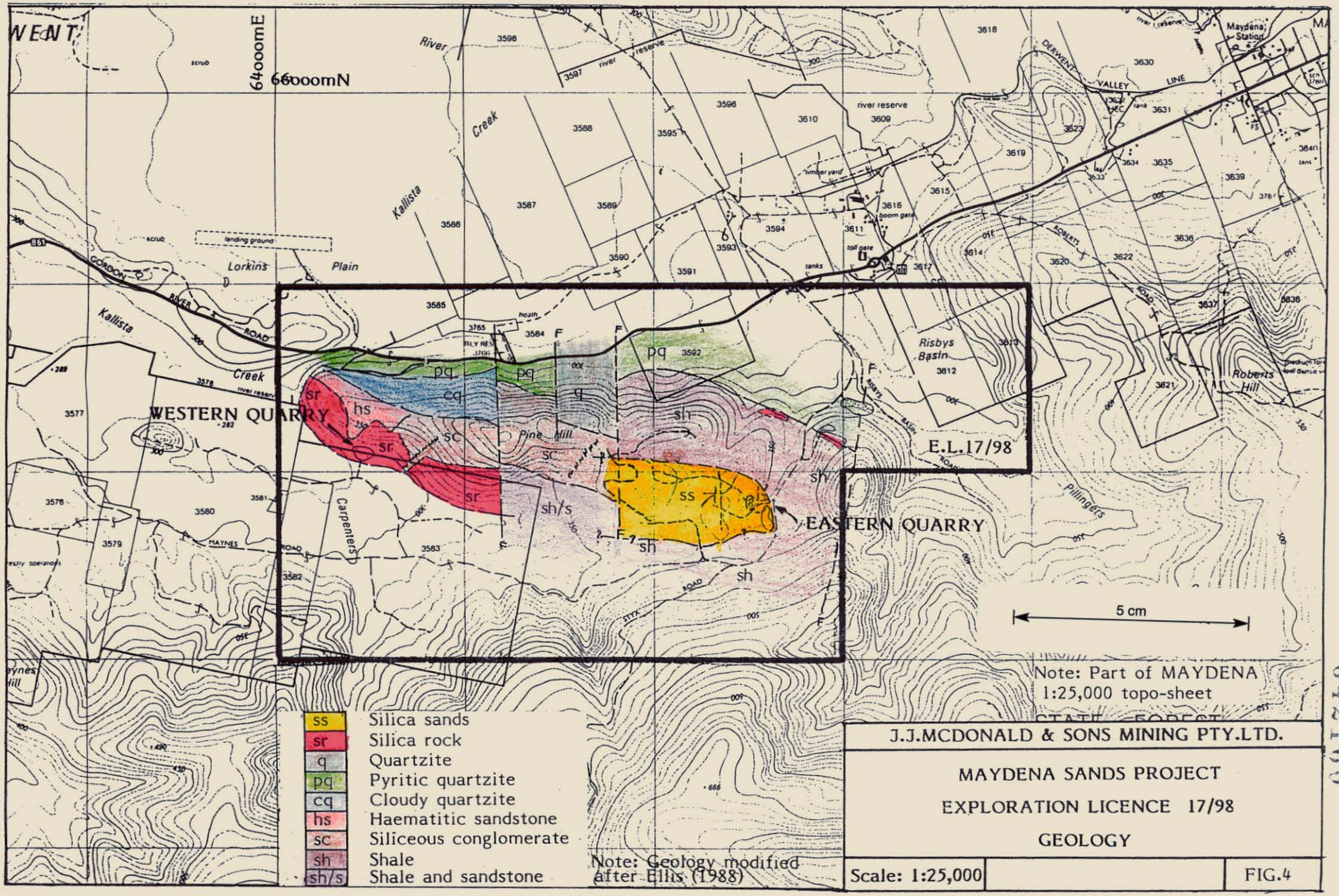
LOCATION MAP

EXPLORATION LICENCE 17/98

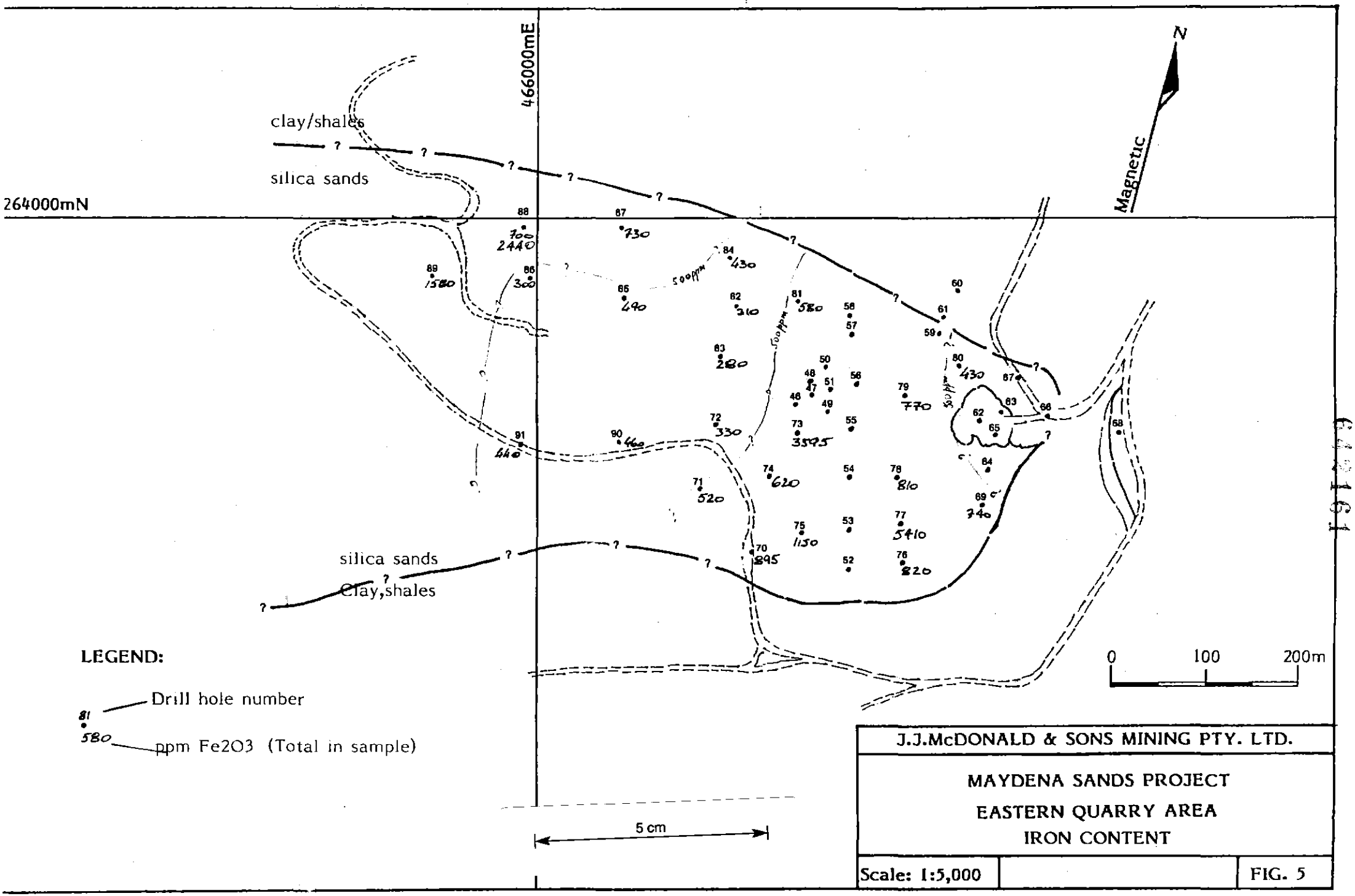
Scale: 1:100,000 | FIG.1

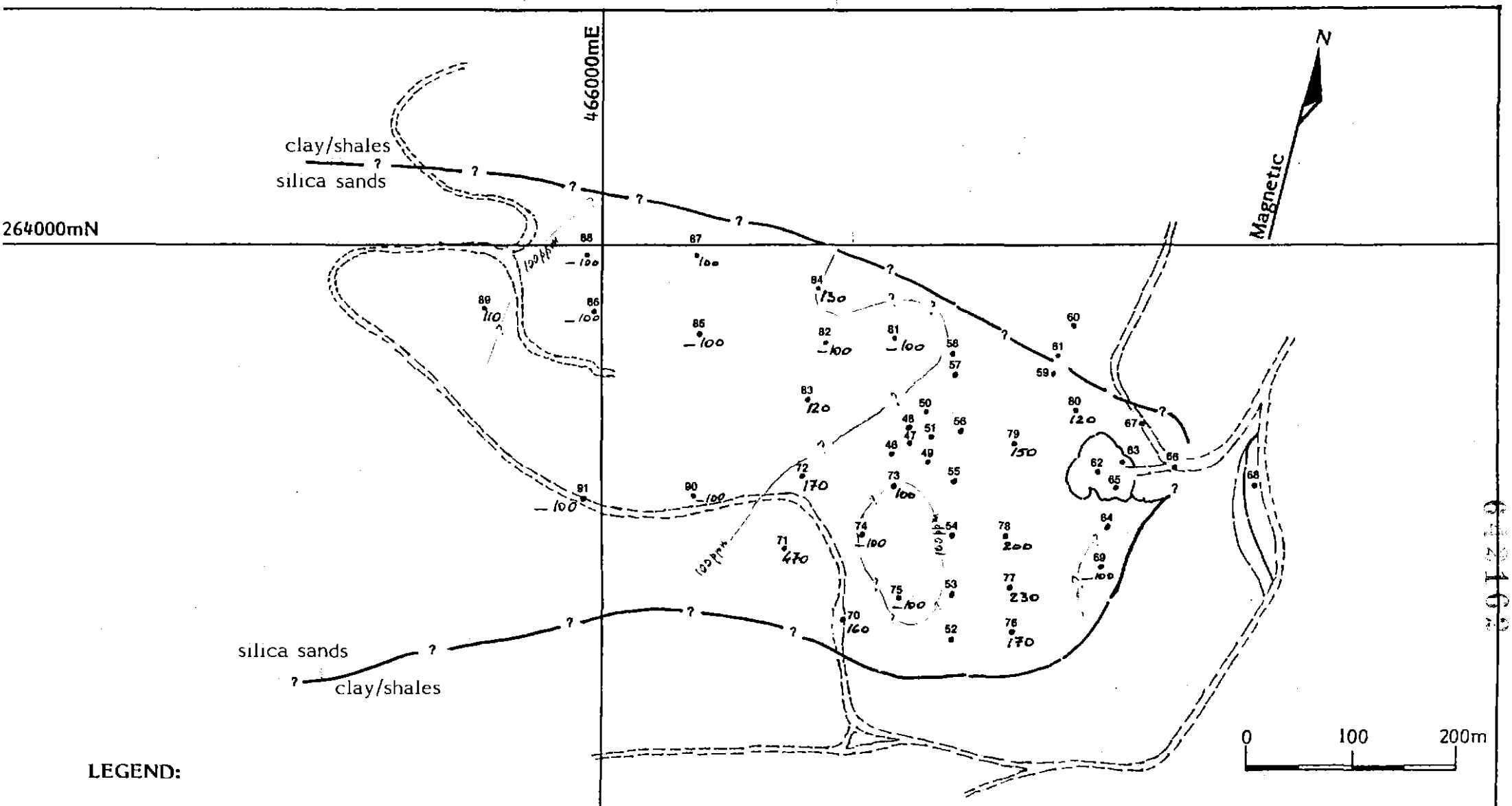

WESTERN QUARRY
EASTERN QUARRY
E.L.17/98
Pine Hill
Risbys Basin
Roberts Hill
Lorkins Plain
Kallista Creek
Carpenters Creek
Pillingers
Maydena Station
DERWENT VALLEY LINE
GORDON RIVER ROAD
MAYNES ROAD
STYX ROAD
ROBERTS ROAD
RISBYS BASIN ROAD
Private property
State forest - multiple use forest land
Crown land - subject to DELM approval
Note: Part of MAYDENA 1:25,000 topo-sheet
5 cm
J.J.MCDONALD & SONS MINING PTY.LTD.
MAYDENA SANDS PROJECT
EXPLORATION LICENCE 17/98
LAND TENURE
Scale: 1:25,000
FIG. 2
64158


WENT
5266000mN
464000mE
River
Creek
Kallista
Lorkins
Plain
GORDON
RIVER
ROAD
Kallista
Creek
WESTERN QUARRY
Pine Hill
Carpenters
MAYNES
ROAD
STYX
ROAD
Risbys
Basin
Roberts
Hill
Pillingers
EASTERN QUARRY
E.L.17/98
Maydena
Station
DERWENT
VALLEY
LINE
ROBERTS
ROAD
timber yard
boom gate
toll gate
river reserve
heath
tanks
landing ground
scrub
Creek
5 cm
Note: Part of MAYDENA
1:25,000 topo-sheet
Silica sands
Silica rock
J.J.MCDONALD & SONS MINING PTY.LTD.
MAYDENA SANDS PROJECT
EXPLORATION LICENCE 17/98
RESOURCE LOCATION MAP
Scale: 1:25,000
FIG. 3
64215g

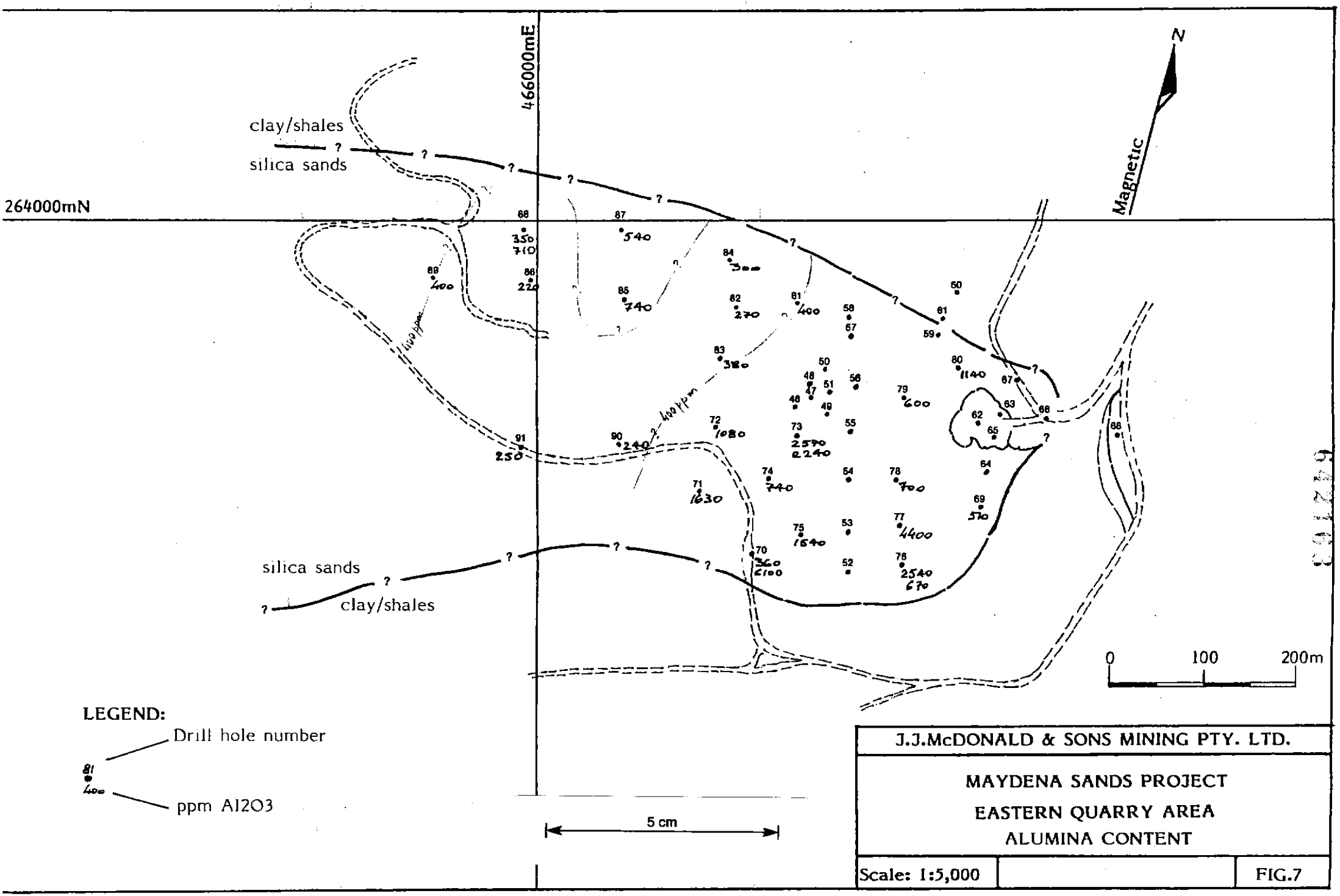

640000mE
660000mN
WESTERN QUARRY
EASTERN QUARRY
E.L.17/98
Pine Hill
Risbys Basin
Roberts Hill
Lorkins Plain
Kallista Creek
GORDON RIVER ROAD
MAYNES ROAD
STYX ROAD
Carpenters
Pillingers
Maydena Station
DERWENT VALLEY LINE
5 cm
ss Silica sands
sr Silica rock
q Quartzite
pq Pyritic quartzite
cq Cloudy quartzite
hs Haematitic sandstone
sc Siliceous conglomerate
sh Shale
sh/s Shale and sandstone
Note: Geology modified after Ellis (1988)
Note: Part of MAYDENA 1:25,000 topo-sheet
J.J.MCDONALD & SONS MINING PTY.LTD.
MAYDENA SANDS PROJECT
EXPLORATION LICENCE 17/98
GEOLOGY
Scale: 1:25,000
FIG.4

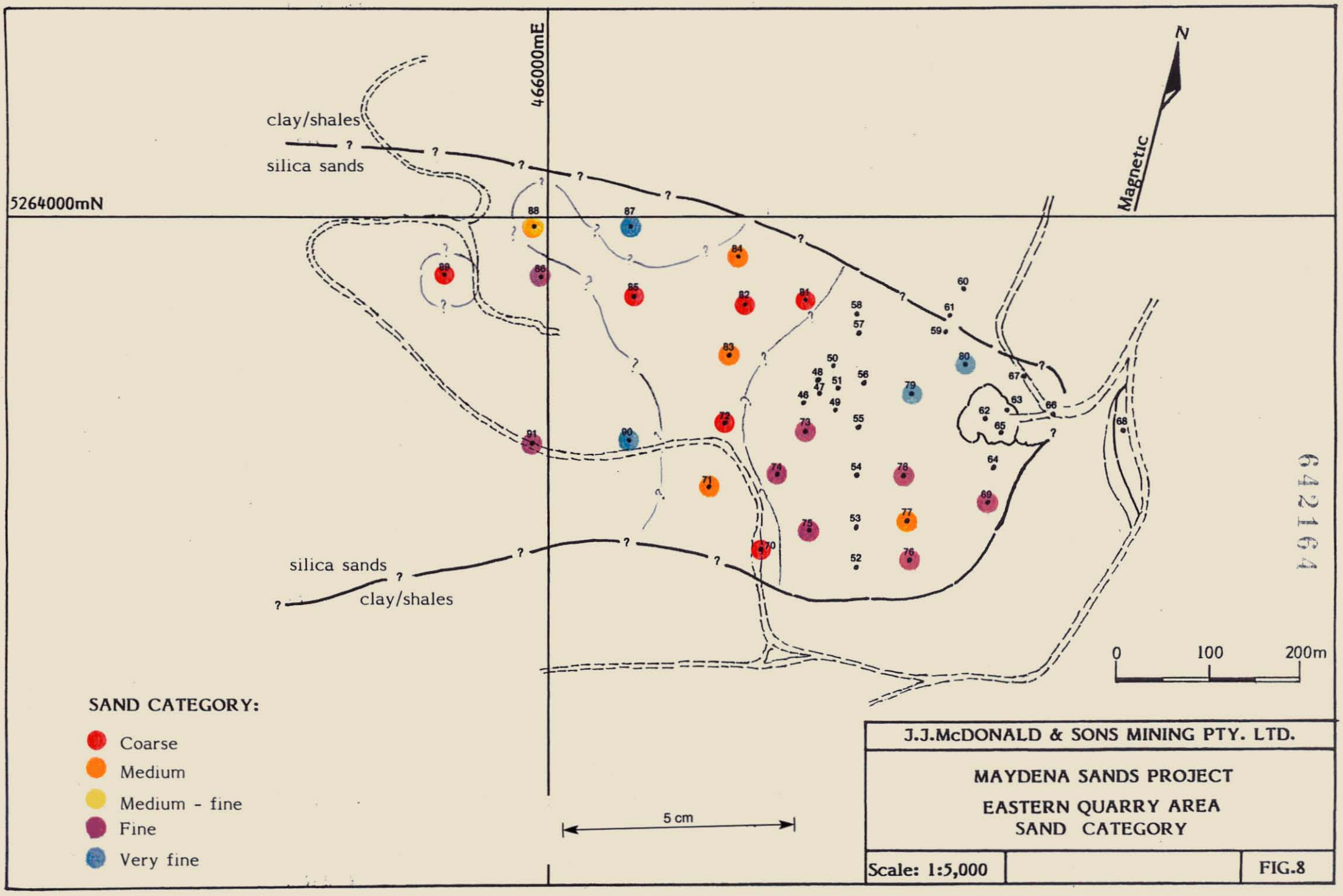
642160

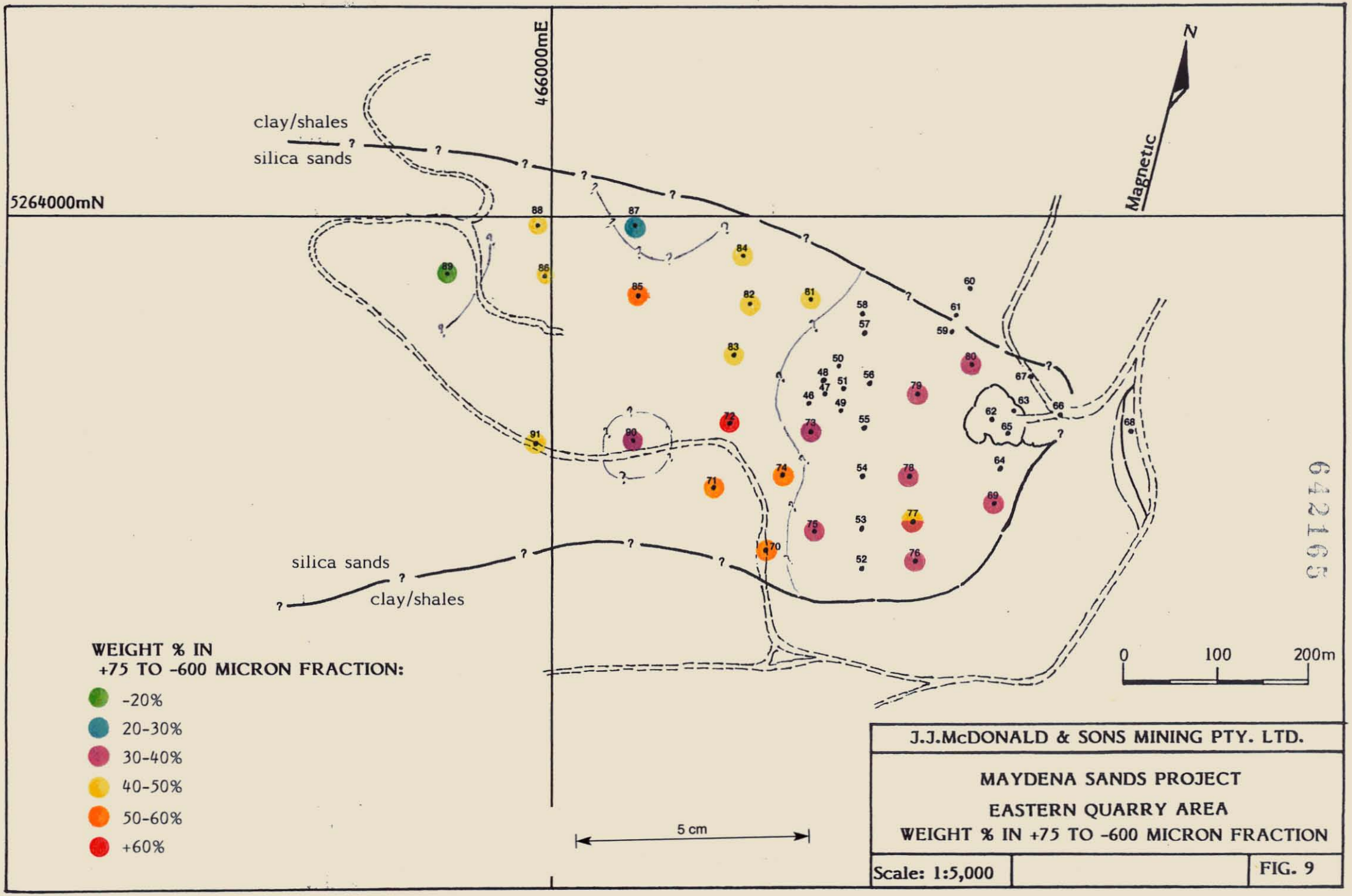

466000mE
264000mN
N
Magnetic
clay/shales
silica sands
silica sands
Clay,shales
500ppm
0
100
200m
5 cm
LEGEND:
Drill hole number
ppm Fe2O3 (Total in sample)
J.J.McDONALD & SONS MINING PTY. LTD.
MAYDENA SANDS PROJECT
EASTERN QUARRY AREA
IRON CONTENT
Scale: 1:5,000
FIG. 5



J.J.McDONALD & SONS MINING PTY. LTD.		
MAYDENA SANDS PROJECT EASTERN QUARRY AREA TITANIUM CONTENT		
Scale: 1:5,000		FIG. 6


466000mE
264000mN
N
Magnetic
clay/shales
silica sands
silica sands
clay/shales
400 ppm
400 ppm
0
100
200m
5 cm
LEGEND:
Drill hole number
ppm Al2O3
J.J.McDONALD & SONS MINING PTY. LTD.
MAYDENA SANDS PROJECT
EASTERN QUARRY AREA
ALUMINA CONTENT
Scale: 1:5,000
FIG.7


466000mE
5264000mN
clay/shales
silica sands
silica sands
clay/shales
N
Magnetic
0
100
200m
5 cm
SAND CATEGORY:
Coarse
Medium
Medium - fine
Fine
Very fine
J.J.McDONALD & SONS MINING PTY. LTD.
MAYDENA SANDS PROJECT
EASTERN QUARRY AREA
SAND CATEGORY
Scale: 1:5,000
FIG.8
6421664


466000mE
5264000mN
N
Magnetic
clay/shales
silica sands
silica sands
clay/shales
WEIGHT % IN
+75 TO -600 MICRON FRACTION:
-20%
20-30%
30-40%
40-50%
50-60%
+60%
5 cm
0
100
200m
J.J.McDONALD & SONS MINING PTY. LTD.
MAYDENA SANDS PROJECT
EASTERN QUARRY AREA
WEIGHT % IN +75 TO -600 MICRON FRACTION
Scale: 1:5,000
FIG. 9
6412165

SOUTH

642166

NORTH

5263900mN

Quartz outcrop

Silica Rock

RL 400m

Road 91

13m

86 Track

13m

88 Track

30m

SECTION 465985mE

Sand

Mudstone/ Shale

Scattered boulders of silica

Track

Track

Track

RL 400m

Road

90 Track

15m

85

4m

Track

87

12m

SECTION 466090mE

Sand

Mudstone/Shale

RL 400m

71(Proj. 2.5mE)

Road

5m

72 (Proj. 10mE)

6m

Track

Track

83 (proj. 3mE)

11m

Fault

82 (Proj. 14mW)

14m

84(Proj. 3mW)

18m

SECTION 466200mE

Sand

Mudstone/Shale

5cm

J.J.McDONALD & SONS PTY. LTD

MAYDENA SANDS PROJECT

EASTERN QUARRY AREA

DRILL SECTIONS

Scale: 1:1,000

FIG.11

SOUTH

642167 NORTH

5263900mN

SECTION 466332mE

RL 400m

52 53 54 55 56 57 58

Shale/ siltst. Sand Sand ? Sand Mudstone/ Shale

RL 400m

EASTERN QUARRY

(Proj. 19m E) (Proj. 5mW) (Proj. 22m E) (Proj. 31m E) (Proj. 59m E) (Proj. 56m E)

64 65 62 63 66 67 80 59 61 60

shale/siltstone sand Sand Clay Sand Mudstone/shale

(Proj. 54m W) (Proj. 39mE)

SECTION 466488mE

5 cm

Sand

? ?

Dolomite

J.J. McDONALD & SONS MINING PTY. LTD.

MAYDENA SANDS PROJECT

EASTERN QUARRY AREA

DRILL SECTIONS

Scale: 1:1,000 FIG. 12

N 5264400
N 5264000
N 5263800
N 5263600
N 5263700
N 5263500
E 480000

Magnetic North

Legend

- Track Edge
- Bank Top
- Bank Toe
- Works Area
- Major Contour/Form Line
- Minor Contour/Form Line
- Contour Number 404
- Spot Height & Label 403.3
- Vegetation Boundary
- Creek
- Drain
- Culvert
- Photo Control Point PC1

Drill hole 22

Silica Sand

Clay/shale

Tall timber - forest

Pine Hill - Maydena

Prepared for:

Brooks Lark & Carrick

By:

HECEC AUSTRALIA PTY LTD
SURVEY & GEOGRAPHIC INFORMATION SERVICES

'Innovative Solutions with Integrity.'

00_4441

Annual Report to end September 1999 - EL17/98 - Maydena
J.J MacDonald and Sons Mining Proprietary Limited*
EL17/98
Krummel, G.

1:1000

0 20 40 80
Metres

Contour Interval : 2.0 m

The information contained on this plan has been derived by photogrammetry from 1:7500 colour aerial photography.
Data acquisition was carried out using a "Zeiss P Series " analytical photogrammetric system

Enhancement of final plans was undertaken in MicroStation.

5 cm

Fig. 10

Photography: F401, Run 1 / 6 , 7 9-Jan-1999

Date: 14-Jan-1999	REVISION 0	G2865_1

642168