MAYDENA SANDS PTY LTD

ACN 111 938 428 ABN 65 111 938 428

RETENTION LICENCE NO. 2/2003

MAYDENA, TASMANIA

ANNUAL REPORT

TO

09 January 2015

GERHARD K. KRUMMEI

DECEMBER 2014

Suite 28, 487 St.Kilda Road, Melbourne Vic 3004 Australia
Telephone and Facsimile: 61 3 9820 2595

created using
BCL easyPDF
Printer Driver
Click here to purchase a license to remove this image

ABSTRACT

Activities to advance the Maydena Sands project continued despite the lingering global economic uncertainties which dampen demand for products based on high purity silica flour and sand. The recent fall in oil prices and the Australian dollar, if sustained over the longer term, could be advantageous to the project's economics.

Acid leach tests to clear iron stain and the use of coal spirals for the removal of carbon/organics from the sand, both showed promising results on which further work will be based in 2015.

Geological data digitisation has been completed, with the generation of a digital deposit model to assist with quarry planning purposes going forward.

Environmental Base Line Studies were completed, with no 'project stoppers' emerging.

Marketing activities continued with a focus on East Asia and, to some extent Australia, with mixed results.

Encouraging are the improvements achieved by TasRail and State Governments moves towards a solution to mitigate seaborne freight costs for products in and out of Tasmania.

Keywords:

Maydena; Silica flour;
Silica sand; Carbon;
Acid leach; Logistics.

created using
BCL easyPDF
Printer Driver
Click here to purchase a license to remove this image

C O N T E N T S

created using BCL easyPDF Printer Driver
Click here to purchase a license to remove this image

1. INTRODUCTION

This report outlines activities by Maydena Sands Pty. Ltd. during its tenth year of tenure of Retention Licence 2/2003, granted for a four year period to 9.01.2008 and then renewed annually to 09.01.2015.

This tenement has its origins in EL 17/1998 of 7sq.km previously held and operated by J.J. McDonald &Sons Mining Pty. Ltd. The current tenement of 4sq.km is located just south of the sealed Gordon River road approximately 4 km west south west of Maydena (pop. 250 approx.) and about 90 km by road from Hobart (Fig.1). There is good access to and within the prospect area. Power, water, housing and basic facilities are readily available from within a short radius of the prospect. The last few years saw the progressive upgrade of the narrow gauge New Norfolk-Maydena rail line to passenger standard but only as far as the entrance to the Mt Field National Park. After a recent assets review, TasRail resolved to hand over the Derwent Valley Railway line west of Boyer to tourist and heritage operators in a deal yet to be finalised. In this context, mooted upgrades to freight standard of the entire stretch are now highly unlikely. An alternative rail loading facility, a major freight hub at Brighton, approx. 65km by road east of Maydena has been completed and is now fully operational. A 700m long gravel airstrip is located 3 km north west of the silica sand deposit.

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

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

In view of the growing use of solar power locally and overseas, interest was also maintained in the silica rock potential of the tenement. This raw material, if of sufficiently high quality, is used in the production of high purity silicon metal, an essential component of photovoltaic solar cells. Also of potential interest is the coarser, higher purity sand fraction for use in the manufacture of technical glass, optical glass and solar cell cover glass with high light transmissivity characteristics.

created using BCL easyPDF Printer Driver
Click here to purchase a license to remove this image

2. PREVIOUS WORK

Exploration by Pioneer Silicon Industries Pty. Ltd. in 1988/89 identified a lag deposit of hard silica rock at the Western Quarry containing a small resource of material deemed suitable for the manufacture of silicon. (Fig.2). From this, approximately 19,500 tonnes of crushed, screened silica rock was produced in 1991 and 1992 for shipment, of which some10,000 tonnes were consigned to Pioneer's silicon smelter at Electrona and about 9,500 tonnes went to Temco's Bell Bay ferrosilicon plant. Extraction, by Duggans Pty. Ltd. under M.L.1396 P/M, virtually ceased upon closure of the Electrona smelter south of Hobart in 1992, although a small parcel of 850 tonnes of silica rock is reported to have been mined in 1995. At the end of the earlier exploration work, a small cutting of white silica sand, first exploited in the 1970s by ANM (now Norske Skog), was located between Pine Hill and the Styx Road in an area now known as the Eastern Quarry Area. Pioneer investigated this deposit in the vicinity of the Eastern Quarry by 23 shallow RC drill holes. Preliminary estimates suggested a resource in the order of some 0.75 – 1.5 million cu. m. of mostly low iron silica sand containing about 10% of high quality lump silica. Pioneer terminated operations at Electrona before any of this latter material could be used for silicon production.

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

During its tenure of EL 17/1998, which contained these deposits, J.J. McDonald & Sons Pty. Ltd., using the air core drill sampling method, completed 43 drill holes totalling 553 m which outlined a raw material resource of about 6 million tonnes of loose silica ranging in size from very coarse to very fine.

The drilling also demonstrated that the deposit is more variable, complex and higher in iron oxides and other impurities than previous data suggested.

created using
BCL easyPDF
Printer Driver
Click here to purchase a license to remove this image

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

Preliminary bench scale beneficiation and bulk sample processing tests, including acid wash tests on samples of the glass size fraction sand, showed that the -250 micron fraction could be upgraded to a high quality product containing only about 50ppm Fe_2O_3 without major environmental impact, with levels of iron as low as 10ppm a possibility.

Sources of good quality limestone and dolomite were noted in relative proximity to the silica sand deposit for eventual acid neutralization uses.

The company's activities in the marketplace identified the natural silica flour as potentially the deposit's most important component economically. This material provided the major focus for ongoing geological, processing and marketing activities, though the coarser size sand fractions and the hard-rock silica potential remain of interest for future attention under the appropriate market conditions.

In early 2004, EL tenure over the area was converted to a Retention Licence

In late 2004, Directors of J.J. McDonald & Sons Mining Pty. Ltd. formed a new holding and operating company, Maydena Sands Pty. Ltd., to which the Retention Licence and all of the former company's interests in the Maydena area were transferred in April 2005.

Since then, all activities are being conducted under the new Company name.

Details of past activities and outcomes are provided in reports listed in Sections 7 and 8 below.

created using
BCL easyPDF
Printer Driver
Click here to purchase a license to remove this image

3. ACTIVITIES FOR PERIOD

These included:

3.1 Work Done

- Geological – all available data was digitised with the aim to generate a deposit model.
- Palaeodating – radiocarbon dating undertaken.
- Beneficiation:

  First round of acid leach tests completed.

  Removal of carbon/organic particles from the silica flour and sand feed was investigated using coal spirals.

  The applicability of the IPJ (in-line pressure jig) to remove "heavies" from the silica sand feed is being investigated and assessed.

- Market related activities:

  Ongoing market research and monitoring – silica sand, silica flour, display panels, technical glass and polysilicon.

  Attendance at several important events including:

  - Austrade's Australia Week in China
  - China Glass 2014 – Shanghai – renewing contacts with –
    - Cencera Corporation – fused silica
    - Innoceram – China – fused silica
    - Ruitai Materials – Taiwan/China – silica refractories and fused silica
    - Sinoma Advanced Materials Co. Ltd. – China – fused silica
    - Zhanjiang Comefar Mining Industry Co. Ltd. – China – producer of raw materials for glass.
    - JinJing Group Co. Ltd. – China – Silica sand and flour

created using
BCL easyPDF
Printer Driver
Click here to purchase a license to remove this image

- Visit to Wuxi Ding Long Company – Wuxi/China – mining, trading, manufacturing and warehousing company.

- TasInvest Forum – focus on Chinese investments in Tasmania – generated contact with –
  - GaoYou Group – silica flour
  - Shandong Qingzhou Micropowder Co. – silica flour, silica powder
  - China United Assets Appraisal Group – investment

In addition, Contacts or Meetings with:

- Glass House and Art Glass production centres in Canberra, Adelaide - silica flour
- James Dodson, Tasmania, Glassblower – Silica flour
- SDI - Australia – Silica flour
- Danny Wong – China – Glass network product promotion to China
- Quality Minerals & Chemicals – India – Sellers and traders
- BRK Minerals – India – Silica flour (?Trader)
- Bhanwal Mine Chem – India – Supplier of silica products
- Maghsand Porcelain Inc. – Iran – Porcelain manufacturer – not relevant
- Alarab Shevczenko – Taiwan – Trader
- Samsung – S.Korea – Silica flour - Exited display panel production
- Shinwon Materials, S.Korea – Silica flour, silica sand
- Piramal Glass Ltd. – Raw materials for glass production to US
- Ozan Tuzcar – Turkey – Silica flour
- SIBELCO - International - Silica flour, silica sand

created using
BCL easyPDF
Printer Driver
Click here to purchase a license to remove this image

- Project Planning:
    - Beneficiation and geology-related activities as described above.
    - Completed Environmental Base Line Studies.
    - Completed topo survey of proposed processing area.
    - Occasional update contact with Toll Tasmania re the logistics scene in Tasmania.
    - Meeting with ANL re logistics, esp. seaborne transport.
    - Meeting with TasPorts re port facilities.
    - General monitoring of transport logistics systems in Tasmania – Including TasRail upgrade progress.
    - Productivity Commission – Tasmanian Shipping and Freight.

- Community relations:

  Occasional contacts with Maydena Development Association.

- Environmental

  No action required.

3.2 Statistical Summary

<u>Test Samples generated</u>:

Drill chip check-sample composites	:	4 x 5 Kg
Carbon dating	:	1 x 10 gm
Acid leach – additional	:	3 x 2 Kg
Acid leach – check samples	:	5 x 30 gm Kg
Coal Spiral tests	:	1 X 70Kg approx
	:	1 X 130Kg
IPJ test	:	1 X 17Kg

created using
BCL easyPDF
Printer Driver
Click here to purchase a license to remove this image

No. of Samples Analysed	:	26 (approx.)
No. of Analyses	:	168 (approx.)

3.3 Expenditure

To Dec 2013 (RL Tenure only)	:	$983,483.00
Period Jan – Dec 2014		
(Including Oct – Dec 2014 Estimate)	:	$113,956.00 (approx)
Estimated Cumulative Total		
for period of RL Tenure (to Dec 2014)	:	$1,097,439.00 (approx)

4. RESULTS

4.1 Geological

4.1.1 Data Digitisation

This was one of the major projects undertaken by Melbourne-based AMC Consultants for Maydena Sands during the latter half of the year under review.

Based on the new DGA 1994 grid, to date all previous assay and geological data relating to the Eastern Quarry sand deposit at Pine Hill has been digitised, allowing the production of computer-generated, topo-contour based drill hole location plans, surface geology plans, geological and assay cross sections, as well as a 3-D interactive deposit model. This should significantly assist with quarry layout planning and on-going deposit assessment. The project is virtually completed with a report pending

4.1.2 Radio Carbon Dating

The Geoconservation survey, which was part of the Environmental Base Line Studies, identified a near surface occurrence of charcoal-rich silica sand with fragments and particles in the sand at GDA co-ordinates 5264052N 466601E (MacIntosh 2013) along the north eastern edge of the deposit.

created using
BCL easyPDF
Printer Driver
Click here to purchase a license to remove this image

Following the suggestion that this material might provide an indication of an age of deposition of the silica sand, the minimum of about 10gm of coarse-particle charcoal was collected for dating. This proved much more difficult than first envisaged. As the material was very friable, a considerable amount of time and effort was expended to extract suitably-sized fragments for first stage clean-up, including the removal of organic contaminants.

The radiocarbon dating method was selected as the most appropriate approach using this material. A brief description of this work, facilitated by P. McIntosh of the Forestry Practices Authority of Tasmania, is given in Appendix 1. It was undertaken by the Radiocarbon Dating Laboratory, The University of Waikato, NZ

The maximum radiocarbon age obtained using the AMS spectrometer was around 40,600 years BP. This is comparable to the ages of 52,800 yrs BP and around 31,600 yrs BP obtained for carbon in two palaeosoil horizons in a roadcutting in nearby Maynes Road (McIntosh et al 2012). It is also considerably younger than the maximum 2.6 my BP age suggested by dating pollen from material in drill hole 71 (Krummei 2011).

4.1.3 Native Metals and Alloys

Previous mineralogical inspections of the silica sand and flour and derived magnetic products indicated the presence of native metals and alloys (Mather in Krummei, 1999 and in Krummei, 2002) interpreted at the time to be most likely drill-derived contaminants.

SEM scans of silica flour material in 2011 (Krummei, 2012) revealed minute traces of native Fe and Ti, as well as alloys of Fe-Ni-Cr and Fe-V-Ti-Ni, the origins of which are enigmatic in this setting and in no way drill-related.

Preliminary discussions regarding research into these materials at UTAS/CODES were suspended when significant cost escalations were flagged as a result of administrative changes affecting the Geology Department at UTAS.

created using
BCL easyPDF
Printer Driver
Click here to purchase a license to remove this image

4.2 Beneficiation

4.2.1 Oxalic Acid Leach Tests

There were two aspects to the oxalic acid leach tests undertaken this year.

4.2.1.1 Oxalic acid leach tests undertaken on six small variously iron-stained sand samples undertaken in 2013 (Krummei 2013) on raw feed ranging from 2.83% – 0.383% Fe_2O_3 were successful in reducing iron content to final levels of 20-30ppm Fe_2O_3. Though a significant result, the target of 10ppm or less of Fe_2O_3 for was not achieved, possibly due to a leach barrier and perhaps also due to minor amounts of residual, iron-bearing, fine carbon particles. The leach barrier concept was tested on the +40-250 micron fraction on sample 101B-1/A which was a subsample of 101B-1 collected from a previously dug pit next to drill hole 101 at AGD 1966 co-ordinates 5263882mN 465983mE.In previous investigations a particular high intensity wet magnetic separation procedure used to clean up the -40-250 micron fraction of sample 101B-1 yielded an end product assaying 10ppm or less of Fe_2O_3.

It was decided to investigate if an oxalic acid leach on this material would be able to match, or improve on, the results obtained by the high density wet magnetic procedure.

The procedures adopted for this test and the results are detailed in Appendix 2. Particular attention in this instance was paid to the roll speeds of the magnetic units used and the presence or otherwise of black carbon particles. The best result obtained was 20ppm Fe_2O_3 from the bromoform sinks, which was short of the target of 10ppm Fe_2O_3. There was also some indication that the removal of carbon specks was of benefit, as evidenced ultimately by the low iron content of the bromoform sinks.

4.2.1.2 The second aspect of the leach tests followed on from the results above to investigate more closely the effect of removing carbon particle contaminants in lowering iron levels in silica flour and sand end products. Washed and deslimed samples TO729-40250 and TO729-250600, both with significant residual content of carbon particles were used. They are the +40-250 micron and +250-600 micron fractions respectively of a sub-sample of bulk sample 101B-3 from a pit at drill hole site 101 at AGD 1966 co-ordinates site

created using
BCL easyPDF
Printer Driver
Click here to purchase a license to remove this image

5263882mN, 465893mE. Each fraction was split into two parts for comparative tests. The procedures and results are described in Appendix 3. In either case, iron levels below 20ppm Fe_2O_3 were not achieved. However, the use of a Superpanner proved effective in removing visible carbon particles, which were found to have relatively high iron content. The result was a reduction in iron content of both materials, by 28% in the finer sample and by 20% in the coarser sample. Thus, the removal of carbon and organics from the silica feed is desirable to lower the iron content of the end products. As there are no Superpanners that can handle commercial quantities of feed, enquiries were made about the applicability of other technologies suited to remove carbon and organics from the silica sand feed. It was suggested that coal spirals be trialled. These successfully and effectively separate rock waste from coal.

4.2.2 Carbon Removal

Carbon removal from feed results in:

- A better visual product impact
- Further reduction or removal of iron and other metallic contaminants in end product
- Expansion of the resource envelope by rendering near-surface, carbon-bearing material potentially viable.

Use of Coal Spirals was identified as a potentially effective method of achieving the above aims. Test facilities were hired at Mineral Technologies, Carrara, Queensland – the recognised experts in this field.

Samples for this purpose were obtained from heavily carbon/charcoal contaminated material at Site 5264052mN, 466601mE, GDA 1994. This site also provided the charcoal for the radiocarbon dating project described above.

Details of procedures, equipment used and results feature in Appendix 4.

created using
BCL easyPDF
Printer Driver
Click here to purchase a license to remove this image

Best results to date were achieved using a 7-turn spiral, with carbon-free product recovery potentially raised from 65% to around 86%, subject to the introduction of a desliming and sizing step. The addition of another bank of 7-turn spirals could also further improve recovery of carbon-free product.

4.2.3 IPJ Test

The In-line Pressure Jig Technology was developed by GEKKO of Ballarat, Vic. as a simple, low cost method to separate "heavies" such as gold, tin/tungsten and ilmenite/rutile in heavy mineral sands from material of lower density.

After scoping discussion, it was thought possible that the method might have application to separate contaminants such as iron minerals, chromite, ilmenite, rutile, chrome spinel, apatite and other "heavies" from the silica sand.

Unfortunately no laboratory IPJ test equipment exists. Based on past experience, GEKKO proposed the use of a Wilfley Table as a proxy. The test work and results are set out in Appendix 5. The results are incomplete and ambiguous to date. Some more work, including assaying, is required for a more definitive conclusion.

4.3 Project Planning

4.3.1 Plant Site

The planned topographic contour survey of the proposed plant site was completed. The latter site of 7ha is located in clear-felled coupe 37G, some 800m north, and downhill, from the silica sand deposit and close to the sealed Gordon River Road. The site has been re-seeded by Forestry Tasmania with new re-growth evident.

Steps are being taken to integrate this latest information with a previously generated, less detailed contour map of the area produced photogrammetrically.

created using
BCL easyPDF
Printer Driver
Click here to purchase a license to remove this image

4.3.2 Environmental Base Line Studies

Environmental Baseline studies, commenced last year, continued through into 2014, using SEMF Consultants of Hobart.

Current status:

- Call back surveys and night spotting, parts of the Flora and Fauna Surveys have been completed. No adverse findings.

- Heritage Surveys – Completed.

  - Aboriginal Heritage: No issues: AHT approval received.

  - European Heritage: Minor sites of interest identified – mostly timber industry related and confined largely to the NE sector of the tenement. Issues identified are manageable and are not “show stoppers”.

4.3.3 Logistics

Rail:

Reliable rail freight facilities remain critical to the Maydena Sands Project so as to get product to port and markets beyond. It was therefore pleasing to note that TasRail made substantial progress in 2014 to provide a well integrated, fit-for-purpose freight network for Tasmania (TasRail, 2014). Relevant to the Maydena Sands Project is the acquisition and commissioning of a fleet of 17 new generation locomotives. 120 new intermodal wagons, suitable to carry containers have also been commissioned and are now in use. To June 2014, a total of 37,034 TEU’s were railed, representing an 8% increase in the general container freight segment. Track upgrades on prioritised sections from Brighton to Burnie were completed. Four life-expired, major railway bridges on the North West coast were replaced in order to improve rail transit times, operational safety and reliability.

created using
BCL easyPDF
Printer Driver
Click here to purchase a license to remove this image

The intermodal Transport Hub at Brighton secured a major anchor tenant and is now fully operational. This paved the way for the relocation of all rail operations from the Hobart rail terminal to Brighton which now offers Maydena Sands a pit-to-port transport solution. The result of all these efforts to date is that TasRail is well set to become a significant economic enabler for Tasmania.

Ports:

Despite the re-opening of the rail line from Launceston to Bell Bay and the refurbishment of the Bell Bay Intermodal Terminal at Georgetown (Krummei 2013) it is disappointing to note that no significant progress has been achieved to secure regular container shipping services from Tasmania to Asia. The only current alternative is trans-shipment via the ports of Burnie and Melbourne. This is particularly detrimental to containerised goods because of the added high shipping costs across Bass Strait.

A meeting with ANL indicated that the company might be able to assist with cost reductions, but again via the ports of Burnie and Melbourne at this time.

There are indications that the Swire Group of Singapore, recently chosen by the Tasmanian Government as its new international shipping partner, may resume some manner of service for container shipments to Asia.

But current debate of the matter tends to favour the recommendation of the Productivity Commission to extend Freight Equalisation Scheme now in place to goods to and from overseas destinations (Productivity Commission 2014).

Road:

Road freight costs will be reviewed about mid 2015 if the fall in oil prices across the globe shows signs of becoming a medium to long term feature. The benefit of recent lower oil prices, if sustained, may also be reflected in reduced road and also rail freight charges.

created using
BCL easyPDF
Printer Driver
Click here to purchase a license to remove this image

4.4 Marketing

The main focus was again on TFT-LCD and other display glass, optical, technical and solar cell cover glass and, to a very much lesser extent, on PV polysilicon.

4.4.1 Overview - Polysilicon

The market outlook for high purity silica rock ex Tasmania as a raw material for the production of polysilicon for the PV industry remains unattractive and uneconomic, with polysilicon spot prices continuing to hover at around a low USD$20/kg despite some increase in demand. Further downward pressure on polysilicon prices will be exerted in the future by new, efficient and cost effective production technologies, such as the high pressure fluidised bed reactor, now under trial. There is also a growing risk that polysilicon may be replaced over time by perovskite, a potential game-changer in the silicon/PV industry, as it is easier and cheaper to produce than polysilicon and a more efficient converter of light to electricity. Notably, in China, by end of May 2014, the number of polysilicon manufacturers decreased from 80 in 2011 to less than 30. Chinese government policies aimed at the polysilicon industry there may, ultimately, result in only around 20 manufacturers of polysilicon. These are some of the factors which continue to deter further involvement with silica rock for the polysilicon/PV industry and reinforce the ongoing focus on high purity silica flour and sand products form the silica sand deposit at Pine Hill.

4.4.2 Overview – Display Glass

On a brighter and more encouraging note for silica flour and sand, demand growth for TFT-LCD glass substrates is steady, rising slightly in part due to increases in the average sizes of TV screens. Annual glass area capacity growth for 2014 is forecast to be around a rather slow 4%, indicating a maturing TFT-LCD business. But demand in the segment of cover glass for smart phones and tablet PCs has continued to grow apace, causing TFT-LCD producers to shift production from soda-lime to aluminosilicate glass. These positives reinforce Maydena Sands' ongoing focus on high purity silica flour and sand at Pine Hill.

created using
BCL easyPDF
Printer Driver
Click here to purchase a license to remove this image

4.4.3 Marketing Activities

Austrade

Participation in the Shanghai leg of the Australian Week in China, a part of the Australian Government Trade Mission to Asia in April. 2014, (Free Trade Agreements signed with Japan and S. Korea and under negotiation with China at the time –now signed) did not result in any direct off-take contacts. However, it provided good contacts with both China and Australia-based Austrade personnel for future approaches and assistance. Associated seminars provided good guidelines on doing business in China and with Chinese companies. Contact and meeting with Austrade representative in Hobart achieved.

China Glass 2014 – Shanghai

This annual exhibition was a bit smaller and seemingly less well attended than previous shows, indicating that the Chinese glass industry is under stress.

New opportunities were identified last year for low iron sand to produce high purity glass cullet for the manufacture of fused silica, such as used in rollers etc, in the glass industry. Potentially useful contacts re-established were with: Cencera Corp., Sonoma Advanced Materials, Ruitai Materials, Innoceram, Tongshu (largest LCD glass manufacturer in China), Vesuvius. Concern was expressed that our material might be too expensive and would have to compete with readily available, cheaper, locally (China) sourced high quality cullet.

Wuxi Ding Long Company was visited in Wuxi to build long-term relationships. This garnet miner and commodity trader, with warehousing facilities at several Chinese ports, remains a useful contact. It also manufactures bulk bags, of which a sample was obtained.

Hong Kong-based Zhanjiang Comefar Mining Industry Co. Ltd., which operates several mines in south east China, indicated interest to buy product or even the deposit, among other options. When an indicative price of USD$400/t CIF China for silica flour was mentioned, the company lost interest and did not resume contact.

created using
BCL easyPDF
Printer Driver
Click here to purchase a license to remove this image

TasInvest

This 3-day event, held in Hobart in November 2014, was structured around the Chinese president's recent visit to Australia and Tasmania and the signing of the Australia-China Free Trade Agreement. There were about 300 participants, of which some 100 were from China, with investment interest mainly in agriculture, aquaculture, tourism, construction and services. Mining did not feature prominently and attracted only muted interest. Language was a serious barrier to meaningful discussion, though a few willing interpreters of Chinese background, both paid and volunteer, were present to assist.

Three companies, China United Assets Appraisal Group (Australia), Shandong Qingzhou Micropowder Co Ltd. and the Guo You Group showed some interest in the Maydena silica sands. The latter Group expected a low price of about USD$200/tonne for silica flour in the 40-80 micron size range for solar glass.

Also, a potentially useful contact with an apparently competent, Sydney based interpreter group eventuated.

Other

Maydena Sands' portal with the glassglobal marketing platform is reported to have recorded some 20,039 search enquiries, though conversion rates to actual contacts cannot be gauged.

However, it is clear that the global economic malaise continues to affect this sector. The number of enquiries received for product during the year for various applications were at a reduced rate and frequency and mostly for small quantities only. These came from Australia, China, India, Iran, Taiwan, Turkey, S.Korea. Of these, the most interesting were from Shinwon Minerals, S.Korea, Sibelco (Asia), and SDI, Melbourne. Contact is being maintained with a major company which tested the Maydena Sands raw material and concluded that it can be processed to a very good quality with the +200 mesh (+75micron) material. A new lead for high purity silica flour and sand emerged, and confirmed, for high quality glass

created using
BCL easyPDF
Printer Driver
Click here to purchase a license to remove this image

and art glass production by glass artists and glassblowers in mainly SE Australia, but for small quantities only, unlikely to exceed 100tpa.

Disappointing is the exit of Samsung from its TFT-LCD production JV with Corning in S. Korea early this year. The JV is now 100% Corning owned.

Details of contacts are provided in Section 3.1.

4.5 Environmental

This year's activities had no environmental impacts.

4.6 Rehabilitation

No rehabilitation was necessary.

4.7 Community Relations

Occasional contacts with members of the Maydena Development Association were maintained.

created using
BCL easyPDF
Printer Driver
Click here to purchase a license to remove this image

5. CONCLUSIONS AND RECOMMENDATIONS

- The global PV polysilicon industry, particularly in China, remains under pressure due to persisting low price levels and high production costs. This discourages further interest in high purity silica rock as a feed for polysilicon production.

- There appears to have been a slight increase in the demand for high quality display glass interpreted to be in part due to higher production of smart phones, iPads and tablet PCs which also requires a shift to aluminosilicate cover glass.

- Marketing and promotion activities this year again generated several useful contacts though the number of enquiries was down year-on-year.

- Radiocarbon dating yielded a relatively young date of max. 40,600y BP for part of the silica sand deposit, suggesting it may not have been heavily impacted by recent glacial activity.

- Oxalic acid tests this year, though yielding significant results, again appear to have struck a leach barrier at about 20-30ppm Fe_2O_3, hinting at the possibility of a second grade product at about that purity level.

- The iron stained sand in drill holes just west of the Eastern Quarry could be test leached. A successful outcome could increase the resource inventory.

- In-line Pressure Jig test proved inconclusive so far. Some minor work and assays are required to bring the matter to a conclusion.

- The use of coal spirals to remove carbon/organics from the sand was successful, though yields of carbon-free material could be improved. This possibility should be further tested.

created using
BCL easyPDF
Printer Driver
Click here to purchase a license to remove this image

- Data digitisation produced a deposit model which will be useful for pit layout planning.
- The Environmental Base Line Studies were completed and indicated no "project stoppers". A few minor manageable issues will need to be addressed before site development.
- Land transport facilities, especially rail, show significant improvement. Seaborne shipping and associated costs remain of concern and has received some attention from State Government.

created using
BCL easyPDF
Printer Driver
Click here to purchase a license to remove this image

6. PROPOSED FUTURE ACTIVITIES

- Complete minor work associated with GEKKO's IPJ tests.
- Expand oxalic acid leach tests to select iron-stained drill chips from holes west of Eastern Quarry to add to resource base.
- Conduct further coal spiral tests to maximise carbon-free silica sand and flour recovery.
- Continue to encourage and support investigations at/by CODES/UTAS researchers into the nature and origin of native metals and alloys found in the silica material.
- Progress quarry and process plant design, site layout and capex/opex estimates.
- Work towards determining a reliable mine gate, FOB and CIF product price.
- Continue with product awareness and marketing, including attendance at China Glass 2015, FPD China Trade Show 2015, Gulf Glass 2015, as well as follow-up activity on 2014 market contacts, opportunities and enquiries, with the aim to secure off-take arrangements.
- Continue monitoring logistic support systems in Tasmania.
- Maintain contact with State and Local Regulatory Authorities, as well as local civic associations, groups and individuals on project related matters.

created using
BCL easyPDF
Printer Driver
Click here to purchase a license to remove this image

7. REFERENCES

Barnes, R. et al.	2013	Maydena Sand Mine Project: Ecological Assessment and Recommendations. SEMF Report for Maydena Sands Pty. Ltd.
Keserue-Ponte, F.	2013	Maydena Sands – Base Line Water Summary. SEMF Memorandum.
Krummei, G.K.	2004	Retention Licence No. 2/2003, Maydena, Tasmania. Annual Report to 09.01.2005
Krummei, G.K.	2005	Retention Licence No. 2/2003, Maydena, Tasmania. Annual Report to 09.01.2006
Krummei, G.K.	2006	Retention Licence No. 2/2003, Maydena, Tasmania. Annual Report to 09.01.2007
Krummei, G.K.	2007	Retention Licence No. 2/2003, Maydena, Tasmania. Annual Report to 09.01.2008
Krummei, G.K.	2008	Retention Licence No. 2/2003, Maydena, Tasmania. Annual Report to 09.01.2009
Krummei, G.K.	2009	Retention Licence No. 2/2003, Maydena, Tasmania. Annual Report to 09.01.2010
Krummei, G.K.	2010	Retention Licence No. 2/2003, Maydena, Tasmania. Annual Report to 09.01.2011
Krummei, G.K.	2011	Retention Licence No. 2/2003, Maydena, Tasmania. Annual Report to 09.01.2012
Krummei, G.K.	2012	Retention Licence No. 2/2003, Maydena, Tasmania. Annual Report to 09.01.2013
Krummei, G.K.	2013	Retention Licence No. 2/2003, Maydena, Tasmania. Annual Report to 09.01.2014
McIntosh, et.al.	2012	Late Quaternary extraglacial cold-climate deposits in low and mid-altitude Tasmania and their climatic implications. Geomorphology 129, p. 21-39.
McIntosh, P.D.	2013	Maydena Sands Investigations. Contract report for Maydena Sands Pty Ltd. September 2013. Forest Practices Authority, Hobart.
Productivity Commission	2014	Tasmanian Shipping and Freight Australian Govt Productivity Commission Report 2014.
TasRail	2013	Annual Report 2012-2013
TasRail	2014	Annual Report 2013-2014

created using
BCL easyPDF
Printer Driver
Click here to purchase a license to remove this image

8. BIBLIOGRAPHY

Bear, I.J.	1975	Technical Note on the identification and Removal of Stain from Zircon Concentrates: AusIMM Proc.No.256 pp 29-31
Calver, C.R.	1990	Limestone Resources of the Maydena-Florentine Valley Area: Tas. Dept. of Mines Report 1990/06
Calver, C.R.	1992	Maydena DDH 1 – Appraisal of the Limestone Resource at Risbys Basin: Tas. Dept. of Mines Report 1992/03
Calver, C.R. & Forsyth, S.M.	1999	Maydena, Tasmania; Digital Geological Atlas, 1:25,000 Series: Tasmanian Geological Survey
Eberhard, R	1994	Inventory and Management of the Junee River Karst System, Tasmania; Forestry Tasmania Report
Forster, M.C.	1992	E.L. 14/88 Maydena, Annual Report – Year 4
Forster, M.C.	1993	E.L. 14/88 Maydena, Annual Report – Year 5
Forster, M.C.	1994	Maydena – Tasmania, Pine Hill High Grade Silica, June 1994
Hansard.	2011	House of Assembly – Government Business Scrutiny Committee – TasRail – 08.12.2011
Hofmann, T.	2009	Applications, Requirements and Trends in the Solar Glass Market. In “Glass Worldwide”, November 2009, p.74.
Houshold, L	1992	Risbys Basin Karst Area – Preliminary Investigation of Geomorphic Features and Cave Fauna. Dept. of Parks, Wildlife & Heritage Report.
Hughes, T.D.	1957	Limestones in Tasmania; Geol. Surv. Tas. Bull. 10
Hughes, T.D. & Everard, G.B.	1953	Limestone Deposits of the Maydena Area; Geol. Surv. Tas. Unpubl. Rept.
Jones, P.A.	1989	Exploration Licence No. 14/88, Maydena, Tasmania. Progress Report on Exploration Activity. 5th August 1988 to 5th July 1989.
Krummei, G.K.	1999	Exploration Licence No. 17/98, Maydena, Tasmania. Annual Report to End September 1999.
Krummei, G.K.	2000	Exploration Licence No. 17/98, Maydena, Tasmania. Annual Report to 04.09.2000.
Krummei, G.K.	2001	Exploration Licence No. 17/98, Maydena, Tasmania. Annual Report to 04.09.2001.
Krummei, G.K.	2002	Exploration Licence No. 17/98, Maydena, Tasmania. Annual Report to 04.09.2002.

created using
BCL easyPDF
Printer Driver
Click here to purchase a license to remove this image

Krummei, G.K. 2003 (a) Exploration Licence No. 17/98, Maydena, Tasmania. Relinquishment Report

Krummei, G.K. 2003 (b) Exploration Licence No. 17/98, Maydena, Tasmania. Annual Report to 04.09.2003.

McGowan, A 1992 Risbys Basin Karst Area – Survey of Cultural Values and Impact of Proposed Access Tracks and Drill Sites. Tas. Dept. Parks, Wildlife and Environment Report.

Nieminen, R. 2009 Glass Processing Opportunities for the Solar Industry. In "Glass Worldwide", November 2009, p.80 et seq

Osterloh, S 2002 Origin of the Maydena Silica Flour and Bedrock Silicification, Tasmania. B.Sc (Hons.) Thesis; CODES; School of Earth Sciences, University of Tasmania

Patterson, W 1990 Exploration Licence 14/88 – Maydena. Annual Report on Exploration Activity. 6th July 1989 to 4th August 1990.

TasRail 2011 Annual Report 2010-2011

TasRail 2012 Annual Report 2011-2012

Wrigley, P.K. 1992 Surface Exploration of the Limestone Resource at Roberts Hill, Maydena. Tas. Dept. of Mines Report 1992/32.

Wrigley, P.K. 1993 Evaluation of the Limestone Resource at Roberts Hill, Maydena. Tas. Dept. of Mines Report 1993/03.

created using
BCL easyPDF
Printer Driver
Click here to purchase a license to remove this image

APPENDIX 1

RADIO CARBON DATING

created using
BCL easyPDF
Printer Driver
Click here to purchase a license to remove this image

THE UNIVERSITY OF
WAIKATO
Te Whare Wānanga o Waikato

Private Bag 3105
Hamilton,
New Zealand.
Ph +64 7 838 4278
email c14@waikato.ac.nz

Radiocarbon Dating Laboratory

Tuesday, 4 November 2014

Report on Radiocarbon Age Determination for Wk- 40097

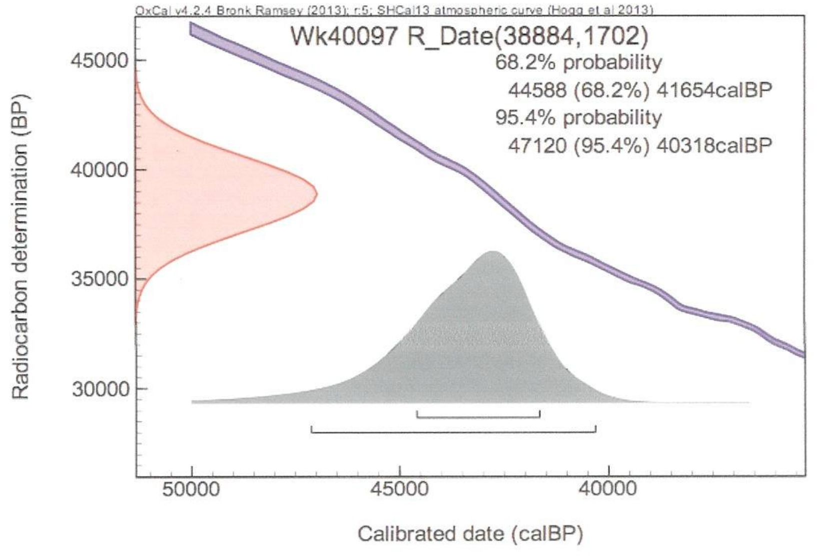
Submitter	P McIntosh
Submitter's Code	Maydena sands
Site & Location	Tasmania, Australia
Sample Material	Charcoal
Physical Pretreatment	Sample cleaned.
Chemical Pretreatment	Sample washed in hot HCl, rinsed and treated with multiple hot NaOH washes. The NaOH insoluble fraction was treated with hot HCl, filtered, rinsed and dried.

$D^{14}C$	-992.1 ±	1.5 ‰
$F^{14}C\%$	0.8 ±	0.2 %
Result	**38,884 ± 1702 BP**	

(AMS measurement)

Comments

Please note: Because of the small size of this sample, the Carbon-13 stable isotope value ($\delta^{13}C$) was measured on prepared graphite using the AMS spectrometer. The radiocarbon date has therefore been corrected for isotopic fractionation. However the AMS-measured $\delta^{13}C$ value can differ from the $\delta^{13}C$ of the original material and it is therefore not shown.



- Explanation of the calibrated Oxcal plots can be found at the Oxford Radiocarbon Accelerator Unit's calibration web pages (http://c14.arch.ox.ac.uk/embed.php?File=explanation.php)
- Result is *Conventional Age or Percent Modern Carbon (pMC)* following Stuiver and Polach, 1977, Radiocarbon 19, 355-363. This is based on the Libby half-life of 5568 yr with correction for isotopic fractionation applied. This age is normally quoted in publications and must include the appropriate error term and Wk number.
- Quoted errors are 1 standard deviation due to counting statistics multiplied by an experimentally determined Laboratory Error Multiplier.
- The isotopic fractionation, $\delta^{13}C$, is expressed as ‰ wrt PDB and is measured on sample CO_2.
- $F^{14}C\%$ is also known as *Percent Modern Carbon (pMC)*.

AG Hogg

created using
BCL easyPDF
Printer Driver
Click here to purchase a license to remove this image

APPENDIX 2

OXALIC ACID LEACHING

SAMPLE 101 B-1A

created using
BCL easyPDF
Printer Driver
Click here to purchase a license to remove this image

MAYDENA SANDS
SAMPLE 101B-1A
21/01/14

1. BACKGROUND

A series of experiments was carried out, aimed at investigating the possibility of using a combination of dry magnetic separation and oxalic acid leaching for the removal of iron contamination from silica particles from the +45-250 micron fraction contained in mostly heavily iron-stained sand intercepts in drill holes 87 and 102 at the Pine Hill silica sand deposit, Maydena, Tasmania.
This work involved samples 70312 OX, 70413 ROX, 70210 OX, 70210 ROX, 70311OX and 70419ROX and was reported in September 2013. Residual iron levels of 30-40 ppm Fe_2O_3 were obtained, which are similar to results obtained in previous investigations using sulphuric acid leaching.
However, in a previous investigation, the +40-250 micron fraction of Sample 101B-1, from a different area of the same deposit, had been deslimed, washed and then subjected to a particular high intensity wet magnetic separation procedure, as a result of which a non-magnetic fraction was produced containing only 10 ppm Fe_2O_3.

2. PROCEDURE

As it is highly desirable that residual Fe_2O_3 levels be reduced to 10 ppm, it was decided that the procedure used in the work involving samples 70312 OX, 70413 ROX, 70210 OX, 70210 ROX, 70311OX and 70419ROX , should be repeated, using material from sample 101B-1.
Accordingly, a small sub-sample of 101B-1 was obtained and labelled as sample 101B-1A. From this sample a +40-250 micron fraction was generated, deslimed, washed and then dried.
This fraction was then subjected to high intensity magnetic separation using a Reading Dry Roll Magnetic Separator at maximum field strength (15,000 gauss). As previous work had indicated that a slower roll speed may be beneficial, the sample was split into two fractions. One fraction was separated at 80 rpm roll speed as before (labelled as 80 rpm N/M) and the other at a slower 60 rpm roll speed (labelled as 60 rpm N/M).
It was also noticed that the non magnetic fractions in each case contained considerable visual organic particles (black dots). It was decided to split off a portion of the 60 rpm N/M fraction and to subject this to bromoform sink/float separation at Sg 2.2, in an attempt to remove the "black dots". This appeared to be partially successful, in that most of the "black dots" floated, whereas all of the silica particles sank.

The bromoform sink was recovered, washed with methylated spirits and dried, to produce a fraction labelled as "60 rpm N/M Bromoform Sink".
The three fractions, namely the 80 rpm N/M, the 60 rpm N/M and the 60 rpm N/M Bromoform Sink, were then subjected to Oxalic Acid leaching at the optimum conditions established in the previous investigation (10% solids, 20 gpl oxalic acid, 5 hour leach duration).
Samples of the +40-250 micron fraction, the 80 rpm N/M, the 60 rpm N/M and the 60 rpm N/M B/S, along with the final residue from the leaching of the three fractions (80 rpm N/M, 60 rpm N/M and 60 rpm N/M Bromoform Sink), were submitted to ALS for analysis.

created using
BCL easyPDF
Printer Driver
Click here to purchase a license to remove this image

3. RESULTS

The results were as follows:-

SAMPLE	Al_2O_3 (%)	CaO (%)	Fe_2O_3 ppm	MgO (%)	TiO_2 (%)	Na_2O (%)	K_2O (%)
-45+250 u	0.007	0.039	**50**	0.006	0.003	<0.001	<0.001
80 rpm N/M	0.007	0.034	**40**	0.006	0.002	<0.001	<0.001
60 rpm N/M	0.005	0.034	**30**	0.006	0.002	<0.001	<0.001
80 rpm N/M Leach Residue	0.005	0.035	**60**	0.005	0.002	<0.001	<0.001
60 rpm N/M Leach Residue	0.007	0.036	**40**	0.006	0.002	<0.001	<0.001
60 rpm N/M Bromoform Sink Leach Residue	0.005	0.037	**20**	0.006	0.002	<0.001	<0.001

4. PREVIOUS WET MAGNETIC TEST RESULTS

The above analyses can then be compared with those obtained from the non-magnetic fraction obtained in a previous investigation, by application of a wet magnetic separation procedure only, to a similar size fraction obtained from a different area of the same deposit.

SAMPLE		Al_2O_3 (%)	CaO (%)	Fe_2O_3 ppm	MgO (%)	TiO_2 (%)	Na_2O (%)	K_2O (%)
Wet Magnetic Tests	B2 N/M	0.004	0.032	**10**	0.005	<0.001	<0.001	<0.001
	B3 N/M	0.004	0.038	**10**	0.005	<0.001	<0.001	0.001

5. DISCUSSION OF RESULTS

In the case of the leach tests, the results are inconclusive and once again show the difficulty of operating close to the detection limit of the ALS method for Fe_2O_3 determination.

For example, as in the procedure developed for previous leach tests, the leach solutions was analysed for iron by AA at 30 minute intervals during leaching. Leaching was terminated after three identical results were obtained, on the assumption that maximum iron removal had occurred.

The results were identical in each case, indicating Fe_2O_3 removal equivalent to 20 ppm on original sample had been achieved after 30 minutes, followed by no further extraction.

However, this is not indicated in the ALS results, which show either little or no beneficial effect or actual increased iron levels, both from magnetic separation and leaching.

There is some indication that removal of the "black dots" was of benefit, as the result obtained from leaching of the bromoform sink at SG 2.2 (20 ppm) is the lowest result obtained in the oxalic leach program.

On the other hand, the analysis results from the previous wet magnetic separation tests showed a consistently low residual iron content.

Perhaps it may be worthwhile repeating all three leaches, but at much higher solids content, as previous results indicate that Fe_2O_3 removal efficiency will not be reduced, particularly considering the stoichiometry (ratio of oxalic acid: iron) used.

The resultant magnification in Fe_2O_3 readings obtained by AA may throw further light on the problem, by giving greater reliability to the readings obtained.

Also the effect of the drying step prior to magnetic separation may need to be considered, in light of the results obtained in the wet magnetic tests.

The consistently lower TiO_2 levels obtained in the alternative procedure also support the inference that some significant difference at magnetic separation may have occurred.

created using
BCL easyPDF
Printer Driver
Click here to purchase a license to remove this image

APPENDIX 3

REDUCTION IN IRON CONTENT BY MAGNETIC SEPARATION/OXALIC ACID LEACHING

created using
BCL easyPDF
Printer Driver
Click here to purchase a license to remove this image

MAYDENA SANDS PTY LTD

REDUCTION IN IRON CONTENT BY MAGNETIC SEPARATION/OXALIC ACID LEACHING INCLUDING EFFECT OF CARBON REMOVAL BY SUPER-PANNING

Samples
T0729-40250 and T0729-250600

June 2014

C.J.Browne

created using
BCL easyPDF
Printer Driver
Click here to purchase a license to remove this image

1. SUMMARY

It has previously been established that carbon particles, often present in sand extracted from the Maydena Sands deposit, can be a major source of iron contamination, probably due to the presence within and upon the carbon particles of iron oxides and or sulphides.
As low iron content (<20 ppm) is a critical consideration in marketing product from this deposit, it is therefore desirable that these carbon particles be removed.
Two samples were received as follows:-

T0729-40250 comprising a 2kg sample of 40-250 μ silica
T0729-250600 comprising a 2kg sample of 250-6000 μ silica

Both samples contained fine organics including carbon particles.
These samples were split into two fractions.
The first fraction was subjected to the standard procedure used for iron removal, as developed in previous test-work using a combination of dry roll magnetic separation at 15,000 gauss and oxalic acid leaching.
The second fraction was sent to the ALS laboratory in Burnie (Tas), where both the T0729-40250 and T0729-250600 samples were passed over a Super-Panner to establish the effectiveness of this machine in reducing the carbon content and, hopefully, the iron content of the samples.
The Super-Panner tailings from the T0729-250600 sample were then passed over a Belt Magnet at 15,000 gauss, to compare its effectiveness with that obtained using the Roll Magnet.
The Super-Panner Concentrates obtained from both T0729-40250 and T0729-250600 and the non-magnetic fraction obtained from the T0729-250600 Super-Panner tailings were then subjected to the standard oxalic acid leach test.
Treatment of both samples by Roll Magnet/oxalic acid failed once again to reduce the residual iron level to below 20 ppm
The Super-Panner proved effective in removal of visual carbon particles, which were found to have relatively high iron content. This resulted in a reduction in iron content of both materials, by 28% in the case of the finer sample and by 20% in the case of the coarser sample.
In the case of sample T0729-250600, Magnetic separation of the super-panner tailings using the Belt Magnet at 15,000 gauss roved equally effective in iron removal to that obtained on the head sample at equivalent field strength using the Roll Magnet.
However, once again, oxalic acid leaching of the non-magnetics proved ineffective in reducing the iron level to below 20 ppm.

created using
BCL easyPDF
Printer Driver
Click here to purchase a license to remove this image

2. STANDARD TEST PROCEDURE

2.1 Magnetic Separation

A head sample was taken from both T0729-40250 and T07029-250600. Both samples were then passed over a Reading Dry Roll Laboratory magnet, using a Field Strength of 15,000 gauss and a Roll Speed of 60 rpm.
A sample was taken of the non-magnetic fraction from this procedure in each case.

2.2 Oxalic Acid Leaching

A 10 gram sample of the Non-Magnetic fraction from both T0729-40250 and T0729-250600 was taken and leached with 100 ml of 50 gpl oxalic acid (10% Solids) for 4 hours, using the beaker/magnetic stirrer method. A sample of both solids and solution were then taken.
A 50 gram sample of the Non-Magnetic fraction from T0729-40250 was also leached with 100 ml of 50 gpl oxalic acid (50% Solids) for 4 hours, using the beaker/magnetic stirrer method. A sample of both solids and solution were then taken.
The purpose of this test was to investigate the effect of increased solids content at constant oxalic acid attack strength.

2.3 Results

Test results were as follows:-

SAMPLE TYPE T0729-40250		CONTENT (%)						
		Al_2O_3	CaO	Fe_2O_3	MgO	TiO_2	Na_2O	K_2O
Head		0.004	0.025	0.005	0.004	0.001	0.003	0.001
Non Magnetics		0.006	0.029	0.002	0.005	0.001	0.003	<0.001
Leach 10% Solids	Leach Solids	0.006	0.023	0.002	0.004	0.001	0.003	0.001
	Leach Solution	<0.0003	0.0015	0.004	0.0003	0.000	0.005	<0.001
Leach 50% Solids	Leach Solids	0.008	0.023	0.002	0.004	0.001	0.003	0.001
	Leach Solution	<0.001	0.002	0.005	0.0002	0.000	0.0002	<0.001

SAMPLE TYPE T0729-250600		CONTENT (%)						
		Al_2O_3	CaO	Fe_2O_3	MgO	TiO_2	Na_2O	K_2O
Head		0.008	0.017	0.005	0.005	0.001	0.009	0.001
Non Magnetics		0.008	0.008	0.003	0.002	0.001	<0.001	<0.001
Leach 10% Solids	Leach Solids	0.008	0.008	0.002	0.002	0.001	0.001	<0.001
	Leach Solution	<0.001	0.0001	0.000	0.0003	0.000	<0.001	<0.001

2.4 Conclusions

On face value these results indicate that the Reading Dry Roll magnetic separation procedure reduced the iron content of the non-magnetic fraction to 20 ppm and that no further improvement was obtained in residual iron content by oxalic acid leaching. However poor balances between the iron levels found in the final solids and solutions, compared to the head, once again cast doubt on the analytical results reported for iron in solids at these low iron levels.

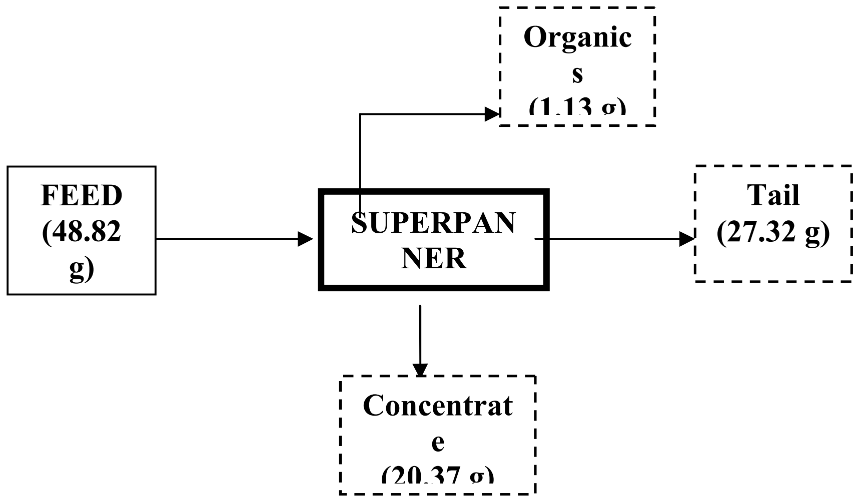
created using BCL easyPDF Printer Driver
Click here to purchase a license to remove this image

3. SUPER-PANNER TESTS

3.1 Sample T0729-40250

3.1.1 Procedure

An approximately 50 gram sample was taken and passed over the Super-Panner. An organic fraction, containing what appeared to be essentially all of the carbon particles, immediately formed and flowed off the bottom of the super-panner, leaving the silica solids, which then split into an identifiably lighter coloured concentrate and a darker coloured tailing. These fractions were collected, dried and weighed.
The circuit used and the mass balances established, were as follows:-



3.1.2 Results

Each of the product samples were then analysed and the results were as follows:-

Fraction	Wt %	CONTENT (%)						
		Al_2O_3	CaO	Fe_2O_3	MgO	TiO_2	Na_2O	K_2O
Feed	100.0	0.004	0.025	0.005	0.004	0.001	0.003	0.001
Concentrate	41.7	0.004	0.035	0.004	0.005	0.001	0.001	<0.001
Tail	56.0							
Organics	2.3	<0.010	0.090	0.060	0.020	<0.010	0.020	<0.010

It was observed that the concentrate and tailings samples from the Super-Panner test were visually free of carbon particles, whereas a large proportion of visual carbon was observed in the organic fraction.
Weight and percentage distributions of the relevant oxides in the various product fractions were calculated as follows:-

Fraction	Wt %	Weight Distribution of Components by Fraction (%)						
		Al_2O_3	CaO	Fe_2O_3	MgO	TiO_2	Na_2O	K_2O
Feed	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Concentrate	41.7	41.7	60.0	34.0	50.0	50.0	33.3	0.0
Tail (by difference)	56.0	56.0	32.0	38.0	37.5	50.0	50.0	100.0
Organics	2.3	2.3	8.0	28.0	12.5	0.0	16.7	0.0

created using
BCL easyPDF
Printer Driver
Click here to purchase a license to remove this image

3.1.3 Oxalic Acid Leach Test

An oxalic acid leach test was conducted on the Super-Panner concentrate sample obtained from the above test, using standard conditions of 10% solids, 50 gpl oxalic acid solution and a leach time of 4 hours.

The results were as follows:-

SAMPLE TYPE T0729-40250		CONTENT (%)						
		Al_2O_3	CaO	Fe_2O_3	MgO	TiO_2	Na_2O	K_2O
Super-Panner Concentrate		0.004	0.035	0.004	0.005	0.001	0.001	<0.001
Leach 10% Solids	Leach Solids	0.004	0.033	0.002	0.004	0.001	0.003	0.001
	Leach Solution	<0.0004	0.002	0.0015	0.0006	0.000	0.009	<0.001

3.1.4 Conclusions

The results indicate that although visual observation indicated that essentially all carbon particles were removed by the super-panner and were found to contain considerable iron, only an overall 28% reduction in iron level in concentrate was achieved.

The concentrate was found to contain elevated levels of Ca and Mg.

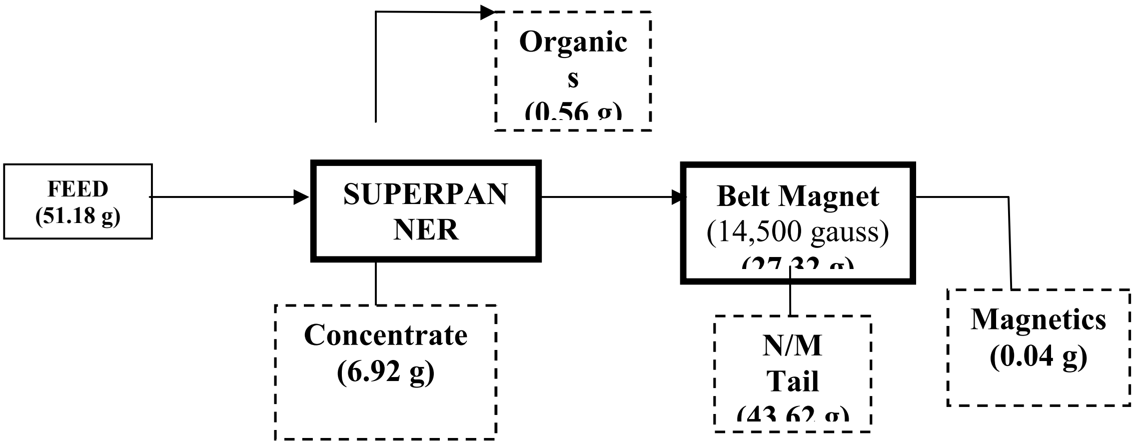
Again, oxalic acid leaching reduced the iron level in the concentrate to the familiar 20 ppm level?

created using
BCL easyPDF
Printer Driver
Click here to purchase a license to remove this image

3.2 T0729-250600

3.2.1 Procedure

Again, approximately 50 gram of this coarser material was taken and passed over the Super-Panner and again the organic fraction, containing what appeared to be essentially all of the carbon particles, immediately formed and flowed off the bottom of the super-panner, leaving the silica solids, which also then split into an identifiably lighter coloured concentrate and a darker coloured tailing. These fractions were collected, dried and weighed.
The tailings from this test were then passed over a Belt Magnet at 15,000 Gauss field strength. The non-magnetic and magnetic fractions were weighed and the non-magnetic fraction was sent for analysis, along with the Super-Panner concentrate and organic fractions.
The circuit used and the mass balances established, were as follows:-



3.2.2 Results

As with the finer material above, the concentrate and tailings samples from the Super-Panner test were found to be visually free of carbon particles, whereas a relatively large amount of visual carbon was observed in the organic fraction.
The analysis results were as follows:--

Fraction	Wt %	CONTENT (%)						
		Al_2O_3	CaO	Fe_2O_3	MgO	TiO_2	Na_2O	K_2O
Feed	100.0	0.008	0.017	0.005	0.005	0.001	0.009	0.001
Concentrate	13.5							
Tail Magnetics	0.08							
Tail Non-Magnetics	85.32	0.006	0.009	0.002	0.003	0.001	0.001	0.001
Organics	1.1	<0.010	0.160	0.090	0.030	0.010	0.010	<0.010

Limited weight and percentage distributions were then calculated as follows:-

Fraction	Wt%	Weight Distribution of Components by Fraction (%)						
		Al_2O_3	CaO	Fe_2O_3	MgO	TiO_2	Na_2O	K_2O
Feed	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Concentrate	13.5							
Tail Magnetics	0.08							
Tail Non-Magnetics	85.32	?	44.8	34.0	52.0	100.0	9.0	80.0
Organics	1.1	?	10.6	20.0	6.0	0.0	11.1	0.0

created using
BCL easyPDF
Printer Driver
Click here to purchase a license to remove this image

3.2.3 Oxalic Acid Leach Test

As the small quantity of concentrate sample produced from this test was consumed in analysis, an oxalic acid leach test was conducted on the Super-Panner Tailings Non-Magnetics, using standard conditions of 10% solids, 50 gpl oxalic acid solution and a leach time of 4 hours.
The results were as follows:-

SAMPLE TYPE T0729-250600		CONTENT (%)						
		Al_2O_3	CaO	Fe_2O_3	MgO	TiO_2	Na_2O	K_2O
Super-Panner Tail Non-Magnetics		0.006	0.009	0.002	0.003	0.001	0.001	0.001
Leach 10% Solids	Leach Solids	0.008	0.008	0.002	0.002	0.001	0.001	<0.001
	Leach Solution	<0.001	0.0001	0.000	0.0003	0.000	<0.001	<0.001

3.2.4 Conclusions

The results indicate that, as with the finer sample, visual observation indicated that essentially all carbon particles were removed by the super-panner and although these were found to contain considerable iron, the overall iron level in concentrate was only reduced by 20%.
Again, indications were that the concentrate contained elevated levels of Ca and Mg.
Magnetic separation of the tailings using the belt magnet at 15,000 gauss produced similar results to those obtained using the Reading roll magnet at equivalent field strength, in that the iron level in non-magnetics was 20 ppm.
However oxalic acid leaching of these non-magnetics again failed to reduce the iron level below this level.

created using BCL easyPDF Printer Driver
Click here to purchase a license to remove this image

Australian Laboratory Services Pty Ltd
32 Shand Street
Stafford
Brisbane QLD 4053
Phone: +61 (7) 3243 7222 Fax: +61 (7) 3243 7218
www.alsglobal.com

Finalized Date: 14 - JUL - 2014
Account: MCDSON

Project: SILICA SAND

CERTIFICATE OF ANALYSIS BR14081157

Sample Description	Method / Analyte / Units / LOR	ME-ICP64 Al2O3 % 0.001	ME-ICP64 CaO % 0.001	ME-ICP64 Fe2O3 % 0.001	ME-ICP64 MgO % 0.001	ME-ICP64 TiO2 % 0.001	ME-ICP64 Na2O % 0.001	ME-ICP64 K2O % 0.001
1		0.004	0.033	0.002	0.004	0.001	0.001	<0.001
2		0.006	0.023	0.002	0.004	0.001	0.003	0.001
3		0.008	0.008	0.003	0.002	0.001	0.004	0.001
4		0.006	0.009	0.003	0.002	0.001	0.001	0.001
5		0.008	0.023	0.005	0.004	0.001	0.007	0.001
1A		0.004	0.035	0.004	0.005	0.001	0.003	<0.001
2A		0.004	0.025	0.005	0.004	0.001	0.003	0.001
3A		0.008	0.017	0.005	0.005	0.001	0.009	0.001
4A		0.004	0.008	0.002	0.002	0.001	<0.001	<0.001
8A		0.006	0.029	0.002	0.005	0.001	0.003	<0.001
9A		0.006	0.009	0.002	0.003	0.001	0.001	0.001

Comments: This is an amended report. Note changes to Al2O3 results.

***** See Appendix Page for comments regarding this certificate *****

created using
BCL easyPDF
Printer Driver
Click here to purchase a license to remove this image

ALS Minerals

Australian Laboratory Services Pty. Ltd.
32 Shand Street
Stafford
Brisbane QLD 4053
Phone: +61 (7) 3243 7222 Fax: +61 (7) 3243 7218
www.alsglobal.com

Finalized Date: 14- JUL- 2014
Account: MCDSON

Project: SILICA SAND

CERTIFICATE OF ANALYSIS BR14081158

Sample Description	Method / Analyte / Units / LOR	ME- ICP64 / Al_2O_3 / % / 0.01	ME- ICP64 / CaO / % / 0.01	ME- ICP64 / Fe_2O_3 / % / 0.01	ME- ICP64 / MgO / % / 0.01	ME- ICP64 / TiO_2 / % / 0.01	ME- ICP64 / Na_2O / % / 0.01	ME- ICP64 / K_2O / % / 0.01
6A		0.01	0.09	0.06	0.02	<0.01	0.02	<0.01
7A		0.03	0.16	0.09	0.03	0.01	0.01	<0.01

Comments: This is an amended report. Note changes to Al2O3 results. Detection limit raised due to smaller sample weight used (due to limited sample).

***** See Appendix Page for comments regarding this certificate *****

created using BCL easyPDF Printer Driver
Click here to purchase a license to remove this image

APPENDIX 4

CARBON REMOVAL

COAL SPIRAL TESTS

created using
BCL easyPDF
Printer Driver
Click here to purchase a license to remove this image

MAYDENA SANDS PTY LTD

CARBON REMOVAL

COAL SPIRAL TESTS
LD7 Spirals

25/11/14

C.J.Browne

created using
BCL easyPDF
Printer Driver
Click here to purchase a license to remove this image

INDEX

created using
BCL easyPDF
Printer Driver
Click here to purchase a license to remove this image

1. SUMMARY

This report describes an investigation undertaken to establish the potential for Coal Spirals to extract a carbon-free silica concentrate from highly carbon contaminated material selectively obtained from the Maydena Sands deposit.
Mineral Technologies have recognised expertise in this field.
Model LD-7 spirals were recommended by Mineral Technologies for this investigation. These machines are available as a 4-turn version, designed for easily processed material and a more advanced 7-turn version for more difficult material.
A test rig featuring full sized models of both versions and designed to operate at commercial rates, was available at Mineral technologies laboratories in Carrara Qld.
An initial test was conducted using the 4-turn version, followed by an analysis of the test results. This analysis indicated only moderate success was achieved in particle size definition. It was established that around 65% of the feed could be extracted as an essentially carbon free product by combination of the concentrate and middling fractions generated in this test.
However the nature of the products from this test suggested that the recovery of carbon-free product could be increased by further processing of the tailings by, for example passage of the tailings over a second spiral.
A second test was then conducted using the 7-turn version, which provided almost double the retention time in the separation zone. A more heavily contaminated sample was chosen for this test.
The results from this test indicated that particle size definition was greatly improved, no doubt, as a result of this greater retention time. Despite this improvement extraction of a carbon free product was only slightly improved at 68%, obtained this time by recovery of the concentrate product only.
However it was established that this extraction could be further increased to around 86% by recovery of the <90 μ fraction from both the middling and tailing products. However this would require an additional process step, perhaps involving either a hydrocyclone or a wet screen.
The results achieved in all three tests would have been considerably enhanced by the introduction of a de-sliming test prior to the spiral.
Over 100 kg of unused sample remains from the latest tests. This quantity of sample is more than sufficient to allow a further test run.
It is recommended that this material be de-slimed and that the de-slimed product be retested using the 7-turn LD spiral test rig.
The carbon free fraction generated from this test could then be subjected to the usual magnetic separation/procedure, followed by oxalic acid leaching, for comparative purposes.

created using
BCL easyPDF
Printer Driver
Click here to purchase a license to remove this image

2. INTRODUCTION

2.1. Objective
This report is concerned with addressing the presence of varying degrees of carbon contamination within the Maydena Sands deposit, as part of a wider investigation into the development of a suitable process for extraction of a high purity silica from this deposit, Desirable properties of high purity silica include extremely low iron content and an optically pleasing appearance, usually expressed as the degree of whiteness
Previous investigations indicated that the presence of these carbon particles can represent a significant source of iron contamination in sand extracted from this deposit due to the presence within and on the surface of the particles of iron compounds, including iron sulphide.
Carbon contamination is also optically undesirable due to its intense black colour.
It is therefore highly desirable that the particles be removed.

2.2. Previous Work
Previous investigations established that the carbon particles do not respond to either magnetic separation or oxalic acid leaching.
However, initial test results obtained by ALS (Burnie), using a Super-Panner, indicated that carbon particles may be removed from carbon contaminated Maydena Sands material by the unique action of this machine, which features a combination of gravity and float action, with a resultant significant reduction in iron levels.
The achieved carbon removal appeared to be more related to surface activity and the type of motion generated by this machine, rather than absolute gravity separation. However, no commercial machines of this type exist. It was recommended by ALS that a Coal Spiral be tried, as this machine may achieve a similar result.

2.3. Mineral Technologies Recommendation
This approach was confirmed by further discussion of the Super-Panner results with Mineral Technologies (Carrara, Qld), who are recognised experts in the field of mineral processing and also manufacture a type of spiral specifically designed for coal purification, known as the LD7 Series.

2.4. Description of LD7 Coal Spirals
The LD Series features both a standard 4-turn model and a 7-turn model developed for more demanding applications, details of which are attached as Appendix Nos 1and 2.
These machines feature high capacity, with each start designed to process 2-5 tonnes/hr of solids at 25-40% pulp density.
It will be seen from this information that these spirals are constructed in nests of 4, 6, 8 or 10 banks, each bank consisting of either a twin or triple start.

2.5. Availability of Test Rig
A full sized test rig is available at the Carrara site for testing both of these machines.
It was decided that this test rig would be used to assessing the effectiveness of this equipment in removal of the carbon particles using bulk samples of relatively high carbon content, selectively obtained from the Maydena Sands deposit.

created using
BCL easyPDF
Printer Driver
Click here to purchase a license to remove this image

3. INITIAL TEST (LD 7 4 Turn Spiral)

It was decided that an initial test would be carried out using the basic LD-7 4-turn model. Assessment of the results obtained from this test would determine whether a second test should be carried out using the more intense 7-turn model.
This test and the results obtained from it are discussed below.

3.1. Description of Test

A single test was conducted by Mineral Technologies, in their Bulk Testing Laboratory at Carrara (Qld) using an LD7 4-turn Coal Separation Spiral (see Appendix No 1), with the objective of investigating the potential of this device to remove carbon particles from a 70 kg bulk sample extracted from the Maydena Sands deposit.
A test rig containing the LD 7 spiral was charged with the bulk sample and the pulp density adjusted to 35%. The pulp was then recirculated over a single turn of the spiral at a rate equivalent to 1.6 tonne/hr solids for 15 minutes, after which a sample of each of the concentrate, middlings and tails fractions was obtained using an automatic sampler.

3.2. Results

The concentrate, middling and tails products obtained from the above test were each wet screened at 250, 150 and 45 microns, to produce four size fractions in each case (+250µ, 150-250µ, 45-150µ and -45µ).
All size fractions were then dried and weighed.
The results were as follows:-

Table 1
Product Distribution by Weight

Particle Size (micron)	Con (%)	Mid (%)	Tail (%)	Total (%)
+250	9.8	16.3	5.3	**31.4**
+150-250	14.4	11.3	4.6	**30.3**
+45-150	1.2	8.9	15.7	**25.8**
<45	2.2	1.2	9.1	**12.5**
Total	**27.6**	**37.7**	**34.7**	**100.0**

Table 2
Product Distribution by Size

Particle Size (micron)	Con (%)	Mid (%)	Tail (%)	Total (%)
+250	31.2	51.9	16.9	**100.0**
+150-250	47.5	37.3	15.2	**100.0**
+45-150	4.6	34.5	60.9	**100.0**
<45	17.6	9.6	72.8	**100.0**

created using
BCL easyPDF
Printer Driver
Click here to purchase a license to remove this image

3.3. Interpretation of Results

From these results the following information was developed.

3.3.1. Feed Size Distribution

By addition of the relevant size fractions found in each of the products of the test, the size distribution of the feed was calculated to be 31.4% +250µ, 30.3% 150-250µ, 25.8% 45-150µ and 12.5% 45µ.

3.3.2. Product Ratios

It was found that distribution of feed to product was relatively even, with 27.6% of the feed appearing as a as concentrate, 37.7% as middlings and 34.7% as tailings.

3.3.3. Product Size Distribution

It was also found that 80-85% of the coarser fractions of the feed (>150 µ) was predominantly evenly distributed between the concentrate and middling fractions, whereas 80-90% of the finer fractions (<150 µ) the finer fractions was distributed across the middling and tailing fractions.
It should be noted that a high proportion of the <45 µ fraction found in each product consisted of dispersed slimes containing considerable carbon and other organics.
It was further noted that this was easily removable by decantation, suggesting that a desliming step involving a hydro-cyclone prior to the spiral would be highly desirable in processing this type of feed and would result in more efficient carbon removal.

3.3.4. Carbon Distribution

As there is no apparent analytical method available for determination of carbon content to the low levels involved. Thus for assessment of the effectiveness of carbon removal, a sample from each size fraction of the concentrate, middlings and tailing product was examined by wet panning, for the presence of visible charcoal particles.
The results of this examination are shown below, in that those size fractions exhibiting visible carbon are shown in red colour:-

Table 3
Visible Carbon Contamination

Particle Size (micron)	Product Wt Distribution (%)			Contamination Wt Distribution (%)	
	Con	Mid	Tail	No visible C	Visible C
+250	9.8	16.3	5.3	**27.1**	5.3
+150-250	14.4	11.3	4.6	**25.7**	4.6
+45-150	1.2	8.9	15.7	**10.1**	15.7
<45	2.2	1.2	9.1	**3.4**	9.1
Total	**27.6**	**37.7**	**34.7**	**66.3**	**34.7**

created using
BCL easyPDF
Printer Driver
Click here to purchase a license to remove this image

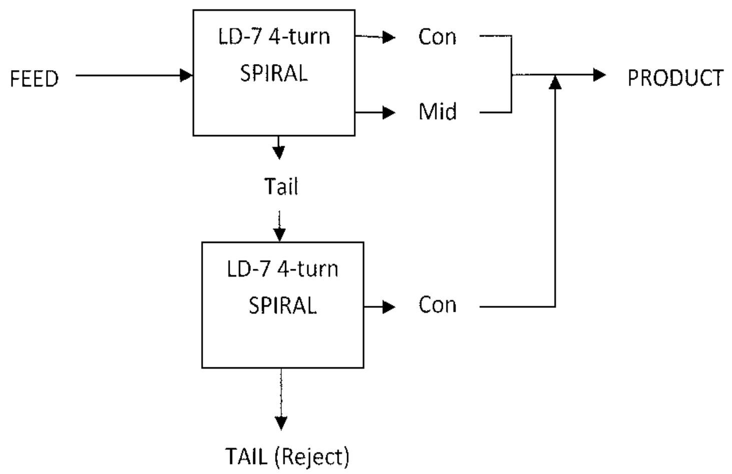
These observations indicate that the spiral concentrate and middlings could be combined to produce a carbon free product, comprising 65.3% of the feed.

3.4. Discussion of Results

In terms of particle size distribution, it can be seen from the results that whilst it was expected that most, if not all of the coarser fractions (>150 μ) would appear in the concentrate, most of the >250 μ fraction and a considerable proportion of the 150-250 μ fraction were found in the middlings.

In terms of carbon removal the results were also disappointing in that they indicate that approximately 65% of the original weight of the type of material submitted can be extracted as a carbon free product, consisting essentially of the concentrate and middling products, whereas it was hoped that an extraction in excess of 80% would be achieved.

Interpretation of these results suggests that insufficient retention time in the stable separation zone was available for efficient segregation of size fractions. This would suggest that a second and perhaps a third pass may be required to achieve the required yield of carbon free product, if using a 4 turn spiral.



A further option would be the use of the 7-turn LD7 spiral (see Appendix No 2), which provides almost double the residence time within a single pass, thus greatly extending the stable separation zone within the spiral operation.

It was decided that these results were sufficiently encouraging to proceed to a second test involving processing of a similar but more severely contaminated sample, using the 7-turn LD-7 machine

created using
BCL easyPDF
Printer Driver
Click here to purchase a license to remove this image

4. FURTHER TEST WORK :- (LD-7 7Turn Spiral)

This work involved a second bulk sample of more severely carbon-contaminated material selectively sampled direct from the Maydena Sands deposit.
Two tests were carried out by myself at Mineral Technologies using the LD-& 7 turn spiral test rig at Carrara.
These tests differed only in the splitter positions, which are used to determine the proportion of concentrate and middling fractions extracted.
Each test was conducted using similar pulp density of 35% and a similar feed rate of 1.6 tonne/hr, as used in the initial test on the 4 turn spiral.
Again, a sample of each of the concentrate, middlings and tails fractions was obtained using an automatic sampler after recirculation for 15 minutes.
These tests differed from the initial test in that products of the tests were de-slimed, by decanting and filtering the process water from each product, thus allowing recovery of the slimes as a separate size fraction from each product.
This would then allow simulation of either a separate de-sliming operation for each product, or of a de-sliming operation on the feed, obtained by bulking the slimes fractions together.

created using
BCL easyPDF
Printer Driver
Click here to purchase a license to remove this image

4.1. TEST No 1

4.1.1. Description of Test

Similar test conditions to those used in the initial test were used, in that the test rig containing the 7-turn spiral was charged with the bulk sample and the pulp density adjusted to 35%. The pulp was then recirculated over a single turn of the spiral at a rate equivalent to 1.6 tonne/hr solids for 15 minutes, after which a sample of each of the concentrate, middlings and tails fractions was obtained using an automatic sampler. .
This test was carried out using the standard splitter conditions used for the machine in the coal industry for maximum coal recovery.

4.1.2. Results

It was also decided to add an extra size fraction by wet screening the concentrate, middling and tails products obtained from the above tests at 250, 150, 90 and 45 µ, thus producing six size fractions in each case (+250µ, 150-250µ, 90-150 µ, 45-90µ, -45µ and slimes).
All size fractions were then dried and weighed.

The results were as follows:-

Table 4
Product Distribution by Weight

Particle Size (micron)	Con (%)	Mid (%)	Tail (%)	Total (%)
+250	28.2	1.4	0.9	**30.5**
+150-250	21.4	1.1	0.5	**23.0**
+90-150	10.0	1.3	1.4	**12.7**
+45- 90	8.1	3.1	6.5	**17.7**
<45	0.8	0.9	7.0	**8.7**
Slimes			7.4	**7.4**
Total	**68.5**	**7.8**	**23.7**	**100.0**

Table 5
Product Distribution by Size

Particle Size (micron)	Con (%)	Mid (%)	Tail (%)	Total (%)
+250	92.4	4.6	16.9	**100.0**
+150-250	93.0	4.8	15.2	**100.0**
+90-150	78.7	10.3	11.0	**100.0**
+45-90	45.8	17.5	36.7	**100.0**
<45	9.2	10.3	80.5	**100.0**
Slimes			100.0	**100.0**

created using BCL easyPDF Printer Driver
Click here to purchase a license to remove this image

4.1.3. Interpretation of Results

From these results the following information was developed.

4.1.3.1. Feed Size Distribution

Addition of the relevant size fractions found in each of the products of the test shows that the feed size distribution was similar, but not identical to that of the feed used in the initial test. The size distribution of the feed was calculated to be 30.5% +250µ, 23.0% 150-250µ, 12.7% 90-150 µ, 17.7% 45-90µ, 8.7% 45µ and 7.4% slimes.

4.1.3.2. Product Ratios

It was found that distribution of feed to product was considerably more selective than obtained in the initial test, with 65.6% of the feed appearing as a as concentrate, 7.8% as middlings and 23.7% as tailings.

4.1.3.3. Product Size Distribution

Again it was found that the size distribution amongst the products was considerably different to that obtained in the initial test. In this case over 90% of the >150 µ fraction appeared in the concentrate, along with 80% of the 90-150 µ fraction and almost 50% of the >45 µ fraction. The majority of the slimes fraction reported to the tailing fraction.

4.1.3.4. Carbon Distribution

Again a sample from each size fraction of the concentrate, middlings and tailing product was examined by wet panning, for the presence of visible charcoal particles, and the results of this examination are shown below, in that those size fractions exhibiting visible carbon are shown in red :-

Table 6
Visible Carbon Contamination

Particle Size (micron)	Product Wt Distribution (%)			Contamination Wt Distribution (%)	
	Con	Mid	Tail	No visible C	Visible C
+250	28.2	1.4	0.9	**28.2**	**2.3**
+150-250	21.4	1.1	0.5	**21.4**	**1.6**
+90-150	10.0	1.3	1.4	**10.0**	**2.7**
+45- 90	8.1	3.1	6.5	**17.7**	
<45	0.8	0.9	7.0	**8.7**	
Slimes			7.4		**7.4**
Total	**68.5**	**7.8**	**23.7**	**86.0**	**14.0**

These observations indicate that a concentrate, comprising 68.5% of the feed, could be produced containing essentially no carbon. A further 17.5% of the feed could be extracted as an essentially carbon free fraction by removal of slimes, either pre or post the spiral operation followed by a wet sizing operation at around 90 µ, giving an overall potential carbon free product recovery of 86.0%.

created using
BCL easyPDF
Printer Driver
Click here to purchase a license to remove this image

4.2. TEST No 2

This test was carried out using a wider middling splitter setting, used in the coal industry for processing lower grade feed material. All other procedures were identical to those used in Test No 1.

4.2.1. Results

As with Test No 1, six size fractions (+250µ, 150-250µ, 90-150 µ, 45-90µ, -45µ and slimes) were produced from each of the concentrate, middling and tail products.

All size fractions were then dried and weighed.

The results were as follows:-

Table 7
Product Distribution by Weight

Particle Size (micron)	Con (%)	Mid (%)	Tail (%)	Total (%)
+250	29.4	1.5	1.1	**32.0**
+150-250	22.0	2.5	0.3	**24.8**
+90-150	9.8	2.5	0.5	**12.8**
+45- 90	3.8	7.0	4.2	**15.0**
<45	0.6	1.4	4.7	**6.7**
Slimes			8.7	**8.7**
Total	**65.6**	**14.9**	**19.5**	**100.0**

Table 8
Product Distribution by Size

Particle Size (micron)	Con (%)	Mid (%)	Tail (%)	Total (%)
+250	91.8	4.7	3.5	**100.0**
+150-250	88.7	10.1	1.2	**100.0**
+90-150	76.6	19.5	3.9	**100.0**
+45-90	25.3	46.7	28.0	**100.0**
<45	9.0	20.9	70.1	**100.0**
Slimes			100.0	**100.0**

4.2.2. Interpretation of Results

From these results the following information was developed.

4.2.2.1. Product Ratios

It was found that the product ratios, as shown in Table 7, were affected by the change in splitter setting, in that whilst the proportion of concentrate product was similar (65.6%), the proportion of middling fraction was almost doubled (14.9%), reflected in a lower volume of tailings (19.5%).

created using
BCL easyPDF
Printer Driver
Click here to purchase a license to remove this image

4.2.2.2. Feed Size Distribution
The feed size distribution, as determined by the totals of each size fraction detected in each product, was a reasonable duplication of the results obtained in Test 1.

4.2.2.3. Product Size Distribution
The product size distribution, as shown in Table 8, indicates a slight shift in distribution of the <90 μ fraction from tailings to middlings.

4.2.2.4. Visible Carbon Distribution
Again a sample from each size fraction of the concentrate, middlings and tailing product was examined by wet panning for the presence of visible carbon particles.

Those size fractions exhibiting visible carbon were noted and are shown in red as follows:-

Table 9
Visible Carbon Contamination

Particle Size (micron)	Product Wt Distribution (%)			Contamination Wt Distribution (%)	
	Con	Mid	Tail	No visible C	Visible C
+250	29.4	1.5	1.1	**29.4**	**2.6**
+150-250	22.0	2.5	0.3	**22.0**	**2.8**
+90-150	9.8	2.5	0.5	**9.8**	**3.0**
+45- 90	3.8	7.0	4.2	**15.0**	
<45	0.6	1.4	4.7	**6.7**	
Slimes			8.7		**8.7**
Total	**65.6**	**14.9**	**19.5**	**82.9**	**17.1**

These observations indicate slightly inferior results to those obtained in test No 1, in that a concentrate, comprising 65.6% of the feed, could be produced containing essentially no carbon. A further 17.3% of the feed could be extracted as an essentially carbon free fraction by removal of slimes, either pre or post the spiral operation followed by a wet sizing operation at around 90 μ, giving an overall potential carbon free product recovery of 82.9%.

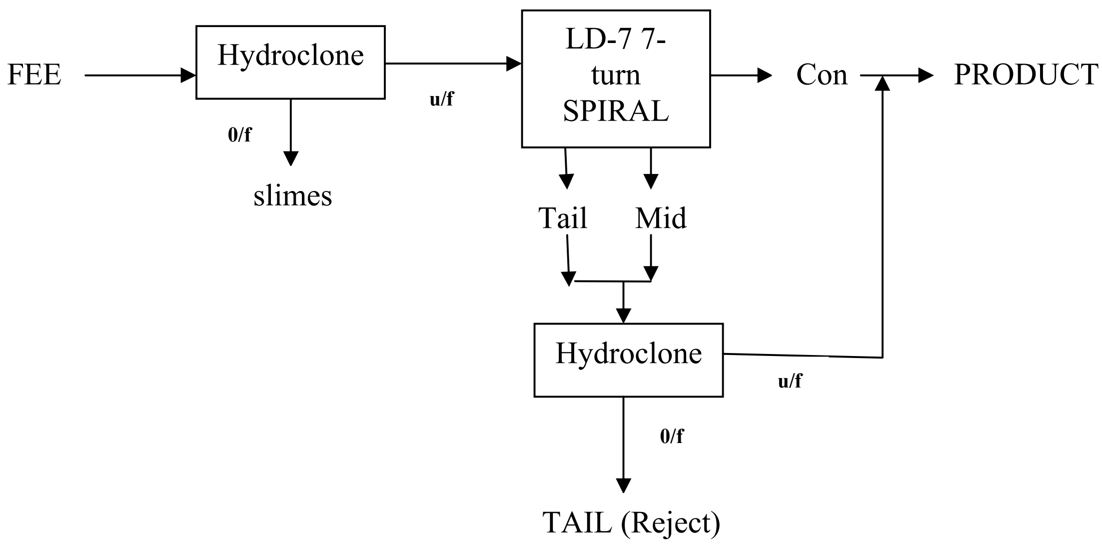
created using
BCL easyPDF
Printer Driver
Click here to purchase a license to remove this image

4.3. DISCUSSION OF RESULTS

In terms of size distribution, the results obtained in the tests using the 7- turn spiral showed that a considerable improvement in definition between size fractions could be obtained in that over 90% of the +150 μ size fraction and around 80% of the 90-150 μ size fraction could be extracted as a concentrate, compared to less than 50% using the 4-turn spiral.

In terms of carbon removal efficiency, whilst the results using the 7-turn spiral indicate that the recovery of carbon free product could be increased from around 65% to around 86%. However this would require extra process steps.

A de-sliming step would be required prior to the spiral operation and a sizing step would be required to remove the >90 μ fraction from both the middling and tailings products.



created using BCL easyPDF Printer Driver
Click here to purchase a license to remove this image

5. RECOMMENDATIONS

It must be considered that spiral separators represent a cheap high capacity wet separation method.

Although the results achieved in these tests are not as conclusive as was perhaps anticipated, there is no doubt that the results achieved in all three tests would have been considerably enhanced by the introduction of a de-sliming test prior to the spiral.

As more than sufficient unused sample remains from the latest tests to permit a third test run, it is recommended that this material be de-slimed using a hydrocyclone or over a wet table and that the de-slimed product be retested using the 7-turn LD spiral test rig.

The carbon free fraction generated from this test could then be subjected to the usual magnetic separation/procedure, followed by oxalic acid leaching, for comparative purposes.

created using
BCL easyPDF
Printer Driver
Click here to purchase a license to remove this image

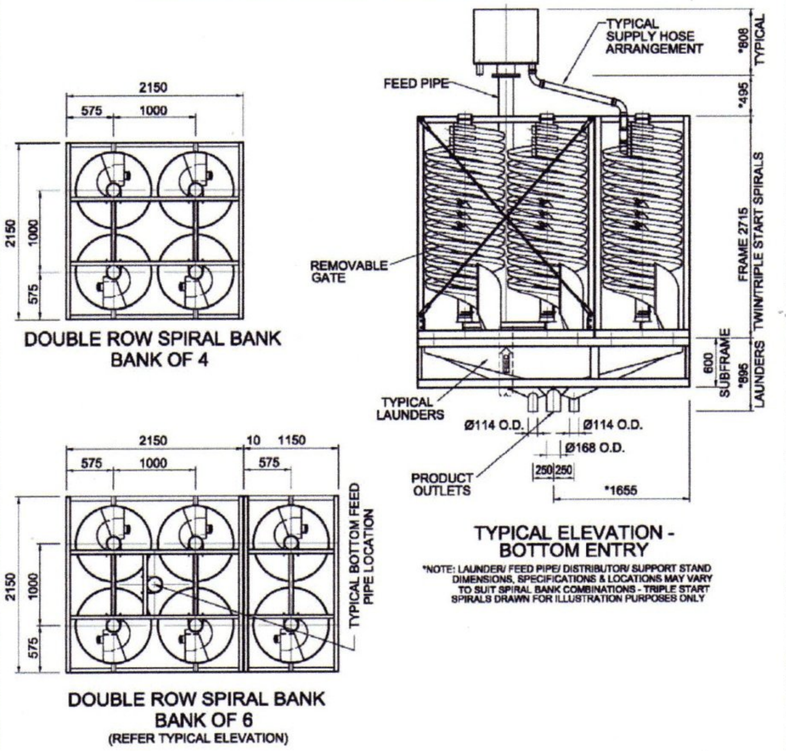
APPENDIX No 1

MINERAL TECHNOLOGIES

TECHNICAL DATA SHEET

Downer EDI Mining

LD7 - 4 TURN SPIRALS



MINERAL TECHNOLOGIES RESERVES THE RIGHT TO ALTER SPECIFICATIONS WITHOUT PRIOR NOTICE

ESTIMATED MASS (tonnes) - BOTTOM ENTRY

SPIRAL BANK	4x2	6x2	8x2	10x2	
TWIN START	1.28	1.75	2.50	3.17	
TRIPLE START	1.38	2.08	2.65	3.35	
CE-1725	06.10.06	FOR CERTIFIED DRAWINGS SUITABLE FOR ENGINEERING DESIGN PURPOSES PLEASE REFER TO MINERAL TECHNOLOGIES			

Downer EDI Mining
Mineral Technologies Pty Ltd ABN 52 105 309 250
11 Elysium Road
Carrara Queensland 4211
PO Box 2569
Nerang Mall Centre QLD 4211
Australia
Tel: 61 7 5569 1300
Fax: 61 7 5525 3810
Email: mineraltechnologies@downeredimining.com
Website: www.mineraltechnologies.com.au

created using BCL easyPDF Printer Driver
Click here to purchase a license to remove this image

MINERAL TECHNOLOGIES

LD7 Spiral Separator

Mechanical Features

- Improved tramp oversize handling characteristics
- Enhanced reject carrying capacity
- Calibrated auxiliary reject slide splitter at the end of turn 2
- Decreased height for easy retrofits
- Replaceable cast polyurethane feed box insert for extended product life
- Splitter position indicators to enable reproducible location of product splitters and consistency of settings across a bank of spiral separators

Design Data

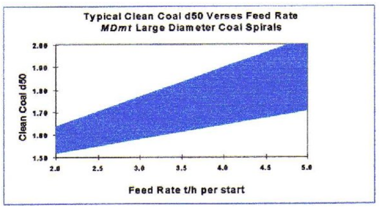
Head Feed (per start)

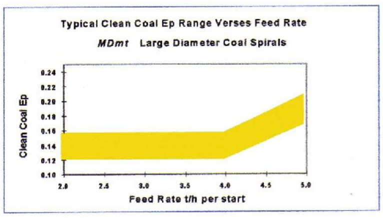
- Capacity: 2.0 – 5.0 t/h per start
- Pulp Density: 25 – 40% w/w
- Size Range: 0.1 – 3.0mm
- Pulp Volume: 6 – 12 m^3/h per start

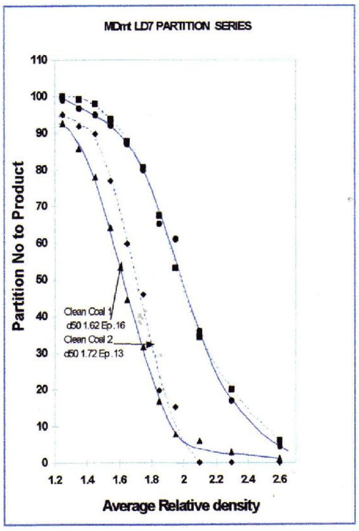
Applications

- Processing of fine raw coal
- Flotation or washwater cyclone tailings coal recovery
- Deslimed tailings dam fine coal recovery
- Separation of pumice and sand

- **Single stage R.D. cutpoint range:** 1.55 – 2.00 (size dependant)
- **Single stage Ep ranges:** 0.10 – 0.25 (size dependant)







Feed solids pulp density w/w maintained in the range 30% to 35%

Downer EDI Mining - Mineral Technologies Pty Ltd ABN 52 105 309 260
11 Elysium Road, Carrara Qld 4211 • PO Box 2569, Nerang MDC Qld 4211
Tel 61 7 5569 1300 • Fax 61 7 5525 3810 • Email mineraltechnologies@downeredimining.com • www.mineraltechnologies.com.au

DownerEDI Mining

created using
BCL easyPDF
Printer Driver
Click here to purchase a license to remove this image

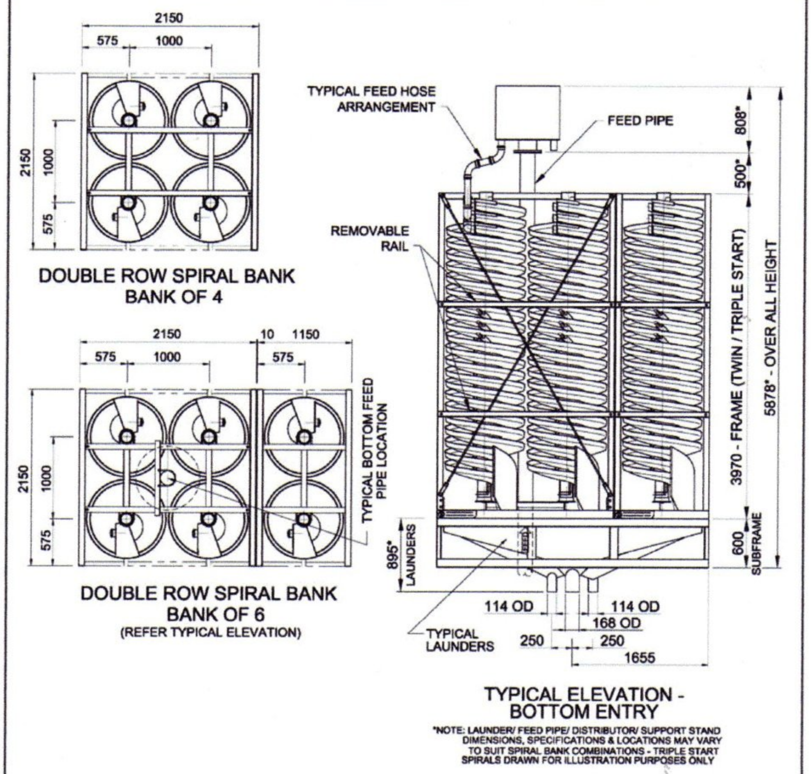
APPENDIX No 2

MINERAL TECHNOLOGIES

TECHNICAL DATA SHEET

Downer EDI Mining

LD7RC - 7 TURN SPIRALS



MINERAL TECHNOLOGIES RESERVES THE RIGHT TO ALTER SPECIFICATIONS WITHOUT PRIOR NOTICE

ESTIMATED MASS (tonnes) - TOP ENTRY

SPIRAL BANK	4 X 2	6 X 2	8 X 2	10 X 2
TWIN START	1.80	2.94	3.70	4.50
TRIPLE START	2.20	3.40	4.20	5.27

CE-2932 | 14.12.06 | FOR CERTIFIED DRAWINGS SUITABLE FOR ENGINEERING DESIGN PURPOSES PLEASE REFER TO MINERAL TECHNOLOGIES

Downer EDI Mining
Mineral Technologies Pty Ltd ABN 52 105 309 260
11 Elysium Road
Carrara Queensland 4211
PO Box 2569
Nerang Mail Centre QLD 4211
Australia
Tel: 61 7 5569 1300
Fax: 61 7 5525 3810
Email: mineraltechnologies@downeredimining.com
Website: www.mineraltechnologies.com.au

created using BCL easyPDF Printer Driver
Click here to purchase a license to remove this image

MINERAL TECHNOLOGIES

LD7RC Spiral Separator

Mechanical Features

- 2-Stage (Rougher-Cleaner) performance on a single assembly in a total of 7 turns
- 3-turn Rougher Stage with slide-style reject splitter
- Slurry Reconditioning System for transition from rougher-stage to cleaner-stage*.
- 4-turn Cleaner-Stage with ganged product outlet splitters
- Number of Starts – single, twin & triple
- Highly wear-resistant polyurethane materials

*patent pending

Design Data

Head Feed (per start)

- Capacity: Up to 4 t/h solids
- Pulp Density: 20 to 45% solids pulp density
- Size Range: Particle size range 0.1 – 2.0mm
- Pulp Volume: Up to 11m³/h slurry volume

Applications

- This spiral separator is particularly suited to more demanding duties than those of conventional coal spirals.
- The principal area of application is coal treatment where increased levels of high-gravity and near-gravity material in the feed result in a greater demand on the separation duty.
- Separation of pumice and other low density materials is also an appropriate application.
- By recirculating middlings, the separation performance of the 2-stage system can be further improved.

patented technology*

Average Coal Feed Size – 1.4mm + 0.100mm

2 Stage Performance

Downer EDI Mining - Mineral Technologies Pty Ltd ABN 52 105 309 260
11 Elysium Road, Carrara Qld 4211 • PO Box 2569, Nerang MDC Qld 4211
Tel 61 7 5569 1300 • Fax 61 7 5525 3810 • Email mineraltechnologies@downeredimining.com • www.mineraltechnologies.com.au

created using BCL easyPDF Printer Driver
Click here to purchase a license to remove this image

APPENDIX 5

TESTWORK REPORT – GEKKO

created using
BCL easyPDF
Printer Driver
Click here to purchase a license to remove this image

TESTWORK REPORT

T1214 – Maydena Sands Testwork Report

GEKKO

25th November 2014

gekkos.com

CONCENTRATING ON THE FUTURE, NOW

created using
BCL easyPDF
Printer Driver
Click here to purchase a license to remove this image

Approved by: Andrew Dixon
Technical Services Manager

Accepted by: Mick Alsop
Sales Manager – Laboratory

Version 1.1
Date: 25/11/2014
Status: Final Report

For more information regarding procedures and testwork results:

Testwork Leader
Dr Adam Teague
Senior Metallurgist
Gekko Metallurgical Laboratory
(ph): +61 3 5339 5859
adamt@gekkos.com

About this document

Filename: T1214 - Maydena Sands - Testwork Report 141125.docx
Produced using Microsoft® Word 2007

Revision History

Version	Date	Author	Description
1.0	17/11/2014	Adam Teague	Draft Testwork Report
1.0	19/11/2014	Peter Gray	Peer Review
1.1	24/11/2014	Adam Teague	Final Report
1.1	25/11/2014	Adam Teague	Amended Final Report with Client Feedback

Copyright Notice

Copyright © 2014 Gekko Systems Pty. Limited. All rights reserved.

created using BCL easyPDF Printer Driver
Click here to purchase a license to remove this image

Executive Summary

This report presents the results of the gravity and magnetic separation sighter tests completed on the Maydena Sands silica sample at Gekko Systems' Metallurgical Laboratory in Ballarat, Australia. The objective of the progam was to obtain an initial indication as to whether the Gekko InLine Pressure Jig could be used to separate the impurities in the silica sand in combination with Wet High Intensity Magnetic Separation (WHIMS).

The results can be summarised as follows:

- The assayed head grade of the as received material was 0.013% Al_2O_3, 0.017% CaO, <1.0 g/t Cr_2O_3, 0.010% Fe_2O_3, 0.004% MgO, <0.001% MnO, 0.003% TiO_2, 0.002% Na_2O, <0.001% K_2O, 0.001% P_2O_5 and the calculated grade by difference for SiO_2 99.95%.
- Separation via gravity concentration followed by WHIMS slightly increased the grade of silica from 99.95% SiO_2 in the feed to 99.96% in the final clean product.
- The grade of most impurities decreased in the final clean product, including 7.7% reduction in Al_2O_3, 41.2% reduction in CaO, 40% reduction in Fe_2O_3, 33.3% reduction in TiO_2 and 25% reduction in MgO. The other impurities did not show any change in grade.
- The two impurities with the highest grades remaining in the final clean product were Al_2O_3 at 0.012% and Fe_2O_3 at 0.006%.
- In the WHIMS non-magnetic fraction, screened at 212 μm, approximately 23% more Al_2O_3, 64% more CaO and 50% more MgO, reported to the minus 212 μm plus 45 μm fraction, compared to the minus 600 μm plus 212 μm fraction. The grade of the other impurities generally remained the same except for TiO_2 which showed an extra 33% in the coarser minus 600 μm plus 212 μm fraction.
- The results from the current tests demonstrate that a combination of the Gekko InLine Pressure Jig with WHIMS has some potential to generate a high grade silica product with low mass yield (14.4 wt% of initial feed). If a higher mass yield of the final clean product is required, further testing would be needed including sending the table tailing to WHIMS, assaying the table concentrate and tailing by size fraction and running multiple passes of the gravity product through the WHIMS to achieve the final product grade.

created using
BCL easyPDF
Printer Driver
Click here to purchase a license to remove this image

It is recommended that:

- Additional testwork is carried out by concentrating the same feed via the Wilfley table and sending the table tailing to WHIMS for cleaning by magnetic separation. It is recommended that all WHIMS variables are verified by the client before testing including running multiple passes through the WHIMS to achieve the final product grade. To enable more complete assessment of the Wilfley table performance, samples of feed, concentrate and tailing should be assayed.
- In parallel, the feed as received should be tested through the WHIMS without prior tabling, to fully understand the potential benefit of gravity concentration via the InLine Pressure Jig.
- Assaying of the current testwork Wilfley table tailing and magnetic fraction from the WHIMS test would enable the recovery and hence effectiveness of the gravity concentration stage to be determined. The table tailing assay would also provide some understanding of the likely feed grade of this material if it was sent to WHIMS instead of the concentrate.

created using BCL easyPDF Printer Driver
Click here to purchase a license to remove this image

TABLE OF CONTENTS

created using
BCL easyPDF
Printer Driver
Click here to purchase a license to remove this image

1. Background

Maydena Sands initially approached Gekko Systems to provide a basic understanding of whether the Gekko InLine Pressure Jig could provide some benefit in concentrating the heavy mineral impurities in their silica sand. Since Gekko routinely uses the Wilfley Table in the laboratory as a close proxy of the InLine Pressure Jig, after further discussions, it was decided to test the silica sand using the Wilfley table in combination with a laboratory WHIMS unit for final upgrade of the clean product. Gekko Systems provided a proposal for this testwork in September 2014. The aim of the program was to obtain an initial indication as to whether the Gekko InLine Pressure Jig could be used to separate the impurities in the silica sand in combination with Wet High Intensity Magnetic Separation (WHIMS) as well as determining the highest grade of silica possible using these separation techniques.

2. Introduction

The scope of the testwork entailed the use of gravity tabling and Wet High Intensity Magnetic Separation (WHIMS) methods to remove as much of the impurities as possible from the high grade silica feed as supplied by the client.

This report refers to testwork proposal number T1214.

A flowsheet of the program can be summarised as follows:

- Single Pass Tabling determines the response of the silica sand to gravity separation of impurities. The gravity concentrate is treated by WHIMS to determine whether further amounts of magnetic impurities can be removed from the high grade silica.

created using
BCL easyPDF
Printer Driver
Click here to purchase a license to remove this image

Definitions and Acronyms

These are the definitions and acronyms used in this document.

Table 1: Acronyms and Their Definitions

Term or Acronym	Definition
AAS	Atomic Absorption Spectrometry
Sn	Tin
SiO_2	Silica
Al_2O_3	Aluminium Oxide
Fe_2O_3	Iron Oxide
TiO_2	Titanium Dioxide
CrO_3	Chromium Oxide
K_2O	Potassium Oxide
MnO_2	Manganese Dioxide
CaO	Calcium Oxide
MgO	Magnesium Oxide
Na_2O	Sodium Oxide
P_2O_5	Phosphorus Pentoxide
FA	Fire Assay
GAL	Gekko Assay Laboratory
Gekko	Gekko Systems Pty Ltd
ICP	Inductively Coupled Plasma
Pxx	Screen Size (µm or mm) XX% of material passes
PSD	Particle Size Distribution
SPT	Single Pass Table
µm	Micron
WHIMS	Wet High Intensity Magnetic Separation
XRF	X-ray Fluorescence

created using BCL easyPDF Printer Driver
Click here to purchase a license to remove this image

3. Sample Receipt and Preparation

3.1 Sample Receipt

The Maydena Sands sample was received by Gekko on the 14th October 2014. The bulk sample weighed 17.22 kg and was assigned the generic name LMAY. The sample was already prepared by the client to the size range, minus 600 µm to plus 45 µm for the subsequent test program.

3.2 Sample Preparation

The sample was logged, dried and weighed. The sample was then homogenized and prepared ready for size by grade and single pass table testwork as per the flowsheet testwork program in Figure 1.

3.3 Sample Remaining

Approximately 14.7 kg of table tailing remains in reserve.

created using
BCL easyPDF
Printer Driver
Click here to purchase a license to remove this image

4. Metallurgical Tests

4.1 Testwork Flowsheet

The testwork flowsheet used in this program is presented in Figure 1 below. It is designated Rev 2 and varies slightly from that originally proposed in the quote: *T1214 – Maydena Sands Gravity Testwork* for the reasons discussed in Section 4.2.

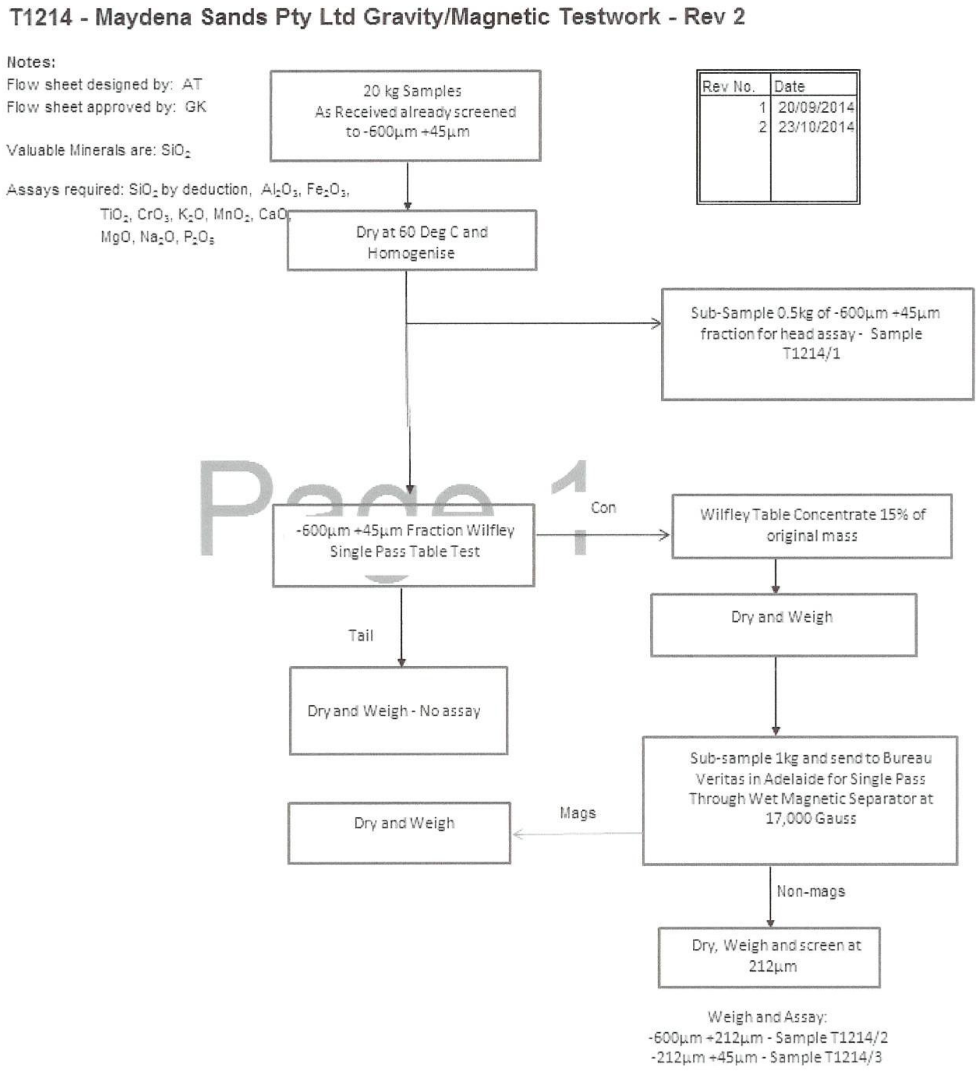


Figure 1 – Maydena Sands Gravity Testwork Flowsheet

created using BCL easyPDF Printer Driver
Click here to purchase a license to remove this image

4.2 Testwork Variations

At times the sample and/or the initial results dictate a variation to the proposed testwork program is required. In this case the only variation came about from the Wilfley Table testwork. During this test, most of the impurities visually reported to the tailing rather than concentrate, so after consultation with the client, the concentrate was sent to Bureau Veritas for WHIMS testing (as the "clean" product) instead of the tailing, which was in the original flowsheet.

4.3 Assaying Methods

During this testwork program, head and wet magnetic separation non-magnetic samples were assayed by ICP (method: ICP64) at ALS laboratories in Brisbane to determine the aluminium oxide, iron oxide, titanium dioxide, chromium oxide, potassium oxide, manganese dioxide, calcium oxide, magnesium oxide, sodium oxide and phosphate pentoxide content. The limit of reporting for this method was 0.001%. Using the assay results for these species, the silica content was calculated by difference.

4.4 Single Pass Table Method

Approximately 17.2 kg of sample in the size range of minus 600 µm to plus 45 µm was tabled using a laboratory sized Wilfley table. During operation of the Wilfley table a thin film of water was applied to the shaking table surface to help separate the lighter particles from the heavier ones. The heavier material was collected in a series of concentrate ports at the end of the table, while the lighter material was collected in a port on the side of the table. The products were collected into individual tubs and decanted, with the solids filtered and dried.

A bulk concentrate product targeting 15% of the original sample mass was produced and the concentrate and tailing samples were then dried and weighed. The concentrate was further processed via wet magnetic separation.

Figure 2 – Laboratory Size Wilfley Table

created using BCL easyPDF Printer Driver
Click here to purchase a license to remove this image

4.5 Wet Magnetic Separation Method

Since the majority of impurities visually reported to the table tailing during the testwork, the table concentrate was the fraction that was sent to Bureau Veritas laboratory in Adelaide for Wet High Intensity Magnetic Separation (WHIMS). Bureau Veritas used a small Outotec WHIMS unit, incorporating 6.4 mm steel ball charge as the magnetic media. The current was set to 3.7 Amp which equates to 17,000 Gauss of magnetic field, as requested by the client. The table concentrate sample was made up to 40 wt% solids with water and slowly pumped into the magnetic zone with a small peristaltic pump in a single pass over a period of 15 minutes. The top of the ball charge was washed three times during the run with a gentle hand spray. A final wash of the ball charge was carried out so that there would be enough sample of magnetic for an assay if required.

5. Results

5.1 Head Grade Determination

The Maydena Sands silica sample as received was already prepared by the client to the size fraction to be tested (minus 600 μm to plus 45 μm). The sample was homogenised and approximately 0.5 kg was split out for head assay determination of aluminium oxide, iron oxide, titanium dioxide, chromium oxide, potassium oxide, manganese dioxide, calcium oxide, magnesium oxide, sodium oxide and phosphate pentoxide via ICP. Because the sample was supplied was high grade silica, it was more accurate to assay the impurities and calculate the silica grade by difference.

Table 2: Maydena Sands Head Grade Results

Al_2O_3 %	CaO %	Cr_2O_3 ppm	Fe_2O_3 %	MgO %	MnO %	TiO_2 %	Na_2O %	K_2O %	P_2O_5 %	SiO_2 %
0.013	0.017	<1	0.01	0.004	<0.001	0.003	0.002	<0.001	0.001	99.948*

* calculated by difference

created using BCL easyPDF Printer Driver
Click here to purchase a license to remove this image

5.2 Single Pass Table Test

Gravity concentration of the silica feed sample was undertaken using the laboratory Wilfley table at the supplied particle size of minus 600 µm to plus 45 µm, to attempt to reject the impurities, prior to WHIMS. One concentrate product was produced at approximately 14.4% of the original feed mass. The dry weights and mass recoveries are given in Table 3. The client instructed Gekko not to carry out assays on the table concentrate or tailing, and as such, no table recovery results can be presented in this report.

Table 3: Maydena Sands Single Pass Table Results

Fraction	Dry Mass (kg)	Mass Recovery (%)	Sub-sample taken for WHIMS (kg)
Feed	17.20	100	-
Concentrate	2.48	14.4	1.0
Tailing	14.72	85.6	-

5.3 Wet Magnetic Separation

Approximately 1 kg of table concentrate was split and sent to Bureau Veritas laboratory in Adelaide for WHIMS testing in an attempt to further separate any remaining magnetic impurities from the high grade silica. Once the magnetic and non-magnetic fractions were received by the Gekko Metallurgical Laboratory, the non-magnetic fraction was screened at 212 µm; subsequently the minus 600 µm plus 212 µm and the minus 212 µm plus 45 µm size fractions were submitted for assay at ALS Brisbane. The results are listed below in Table 4, including the non-magnetic weighted average of both size fractions which represents the final clean silica product.

created using
BCL easyPDF
Printer Driver
Click here to purchase a license to remove this image

Table 4: Maydena Sands Wet Magnetic Separation Results

Sample	Mass (g)	Al_2O_3 %	CaO %	Cr_2O_3 ppm	Fe_2O_3 %	MgO %	MnO %	TiO_2 %	Na_2O %	K_2O %	P_2O_5 %	SiO_2 %
Mags	13.58											
Non-Mags	991.14											
Non-Mags (-600µm +212µm)	421.32	0.010	0.005	<1	0.006	0.002	<0.001	0.003	0.002	<0.001	<0.001	99.969
Non-Mags (-212µm +45µm)	569.74	0.013	0.014	<1	0.006	0.004	<0.001	0.002	0.002	<0.001	0.001	99.956
Non-Mags Weighted Average (-600µm +45µm)	991.06	0.012	0.010	<1	0.006	0.003	<0.001	0.002	0.002	<0.001	<0.001	99.962

The data in Table 4 show that from the WHIMS test on the table concentrate, 1.35 wt% (13.58 grams) of the test feed reported to the magnetic fraction which represented 0.19 wt% with respect to the as received feed sample.

The magnetic fraction was not assayed as requested by the client.

The non-magnetic fraction weighed 991.14 grams representing 98.65 wt% of the test feed or 14.21 wt% of the as received material.

The two non-magnetic size fractions that were assayed; minus 600 µm to plus 212 µm and minus 212 µm to plus 45 µm showed that on average, slightly more impurities are contained in the finer minus 212 µm to plus 45 µm fraction than the coarser fraction. In relative grade terms this equates to approximately 23% more Al_2O_3, 64% more CaO and 50% more MgO, whilst the concentration of the other impurities remains the same except for TiO_2 which shows 33% more in the coarser fraction. Since liberated Al_2O_3, CaO and MgO are not magnetic, the majority of these would be expected to pass through to the non-magnetic fraction. The presence of fewer impurities in the coarser minus 600 µm plus 212 µm fraction compared to the minus 212 µm to plus 45 µm fraction may be an inherent quality of the elemental distribution in the "as mined" feed and indicates some potential for Maydena Sands to remove impurities via screening at this size split.

created using BCL easyPDF Printer Driver
Click here to purchase a license to remove this image

5.4 Overall Results

Table 5 and Figure 3 provide a summary of the impurities in the high grade silica feed compared to the non-magnetic cleaned product weighted average.

Table 5: Comparison of Impurity Grades in Feed and Clean Silica Product

Sample	Al_2O_3 %	CaO %	Cr_2O_3 ppm	Fe_2O_3 %	MgO %	MnO %	TiO_2 %	Na_2O %	K_2O %	P_2O_5 %	SiO_2 %
Feed	0.013	0.017	<1	0.010	0.004	<0.001	0.003	0.002	<0.001	0.001	99.948
Non-Mags Weighted Average (-600µm +45µm)	0.012	0.010	<1	0.006	0.003	<0.001	0.002	0.002	<0.001	<0.001	99.962
% Decrease in Grade	7.7	41.2	0	40.0	25.0	0	33.3	0	0	0	

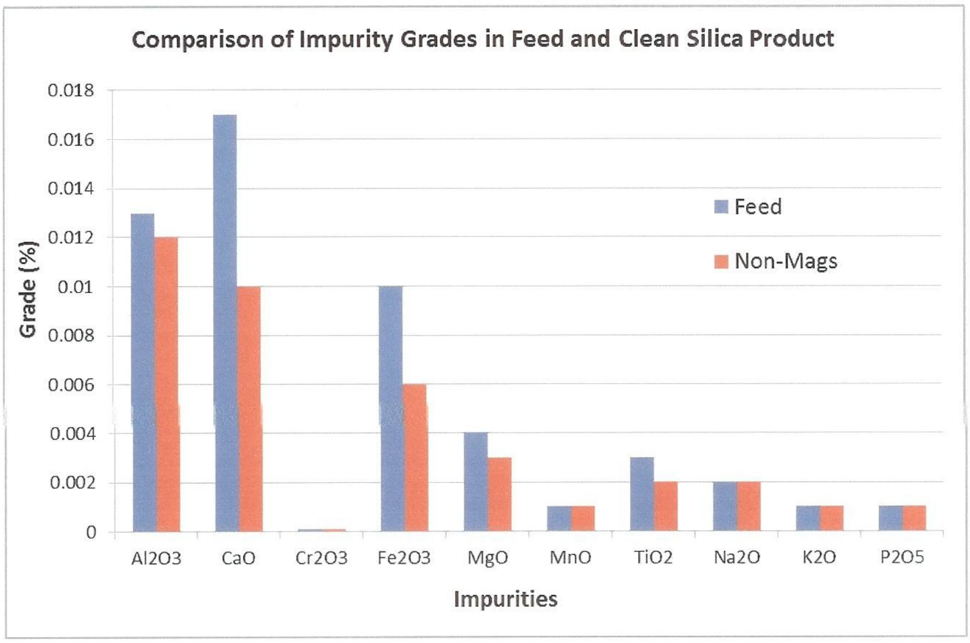


Figure 3 – Comparison of Impurity Grades in Feed and Clean Silica Product

created using BCL easyPDF Printer Driver
Click here to purchase a license to remove this image

The data in Table 5 and Figure 3 illustrate that the testwork flowsheet to reject the impurities via gravity concentration followed by WHIMS decreased the grade of most impurities in the final clean silica product, including Al_2O_3 (7.7%), CaO (41.2%), Fe_2O_3 (40%), TiO_2 (33.3%) and MgO (25%). The other impurities did not show any discernible difference in grade. The calculated grade of silica improved marginally from 99.948% SiO_2 in the feed to 99.962% in the final clean product. At the completion of the testwork, the two impurities with the highest grades remaining in the final clean product were Al_2O_3 at 0.012% and Fe_2O_3 at 0.006%. If further reduction of these two impurity grades is required, it may be possible to reduce the Fe_2O_3 grade by the addition of a cleaner stage to the gravity concentration, such as passing the table concentrate over a Mozley Super Panner; also by including multiple passes through the WHIMS, representing a scavenging stage on the non-magnetic fraction. This may be at the expense of decreasing the overall recovery of silica. Further reduction in both Al_2O_3 and Fe_2O_3 grades may also be possible via flotation of silica and simultaneous depression of these species with guar gum.

6. Conclusions

The following conclusions can be made:

- The head grade of the as received material was 0.013% Al_2O_3, 0.017% CaO, <1.0 g/t Cr_2O_3, 0.01% Fe_2O_3, 0.004% MgO, <0.001% MnO, 0.003% TiO_2, 0.002% Na_2O, <0.001% K_2O, 0.001% P_2O_5 and calculated by difference 99.948% SiO_2.
- The single pass tabling recovered 14.4% of the feed mass into a gravity concentrate. The table concentrate and tailing were not assayed as requested by the client, so the distribution of impurities to the concentrate and tailing could not be determined.
- WHIMS testing on the table concentrate removed 1.35% of the mass to the magnetic fraction. This represented 0.2wt% with respect to the as received feed sample. The magnetic fraction was not assayed as requested by the client.
- The WHIMS non-magnetic fraction represented 14.2wt% of the as received feed sample. When screened at 212 μm, approximately 23% more Al_2O_3, 64% more CaO and 50% more MgO, reported to the minus 212 μm plus 45 μm fraction, compared to the minus 600 μm plus 212 μm fraction. The grade of the other impurities generally remained the same except for TiO_2 which showed an extra 33% in the coarser minus 600 μm plus 212 μm fraction.

created using BCL easyPDF Printer Driver
Click here to purchase a license to remove this image

- Separation of the impurities via gravity concentration followed by WHIMS decreased the grade of most impurities in the final clean product, including 7.7% reduction in Al_2O_3, 41.2% reduction in CaO, 40% reduction in Fe_2O_3, 33.3% reduction in TiO_2 and 25% reduction in MgO. The other impurities did not show any discernable change in grades.
- The grade of silica increased from 99.948% SiO_2 in the feed to 99.962% in the final clean product.
- It was found that the two impurities with the highest grades remaining in the final clean product were Al_2O_3 at 0.012% and Fe_2O_3 at 0.006%.
- The results from the current tests demonstrate that a combination of the Gekko InLine Pressure Jig with WHIMS has some potential to generate a high grade silica product with low mass yield (14.4 wt% of initial feed). If a higher mass yield of the final clean product is required, further testing would be needed including sending the table tailing to WHIMS, assaying the table concentrate and tailing by size fraction and running multiple passes of the gravity product through the WHIMS to achieve the final product grade.

7. Recommendations

It is recommended that:

- Additional testwork is carried out by concentrating the same feed via the Wilfley table and sending the table tailing to WHIMS for cleaning by magnetic separation. It is recommended that all WHIMS variables are verified by the client before testing including running multiple passes through the WHIMS to achieve the final product grade. To enable more complete assessment of the Wilfley table performance, samples of feed, concentrate and tailing should be assayed.
- In parallel, the feed as received should be tested through the WHIMS without prior tabling, to fully understand the potential benefit of gravity concentration via the InLine Pressure Jig.

created using
BCL easyPDF
Printer Driver
Click here to purchase a license to remove this image

- Assaying of the current testwork Wilfley table tailing and magnetic fraction from the WHIMS test would enable the recovery and hence effectiveness of the gravity concentration stage to be determined. The table tailing assay would also provide some understanding of the likely feed grade of this material if it was sent to WHIMS instead of the concentrate.

created using BCL easyPDF Printer Driver
Click here to purchase a license to remove this image

Appendix A – Assay Results

BR14165518 - Finalized
CLIENT : "MODSON - Maydena Sands Pty Ltd"
# of SAMPLES : 3
DATE RECEIVED : 2014-11-04 DATE FINALIZED : 2014-11-11
PROJECT : "141031_MAY"
CERTIFICATE COMMENTS : ""
PO NUMBER : ""

SAMPLE	ME-ICP64	ME-ICP64	ME-ICP64	ME-ICP64	ME-ICP64	ME-ICP64	ME-ICP64	ME-ICP64	ME-ICP64	ME-ICP64	OA-GRA05		
	Al2O3	CaO	Cr2O3	Fe2O3	MgO	MnO	TiO2	Na2O	K2O	P2O5	LOI		
DESCRIPTION	%	%	ppm	%	%	%	%	%	%	%	%		
E3405 T1214/1	0.013	0.017	<1	0.01	0.004	<0.001	0.003	0.002	<0.001	0.001	0.08	Feed Assay	Sample As Received
E3406 T1214/2	0.01	0.005	<1	0.006	0.002	<0.001	0.003	0.002	<0.001	<0.001	0.07	-600µm to +212µm Non mags	Single Pass Table Con
E3406 T1214/3	0.013	0.014	<1	0.006	0.004	<0.001	0.002	0.002	<0.001	0.001	0.07	-212µm to +40µm Non mags	Single Pass Table Con

created using BCL easyPDF Printer Driver
Click here to purchase a license to remove this image

Appendix B - Disclaimer

Interim reports are provided as a means of keeping the client informed of testwork progress and to obtain feedback and discussion of the results. Conclusions drawn in these interim reports are to be viewed with caution until the testwork program is completed and the final report issued

Gekko has undertaken test work to characterize the response of your ore to certain separation techniques and/or to help your own experts make a decision as to whether you wish to purchase our product and, if so, the number and type.

It is important that you understand that:

- *Our testing is preliminary only.*
- *You should obtain, independent advice from all relevant specialists, including a metallurgist, before acquiring any equipment and before committing to and proceeding with your project.*
- *You must have your own experts examine the detailed analysis in our report to decide its applicability to your project.*
- *We analyse only the sample you provide. Any one of a number of factors may cause that sample inaccurately to reflect the ore body. You must determine the extent to which the sample represents the ore body. That includes the detection limits and confidence intervals relevant to our results.*

At all times we endeavour to provide accurate test work outcomes but you should not use our results as a basis for your broader business decisions about your project.

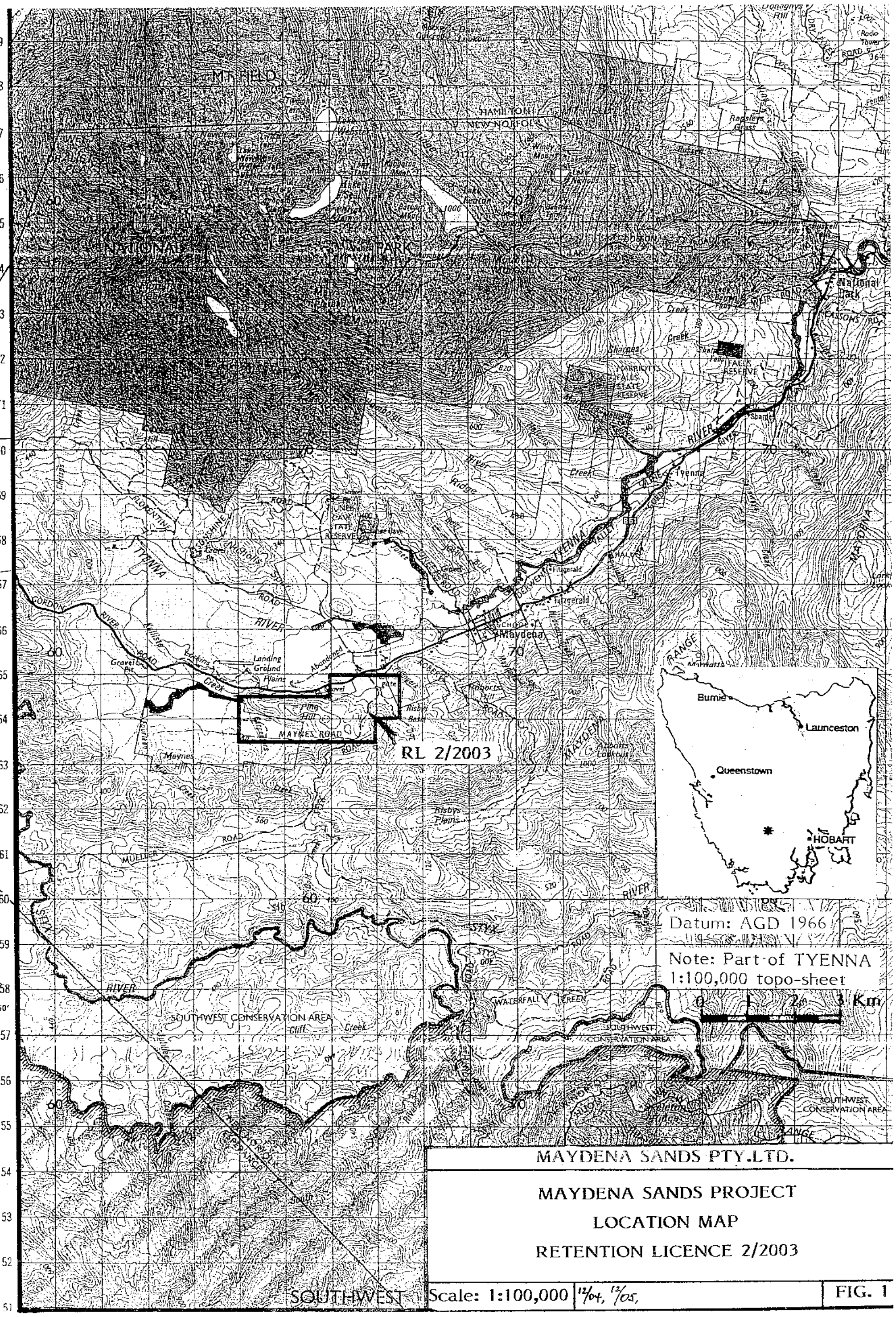
If we have not exercised due care with our tests, the limit of our liability, both at common law and under any statute, will be to provide a further set of test results to you free of charge. You indemnify us with respect to all other loss and damage of every kind, including, without limitation:

- *damage to or loss of property;*
- *injury to or death of any person; and*
- *economic and consequential loss arising from the negligent act or omission of us or any one else in connection with our test*

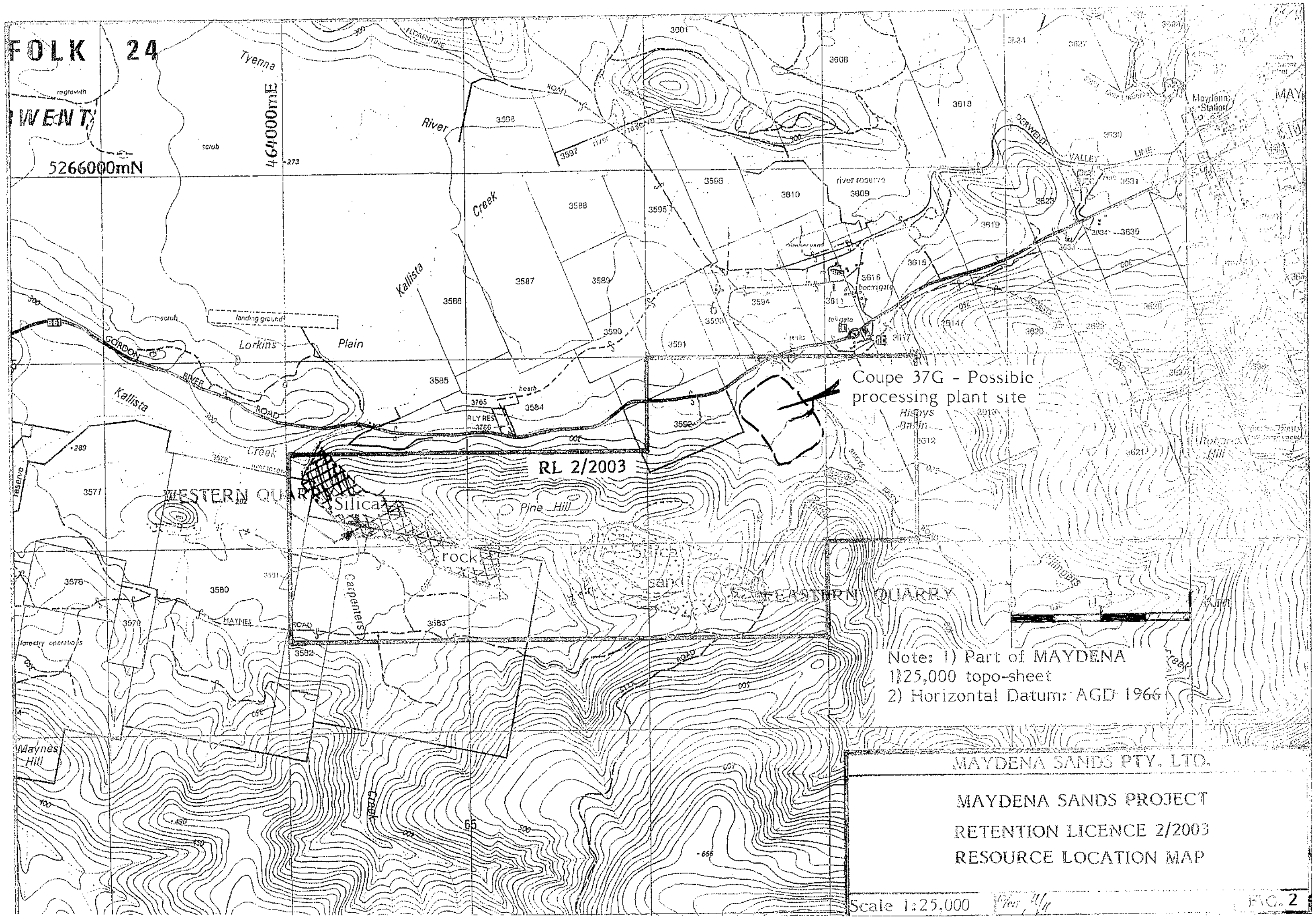
created using
BCL easyPDF
Printer Driver
Click here to purchase a license to remove this image

ILLUSTRATIONS

created using
BCL easyPDF
Printer Driver
Click here to purchase a license to remove this image



created using
BCL easyPDF
Printer Driver
Click here to purchase a license to remove this image



MAYDENA SANDS PTY. LTD.

MAYDENA SANDS PROJECT

RETENTION LICENCE 2/2003

RESOURCE LOCATION MAP

Scale 1:25,000

FIG. 2

created using
BCL easyPDF
Printer Driver
Click here to purchase a license to remove this image