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MINERAL HOLDINGS AUSTRALIA PTY LTD

MF 012604 - 012605

ANNUAL REPORT FOR 1991-2

E.L.24/88 (CHAMPION ROAD) & E.L.25/88 (RIP RANGE)

**OPEN FILE**

by

Vic Threader

for MINERAL HOLDINGS AUSTRALIA PTY LTD

92-3395.

October 1992

Vic Threader and Associates Pty Ltd  
Kingston Beach

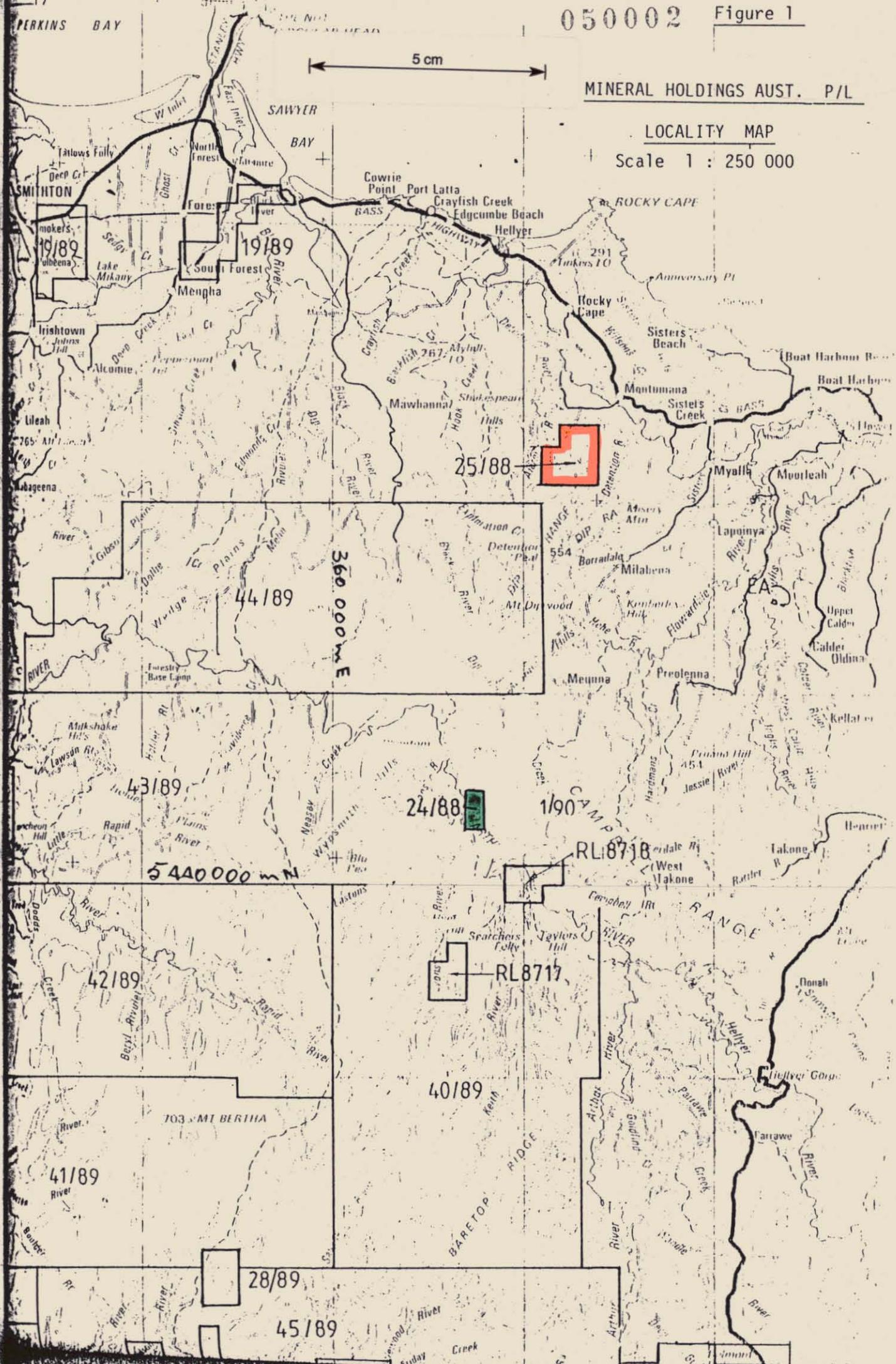
PERKINS BAY

5 cm

MINERAL HOLDINGS AUST. P/L

LOCALITY MAP

Scale 1 : 250 000



C O N T E N T S

## Introduction

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Exploration 1991-2

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Discussion

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Unimin

Santos

N. Queensland Energy Pty Ltd  
Stim Lab

(Previous Fracturing Sand Test Results are included  
in A.R. 1990-91 relating to testing during the 1991-2  
exploration year)

## Specifications:

Glass Sand (A.C.I.)

(Monier)

Crystal Sand (M.K. Silica) - Product Specification

Specialist Sands T, G and WQ series (Comm.Minerals)

Foundry Sand (Monier)

## Introduction

The two licences are located in N.W. Tasmania. E.L.24/88 (Champion Road) is on a fine sand deposit in the Arthur Lineament and is situated immediately east of the Arthur River and 30 km S of Rocky Cape on the Bass Highway. E.L.25/88 (Dip Range) is on a quartzite and derived sand deposit belonging to the Precambrian Rocky Cape Group and lies 10 km south of Rocky Cape. Both licences have been reported separately previously but a combined report has been considered more appropriate this time because of the market potential review which has been undertaken this year.

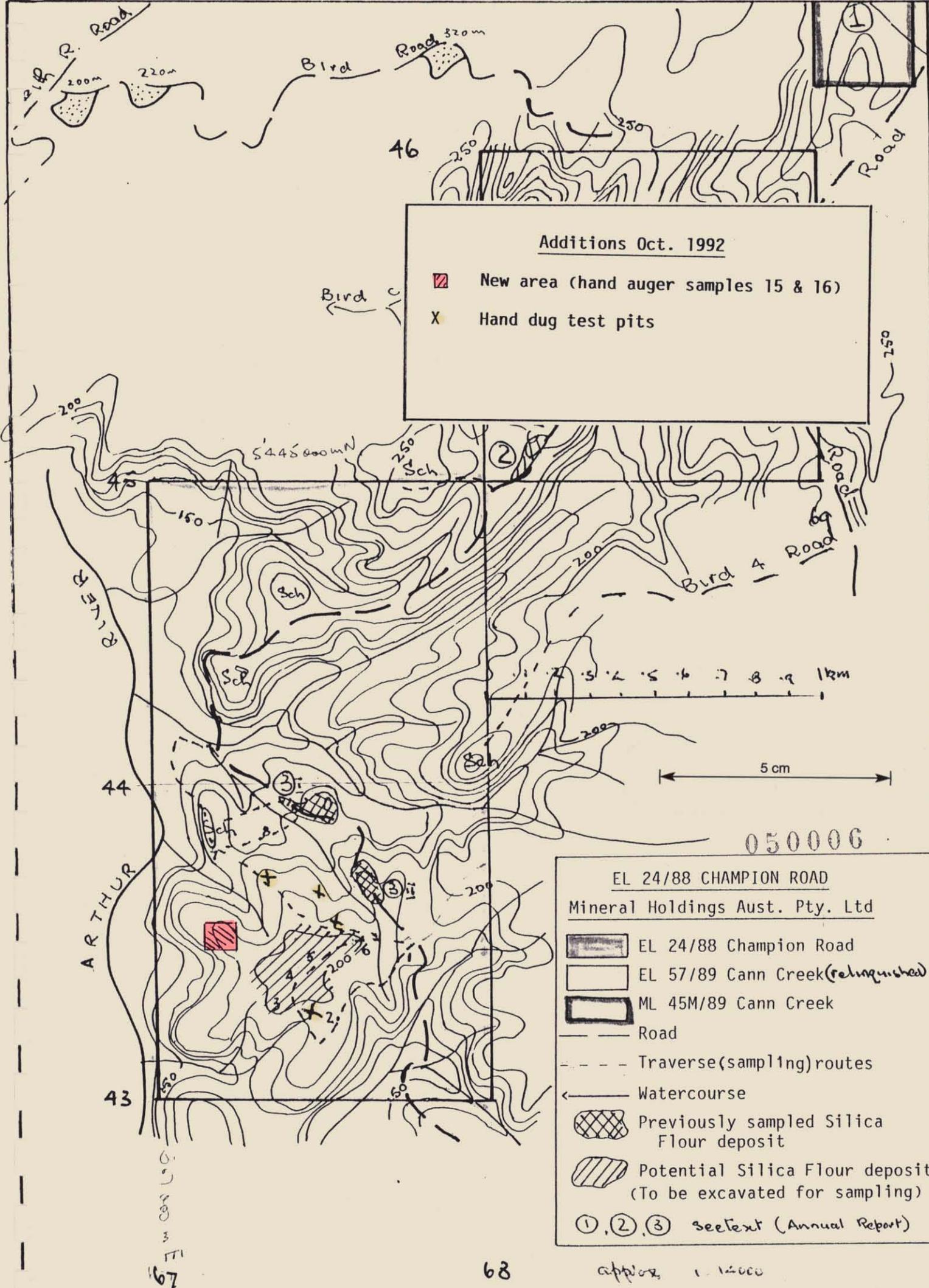
### Champion Road (E.L.24/88)

Exploration 1991-2. Shallow pits dug by hand in the southwest of the licence (Fig.2) revealed that much of the prospective area designated in the 1990 Annual Report consists of a thin layer of sand over bedrock (schist) and does not warrant further investigation. One area centred on 367200mE 5443500mN, estimated to be 100m x 100m, was drilled by hand auger to 1m. Samples from two pits were analysed by Analabs and results are included in Table 1 of this report. This area contains an indicated 10 000m<sup>3</sup> of sand per metre depth and the quality is comparable with samples 1 to 14 although iron content is appreciably higher.

The new area could be accessed by a track along the 190m contour for 700m from Champion Road but it is not intended to evaluate it further unless or until a market for the already proven resource in this licence can be established.

Summary Data. The following tables summarise the data so far accumulated on the licence:

Table 1 Chemical analyses of test pit samples



Additions Oct. 1992

New area (hand auger samples 15 & 16)  
X Hand dug test pits

EL 24/88 CHAMPION ROAD  
 Mineral Holdings Aust. Pty. Ltd

	EL 24/88 Champion Road
	EL 57/89 Cann Creek (relinquished)
	ML 45M/89 Cann Creek
	Road
	Traverse (sampling) routes
	Watercourse
▨	Previously sampled Silica Flour deposit
▧	Potential Silica Flour deposit (To be excavated for sampling)
①, ②, ③	See text (Annual Report)

050007

## CHEMICAL ANALYSES OF SAND SAMPLES FROM CHAMPION ROAD IN P.P.M.

No.	Fe2O3	TiO2	Al2O3	CaO	MgO	P2O5	Na2O	K2O	Mn	Cu	Cr	Ni	SiO2 %	LoI %
CR1	292	250	190	80	99	<2	20	16	1	-	-	-	99.67	0.24
2	93	500	230	100	140	<2	34	16	1	-	-	-	99.65	0.24
3	107	450	260	160	198	8	40	16	1	-	-	-	99.64	0.24
4	57	150	170	210	216	4	26	16	1	-	-	-	99.61	0.31
5	143	1850	660	220	348	4	74	22	1	-	-	-	99.50	0.17
6	50	350	300	200	265	2	40	16	1	-	-	-	99.62	0.26
7	64	350	250	350	348	4	40	30	1	-	-	-	99.68	0.18
8a	37	70	250	682	583	-	-	-	0.2	.5	.2	.2		
b	186	570	400	588	580	9	47	31	4	5	<5	5	99.1	0.69
d	128	1170	760	190	364	4	54	34	3	5	<5	5	99.4	0.35
9a	64	90	145	294	264	-	-	-	0.4	.3	.2	.3		
11a	83	59	193	265	252	-	-	-	0.3	.6	.2	.4		
b	172	200	320	210	250	4	34	22	4	5	<5	5	99.7	0.22
d	186	330	340	90	200	6	34	24	1	5	5	5	99.7	0.18
12a	48	45	80	359	276	-	-	-	.2	.5	.2	.2		
c	39	91	99	130	120	-	-	-	.2	.7	.3	.2		
13a	34	83	366	1415	1108	-	-	-	.3	.2	.2	.3		
b	143	400	660	1400	1080	9	54	46	10	5	<5	5	99.3	0.33
d	42	630	1510	230	680	2	121	20	1	5	<5	5	99.6	0.12
14a	19	45	285	797	660	-	-	-	.1	.3	.2	.2		
c	9	36	300	230	320	-	-	-	.1	.8	.2	.2		
15	395	240	1081	203	114	5	94	123	6	-	-	-	99.55	0.22
16	380	640	2116	88	113	18	102	211	4	-	-	-	99.38	0.25

Nos 1 - 7 by Analabs (whole samples) )  
 )  
 8 - 14a by M.K. Silica (-250+75 µm fraction) )  
 )  
 b by Analabs ( " ) ) Reported  
 )  
 c by M.K. Silica (- 75µm fraction) ) previously  
 )  
 d by Analabs ( " ) )  
 )  
 15,16 by Analabs )

Table 2: Particle Size Distribution

Figure 3: Frequency Curves

Champion Road Mean Particle Size Distribution Table 2

(extracted from Sizing analyses of 7 test pits. See AR 1989-90 TCR 89-303)

<u>Diameter</u>	<u>Mass %</u>	<u>Cumulative Mass %</u>			
+4.75 mm	11.9	11.9			
2.36	1.5	13.4			
1.18	4.3	17.7	0		
600µm	5.1	22.8	6.2	0	
300	4.6	27.4	12.8	6.0	
150	5.0	32.4	18.9	12.5	0
75	10.9	43.3	32.1	26.6	32.4
38	22.6	65.9	59.6	55.9	67.6
-38	34.1	100.0	100	100	100

Discussion. By analogy with the Corinna "Silica Flour" the Champion Road material is assumed to be derived by disaggregation of silicified carbonates (see Khin Zaw et al in Bulletin 70 Dept of Mines). In current usage, the term silica flour refers to pulverised quartz which is used mainly in the commercial cleanser market (ref. Ind Mins & Rocks AIME 5th Ed.1983). The Commercial Minerals Ltd specifications for pulverised quartz (WQ series) with respect to 38µm content are:

<u>WQ No.</u>	<u>%</u>
60	58

<u>WQ No.</u>	<u>%</u>
100	68
200	78
300	98
400	100

(Full specification in appendix)

Champion Road sand has a mean  $-38\mu\text{m}$  content of 34% (Fig.3) which is extremely fine grained for a naturally occurring sand but is coarser than all the grades of commercially produced pulverised quartz.

Corinna sand is somewhat coarser with a  $-38\text{mm}$  content of 10%. The grain size of the original carbonate rock - stated by Khin Zaw et al to be 20-300 $\mu\text{m}$  - probably determined the grain size of the replacement silica.

These deposits are probably best described as very fine sand or perhaps superfine sand but not "flour", which implies pulverising (as in rock flour) and a content of around 50% of 2 to 20 $\mu\text{m}$  material.

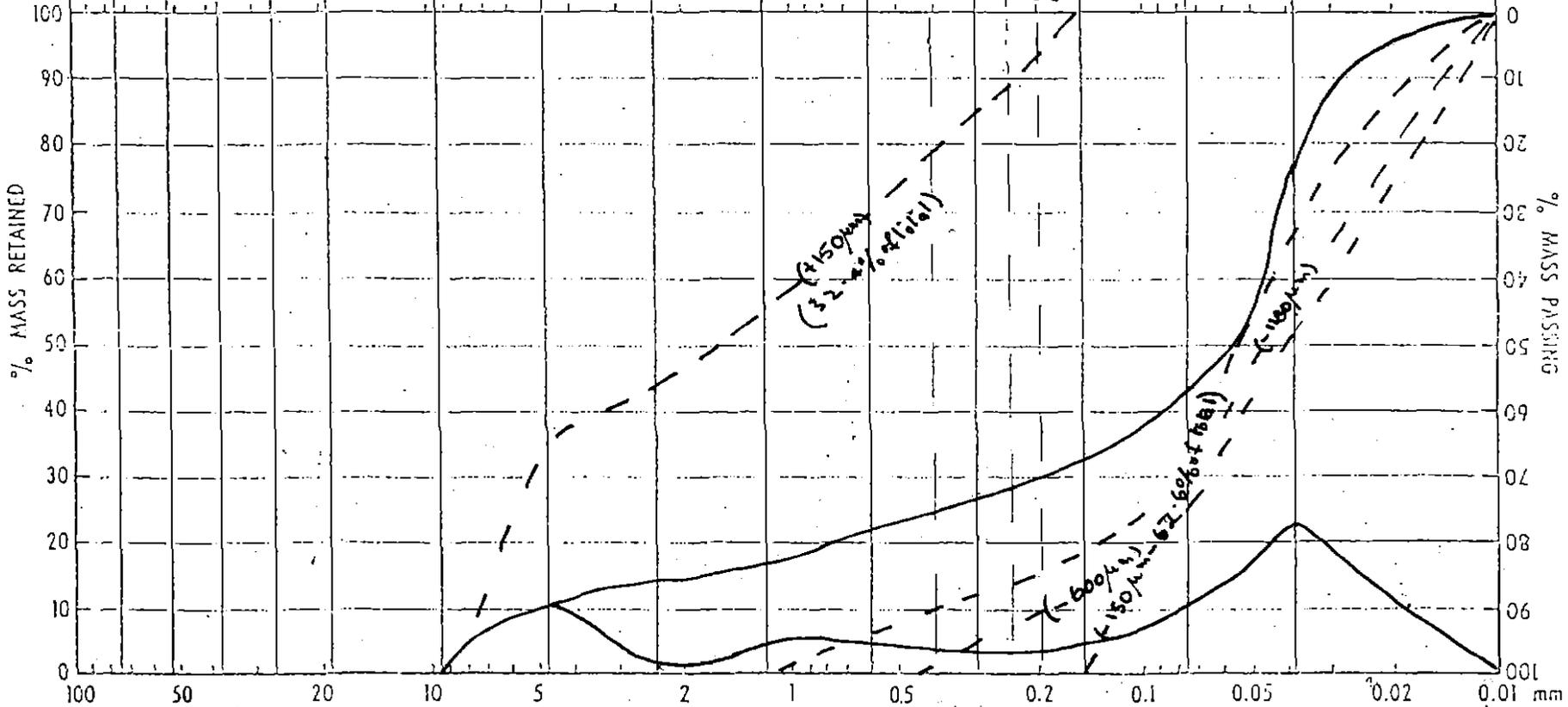
A Comalco report (see Appendix) states that Champion Road silica sand contains 10% of particles  $> 234 \mu\text{m}$  and is therefore a coarse powder.

The Champion Road sand has an apparent bimodal grain size distribution with peaks in the  $-38\mu\text{m}$  and  $+4.75\text{mm}$  fractions. The latter peak is due in part to composite grains of sand and in part to an admixture of quartz pebbles from an unrelated source.

The sand has been transported from its area of formation (presumably Cann Creek magnesite and dolomite) and now occurs as discrete pockets and hill cappings on Precambrian schist bedrock. Thin layers of a few cm of this sand are common throughout the licence area.

Corinna sand is described (ibid) as occurring as a residual deposit

REFERENCE No.	LAB. SERIAL No.	LOCALITY					SEDIMENT ANALYSIS PARAMETERS							
		Grading Curves - Champion Road (mean of 7 test pits)					M =	Y =	Sk =	K =				
COARSE AGGREGATE			FINE AGGREGATE			A77-1957 (concrete)								
COARSE AGGREGATE		FINE AGGREGATE			BINDER		N.A.A.S.R.A. (road materials)							
COBBLE	PEBBLE		GRANULE	SAND					SILT					
				V. COARSE	COARSE	MEDIUM	FINE	V. FINE						
-6	-5	-4	-3	-2	-1	0	2	3	4	5	6 $\phi$			
75	53	37.5	26.5	19	9.5	4.75	2.36	1.18	0.6	0.3	0.15	0.075	0.038	Aust. Stand. Sieve



050010  
Figure 3

on the parent rock which no doubt accounts for the presence of agatey quartz in the silica/carbonate contact zone. The composites in Champion Road sand are more likely due to recementation although the net result is much the same and agatey quartz from pit no.10 were tested successfully by Temco for furnace feed in ferrosilicon production.

The M.K. Silica plant at Heybridge (now owned by Index Minerals) was designed specifically to treat Corinna sand for the Japanese crystal glass industry and the acceptable grain size of raw feed is -250+75 $\mu$ m, which would exclude 85% of Champion Road sand (see Appendix for Product specification).

Stringent limits of contaminants would also exclude Champion Road sand from this market, particularly the TiO<sub>2</sub> and CaO and MgO levels.

Dip Range E.L.25/88

Exploration 1991-2. Mineral Holdings Australia Pty Ltd has carried out a reconnaissance auger drilling and in-field screening of sand on the edge of the sand deposit (figs 4 and 5). The purpose of this was to search for sand in the size range -850+425 $\mu$ m (20/40ASTM) which is the most used fracturing sand grading. The area of this investigation is about 3000m<sup>2</sup> and the mean depth of auger holes was 900mm. The result (Table 2) shows a significant increase in the 20/40 range over previous gradings; about 1/3 of the area contained >40% of this size whereas the mean result from previous laboratory conducted sizing analyses is 25%. The difference may be due to inherent material characteristics but it is first necessary to eliminate other causes. It is noted that the field sizings are biased towards the coarse end of the grading scale when compared with previous results.

050012

## FIELD SCREEN ANALYSES K.PINNER ML8M/89

## Pit Nos 10 - 27

<u>Particle Diam <math>\mu</math>m</u>	<u>Mass % Retained</u>	<u>Cumulative Mass % Retained</u>	<u>Mass % Retained</u>	<u>Cumulative Mass % Retained</u>	<u>Mass % Retained</u>	<u>Cumulative Mass % Retained</u>
	<u>No. 10</u>		<u>No. 11</u>		<u>No. 12</u>	
+2000	13	13	11	11	2	2
-2000+850	6	19	6	17	4	6
-850+420	25	44	22	39	33	39
-420	56	100	61	100	61	100
	<u>No. 13</u>		<u>No. 14</u>		<u>No. 15</u>	
+2000	0	0	2	2	2	2
-2000+850	2	2	4	6	5	7
-850+420	34	36	41	47	38	45
-420	64	100	53	100	55	100
	<u>No. 16</u>		<u>No. 17</u>		<u>No. 18</u>	
+2000	1	1	2	2	4	4
-2000+850	4	5	5	7	4	8
-850+420	39	44	36	43	33	41
-420	56	100	57	100	59	100
	<u>No. 19</u>		<u>No. 20</u>		<u>No. 21</u>	
+2000	19	19	4	4	3	3
-2000+850	5	24	4	8	2	5
-850+420	24	48	27	35	55	60
-420	52	100	65	100	40	100
	<u>No. 22</u>		<u>No. 23</u>		<u>No. 24</u>	
+2000	3	3	4	4	20	20
-2000+850	2	5	4	8	7	27
-850+420	49	54	47	55	26	53
-420	46	100	45	100	47	100
	<u>No. 25</u>		<u>No. 26</u>		<u>No. 27</u>	
+2000	4	4	3	3	11	11
-2000+850	11	15	3	6	5	16
-850+420	44	59	47	53	42	58
-420	41	100	47	100	42	100

Mineral Holdings Australia Pty Ltd

Hand Augering in ML8M/89

Scaler 1 : 1000

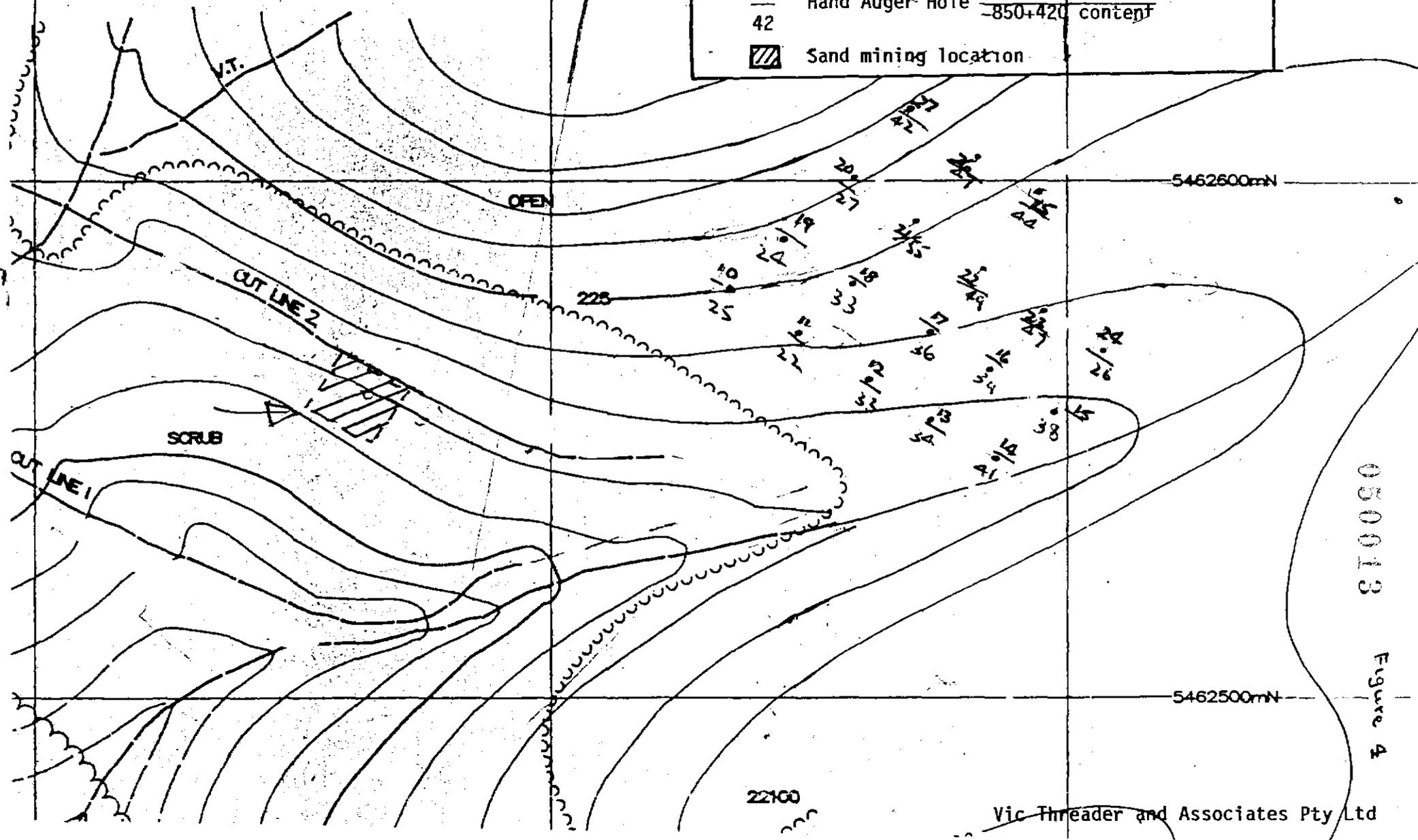
Cut Line 1 } Investigation Sites 1 & 2  
Cut Line 2 }

(Longworth and McKenzie EL43170  
April 1981)

27 Hand Auger Hole No  
42 -850+420 content

 Sand mining location

230



050013

Figure 4

Vic Threader and Associates Pty Ltd

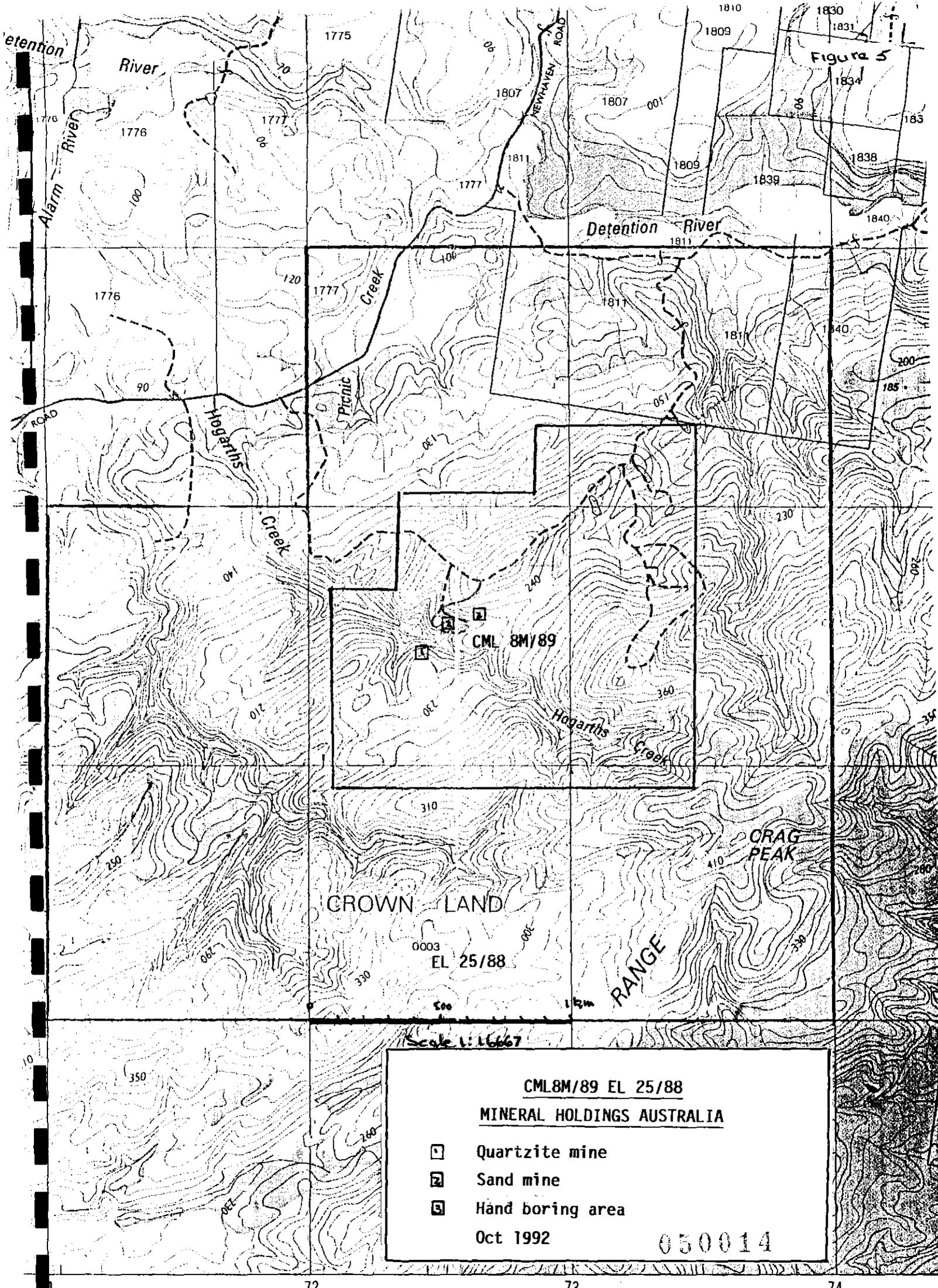


Figure 5

CROWN LAND

ORAG PEAK

RANGE

Scale 1:16667

**CML8M/89 EL 25/88**  
**MINERAL HOLDINGS AUSTRALIA**

- Quartzite mine
- Sand mine
- Hand boring area

Oct 1992 050014

<u>Diam <math>\mu</math>m</u>	<u>Mass % retained -averages</u>	
	<u>Field</u>	<u>Laboratory</u>
+850	10	2
-850+425	37	25
-425	53	73
	<u>100</u>	<u>100</u>

Check screen analysis of duplicate samples by an accredited laboratory should resolve this problem.

A further sample of -850+425 $\mu$ m sand was sent overseas (Stim Lab USA) for testing to API RP56 standard (Recommended Practices for Testing Sand used in Hydraulic Fracturing Operations). The sample failed the API specification in areas of cluster grains and crush resistance. A duplicate sample was tumble milled for 8 hours and retested with some improvement in results. It was concluded by the laboratory that the sand could be used as a proppant in some markets - full details in appendix. (For previous fracturing sand test results see AR 1991, TCR 91-3307). See also reports by Unimin and Santos in the appendix which support this view.

Fracturing agents for use in oil well drilling are currently imported (unit price as much as \$350/t). Dip Range sand has been tested to 4000 PSI which is adequate for shallow wells. Deep wells require fracturing sand capable of withstanding 6000 PSI and sintered bauxite is frequently used in this application because of the difficulty of finding natural sands of sufficient strength.

The grain size requirements for this application are:

<u>ASTM Screen No.</u>	<u>BSS Screen Size <math>\mu</math>m</u>	<u>Proportion in Dip Range Sand %</u>
20	+850	3
20/40	-850+425	24

SAMPLE INTERVAL (M)	SiO2	Al2O3	Fe2O3	Cr2O3	TiO2	CaO	MgO	Na2O	K2O	MnO	P2O5	GEOLOGICAL LOG
0-2	98.20	0.25	0.20	0.02	0.05	< 0.01	0.1	< 0.1	0.1	0.01	0.03	0 - 2m Hard, Fine Grained White Quartzite
2-3	99.00	0.19	0.30	0.02	0.07	< 0.01	0.1	0.2	< 0.1	0.01	0.03	2 - 5m As above with soft patches up to 300mm in width
3-4	98.90	0.30	0.30	0.02	0.06	< 0.01	0.1	0.2	0.1	0.01	0.03	
4-5	99.40	0.15	0.30	0.03	0.08	< 0.01	0.1	< 0.1	< 0.1	0.01	0.03	5 - 9.5m As above and fairly hard, fine to medium grain size
5-6	98.40	0.44	0.30	0.03	0.08	< 0.01	0.1	0.5	0.1	0.01	0.03	
6-7	98.70	0.36	0.20	0.02	0.07	< 0.01	0.1	0.4	0.1	0.01	0.03	
7-8	99.10	0.10	0.30	0.02	0.06	< 0.01	0.1	0.3	< 0.1	0.01	0.03	9.5 - 13m Soft, Partly consolidated sand, fine grained. Possible limit of oxidised zone at 13 metres
8-9	99.20	0.22	0.20	0.02	0.07	< 0.01	0.1	< 0.1	0.1	0.01	0.03	
9-10	98.90	0.05	0.20	0.02	0.05	< 0.01	0.1	0.5	< 0.1	0.02	0.03	
10-11	99.40	0.06	0.20	0.02	0.11	< 0.01	0.1	< 0.1	< 0.1	0.01	0.03	
11-12	98.80	0.37	0.40	0.04	0.06	< 0.01	0.1	0.1	0.1	0.02	0.04	13-14m Dark Brown unconsolidated fine grained sand
12-13	99.20	0.24	0.30	0.02	0.09	< 0.01	0.1	< 0.1	0.1	0.02	0.04	
13-14	98.10	0.92	0.30	0.02	0.06	< 0.01	0.1	0.3	0.1	0.03	0.04	14-20m Harder, fine to medium grained quartzite/sandstone, light brown to cream in colour
14-15	98.40	0.68	0.30	0.02	0.06	< 0.02	0.1	0.1	0.2	0.04	0.04	
15-16	98.60	0.65	0.30	0.02	0.06	< 0.01	0.1	< 0.1	0.2	0.01	0.03	20-25m Medium hard fine to medium grained light brown to cream coloured quartzite.
16-17	98.50	0.79	0.30	0.02	0.07	< 0.01	0.1	< 0.1	0.07	0.02	0.04	
17-18	98.50	0.78	0.30	0.02	0.07	< 0.01	0.1	< 0.1	0.2	0.03	0.03	
18-19	98.20	0.73	0.30	0.02	0.06	< 0.01	0.1	0.3	0.2	0.03	0.04	
19-20	98.20	0.88	0.40	0.02	0.08	< 0.01	0.1	< 0.1	0.3	0.03	0.04	25-26m Soft, fine grained cream coloured sand.
20-21	98.20	0.66	0.30	0.02	0.06	< 0.01	0.1	0.3	0.2	0.03	0.03	
21-22	98.10	0.94	0.40	0.02	0.07	< 0.01	0.1	< 0.1	0.3	0.01	0.04	26-32m Medium hard cream to white, fine grained quartzite.
22-23	98.10	0.84	0.40	0.03	0.06	< 0.01	0.1	0.1	0.2	0.03	0.03	
23-24	98.20	0.88	0.40	0.03	0.08	< 0.01	0.1	0.1	0.2	0.01	0.03	32-33m Dark brown med grained, medium hard quartzite with some water.
24-25	98.30	0.79	0.40	0.03	0.06	< 0.01	0.1	< 0.1	0.2	0.01	0.03	
25-26	98.30	0.85	0.40	0.02	0.07	< 0.01	0.1	< 0.1	0.07	0.01	0.03	
26-27	98.30	0.66	0.50	0.03	0.05	< 0.01	0.1	< 0.1	0.2	0.01	0.04	
27-28	98.50	0.59	0.40	0.02	0.06	< 0.01	0.1	< 0.1	0.2	0.01	0.03	33-35m Medium hard, fine grained, cream coloured quartzite.
28-29	98.30	0.58	0.40	0.02	0.05	< 0.01	0.1	0.3	0.2	0.09	0.04	
29-30	98.50	0.68	0.40	0.02	0.05	< 0.01	0.1	< 0.1	0.2	0.02	0.03	35-43m Soft brown quartzite grading to medium hard lighter brown quartzite at 43m. Material generally fine grained and water in hole from 35m onwards. Hole abandoned at 43m due to loss of bit.
30-31	98.60	0.61	0.40	0.02	0.05	< 0.01	0.1	< 0.1	0.1	0.02	0.03	
31-32	98.10	0.79	0.40	0.02	0.06	< 0.01	0.1	0.2	0.2	0.02	0.03	
32-33	98.60	0.63	0.30	0.02	0.05	< 0.01	0.1	< 0.1	0.2	0.01	0.03	
33-34	97.80	1.04	0.50	0.02	0.08	< 0.01	0.1	< 0.1	0.3	0.01	0.03	43-50m Hard, fine grained, white to cream coloured quartzite.
34-35	97.70	1.02	0.50	0.03	0.08	< 0.01	0.1	0.2	0.3	0.05	0.03	
35-36	98.80	0.48	0.30	0.02	0.06	< 0.01	0.1	0.1	0.1	0.02	0.04	N.B. The overlapping interval between bores DRP1A and DRP1B, ie 40 to 43 metres, indicates some variation in colour and may give an indication of degree of variation along strike. Ground water level intersected at 45m.
36-37	98.90	0.44	0.20	0.02	0.04	< 0.01	0.1	< 0.1	0.1	0.01	0.03	
37-38	98.80	0.58	0.40	0.03	0.04	< 0.01	0.1	< 0.1	0.2	0.01	0.03	
38-39	NO SAMPLE											
39-40	98.90	0.42	0.20	0.02	0.04	< 0.01	0.1	0.1	0.1	0.01	0.03	50-52m Medium to coarse grained unconsolidated sand with considerable water, light brown in colour.
40-41	98.70	0.55	0.50	0.03	0.05	< 0.01	0.1	0.3	0.1	0.01	0.03	
41-42	98.70	0.48	0.40	0.03	0.04	< 0.01	0.1	< 0.1	0.2	0.01	0.03	52-55m Hard, fine grained, light brown quartzite.
42-43	98.40	0.61	0.50	0.03	0.05	< 0.01	0.1	< 0.1	0.2	0.01	0.03	
43-44	98.00	0.88	0.40	0.03	0.07	< 0.01	0.1	< 0.1	0.3	0.05	0.04	
44-45	98.20	0.79	0.50	0.02	0.07	< 0.01	0.1	< 0.1	0.2	0.01	0.02	
45-46	98.10	0.86	0.40	0.02	0.06	< 0.01	0.1	0.2	0.3	0.03	0.03	50-52m Medium to coarse grained unconsolidated sand with considerable water, light brown in colour.
46-47	98.10	0.81	0.50	0.03	0.07	< 0.01	0.1	< 0.1	0.2	0.01	0.03	
47-48	98.30	0.74	0.50	0.04	0.06	< 0.01	0.1	< 0.1	0.2	0.01	0.03	52-55m Hard, fine grained, light brown quartzite.
48-49	98.30	0.73	0.60	0.02	0.06	< 0.01	0.1	< 0.1	0.2	0.01	0.03	
49-50	98.00	0.91	0.40	0.03	0.07	< 0.01	0.1	0.1	0.3	0.01	0.03	50-52m Medium to coarse grained unconsolidated sand with considerable water, light brown in colour.
50-51	98.40	0.65	0.30	0.02	0.06	< 0.01	0.1	0.1	0.1	0.05	0.03	
51-52	98.80	0.52	0.30	0.02	0.05	< 0.01	0.1	0.1	0.1	0.11	0.03	52-55m Hard, fine grained, light brown quartzite.
52-53	98.70	0.31	0.30	0.03	0.05	< 0.01	0.1	0.2	0.1	0.03	0.03	
53-54	98.80	0.31	0.20	0.02	0.05	< 0.01	0.1	0.2	0.1	0.08	0.03	52-55m Hard, fine grained, light brown quartzite.
54-55	98.90	0.39	0.20	0.02	0.06	< 0.01	0.1	< 0.1	0.1	0.02	0.03	

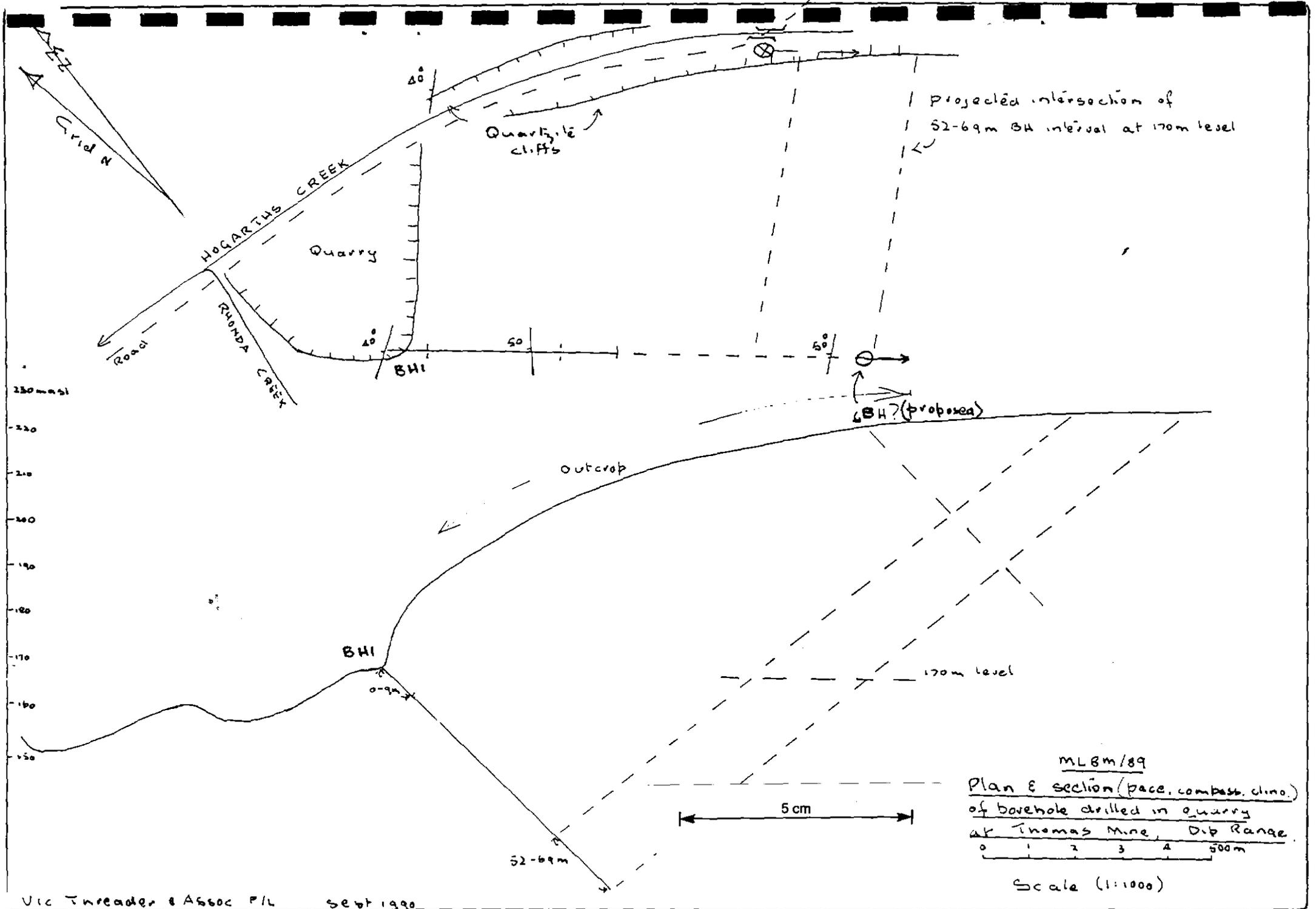
Table 3 (1)  
050016

55-56	98.50	0.60	0.30	0.02	0.06	< 0.01	0.1	0.1	0.2	0.02	0.03	55-59m Dark grading to light brown medium hard, fine to medium grained quartzite.
56-57	98.60	0.40	0.30	0.03	0.05	< 0.01	0.1	0.3	0.1	0.01	0.03	
57-58	98.70	0.55	0.20	0.02	0.06	< 0.01	0.1	0.1	0.2	0.01	0.03	
58-59	99.10	0.33	0.20	0.02	0.05	< 0.01	0.1	< 0.1	0.1	0.02	0.03	
59-60	98.70	0.50	0.20	0.03	0.06	< 0.01	0.1	0.1	0.2	0.02	0.03	
60-61	99.00	0.32	0.30	0.03	0.05	< 0.01	0.1	0.1	0.1	0.02	0.02	
61-62	99.00	0.29	0.20	0.02	0.04	< 0.01	0.1	0.1	0.1	0.08	0.03	
62-63	99.10	0.26	0.20	0.03	0.04	< 0.01	0.1	0.1	0.1	0.05	0.03	
63-64	99.20	0.22	0.20	0.02	0.03	< 0.01	0.1	< 0.1	0.1	0.02	0.04	
64-65	98.90	0.42	0.20	0.02	0.08	< 0.01	0.1	0.1	0.1	0.02	0.03	
65-66	99.10	0.34	0.20	0.02	0.05	< 0.01	0.1	< 0.1	0.1	0.02	0.02	
66-67	99.10	0.37	0.20	0.02	0.05	< 0.01	0.1	< 0.1	0.1	0.01	0.02	
67-68	99.20	0.39	0.20	0.02	0.04	< 0.01	0.1	< 0.1	0.1	0.03	0.02	
68-69	99.20	0.29	0.20	0.02	0.04	< 0.01	0.1	< 0.1	0.1	0.01	0.03	
69-70	98.60	0.73	0.20	0.02	0.08	< 0.01	0.1	< 0.1	0.2	0.01	0.03	
70-71	98.70	0.62	0.20	0.01	0.06	< 0.01	0.1	< 0.1	0.2	0.03	0.03	
71-72	98.70	0.54	0.20	0.02	0.06	< 0.01	0.1	< 0.1	0.2	0.07	0.03	
72-73	98.60	0.78	0.20	0.02	0.06	< 0.01	0.1	< 0.1	0.2	0.02	0.03	
73-74	98.60	0.79	0.20	0.02	0.07	< 0.01	0.1	< 0.1	0.2	0.01	0.03	
74-75	98.50	0.65	0.30	0.02	0.08	< 0.01	0.1	< 0.1	0.2	0.01	0.03	
75-76	98.30	0.72	0.20	0.03	0.07	0.11	0.2	< 0.1	0.1	0.10	0.03	
76-77	99.10	0.31	0.20	0.03	0.04	0.06	0.1	< 0.1	0.1	0.07	0.03	
77-78	98.80	0.37	0.10	0.01	0.06	0.05	0.1	< 0.1	0.1	0.22	0.03	
78-79	98.90	0.41	0.20	0.02	0.05	< 0.01	0.1	0.2	0.1	0.14	0.03	
79-80	98.70	0.55	0.20	0.02	0.06	0.01	0.1	0.1	0.2	0.10	0.03	
80-81	97.80	1.22	0.20	0.02	0.12	< 0.01	0.1	0.1	0.4	0.01	0.03	
81-82	98.50	0.63	0.20	0.03	0.07	< 0.01	0.1	0.1	0.2	0.04	0.03	
82-83	99.00	0.23	0.40	0.03	0.04	0.01	0.1	< 0.1	0.1	0.02	0.02	
83-84	98.80	0.23	0.40	0.02	0.04	< 0.01	0.1	0.2	0.1	0.03	0.03	
84-85	97.80	1.06	0.40	0.04	0.09	< 0.01	0.1	0.1	0.3	0.05	0.03	
85-86	98.90	0.32	0.40	0.04	0.04	< 0.01	0.1	< 0.1	0.1	0.03	0.03	
86-87	96.90	1.46	0.40	0.04	0.12	< 0.01	0.1	0.4	0.5	0.01	0.03	
87-88	98.10	0.89	0.30	0.04	0.07	0.06	0.2	< 0.1	0.2	0.07	0.03	
88-89	96.50	1.92	0.40	0.04	0.15	< 0.01	0.1	0.2	0.6	0.02	0.03	
89-90	98.80	0.30	0.40	0.03	0.05	< 0.01	0.1	0.1	0.1	0.02	0.03	
90-91	99.00	0.27	0.40	0.04	0.04	0.07	< 0.1	< 0.1	0.1	0.01	0.02	
91-92	99.10	0.25	0.40	0.04	0.05	< 0.01	0.1	< 0.1	0.1	0.01	0.02	
92-93	99.20	0.18	0.40	0.03	0.03	< 0.01	0.1	< 0.1	0.1	0.01	0.02	
93-94	98.40	0.62	0.40	0.04	0.07	< 0.01	0.1	< 0.1	0.1	0.05	0.03	
94-95	98.90	0.33	0.40	0.04	0.04	0.05	0.1	< 0.1	0.1	0.05	0.04	
95-96	98.80	0.39	0.30	0.04	0.04	< 0.01	0.1	0.2	0.1	0.02	0.03	
96-97	98.70	0.46	0.40	0.07	0.07	< 0.01	0.1	< 0.1	0.1	0.01	0.03	
97-98	98.80	0.45	0.40	0.06	0.06	< 0.01	0.1	< 0.1	0.1	0.01	0.03	
98-99	98.70	0.48	0.30	0.05	0.05	< 0.01	0.1	< 0.1	0.1	0.01	0.03	
99-100	99.20	0.20	0.30	0.04	0.04	< 0.01	0.1	< 0.1	0.1	< 0.01	0.03	
100-101	99.00	0.38	0.40	0.04	0.04	< 0.01	0.1	< 0.1	0.1	0.01	0.40	
101-102	98.80	0.45	0.30	0.05	0.05	< 0.01	0.1	< 0.1	0.1	0.01	0.03	

55-59m Dark grading to light brown medium hard, fine to medium grained quartzite.
59-60m As above but cream in colour.
60-69m Alternating hard and soft fine to medium grained brown quartzite - predominantly hard material.
69-82m Medium to fine grained, medium hard (some soft patches of minor extent) white to light brown quartzite. Notable softer patch from 76 to 79m.
82-85m Soft, medium grained cream to white quartzite.
85-86m Hard material of similar description to above.
86-90m Soft unconsolidated sand. Fine to medium grain size, cream in colour.
90-94m Darker material as above.
94-95m Soft uncemented, fine grained white sand.
95-99m Medium to fine grained unconsolidated soft sand, cream in colour.
99-100m Soft uncemented, fine grained white sand
100-102m As for interval 95-99m - hole abandoned due to cave in of sand.
EOH

050017

Table 3 (2)



Vic Treadwell & Assoc P/L Sept 1990

050018

Figure 6

MINERAL HOLDINGS AUSTRALIA PTY. LTD.THOMAS MOUNTAIN SANDCHEMICAL COMPOSITION

(Unbeneficiated Samples)

<u>Element/Oxide</u>	<u>Average</u>	<u>No. of Analyses</u>
SiO <sub>2</sub>	99.83%	6
Al <sub>2</sub> O <sub>3</sub>	293 ppm	7
Fe <sub>2</sub> O <sub>3</sub>	222 ppm	17
TiO <sub>2</sub>	300 ppm	6
MgO	< 186 ppm	5
CaO	< 79 ppm	6
MnO	125 ppm	4
Li <sub>2</sub> O	2 ppm	1
Na <sub>2</sub> O	< 213 ppm	6
K <sub>2</sub> O	< 96 ppm	6
P <sub>2</sub> O <sub>5</sub>	< 100 ppm	3
So <sub>3</sub>	767 ppm	3
ZrO <sub>2</sub>	36 ppm	1
Cr <sub>2</sub> O <sub>3</sub>	1.5 ppm	1
Cu	1 ppm	1
U	0.5 ppm	1
Y	1 ppm	1

Source of Data

A.C.I. (Australian Glass Manufacturers Coy)	March, 1991
Hepworth Minerals & Chemicals Ltd.	July, 1990
Monier Ltd.	June, 1987
Tasmanian Dept. of Mines	June & October, 1990
T.S.L. Group P.L.C.	October, 1989
Unimin Corporation	July, 1989

MINERAL HOLDINGS AUSTRALIA PTY. LTD.THOMAS MOUNTAIN SANDPARTICLE SIZE DISTRIBUTION

(Unbeneficiated Material)

<u>U.S.A. Sieve</u> <u>ASTM</u>	<u>Aperture</u>	<u>% Mass Retained</u>		<u>No.</u> <u>of Analyses</u>
		<u>Individual</u>	<u>Cumulative</u>	
4	4.75 mm	1.31	1.31	3
8	2.36 mm	0.03	1.34	4
10	2.00 mm	0.16	1.50	E
16	1.18 mm	0.15	1.65	4
18	1.00 mm	0.35	2.00	E
20	850 $\mu$	0.78	2.78	* 5
30	600 $\mu$	6.41	9.19	0 7
40	425 $\mu$	18.26	27.45	14
50	300 $\mu$	18.82	46.27	40.8 14
60	250 $\mu$	13.74	60.01	10
70	212 $\mu$	7.01	67.02	12
100	150 $\mu$	14.37	81.39	79.4 12
140	106 $\mu$	8.12	89.51	7
200	75 $\mu$	2.74	92.25	91.4 10
400	38 $\mu$	2.30	94.55	93.9 4
	-38 $\mu$	5.55	100	

Source of Data

Analabs,  
MK Silica,  
Tas. Dept. of Mines,  
Yuba Silica

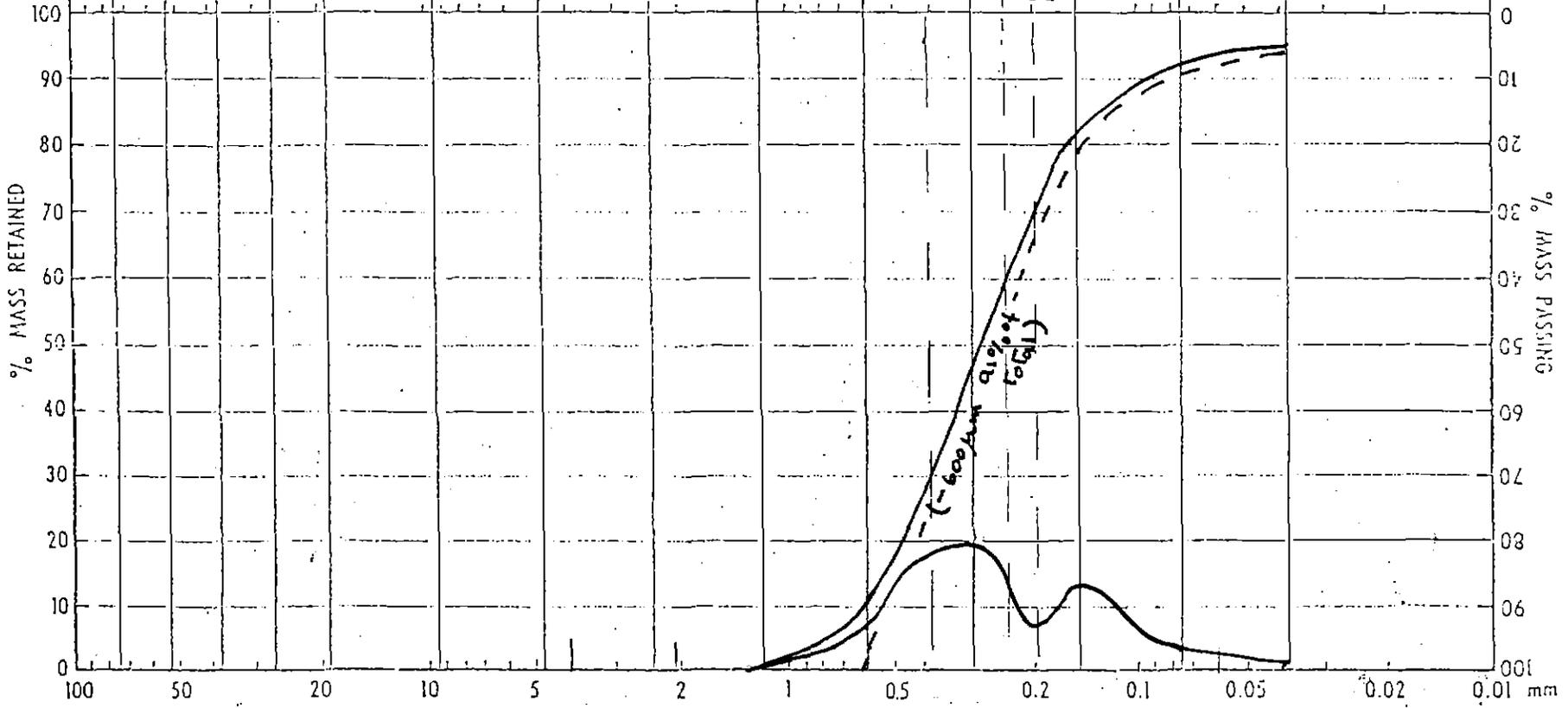
December, 1990  
October, 1990  
October, 1990  
January, 1987

(E : extrapolated from adjacent values)

\* Calculated - 600  $\mu$  grading

M 1324

REFERENCE No.	LAB. SERIAL No.	LOCALITY					SEDIMENT ANALYSIS PARAMETERS							
		Mean Grading Dip Range Sand					M =	V =	Sk =	K =				
COARSE AGGREGATE			FINE AGGREGATE			A77-1957 (concrete)								
COARSE AGGREGATE		FINE AGGREGATE		BINDER		N.A.A.S.R.A. (road materials)								
COBBLE	PEBBLE		GRANULE	SAND					SILT					
				V. COARSE	COARSE	MEDIUM	FINE	V. FINE						
-6	-5	-4	-3	-2	-1	0	1	2	3	4	5	6 φ		
75	53	37.5	26.5	19	9.5	4.75	2.36	1.18	0.6	0.3	0.15	0.075	0.038	Aust. Stand. Sieve



253 254 255  
(0.2) (0.075) (0.075)

050021

Figure 7

40/70	-425+212	39.5
70/140	-212+106	22.5
140	-106	10
	Total	100
<hr/>		
30/50	-600+300	37

Summary Data:

1). Quartzite. A ridge of quartzite striking NW-SE and dipping SW passes through the licence area and has been mined in the lease CML8M/89 for the ferrosilicon and silicon metal industries. There is no current production due to the closing down of both these operations.

Drilling of the southeasterly end of the quartzite ridge has been proposed but has been postponed pending development of a market for the quartzite.

Temco analyses of drilling through the quartzite ridge are summarised below.

In 102m of drilling through the quartzite on the SE bank of Hogarths Creek the following sequence was recorded: 0-85m hard quartzite with soft bands (9-14, 25-29, 35-36, 49-52, 82-85) and 85-102 sand (soft sandstone). The complete log and chemical analysis is given in Table

3. A 17m true width (52-69m) was selected by Temco as a suitable mining target as shown on the schematic section (fig. 6). The grade of this section of the hole was 88.9% SiO<sub>2</sub> with 0.37% Al<sub>2</sub>O<sub>3</sub>. Quartzite from the B.H. collar was successfully furnace trialled by Temco.

The average grade of this 4000t was 98.7% SiO<sub>2</sub> and 0.2% Al<sub>2</sub>O<sub>3</sub>.

2). Sand. Mean chemical and sizing analyses of sand from the licence and lease are given in Tables 4 and 5 and Figure 7. Sand is currently

FACSIMILE TRANSMITTAL FORM

050023



Glass Packaging Division

SYDNEY

DATE 26-5-92

SENDER G. HIGGIN BOTTAM

FAX TO: AGM HOBART

ATTN: Mr. H. WOOLLEY cc. Mr. N. THOMAS

SUBJECT: SAND Mt. THOMAS

No. of PAGES 1  
(including this page)

(A Unit of ACl Operations Pty. Ltd. A.C.N. 004 230 328  
817 South Dowling Street, Waterloo, Sydney, Australia  
Postal Address: Box 1, P.O. Waterloo, N.S.W. 2017  
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Telex: AA22876

FAX NO. (02) 699 8085

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NOTE: Please advise by telex if any parts of transmission have failed.

ANALYSIS NEW SHIPMENT PROCESSED SAND

SiO <sub>2</sub>	99.88
Na <sub>2</sub> O	0.01
K <sub>2</sub> O	<0.01
CuO	<0.01
MgO	<0.01
Al <sub>2</sub> O <sub>3</sub>	0.02
TiO <sub>2</sub>	0.05
Fe <sub>2</sub> O <sub>3</sub>	0.015
Cr <sub>2</sub> O <sub>3</sub>	0.0002

Regards

*G. Higgin Bottam*

Faxed to Dr. J. Nixon 27/5/92 for Codes

being mined (location on figure 5) and supplied to ACI for table glassware production on a spot sales basis but as yet a sales contract to secure the long term future of the operation has not been finalised.

Glass sand. The ACI purchase acceptance standard and the Monier specification (fine sand and superfine sand for glass making) are given in the appendix. Figure 11 indicates the cumulative frequency curve for the specification and the grading of the -600µm Dip Range sand for comparison.

Ideally the sand contains 10% oversize and 10% undersize to meet this specification and with regard to chemical purity, the sand is outside specification in respect of SiO<sub>2</sub> content by 0.3% and Fe<sub>2</sub>O<sub>3</sub> by 20ppm. The sand is however of acceptable quality for the production of table glassware by ACI and is currently being produced for that market. It is noted that the most recent consignment of processed sand was of significantly higher grade than the mean values listed in the table with SiO<sub>2</sub> up to 99.88% and Fe<sub>2</sub>O<sub>3</sub> down to 150 ppm as per attached ACI analysis.

Discussion

In addition to the glass sand and metallurgical quartzite markets already mentioned, a range of industrial applications has been and is continuing to be made for utilisation of sand and quartzite from these licences.

1) Sodium Silicate. P.I.Q.Australia have recently commenced production in Victoria. Specification of raw material:

<u>Contaminant</u>	<u>Upper limit (ppm)</u>
Fe <sub>2</sub> O <sub>3</sub>	350
Al <sub>2</sub> O <sub>3</sub>	4000
TiO <sub>2</sub>	500
CaO + MgO	700

Grain size limits:  $850\mu\text{m}/\leq 15\%$ ,  $+150\mu\text{m}\geq 85\%$  and  $+106\mu\text{m}\geq 95\%$

Requirements: estimated 22 000 t.p.a.

Dip Range sand is within specification and prospects are good for utilisation in this market.

2) Fused Silica. This (and fused alumina) are produced in USA and Japan for the manufacture of abrasives. The preferred size range of raw material is  $-8\text{mm}+2\text{mm}$  and silica content: 99.8%. The market is limited to 6-7000 t.p.a. and would be an outlet for the Thomas Mountain quartzite mine since the closing of ferrosilicon and silicon metal production in the state.

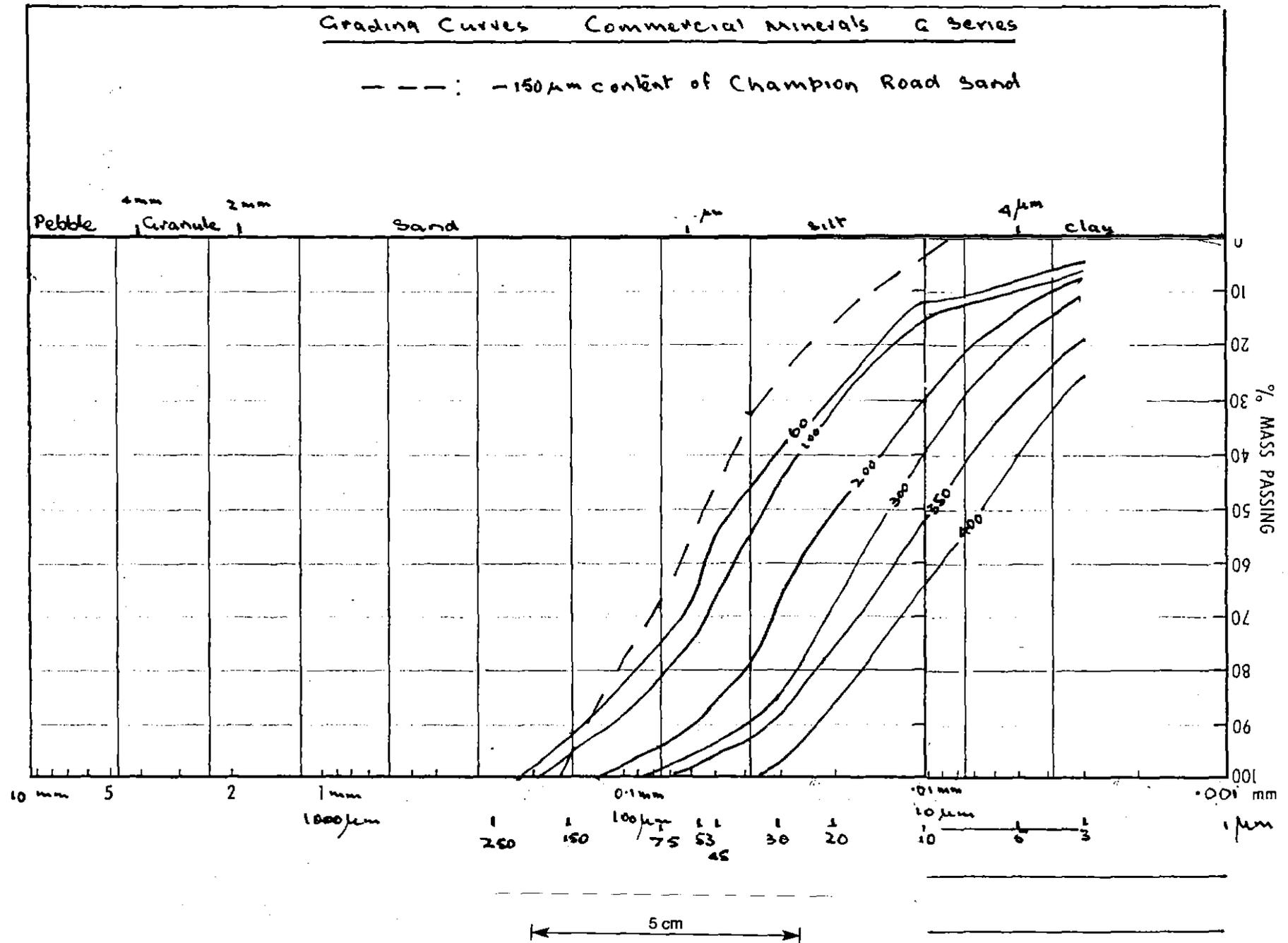
3) Foundry Sand. There are several specifications of size gradings in the foundry industry and two (by Monier) are listed in the appendix. These two have AFS fineness numbers of 37 and 47 but in a list of eight naturally occurring foundry sands in USA the fineness number ranges from 29 to 191. The finer grades of sand produce the highest numbers and are employed for precision castings and non-ferrous castings.

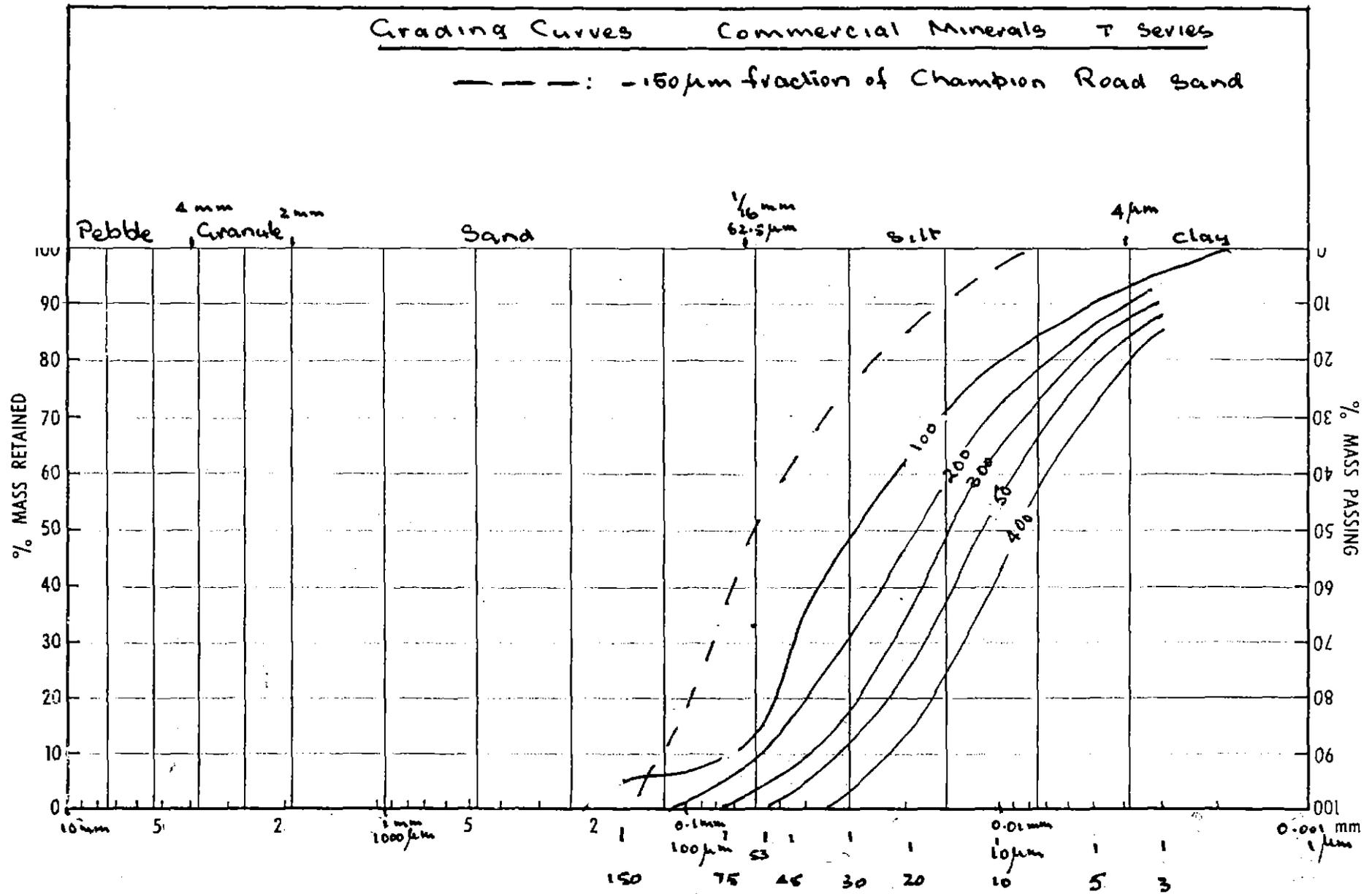
Dip Range sand has an AFS number of 78, but removal of the  $-75\mu\text{m}$  fraction reduces it to 55.

The sand meets the Monier specification with respect to contaminants ( $\text{SiO}_2$  : 99.6%,  $\text{Al}_2\text{O}_3$  : 400 ppm,  $\text{Fe}_2\text{O}_3$  : 600 ppm,  $\text{TiO}_2$  : 1600 ppm, LoI : 0.10%). Full specification in Appendix, see also figure 11.

There is a limited market for foundry sand as most foundries are located in mainland states and their supplies are secured under contracts. The main Tasmanian foundry is controlled by Boral which is also a major sand supplier. Attempts to secure an outlet in the local market have so far been unsuccessful.

4) Other Applications. Quartz sand of high purity is required





050027.

Figure 9

Grading Curves

Commercial Minerals WQ series

--- : -150mm fraction of Champion Road sand  
(67.6% of total)

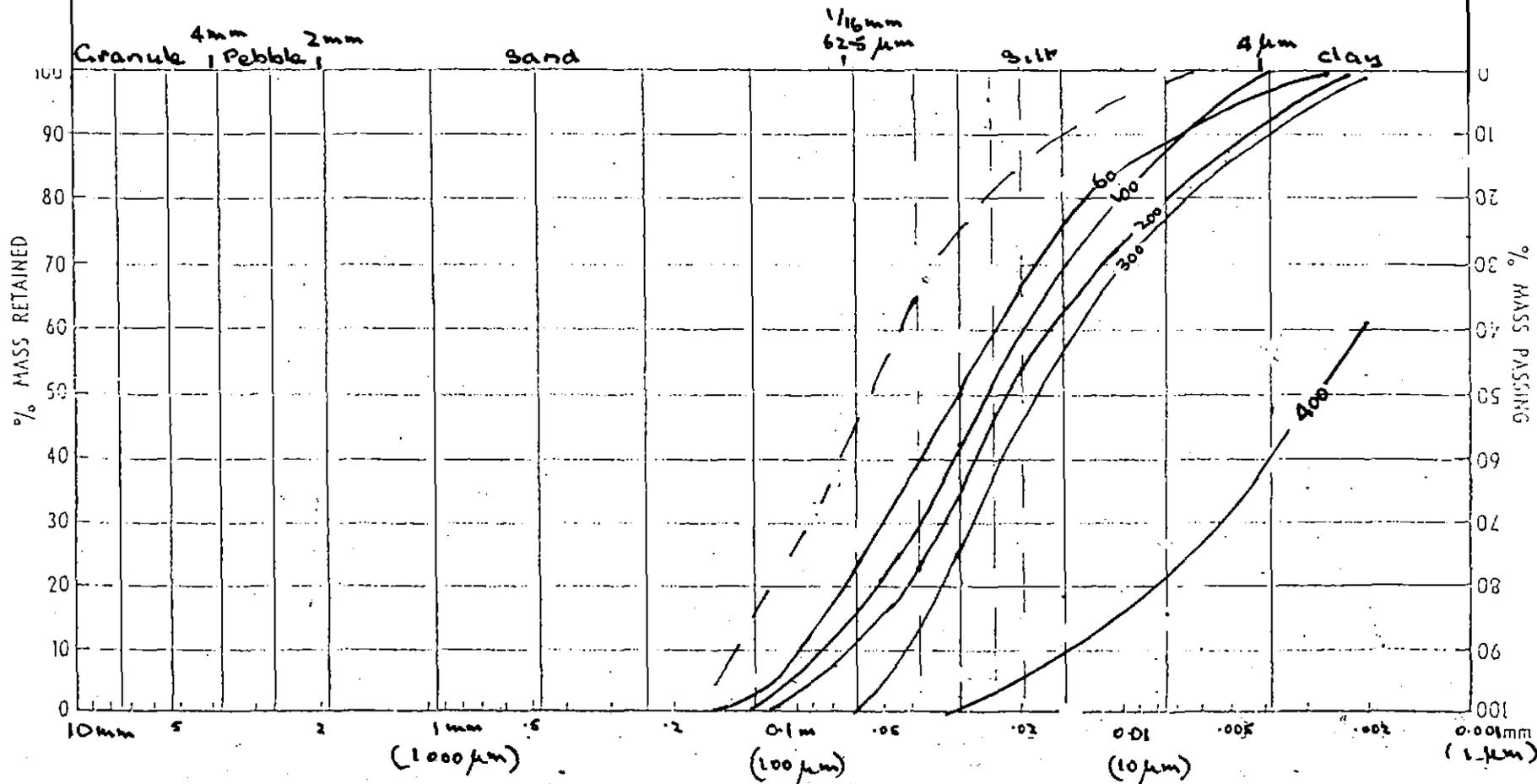
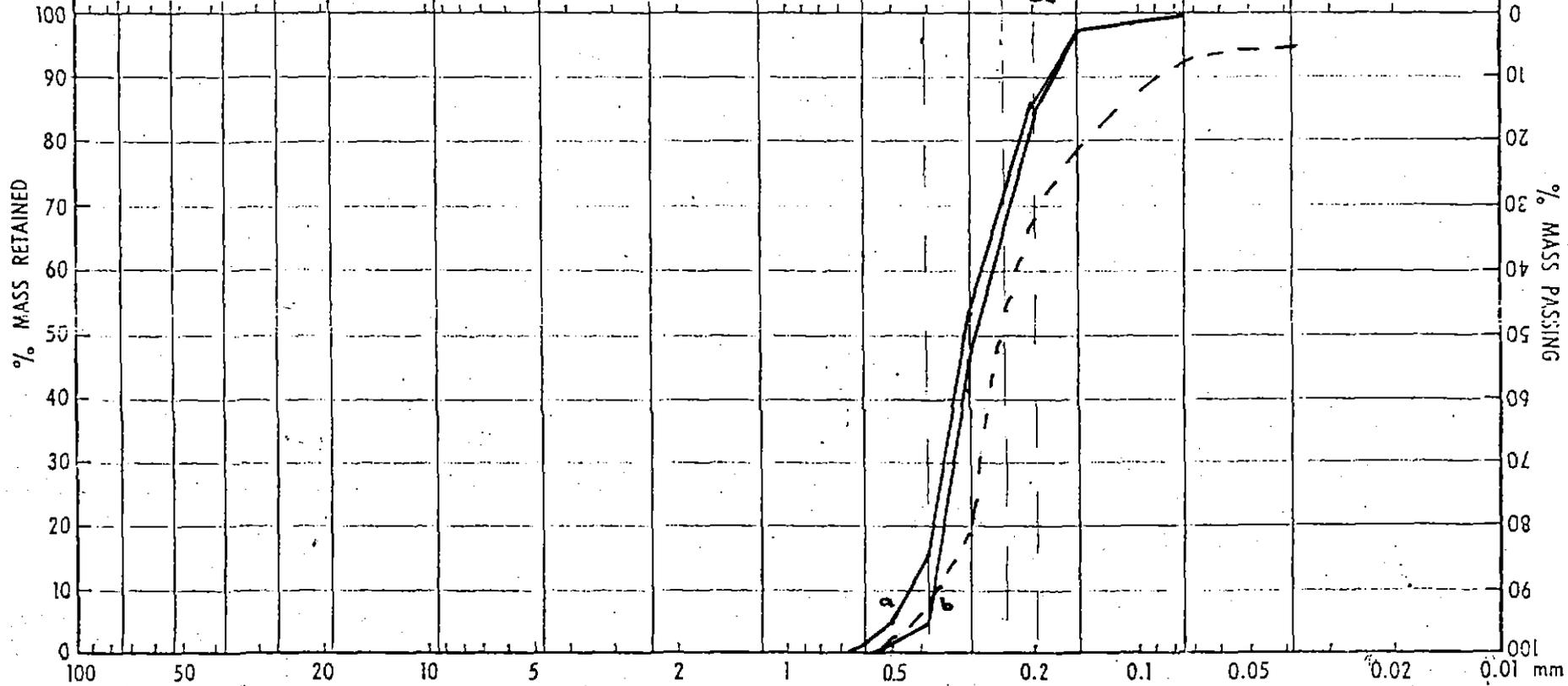


Figure 11

M 1324

REFERENCE No.	LAB. SERIAL No.	LOCALITY					SEDIMENT ANALYSIS PARAMETERS							
		<i>Monier Glass sand specification a. fine, b. superfine</i>					V =	Sk =	K =					
COARSE AGGREGATE			FINE AGGREGATE					A77-1957 (concrete)						
COARSE AGGREGATE			FINE AGGREGATE			BINDER		N.A.A.S.R.A. (road materials)						
COBBLE	PEBBLE		GRANULE		SAND					SILT				
					V. COARSE	COARSE	MEDIUM	FINE	V. FINE					
-6	-5	-4	-3	-2	-1	0	1	2	3	4	5	6	φ	
75	53	37.5	26.5	19	9.5	4.75	2.36	1.18	0.6	0.3	0.15	0.075	0.038	Aust. Stand. Sieve



--- Dip Range sand  
 - 600 μm fraction (Dip Range)

CS3 CS4 CS5  
 (0.2) (0.15) (0.12)

050029

Figure 11

in the production of ceramics, refractories, plastics, adhesives and grouts. Full specifications from Commercial Minerals of their G, T and WQ series are included in the appendix.

Figures 8, 9 and 10 show the frequency curves of these gradings. The  $-150\mu\text{m}$  fraction of Champion Road sand is indicated on these curves for comparison. The closest approximation is in the G series. Sizing by sedimentation carried out by the Department of Mines (R904) and reported in 1990 indicates that Champion Road sand has 94%  $+20\mu\text{m}$  and 0.6%  $-10\mu\text{m}$ .

Comalco, in their assessment, suggested a possible use of Champion Road sand in insulation. This outlet may only be feasible if a local market could be established as the unit price is unlikely to be sufficient to warrant transport to an interstate market.

#### Market Potential

The wide range of specifications with regard to chemical purity, grain size distribution and physical properties of industrial minerals, their low unit price and Tasmania's relative isolation makes it difficult to secure sale contracts in what is a highly competitive market. Mineral Holdings has commissioned a market survey of sand, included in the appendix to this report, which highlights some of these problems.

A P P E N D I X

PRELIMINARY REVIEW OF MARKET POTENTIAL  
FOR SILICA SAND & SILICA FLOUR

INTRODUCTION

Mineral Holdings (Aust.) P/L holds several types of Silica resources in north west Tasmania ranging from lump silica at Thomas Mountain mine, silica sand adjacent to this mine, and silica flour at Champions Road and near Cann Creek. Potential uses for all these resources are varied, and this review focuses on the silica sand and flour.

~~THOMAS MOUNTAIN SILICA SAND~~

Typical Characteristics

The Thomas Mountain deposit of silica sand is considered to be formed by the weathering and desilicification of matrix silica from bedrock orthoquartzites, and much of the sand appears to be in situ.

The deposit occurs over approximately 1 km of strike, averages 50m in width, and averages approx. 12m in thickness; wide spread pitting and drilling is sufficient to permit the estimation of an indicated sand resource totalling approx. 1 million tonnes.

This sand is of high chemical quality (refer Appendix 1.) with 99.5% SiO<sub>2</sub>, and has a particle size distribution (Appendix 2.) mainly between 1.0mm and 77µm, with D25 = 450µ, D50 = 285µ, and D75 = 175µ.

Potential Markets

The likely applications for the sand include precast concrete products (face and layer), proppants (to promote hydraulic fracturing of hydrocarbon reservoirs), filters (water purification), foundries (moulding sand), ceramic/glass, abrasives and chemical (feedstock in the manufacture of sodium silicates). Further details are shown in Table 1.

Because of the relative isolation of Tasmania from mainland Australia, certain outlets for the sand are precluded due to cost of freight over Bass Strait; accordingly, some of the potential applications only exist in Tasmania as shown in Table 1:

TABLE 1.

THOMAS MOUNTAIN SANDPRELIMINARY REVIEW OF MARKET POTENTIAL IN AUSTRALIA

Product		Particle Size Range		Est. Consumption (t/yr.)		Unit S.P.	Gross Sales Potential
Code	Use	ASTM#	Diameter	Tas.	Mainland	(\$/t)	(\$000)
S1	Face		-3.00 mm + 150 $\mu$	20,000	NA	15	300
S2	Proppant	12/20	-1.70 mm + 850 $\mu$	-	?	?	?
S3	Filter	16/30	-1.18 mm + 600 $\mu$	?	1000	100	100
S4	Layer	16/50	-1.18 mm + 300 $\mu$	500	?	110	55
S5	Proppant	20/40	- 850 $\mu$ + 425 $\mu$	-	3500	450	1575
S6	Chemical	20/140	- 850 $\mu$ + 106 $\mu$	NA	22000	45	990
S7	Proppant	30/50	- 600 $\mu$ + 300 $\mu$	-	?	?	?
S8	Filter	30/60	- 600 $\mu$ + 250 $\mu$	?	?	?	?
S9	Glass		- 600 $\mu$ + 150 $\mu$	23,000	NA	20	460
S10	Foundry	40/60	- 425 $\mu$ + 250 $\mu$	500	?	80	40
S11	Proppant	40/70	- 425 $\mu$ + 212 $\mu$	-	?	?	?
S12	AFS60 Foundry	50/100	- 300 $\mu$ + 150 $\mu$	-	250	190	48
S13	Proppant	70/140	- 212 $\mu$ + 106 $\mu$	-	?	?	?
S14	Ceramic			?	15000	40	600
S15	Abrasive		Variable	?	<100	600	60

The data shown in Table 1. lists the likely sand products as S1, S2 etc. in order of decreasing size fractions, and the data on consumption, selling prices and gross sales potential are not exhaustive but assumed to be satisfactory at this stage of assessment.

Operation production costs were estimated as follows:

Mining - \$5/tonne

Washing- \$3/tonne

Screening-\$3/tonne/screen (ie. first screen 1.18mm,  
2nd screen 850/600/425 um,  
3rd screen 150/106 um etc etc)

thus mining, washing and a single screening exercise would cost \$11/tonne.

These production costs were divided by the yield of each size fraction to obtain the effective cost of production, which was then divided into the unit selling price to derive the operational Profit Index (refer Table 2.)

A Profit Index of 1. is equated with an operational break even situation.

Figure 2. is a plot percentage yield versus gross market value, and Figure 3. relates profit index to gross market value for selected sand products.

#### Comments

For single sand product output, the product with the best potential (ie. most profitable) are:

20/40 proppant > 50/100 foundry > layer > ceramic > chemical > 40/60 foundry.

Face, glass and filter sands appear unprofitable.

However, use of the sand resource could be optimised in several ways:

- a) Production of 20/40 proppant; 40/60 foundry;  
? 60/100 glass sands
- b) Production of 16/50 layer; 50/100 foundry sands
- c) Production of ? 16/400 ceramic sand
- d) Production of 20/140 chemical sand

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THOMAS MOUNTAIN SANDCOMPARISON OF POTENTIAL APPLICATIONS IN AUSTRALIA

Product	Prelim. Prod. Cost \$/tonne	Yield %	Effective Prod. Cost \$/tonne	Selling Price \$/tonne	Operational Profit Index
S1 Face	14	80.1	17.5	15	0.9
S2 Proppant					
S3 Filter	14	7.5	186.7	100	0.5
S4 Layer	14	44.6	31.4	110	3.5
S5 Proppant	14	24.7	56.7	450	7.9
S6 Chemical	17	86.7	19.6	45	2.3
S7 Proppant					
S8 Filter					
S9 Glass	17	72.2	23.5	20	0.8
S10 Foundry	17	32.6	52.1	80	1.5
S11 Proppant					
S12 Foundry	17	35.1	48.4	190	3.9
S13 Proppant					
S14 Ceramic	17	95.0	17.9	40	2.2
S15 Abrasive	? 14	?25	56	600	10.7

Comments cont'd.)

Composite production allows certain economies so that the effective production costs are modified:

a: 1 Mining, washing and 2. screens =  $14/0.25 = \$56/\text{tonne}.$

Effective value =  $450 \times 0.25 = \$112.5/\text{tonne}$

PI = 2.0

a: 2 Mining, washing and 4. screens =  $23 / (0.25 + 0.33 + 0.21) = \$29.1/\text{tonne}$

Effective value =  $(450 \times 0.25) + (80 \times 0.33) + (20 \times 0.21) = \$143.1/\text{tonne}$

PI = 4.9

b: Mining, washing and 3. screens =  $20 / (0.45 + 0.35) = \$25/\text{tonne}$

Effective value =  $(110 \times 0.45) + (190 \times 0.35) = \$116.0/\text{tonne}$

PI = 4.6

c: Mining, washing and ? 1. screen - effective production cost =  $\$14.7/\text{tonne}; PI = 2.7$

d: Mining, washing and 2. screens - effective productions costs =  $\$19.6/\text{tonne}; PI = 2.3$

Maximum market penetration in Australia for each of the cases outlined above would generate the following gross revenues:

a-1:  $3500 \times 450 = \$1,575,000$

a-2:  $(3500 \times 450) + (500 \times 80) + (2940 \times 20) = \$1,673,800$

b:  $(500 \times 110) + (250 \times 190) = \$102,500$

c:  $15,000 \times 40 = \$600,000$

d:  $22,000 \times 45 = \$990,000$

NB: case a. would result in a surplus of 40/60 foundry sand of  $14033-500 = 13533$  tonnes.

Conclusions

1. Ongoing Market Research and production pre-planning should be focused in two areas;

Group one; proppant (20/40) sand and sand for chemical use.

Group two; sand for use in ceramics, foundries and pre-cast (layer) applications

2. The review has been constrained to the Australian market, but if current tests confirm the sand as being suitable for proppant use, then the international market (including bauxite substitution etc.) should be investigated.

CHAMPIONS ROAD SILICA FLOUR

A Typical Characteristics

The Champions Road deposit of silica flour is believed to have formed by the silicification of dolomite, followed by fluvial transport to the present setting.

The total resource has not been comprehensively explored and work to date indicates an insitu indicated resource totalling approx. 500,000 tonnes in one of the deposits.

The silica flour is of high chemical purity (Appendix 3.) with 99.6% SiO<sub>2</sub> and has a broadly bimodal particle size distribution (Appendix 4.) ranging from approx. 20mm to < 38 um; D25 = 3mm, D50 = 700μ, D75=35μ. The flour material is typically < 150 um, but has been "diluted" by larger fragments of quartz and cemented flour; screening of the flour to 1mm gives a PSD curve similar to the Corinna deposit of silica flour.

B Potential Markets

The likely applications for the flour include fibre glass, glass, fluid loss agent (oil/gas reservoirs), refractory additive for cement (oil/gas), ceramic, foundry (DRQ) and possibly chemical. Full details are shown in Table 3.

No major potential user of silica flour has been located in Tasmania, such that the best potential has to be mainland Australia and overseas markets. The data shown in Table 4. is based on actual production costs at the MK Silica plant near Burnie, where, excluding freight and royalty, the unit cost = \$56/tonne; if certain modifications were done to the plant (ie. installation of an extra belt drier), the cost would drop to \$48/tonne. Similarly to the sand assessment, no allowance has been made for capital expenditure in Table 4.

TABLE 3.

050038

CHAMPIONS ROAD SILICA FLOURPRELIMINARY REVIEW OF MARKET POTENTIAL IN AUSTRALIA

Product		Size Fraction	Est. Consumption (t/yr.)		Unit S.P. (\$/t)	Gross Sales Potential (\$000)
Code	Use		Tas.	Mainland		
F1	Fibre glass	-600 $\mu$ + 150 $\mu$	-	7000	<100	700
F2	Oil/fluid loss	-150 $\mu$ + 75 $\mu$	-	≈ 50	550	28
F3	Glass	-150 $\mu$ + 75 $\mu$ (Japan)	-	15000	170	2550
F4	Oil/cement	- 75 $\mu$	-	1600	150	240
F5	Glass	- 75 $\mu$ (Japan)	-	5000	110	550
F6	Ceramic	- 75 $\mu$	?	1000	150	150
F7	Chemical		-	? 22000	? 40	880
F8	Foundry (DRQ)		-	? 500	420	210

TABLE 4.

COMPARISON OF POTENTIAL APPLICATIONS IN AUSTRALIA

Product		Prelim. Prod. Cost \$/tonne	Yield %	Effective Prod. Cost \$/tonne	Selling Price \$/tonne	Operational Profit Index
Code	Use					
F1	Fibre Glass	50	9.0	555.5	100	0.2
F2	Fluid loss	50	10.3	485.4	550	1.1
F3	Glass	50	10.3	485.4	170	0.3
F4	Cement	50	47.5	105.3	150	1.4
F5	Glass	50	47.5	105.3	110	1.0
F6	Ceramics	50	47.5	105.3	150	1.4
F7	Chemicals	?15	? 95	15.8	40	2.5
F8	Foundry (DRQ)	?15	? 95	15.8	420	26.6

[C.] Comments

The effective costs of production (for single products) are generally characterised by low profit index values and the products with the best potential appear to be the foundry and chemical applications.

Fluid loss agent, ceramic, cement additive and glass (F5) appear marginal while fibre glass and glass (F3) appear unprofitable. However, although MK Silica have been producing the F3 and F5 size fractions for glass manufacture in Japan the low yield of F3 flour from Champions Road is not necessarily a negative factor providing grinding (SAG mill) is incorporated during treatment of the flour.

Fibre glass is not a likely potential market because of specific customer requirements, environmentally strict health regulations and customer resistance regarding any alternative supplies.

[D.] Conclusions

1. Composite production from the Champions Road silica flour deposit does not appear to be a major option, and future evaluation work should focus on high volume/medium price single products typified by the glass and chemical applications.
2. Assessment of the foundry, cement and ceramic uses should possibly be given a lower priority, based on current information.

*T.G. Summons*

T.G. SUMMONS

# ANALABS

A Division of Inscope Inspection and Testing Services Australia Pty. Ltd.  
A.C.N. 004 501 854

050040

## ANALYTICAL DATA

SAMPLE PREFIX

ai

REPORT NUMBER

REPORT DATE

CLIENT ORDER No.

PAGE

109515.60.09023

16/10/92

K. PINNER

2 OF 2

TUBE No.	SAMPLE No.	S102	LDI						
1	CR 35	99.55	0.22						
2	CR 16	99.38	0.25						
3		100.18	0.167	1.66	34	107.75	1.015	1.136	6.22
4					0.127	15.37	1.007		
5									
6									
7									
8									
9									
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13									
14									
15									
16									
17									
18									
19									
20									
21									
22									
23	DETECTION	0.01	0.01						
24	UNITS	%	%						
25	METHOD	DA144	DA144						

Results of tests on samples otherwise specified  
shall be given on the basis of the lowest concentration for which a method  
has been developed or below detection limit  
where not determined

AUTHORISED  
OFFICER



# ANALABS

A Division of Inchope Inspection and Testing Services Australia Pty. Ltd.  
A.C.N. 604 981 684

050041

## ANALYTICAL DATA

SAMPLE PREFIX

REPORT NUMBER

REPORT DATE

CLIENT ORDER No.

PAGE

109515.60.09023

16/10/92

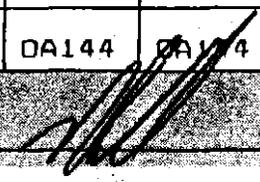
K. PINNER

1 OF 2

TUBE No.	SAMPLE No.	Na2O	K2O	CaO	MgO	Fe2O3	MnO	Al2O3	TiO2	P2O5
1	CR 16	0.0094	0.0123	0.0203	0.0141	0.0395	0.0009 <sup>0.0006</sup>	0.1081	0.024	0.0005
2	CR 16	0.0102	0.0211	0.0088	0.0113	0.0380	0.0006 <sup>0.0004</sup>	0.2116	0.064	0.0018
3										
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18										
19										
20										
21										
22										
23	DETECTION	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0010	0.005	0.0002
24	UNITS	%	%	%	%	%	%	%	%	%
25	METHOD	OA144	OA144	OA144	OA144	OA144	OA144	OA144	OA144	OA144

Results in parts per million unless specified  
 \* Accuracy of results is a function of the test method used  
 \* A minimum concentration is always the detection limit  
 \* Results are not guaranteed

AUTHORISED OFFICER





# ANALABS

A Division of Inchoape Inspection and Testing Services Australia Pty. Ltd.

050042

Phone (004) 319837

14 Thirlell St. CODEE TAS 7320

Fax (004) 319890

## ANALYTICAL REPORT No.

109515.60.09003

THIS REPORT MUST BE READ IN CONJUNCTION WITH THE ACCOMPANYING ANALYTICAL DATA

INVOICE TO:

Mr N Thomas  
Mineral Holdings Australia Pty Ltd  
2nd Floor  
135 Collins Street  
MELBOURNE VIC 3000

ORDER NO

PROJECT

K. FINNER

DATE RECEIVED

RESULTS REQUIRED

30/09/92

ASAP

No. OF PAGES OF RESULTS

DATE REPORTED

No. OF COPIES

TOTAL No. OF SAMPLES

2

16/10/92

1

2

SAMPLE NUMBERS

SAMPLE DESCRIPTION

ELEMENT/METHOD

CR 25, CR 26

SS Prep : GP019

Analysis of Silica Sands/OA144

RESULTS TO

Mr N Thomas  
Mineral Holdings Australia Pty Ltd  
2nd Floor  
135 Collins Street  
MELBOURNE VIC 3000

RESULTS TO

[Empty box for results recipient]

RESULTS TO

[Empty box for results recipient]

REMARKS

AUTHORISED OFFICER



Technical Note

*File:*

*Ref:* TN.509/sa:mp

*Date:* 17 January 1992

*To:* D. Smith

*From:* S. Aruliah

*At:* CRC

*At:* CRC

*cc:* C. Goodes, CRC  
M. Couper, CRC

*Subject:* *Potential use for* Champions Road  
*Silica Flour and Sand* from Thomas  
Mountain Mine

Two products, Champion road Silica Flour and Quartz Sand were assessed to identify possible uses.

Chemical analysis indicate that both products have 99.0% purity with other major constituents being  $\text{Fe}_2\text{O}_3$  and  $\text{TiO}_2$  (see Table 1).

The Particle size distribution of silica flour shows that 10.0% of particles are greater than  $234 \mu\text{m}$  and this is therefore a coarse powder (see Table 2). This is in agreement with scanning electron micrographs which show that the silica flour has particles greater than  $250 \mu\text{m}$  and that the particle size of silica sand is greater than 1 mm. Further the particles have large pores and are therefore susceptible to intergranular fractures (see Figure 1a and 1b). It is believed that the physical quality of the silica flour and sand does not allow it to be used as reinforcement in aluminium. In addition incorporation of  $\text{SiO}_2$  in the aluminium as reinforcement can cause a thermite reaction which may not be acceptable.

### Proposed Uses

The products appear to have no potential applications within Comalco presently. Other avenues for their use however include:

1. Glass and glass fibre for insulation. Pilkington, NSW, uses 2500t/week in their glass manufacturing process. For this purpose the purity of the raw powder is adequate and the particle size of the silica sand seems appropriate.

2. Mullite, Sialon, Silicon nitride advanced ceramics can be produced with the silica powder as a starting material but further processing of the silica would be required.
3. The silica flour is best used in insulating blocks. The requirement is about 60-70% silica powder. The particle size of the powder needs to be about 85% less than 100  $\mu\text{m}$ . The main ingredients to produce blocks are silica sand, cement, gypsum, burnt lime, aluminium powder and surface active agents.
4. Silica can be used as fillers in rubber compounds for battery cases and as insulators for electronic substrates.

More detailed study would be required to identify further uses and processing needs.

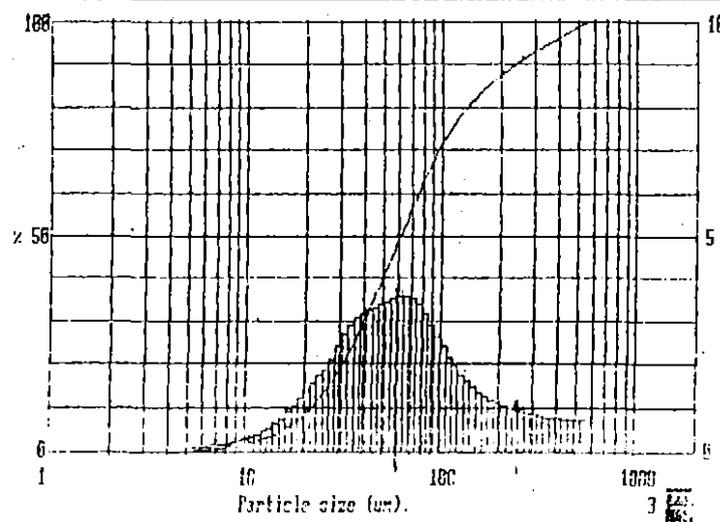
Table 1

Chemical Analysis in wt%				
Powder	SiO <sub>2</sub>	Fe <sub>2</sub> O <sub>3</sub>	TiO <sub>2</sub>	Al <sub>2</sub> O <sub>3</sub>
Silica flour	99.0	0.3	<0.05	0.1
Silica sand	99.0	0.2	0.2	0.1

Table 2

High Size	Under %	Span										
544	100	254	91.1	114	76.1	51.3	41.6	23.1	11.4	10.4	2.0	D(4,3)
524	99.3	236	90.1	106	73.9	47.7	38.2	21.4	9.9	9.64	1.7	96.10 $\mu\text{m}$
488	96.5	219	89.1	98.4	71.5	44.4	34.8	19.9	8.4	8.97	1.4	
454	97.7	204	88.0	91.7	68.8	41.2	31.6	18.5	7.2	8.34	1.2	D(3,2)
422	97.0	190	86.9	85.3	65.9	38.4	28.4	17.2	6.1	7.76	1.0	42.64 $\mu\text{m}$
392	96.2	176	85.6	79.3	62.2	35.7	25.3	16.0	5.2	7.21	0.8	
365	95.4	164	84.4	73.8	59.3	33.2	22.4	14.9	4.4	6.71	0.7	D(v,0.9)
339	94.6	153	83.0	66.6	55.7	30.8	19.7	13.9	3.8	6.24	0.5	234.45 $\mu\text{m}$
315	93.7	142	81.5	63.8	52.1	28.7	17.3	12.9	3.2	5.80	0.4	
293	92.9	132	79.9	59.3	48.6	26.7	15.1	12.0	2.7			D(v,0.1)
273	92.0	123	78.1	55.2	45.0	24.8	13.2	11.2	2.3			21.60 $\mu\text{m}$

Source = Sample    Mean length = 14.3  $\mu\text{m}$     Model indp  
 Log. Diff. = 2.458  
 Focal length = 300  $\mu\text{m}$     Obscuration = 0.1021    Volume Conc. = 0.0107%  
 Presentation = oil    Volume distribution    Sp. S.R. = 0.1407  $\mu^2/\text{cc}$



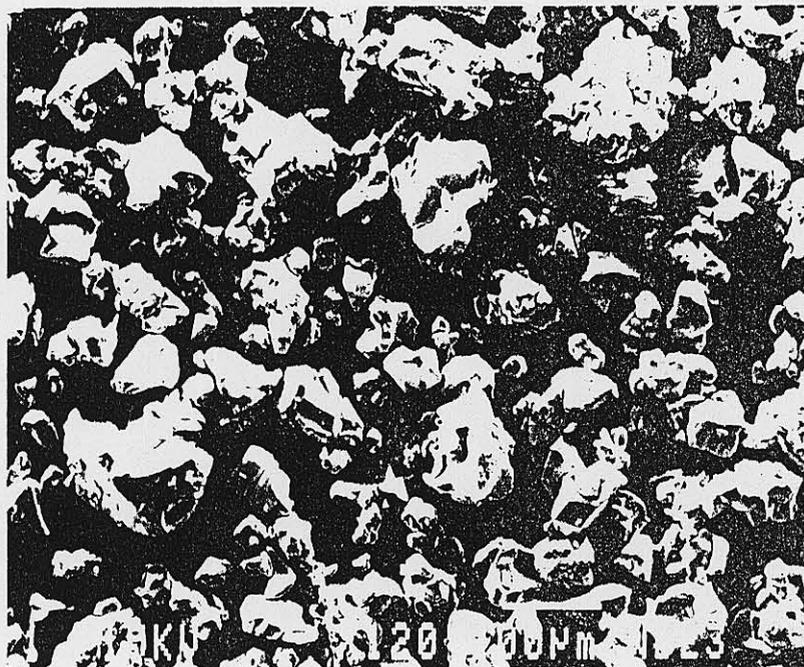


Figure 1a: Silica Flour showing coarse grains and the presence of intergranular fractures.

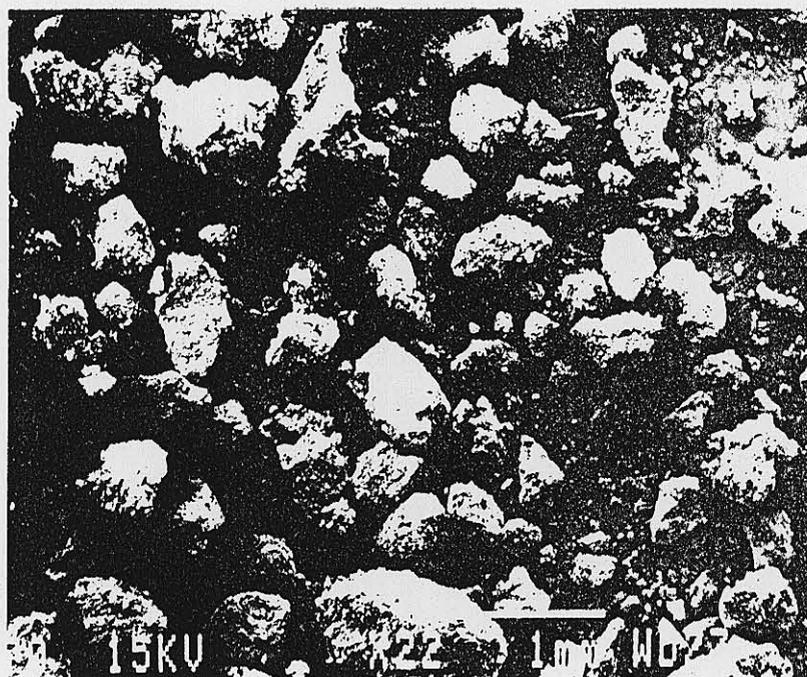


Figure 1b: Silica Sand particle size is greater than 1 mm

MINERAL HOLDINGS - AUSTRALIA  
COMPETITIVE ORE ANALYSIS

REPORT DATE: 03/14/92

DATE REC'D	03/10/92		
SAMPLE ID	20/40 SIZED FROM ORIG MAT'L	20/40 SIZED FROM SCRUB PROD	20/40 API FRAC SPECIFICATION
UCL NUMBER	92-3-109B	92-3-238	
16M	-	T	0.1 Max.
20M	T	0.1	
30M	22.7	21.2	
35M	40.8	38.4	
40M	34.6	35.5	
50M	1.6	4.7	
PAN	0.2	T	1.0 Max.
-20/+40	98.1	95.1	90.0 Min.
% ACID SOLUBILITY	0.428	0.229	2.0 Max.
TURBIDITY (FTU's)	245	< 1	250 Max.
ROUNDNESS	0.6	0.7	0.6 Min.
SPHERICITY	0.7	0.7	0.6 Min.
% AGGLOMERATED GRAINS	< 1.0	< 1.0	1.0 Max.
CRUSH RESISTANCE % FINES GEN.			
4000 psi	24.5	22.0	14.0 Max.

REMARKS:

cc: H. F. Barnard, R. Peddicord

# UNIMIN

050047

Unimin Corporation  
258 Elm Street, New Canaan, CT 06840  
Phone: 203-966-8880 Telex: 99-6355  
Fax: 203-966-3453 or 203-972-1870

April 3, 1992

Mr. Neil M. Thomas  
Chairman  
MINERAL HOLDINGS AUSTRALIA PTY. LIMITED  
2nd Floor  
100 Collins Street  
Melbourne, Australia 3000  
Facsimile 011-61-3-650-3855

*A. 3/4/92*

Dear Mr. Thomas:

Relative to the three (3) samples received, I want to advise you what our studies indicated.

First of all, the naturally occurring silica flour is quite pure and is a reasonably good looking product, but represents no real interest to Unimin.

The unbeneficiated silica that we thought might have an application for frac sands does not meet API (American Petroleum Institute) specification, which is a requirement.

The roundness and sphericity of the grains is marginal and it definitely does not pass crush resistance criteria, which is extremely important. I am attaching for you the data on the testing of this material.

The dolomite sample is interesting, as it has a very low level of acid insolubilities and the alumina and iron contents are fairly low. We might have some interest in this product, but I am going to be traveling for the next couple of weeks and need to get together with some other Unimin personnel to discuss the potentials, so I will get back to you at a later date to see if there is some opportunity here.

If you have any questions I will be back in the office commencing the week of April 13th, so let me know.

Very truly yours  
UNIMIN CORPORATION



H. Frederick Barnard, III  
Senior Vice President  
Marketing & Sales

040301

Glass Sands • Frac Sands • Foundry Sands • Ground Silica • Feldspar • Nepheline Syenite  
High Purity Quartz • Microcrystalline Silica • Mica • Primary Kaolin • Dolomite • Specialty Sands

P.1/2

RRR 03.92 11:22 UNIMIN



# SANTOS LTD

(Incorporated in South Australia)

A.C.N. 007 550 923

050048

Postal Address:

G.P.O. BOX 2319, ADELAIDE, SOUTH AUSTRALIA 5001, Telex: AA 82716, Facsimile: (08) 212 5476

REF: PEO:0320/91 - WP:7101G(53)

29 April 1991

Mineral Holdings Australia Pty Ltd  
2nd Floor  
100 Collins Street  
MELBOURNE VIC 3000

Attention: Mr N.M. Thomas

Dear Mr Thomas

RE: THOMAS MOUNTAIN SPHERICAL SAND

SANTOS has just received the results of analysis on the sample of 20/40 sand supplied by Mineral Holdings Australia from the Thomas Mountain Spherical Sand Mine, Tasmania. Initial results appear to be favourable, see the attached sheets, however SANTOS do have reservations regarding a number of the characteristics of the sand as follows:

- (1) Turbidity - higher than API RP56 specifications, but this may be rectified by improved washing.
- (2) Roundness - grains were slightly out of round when compared to API RP56 criteria, the impact of this on proppant pack conductivity is unknown.
- (3) Fines - the sample exhibited a higher percentage of fines than specified by API RP56.

I would like to reiterate that SANTOS would only be providing a recommendation to Dowell and Halliburton to obtain sand from a local source and that in future any correspondence should be directed to Ron Mientjes (08-347-0909) or Robert Pike (08-349-4588) of Dowell Schlumberger and Halliburton respectively. Additionally, please note that if we do utilise your sand as proppant, we will require packing in 3000 lbs "Bulka Bags".

Yours very truly

N.A. BUTT

Manager - Petroleum Engineering Operations

Copy: Frac File

AFD/jmt

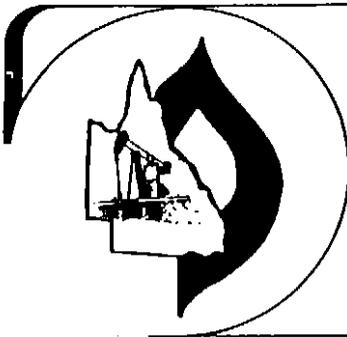
FRAC SAND CRITERIA

API RP56 "RECOMMENDED PRACTICES FOR TESTING SAND USED IN HYDRAULIC FRACTURING OPERATIONS"

PROPERTY	UNITS	API RECOMMENDED LIMITS	THOMAS MOUNTAIN SAND AMDEL ANALYSIS	*** COMPARISONS ***		
				Sand ie. Northern White, Texas Brown.	Intermediate Strength Proppant	Sintered Sauxite
SIEVE ANALYSIS	% BY WEIGHT RETAINED	ON TOP SIEVE BETWEEN PRIMARY SIEVES PAN	0.0 % 96.2 %  3.8 %	0.1 MAX. 90.0 MIN.  1.0 MAX.	0.1 MAX. 90.0 MIN.  1.0 MAX.	0.1 MAX. 90.0 MIN.  1.0 MAX.
SOLUBILITY IN 12% MUD ACID 30 MIN @ 150 F	% BY WEIGHT	20/40	0.44 %	2% MAX.	7% MAX.	7% MAX.
TURBIDITY	FTU		474	250 MAX.	-	-
KRUMBEIN	-ROUNDNESS -SPHERICITY		0.35 0.70	0.6 MIN. 0.6 MIN.	0.7 MIN. 0.3 MIN.	0.7 MIN. 0.7 MIN.
CRUSH RESISTANCE @ CLOSURE STRESS	% FINES @ 4000 PSI	20/40	0.58 %	14% MAX.	10% MAX.	10% MAX.

050049

ATTACHMENT #1



# NORTH QUEENSLAND ENERGY PTY. LTD.

A.C.N. 010 715 223

Level 3, Prudential Building,  
6 Queen Street, Brisbane, Qld. 4000.  
Telephone: (07) 210 0866

P.O. Box 34, North Quay,  
Brisbane, Qld. 4002  
Fax: (07) 210 0858

050050

26 February 1992

Mineral Holdings Australia Pty. Limited  
2nd Floor  
100 Collins Street  
Melbourne Vic. 3000

A. 3/3/92.

Attention: **Mr Neil M. Thomas**  
**Chairman**

Dear Mr Thomas,

We refer to previous discussions and correspondence about Thomas Mountain silica sand. Thank you for the sample and the test analyses. Our initial review of the test analyses has been encouraging and we outline our comments below:

## 1. Technical Issues

In both cases the chemical composition is satisfactory. Information on the variability of the deposits would be useful. The range of results from the samples analysed by the various companies could provide this information.

The attached graphs plot the particle size distribution. In frac work the 20-40 size range is used extensively followed by the coarser 12-20 or 16-20 ranges. There is little demand for the finer fractions. From the data provided, the Champions Road deposit is deficient in these size fractions and processing would be uneconomical.

The Thomas Mountain deposit appears to have about 20% of the 20-40 fraction and recovery may be an economical proposition. Please advise your thoughts on this.

As in the case of the chemical composition it would be useful to have the range of results to check the variability of the deposit.

The acid solubility looks OK.

Turbidity is a measure of cleanliness of the sample and can be controlled by washing.

It is assumed that the Crush Resistance measurement has been undertaken on the 20-40 fraction. If this is the case it is a good result. This is an important parameter and normally silica sand has problems in meeting this criteria. Could you please confirm this.

Sphericity is satisfactory but roundness is low. This is not necessarily a problem. The important criteria is conductivity which is more sensitive to size distribution and sphericity than roundness. It is not clear whether these tests have been made on the 20-40 size fraction. Only size fractions screened to specification limits should be tested. Please advise the basis for the tests .

Conductivity tests should be made to properly evaluate the suitability of sand for frac work. This test result can be a strong selling point.

## 2. Commercial Issues

For sale for frac work normal requirement is for packaging in 25 or 50 kg multiply bags with plastic liner. Palletised and shrunk wrapped. There may be opportunities for 1 tonne Big Bags but these would be limited.

Opportunities exist in South East Asia for frac sand. Shipments would be through Singapore.

Freight rates from point of processing to Singapore need to be investigated. These rates together with an estimate of the FOB price will enable the commercial viability of any frac sand project to be determined.

Please advise details of closest port, preferred method of packaging etc. We can then get some freight rates. We would also determine Singapore repacking costs if the product is delivered to Singapore in bulk.

## 3. Market Entry

To enter the market samples of product and specification sheets will be required.

Traditionally the frac sand serviced from the USA by suppliers is well known to the oil well service companies. Prices have been high due to freight rates and lack of competition. Local sand has to prove reliability of supply and quality.

There is a place for a local supplier who could gain the confidence of the industry at the right price.

The sand has possibilities and we would be happy to discuss ways in which we could provide further assistance. In particular, assuming all the technical issues can be satisfactorily resolved, and once we ascertain FOB price, shipping and handling costs etc., we will be able to tell you whether you are likely to be able to compete in the Asian markets with which we are familiar.

Please advise your interest in progressing the South East Asian market opportunities and in resolving outstanding technical concerns.

Thank you

Yours faithfully



BRIAN J. BARKER  
Managing Director

050053



3445 N. 81 HIGHWAY, BUILDING B • P. O. BOX 1844 • DUNCAN, OK 73534  
TELEPHONE 405/252-4309 • FAX NUMBER 405/252-6979

GLENN PENNY  
President

October 21, 1991

Mr. N. M. Thomas  
Mineral Holdings Australia Pty. Limited  
Second Floor  
100 Collins Street  
Melbourne, Australia, 3000

A. 27/10

Dear Mr. Thomas;

STIM-LAB completed this weekend the second requested set of tests on the sand submitted from the Thomas Mountain Deposit. The results of these tests are presented in Table One, and a comparison of these tests to the previous tests on the unbeneficiated sample is given in Table Two.

According to your instructions, a sample of the sand was washed and placed in a tumble mill in an effort to clean the sand and to disassociate parts of any clusters. The sample was checked periodically to monitor apparent improvement, and it was found that after 8 hours of tumble milling, no further appreciable benefit was achieved. This sample was then washed again and used for the tests described in Table One. Although some improvement was made, the needed improvement in crush resistance was not realized. Some sand clusters were still not reduced, some broken grains survived, and some grains were still carrying satellites. It is possible that some more aggressive mill (such as vibratory or attrition) could produce some of the desired benefit; we do not have any of these mill types in our laboratory. Please advise me of any further steps you wish to take with this sample.

Thank you for having STIM-LAB perform this work. If we can be of service in any way, let me know.

Sincerely,

Ron Bruner, Group Leader  
Conductivity and Analysis

RB/ab

050054

**Table One**  
**API RP 56 Tests Performed on**  
**20/40 Sand**

Sieve Analysis of Submitted Sample per Section 4, API RP 56

<u>Sieve Size</u>	<u>Percent Retained</u>	<u>Cumulative Percent</u>
16	0.00	0.00
20	0.19	0.19
25	15.32	15.52
30	32.03	47.55
35	29.71	77.26
40	21.90	99.16
50	0.68	99.84
pan	0.16	100.00

Section 5, RP 56, Shape Factor

Sphericity	.6
Roundness	.6
Minimum Acceptable	.6

Section 5, RP 56, Sand Grain Clusters

Percent	32.50
Maximum Acceptable	1.00

Section 6, RP 56, Acid Solubility In HCl-HF (12:3)

Weight Percent	1.18
Maximum Acceptable	2.00

Section 7, RP 56, Turbidity

FTU	40.00
Maximum Acceptable	250.00

Section 8, RP 56, Crush Resistance

4000psi	21.80
Maximum Acceptable at 4000 psi	14.00

050055

Table Two  
Comparison of Results of API RP 56 Tests on Beneficiated  
Sand Compared to Test Results on Unbeneficiated Sand

Test	Beneficiated	Unbeneficiated	Notes
Sieve Analysis	No significant differences between samples		
Sphericity	0.6	0.6	No change
Roundness	0.6	0.5	Improvement
Clusters	32%	50%	Improvement
Acid Solubility	1.18	1.20	No change
Turbidity	40	170	Improvement
Crush Resistance	21.8%	23.1%	Slight improvement

050056



TELEPHONE 405/252-4309 • P. O. BOX 1644 • DUNCAN, OK 73534

GLENN PENNY  
President

January 16, 1992

Mr. N. M. Thomas  
Mineral Holdings Australia Pty. Limited  
Second Floor  
100 Collins Street  
Melbourne, Australia 3000

Dear Mr. Thomas:

STIM-LAB has completed the series of tests requested by your firm on the submitted sample of sand from the Thomas Mountain Deposit, Tasmania. The procedures used during these tests are described in the procedures section. The data from the first series of tests is presented in Table One. The data from the second series of tests is shown in Table Two. Table Three notes the differences between the data obtained in the two test series.

Thank you for having STIM-LAB perform these tests. If we may be of service in any other way, please let me know.

Sincerely,

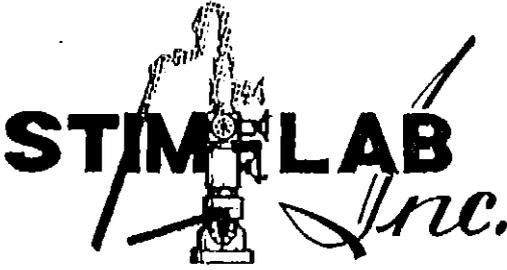
Ron Bruner, Group Leader  
Conductivity and Analysis

RB/ab

Enclosures

050057

(X)



3445 N. 81 HIGHWAY, BUILDING B • P. O. BOX 1644 • DUNCAN, OK 73534  
TELEPHONE 405/252-4309 • FAX NUMBER 405/252-6979

GLENN PENNY  
President

January 24, 1992 *R. 3/r*

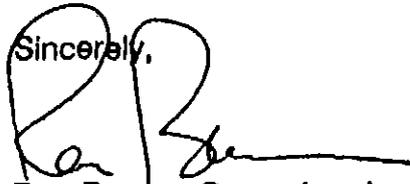
Mr. N. M. Thomas  
Mineral Holdings Australia Pty. Limited  
Second Floor  
100 Collins Street  
Melbourne, Australia 3000

Dear Mr. Thomas:

STIM-LAB has completed the series of tests requested by your firm on the submitted sample of sand from the Thomas Mountain Deposit, Tasmania. This sample was tested as outlined in API RP 58, Recommended Practices for Testing Sand Used in Hydraulic Fracturing Operations. It passed the sieve analysis, shape factor, acid solubility, and turbidity tests; the cluster content and the crush percentage exceeded the test standards. The sand has a high quartz content, with very few contaminants.

In any case, this sand may very well be serviceable for use in low-closure reservoirs, particularly coalbed methane.

Thank you for having STIM-LAB perform these tests. If we may be of service in any other way, please let me know.

Sincerely,  
  
Ron Bruner, Group Leader  
Conductivity and Analysis

RB/ab

050058

**API RP 56 Tests Performed on  
A 20/40 Sand Sample from the  
Thomas Mountain Deposit**

Prepared for

Mineral Holdings Australia Pty. Ltd.  
Second Floor, 100 Collins Street  
Melbourne, Australia 3000

By

STIM-LAB, Inc.  
P.O. Box 1644  
Duncan, Ok. 73534

File Number: SL 2518

January 16, 1992

**STIM-LAB**  
*Inc.*

## Procedures

For the initial series of tests, the submitted sample of sand was split. One of these split portions was sieved into a 20/40 cut of sand, with no additional sieving to change the natural distribution of the sand between the 20 and 40 sieves. This sieved sand was then tested as required by API RP 56, Recommended Practices for Testing Sand Used in Hydraulic Fracturing Operations. The data from these tests are found in Table One.

Because of the failure of this sample to pass the API specification for a fracturing sand, a second sample was prepared. This sample was washed and placed in a tumble mill in an effort to clean the sand and to disassociate the parts of any clusters. The sample was checked periodically under the microscope to monitor apparent improvement during milling. After 8 hours of tumble milling, no further appreciable benefit was achieved. The sample was then tested by the procedures presented in API RP 56; the data from these tests are found in Table Two.

## Conclusions

These tests show that this sand does meet or exceed the standard for many of the parameters required by API RP 56. Beneficiation does improve somewhat the performance of this sand in these tests, but may not be necessary for successful marketing of this sand as a proppant in some markets.

Table One  
API RP 56 Tests Performed on  
20/40 Sand

Sieve Analysis of Submitted Sample per Section 4, API RP 56

<u>Sieve Size</u>	<u>Percent Retained</u>	<u>Cumulative Percent</u>
16	0.0	0.0
20	0.2	0.2
25	18.8	19.0
30	35.8	54.8
35	27.4	82.2
40	17.4	99.6
50	0.2	99.8
pan	0.2	100.0

Section 5, RP 56, Shape Factor

Sphericity	.6
Roundness	.5
Minimum Acceptable	.6

Section 5, RP 56, Sand Grain Clusters

Percent	40 to 50.0
Maximum Acceptable	1.0

Section 6, RP 56, Acid Solubility in HCl-HF (12:3)

Weight Percent	1.2
Maximum Acceptable	2.0

Section 7, RP 56, Turbidity

FTU	170.0
Maximum Acceptable	250.0

Section 8, RP 56, Crush Resistance

4000 psi	23.1
Maximum Acceptable at 4000 psi	14.0

Table Two  
API RP 56 Tests Performed on  
20/40 Sand

Sieve Analysis of Submitted Sample per Section 4, API RP 56

<u>Sieve Size</u>	<u>Percent Retained</u>	<u>Cumulative Percent</u>
16	0.0	0.0
20	0.2	0.2
25	15.3	15.5
30	32.0	47.5
35	29.7	77.2
40	21.9	99.1
50	0.7	99.8
pan	0.2	100.0

Section 5, RP 56, Shape Factor

Sphericity	.6
Roundness	.6
Minimum Acceptable	.6

Section 5, RP 56, Sand Grain Clusters

Percent	32.5
Maximum Acceptable	1.0

Section 6, RP 56, Acid Solubility in HCl-HF (12:3)

Weight Percent	1.18
Maximum Acceptable	2.00

Section 7, RP 56, Turbidity

FTU	40.0
Maximum Acceptable	250.0

Section 8, RP 56, Crush Resistance

4000 psi	21.8
Maximum Acceptable at 4000 psi	14.0

Table Three  
Comparison of Results of API RP 56 Tests on Beneficiated  
Sand Compared to Test Results on Unbeneficiated Sand

Test	Beneficiated	Unbeneficiated	Notes
Sieve Analysis	No significant differences between samples		
Sphericity	0.6	0.6	No change
Roundness	0.6	0.5	Improvement
Clusters	32%	50%	Improvement
Acid Solubility	1.18	1.20	No change
Turbidity	40	170	Improvement
Crush Resistance	21.8%	23.1%	Slight improvement



GLASS PACKAGING DIVISION

050063

NO.: P.A.S. 041-01

DATE: 1.4.91

**PURCHASE ACCEPTANCE STANDARD**

P.A.S. 041-01 SAND (TABLEWARE)

A. SCOPE

This specification prescribes the requirements both physical and chemical for "Sand" suitable for the manufacture of "Tableware" by ACI Glass Packaging.

B. GENERAL DESCRIPTION

Minute fragments resulting from the wearing down of siliceous rocks. This material consists of silica plus other impurities of which iron and chromite oxide are the most objectionable.

C. CHEMICAL DESCRIPTION

Silica (quartz)  $SiO_2$

D. SPECIFICATION

(a) Chemical Composition

$SiO_2$	99.8% Min.
$Fe_2O_3$	0.014% Max.
$Cr_2O_3$	0.0005% Max.
$Al_2O_3$	Note I
$H_2O$	Note II

Note I

The maximum acceptable alumina level is negotiable. The level however must remain within  $\pm 0.05\%$  of the nominated value.

Note II

The maximum acceptable figure for the percentage moisture content of the sand as received shall not exceed 5 (five per cent).

(b) Physical Properties

Nominal Size of Aperture mm	BSS English	USBS American	TYLER American	ACI Standard Specification	8 $\mu$ m
1.000	+16	+18	+16	NIL	0
0.600	+25	+30	+28	2% Max.	15
0.415	+36	+40	+35	10% Max.	30
0.105	-150	-140	-150	1% Max.	1

NOTE: British Standard Sieves are used.

050064

P.A.S.041-01  
1.4.91

The chemical and physical composition of the material must remain uniform from shipment to shipment.

This material must be free of foreign matter detrimental to the glass melting process such as colouring materials or refractory particles. In particular the material must be free of picotite or iron chromite particles.

E. TEST METHODS AND SAMPLING

Methods employed by ACI as developed by ACI Engineering Services.

F. REJECTIONS

ACI reserves the right to reject any portion or all of the material furnished under this specification which does not conform to all of the requirements set forth herein upon receipt at ACI designated stores.

## HIGH QUALITY GLASS SAND SPECIFICATION

CHEMICAL ANALYSIS

(MONIER)

SiO <sub>2</sub>	Al <sub>2</sub> O <sub>3</sub>	Fe <sub>2</sub> O <sub>3</sub>	TiO <sub>2</sub>	L.O.I.
99.9 %	0.03 %	0.012 %	0.02-0.04%	0.02 %

PHYSICAL GRADING

<u>Fine</u>			<u>Super Fine</u>		
<u>Microns</u>	<u>% Retained</u>	<u>Cumulative</u>	<u>Microns</u>	<u>% Retained</u>	<u>Cumulative</u>
+ 850	-	-	+ 850	-	-
+ 600	2	2	+ 600	-	-
+ 500	3	5	+ 425	6	6
+425	11	16	+ 300	41	47
+ 300	37	53	+ 212	36	83
+ 212	32	85	+ 150	14	97
+ 150	12	97	+ 106	2.4	99.4
+ 106	2.6	99.6	+ 75	0.5	99.9
+ 75	0.3	99.9	pan	0.1	100
pan	0.1	100			

Other special coarse or fine grain size requirements can be negotiated.

050066



Office:  
Albion Road, Heybridge, Burnie, Tasmania  
Postal Address:  
P.O. Box 1102 BURNIE, Tasmania 7320 Australia  
Telephone: (004) 31 3066 Facsimile: (004) 31 5769

SILICA FLOUR 7/250

PRODUCT SPECIFICATION

PARTICLE SIZE SPECIFICATION

+ 1425 micron	0%
+ 1300 micron	Tr
+ 1250 micron	1% max
-75 micron	30% max
-45 micron	2% max

CHEMICAL SPECIFICATION

✓ Fe <sub>2</sub> O <sub>3</sub>	7 ppm max
✓ TiO <sub>2</sub>	10 ppm max
✓ Al <sub>2</sub> O <sub>3</sub>	50 ppm max
✓ CaO	150 ppm max
✓ MgO	70 ppm max
✓ K <sub>2</sub> O	5 ppm max
✓ Mn	0.5 ppm max
✓ Cu	0.5 ppm max
✓ Cr	0.1 ppm max
✓ Ni	0.1 ppm max

# MK/Silica

Office:  
 Minna Road, Heybridge, Burnie, Tasmania  
 Postal Address:  
 P.O. Box 1102 BURNIE, Tasmania 7320 Australia  
 Telephone: (004) 31 3066 Facsimile: (004) 31 5769

## SILICA FLOUR 20/250

### PRODUCT SPECIFICATION

#### PARTICLE SIZE SPECIFICATION

+ 1425 micron	0%
+ 1300 micron	Tr
+ 1250 micron	1% max
- 75 micron	30% max
- 45 micron	2% max

#### CHEMICAL SPECIFICATION

Fe <sub>2</sub> O <sub>3</sub>	20 ppm max
TiO <sub>2</sub>	40 ppm max
Al <sub>2</sub> O <sub>3</sub>	100 ppm max
CaO	400 ppm max
MgO	200 ppm max
K <sub>2</sub> O	10 ppm max
Mn	0.5 ppm max
Cu	0.5 ppm max
Cr	0.1 ppm max
Ni	0.1 ppm max



050068

Office: Alhna Road, Heybridge, Burnie, Tasmania  
Postal Address: P.O. Box 1102 BURNIE, Tasmania 7320 Australia  
Telephone: (004) 31 3066 Facsimile: (004) 31 5769

SILICA FLOUR 25/75

TYPICAL PROPERTIES

PARTICLE SIZE DISTRIBUTION

	<i>Cumulative mass%</i>
+ 150 micron	0%
+ 125 micron	1%
+ 105 micron	35%
+ 90 micron	80%
+ 75 micron	99.5%
+ 45 micron	100%
- 45 $\mu$ m	0%

CHEMISTRY

SiO <sub>2</sub>	99.5%
Fe <sub>2</sub> O <sub>3</sub>	22 ppm
TiO <sub>2</sub>	25 ppm
Al <sub>2</sub> O <sub>3</sub>	25 ppm
CaO	145 ppm
MgO	75 ppm
Na <sub>2</sub> O	5 ppm
Mn	0.3 ppm
Cu	0.2 ppm
Cr	0.2 ppm
Ni	0.1 ppm

Loss on ignition 1% max

**Description :** The T series of silica products is processed from crystalline alpha quartz of exceptional purity. Their excellent whiteness and low impurity level, makes these products suitable for use in ceramics, refractories, plastics, adhesives and grouts.

**Typical Analysis :**

Silica	SiO <sub>2</sub>	99.10%
Alumina	Al <sub>2</sub> O <sub>3</sub>	0.55%
Iron Oxide	Fe <sub>2</sub> O <sub>3</sub>	0.03%
Calcium Oxide	CaO	0.02%
Magnesium Oxide	MgO	0.03%
Sodium Oxide	Na <sub>2</sub> O	0.01%
Potassium Oxide	K <sub>2</sub> O	0.03%
Titanium Oxide	TiO <sub>2</sub>	0.01%
Manganese	MnO	0.01%
Loss On Ignition		0.15%

**Physical Characteristics :**

pH	7.0
Refractive Index	1.544
Specific Gravity	2.65
Hardness (Mohs)	7

**Typical Physical Properties:**

	100T	200T	300T	350T	400T
Reflectance 457mu	89	89	90	91	92
Oil Absorption (rub out) ml/100g	24	25	28	29	31
Bulk Density (compacted) g/cc	1.5	1.35	1.3	1.25	1.1

**Sizing :**

% finer than 150 micron	95				
75 micron	91	95			
53 micron	84	91	95		
45 micron	70	84	92	95	
30 micron	52	68	82	89	98
20 micron	38	53	65	75	88
10 micron	20	28	35	45	58
5 micron	10	14	18	21	28
3 micron	5	7	10	12	15

**Prov. 9/87**

**DESCRIPTION**

Standard grades 60G, 100G, 200G, 300G, 350G, 400G are high-purity, white crystalline silica.

Silica is used in ceramics, refractories, abrasives, polishes, enamels, fibreglass and as a filler in paints, adhesives, grouts and plastics.

**TYPICAL ANALYSIS**

Silica	SiO <sub>2</sub>	99.0%
Iron Oxide	Fe <sub>2</sub> O <sub>3</sub>	0.03%
Loss on Ignition		0.2%

**PHYSICAL CHARACTERISTICS**

Ph		6.9
Refractive Index	1.544	1.553
Specific Gravity		2.65
Hardness (Mohs)		7

**TYPICAL PHYSICAL PROPERTIES**

	<u>60G</u>	<u>100G</u>	<u>200G</u>	<u>300G</u>	<u>350G</u>	<u>400G</u>
Reflectance 457mu	73	74	78	80	82	83
Oil Absorption (rub out) ml/100g	21	22	23	24	25	26
Bulk Density (compacted) g/cc	1.5	1.5	1.35	1.3	1.25	1.2

**SIZING**

	<u>60G</u>	<u>100G</u>	<u>200G</u>	<u>300G</u>	<u>350G</u>	<u>400G</u>
finer than-250 micron	95					
150 micron	92	95				
75 micron	78	83	95			
53 micron	65	75	92	95		
45 micron	50	65	86	93	95	
30 micron	40	45	68	85	90	98
20 micron	30	32	50	68	75	88
10 micron	12	15	30	40	52	62
5 micron	8	10	15	20	32	40
3 micron	4	5	8	10	18	25

## SILICA 60WQ

**DESCRIPTION:**

Milled from selected washed quartz

**TYPICAL CHEMICAL ANALYSIS:**

Loss on Ignition		0.2 %
Silica	SiO <sub>2</sub>	99.5 %
Ferric Oxide	Fe <sub>2</sub> O <sub>3</sub>	0.05%

pH 8.5

Refractive Index 1.54 - 1.55

Specific Gravity 2.65

Hardness (Mohs) 7

Specific Surface N/A

Oil Absorption (rub out) 25 ml/100g

Bulk Density (compact) 1.7 g/cc

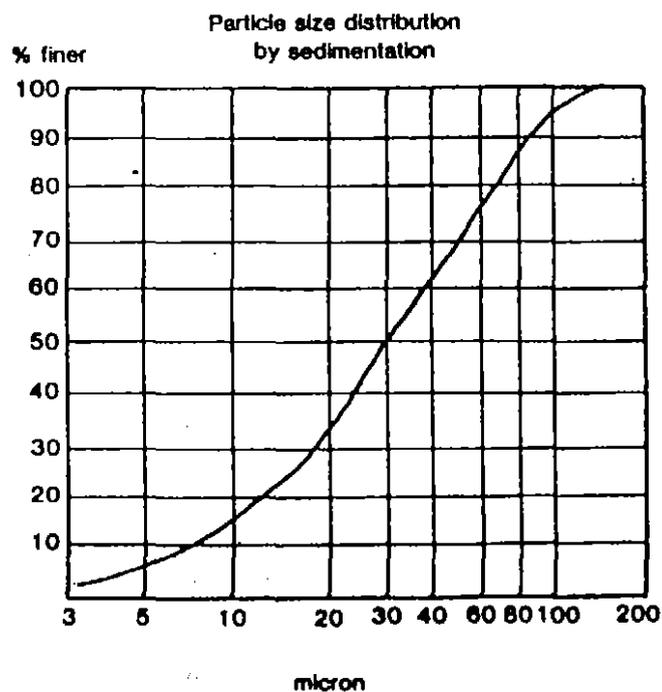
Reflectance (457 mu) 79

**TYPICAL APPLICATION:**

- \* Ceramics
- \* Abrasives

**SIZING:**

Residue + 250 microns 1.0% max



## SILICA 100WQ

DESCRIPTION:

Milled from selected washed quartz

TYPICAL APPLICATION:

- \* Ceramics
- \* Abrasives
- \* Grouting Compounds

TYPICAL CHEMICAL ANALYSIS:

Loss on Ignition		0.2 %
Silica	SiO <sub>2</sub>	99.5 %
Ferric Oxide	Fe <sub>2</sub> O <sub>3</sub>	0.05%

SIZING:

Residue + 150 microns 3.0% max

pH 8.5

Refractive Index 1.54 - 1.55

Specific Gravity 2.65

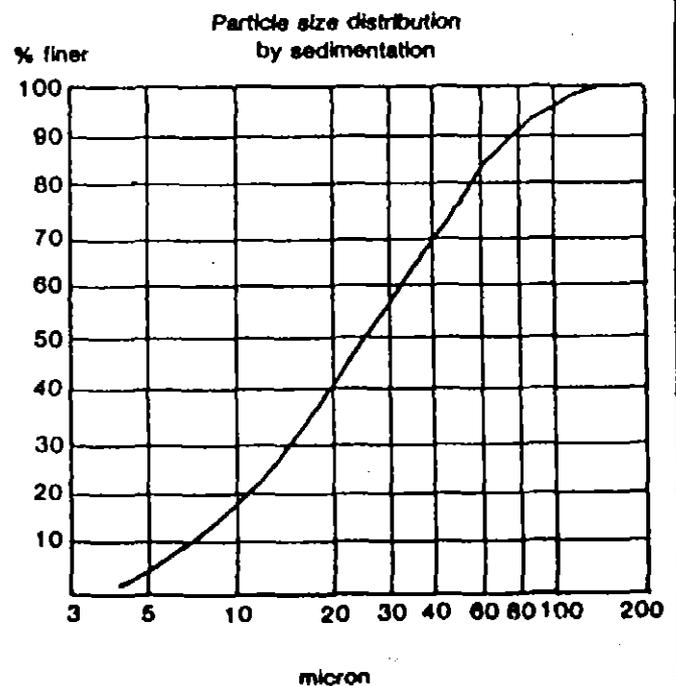
Hardness (Mohs) 7

Specific Surface N/A

Oil Absorption (rub out) 26 ml/100g

Bulk Density (compacted) 1.5 g/cc

Reflectance (467 mu) 79



## SILICA 200WQ

**DESCRIPTION:**

Milled from selected washed quartz

**TYPICAL APPLICATION:**

- \* Ceramics
- \* Abrasives
- \* Enamels & Glazes
- \* Grouting Compounds

**TYPICAL CHEMICAL ANALYSIS:**

Loss on Ignition		0.2 %
Silica	SiO <sub>2</sub>	99.5 %
Ferric Oxide	Fe <sub>2</sub> O <sub>3</sub>	0.05%

**SIZING:**

Residue + 75 microns 5.0% max

pH 8.5

Refractive Index 1.54 - 1.55

Specific Gravity 2.65

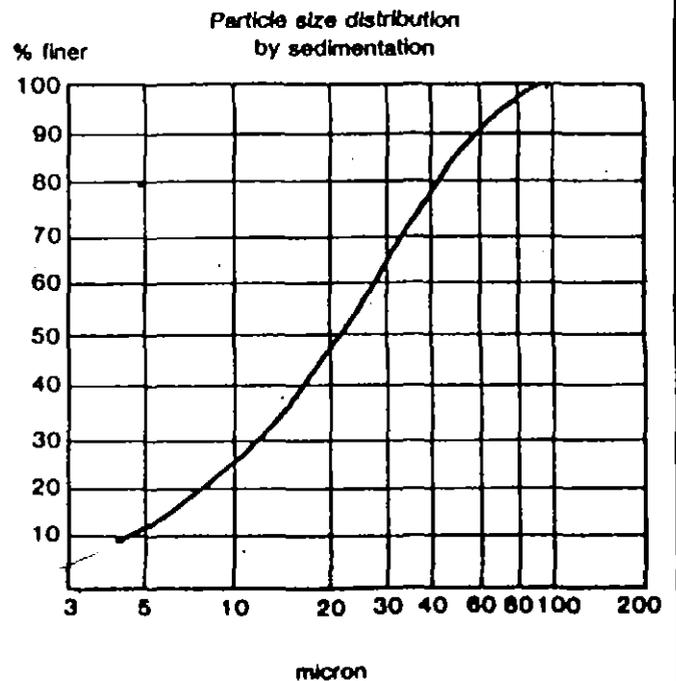
Hardness (Mohs) 7

Specific Surface 2,500 sq cm/g

Oil Absorption (rub out) 24 ml/100g

Bulk Density (compactd) 1.3 g/cc

Reflectance (457 mu) 80



SILICA 300WQ

<b>DESCRIPTION:</b>	
Milled from selected washed quartz.	
<b>TYPICAL CHEMICAL ANALYSIS:</b>	
Loss on Ignition	0.2 %
Silica            SiO <sub>2</sub>	99.5 %
Ferric Oxide    Fe <sub>2</sub> O <sub>3</sub>	0.1 %
<b>pH</b>	8.5
<b>Refractive Index</b>	1.54 - 1.55
<b>Specific Gravity</b>	2.65
<b>Hardness (Mohs)</b>	7
<b>Specific Surface</b>	4400 sq.cm/g
<b>Oil Absorption (rub out)</b>	28 ml/100 g
<b>Bulk Density (compacted)</b>	1.4 g/cc
<b>Reflectance (457 mu)</b>	82

**TYPICAL APPLICATION:**

- \*Ceramics
- \*Abrasives
- \*Fillers

**SIZING:**

Residue + 53 mu 5.0 % Max

Particle size distribution  
by sedimentation

Micron Size	% Finer
3	10
5	15
10	30
20	60
30	75
40	85
60	100

## SILICA 400WQ

**DESCRIPTION:**

Superfine silica produced from  
selected washed quartz

**TYPICAL CHEMICAL ANALYSIS:**

Loss on Ignition		0.2 %
Silica	SiO <sub>2</sub>	98.8 %
Ferric Oxide	Fe <sub>2</sub> O <sub>3</sub>	0.2 %

pH 9.0

Refractive Index 1.54 - 1.55

Specific Gravity 2.65

Hardness (Mohs) 7

Specific Surface 22,000 cm<sup>2</sup>/g

Oil Absorption (rub out) 36 ml/100g

Bulk Density (compacted) 0.8 g/cc

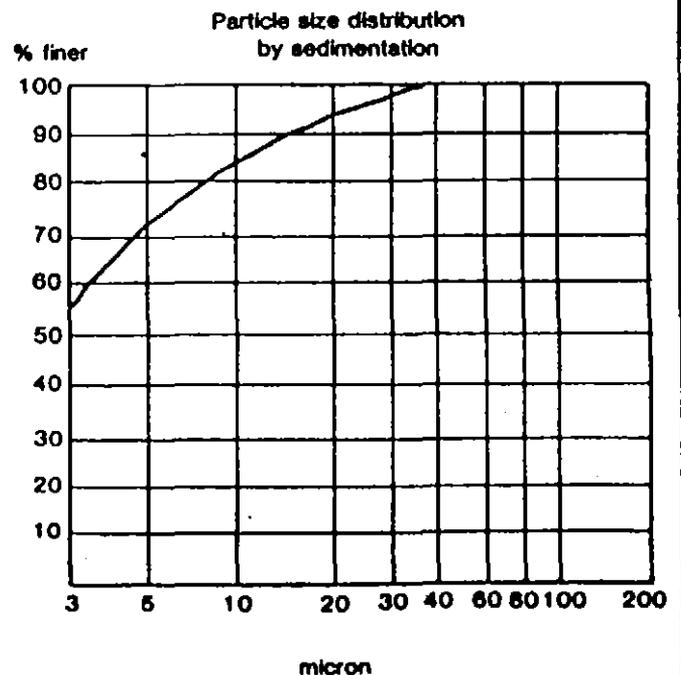
Colour Off White

**TYPICAL APPLICATION:**

- \* Paint
- \* Adhesives
- \* Tile Grouts

**SIZING:**

98% passing 38 microns



FOUNDRY SAND SPECIFICATION

CHEMICAL ANALYSIS

(Nomier)

SiO <sub>2</sub>	Al <sub>2</sub> O <sub>3</sub>	Fe <sub>2</sub> O <sub>3</sub>	TiO <sub>2</sub>	L.O.I.
99.6%	0.04%	0.06%	0.16%	0.10%

PHYSICAL GRADING

Fine AFS = 45-50

Coarse AFS = 33-36

<u>Microns</u>	<u>% Retained</u>	<u>Cumulative</u>	<u>Microns</u>	<u>% Retained</u>	<u>Cumulative</u>
+ 850	1	1	+ 850	6.5	6.5
+ 600	3	4	+ 600	23.2	29.7
+ 500	4	8	+ 500	-	-
+425	9	17	+ 425	39.3	69.0
+ 300	38	55	+ 300	22.6	91.6
+ 212	30	85	+ 212	7.0	98.6
+ 150	12	97	+ 150	1.1	99.7
+ 106	2.6	99.6	+ 106	0.1	99.8
+ 75	0.3	99.9	+ 75	0.1	99.9
pan	0.1	100	pan	0.1	100

Other special coarse or fine grain size requirements can be negotiated.