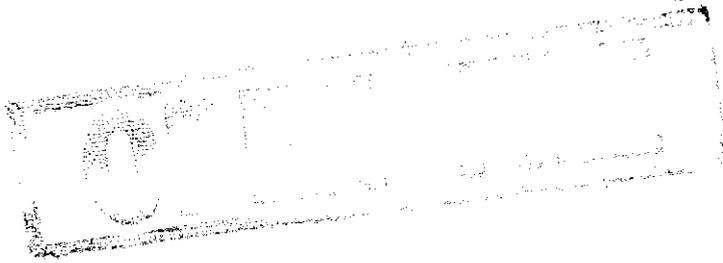


132001

0000



TCR 91-3307

MINES	
File Ref.	E.L. 25/88
25 OCT 1991	
Doc. Ref.	
Action Officer	Initials
REFER	TO
COVER SHEET	
OCT 91	
(FOLIO 77)	
Resubmit to	Date

ANNUAL REPORT

E.L. 25/88 - DIP RANGE

by

Vic Threader

for

MINERAL HOLDINGS AUSTRALIA PTY. LTD.

91-3307.

October 1991

Vic Threader and Associates Pty. Ltd.
Kingston Beach.

Figure 1

PERKINS BAY

CIRCULAR HEAD

132002

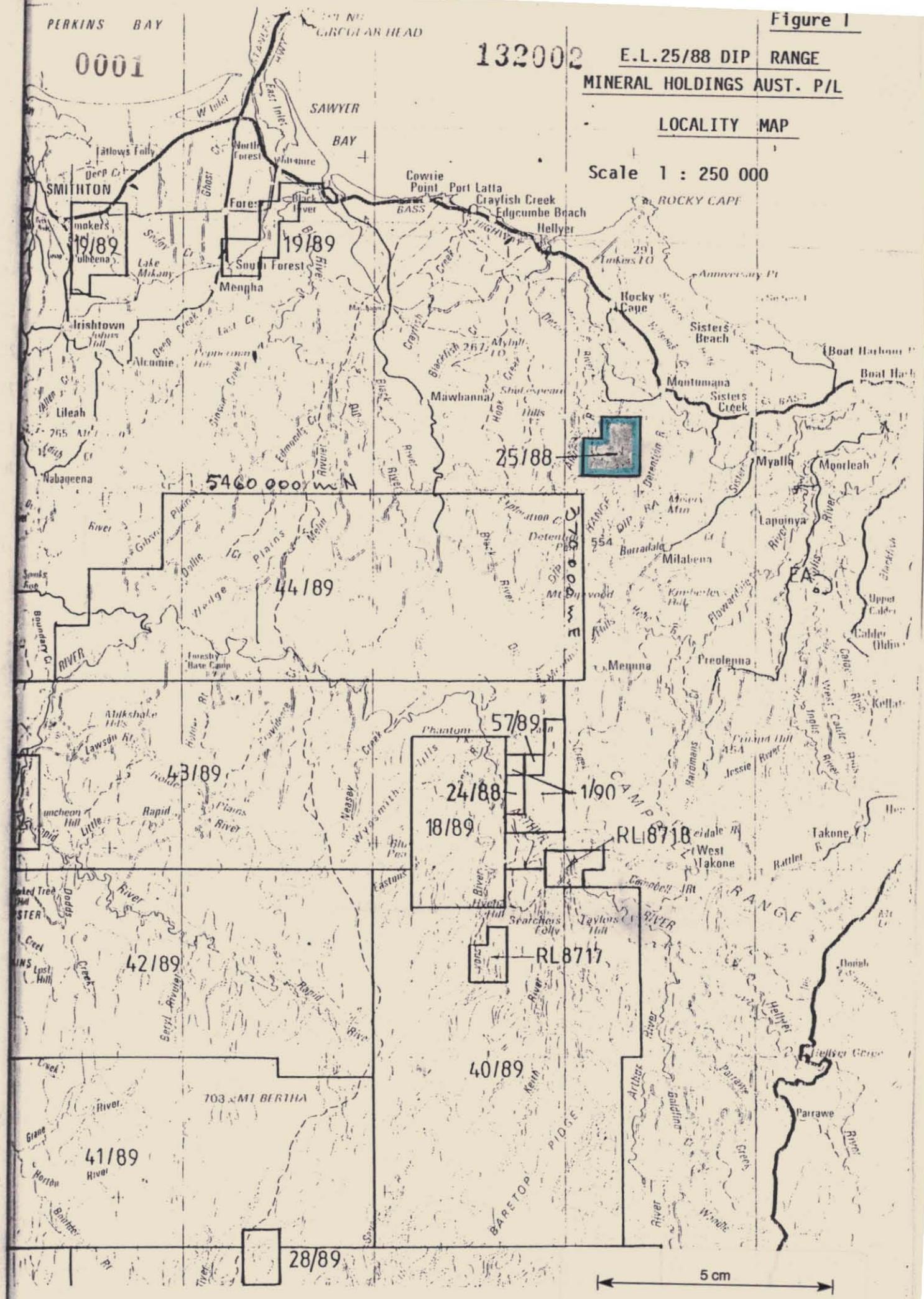
E.L.25/88 DIP RANGE

MINERAL HOLDINGS AUST. P/L

0001

LOCALITY MAP

Scale 1 : 250 000



C O N T E N T S

Introduction

Exploration

1990-91

1991-92

Figures

Locality Map

E.L. Map

Exploration Map

Appendix

Test Reports by:

Stim Laboratory

Halliburton Services

Dowell Schlumberger

Santos

Amde1

A.C.I.

Introduction

The licence area of 7 km² surrounds the company's lease CML8M/89 161 ha. Quartzite from this lease has been successfully trial run at the Pioneer Silicon Plant, Electrona, and the Temco ferrosilicon plant, Bell Bay. The combined effects of the closure of the silicon plant and the failure to secure a sales contract with Temco have necessitated suspension of activities on the lease and have discouraged further exploration in the licence area.

Activities during the year have been directed to:

- 1) testing the sand for use in the glass industry and as a propping agent in oil drilling
- 2) field inspection along the continuation of the ridge to the southwest to search for a possible quartzite and/or sand resource.

Exploration 1990/91

1. Proppant sand is required in a variety of grain sizes:

<u>U.S. Classification</u> (Screen No.)	<u>B.S.S.</u> µm	<u>Proportion in Dip Range Sand</u> %
	+850	<5
20/40	-850+420	25
30/50	-600+300	45
40/70	-420+212	50
70/140	-212+106	20
	-106	5

Dip Range sand is actually a fine/medium grained material with a median value of 250µm. As the above table shows, the 20/40 size fraction is only 25% of the total.

Dip Range sand samples have been tested by Stim Laboratories, Halliburton Services and Dowell Schlumberger, all of U.S.A. Tests were

carried out in the 20/40 size range with the following results: the single grain/aggregate grain ratio was deficient by 50%, the grain roundness factor by 17% and crush resistance by 30%.

According to the Halliburton report, the low crush resistance restricts the use of this sand to shallow oil wells (<1200m) but the industry tends to rely on the higher crush resistance of calcined bauxite for application in deep wells. Stim Laboratory has stated that "visual examination reveals that the angular grains are frequently clusters or fractured grains". They therefore suggest that washing and/or milling may improve the grain shape, grain cluster and crush resistance factors and could also enhance turbidity and acid solubility even though the samples passed these two tests.

The recovery of the 20/40 fraction will be consequently reduced by this beneficiation but as frac. sand has a high unit value (Halliburton state it to be \$225-270 (US)/2000 lb i.e. A\$378/t for the top price) it may still be economic to do this. Further testing is required to ascertain whether i) the material can be beneficiated to API specification and ii) it can be done economically. This is proposed in the next year of tenure.

M.H.A. has provided samples of 30/50 and 40/70 fractions of this material to Temco for trials as ladle sand. This trial is stated to have been successful but no reports are currently available. A further trial lot of 150t (at \$110/t delivered) is currently being negotiated.

2. Further field traversing has been carried out in the southwest corner of the licence to determine the extent of the quartzite.

Two ridges, sub parallel to the main quartzite ridge, were examined; quartzite was only found on the easterly of the two and sand accumulations in only one location as marked on figure 3.

Fifty hand auger holes were sunk along the ridge crest and slopes. Most holes contained shallow sand and bottomed on quartzite/sandstone. Two holes on the ridge penetrated 1.2m of soft sandstone and one at the bottom of the slope drilled into 2.4m of sand but the result was not repeated in other holes in the area. This result is similar to the 1989-90 experiences on the ridge further northeast, where colluvial sand was only found to range in thickness from 650mm to 1.4mm.

The full depth of sand/sandstone could not be determined by hand boring so it is not known at present whether or not an economic resource is present in this area. Recent experience in the lease area (8M/89) indicates that the sandstone is friable and breaks down on extraction and handling, thereby increasing the sand resource.

A hammer drill programme, as recommended in the previous Annual Report to test the quartzite along the S.E. continuation of the quartzite ridge, could be extended to test this area for sand and quartzite.

Exploration 1991-92

It is proposed to continue field investigations, beneficiation testing and market research into the sand resource and its end uses in the coming year.

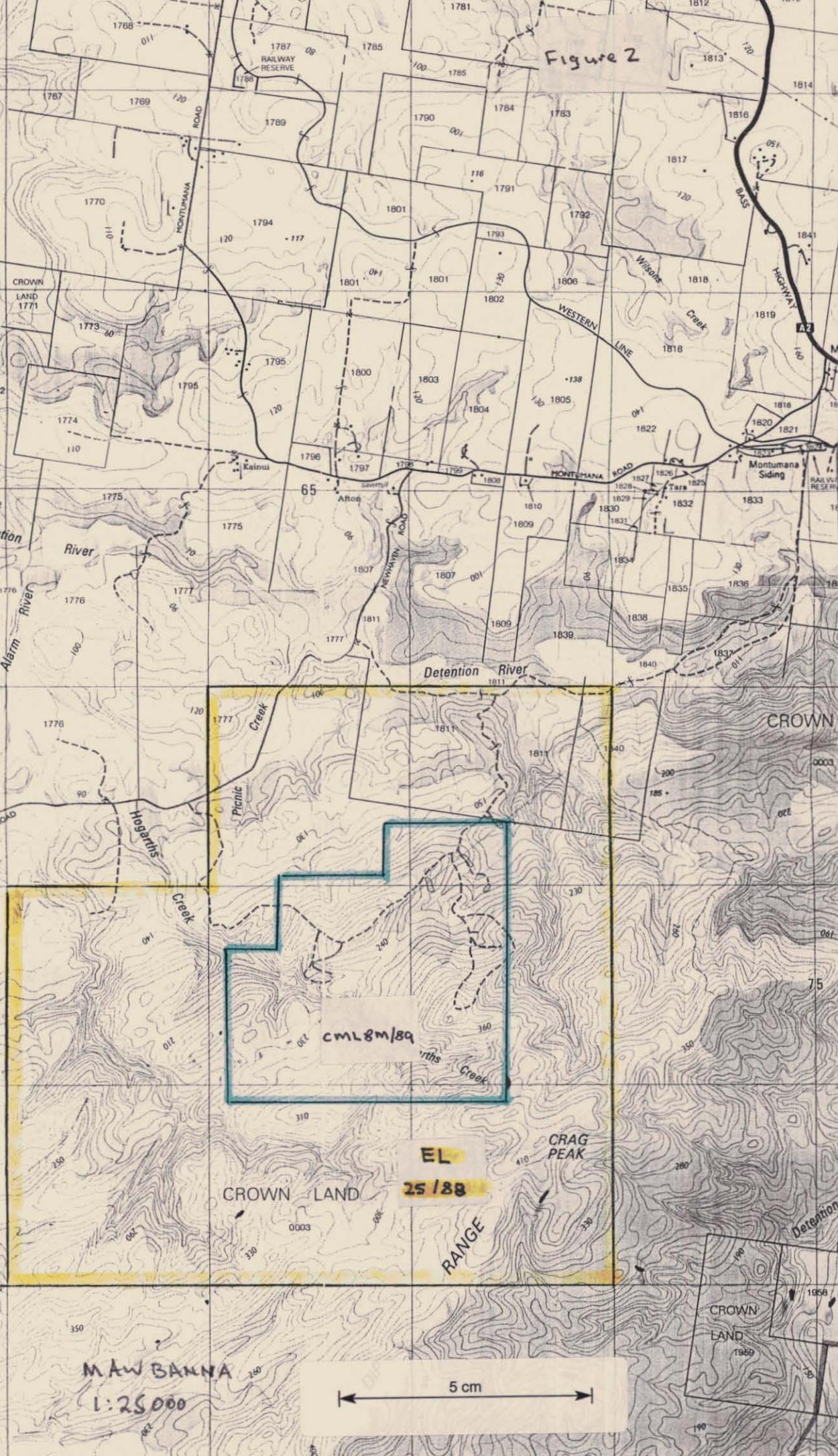
The present poor outlook for quartzite sales is a deterrent to further exploratory drilling in the foreseeable future. This will be reviewed if market conditions improve.

FOREST

CROWN LAND 1767

Figure 2

0006



cmlgm/sq

EL 25/88

CROWN LAND

RANGE

Crag Peak

MAW BANNA
1:25000

5 cm

132007

Mawbanna
1:25000

Figure 3

Additions 21.10.91

E.L.25/88 DIP RANGE

MINERAL HOLDINGS AUSTRALIA P/L

132008

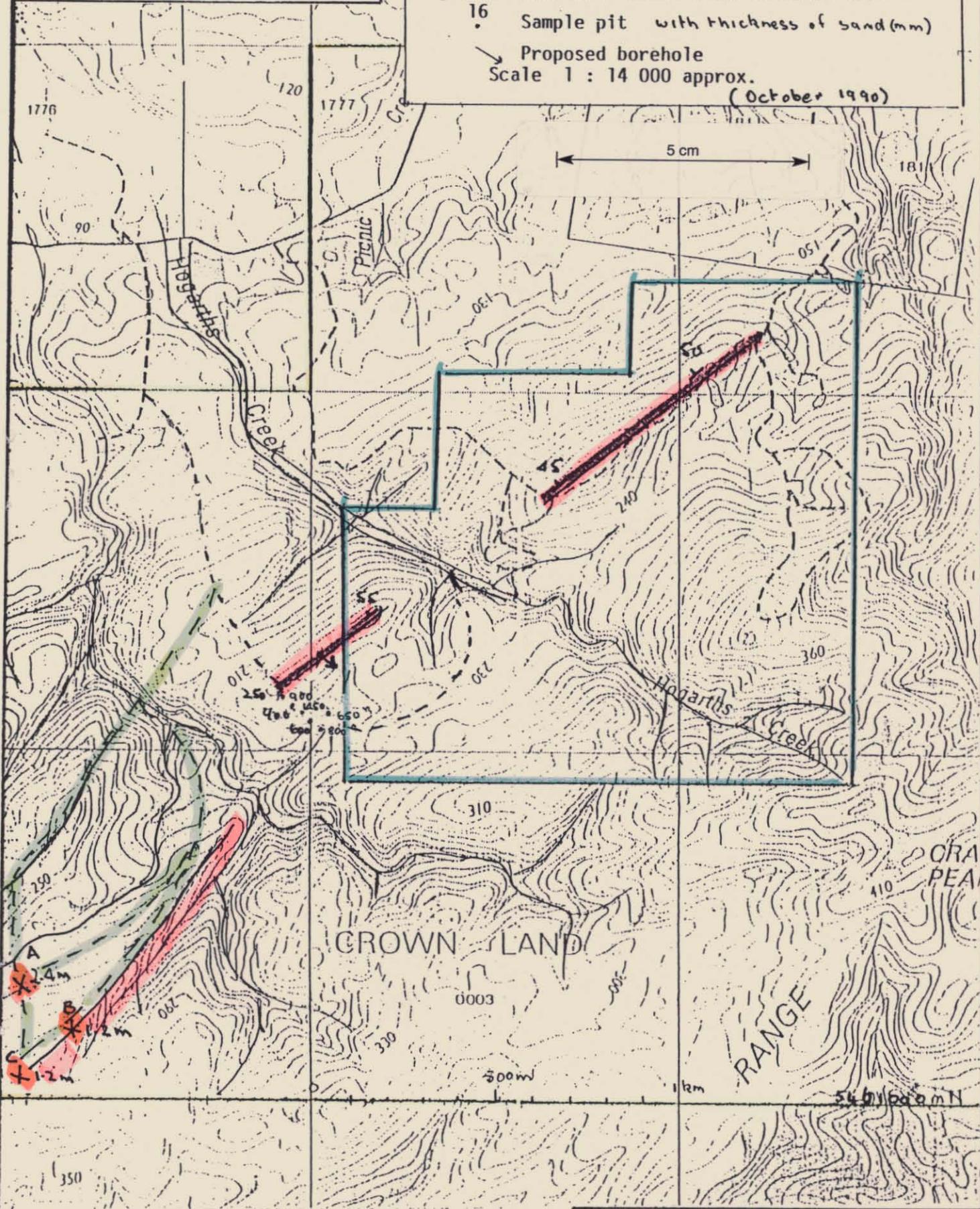
Hand Auger Traverse

X Sand (thickness m)

A	AMG 371	200/5	461	300
B	372	350/5	461	300
C	371	200/5	461	050

- E.L.25/88
 - ML8M/89
 - Strike Ridge of Quartzite
 - Mine Road
 - Excavator route from Newhaven Road
 - 16 Sample pit with thickness of sand (mm)
 - Proposed borehole
- Scale 1 : 14 000 approx.
(October 1990)

0007



0008

132009

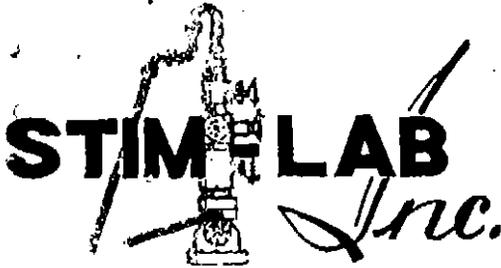
APPENDIX

0009

TEL.

000 00

132010



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

October 9, 1991

A. 9/10/91

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 API RP 56 tests requested by your firm on the submitted sample of sand from the Thomas Mountain Deposit, Tasmania. A 20/40 size distribution was made from a split portion of the sample, and the tests referred to in Table One were performed on that 20/40 sizing.

The sample we received passed the sieve analysis, the acid solubility test, and the turbidity test. It failed the shape factor, sand grain clusters and crush resistance tests. With washing, it is possible that the performance of this proppant in the acid solubility and turbidity tests could be enhanced, even though they passed. It is also possible that this washing would allow the proppant to pass the cluster test and improve its performance in the crush resistance test. A visual examination of this sand reveals that many of the grains are very spherical and well rounded, while others are angular and pointed. The angular grains are frequently clusters or fractured grains. If washing does not improve the sand, then potentially some form of mill might do the job.

Thank you for sending this sample to STIM-LAB. If we can be of further assistance, please let me know.

Sincerely,

Ron Bruner, Group Leader
Conductivity and Analysis

RB/ab

Enclosure

0010

132011

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

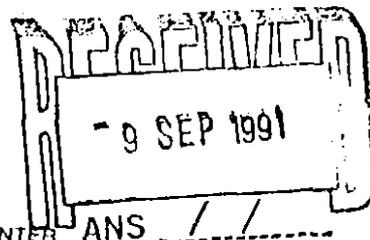
Section 8, RP 56, Crush Resistance

4000 psi	23.1
Maximum Acceptable at 4000 psi	14.0

132012



HALLIBURTON SERVICES



0011

ED STAHL
RESEARCH STAFF ASSOCIATE
Fracturing

RESEARCH CENTER
DRAWER 1431, DUNCAN, OKLAHOMA 73536-0410
PHONE: (405) 251-3838
FAX: (405)251-3218 / 3008

August 30, 1991

Mr. Neil Thomas
Mineral Holdings Australia Pty. Limited
100 Collins Street
Melbourne, Australia, 3000

Dear Mr. Thomas:

Relative to your inquiry on August 13, 1991, I would offer the following comments or opinions.

1. I do not believe faulty screening on the sample prior to our receiving it would have affected the crush test. As you will note, if you have a copy of API RP 56, the crush resistance test is discussed in Section 8 on pages 12 and 13. Further in step 8.3, the portion of the sample to be tested is rescreened and only the sand within the specified range, ie. for 20/40 sand only sand passing a U.S. 20 mesh sieve and retained on a U.S. 40 mesh sieve, is used in the crush test. All coarser and finer material is discarded. Thus, any error in initial screening of the sand prior to its receipt by Halliburton should not affect these results.
2. Based on comments from other sand suppliers, I would expect the amount of coarse material (20/40) relative to finer material (70/140) to change some as you move to different areas in the deposit and vary by depth in the deposit. However, based on deposition over geologic time, I do not think my experience would indicate any major change would be seen in the individual particle properties by going to other areas within the deposit. Also, I would not expect much difference between near surface samples and those at 40 feet relative to weathering.
3. Although I do not deal directly with shipments of sand to Australia, I believe we can get high quality frac sand for the U.S. into Australia for something close to \$225-275 per 2000 pounds in U.S. dollars. I am sure this would depend on volume and type of packaging.

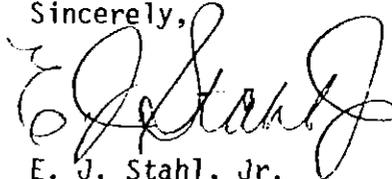


A Halliburton Company

Mr. Neil Thomas
Page No. 2
August 30, 1991

I appreciate your interest in attempting to develop a use for this sand, however, at this time the demand by our customers appears to be for a sand which more closely meets the API RP 56 guidelines.

Sincerely,



E. J. Stahl, Jr.

EJS:lm

cc: Dr. Robert Tiner
Mr. Bill Gilchrist
Mr. Reg Lasater
Dr. Larry Harris
Mr. Danny Dorsey

0013

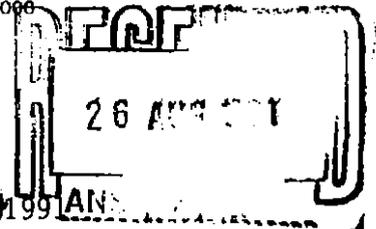


HALLIBURTON SERVICES

132014

ED STAHL
RESEARCH STAFF ASSOCIATE
Fracturing

RESEARCH CENTER
DRAWER 1431, DUNCAN, OKLAHOMA 73536-0410
PHONE: (405) 251-3838
FAX: (405)251-3218 / 3000



August 12, 1991

Mr. Neil M. Thomas
Mineral Holdings Australia Pty. Limited
100 Collins Street
Melbourne, Australia, 3000

Dear Mr. Thomas:

I received your telefaxes of July 31, 1991 and August 12, 1991. I have also forwarded the results of our testing to our Division Manager and Division Engineer in Singapore as well as our engineer in Melbourne, Australia. Based on those results, I am not very encouraged about them deciding to use this sand based on the reasons I submitted to you in my letters on July 11 and 22, 1991.

While none of the samples contained more than one percent fines in the pan (pass 50 mesh) on the screen analysis, our experience also indicates there may be some increase in fines due to shipping and handling.

I appreciate your interest in attempting to develop this sand deposit, however, until I hear anything further from our people the results of our testing does not justify further pursuit by our laboratory. I appreciate your desire to work with Halliburton as I too had hoped this sand deposit might have been usable for frac sand.

Sincerely,

E. J. Stahl, Jr.

EJS:lm

cc: Dr. Robert Tiner
Mr. Bill Gilchrist
Mr. Reg Lasater
Dr. Larry Harris
Mr. Danny Dorsey

0014



HALLIBURTON SERVICES

132015

ED STAHL
RESEARCH STAFF ASSOCIATE
Fracturing

RESEARCH CENTER
DRAWER 1431, DUNCAN, OKLAHOMA 73536-0410
PHONE: (405) 251-3838
FAX: (405)251-3218 / 3008

July 11, 1991

J. J. 7/91.

Mr. Neil M. Thomas
Mineral Holdings Australia Pty. Limited
100 Collins Street
Melbourne, Australia 3000

Dear Mr. Thomas:

As I indicated to you in my letter on June 3, 1991, the results of tests on the submitted sand samples should be completed in about two months. Although I have not yet received the final report, I have been provided the data on all four of the samples you submitted.

Based on the API RP 56 guidelines for sand used as a propping agent, the following table will summarize our tests.

API TESTS	SAMPLE SIZE			
	20/40	30/50	40/70	70/140
1. X-ray Analysis	? P	P	P	P
2. HF/HCl Solubility	P - P	P	P	P
3. Screen Analysis	F - F	P	F	F
4. Roundness	F - F	F	F	F
5. Sphericity	? F P	F	F	F
6. Crush Resistance	? F P	F	F	F

P = Pass - Meets API guidelines
F = Fail - Does not meet API guidelines

As you can see, none of the submitted samples would meet the API guidelines which is what is used by Halliburton and our customers to compare various sands as propping agents. This does not necessarily mean the sand could not or would not be used by our customers but would probably severely limit its application to only very shallow wells probably those less than 3000 to 4000 feet in depth.



A Halliburton Company

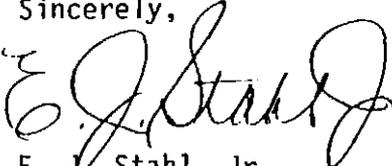
Mr. Thomas
Page No. 2
July 11, 1991

The fact that three of the products did not have in excess of 90 percent of sample within the specified range on the screen analysis can be overcome with closer screening of the product. None of the samples exhibited a roundness and sphericity of equal to or greater than 0.6 and this is not something that can be changed however, this property alone is not that serious a drawback. The main problem, as I see it, is the lack of crush strength in the sand and this is solely a function of the strength of the individual grains and it is not something that can normally be improved. It is simply a property of the grains when they were formed. Again, because of low crush strength the sand would probably only be considered for use in shallow wells.

When I have received the final typed report, I will furnish it to our international personnel in Houston, TX as well as to the Halliburton personnel in Australia. I do not anticipate they will have a copy of the report before August 5, 1991.

If there is any additional information I can pass on to you I will be back in contact. I would like to have some indication as to cost of this sand FOB Port Adelaide, Australia to include with the research report on the sand when it is sent to management, if you can provide it within the week. I appreciate your interest in working with Halliburton and possibly some market for this sand can be developed.

Sincerely,


E. J. Stahl, Jr.

? CIF
Adelaide

EJS:lm

cc: Mr. Bill Gilchrist
Mr. Reg Lasater
Dr. Larry Harris
Mr. Danny Dorsey

0016



HALLIBURTON SERVICES

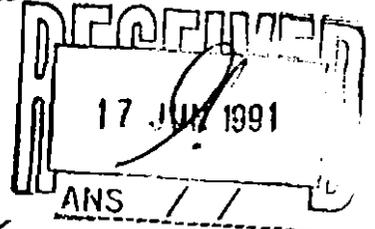
132017

ED STAHL
RESEARCH STAFF ASSOCIATE
Fracturing

RESEARCH CENTER
DRAWER 1431, DUNCAN, OKLAHOMA 73536-0410
PHONE: (405) 251-3838
FAX: (405)251-3218 / 3008

Mr. Neil M. Thomas
Mineral Holdings Australia Pty. Limited
100 Collins Street
Melbourne, Australia 3000

June 3, 1991
5/6/91
A - Tim
Copy of fax to which we
have already replied.
G
14



Dear Mr. Thomas:

I received the four samples of sand today and will take them to the lab for evaluation. We are aware of the increased interest in Australia relative to the stimulation of coalbed methane wells to help de-gas the coal and recover methane gas.

When Halliburton has completed our testing of the sands I will let you know if the sand can be used for hydraulic fracturing. These tests will be based on the procedures outlined in the American Petroleum Institute guidelines referred to as API RP 56, however, the results of our tests are not released but are for internal use only.

Whether or not the sand can or will be used in Australia or elsewhere will depend on the results of our tests which will be transmitted to our people as well as the cost of the sand. If the sand can be used, I would expect the 20/40 mesh material to comprise the major usage. Please supply me the costs of the sand FOB Australia. This should include freight from Tasmania and any duty or other charges for import into Australia. These costs will also be forwarded to our people along with our recommendations. Due to the amount of testing we already have scheduled on proppants, I don't anticipate results from our lab for at least two months.

I appreciate your prompt response in supplying these samples to Halliburton and will contact you when our tests are completed.

Sincerely,

E. J. Stahl, Jr.

EJS:lm

- cc: Mr. Bill Gilchrist
- Mr. Reg Lasater
- Dr. Larry Harris
- Mr. Danny Dorsey

0017

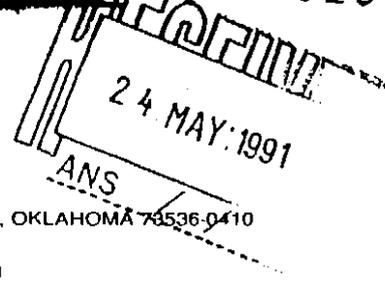
USA

HALLIBURTON

132018



HALLIBURTON SERVICES



ED STAHL
RESEARCH STAFF ASSOCIATE
Fracturing

RESEARCH CENTER
DRAWER 1431, DUNCAN, OKLAHOMA 73536-0410
PHONE: (405) 251-3838
FAX: (405)251-3218 / 3008

May 15, 1991

A. 24/5/91.

Mr. Neil M. Thomas
Mineral Holdings Australia Pty. Limited
2nd Floor
100 Collins Street
Melbourne, Australia 3000

Dear Mr. Thomas:

I have been asked by Mr. Bill Gilchrist to respond to your inquiry relative to the Thomas Mountain Mine. Also, for your records it should be noted that both Messrs W. T. Malone and A. B. Waters have retired from Halliburton.

Based on the data you supplied on the Thomas Mountain sand and realizing it is an unbeneficiated sample, I have some reservations that the sand can provide fracture flow capacity (fracture conductivity) comparable to other sands currently in use. This is based primarily on the roundness and sphericity which indicate this is an angular sand, however, this may be overcome if it is a high strength sand. Generally, this type sand has high conductivity at low closure pressures (less than 4000 psi), however, at closure pressures of 4000 to 6000 these sands generally lose fracture conductivity rapidly and exhibit the generation of a large amount of fines which is undesirable.

I have some doubt the sand would find much usage in the United States based on what I assume will be its performance and cost, however, it may be very acceptable for use in wells in the Pacific Basin which exhibit lower closure stresses. This can only be determined by evaluating a processed (washed and graded) production sample of each size sand available. If you will submit five pounds of 20/40, 30/50, 40/70 and 70/140 mesh sands, we will attempt to work them into our testing schedule. Please do not submit any unbeneficiated samples for this testing.



A Halliburton Company

0018

Mr. Neil M. Thomas
Page No. 2
May 15, 1991

132019

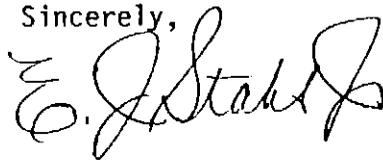
Also, please supply the anticipated selling price for each size and the shipping or stocking point.

We appreciate your interest in Halliburton and will await further information as to whether samples are being shipped prepaid to the following address.

Mr. E. J. Stahl
Halliburton Services
Research Center
P. O. Box 1431
2600 South Second Street
Duncan, OK, USA 73536

If you have further questions I can be reached by phone at (405) 251-3838 or by FAX (405) 251-3218.

Sincerely,



E. J. Stahl, Jr.

EJS:lm

cc: Mr. Bill Gilchrist
Mr. Reg Lasater
Dr. Larry Harris
Mr. Danny Dorsey



DOWELL SCHLUMBERGER

ASIA REGION LABORATORY



REPORT NO: 91-Q-048

DATE: 1 AUGUST 1991

**QUALITY CONTROL
&
PERMEABILITY VS CLOSURE STRESS TESTS
OF FRAC SAND
FOR MINERAL HOLDINGS, AUSTRALIA
(LAR NO. 02678)**

REQUESTED BY: R MIENHES

DISTRIBUTION:

FEA - RMM
CAS
ASL

SIGNATURE:

DR. C. K. CHENG
(REGION LAB. MANAGER)



**I. SAMPLE IDENTIFICATION**

Sample : Approximately 1.5 kg of frac sand
Customer : Mineral Holdings
Country : Australia
Date Received : 22 July 1991

II. INFORMATION REQUESTED

- a) Quality Control Test of 20/40 frac sand as per API RP56.
- b) Permeability and Fracture Conductivity Test.

III. SUMMARY

The sand sample failed to meet with the API QC Specifications for 20/40 Frac sand. The sand also failed to meet with the Size Distribution Specification for 30/40 and 40/50 Frac sands.

The fracture conductivity and permeability measured upto 6,000 psi is included in the report.



IV. LABORATORY RESULTS

A) Quality Control Test

Quality Control Test	API Specification for 20/40 Frac Sand	Sample
<u>Size Distribution</u> :		
Through US Mesh No. 20 on US Mesh No. 40	90% by wt min	89% wt
Through US Mesh No. 50	1% by wt max	0% wt
On US Mesh No. 16	0.1% by wt max	0.0% wt
<u>Acid Solubility</u>		
12% HCl + 3% HF	2% max	2%
<u>Shape</u> :		
Krumbein Sphericity	0.6 min	0.7
Krumbein Roundness	0.6 min	0.6
<u>Silt Test</u> :		
Turbidity	250 FTU max	31 FTU
<u>Crush Resistance</u> :		
% material passing US Mesh No. 40 after crushing at 4000 psi	14% max	22%

B) Fracture Conductivity & Permeability

Test Conditions

Test Temperature : 24°C
 Sand Loading : 2 lb/ft²
 Fluid Used : Diesel

Closure Stress (psi)	Fracture Conductivity (mD•ft)	Permeability to Diesel (mD)
1000	2,977	140,700
2000	1,907	96,260
4000	848	47,590
6000	442	27,060

0022



SANTOS LTD

(Incorporated in South Australia)

A.C.N. 007 660 923

132023

Postal Address:

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

[Handwritten signature]
3/5/91

FACSIMILE TO: MINERAL HOLDINGS AUSTRALIA P/L (03) 650-3855 PAGE 1 OF 1

ATTENTION: N THOMAS

FROM: MANAGER - PETROLEUM ENGINEERING OPERATIONS

REF: WP:7123G(60)

DATE: 29 MAY 1991

RE: THOMAS MOUNTAIN SPHERICAL SAND

Faxed: 31/5/91

SANTOS had arranged for further "Crush Resistance" tests to be conducted on the remainder of the sample of Thomas Mountain Sand. The results (attached) show that the crush resistance of the sand deteriorates rapidly above a pressure of 4000 psi. Due to this fact the sand would not be suitable for use as an intermediate strength proppant.

SANTOS obtained from Halliburton the price of 20/40 frac sand delivered to Adelaide storage as 17c/lb. Apparently Halliburton Adelaide only import the 20/40 fraction so prices are not available for the other sizes.

In response to your query on silica flour, the SANTOS Petroleum Engineering Department does not use the above in its fracture stimulation operations as it is believed to cause plugging of the pore space in the reservoir. The silica flour is used as a high temperature stabiliser in the cementing of deep wells. The local service companies (Dowell Schlumberger, Halliburton) provide the supply of "Hitemp Blend" cements which has the silica flour pre-mixed with type 'G' oilwell cement.

SANTOS trust this information has been of use in your quest to develop the Thomas Mountain Sand resource.

[Handwritten signature]
Regards
N A BUTT

Copy: A F Mayers/Frac File

Encl: 3 Attachments

AFD/ih



SANTOS LTD

(Incorporated in South Australia)

A.C.N. 007 550 923

132024

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"

0124

*** COMPARISONS ***

PROPERTY	UNITS	API RECOMMENDED LIMITS	THOMAS MOUNTAIN SAND AMDEL ANALYSIS	Sand ie. Northern White, Texas Brown.	Intermediate Strength Proppant	Sintered Bauxite
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 12/3 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. 0.8 MIN.	0.7 MIN. 0.7 MIN.
CRUSH RESISTANCE @ CLOSURE STRESS	% FINES @ 4000 PSI	20/40	0.58 %	14% MAX.	10% MAX.	10% MAX.

HYPERMENT # 1

132025

CRUSH RESISTANCE TEST

132026

Company: SANTOS Limited

Sample Identification: 20/40 US Mesh Frac Sand

TABLE I

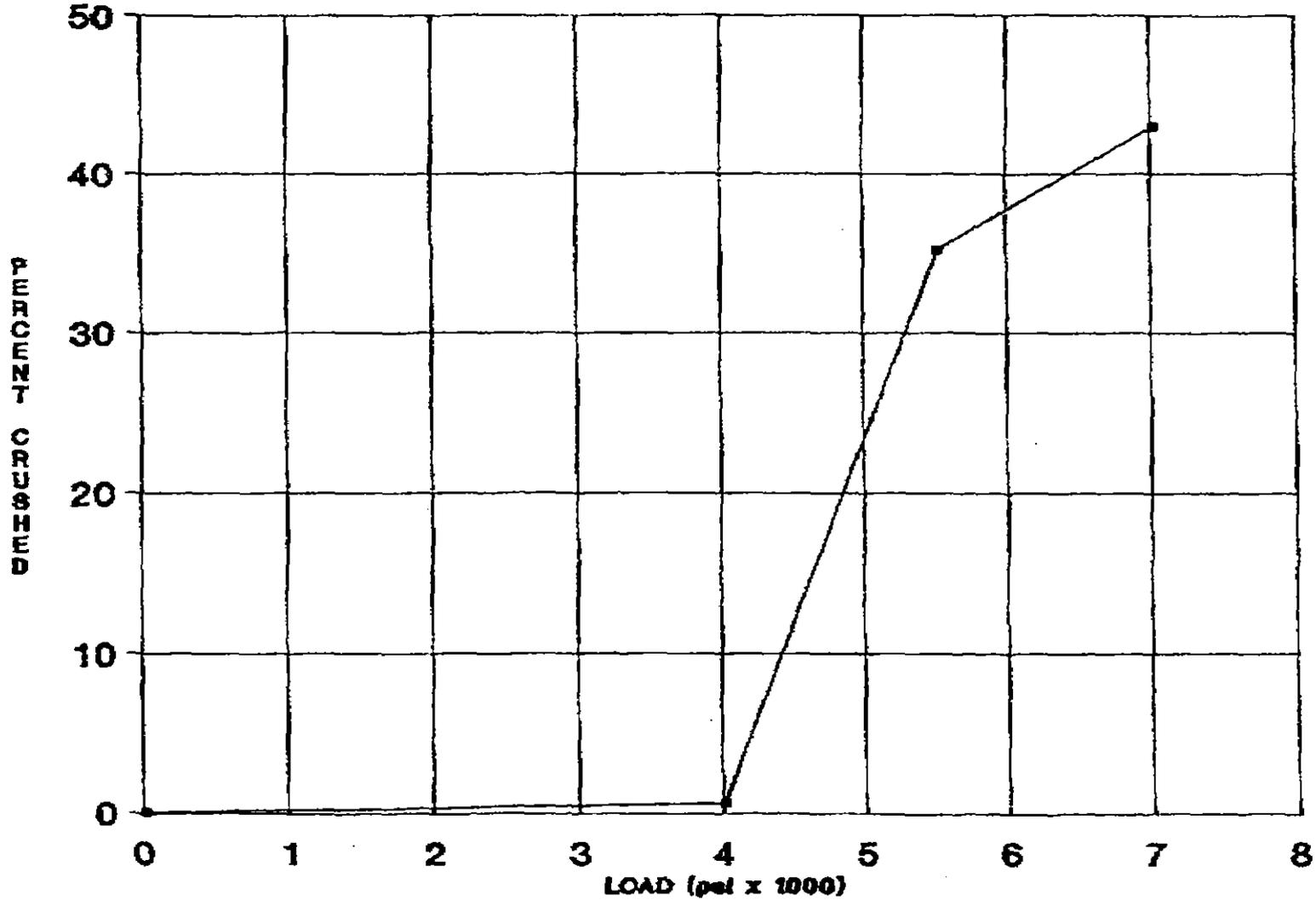
Load (psi)	Initial Weight (grams)	Terminal Weight (grams)		Final Weight (grams)	Terminal Weight (percent)	
		>40Mesh	<40Mesh		>40Mesh	<40 Mesh
4000	22.50	22.37	0.13	22.50	99.42	0.58
5500	22.08	14.31	7.77	22.08	64.81	35.19
7000	22.22	12.69	9.53	22.22	57.11	42.89

Figure 1.

CRUSH RESISTANCE

Company: SANTOS Limited

Sample Identification: 20/40 US Mesh Sand

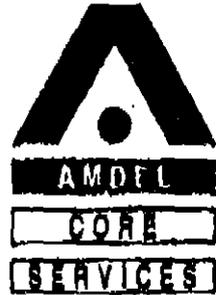


0027

132023

FACSIMILE TRANSMISSION FROM:

AMDEL CORE SERVICES PTY LIMITED
31 FLEMINGTON STREET FREWVILLE SA 5063
FACSIMILE NO: 08 372 2861
TELEPHONE NO: 08 372 2834



TO: Andrew De GABIS

COMPANY: SANTOS Limited

FAX NO: 212 5476

DATE: 24 May 1991

COPY TO:

FROM: Anthony Drake

TOTAL PAGES: 3

Andrew,

Following are the results to the two crush resistance tests you requested on the 20/40 US Mesh Frac sand supplied. I apologise for the delay in getting the results to you.

As you can see there has been a large decrease in the crush resistance with an increase in load. We feel that there may be a point between 4000 psi and 5500 psi where the sand exceeds its threshold resistance to crushing. To confirm this further testing would be necessary.

Also attached is a graph displaying the results.

If you have any questions regarding the analysis please do not hesitate to contact me.

Regards,

A. M. Drake

0026

132029

31 15:19 A.C.I. SYD 02 6998085

P.

FACSIMILE TRANSMITTAL FORM



Glass Packaging Division

SYDNEY

DATE: 24TH MAY 1991

SENDER: GEOFFREY HIGGINBOTHAM

FAX TO: MINERAL HOLDINGS AUST. (03)6503855

TO: NEIL M. THOMAS CC: G. DEITZ

SUBJECT:

No. of PAGES: 2 (including this page)

(A Unit of ACI Operations Pty. Ltd. A.C.N. 004 230 326
813 South Dowling Street, Waterloo, Sydney, Australia
Postal Address: Box 1, P.O. Waterloo, N.S.W. 2017
Telephone: (02) 699 8611
Telex: AA22876

FAX NO. (02) 699 8085

INT. FAX No. 0011 61 2 699 8085

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

PREPARATION OF SCREENED FRACTIONS OF THOMAS MOUNTAIN SAND

Notes: Since the mesh sizes required overlapped it was not possible to use the same sample of sand to prepare all the material required. Sand (designated A) was screened using BSS Mesh Screens 18, 36, 72, 150 (equivalent to US Mesh Screens 20, 40, 70, 140) until the required quantities of BSS 18/36 (US 20/40) and BSS 36/72 (US 40/70) material had been obtained (about 2.3kg). Sand (designated B) was then screened using BSS Mesh Screens 25, 52, 72, 150 (equivalent to US mesh screens 30, 50, 70, 140) until the required quantity of BSS 25/52 (US 30/50) material had been produced. The BSS 72/150 (US 70/140) material produced from sand 'B' when added to the material produced from sand 'A' exceeds the required amount of 2.3kg. While packed separately then they can be combined to produce a composite sample of the required weight.

Please note that to produce the required quantity of sand has involved screening for over 3 days. During this period staff were actually involved for 25% of the time. The charge will therefore be calculated on the basis of 6 man-hours plus freight.

0029

132030

1 '91 15:20 A.C.I. SYD 02 6998085

The larger box contains the screened samples and the smaller box the tailings.

BSS	US	SAND A	
		WT	%
+18	+20	120	1.7
-18 +36	-20 +40	2460	34.1
-36 +72	-40 +70	1486	34.5
-72 +150	-70 +140	1619	22.5
-150	-140	526	7.3
		-----	-----
		7211	100.1
		-----	-----

SAND B			
+25	+30	969	12.0
-25 +52	-30 +50	2475	30.8
-52 +72	-50 +70	1475	18.3
-72 +150	-70 +140	2277	28.3
-150	-140	850	10.6
		-----	-----
		8046	100.0
		-----	-----