CONTENTS ENVELOPE 1757

TENEMENT: S.M.L. 621 - Warrow Area.

TENEMENT HOLDER: Blacker Motors Pty. Ltd.

PLANS: Nil.

720/1

BLACKER MOTORS PTY. LTD.

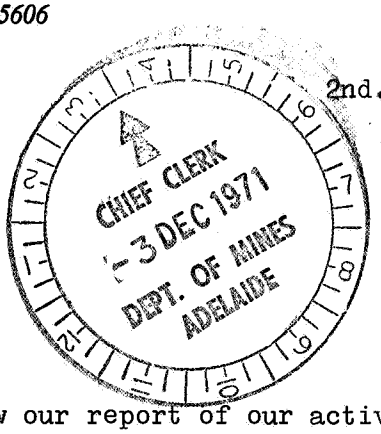
AUTHORIZED DEALER CHRYSLER AUSTRALIA LTD.

0035

CLAAS | NUFFIELD | TWIN CITY | OLIVER | VALIANT | DODGE | COMMER | HILLMAN

LIVERPOOL STREET, PORT LINCOLN, S.A. 5606

P.O. Box 397
Telephone 23700 (3 lines)



2nd. December, 1971

Enc. 1757.

The Director of Mines,
169, Rundle Street,
ADELAIDE. 5000.

Dear Sir,

We set out below our report of our activity on SML621 during the three months ending 25th November 1971. A drilling log is attached. A statement of our expenses was left in Mr. Keith Johns' office together with a geologist report by Mr. Les Nixon and Amdel report on samples, on Thursday 25th November.

During the period, Messrs. H. F. & H. G. Blacker carried out extensive prospecting activity and interviewing of local residents re wells, bores, outcrops, etc. Mr. Nixon undertook a geological survey on behalf of Cresco Fertilizers who are very interested in what we had found. Mr. Nixon gave what we believe is a very good report on the kaolin prospect, which was later confirmed by the Amdel test on samples and reports from other parties who have received samples from subsequent drill holes. Mr. Nixon inspected twelve points of interest in particular.

From his report our main interest focused on three areas. They are:

1. Riley's Farm (Stop 1) We originally proposed drilling this area first. This plan was upset by not having this area included in our SML and we have since applied to have the area between the road and the range proper included in our SML with the right to drill only and not to do anything further without Ministerial consent. We believe this area which is practically all cleared farm land, may include some of the best and most accessible kaolin and must be explored. No damage to the flora and fauna or farmland is likely.

2. Hundred of Ulipa (Stop 12) Extensive testing on samples from bore cuttings were done which proved the kaolin to be highly prospective. Heavy rain which has fallen regularly since winter (another inch ten days ago) made much of this area impossible to get into. The only area not saturated was in crop and therefore not accessible.

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From our observations of wells etc. we put down three bores in an east west line from near Mount Drummond Post Office to determine where kaolin petered out. E1 revealed 15 feet of overburden, 15 feet white Kaolin, 25 feet of pink kaolin and then 10 feet sand. The plant moved several miles west and two holes were put down west of a well which showed white kaolin in the cuttings. These holes both produced sand. Extensive overburden being established, they were abandoned.

3. North and South Block (Stop 9) Two previous geologists had suggested that Kaolin would occur on lowlands which conflicted with our deductions and we decided to drill at S1 which is approximately half way up the foothill of the north and south block rising from a creek. We estimate it would be approximately 80 feet above the creek bed. Overburden was virtually nil, about two feet of contaminated kaolin being drilled before breaking into a clean, very white sample. The colour and texture remained constant until approximately 40 feet when dampness increased. Finally the drilling stopped at 70 feet still in clean kaolin because the sample was wet and the air compressor was unable to cope.

S2 The plant then moved 300 yards west, across the creek and at a point about 20 feet above the creek bed. Approx. five feet of overburden and then clean white kaolin for another 25 feet at which point quartz feldspar rock was encountered. This was hammer drilled for 30 feet and texture did not seem to vary markedly.

S3 The plant was subsequently moved westward, over and down the other side of the next hill another 1,460 yards, kaolin outcrops being evident along this interval. Drilling provided approximately four feet of contaminated kaolin after which the same type of very white fine textured kaolin was encountered without much variation at all until 100 feet where quartz felspar was again reached. We estimate we were at least 50 feet below the top of the rise between S2 and S3. Assuming the felspar quartz layer is approximately level we believe the kaolin layer between S2 and S3 would be at a maximum of 150 feet thick and that S1 would have bottomed at around 100 feet. Also we believe it would increase to 150 feet or so thick at a point around 250 yards north east of S1. The rounded hill between S2 and S3 runs roughly north and south, merging into hills each end, kaolin being evident at many points in each for several miles, the indications being that much of the hills' foundation is made up of kaolin deposit. Storm washouts, ant holes, dams and wells all confirm this.

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At this point of the programme we moved all of the drill cuttings to Port Lincoln (where they are stored) for study. The plant was put on standby pending expert opinion on results and samples which are still not completed.

A study of Mr. Nixon's report and Amdels tests was made when they became available to us in October. We note that one sample tested by Amdel came from Stop 9 and actually was taken from Kaolin exposed in an erosion channel about 25 yards from where S1 was drilled. We also took note that reflectivity 85.5%, particle size 13.7% < 2 microns and fine quartz fraction 1% was very good and very similar to that sample exhaustively tested in Amdel Report MT1852/72 from Ulipa (Stop 12) figures being, reflectivity 86.5%, 13.7% <2 microns and fine fraction quartz 4%. These two deposits are 15 miles apart.

Mr. Nixon mentions that Stop 10 on page 14 of his report revealed no evidence of Kaolin. Since it was very wet at the time and Mr. Nixon walked the last two miles unguided, we claim he missed the area because we have since re-located it and further extensive kaolinization below it. This is a two or three mile extension of foothill on which S1 was drilled.

During the period of the S.M.L. our research into kaolin both from general knowledge, uses and market potential were stepped up. Enquiries through the Mines Department, The Premier's Department, The Department of Trade and Industry, The Stock Exchange, The N. S. W. Dept. Mines, John P. Young and Associates (S.A.) Pty. Limited, Australian Paper Manufacturers, B. H. P., Commercial Bank of Australia, Universal Business Directories (Aust) Pty. Limited, etc. provided us with a wealth of information and potential buyers. Much was learnt by study at the Institute of Technology and the Public Library.

During October and November we established contact with many parties in Australia, Canada, U.S.A., Japan, Germany, England, Holland, France and in all, around 100 samples were set upon request. A number have asked for more for further exhaustive testing, the most notable being English China Clay (Kaolin Australia) Pechiney, Metallgesellschaft of Australia, Cresco Fertilizers (W. R. Grace of U.S.A.), Mines Exploration, Australian Development, Engelhard Minerals and Chemicals Corp U.S.A., Placer Prospecting, Iwatani & Co., Kyoritsu Ceramics, Shumitomo Shoji, Waka Bussan, Mitsui, and Cominco. A number of smaller companies have asked about supplies of water (one million gallons a day) which we followed up successfully with the E. & W. S. and obtained water analysis. Also they needed other information for basic feasability studies, which was obtained. Much hinged on having reserves of five to six million tons to back up a project.

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We also obtained detailed information on the various uses, grades, and types of kaolin on world scene, plus much detail on major world deposits and refiners. Market research led us to many potential buyers and companies interested in taking a major part in the development of the deposit.

Conclusions

We believe our drilling to date has given us a solid indication of a deposit in the vicinity of S1, S2 and S3 which can probably be reckoned in tens of millions of tons, e.g. 1000 yards x 400 yards x 90 feet thick = 12 million cubic yards. Our prospecting and observations which have been carried on throughout the term of the lease indicate we have many concentrations like this.

The response by knowledgeable people in kaolin, to our assays, reports and samples has been very positive and we believe that once more detailed reports come in we will be able to form a logical programme to prove up and develop the area. World usage of refined Kaolin is around 17,000,000 tons per year and is expanding at 8% to 10% per year, plus new uses are developing rapidly also. We understand that these figures do not include ceramics or refractory usage. Australia imports approximately $1,500,000 worth of kaolin per year.

The expected recovery rate of fine kaolin from our raw product is well up in world standards and it will make paper grade.

Our research on kaolin in this area goes back to early 1968 when kaolin was first observed about 500 feet up the western side of the Marble Range and in a well, and a great deal of time and money has been expended before the lease was issued in our names. We believe now that an intelligent and patient approach to the development of the prospect will produce results but we must have a long term lease renewal to allow us to locate the useful areas and negotiate with interested parties, the first enquiry of any interested party being, how long does the lease run? We now require a minimum renewal of twelve months with a great degree of flexibility in our programme. This is to allow us to work along the lines suggested by the results of our sample tests and market contacts and surveys.

Yours faithfully,
BLACKER MOTORS PTY. LIMITED

H. G. Blacker,
DIRECTOR.

NOTED

CREW'S NAMES
R. LESLIE C. GOOD
B. REINHARDT

MINES EXPLORATION PROPRIETARY LTD.
DRILLING OPERATORS REPORT SHEET

MONTH ~~AUG~~ - SEPT-OCT YEAR

LOCATION WANGARY - WARROW PLANT DRILL-MATIC

VEHICLE MILEAGE

DAY	DATE	SHIFT	OPERATOR	OFFSIDER	HOLE NO.	FROM	TO	F.T.DRILL'D	HAMMER	ROTARY	TIME: DRILLING	TIME: SHIFTING	TIME: COLLAR	TIME: REAMING	TIME: CASING IN	TIME: CASING OUT	CAS. SIZE	FT. CASED	HOURS	SCHRAMM DELAYS LOST TIME DRILLING	WHO	HOURS	TOTAL HRS.	DELAYS
TUES	29/9	D	B/R																		B/R	15-30		LEAVE ADELAIDE WITH COMP FOR PT. LINCOLN
WED	30/9	D	B/R																		B/R	8	46	ARRIVE PT LINCOLN
THUR	31/9	D	B/R																		CBR	8:	24	GET GEAR TOGETHER
																								GO TO RYANS
																								WAITED AT RYANS
																								CRG WENT WITH LORLOR
																								CRG WENT TO ADEL
																								BOYS TOOK GEAR OUT TO EATON
																								THEN BACK TO ADELAIDE
FRI	1/10	D	RC																		CPR	8	24	FLEW TO LINCOLN
																								SORTING OUT GEAR
																								ARRANGED ABOUT CARAVAN & VEHICLE
SAT	2/10	D	R/C																		CR-9	27		TRAVELLED TO WANGARY
																								PICKED UP RIG AND VEHICLES
																								DROVE TO DRILL SITE
SUN	3/10	D	R/C		E1	0'	65'	65'		65'	7-30AM 6-0PM	½			2HRS ~~4HRS~~	½ ~~1~~	4"	40'						
MON	4/10	D	R/C		N/1	0'	50'	50'		50'	7-30AM ~~7-30PM~~ 2HRS					2HRS								
					B/2						7-30PM 2 HRS													
																			13/4	HELP BLACKER TO PICK DRILL SITES			
TUES	5/10	D	R	M	S/1	0'	70'	70'		70'	7-30AM	½			5'		5"	5'		OVERBURDEN 2'		½		LUNCH
		D	R	M	S/2	0'	70'	70'	30'	40'	9-30PM	½	½		5'		5"	5'		OVERBURDEN 5'				
WED	6/10	D	R	M	S/3	0'	100'	100'		100'	8:0AM 7:0PM	½			5'		5"	5'		OVERBURDEN 4'		½		LUNCH
~~THURS~~	~~7/10~~			~~M~~																				
																			4	UNLOADED COMP PICKED UP SAMPLES, TOOK SAME TO PT. LINCOLN				
THURS	7/10																			UNLOADED SAMPLES AT MR. BLACKERS, WASHED DOWN VAN, PACKED GEAR AWAY AT BLACKER MOTORS				
FRI	8/10																			CAUGHT PLANE FOR ADALAIDE				

355 30 325 2. 2. 10 3/4

DRILLER'S SIGNATURE R Leslie

0039

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S.M.L. 621
Quarterly Report

CRESCO FERTILISERS LIMITED

PROSPECT EXAMINATION REPORT

S.M.L. 621, WARROW AREA, EYRE PENINSULA

SOUTH AUSTRALIA

(BLACKER MOTORS PTY. LTD. PT. LINCOLN)

CRESCO FERTILISERS LIMITED

PROSPECT EXAMINATION REPORT

S.M.L. 621, WARROW AREA, EYRE PENINSULA

SOUTH AUSTRALIA

(BLACKER MOTORS PTY. LTD. PT. LINCOLN)

BY

L.G. NIXON
L.G.B. NIXON & ASSOCIATES

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30.9.1971

L.G. NIXON & ASSOCIATES

CRESCO FERTILISERS LIMITED

PROSPECT EXAMINATION REPORT

S.M.L. 621 WARROW AREA, EYRE PENINSULA

SOUTH AUSTRALIA

(BLACKER MOTORS PTY. LTD. PT.LINCOLN)

SUMMARY:

Preliminary laboratory tests on kaolin clays occurring in S.M.L. 621 indicate that they may be suitable for use as paper coating. Further testing of these areas is warranted provided suitable joint venture terms can be suggested by Blacker Motors Pty. Ltd.

The clays are of lateritic origin and for this reason it is expected that where suitable rock types exist kaolinitic clays will be found.

It is suggested that Cresco Fertilisers Limited initiate their own exploration programme with a view to acquiring an S.M.L.

INTRODUCTION:

This investigation was undertaken at the request of Mr. J. Carter, General Manager, South Australia of Cresco Fertilisers Limited. Cresco's interest was invited by Mr. D. Dickson of Adelaide acting for Blacker Motors of Port Lincoln who have occupation rights by virtue of their S.M.L.

The Special Mining Lease numbered 621, was approved to Blacker Motors effective from the 26th August, 1971 for a period of four months Expiry date is December 25th, 1971. It covers an area of 439 square miles extending between latitude $33^{0}55'S$ and $36^{0}30'S$ (approximately 30 miles N-S) and between longitudes $135^{0}29'E$ and $135^{0}32'E$ (approximately 23 miles E-W). A copy of a map showing the concession area is attached (See Appendix I).

Under the terms and conditions of approval of the Special Mining Lease (copy attached, Appendix II) it should be noted:-

i) that a minimum of $10,000.00 is to be expended on drilling sampling, and testing before December 25th, 1971 (i.e. within four months of approval of the S.M.L.).

ii) the lease is not available for transfer, or made the subject of any dealing without the consent of the Honourable the Minister for Development and Mines after a full disclosure of all considerations concerned. (copy of terms and conditions attached, See Appendix II).

In addition, attention is drawn to the proposed exploration programme and expenditure submitted by Blacker Motors - "Immediately drilling and prospecting for rare earths to a crash programme with an unknown quantity of drilling, on outcrops expect not less than $15,000.00". A copy of the application form is attached. (See Appendix III).

After discussion with Mr. D. Dickson of Adelaide representing Blacker Motors, a brief visit to the concession area was arranged.

On Wednesday 1st September, 1971 Dickson and the writer flew to Port Lincoln where they joined Messrs. R. Abbot of Cresco and Mr. F. Blacker of Blacker Motors. Mr. Blacker acted as guide and Mr. Abbot provided the transportation. One and a half days were spent in reconnaissance of the area. Because of the extremely wet ground conditions it was impossible to visit some of the areas reputed to contain kaolin.

The assistance given by all Cresco's staff and by Mr. Blacker is acknowledged.

GENERAL STATEMENT

The present investigation was initiated by Mr. J. Carter General Manager (S.A.) of Cresco Fertilizers Limited with a view to

assessing the potential of paper grade kaolin in S.M.L. 621, Eyre Peninsula, South Australia. Kaolin is defined as a rock mass which is composed essentially of a clay material that is low in iron and usually white or nearly white in colour. The kaolin-forming clays are hydrous aluminum silicates of approximately the composition $2H_2O\ Al_2O_3\ 2SiO_2$ and it is believed that other bases if present represent impurities or absorbed materials. Kaolinite is the mineral that characterises most kaolins. The kaolin clays are not composed of a single mineral species, and minerals of that composition are also not all of the same species, but are three distinct species represented by kaolinite, nacrite and dickite. The theoretical composition of kaolin minerals is SiO_2 46.54%, Al_2O_3 39.50%, H_2O 13.96%.

Kaolinisation is the process whereby feldspars and other alumino-silicates are altered to kaolin, the active agents being water (magmatic or meteoric) and carbon dioxide.

According to Bateman kaolinite is a common product of weathering and rarely of hydrothermal alteration whereas nacrite and dickite are generally of hydrothermal alteration.

Under the influence of carbonic acid and water (particularly if the rocks are covered by marshes and bog earth developing humic acid) and if the access of atmospheric oxygen is prevented, the feldspar is decomposed and clay is formed.

Potassium feldspar which is the main constituent of the acid igneous rocks has the formula $K_2O.\ Al_2O_3.\ 6\ SiO_2$ and contains 16.9% potash, 18.3% Alumina and 64.8% silicic acid. The decomposition of feldspar is a process in which potash and a part of the silica is dissolved by water while at the same time the remnants of decomposition attract water and combine with it. The process takes place in the following way:-

	SiO_2	Al_2O_3	K_2O	H_2O
K - Feldspar	64.63	18.49	16.88	-
Dissolved	-43.05	-	16.88	-
Added	-	-	-	+6.47
Clay formed (46.5 parts)	21.58	18.49	-	6.47
Conversion to percentages	46.3%	39.8%	-	13.9%

The dissolved potash and silica are washed away and clay remains.

Raw kaolin consists mainly of three substances -

1) True clay particles
2) Quartz grains of various sizes
3) Undecomposed feldspar

In addition many impurities in the original rock such as mica, titanium and iron compounds still remain in the raw kaolin.

Kaolinite clays can originate as hydrothermal deposits, as residual weathering deposits and as sedimentary deposits, any of which can be commercial. Kaolins are not common and where they occur, ceramic centres of world renown have developed. They are residual clays of limited occurrence of the purest, whitest and most expensive type. The higher grade washed clays are used for fine chinaware and fine coated printing papers, they are also used for whiteware, porcelains of all kinds and for paper filler. Their chief distribution is in England, Czechoslovakia, Germany, France, China and America.

Little has been published regarding the geology of the clay deposits, and some general comments on some of the deposits would be pertinent to this report.

England: Residual deposits occur in Cornwall and Devon the products of alteration of a porphyritic granite. The clays are restricted to low

lying areas. The depth of alteration is unknown, but the economic limit of open pit operation is 300ft. The raw product averages 20% to 25% clay substance, and the remaining "sand" or other granite disintegration products including cordierite, topaz, andalusite tourmaline and locally considerable fluorspar are removed by processing.

Czechoslavia: In the Zettlik district kaolin occurs in a graben forming a belt about 12 kilometers long and about 4 kilometers wide. The deposit is approximately 14 meters thick, the lower part grades into granite. It is high quality kaolin containing 25% to 40% clay substance, the product of normal weathering. In the Pilson area the kaolin has been derived from the weathering of highly feldspathic carboniferous arkosic sandstones. It is a very high grade paper kaolin consisting of 25% to 40% clay minerals, the remainder being almost all quartz.

Germany: Near Arnberg kaolin derived from arkosic sandstone of Triassic age crops out as a belt 50 to 150 meters wide and 9 kilometers long. The kaolin content ranges from 10% to 25%. (Ours is 32.5% or better)

United States: Deposits of high grade kaolin occur in North Carolina, Virginia and Georgia where they are derived from pegmatite dykes. The deposits are up to 150 feet wide and 100 feet deep. The content of kaolin substance averages around 25% but reaches 40%.

A feature common to the majority of the deposits described is that the kaolin content is between 20% and 45% of the rock mass. No figures are available as to the size fractions in these clays, although it is believed the percentage of -2 micron particle size is fairly low, possibly around 10% or even less. (Ours is 11.0% according to the

Paper clay:

Paper is a single thin uniform sheet of cellulose fibers unsuitable for high fidelity printing because of transparency and of ir-

regularities of the surface. To correct these differences binding agents such as starch and resin are added. In addition a filler such as calcium carbonate, calcium sulphate and especially relatively pure white clay is incorporated mechanically. The filler may amount to 35% of the weight of the paper.

Because ordinary filled paper lacks the perfection of surface smoothness required for accurate print production the sheet is coated with a pigment, especially pure white clay in an adhesive mixture such as starch and resin. The amount of coating ranges up to 25% of the weight of the paper.

Specifications of kaolin for paper use:- (Gums tested 81 - 86%)

Filler clay. Brightness from 80% to 84%.

Residue on 325 mesh generally less than 0.15%.

Particle size varies but there are relatively small amounts coarser than 10 micron and finer than 1 or 2 micron.

A moderate range of particle sizes if favoured as it increases opacity. Abrasion-test values ranges between 13 to 16 mg.

The viscosity is not important but the clay must disperse easily.

Coating clay: Brightness. These are chemically bleached to obtain the desired brightness which is frequently from 85-88%.

Residues on the 325-mesh screen is only a trace (0.01%) and a very small quantity of particles are coarser than 2 micron. In the best grades of coating clays the bulk of the particles are finer than about 1 micron.

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Physical Properties of some Kaolins used in Paper Manufacture

	Filler clay			Coating clay		
	A	B	C[b]	D	E	F[b]
Particle-size distribution, equivalent spherical diameter, % by weight:						
0 - 0.5 micron	20	4	44	44	30	26
0.5 - 1 "	21	6	28	28	27	29
1 - 2 "	17	10	20	20	23	23
2 - 5 "	13	31	8	8	17	20
5 -10 "	12	30	0	0	3	7
10 - 30 "	7	19	0	0	0	0
Maximum screen residue, wet, 325 mesh	0.15	0.15	0.005	0.01	0.01	0.008
GE brightness	82.5-84	80.5-83	86.5-88	86.5-88	85 -86.5	85 -86.5
pH	4.2-50	3.8-4.6	6.3-70	4.2-46	4.2-46	6.3- 7.0
Maximum viscosity:[a]						
at 10 rpm			500	500	550	300
at 100 rpm			200	200	200	180

a. TAPPI procedure, Brookfield, R.V.F., 70 per cent solids; No. 3 spindle.

b. Clays C and F are "predispersed."

Chemical Properties of some Kaolins used in Paper Manufacture.

	1	2	3	4	5	6	7
SiO2	46.90	44.81	45.20	46.77	44.59	54.32	48.80
Al2O3	37.40	37.82	37.02	37.79	36.83	29.96	35.18
Fe2O3	0.65	0.92	0.27	0.45	1.14	2.00	1.24
FeO	-	-	0.06	0.11	-		
MgO	0.27	0.35	0.47	0.24	0.39	0.14	
CaO	0.29	0.43	0.52	0.13	1.02	0.32	0.22
K2O	0.84		0.49	1.49	0.52	-	0.40
Na2O	0.44		0.06	0.05	0.13	0.37	0.25
TiO2	0.18	0.37	1.26		2.17		0.61
H2O		1.10	1.55	0.61		0.84	1.16
H2O+	12.95	11.27	10.[illegible]	12.13	12.53	11.[illegible]	10[illegible]
TOTAL	99.93	100.07	100.[illegible]	[illegible]	[illegible]	[illegible]	100.07

General specifications for paper grade kaolins

CHEMICAL

SiO_2	44 - 46%
Al_2O_3	37 - 39.5%
Fe_2O_3	0.3 - 1.5%
CaO	0.1 - 0.2%
MgO	0.1 - 0.2%
Ignition loss	13 - 14%

PHYSICAL

Whiteness	87.0% ± 1.0% (after bleaching)	
pH	4.0 - 5.0	
Size	+ 10 microns	0.43%
	-10 + 5 microns	1.77%
	- 5 + 2 microns	16.44%
	- 2 microns	81.36%

Evaluation Tests

1) Abrasion (Valley Abrasion). A clay slurry of specified concentration is circulated through a perforated rubbing block in contact with a small section of wire. Abrasiveness is recorded in terms of loss of wire weight in milligrams.

2) Brightness. This property is determined with a reflectometer in which the percentage reflectance of the clay sample is obtained by comparison with a known sample.

3) Make down test. The perfection of any coated surface depends on how well the clay has been dispersed in the coating mixture. No single laboratory method has been developed for this test but some measure of this property

is obtained by spreading a thin film of the finished colour on a smooth glass plate and the surface graded according to the size and number of undispersed clay particles visible under 4-5 magnifications.

4) Particle size distribution. This test relates settling rate in a liquid to density and size of particles and the specific gravity and viscosity of the liquid. The particle size distribution relates to these factors using Stokes' law which is based on spherical particles.

5) Screen Residue. This value is the residue on 200 and 325 mesh screens determined by placing the dry pigment on screens, wetting with water and washing pigment through the screens with water. The test is not considered very satisfactory because the results depend on the amount of brushing or rubbing done to break up the aggregates.

6) Viscosity. This parameter is determined by instruments capable of applying varying shearing stresses. For ordinary purposes a mixture of 42% total solids with 15 parts of casien to 100 parts of clay is acceptable for differentiating clays for different types of operation.

GEOLOGY

Regional Geology

Johns (1961) has discussed the geology of the area in the reference listed. The area is generally referred to as the Western Highlands and includes such prominences as Marble Range, Mount Dutton, Mount Greenly, Mount Hope the Frenchman and North Block. Most of these salients are composed of quartzites with the lower slopes of granite gneiss.

Johns op.cit., places all the precambrian rocks of this area in the Flinders group which includes gneisses, quartzites, dolomites, schists and amphibolites.

Flinders Group: The gneisses and other metasediments occupy the domed anticlinal cores of the major fold structures. They show various degrees of alteration which are thought to reflect the original composition of the sediments, quartzites and dolomites have remained virtually unaltered within foliated gneisses and migmatites..

The gneisses are characterised by foliation which generally approximates the original bedding. Composition varies from granitised varieties through to zones of completely injected rocks all of which enclose metamorphosed sediments.

In the Western Highlands, coarse gneissose granite encloses the quartzite beds forming the salients mentioned earlier. The gneissic granite and quartzites show conformable relationships and Johns considers the granite to be the product of metasomatism of pre-existing arkosic sediments. Whatever its origin the granitic rocks cover avast area of southern Eyre Peninsula and are the most important rocks for prospecting for kaolin occurrences.

The sedimentary mantle unconformably overlying these ancient sediments is relatively young, allthe younger rocks belong to the Cainozoic era. It is possible that sediments of Tertiary age may occur in areas such as between Mt. Greenly and North Block, the Frenchman and Marble Range and south of Marble Range.

Widespread Tertiary peneplanation marked by laterites and lateritic gravels are preserved in the southern part of the region. It is this feature that is of importance in the formation of much of the kaolinitic clay on the peninsula.

Johns in discussing white clays comments "Kaolinisation of gneisses and granitoid rocks of this region is widespread though only in the northernmost parts of the uplands do the resultant clays appear generally white and free of iron staining.

This generalisation is not applicable in the concession under discussion since the presence of white kaolin extends virtually across the entire lease area.

THE CLAY POTENTIAL S.M.L. 621

Origin of Kaolin: Gaskin and Samson (1951) noted that some of the kaolins on Eyre Peninsula were of hydrothermal origin. Johns and others have suggested a residual origin related to laterisation. Recent work by the S.A. Geological Survey has confirmed that clays originally thought to be of hydrothermal origin are probably residual.

The process of lateritisation is one associated with tropical regions in which a wet season is followed by a dry season with high temperatures and consequent rapid evaporation. Under these conditions the weak solutions produced by leaching of rocks during the wet season become concentrated by evaporation and the dissolved materials including hydroxides of aluminum and iron, silica and other salts are precipitated at the surface. Except for the iron and aluminum hydroxides, most of the other salts are redissolved by the following wet season, the iron and aluminum remain at or near the surface and gradually accumulate to form the iron and aluminum laterite cappings common in Australia. In depth the material is transitional into a variegated zone referred to as the mottled zone below this is the white kaolinitic zone known as the pallid zone where the bedrock is intensely decomposed and there is abundant development of clay minerals. With this concept i.e. widespread laterisation over southern Eyre Peninsula it is reasonable to assume

that there is also widespread kaolinisation and this interpretation is confirmed by the widespread kaolin occurrences.

It is evident however that good grade kaolin clays will be confined to those areas where the parent material was of suitable composition such as granite and granite gneiss areas, and those rocks with a high feldspar content.

Because of the gneissic nature of the Flinders Group and the possibility of sediments, such as dolomite and quartzite occurring in the sequence, it is probable that many relatively narrow zones of kaolinised rock will be found, and systematic and continued exploration will be necessary to prove up a viable deposit.

The kaolin occurrences are widespread in the concession area and the various occurrences are marked on the map appended. (Fig. 1). Observations made at the various stops may be summarised as follows:-

STOP 1: Riley Md. Warrow, Section 141. This occurrence is being pegged by F. Blacker because it is excluded from S.M.L. 621.

The kaolin occurs on the western flank of a spur trending northeasterly on the western side of Marble Range.

Kaolinitic clays occur at the surface and have been exposed in a shallow pit near the farmhouse. The kaolin occurs in the pallid zone of a lateritic profile, remnants of a lateritic grit are to be found to the north of the pit. It is possible that this deposit may extend laterally for some considerable distance and would be worth prospecting if results from preliminary testing of the kaolin from here were encouraging. The country rock hereabouts is a granite gneiss.

STOP 2. Warrow Farm. Marble Range Well adjacent to public road. Kaolinised granite gneiss on spoil heap around well. Depth to clay unknown. Basement overlain by unknown thickness of calcareous amphibolite. Testing by boring

would be necessary to obtain information about depth to clay, size of deposit and quality.

STOP 3: Well in a level paddock. The spoil heap around the well consisted of lumps and slime of coarse muscovite, smoky quartz and kaolin derived from the weathering of a fairly coarse gneissic even pegmatite granite. No indication of depth of overburden could be found, the well was closed in and the water level fairly near the surface. The kaolin looked a good white colour.

STOP 4: Basement is exposed in a shallow pit alongside the main Lincoln - Streaky Bay highway. The cover rock is kunker presumably taken for surfacing the roads. Basement is not very weathered and the exposed rock is iron stained and greyish gneiss. No further work is recommended here.

STOP 5: This point is an old mill on the property of Le Brun. The bore is closed and only material around the collar of the hole could be examined. There is a noticeable mica content on the spoil heap which the farmer says persists all the way to the bottom of the bore. The clay was off-white and not the best looking kaolin seen. No indication as to depth to bedrock but it appears to be relatively shallow.

STOP 6: This spot is adjacent to a minor road near the southern boundary of S.M.L. 621. Material on the spoil heap consisted of poor quality grit and transported clay. This occurrence is not worth further prospecting at this stage.

STOP 7: Kaolinitic clay is on the spoil heap around this old well but depth of weathering is unknown. A nearby gully has cut through the superficial soil cover to expose a lateritic profile approaching a clayey mottled zone. It is possible that good quality kaolin will occur in the pallid zone in this area. The depth to the pallid zone is unknown, but

0018

is thought to be of the order of 25 - 30ft.

Saddle Andrews a rich road

STOP 8: This stop is on the east side of the road leading to the Gap between North Block and South Block. A sample of kaolinitic type clay from the spoil heap around an old collapsed well at this stop was selected for testing because of its whiteness and apparent superiority to several other samples. The country rock appears to be a weathered kaolinised granite gneiss.

Tests carried out on this sample by AMDEL were limited because of the hard nature of the rock and the fact that it did not disperse in water. The mineralogy of this sample showed a very high quartz content (approximately 35%). It is possible that this sample was not representative of the area and other samples should be collected.

Saddle

STOP 9: This location is on the western side of North Block, alongside the road leading up to the gap. There is an erosion channel on the northern side of the road that exposes a dense fine grained argillaceous type rock which gives the appearance of being a sediment, however, there is no apparent bedding and further field examination and microscopic work would be necessary to determine its origin. A sample from this location was selected for testing mainly because of its colour. Results of tests were as follows:-

This is where we drilled three holes. Kaolin is 100' thick or more.

Reflectivity 85.5, particle size measured - 13.7% < 2 microns, quartz in the fine fraction is approximately 1%. Results are sufficiently encouraging to warrant further field and laboratory testing to determine the extent of the occurrence and its suitability for paper coating use.

STOP 10: Mr. F. Blacker claimed to have found kaolin on the north flank of North Block and a circuit was made of the range with a view to visual examination and sampling. No evidence of white clay was found.

Mr. R. Abbott of Cresco also searched for the deposit without success.

Blacker advised that the approach to the deposit was by another road which was impassable at the time of the current investigation, because of the wet condition of the roads.

STOP 11: This stop is at the Le Brun farmhouse. A well located about one hundred yards to the northwest yielded a very micaceous kaolinitic clay of off-white colour. Visual assessment of the material suggests that colour and clay content may not be of the quality necessary for paper grade clays. No further work would be warranted at this spot at this stage.

- Meaney -

STOP 12: Section 112, Hd. Ulipa. This stop involved examination of three clay occurrences. These were Clover Paddock, New Well and Main Road Well.

i) At the Clover Paddock deposit no examination was made of the rock "in situ". The material on the spoil heap was found to be a kaolinised granite of good white colour and was sampled for further testing. It is evident that this kaolin is the result of deep weathering and is from the pallid zone of a lateritic profile. Remnants of laterite are found capping the hills nearby. The depth to the pallid zone at this location is not known. Results:- Reflectivity 84.5%, Quartz 2% (approx.)

ii) New Well is located on the edge of a paddock in gently undulating country. A well has been sunk through a capping of kunkar into weathered rock showing the following general profile:-

DEPTH IN FEET	GEOLOGICAL LOG
0 - 1	Pisolitic laterite
1 - 6	Iron rich red clay
6 - 14	Mottled clay zone
14 - 23	White kaolinised zone. Water at 23 feet.

This is a typical lateritic profile.

A sample of clay from the spoil heap around this well was selected for preliminary testing by AMDEL. The following results were obtained:- Note result is almost identical with sample from Hole 9 (Saddle) approx 15 miles away.

Reflectivity 86.5%, particle size measurement weight per cent, passing 2 microns 13.7% quartz in this fine fraction approximately 4%.

These results are sufficiently encouraging to warrant further testing of this clay to more fully investigate its suitability for paper coating. If these tests prove the clay to be suitable for this use, an exploration programme should be constructed to test the extent of the deposit and to outline possible reserves.

iii) Main road well is so named because of its proximity to the main bitumen highway between Port Lincoln and Streaky Bay. Material on the dump around the well consisted of a variety of kaolinised rocks of varying quartz and mica content. This clay is from the pallid zone in a fairly typical lateritic profile. The sequence exposed in the walls of the well are as follows (all depths estimated only):-

DEPTH IN FEET	GEOLOGICAL LOG
0 - 12	Kunkar fairly tough decise cream coloured.
12 - 25	Mottled clay zone. Water occurs at 25 feet and the extension of the mottled zone beneath the water level is unknown, but is believed to be negligible.
25 - 33	Pallid zone.

Although a sample was collected from this area no laboratory tests were carried out mainly because of the necessity to test the better looking samples from elsewhere.

COMMENTS

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Kaolin clays are widespread in S.M.L. 621. They are interpreted as being residual deposits occurring in the pallid zone of a lateritic profile.

Preliminary tests have indicated that the kaolins have potential as paper coating clays and further laboratory tests on bulk samples is warranted.

If these tests show that the bulk samples meet the specifications for paper coating clays a comprehensive drilling programme should be constructed to outline possible reserves.

Because of the lateritic origin of the kaolins there is no geological reason for supposing they are confined to S.M.L. 621. In fact good quality kaolins are reported from near Kapinnie and elsewhere on southern Eyre Peninsula. On this basis it is a reasonable assumption to anticipate the occurrence of kaolin clays in areas not currently held under S.M.L's by others. The attached photograph shows the development of kaolin in a cutting on the main road not far southwest of the Pt. Lincoln gaol.

Because of the heavy expenditure commitments required by the Mines Department in connection with the exploration on S.M.L. 621, and of the very limited time in which to fulfil these expenditure requirements it is in Cresco's interests to arrange some alternative agreement with F. Blacker other than exploration of the whole of S.M.L. 621 under the existing terms and conditions.

One alternative is for Cresco to initiate its own exploration programme with a view to acquiring an S.M.L. for Cresco Fertilisers Limited.

30.9.1971

L.G. [illegible] B.Sc., A.A.S.T., I.M.M.,
[illegible]

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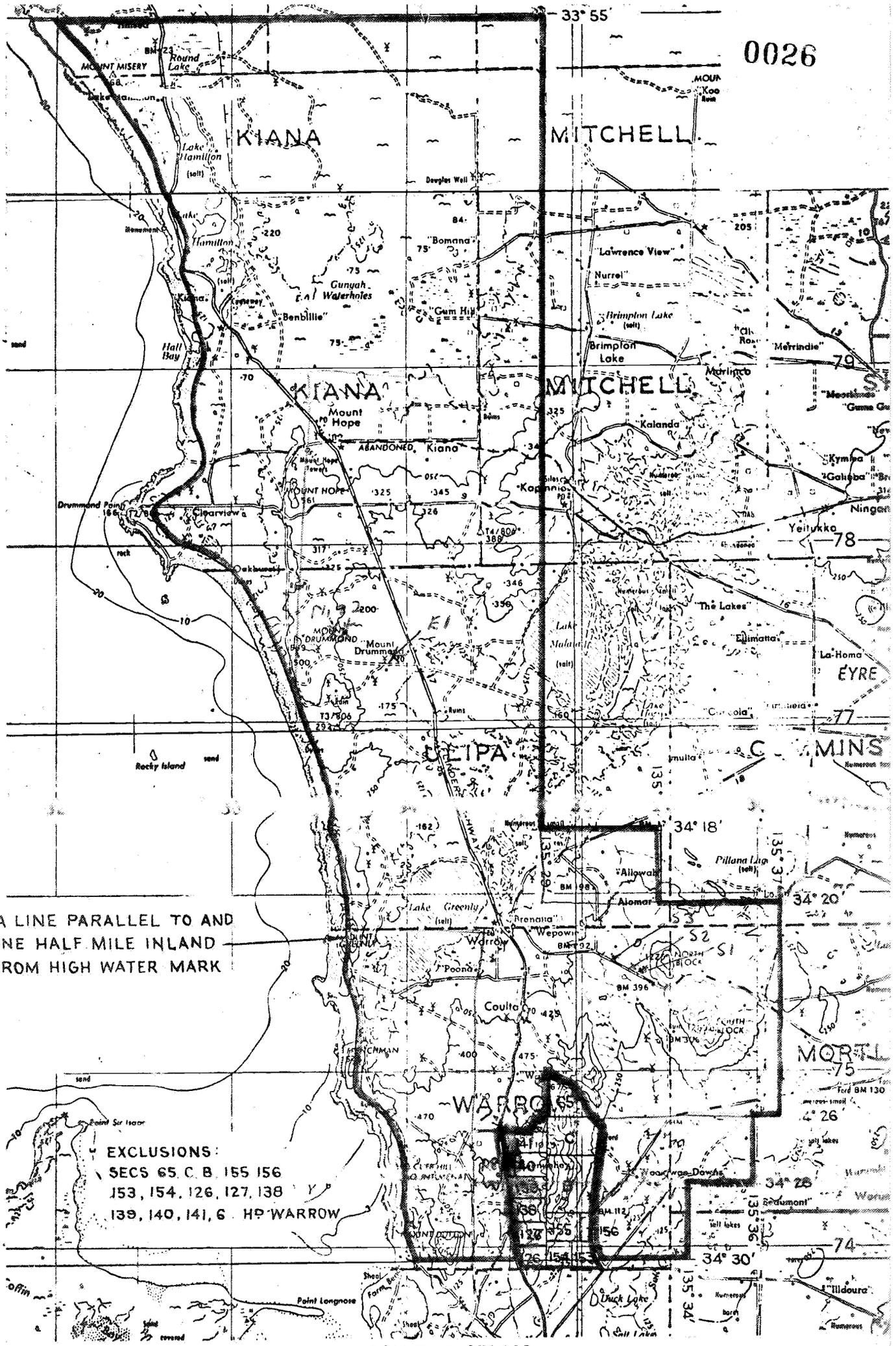

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BLACKER MOTORS PTY. LTD.

DOCKET DM. 720/71 AREA 439 SQ MILES

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LINCOLN

LOCAL

S.M.L. No.

APPENDIX 1V

AMDEL REPORT MT 1228/72

0022

SUMMARY

A preliminary investigation of clay samples for paper applications show that New Well, Spot 9 and Clover Paddock are just within the specified brightness of paper coating clays (85%). These clays however contain traces of mica, calcite and small amounts of quartz (1-4%) which could be removed with advantage to improve the brightness still further.

As these clays show promise it is recommended that additional beneficiation be carried out to produce a quantity of 20 micron and 2 micron material and further tests made of brightness, valley abrasion and viscosity.

1. INTRODUCTION

Seven samples of clay were submitted and four of these were examined in detail for paper application.

Initially the two whitest specimens were selected (New Well and Clover Paddock) for investigation and at a later date two others were assessed (Spot 8 and Spot 9)

2. PROCEDURE AND RESULTS

21 Sample Preparation

Represantative portions of the clays were selected, plunged in water and wet sieved on 300 mesh. One sample (spot 8) was very hard and did not disperse in water and only limited amount of work was completed on it.

The minus 300 mesh material was air dried at 105°C and tested. No value of the plus 300 mesh was requested but it was estimated that about 50% was retained.

2.2 Reflectivity

The minus 300 mesh fraction was lightly pulverised, sieved on

mesh, and compacted at 30 psi to form a specimen suitable, for reflectivity measurements, the method employed being that recommended by TAPPI T646 ts-54. An EEL Reflectometer was used to measure brightness. The instrument has been calibrated against a GE Meter by the Institute of Paper Chemistry (USA) using Blue Light (457 nm).

The values obtained, shown in Table 1, indicated that the clays are just within the specification for a paper coating clay (greater than 85%).

2.3 Particle Size Distribution

An EEL Photosedimentometer was used to obtain the particle size distribution of the minus 300 mesh fraction and the results shown in Table 2 and Figure 1 indicate that about 13% was less than 2 microns.

2.4 Mineralogy

A semi-quantitative estimate of minerals present in the clay was obtained using an X-ray Diffractometer technique and the results are given in Table 3, showing the presence of kaolin, quartz, mica and calcite in two samples (New Well and Clover Paddock), the quartz level being very low at approximately 2 and 4%. The remaining samples contained only kaolin, mica and quartz, no calcite being detected.

3. DISCUSSION

Of the seven samples submitted a visual observation indicated that specimens New Well and Clover Paddock appeared the whitest while Spot 9 and Spot 8 were also very white. All samples contained considerable amounts of coarse quartz and a micaceous mineral. Specimen Spot 8, in lump form, was found to be very difficult to disperse in water and all subsequent tests were carried out on small chips broken off the main piece.

The brightness of the minus 300 mesh material of New Well, Clover Paddock and Spot 9, were encouraging in that they were just within specification for a paper coating clay ($\geq$ 85%).

The mineralogy indicated very low quartz content (1-4%) with traces of calcite and mica.

Particle size distribution values show that only a small proportion of the minus 300 mesh fraction (13%) was less than 2 microns, the fraction used for paper coating and filler applications.

At this initial stage of the investigation the results obtained on the three clays New Well, Clover Paddock and Spot 9 show promise because of the good reflectivity value and low quartz content in the minus 300 mesh fraction.

It is considered that reflectivity could be improved markedly if the mica, and possibly calcite, was removed.

Further tests recommended to assess the paper coating properties of the clay are as follows:-

1. Preparation of a quantity of minus 20 micron and minus 2 micron fraction by hydrocycloning or sedimentation to possibly remove mica and calcite.

2. Brightness value according to TAPPI standard.

3. Chemical analyses of the fine fraction for SiO_2, Al_2O_3, Fe_2O_3, FeO and TiO_2.

4. Viscosity measurements to determine solids content of slurry according to TAPPI standards.

These tests are necessary as they are requested by users of paper coating clays and must be determined to ensure that they comply with the minimum values laid down.

If further information or advice is required regarding the results presented in this report and the recommended follow-ups please do not hesitate to contact us.

TABLE 1: REFLECTIVITY (%) MINUS 300 MESH FRACTION
BLUE LIGHT - G.E. BRIGHTNESS

Sample	Brightness (%)
New Well	86.3
Clover Paddock	84.5
Spot 9	85.5

TABLE 2: PARTICLE SIZE MEASUREMENT

Stokes Diameter (u)	Weight % Passing	
	New Well	Spot 9
50	100	100
25	85.8	86.7
20	79.0	80.2
15	74.1	71.1
10	67.7	62.0
8	58.7	55.6
7	55.0	50.5
6	47.3	43.2
5	38.9	36.4
4	30.1	29.8
3	22.4	22.0
2	13.2	13.7
1	5.9	5.3

TABLE 3: MINERALOGY

	Minerals Detected
NEW WELL (Minus 300 mesh)	Kaolinite Trace Mica Trace Calcite Trace Quartz (approximately 4%)
CLOVER PADDOCK (Minus 300 mesh)	Kaolinite Trace Mica Trace Calcite Trace Quartz (approximately 2%)
SPOT 9 (Minus 300 mesh)	Kaolinite Moderate Mica Trace Quartz (approximately 1%)
SPOT 8 As received	Kaolinite Quarts (approximately 35%) Mica - fairly abundant Trace feldspar

APPENDIX V

Photograph showing kaolinised gneiss in road cutting on Pt. Lincoln - Warrow road near gaol.

amdel
The Australian Mineral Development Laboratories
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Phone 79 1662, telex AA82520

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Please address all correspondence to the Director
In reply quote: MT 3/0/0

9 November 1971

Cresco Fertilizers Limited
102 North Terrace
ADELAIDE 5000

Attention: Mr D. Noblett

REPORT MT 1852/72

YOUR REFERENCE: Application dated 8/10/71

MATERIAL:
1. New Well Clay (7 Kg) — Hole S1 drilled by J. Blacker
2. TTG Clay (½ Kg)

IDENTIFICATION:
CE 3982 New Well Clay
CE 3983 Tea Tree Gully Clay

WORK REQUIRED:
1. CE 3982 Wet split at 300 mesh and minus 20-micron.
Chemical analysis and brightness on minus 20-micron.
2. CE 3983 Wet split at 300 mesh and minus 20-micron brightness.

Investigation and Report by: K.M. Pluck and D.R. Ashworth

Officer in Charge, Materials Technology Section: Dr G.L.F. Powell

for F.R. Hartley
Director

SUMMARY

The two clays submitted were processed and the minus 20-micron fraction obtained and the following results obtained:

1. New Well Clay

   No improvement in brightness was found compared to the minus 300 mesh fraction and the chemical analysis showed the presence of calcite, mica, quartz and a form of TiO_2.

   It is recommended that brightness measurements should be carried out on the minus 2-micron fraction and the sample assessed for the presence of these minerals as they affect both the brightness and abrasive nature of the clay.

   The minus 20-micron fraction is suitable as a paper filler clay as far as brightness is concerned, but it must also have a low abrasive value. If both discolouring and abrasive minerals can be reduced, the clay may then find an application as a paper coating clay.

2. Tea Tree Gully Clay

   The minus 20-micron fraction has a brightness of 85.0% which is in the lower limits for an acceptable paper coating clay, but within the specification for a paper filler clay. Further tests, however, are required to improve brightness and assess its abrasive nature.

1. INTRODUCTION

Two clays were submitted for assessment, one of which (CE 3982) was examined previously (see report MT 1228/72).

2. PROCEDURE AND RESULTS

The clays were blunged in distilled water, deflocculant was added and they were sedimentated to obtain the plus 20-micron and minus 20-micron fraction.

2.1 New Well Clay

All of the sample (approximately 7 Kg) was dispersed and after settling and drying, the percentage of plus 20-micron and minus 20-micron determined (see Table 1). A particle size distribution of the minus 20-micron fraction was also obtained using an EEL photosedimentometer and the results are given in Table 2 and Figure 1.

Brightness measurements were made on the minus 20-micron fraction. The method used was that recommended by TAPPI Standard 646ts-54 and an average G.E. brightness value of 83.5% was obtained (see Table 3).

A full chemical analysis was also carried out and the results are given in Table 4.

A quantity of the minus 20-micron fraction (approx. 2 Kg) was prepared and supplied to the client.

2.2 Tea Tree Gully Clay

A similar procedure was used to obtain the minus 20-micron fraction and the percentage split was also obtained (see Table 1).

The average reflectivity value was determined as 85% (see Table 3).

3. DISCUSSION

3.1 New Well Clay

The wet split showed the presence of large quartz lumps and floating organic matter. The percentage split at 20-micron and the particle size distribution of the minus 20-micron fraction indicates that only a very small fraction of the minus 2-micron portion was recovered, amounting to approximately 4-5%.

This result does not agree with the values given in the previous report (MR 1228/72), where 13% of the minus 2-micron fraction was recovered from the minus 300-mesh fraction. It would therefore be expected that a larger percentage of the minus 2-micron fraction would be obtained from the minus 20-micron fraction. This aspect requires clarifying as it obviously affects the economics of the deposit.

The brightness value of the minus 20-micron fraction is not significantly different from the previous value obtained on the minus 300-mesh fraction, although an improvement would have been expected if the coarser (plus 20-micron) deleterious minerals had been removed.

The chemical analysis confirms that the sample contains calcite, as previously found, as both CaO and CO_2 are relatively high (approx. 1% each). The high K_2O value (1.15%) indicates the presence of mica, as detected in the previous sample. The SiO_2 is about 2% higher than for a pure kaolinite, the Al_2O_3 value being about 6% less than theoretical.

Discolouring compounds such as Fe_2O_3, FeO are at a low level and comparable to commercial coating clays. The presence of TiO_2 (0.55%) is higher than most commercial clays (usually less than 0.1%).

It is recommended that a small portion of the minus 2-micron fraction be prepared by sedimentation and its brightness measured. It is expected that at this level of fineness, the majority of discolouring impurity minerals would be removed with consequent improvement in brightness. A mineralogical assessment is also recommended to determine the presence of abrasive material, such as quartz or mica. A prerequisite of an acceptable coating or filler clay is that it must have a low abrasive value, the most common abrasive minerals being quartz and mica.

In conclusion, the New Well clay at the minus 20-micron level has a brightness which would be acceptable as a filler clay (75-85% reflectivity). The chemical analysis, however, indicates the presence of both discolouring minerals (FeO, Fe_2O_3 and mica and abrasive minerals (quartz and mica). Further investigations are required to determine the brightness and abrasive nature of the clay at the minus 2-micron level and its possible use as a paper coating clay.

3.2 Tea Tree Gully Clay

The brightness value at the 20-micron level is within specification for a paper filler clay and may possibly be acceptable to some uses as a paper coating clay as far as brightness is concerned.

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TABLE 1: PERCENTAGE WET SPLIT

Clay	Plus 20 Micron %	Minus 20 Micron %
CE 3982	67.5	32.5
CE 3983	56.4	43.6

Test Tree Finally

TABLE 2: PARTICLE SIZE DISTRIBUTION
(Minus 20-micron fraction
CE 3982

Stokes Diameter (Microns)	Percentage Passing (Weight, %)
20	100.00
15	95.6
10	81.3
8	64.9
7	56.7
6	47.0
5	37.2
4	28.5
3	20.5
2	11.8
1	5.1

Paper Fodder

← Paper Coating

TABLE 3: REFLECTIVITY OF THE MINUS 20-MICRON FRACTION
(G.E. Brightness - Blue Light)

Clay	Range, %	Average, %
CE 3982	81-86	83.5
CE 3983	83-87	85.0

TABLE 4: CHEMICAL ANALYSIS OF THE MINUS 20-MICRON FRACTION (CE 3982)

Component	Weight, %	Typical Commercial Coating Clay	Pure Kaolinite, %
SiO_2	48.8	47.5	46.54
Al_2O_3	33.2	37.5	39.50
Fe_2O_3	0.60	0.42	
FeO	0.15	-	
CaO	1.05	0.2	
MgO	0.60	0.2	
MnO	0.01	-	
Na_2O	0.10	0.06	
K_2O	1.15	1.3	
Cr_2O_3	0.10	-	
V_2O_5	0.03	-	
P_2O_5	0.16	-	
TiO_2	0.55	0.05	
SO_3	0.13	-	
Cl	0.08	-	
CO_2	0.95	-	
H_2O^+	11.8	12.7	13.9

3/010 - 1856/72   CC 3982   13/10/71

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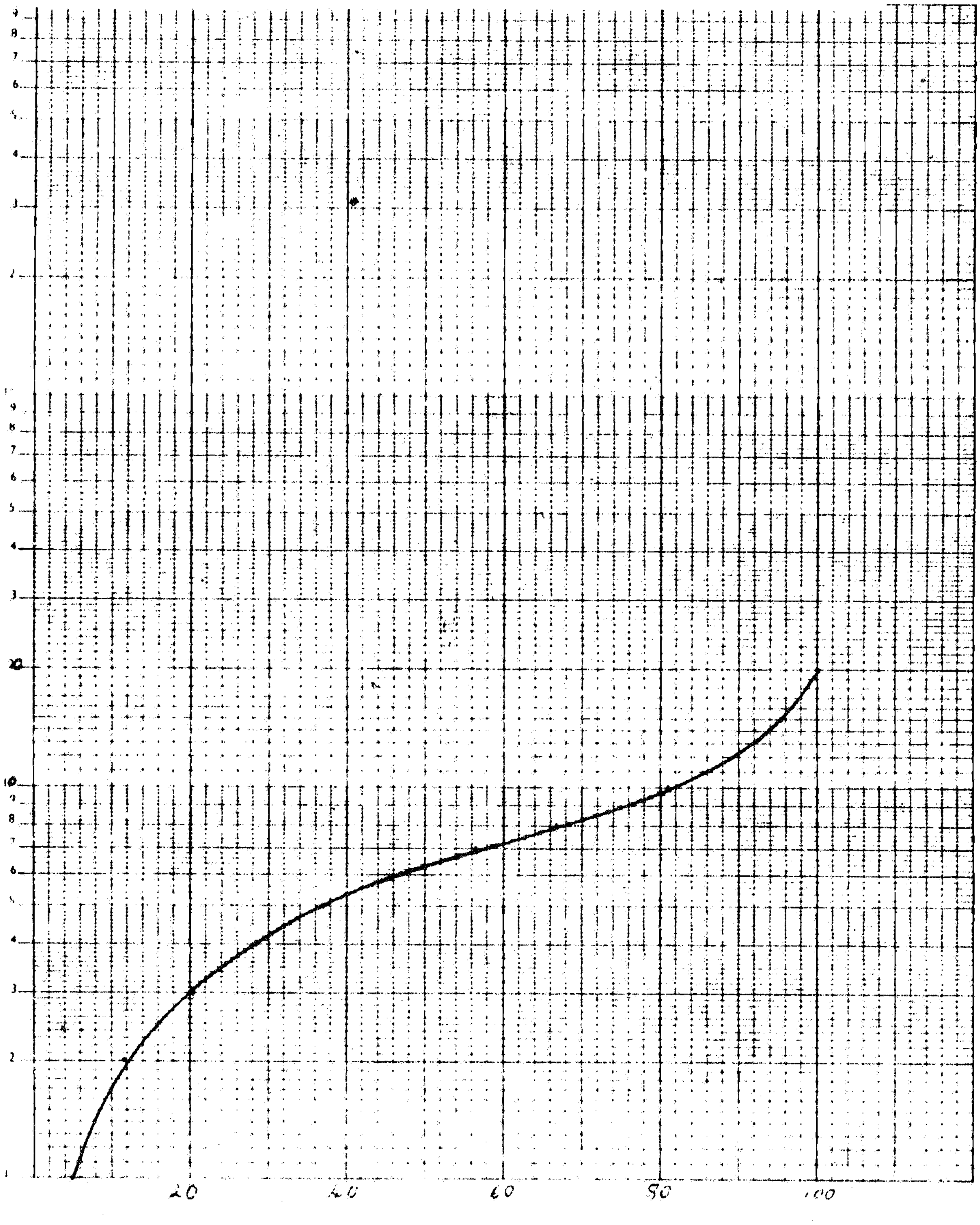

Cum % Passing

№ 0341 SEMI-LOG. 3 CYCLES × 1/10 INCH

Fig 1 Particle size distribution