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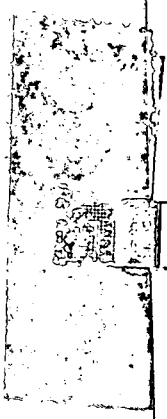
DEPARTMENT OF MINES
SOUTH AUSTRALIA

THE SITUATION OF THE GYPSUM MARKET WITH PARTICULAR REFERENCE TO PRODUCTION FROM LAKE MacDONNELL



by

J. R. Adam
Mineral Development Engineer

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CONTENTS

	Page
INTRODUCTION	1
INFORMATION ON THE GYPSUM SITUATION	3
The Lake MacDonnell Deposit	3
Deposit	3
Grade	3
Relative Importance	4
Access	4
Leases	6
Facilities established at Lake MacDonnell and Thevenard	6
Lease Rents and Royalty Payments	7
Labour Conditions	8
Production from Lake MacDonnell	8
Legal Aspects of Granting Suspension of Labour Conditions or Covenants	9
Forfeiture of Mining Lease	9
Certificate of Suspension from Work	9
Power of Minister to Suspend or Remit Covenants	9
Australian Production of Gypsum	11
South Australian Production of Gypsum	11
Reserves of Gypsum in Australia	12
New South Wales and Victoria	12
Western Australia	12
Queensland, Tasmania and Northern Territory	12
South Australia	12
Uses of Gypsum in Australia	13
As Plaster of Paris	13
In the Manufacture of Portland Cement	14
Other Uses	15
Use in the Manufacture of Sulphuric Acid or Ammonium Sulphate Overseas	16
Economics of the Production of Sulphuric Acid from Gypsum in Australia	17

Page

Australian Consumption of Gypsum 18
Main Consumption Localities 18
Exports 19
The Export Potential 20
Difficulties 20
Competitors 21
Markets 21
Artificial Gypsum from the salt and chemical Industry 23
Artificial or "Chemical Gypsum" from the Fertilizer Industry 23
Changes in the production of superphosphate 23
Concentrated superphosphate 23
Production of Chemical Gypsum 24
Quantity and Location of Future Chemical Gypsum Production 25
Competition of Chemical Gypsum with Natural Gypsum 26
Experience with the use of Chemical Gypsum 26

FORECASTS OF FUTURE TRENDS IN THE MARKETS FOR AUSTRALIAN GYPSUM 28
Future Demand in Australia for Gypsum 28
In the Cement Industry 28
In the Plaster Industry 29
Future Demand in Other Uses. 31
Possible Future Demand in the Manufacture of Sulphuric Acid and its products 32
Forecast of the Export Potential 32

SUMMARY OF THE MARKET SITUATION 34
In Australia 34
Exports 34
With Special Regard to Lake MacDonnell 34

THE SITUATION AT LAKE MacDONNELL 36
Present Position 36
Points to be considered 37

SUGGESTED ACTION 40
With Regard to the Granting of Suspension of Labour Conditions 40
With Regard to the Development of the Gypsum Industry 41

APPENDICES

A. Gypsum Leases Held at Lake MacDonnell
B. Lake MacDonnell Production 1920-1965
C. Australian Cement Plants
D. Types of Superphosphate
E. Chemical Actions in the Production of Concentrated Superphosphate.

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THE SITUATION OF THE GYPSUM MARKET WITH PARTICULAR REFERENCE TO PRODUCTION FROM LAKE MacDONNELL

INTRODUCTION

The Colonial Sugar Refining Coy. has expressed a wish to cease the production of gypsum from their Lake MacDonnell leases for a couple of years. They wish to concentrate their production on their leases at Kangaroo Island to save costs on the gypsum because they are embarassed by the present very depressed prices of sugar. Application has been made for suspension of labour conditions on their Lake MacDonnell leases so that there will be no fear of them losing those leases because it is essential that they hold the leases to assure their future source of gypsum when the Kangaroo Island leases are worked out in about 12 years' time at the present rate of production.

The Company has also stated that the quantity of their future requirements of natural gypsum is very uncertain at present. This uncertainty is caused by the fact that changes in the method of production of superphosphate in Australia is causing competition on the gypsum market from quantities of "chemical gypsum" produced as a byproduct by the fertilizer industry. The chemical gypsum is being produced in large quantities close to the main plaster works and some cement works in the eastern states.

This has all come at a most inopportune time as the South Australian Government is just completing the third stage of extensive improvements to the facilities for handling gypsum from Lake MacDonnell on to the sea off the port of Thevenard near Ceduna. These improvements consisted of bulk handling arrangements at Thevenard, improvements to the jetty and re-location of the railway. Over £1,000,000 has been spent by the South Australian Government on this and the new railway deviation

almost halving the distance of haul is about to be opened.

The money was spent to cater for an expected large increase in production of gypsum from Lake MacDonnell by the two companies, the Waratah Gypsum Company and the Colonial Sugar Refining Coy. It was anticipated that the improvements would enable these companies to secure large export orders as well as to supply a large portion of the Australian market from the deposit of over 500 million tons. Now it appears that, apart from not gaining extra export orders, the demand for natural gypsum for the eastern states may be considerably reduced.

This report gives the results of investigations made to ascertain how matters really stood. The information was gained from previous reports and articles and from special visits to -

the Lake MacDonnell deposits

the plaster works of Australian Plaster Industries (A.P.I.) in Adelaide.

the plaster works of C.S.R. in Sydney

the Bureau of Mineral Resources in Canberra

the C.S.I.R.O. Laboratories at Fishermen's Bend and at Higate in Melbourne

and the Commonwealth Fertilisers (I.C.I.) new superphosphate plant at Yarraville, Melbourne.

but the research laboratories of A.P.I. in Melbourne were not visited.

The main points of information which affect the production from Lake MacDonnell are given first, followed by points affecting the general production and use of gypsum and the "chemical gypsum" position. Forecasts are given of likely future trends in the gypsum market. The situation as regards the Lake MacDonnell deposit is discussed and some actions are suggested.

INFORMATION ON THE GYPSUM SITUATION

The Lake MacDonnell Deposit

(Mining Reviews 87, 88, 89, 110 & 114)

Deposit

The occurrence of gypsum in the Lake MacDonnell area is considered to contain over 500 million tons of very high grade rock flour and crystalline gypsum. It is situated adjacent to the coast about 35 miles west of the shipping port of Thevenard near Ceduna. This harbour is about 450 miles by sea north-west of Adelaide, about 1000 miles from Melbourne, 1500 miles from Sydney and about 6000 miles from Japan by sea. The rock, flour, and crystalline gypsum covers about 30 square miles to an average depth of about 12 feet. The major portion is rock gypsum which is up to 24 feet thick and is covered with about 3 feet of flour and crystalline gypsum and from nought to about 6 inches of overburden, except under Lake MacDonnell itself where at the centre there is about 12 feet of salt and mud over 14 feet of rock gypsum.

Grade

Much of the rock gypsum contains over 99% gypsum. The average grade of the rock, flour and crystalline gypsum excluding the overburden was calculated to be 94.5% gypsum from the test drilling in 1947, the gypsum carrying an average of only 3½% calcium carbonate and under 1% salt with practically no insolubles (under 0.2%). Considerable rock gypsum of over 99% grade has been shipped to Japan without any washing being necessary. It is about 2½% purer than other imports into Japan and also it has the special quality of gradually breaking down on handling to finger sized pieces. This gives easier crushing which is less costly and reduces the dust worries of the consumers. The gypsum requires washing for the plaster industry

to remove salt but not for the cement industry. So far insufficient fresh water for washing has been found at the deposit.

Relative Importance

The deposit at Lake MacDonnell is by far the largest in Australia. It accounts for over 90% of the resources of the South Australian deposits which are being worked and which are providing about 70% of the Australian production of gypsum. The grade as mined is higher than from any other deposit. It could supply the total Australian needs of gypsum at the present rate of consumption for about 1000 years. It is cheap to mine but the cost of transport to the sea and its distance from the markets makes it more expensive to use than the gypsum from other sources, mainly Stenhouse Bay and Kangaroo Island. However it will be there to fall back on when other deposits cut out. In the meantime its chief use is for the export trade.

This is a large deposit but there are much larger ones in North America, e.g. the "White Sands" near Alamagordo, New Mexico, which cover an area of 270 square miles with an average thickness of 20 ft. in dunes 10-30 ft. high which contain about 5,000 million tons. There appear to be unlimited reserves in Michigan, Texas, New Mexico. Some deposits of anhydrite cover thousands of square miles and are as thick as 1,800 feet. (Industrial Minerals and Rocks).

Access

At Lake MacDonnell in the very early days gypsum was bagged and carted about 6 miles to Port Le Hunte, a small port, where it was loaded onto small coastal vessels from a jetty sheltered by Point Sinclair. At present the gypsum is transported by a circuitous railway route of 64 miles to Thevenard harbour where the jetty was modernised by the S.A. Harbours Board in 1961 with the installation of bulk-loading facilities at the estimated cost of £160,000 and where harbour improvements,

completed in 1965 at the cost of £126,000, now allow 10,000 ton D.W.T. ships to sail at day or night high tides.

The Government is just completing the relocating and improvement of the railway from the deposit to Thevenard reducing the distance from 64 miles to 36 miles and improving the grade. This work was approved in 1963 to be completed for an estimated cost of £840,000. (It had been estimated that it would have cost over £800,000 to make the old line capable of handling the large tonnage which was anticipated).

Railway freight rates were reduced in 1962 following representations by the companies to enable them to compete on the Japanese markets. The present rates are 17/9d. per ton for the first 50,000 tons per year reducing to 10/- per ton for combined tonnages of the companies over 50,000 tons per year, and drop to 9/- for tons in excess of 200,000 tons/year. (The class "M" rate is 33/- per ton for 64 miles and 22/3 per ton for 38 miles). The opening of the new railway route with the shorter run and easier grades will reduce the running cost of the railway but at the time the scheme was proposed no further reduction of freight rates was envisaged.

It now appears that it might be possible, with the modern techniques of loading ships in open water, to construct a loading point for large ships of up to 100,000 tonnage at Point Sinclair about 8 miles from the present workings on the deposit. This has been estimated to cost roughly £750,000.

The Stenhouse Bay deposits are 3 5/8 miles from a jetty which can take ships up to 320' length with maximum cargo capacity of 4,500 tons. The Kangaroo Island deposits are 14 miles by road from the Ballast Head bulk loading jetty which has 26' of water and can take ships of up to about 8,000 ton capacity.

Leases

Most of the Lake MacDonnell deposit is leased by the Waratah Gypsum Company, a wholly owned subsidiary of Australian Plaster Industries Pty. Ltd. (A.P.I.). This company holds an area of 11,000 acres containing an estimated tonnage of gypsum of over 300 million tons. The C.S.R. Coy. holds three leases covering 900 acres and containing about 17 million tons of good rock gypsum. There is also thought to be about 100 million tons under Lake MacDonnell over which Waratah Gypsum holds leases for salt only and about 50 million tons of rock gypsum and up to 50 million tons of lower grade flour gypsum in the remaining area which has been reserved from the operation of the Mining Act.

About 6500 acres were withdrawn from Waratah Gypsum in 1959 by agreement as it was considered that they had far more than they were ever likely to use judging by their existing activity. The Mines Department agreed to allow them amalgamation of their remaining 11,000 acres as protection against plaints. (DM 1535/60) (Appendix A. Leases Held).

Leases over 4,800 acres come up for renewal within the next 18 months.

Now another large company is enquiring about obtaining extensive leases on the Lake MacDonnell gypsum deposit and salt leases on the adjoining Bell Point Lakes to produce gypsum and salt in a large way and to ship it cheaply by establishing a deep sea bulk-loading facility at Point Sinclair about 8 miles from the present workings.

Facilities established at Lake MacDonnell and Thevenard

Waratah Gypsum has recently spent £200,000 on crushing, screening and loading plant at Lake MacDonnell. Their old plaster factory at Thevenard has been closed down but they have established modern stock piling and recovery plant there to load onto the Harbour's Board belt on the jetty. The company uses Roche Bros., contractors, to break up and dig out the

rock gypsum. About 5 men who live at Penong are employed on this, and Waratah Gypsum have about 10 men at Lake MacDonnell and 12 at Thevenard at present. They have about 16 houses for their staff and employees of which two are at Penong and the rest at Thevenard.

The C.S.R. Coy. on the other hand uses contractors Brambles Transport Ltd. of Whyalla to do all their mining and handling of the gypsum onto the train and also from the train to the stock piles at Thevenard and onto the Harbour's Board belt. Brambles has supplied all the equipment at Lake MacDonnell, all of which is mobile. The C.S.R. has spent about £50,000 on the stockpiling and recovery plant at Thevenard and paid Waratah Gypsum £15,000 for permission to use the 8 miles of branch railway which was put in from Kowalka to Lake MacDonnell for Waratah Gypsum in 1950 and for which that company has been paying £800 per year.

As already mentioned the Harbour's Board has bulk loading facilities at the Thevenard jetty which were completed in 1961 for £160,000. This was constructed mainly for gypsum for the two gypsum companies but is also used for grain from silos which have been recently established there. Both Waratah Gypsum and the C.S.R. Coy. were to pay half each of the estimated extra cost of £30,000 per year for 21 years to cover the extra cost of this equipment to the Harbour's Board. This cost is reduced according to the amount of grain that is handled to share the cost.

Lease Rents and Royalty Payments

Royalty is charged at 6d. per ton for all gypsum which is shipped from the area. This is £2,500 for 100,000 tons and the royalty payments were nearly £2,800 in 1963 and nearly £4,800 in 1964. Lease rental is at the rate of 1/- per acre per year and Waratah Gypsum pays £549 per year and C.S.R. £45 per year in rents on the Lake MacDonnell gypsum leases.

Labour Conditions

Under the Regulations under the Mining Act, section 138(2) at least two men must be constantly employed throughout the year (i.e. for 8 hours on every working day) for every 40 acres of gypsum lease held and under Regulation 170 every horsepower of machinery employed shall, when in actual use in working or treating the ore, be counted as two men. Thus the C.S.R. require a minimum of 45 men and Waratah Gypsum 550 men or say 5 men and 20 H.P. and 10 men and 270 H.P. working continuously.

Production from Lake MacDonnell

Waratah Gypsum Pty. Ltd. has produced about 800,000 tons of gypsum from the Lake MacDonnell deposit since 1947. Production was about 14,000 tons per year between 1949 and 1953 at the rate of about 40,000 tons per year from 1956 to 1961, 100,000 tons per year in 1962 and 1963, 186,000 tons in 1964 and the production for the first six months of 1965 was at the rate of 125,000 tons per year. Most of this is used to supply the export markets. (Waratah Gypsum's main supply comes from Stenhouse Bay where they are mining over 200,000 tons per year. This is mainly used in Australia).

The C.S.R. Coy has held leases at Lake MacDonnell since 1946 and mined a total of 6,200 tons between 1949 and 1953 then ceased production and has only recently recommended production. 261 tons were shipped in 1963, 4,700 tons in 1964 and 10,600 tons in the first half of 1965, making a total of 21,100 tons. (The C.S.R. Coy. developed InghamPlaster's gypsum deposit at Kangaroo Island in 1960 while waiting for bulk handling facilities for Lake MacDonnell gypsum. They had produced 430,000 tons from the Kangaroo Island deposits by June 1965 and are mining at the rate of about 120,000 tons per year there). (Appendix B. Lake MacDonnell Production, 1920-1965).

Legal Aspects of Granting Suspension of Labour Conditions or Covenants

Forfeiture of Mining Lease for Non-Compliance with Labour Conditions or upon Application.

The Governor has the power to cancel any mining lease in the case of non-compliance with the labour conditions (Regulation 159(3); Mining Act, Section 126). He also has discretionary power to cancel a lease on which a plaint note has been lodged and a warden has decided that the lease is liable to forfeiture (Regulation 160; Act, Section 70-75). (This is in contrast to the forfeiture of a claim which is compulsory if a plaint note has been lodged and the claim been found to be liable to forfeiture (Regulation 93; Act, Section 37).

Certificate of Suspension from Work

On good cause being shown, a certificate of suspension of labour conditions for a period not exceeding one month may be granted by a warden after six months work has been duly performed on the lease (Regulation 184) or not exceeding three months by the Minister (Regulation 185). Also "No certificate of suspension of the labour conditions of a mining lease shall be renewed, and no second or subsequent certificate of suspension shall be granted except as hereinafter provided either by a warden or the minister until six months' work, in the manner required by such lease, has been done on the leased lands subsequently to the date of the expiration of the last certificate of suspension." (Regulation 187).

Power of Minister to Suspend or Remit Covenants

"The Minister may, at any time before breach thereof suspend or wholly or partially remit all or any of the covenants and conditions contained in any mining lease, in any case where he is satisfied that by reason of special circumstances it would be impossible to comply with, or would inflict great

hardship upon the lessee to enforce the covenants or conditions". (Regulation 188; Act, Section 116 (1)).

In this Regulation and Section the placing of the comma after "mining lease" and the placing of the clause that follows after the main part of the sentence, could lead to the interpretation that the Minister has the power to suspend or remit ..... in general and "in any case" (or especially) "where he is satisfied ....." On the other hand the regulation could mean that the Minister has the power to suspend or remit---only "in any" particular "case where he is satisfied .....". Much clearer wording is used to convey this latter meaning in the case of a claim in Regulation 88. Here sub-regulation (4) states that "a warden, if satisfied that by reason of special circumstances it is impossible to comply with the conditions ..., or that it would inflict great hardship ...., may grant to such owner a certificate of suspension ....." and similar wording could have been used in Regulation 188 if this meaning was to be implied. However the general tenor of the preceding regulations seems to imply this meaning i.e. that the Minister has the power to suspend or remit only "in any" (particular) case where he is satisfied that .... it would be impossible to comply with or would inflict great hardship ....", in other cases he can only grant a certificate of suspension of labour conditions for periods not exceeding three months and cannot in those latter cases renew the certificates.

This means that the Minister must be satisfied that great hardship would be inflicted if the labour suspensions are not granted, and in this case the great hardship would be the possible loss of a secured supply of good gypsum for their future existence in the plaster industry, otherwise the carrying on of a token production at a loss to the Company to hold their leases. Section 116 of the Act has been invoked in several cases in South Australia e.g. with Augusta Salt at Port Paterson and Australian Salt at Barunga and Lake Fowler and with A.C.I. at Port Gawler. In some cases the labour conditions have been

altered but in the case of Augusta Salt full suspension was given.

Under Subsection 116(2) of the Act " a return of all such remissions, with the reasons, thereof, shall be annually laid before Parliament. -"

Australian Production of Gypsum

Nearly 800,000 tons of gypsum worth almost £1,000,000 at the deposit was produced in Australia in 1964, 74% of it coming from South Australia as shown in the following tonnage figures:- (Aust. Mineral Industry Review)

Year	S.A.	Vic.	NSW	WA	Total	Value ex Mine
1963	498,000	76,000	62,000	51,000	687,000	£857,000
1964	581,000	96,000	64,000	45,000	787,000	£979,000
1964	74%	12%	8%	6%	100%	

South Australian Production of Gypsum

Extensive high grade rock gypsum deposits are being worked at Stenhouse Bay, Kangaroo Island and Lake MacDonnell the other production is of lower grade and mainly from seed gypsum deposits. The tonnages for the last 2½ years were as follows:-

Location	1963	1964	1965 (6 mths.)	Use
Stenhouse Bay	205,500	227,600	111,250	for Plaster in S.A. & Eastern States and some cement in NSW and Q.
Lake MacDonnell	111,820	190,940	73,050	for Export
Kangaroo Island	113,150	103,000	58,050	for Plaster in S.A. & Eastern States
sub-total	430,570	521,540	242,300	
Whyalla Area	14,000	15,200	-	for local plaster
Lake Fowler District	7,000	10,000	-	for Adelaide Cement Co.
Cooks Plains	14,100	17,000	-	for Adelaide Cement Co.
Blanchetown Area	13,700	13,800	-	for S.A. Portland Cement Co.
Total	498,000	581,200	-	

Reserves of Gypsum in Australia

New South Wales and Victoria

New South Wales and Victoria which consume the bulk of the gypsum in Australia each only have deposits of low grade material, mainly 30-50% gypsum as mined, which are considerable distances from their markets and which mostly require washing to up grade the material. The N.S.W. deposits nearer to the cement manufacturers on the western slopes of the Blue Mountains are cutting out and will leave only the far western deposits or those remote from the railway. In Victoria the main deposits are all about 300 miles from Melbourne in the northwest of the state. They will last longer than the N.S.W. deposits but they are not really large deposits.

West Australia

The Western Australian deposits supply all the needs for their state but no exports are made from there. They have no large deposits like the Lake MacDonnell one.

Queensland, Tasmania and Northern Territory

No gypsum is being produced in Queensland, Tasmania or the Northern Territory.

South Australia

South Australia holds the main reserves of gypsum in Australia. The approximate reserves of the main South Australian commercial deposits are given below:-

South Australian Reserves in millions of tons and Life at present rate of production

Location	Reserves million tons	Distance from Port miles	Type of gypsum	Grade	Main uses	Life Years	Refer. M.R.
Lake MacDonnell	over 500	36	mainly rock	94½%	all	3,000	114
Stenhouse Bay	2½-5	3-5	rock and sand	94% 92%	all	10-20	91 & 110
Kangaroo Island	2	14	rock	92%	all	17(a)	105
Lake Fowler	1½	9	seed	92%	Cement and plaster	150 150	110
Cooke Plains	3	85	seed	88%(b)	Cement	150	
Craigie Plain	½ 1½	75	seed low grade	68% 30%	Cement and plaster	*	112
Blanchetown	?	90	seed	?	Cement		-
Whyalla area	1 10	40 "	seed lower grade	80% 70%	Cement and local Plaster	70 *	93
Streaky Bay	30	10	grey sand	91%	all	*	110
Total over 550 million tons							

(a) C.S.R. quotes reserves 2,100,000 tons in October 1965 with anticipated life of 12 years allowing for increasing production.

(b) Adelaide Cement has been using some gypsum from Cooke Plains but in future will be obtaining all gypsum from Lake Fowler because of cheaper freight. Cooke Plains gypsum is not suitable for plaster as it is too costly to remove the silica which is usually over 10%.

* Life infinite as no production at present.

Uses of Gypsum in Australia

As Plaster of Paris -

About 2/3rds of the gypsum used in Australia is calcined to produce plaster of paris ($CaSO_4$, $\frac{1}{2}$ H_2O) almost all of which is used in the building industry either with sisal fibre as fibrous plaster or as plaster "board" or in minor uses such as plaster coatings and acoustic tiles. The plaster board mainly sold under the names of "Gyprock" or "Victor Board" consists of

thin layers, $\frac{3}{8}$" to $\frac{5}{8}$" thick, between two heavy paper sides. (The outside paper is strongest and is called a "chipboard"). Some special plaster boards are made with aluminium foil on one side to add to the insulating quality and to act as a moisture barrier. These plaster boards have been used very extensively in America and their use in Australia is growing rapidly.

A few years ago considerable work was done on the use of solid plaster walls about 2 inches thick and on the pre-casting with plaster of whole rooms including the ceilings. Evidently the cost with the use of so much gypsum was too great as the practice does not seem to have been used much, however solid plaster walls were recently used as partitions in the Adelaide Hospital additions.

In the Manufacture of Portland Cement -

About 30% of the gypsum consumed in Australia is used in the manufacture of Portland Cement where it is added to the cement sinter before grinding in the final stage of cement production. The gypsum is used to control the setting time of the tri-calcium aluminate, an ingredient which would otherwise set straight away. The addition of the gypsum has the effect of increasing the rate of gain of strength and reduces the rate of heating thus reducing the drying shrinkage. It does also have the undesirable effect of continuing to act on the tri-calcium aluminite causing slight late expansion in the surfaces of concrete which are exposed to wetting and drying.

In Australia, where gypsum is comparatively cheap, about $5\frac{1}{2}$ tons of gypsum are used in the cement industry for the production of every 100 tons of cement so the gypsum accounts for only about 2% of the production cost of cement. Most of the gypsum comes from lower grade deposits as high quality gypsum is not considered necessary. The impurities are usually harmless and only act as dilutents in the final cement. An extra 10% impurity in the gypsum is only an extra $\frac{1}{2}$% dilutent

in the cement. This means that most cement companies use gypsum from deposits as close as possible to their factories and usually from within their own state whether these are high grade or not.

One visiting American expert, however, claimed that the purity of the gypsum was important and he reduced the troubles which were being experienced at one N.S.W. cement company by changing over to high grade gypsum. Now a Victorian cement manufacturer is trying out 50 tons of Lake MacDonnell gypsum because of the purity.

Less gypsum is used per ton of cement in Japan because of the shortage of cheap gypsum.

Other Uses

A number of miscellaneous uses make up a relatively small portion of the gypsum market. Gypsum is used in agriculture as a soil conditioner and as a fertiliser. Gypsum can improve the soil texture of clayey soils by breaking down the large aggregates and in loose friable soils it improves the coherency of the grains. It has recently been found in the Riverina that the water holding characteristics of light textured irrigated soils are improved by the use of heavy applications (4-5 tons per acre) of broadcast gypsum. Frequency of watering was halved and pasture yields doubled. (C.S.I.R.O. 1964-5). In the New England district of N.S.W. and other areas gypsum has been found very helpful as a fertilizer and in some limited areas it is thought that the gypsum content of superphosphate does as much good as the phosphate.

Other minor uses for gypsum are as "Terra Alba" for paper and textile fillings; in paints crayons and calcines; in chemical processes; as a heat insulator; for special plasters such as "Keene's cement", dental andsurgical plasters; in the treatment of water for special uses and in art. All these uses make up about 5% of the Australian demand.

Use in the Manufacture of Sulphuric Acid or Ammonium Sulphate Overseas

Both gypsum (46.5% SO_3) and anhydrite (55.2% SO_3) have been used to produce sulphuric acid and cement at Billingham in England, near Marseilles in France, in Germany, Turkey and India and now a plant has started up in Japan.

Processes

In England the acid is produced by feeding a mixture of crushed anhydrite (80%), shale (14%) and coke (6%) into long kilns and roasting. Sulphur dioxide is produced which is converted into sulphur trioxide and then sulphuric acid. The lime clinker is ground and gypsum added to make cement. Another process is to use ammonia and carbon dioxide to make ammonium sulphate and chalk. A third method uses reductive roasting producing calcium sulphide which is converted by nitric acid into nitro-chalk fertilizer and calcium sulphide which in turn is changed into sulphur dioxide and then sulphuric acid.

The Sulphur Position

Australia has no known supplies of brimstone or as yet of sulphur from sour natural gas, however sulphur is produced in the refining of imported oil and from pyrite and from lead and zinc ores. About half of Australia's requirements are imported. In 1963, 222,500 tons of brimstone was imported into Australia, 205,000 tons being used to make sulphuric acid. Imports of brimstone this year (1965) will have cost Australian purchasers about £3,000,000.

The latest estimate of the present-known world reserves of brimstone is 235,000,000 tons and this is being used at the rate of about 10,000,000 tons per year so gives a known supply of only about 20 years under the present pattern of use. This

indicates that the demand for sulphur from other sources is likely to grow. (Pure gypsum contains 18.6% sulphur so the total sulphur content of the Lake MacDonnell gypsum deposit probably exceeds 100,000,000 tons of sulphur.)

Economics of the Production of Sulphuric Acid from Gypsum in Australia

The I.C.I.A.N.Z. Coy. has recently looked closely into the production of sulphuric acid and cement from gypsum but has found that it is uneconomic under the present conditions. A large plant is required and the production of the acid has to be tied up with the production of cement which also requires expensive plant, and the entering of a new market. They would like to recover the sulphuric acid from the chemical gypsum produced in the manufacture of concentrated superphosphate at Yarraville but here they are hampered by the lack of space at their works.

Gypsum contains 18.6% sulphur which if all recovered as elemental sulphur worth say £15 per ton would be worth 56/- per ton of gypsum used. The recovery is more likely to be about 80% giving a return of 45/- per ton of gypsum so the help of the sale or use of the clinker for cement would be needed to give anywhere near an economic proposition. If the sulphur is recovered as sulphuric acid this would bring in extra returns and the Sulphuric Acid Bounty given by the Commonwealth Government could probably be claimed for acid for the fertilizer industry and possibly some assistance such as that given to the pyrites industry in the Pyrites Bounty Act No. 102 of 1960

The production of sulphuric acid from gypsum would save some of the £3,000,000 being spent annually on imports of elemental sulphur.

Australian Consumption of Gypsum

The Australian consumption of gypsum was split up in the following manner:

Industry	1962-3 tons	1963-4 tons	%
Plaster of Paris	320,000	337,000	62%
Portland Cement	161,000	173,000	32%
Other uses approx.	33,000 *	35,000 *	6%
Total	514,000	545,000	100%

* estimated figure. J.R.A.

Main Consumption Localities

The major plaster works are situated at inner suburbs of the major cities hence near the ports,

in Sydney at Concord and Camilla

in Melbourne at Brunswick, Yarraville, South Yarra and Oakleigh (Dandenong).

in Geelong

in Adelaide at Pt. Adelaide, and Wingfield.

in Brisbane

and several localities in W.A.

The Cement manufacturers are usually located near limestone deposits or with easy access to them. 40% of the Australian cement is made in N.S.W. Here the limestone deposits are inland just on or over the Dividing Range. Most of the cement works are about 100 miles from the coast at Sydney, in the Kandos, Charbon, and Portland area. They get most of their gypsum from the low grade deposits of western N.S.W. One of these factories uses some chemical gypsum from the Psizer Chemical Company, Sydney. Some South Australian gypsum is supplied to another large producer at Berrima, 50 miles inland from Port Kembla. Another producer is at Picton 34 miles from Port Kembla.

In Victoria the main cement works are near Geelong but one at Traralgon is further inland. In Queensland the cement factories are all on the coast at Brisbane, Rockhampton and Townsville and are supplied with gypsum from South Australia. (There is no gypsum production in Queensland). One of the South Australian cement works is at Port Adelaide. It has been using low grade gypsum from Cooke Plains but will in the future be getting its own gypsum from Lake Fowler on Yorke Peninsula near its limestone quarry at Wool Bay. The other S.A. producer is 50 miles inland at Angaston and is supplied with low grade gypsum from the Blanchetown area. The Tasmanian cement factory is at Railton near Devonport on the coast, and Western Australia supplies its own cement works with gypsum. (Appendix C Australian Cement Plants).

Exports

All the exports of gypsum from Australia come from South Australia and nearly all from Lake MacDonnell. Waratah Gypsum Pty. is virtually the only exporting company with its main markets (just over 50%) in New Zealand where gypsum is supplied to the cement factories and to its own associated plaster companies. In 1962 after the railway freights from Lake MacDonnell were reduced for large quantities and when shipping freights were low, Waratah Gypsum managed to break into the Japanese market and dominated the market that year but the competitors fought back and secured most of the market again. However Waratah Gypsum are still holding markets to some other islands north of Australia.

The Australian export figures for gypsum in 1963 and 1964 are -

Country	1963	1964
New Zealand	77,000 tons	104,000 tons
Japan	42,800 tons	19,000 tons
Malaya	14,300 tons	30,200 tons
Phillippines	8,200 tons	29,700 tons
Other	1,500 tons	22,300 tons
Total	143,800 tons	205,200 tons
Value	£357,400	-

The Export Potential

Difficulties

In November 1962 the C.S.R. Coy. expressed the hope of securing half of the Australian exports to Japan and S.E. Asia i.e. about 50,000 tons but in March 1964 they said they had been unsuccessful and that they would only be sending 20 - 40,000 tons from Lake MacDonnell to N.S.W. for their own use.

In March 1964 Waratah Gypsum Pty. was confident that orders for 300,000 tons could be secured annually from New Zealand, Japan, Malaya and the Phillipines, if facilities were provided at Thevenard to ship 10,000 ton cargoes regularly throughout the year. However in September 1965 they said that they had lost the market for the supply of foreign gypsum to Japan to the Kaiser Corporation who were shipping gypsum from Mexico in 40,000 ton ships. They were only able to hold the other oriental market by dropping their f.o.b. price to 30/- per ton which was practically their costs, and even at 30/- f.o.b. they could not compete successfully for the Japanese market if the shipping freight were over 50/- per ton, and their

Japanese importers made a slight loss on the later shipments.

Competitors

The main competitors for the Far Eastern markets of gypsum are Mexico, Egypt and Cyprus. All these places have the advantage of low costs and ports which can handle larger vessels. At Kaiser's Saint Marcos Island deposit on the Mexican coast the gypsum is handled straight from the quarry to the harbour stock-pile from which it is handled at 1600 tons per hour onto ships which have self-trimming and self-discharging.

Markets

Japan is reported to use 1,200,000 tons of gypsum per year in the cement industry. Most of this is provided from their gypsum mines in the North West but the Japanese Government allows imports of 10% in the winter between November and March when the snow and cold give difficulties in the rail transport over the mountains to the cement factories in the South East.

The Japanese cement industry is growing at about 10% per year and so is their production of gypsum. The gypsum used for plaster is relatively small and rather unstable but is said to be still significant. This is not borne out in the statistics which show that the total of production and imports of gypsum only amounted to about 3% of the tonnage of cement manufactured (29½ million tons in 1963) so even if Japanese cement contains only half the gypsum of Australian cement little gypsum can be used in other industries. Production at the mines may be increased but costs may rise if mines start being worked out. It appears that the import control system is to be removed in April 1967. All this means that the Japanese potential import market, which is about 120,000 tons at present, is likely to increase sharply unless it is effected by any use of chemical gypsum from the fertilizer industry. (This is discussed later).

New Zealand has a steady growing market for gypsum for the cement industry and also for the plaster industry which is run mainly by companies associated with Waratah Gypsum. The market showed a sudden rise from 77,000 tons in 1963 to 104,000 tons in 1964. Almost all the gypsum used in New Zealand is imported from Australia.

Malaysia - The cement industry is growing and imports of gypsum are likely to increase to 40,000 tons in 1966 and to continue to increase.

Philippines - The requirements for the cement industry are growing and should reach 60-80,000 tons per year in 1966.

Formosa should require 50,000 tons per year and the demand should increase.

Indonesia - When things settle down and normal commercial expansion takes place the present requirements of 20-25,000 tons per year should grow rapidly.

Taiwan requires small quantities of gypsum. A market in Ceylon may also be approached.

United States imported nearly 5,500,000 tons of gypsum in 1963, 4,400,000 tons (80%) of this came from Canada and 900,000 tons from Mexico (16%) and the rest from Jamaica ($3\frac{1}{2}$%) and the Dominican Republic ($\frac{1}{2}$%). This is a very large market but it would be difficult for any Australian gypsum to compete with that coming from adjacent countries unless it is required for its higher purity or the landed cost can be made attractive. Perhaps cheap freights could be obtained as back loading from oil deliveries if universal carriers could be handled at the gypsum ports.

The amount of these markets that can be captured depends on the price at which the Australian gypsum can be landed in these countries and this depends mostly on shipping costs which again depends on the size cargoes which can be loaded and unloaded. The Lake MacDonnell gypsum has got the advantage of being about $2\frac{1}{2}$% higher grade than its competitors.

This should help.

Artificially deposited Gypsum from the Salt and Chemical Industries

In the manufacture of 100 tons of salt from seawater 4.6 tons of gypsum are deposited in the early stages of evaporation. This artificially deposited gypsum is gradually accumulating in the evaporation areas. The I.C.I. Company which is the major Australian salt producer is producing 300,000 tons of salt per year at Dry Creek at present so gypsum is accumulating on their leases at the rate of about 15,000 tons/year. About seven years ago the Company carried out some investigations into possible uses for this product but apparently went no further with the matter.

Some artificially made gypsum from the manufacture of demicals is sold by the Psizer Chemical Company to the Australian Portland Cement Coy. at Kandos in New South Wales for use in the manufacture of cement.

Artificial or "Chemical Gypsum" from the Fertilizer Industry

Changes in the production of Superphosphate

Large changes are taking place in the manufacture of superphosphate fertilizer in Australia. Most of the major producers are erecting or have just erected new plants to produce "concentrated superphosphate with a strength of 42-50% available P_2O_5 as compared with normal superphosphate, strength about 20% available P_2O_5.

Concentrated Superphosphate

This "concentrated superphosphate" (also called "double", "triple" or "treble" superphosphate) is being made by the production of phosphoric acid (H_3PO_4) through the action of sulphuric acid on phosphate rock and then using the phosphoric

acid on more phosphate rock to produce the concentrated superphosphate. (Appendix D Types of superphosphate).

Concentrated superphosphate costs more per ton of available P_2O_5 to produce but the freight per P_2O_5 is halved so that it is cheaper for the farmers who are more than 100 miles from the superphosphate plants and also the farmers only have to handle half the bulk. This is especially beneficial in aerial spreading. The Commonwealth Government under "the Phosphate Fertilizers Bounty Act 1963" is paying a bounty to the fertilizer manufacturers at the rate of £15 for each ton of available P_2O_5 content of the fertilizer they produce, provided that the benefit of the bounty is passed on to the consumer.

Production of Chemical Gypsum

In the process of making the phosphoric acid for this concentrated superphosphate calcium sulphate is formed and deposited as a "chemical gypsum" ($CaSO_4$, $2H_2O$). For every ton of P_2O_5 content of the phosphoric acid made over 4 tons of chemical gypsum is formed. At the Yarraville plant of Commonwealth Fertilizers (I.C.I.) 2.8 tons of phosphate rock and 2.6 tons of sulphuric acid are used to produce 1 ton of P_2O_5 content of the phosphoric acid and 4.18 tons of chemical gypsum is discarded. (Appendix E Chemical Actions in the Production of Concentrated Superphosphate).

There are a number of methods of manufacturing concentrated superphosphate. Among these are the Tennessee Valley dry method in which no chemical gypsum is formed, the Dorr-Oliver process known here as the American process, used in America extensively for many years, in which the chemical gypsum deposited is very fine and takes considerable time to dry out, the Praynor method from Holland, a French method, and the newer Nissan or Japanese process in which the gypsum is coarser, in less needle-like crystals which dry out much more rapidly than that from the American process.

Quantity and Location of Future Chemical Gypsum Production

The changes planned in the fertilizer production means that four plants will be producing phosphoric acid for concentrated superphosphate in the eastern states by 1967, two of these are already operating. The capacities of these four plants will be -

Location	P_2O_5	gypsum		Process	Remarks
	tons/day	tons/day	tons/year		
Pt. Kembla	100	418	140,000	Dorr-Oliver	In operation.
Melbourne	170	700	230,000	Nissan	"
Cockle Creek	170	700	230,000	Nissan	Under construction
Queensland	100	418	140,000	?	planned
Total	540	2236	740,000		

The production will not be seasonal to the same extent as normal superphosphate manufacture because the phosphoric acid will be used in the manufacture of certain "high analysis" fertilizers which are used before Christmas. Where production is in full swing about 90% of the annual capacity should be realised.

Thus these plants in the eastern states when working at full capacity would produce chemical gypsum at the rate of 740,000 tons per year i.e. at the same rate as gypsum was mined in 1964 in the whole of Australia excluding Western Australia (787,000 tons - 45,000 tons). This is 200,000 tons more than was consumed in those states that year as the exports were 205,000 tons.

There do not appear to be any plans at present to produce concentrated superphosphate in South Australia where there are six superphosphate plants scattered through the state (3 in Adelaide, 2 in Wallaroo and 1 in Port Lincoln) nor in Western Australia where there are seven plants.

Competition of Chemical Gypsum with Natural Gypsum

The Australian Fertilizer Coy's. American-type plant at Port Kembla has been working for about a year, and the Commonwealth Fertilizer Coy's. Japanese-type plant at Yarraville, Melbourne, has been producing intermittently for some months. As yet none of this chemical gypsum has been used commercially in the manufacture of plaster or cement in Australia and there is some doubt about its suitability. However large quantities of chemical gypsum will be produced right at the main localities of consumption of gypsum. If the product is not used it will cost the fertilizer companies about 6/- per ton for dumping, on the other hand although the mining of gypsum is not costly, the transport from the deposits in South Australia to the markets in the eastern states brings the price of gypsum there to about £5 per ton. This means that the fertilizer industry can afford a considerable amount of beneficiation work if this is necessary to make the chemical gypsum marketable.

Both Waratah Gypsum and the C.S.R. Coy. are testing out plaster made from the chemical gypsum. They will use this new material if satisfactory plaster products can be made from it. They are arranging to buy all this gypsum from the fertilizer companies as they do not wish to have any possibility of a new large competitor entering the plaster industry.

Experience with the use of Chemical gypsum

Some care must be taken in predicting the future use of chemical gypsum from experience in the past because of the different qualities of the gypsum produced by different methods. However the following experiences are given as an indication.

Australia

The chemical gypsum produced in the manufacture of concentrated superphosphate is wet and fine-grained (especially from the American process at Port Kembla) and contains some

phosphoric and sulphuric acid. Tests on Australian gypsum both from Port Kembla and from Yarraville have so far shown it unsuitable for the manufacture of good plaster, mainly because there is too much acid present. The acidity of plaster should be within the 6 to 8 pH range. On the other hand plaster made from samples of chemical gypsum from Japan appears to be of quite good quality though not quite white. It should be alright for plaster board but will probably be inferior to the present plaster used.

America

Concentrated superphosphate has been made in America continuously since 1907 and its use there has increased so that by 1960 44% of the P_2O_5 in fertilizer was supplied in this form. Experiments have been made with various uses of the chemical gypsum by-product but it is nearly all discarded into waste ponds. Some plants located in gypsum hungry agricultural regions sell the product which has dried in these ponds for soil conditioning. The phosphate content has been reported to make it unsuitable for the use in the manufacture of portland cement. Use in plaster wall board and precast blocks for interior partitions was tried in Tampa, Florida, but did not prove successful. It was calculated that the chemical gypsum was accumulating in waste dumps at the rate of over 3 million tons per year in 1961.

England

The I.C.I. Company has been using chemical gypsum to produce a satisfactory plaster wallboard at Billingham for some years.

Japan

The Japanese are also using it to make plaster wallboard. This board is reported to be not as high quality as the Australian board but quite satisfactory. The adhesion of the paper to the plaster was slightly lower. The Japanese fertilizer industry is not as large as the Australian one so the competition from the chemical gypsum will not be as great there.

FORECASTS OF FUTURE TRENDS IN THE MARKETS FOR AUSTRALIAN GYPSUM

Future Demand in Australia for Gypsum

In the Cement Industry

The Australian cement industry which accounts for about 30% of the Australian consumption of gypsum is growing at about 6% per year. This is greater than the population growth which is about 2% so there is a steadily rising use per person. The Australian use of cement stood at 710 lbs. per head in 1964 which was higher than that in most countries though exceeded by West Germany and Switzerland.

The proportion of gypsum used in the manufacture of portland cement is likely to stay the same, i.e. at about 5½% of the cement, for some time. A cheap alternative controller of the setting time may be found one day or the troublesome tricalcium aluminate, which the gypsum is used to control, may be eliminated. The C.S.I.R.O. research officers can see no changes in this direction at present.

From this it appears that the demand for gypsum for the Australian cement industry is likely to grow at about 5% per year from the 1963-4 annual consumption of 161,000 tons.

Whether the chemical gypsum will take over a large part of this market depends on whether the present chemical gypsum can be made consistent, reliably phosphate-and acid-free, and dry, at a low enough cost. The very large quantities of chemical gypsum which are being produced every day in America are still being dumped. On the other hand the new Japanese Nissan Process which will be used at Yarraville and Cockle Creek is reported to produce a more suitable product. Anyway, the chemical gypsum will be a serious threat to the use of natural gypsum in the cement industry.

This will not affect the position at the rock deposits in S.A. greatly because only a small portion of their production goes to the Australian cement industry at present. However it

will mean that any future large expansion of the demand for South Australian rock gypsum for the cement industry seems unlikely unless its high purity can be proved to be a great benefit.

In the Plaster Industry

Present Markets

The consumption of gypsum in the plaster of paris industry, which accounts for about two-thirds of the Australian gypsum consumption, has fluctuated somewhat lately mainly with the activity in private house building. However there appears to be a general overall growth of about 3% per year. The use of fibrous plaster sheets, which are peculiar to the Australian industry, is falling while the use of plaster boards ("Gyprock" and "Victorboard") is likely to grow very rapidly. Great use is made of plaster boards in America and in Australia in the last two years new plaster board plants have been erected in Sydney and Adelaide by A.P.I. and in Brisbane, Adelaide and Melbourne by C.S.R.; adding to the ones already in Sydney and Melbourne. The new C.S.R. plant in Melbourne is at their Yarraville works which are located directly between the Commonwealth Fertilizers new phosphoric Acid plant and their superphosphate plant so will be on the spot for the chemical gypsum.

It now appears likely that the chemical gypsum may start to take over a large portion of the gypsum market for this paper covered wall board, but it is expected that natural gypsum will hold the fibrous plaster and the rest of the plaster of paris trade. If a good plaster board can be sold at a lower cost with the use of chemical gypsum then this may take over more of the building lining trade from other linings and the growth of the plaster industry may more than double the present 3%.

At present almost the whole of this plaster industry is supplied with high grade rock gypsum from Stenhouse Bay and Kangaroo Island, so it appears that production from these

centres could be as much as halved if the Australian chemical gypsum proves satisfactory for plaster board use. This could have the effect of doubling the life of these deposits to about 30 years for Stenhouse Bay and 25 years for Kangaroo Island, unless large new markets can be developed to use the cheap chemical gypsum.

New Markets

The main plaster manufacturers are hopeful that they will be able to develop large new markets for gypsum products with the use of cheap gypsum from the fertilizer industry. Attempts were made some years ago to develop much greater use of plaster products in the building industry e.g. precast solid plaster walls and rooms. Apparently these new products failed to gain favour and their lack of success was largely blamed on the cost. Arrangements are being made with the producers of chemical gypsum for a lower price to be paid for chemical gypsum which is used in any new field of use.

One of the officers at the C.S.I.R.O. Building Research Section feels that gypsum products even at the present price could be developed to take a very much larger share of the building materials market and could be used in most places where concrete is used now. Even floors could be made of special hard plasters now being developed. The main gain would be in time because plaster sets in a few minutes. It can be load bearing very soon after pouring so can be used almost straight away. The formwork can be plaster wall board which can be left as the finished surface without any stripping or finishing. Strong formwork is not necessary because the lower sections of walls etc. are set before much hydraulic head is developed from the higher layers. However he said that a major change here would take a lot of investigation work and much organisation and pushing and publicity and he does not think the effort will be exerted. (There does not appear to be any major developments along these lines in other countries where much more money can

be spent on investigations etc.).

The C.S.R. and A.P.I. both have large research organisations and among other things are working on this problem. They are supporting the C.S.I.R.O. to the extent of over £5,000 per year where work is being carried out on the production of stronger plasters and other developments. However there does not appear to be any major effort being put into major changes at present. The C.S.R. policy is to sell calcined gypsum and plasterboard but not to open out into the manufacture of plaster goods other than "Gyprock". They wish to remain the suppliers of the materials but are helping to develop new materials for others to use their plaster on.

To sum up the potential of the new markets in the plaster industry is large but much work will have to be put into this by all parties especially the plaster and fertilizer manufacturers. Much new ground will have to be broken. At present both manufacturers are very busy getting their new plants firmly established and running properly and may later be able to put greater combined effort into the establishment of new industries based on the by-product gypsum.

Future Demand in Other uses

There does not appear to be any great developments in the other uses of gypsum which can account for large new demands. Gypsum may be used in greater quantities for fertilizer, more use can be made of it in stabilizing soils, possible markets may be developed in use as backfill to help in the cathode protection of pipes etc. and many small uses could be enlarged. However none of these except possibly the fertilizer and soil conditioner use is likely to make much change in the demand.

Possible Future Demand in the Manufacture of Sulphuric Acid and its products

This is one of the major other potentials of gypsum. It contains 46½% SO_3 or 18½% sulphur. As yet it has not appeared economic to use gypsum for this purpose in Australia though in some countries it has been used for the production of sulphuric acid or ammonium sulphate for a long time. Over £3,000,000 a year is being spent on imported brimstone by the Australian fertilizer industry and much more will be spent with its expansion. Added to this the brimstone market appears to be becoming tighter.

Forecast of the Export Potential

New Zealand

The major export market for Australian gypsum at present is in New Zealand where gypsum is used by the cement and plaster industries. As yet there appears to be no plan for concentrated superphosphate production in New Zealand so there is no threat to the natural gypsum demand there at present. The plaster manufacturers are largely tied to A.P.I. so the market for Australian gypsum should remain much the same.

Japan

The greatest export potential for Australian gypsum is to Japan (6,000 miles from Lake MacDonnell) which has to mine its own gypsum and where imports have been growing steadily and had reached 108,000 tons in 1963. The Japanese cement industry has been growing rapidly, at the rate of 10% per year over the five years to 1963, and in that year Japanese production of gypsum was nearly 800,000 tons and imports were 108,000 tons.

The government has restricted imports to 10% of their requirements but it is said that this restriction is to be removed in 1967. Australia did gain 40% of this market in 1963 but return competition from Mexico and Egypt regained them the market the following year. Although these competitors from the Middle East have longer shipping distances (8,000 miles) and mexico about 5,500 miles, they gain lower freight rates by being able to use larger ships. At present Australian producers cannot compete with an f.o.b. price of 30/- unless they can obtain freight rates of under 50/-. Unfortunately no ships are returning to Japan in ballast as all bulk loads are from Australia to Japan so gypsum has to compete with ordinary rates. Cheaper transport costs in Australia to the port would help by reducing the f.o.b. price. If this f.o.b. price could be lowered to about 25/- per ton a hold on the Japanese market might be obtained.

Islands north of Australia

Markets in Malaya and the Philippines should continue to grow.

SUMMARY OF THE MARKET SITUATION

In Australia

From all this it appears that although the use of gypsum of all types is likely to grow at about 5% per year in Australia, the use of natural gypsum could fall severely in the next few years due to competition from the new chemical gypsum. If this situation is tackled vigorously by all parties interested in promoting the use of gypsum a much larger portion of the building materials market could possibly be gained and the use of natural gypsum could continue to grow in Australia. At present, however, it does not appear that a sufficiently high effort is being extended to achieve this rather extensive change.

Exports

Exports to New Zealand are likely to continue to increase for some time and further gains may be made in the islands north of Australia. However the main potential market which is in Japan and which is likely to increase rapidly, will be difficult to capture unless the c.i.f. price of Australian gypsum in Japanese ports can be reduced to compare with that of its main competitors from Mexico, and Egypt. This can only be done by reducing the f.o.b. price and by achieving cheaper freight rates by catering for larger shipments.

With Special Regard to Lake MacDonnell

The Lake MacDonnell deposit is used by Waratah Gypsum almost solely for the export market except for some 25,000 tons per year to Pt. Kembla for a cement company which prefers high grade gypsum. Their production shipped in 1965 will be about the same as last year, i.e. 190,000 tons.

The C.S.R. Coy. had, in December 1963, indicated that they had firm markets for 50,000 tons of gypsum a year from Lake MacDonnell and hoped to build up their share of the

export market to another 50,000 tons. However in 1964 they said they were unable to compete in the export trade and that they only expected to ship 20,000 - 40,000 tons per year to N.S.W. They only shipped 4,700 tons in 1964 and 10,600 tons in the first half of 1965, and now have asked for the suspension of labour conditions on their Lake MacDonnell leases for a couple of years. They want to save costs by taking all their South Australian gypsum needs from Kangaroo Island. If the new chemical gypsum from the fertilizer industry takes over much of the demand for gypsum in the eastern states the life of the Kangaroo Island deposits could be extended to over 20 years thus increasing the time before Lake MacDonnell will be required to supply the bulk of C.S.R. Coy's. needs.

From this it can be seen that the Lake MacDonnell deposit is main standby for the Australian gypsum industry to fall back on when the smaller cheaper deposits are worked out. In the meantime its main use will be to supply the export market.

THE SITUATION AT LAKE MacDONNELL

Present Position

Thus the C.S.R. Coy. are asking to close down their work at Lake MacDonnell and Thevenard just at the time that the new railway deviation which has cost over £800,000 is being completed and placed into commission. At the same time Waratah Gypsum has lost the large Japanese market which they had just gained. Added to this the threat to the gypsum markets from the chemical gypsum of the fertilizer industry has just emerged.

Waratah Gypsum which holds amalgamated leases over about 11,000 acres thought to contain over 300 million tons of high grade gypsum has just started to work the Lake itself for salt from salt leases taken up this year. The C.S.R. Coy. holds three leases totalling 900 acres containing about 17 million tons of good rock gypsum, and the remaining area containing some 50 million tons of rock gypsum and 50 million tons of lower grade crystal and flour gypsum is reserved from the operation of the Mining Act. There is also thought to be about 100 million tons of rock gypsum under the salt leases of Lake MacDonnell.

Another large company is enquiring about availability of salt and gypsum leases in the area forthe development of large export trade by means of suggested new deep water facilities at Point Sinclair about 8 miles away. They hope to halve the present f.o.b. price of gypsum by large production, new methods, and new shipping facilities adjacent to the deposit.

If this scheme eventuates and it seems to be the only hope of securing and holding the large eastern market then the new railway deviation will not be used. In any case it appears that the railway will not be used for any extensive tonnages unless transport costs can be reduced considerably so that the f.o.b. price of gypsum can be lowered to about 25/- per ton.

Points to be considered in making a decision on the C.S.R. Coy's. request for suspension of labour conditions

General

. The Lake MacDonnell Deposits contain over 500 million tons of gypsum enough to supply Australia's needs for 1,000 years at the present rate of consumption.

. The C.S.R. Coy's. leases probably only contain about 4% of the deposit.

. Their total production from S.A. in the next few years will be the same whether any comes from Lake MacDonnell or not.

. It will be much more economical for them to produce all their S.A. gypsum from Kangaroo Island.

. They wish to be allowed the suspension of labour conditions for a year or two while their sugar prices are low and while the chemical gypsum situation is sorted out.

. They feel they must retain their Lake MacDonnell leases as future reserves.

. If forced to they will continue to work the deposit but may reduce their production to nearer the minimum rate that is necessary to hold their leases.

. The future of the Lake MacDonnell leases is really bound up in the development of large overseas markets or of an extensive increase in the use of gypsum in Australia.

<u>If Suspension of Labour conditions are allowed</u> -

. the C.S.R. will not renew their contracts with Brambles, the contractors, who will withdraw their men and machinery.

. There will probably be a drop of about 20,000 tons or 10% on this year's production from the deposit and a drop to the district of about £25,000 worth of trade a year, made up of about £15,000 from mining and handling the gypsum and £10,000 in reduced revenue to the railways.

. There will be very little loss to South Australia as a whole because extra money will be spent at Kangaroo Island to mine an extra equivalent tonnage.

. The C.S.R. will save money mainly by reduced freight on this tonnage.

. The Waratah Gypsum will be penalised to a small extent in that the reduction in freight rates is tied to total combined tonnage of the two companies.

. The granting of labour suspensions to C.S.R. may make it hard to push Waratah Gypsum in the future to release any of the excess leases they still hold. (They hold the best part of the deposit, 11,000 acres containing over 300 million tons).

. The granting of labour suspensions may bring adverse criticism especially as it would coincide with the opening of the new railway deviation.

<u>If the labour suspensions are not allowed</u> -

. the C.S.R. will most probably continue to mine the deposit.

. but they may reduce their production to a lower rate say to 45,000 tons per year, closer to the minimum required to hold their leases.

. Their leases cannot be withdrawn unless they fail to pay their rent or to fulfil their labour requirements which for 900 acres of gypsum leases are 45 men (some of whom can be replaced with machinery at the rate of 2 men to every horspower e.g. 3 men and 21 horsepower). The men and machinery must be continuously employed for not less than 8 hours on every working day in any operation in South Australia connected with the making merchantable or the extraction of the products of the lease. (Mining Act Regulation 170).

. If they reduce production to 5,000 tons per year the effect on the trade in the district will be almost as much as with the granting of labour suspensions and the cessation of

work i.e. a drop of about £19,000 in district trade compared with £25,000.

. The action would be irksome to the C.S.R. who would feel that they were being committed to unnecessary expense by the South Australian Government with no benefit going to South Australia.

. The action is not likely to achieve its object of forcing the development of the deposit or freeing the leases for others to work.

. There is much more unleased gypsum available at Lake MacDonnell than in the whole of the C.S.R. leases at Lake MacDonnell, and a further 30 million tons or more open for pegging at Streaky Bay.

SUGGESTED ACTION

With Regard to the Request for Suspension of Labour Conditions on the C.S.R. Leases at Lake MacDonnell

Considering all these factors it seems that the best course is to come to some arrangement with the C.S.R. Coy. such as allowing them the suspension of labour conditions for, say, two years provided that at the end of that period they either release half of their area or work it at a reasonable rate say at least 50,000 tons a year. Under this arrangement if, within the two years, the chemical gypsum has been shown to be suitable for some of the major uses of gypsum in Australia, then the life of the C.S.R. leases at Kangaroo Island and Lake MacDonnell will have been considerably increased by the decreased demand for natural gypsum. This could have the effect that half their leases at Lake MacDonnell would still give them about the same life as their present leases held without the chemical gypsum. On the other hand if they wish to hold their whole leases the agreement to mine 50,000 tons per year at Lake MacDonnell could help to stir them into a more active search for new markets at home or abroad.

An alternative offer may be made to them giving them suspension of labour conditions for say 2 years provided that they step up their efforts to expand the gypsum industry. Under this arrangement the increased effort would have to be defined in some way.

Perhaps the C.S.R. could be asked to put forward a proposal along these lines. At the moment the Government has a slight bargaining point but not much and the advantage will be lost as soon as a decision is made so a conditional decision seems appropriate.

With Regard to the Development of the Gypsum Industry

There seem to be three main uses which should be pushed in attempting to increase the demand for gypsum in Australia to absorb the chemical gypsum and still leave good markets for the natural gypsum.

The greatest potential appears to be in following up developments in the use of gypsum products in the building industry. This absorbs two-thirds of the gypsum at present but its use could be more than doubled if some benefits of plaster over concrete could be fully exploited.

The next most likely large increased use is in agriculture where its soil conditioning properties can be of great benefit. The gypsum would have to be cheap to gain much hold here, but there is a possibility that large quantities could be used.

The third use is in the manufacture of sulphuric acid and its products. This is reported to be uneconomical at present but further work should be done on this because of the lack of sulphur deposits in Australia and of the growing shortage of future supplies of elemental sulphur. Imports of sulphur are costing Australia over £3 million and are growing rapidly.

There are many other uses of gypsum which should be further developed but the three mentioned are the ones which could have a significant influence in the demand for gypsum in Australia.

As far as outside Australia goes, development of the idea that it pays to use adequate amounts of high grade gypsum in the manufacture of cement could possibly cause a large increase in the demand for gypsum for Japan where they appear to use the minimum requirements. The benefit of plaster as a building material does not appear to be realised in Japan due probably to its scarcity and high price. Any move in this

direction could build up greatly increased demand for gypsum imports but this will not help Australia unless our gypsum can be competitive with the Mexican, Egyptian and Cyprus gypsum.

It is suggested that, as South Australia supplies three quarters of the Australian production of gypsum and has probably over 90% of the easily available reserves, efforts be made to stir up greater activity in the development of the products of gypsum and their uses. This can be done by using AMDEL to carry out some of the research work, by encouraging C.S.I.R.O. and the plaster companies in their work and perhaps by initiating some move towards forming a combined organisation of the plaster companies, the fertilizer producers of chemical gypsum, the C.S.I.R.O., the building industry and the South Australian Government. Any way interest should be taken in all the developments in the use of gypsum and its products, and encouragement and assistance given where possible.

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