

DEPARTMENT OF MINES
SOUTH AUSTRALIA

Report on

MACHINE AUGER BORING - GYPSUM DEPOSIT

BLOCKS Q & N, HUNDRED STUART, COUNTY YOUNG

(C.H. KUCHEL)

By

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NON METALLIC SECTION
GEOLOGICAL SURVEY

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Appendix I - Geological Logs of Machine Auger
Boreholes.

II - Results of Partial Chemical Analyses.

<u>Plan No.</u>	<u>Title</u>	<u>Scale</u>
63-830	Location of boreholes-Morgan Gypsum Deposit Blocks Q & N Hd. Stuart, HL 665 & 678 (C.H. Kuchel)	1 inch = 100 feet.
64-253	Morgan Gypsum Deposit - Cross Sections.	1 inch = 100 feet
53625	Morgan Gypsum Deposit - Locality Various. Plan.	

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1. ABSTRACT

Auger boring on a gypsum dune, north-east of Morgan, has proved 1,300,000 cubic yards of crude gypsum. Total reserves within M.L. nos. 665 and 678 exceed this value as the gypsum extends outside the area tested. 400,000 cubic yards of flour gypsum, averaging 83.6% $\text{CaSO}_4 \cdot 2\text{H}_2\text{O}$ cover 900,000 cubic yards of seed gypsum, averaging 75.6% $\text{CaSO}_4 \cdot 2\text{H}_2\text{O}$. The underlying gypsaceous clay is too low grade to warrant exploitation.

2. INTRODUCTION

Following a request from Mr. C.H. Kuchel, Miscellaneous (Gypsum) Leases nos. 665 and 678 situated in Blocks Q and N, Hundred Stuart, County Young, 10 miles north-east of Morgan and 114 miles north-east of Adelaide, were inspected on 2nd September 1963.

The leases were topographically surveyed from 16th to 25th September 1963 and a programme of 28 machine auger holes was devised to test the most promising area. The accompanying plans and sections are based on a stadia theodolite survey by G. Samuel (Surveyor). Boring commenced on 25th November and was completed on 16th December 1963. The geological logs of the boreholes are appended together with the results of partial chemical analyses of samples submitted to The Australian Mineral Development Laboratories.

Previous Reports

Miller, P.G. (1964) Reconnaissance Survey - Quaternary Sedimentary Succession and Sub-surface Drainage - Murray River Irrigation Area.
unpub. R.B. 58/5.

Moffitt, P.B. and Hosking, P.K. (1962) Morgan Gypsum Washing Tests.
Min. Rev. 114, p.9-12.

Whitten, G.F. (1962) Gypsum Deposit, Blocks Q and N, Hd. Stuart.
Min. Rev. 113, p.25-31.

3. GEOLOGY

The general geology of the area, which is near the north-western margin of the Murray Basin, has been described by Whitten (1962).

Miscellaneous (Gypsum) Leases nos. 663 and 678 cover portion of a seed gypsum dune on the eastern rim of a shallow depression. Seed gypsum is being quarried on the adjacent lease no. 667 (see locality plan no. S 3625). The dune has been formed by the action of the prevailing winds on the crystalline gypsum which was deposited in the lake bed. At the surface the seed has weathered to amorphous flour gypsum.

The sediments exposed in a small quarry on the south-west margin of the depression are clayey marls, regarded as an upper horizon of the Morgan Limestone (Miocene) covered by Pliocene limestones (Dr. N.H. Ludbrook, pers. comm.)

4. RESULTS OF AUGER BORING

The results of the 28 machine auger boreholes are outlined on the accompanying cross sections, plan no. 64-253.

Samples were taken over 3 feet intervals, hence all geological boundaries are approximate. Due to the grinding action of the bit, it was difficult in places to differentiate between flour and fine seed.

In the lower areas, the surface layer of flour gypsum generally, is covered by a superficial layer of loam (less than 1 foot thick). In the vicinity of boreholes nos. B4, C3 and G3, seed gypsum outcrops.

3.

The flour gypsum, averaging 3.5 feet in thickness, is white to pale brown or pale pink in colour. The maximum depth of flour, viz. 10 feet, was intersected in borehole No. A2.

The interval from 11 to 16 feet in borehole no. A1 is logged as flour gypsum but may represent very fine seed gypsum.

Seed gypsum varies in colour from white, cream, light brown and orange to yellow-brown and red brown at depth. The darker colour generally indicates the presence of clay. The maximum grain size of the seed in the auger samples was $\frac{1}{4}$ inch. Seed gypsum was penetrated to a depth of 30 feet, the limit of the boring plant, in borehole no. B4.

The seed gypsum is underlain by mottled yellowbrown, grey and green sandy clay which forms the surface of the depression at R.L. 62 feet. This clay contains the crystalline gypsum previously investigated by Whitten (1962). The mean gypsum content of the clay is 45% $\text{CaSO}_4 \cdot 2\text{H}_2\text{O}$.

The base of the seed gypsum slopes gently upwards towards the east to the 80 feet level (see cross-sections B-B', C-C', F-F' and G-G'). In cross-section B-B', a sandy and gravelly facies of the basal clay was detected and a lens of fine clayey sand was intersected from 6 to 9 feet in borehole B2 below the flour gypsum.

In cross-sections D-D' and E-E', seed gypsum is underlain by kunkar which caps the basal gypsaceous clays. The kunkar marks the edge of a more extensive depression which existed before the accumulation of the seed gypsum.. The maximum known thickness of kunkar is 6 feet, which was intersected in borehole no. D1.

Both flour and seed gypsum extend to the north and east beyond the area tested.

5. RESULTS OF PARTIAL CHEMICAL ANALYSES

The results of partial chemical analyses are summarised below; full details are appended and the gypsum content of the samples is included in the geological logs of the boreholes.

Flour Gypsum	Mean	Maximum
Gypsum ($\text{CaSO}_4 \cdot 2\text{H}_2\text{O}$)	83.6%	97.25% 0-3' in borehole no. A4.
Calcium Carbonate (CaCO_3)	4.1%	9.95% 0-3' in borehole no. F4.
Acid Insolubles	10.8%	25.8% 0-3' in borehole no. B1.
Iron Oxide (Fe_2O_3)	0.30%	1.29% 0-3' in borehole no. G1.
Salt (NaCl)	0.15%	0.38% 0-3' in borehole no. F3.
Seed Gypsum.	Mean	Maximum
Gypsum ($\text{CaSO}_4 \cdot 2\text{H}_2\text{O}$)	75.6%	95.75% 3-15' in borehole no. A4.
Calcium Carbonate (CaCO_3)	4.7%	24.25% 4-9' in borehole no. G2.
Acid Insolubles	17.4%	38.0% 6-12' in borehole no. D3.
Iron Oxide (Fe_2O_3)	0.58%	1.49% 9-12' in borehole no. B2.
Salt (NaCl)	0.16%	0.47% 9-12' in borehole no. D1.

The two samples collected from pits A and B, which represented vertical faces of 4 feet and 5 feet respectively, were included in the calculations of the mean assays for seed gypsum.

The thickest development of high grade seed gypsum was intersected in borehole no. B4 where 30 feet of gypsum averaged 93.7% $\text{CaSO}_4 \cdot 2\text{H}_2\text{O}$.

The content of acid insolubles increased generally with depth due to the presence of sand and clay toward the base of the seed gypsum.

The calcium carbonate (CaCO_3) content increased near the kunkar horizon. Much of the basal clay was rich in carbonate, 47.0% CaCO_3 was recorded from 9 to 12 feet in borehole E4.

No anomalously high amounts of either iron oxide (Fe_2O_3) or salt (NaCl) were obtained,

6. RESERVES

Reserves of crude gypsum proved by boring are:

400,000 cubic yards of flour gypsum, and

900,000 cubic yards of seed gypsum,

as outlined on the accompanying cross sections plan no. 64-253.

Total crude seed gypsum would exceed 1 million cubic yards as boroholes nos. A1, A2, A3, A4, B2, B4, C3, E3 and F2 did not reach the base of the gypsum dune. Total reserves within the two claims are in excess of these values as the gypsum extends north and east of the area tested.

With the removal of deleterious sand, clay and kunkar fragments, reserves of gypsum (specific gravity = 2.3) are estimated as:-

flour - with an average grade of 83.6% $\text{CaSO}_4 \cdot 2\text{H}_2\text{O}$

1/3 million cubic yards = $\frac{1}{3}$ million tons.

seed - with an average grade of 75.6% $\text{CaSO}_4 \cdot 2\text{H}_2\text{O}$

2/3 million cubic yards = 1 million tons.

The tonnages of refined gypsum obtained will depend on the efficiency of the beneficiation process.

7. CONCLUSIONS

Auger boring on a gypsum dune in Miscellaneous (Gypsum) Lease no. 665 intersected flour and seed gypsum underlain by kunkar, sand, gravel and gypseous clay.

Proved reserves of crude gypsum are 1,300,000 cubic yards, consisting of 400,000 cubic yards of flour and 900,000 cubic yards of seed gypsum.

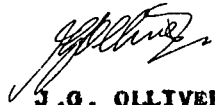
The average gypsum content of the flour is 83.6% $\text{CaSO}_4 \cdot 2\text{H}_2\text{O}$ and of the seed 75.6% $\text{CaSO}_4 \cdot 2\text{H}_2\text{O}$.

With an efficient upgrading process, the proved reserves could realise 1 million tons of refined seed gypsum, and half million tons of flour gypsum.

6.

Further boring is required to test the extension of the gypsum north and east of the area tested.

JGO:AGK:AWK
27.3.64


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APPENDIX I
GEOLOGICAL LOGS OF
MACHINE AUGER BOREHOLES.

Borehole No. A1

<u>Depth (feet)</u>		$\text{CaSO}_4 \cdot 2\text{H}_2\text{O}$ (%)	<u>Description</u>
<u>From</u>	<u>To</u>		
0	4	76.1	White flour gypsum.
4	11	70.8	Pale brown seed gypsum.
11	16	77.5	Pale brown flow gypsum with aggregates of seed.
16	20	63.4	Light brown seed gypsum.

Borehole No. A2

<u>Depth (feet)</u>		$\text{CaSO}_4 \cdot 2\text{H}_2\text{O}$ (%)	<u>Description</u>
<u>From</u>	<u>To</u>		
0	6	91.10	Offwhite flour gypsum.
6	12	84.55	Pale brown seed gypsum.
12	16½	74.20	Light brown seed gypsum.

Borehole No. A3

<u>Depth (feet)</u>		$\text{CaSO}_4 \cdot 2\text{H}_2\text{O}$ (%)	<u>Description</u>
<u>From</u>	<u>To</u>		
0	3)	90.60	White flour gypsum.
3	6)		Pale brown flour gypsum grading down into fine seed.
6	14	73.05	Light brown at top, darker with depth, seed gypsum.

Borehole No. A4

<u>Depth (feet)</u>		$\text{CaSO}_4 \cdot 2\text{H}_2\text{O}$ (%)	<u>Description</u>
<u>From</u>	<u>To</u>		
0	3	97.25	White flour gypsum.
3	15	95.75	Offwhite seed gypsum.
15	27	87.45	Light brown seed gypsum with some flour from 15 to 18 feet.

Borehole No. B1

<u>Depth (feet)</u>		$\text{CaSO}_4 \cdot 2\text{H}_2\text{O}$	<u>Description</u>
<u>From</u>	<u>To</u>	(%)	
0	3	59.1	Pale pink to brown sandy and clayey flour gypsum.
3	12	76.3	Cream fine seed gypsum.
12	18	58.75	Light brown sandy and clayey seed gypsum.
18	21	42.75	Light brown seed gypsum with abundant sand and clay and minor crystalline gypsum.
21	24		
			Yellow brown sandy clay with crystalline gypsum and kunkar fragments.

Borehole No. B2

<u>Depth (feet)</u>		$\text{CaSO}_4 \cdot 2\text{H}_2\text{O}$	<u>Description</u>
<u>From</u>	<u>To</u>	(%)	
0	6	84.55	White to pale brown flour gypsum.
6	9	37.25	Light brown fine clayey sand with seed gypsum.
9	12	52.95	Brown seed gypsum; clayey and sandy.
12	21	63.3	Light brown seed with white pellets of clay and seed gypsum.

Borehole No. B3

<u>Depth (feet)</u>		$\text{CaSO}_4 \cdot 2\text{H}_2\text{O}$	<u>Description</u>
<u>From</u>	<u>To</u>	(%)	
0	3	80.7	White flour gypsum.
3	12	69.0	Light brown to pink fine seed and flour gypsum.
12	18	63.3	Pale brown fine seed gypsum with minor sand.
18	21	48.55	Pale brown sand, clayey and gypsaceous.
21	24	25.85	Coarse sand to gravel, clayey and gypsaceous.
24	27	17.6	As for 21 to 24 feet with kunkar fragments.

Borehole No. B4

<u>Depth (feet)</u>		$\text{CaSO}_4 \cdot 2\text{H}_2\text{O}$
<u>From</u>	<u>To</u>	<u>(%)</u>
0	9	93.7
9	21	94.5
21	30	93.0

Description

White to pale brown seed gypsum.

Borehole No. C1

<u>Depth (feet)</u>		$\text{CaSO}_4 \cdot 2\text{H}_2\text{O}$
<u>From</u>	<u>To</u>	<u>(%)</u>

Description

0	3	83.85	White flour gypsum.
3	15	81.9	Pale brown to grey seed gypsum.
15	21	59.9	Pale brown seed gypsum sandy and clayey.
21	27	55.1	Light brown seed gypsum sandy and clayey with nodules of cemented seed.
27	30	48.4	Light yellow brown sandy clay with abundant crystalline gypsum and kunkar fragments.

Borehole No. C2

<u>Depth (feet)</u>		$\text{CaSO}_4 \cdot 2\text{H}_2\text{O}$
<u>From</u>	<u>To</u>	<u>(%)</u>

Description

0	10	85.7	Pale brown to white flour gypsum.
10	15	60.75	Light brown seed gypsum clayey and sandy.
15	21	39.7	Light brown sandy clay with seed gypsum.

Borehole No. C3

<u>Depth (feet)</u>		$\text{CaSO}_4 \cdot 2\text{H}_2\text{O}$
<u>From</u>	<u>To</u>	<u>(%)</u>

Description

0	3	92.3	Cream seed gypsum.
3	9	86.9	White flour gypsum with minor light red-brown clay at top.
9	12	83.2	Pale orange-brown fine seed gypsum.

Borehole No. C4

<u>Depth (feet)</u>		$\text{CaSO}_4 \cdot 2\text{H}_2\text{O}$
<u>From</u>	<u>To</u>	(%)
0	3	93.8
3	9	86.1
9	12	76.3
12	15	
15	18	54.7

Description

White to pale brown flour gypsum.

Pale orange-brown to pale yellow-fine seed with flour gypsum.

Cream seed gypsum.

Light brown seed gypsum.

Light brown seed over yellow brown clay containing crystalline gypsum.

Bore No. D1

<u>Depth (feet)</u>		$\text{CaSO}_4 \cdot 2\text{H}_2\text{O}$
<u>From</u>	<u>To</u>	(%)
0	3	92.8
3	9	76.7
9	12	74.3
12	21	58.6
21	24	37.6
24	27	29.0

Description

White flour gypsum.

Light brown to pale red-brown seed with minor flour gypsum.

Light brown seed gypsum with cemented pellets of seed gypsum.

Light brown seed, claywy with some kunkar fragments.

Kunkar fragments, light brown seed gypsum and clay.

Kunkar with less gypsum and clay.

Borehole No. D2

<u>Depth (feet)</u>		$\text{CaSO}_4 \cdot 2\text{H}_2\text{O}$
<u>From</u>	<u>To</u>	(%)
0	3	82.0
3	6	86.4
6	9	76.1
9	15	60.5
15	18	63.5
18	21	75.7
21	24	48.7

Description

Offwhite flour gypsum.

Offwhite fine seed gypsum.

Light brown seed gypsum with minor sand.

Pale yellow-brown fine sandy seed gypsum.

Pale red-brown seed gypsum with sand.

Pale brown to white seed gypsum.

Crystalline gypsum with kunkar fragments and light red-brwn clay.

Borehole No. D3

<u>Depth (feet)</u>		<u>CaSO₄.2H₂O</u>
<u>From</u>	<u>To</u>	<u>(%)</u>

0	6	73.3
6	12	52.7
12	15	66.5
15	18	-
18	21	-

Description

Pale brown flour gypsum.

Pale red-brown seed gypsum with fine to coarse sand.

As above but paler with less sand.

Kunkar pebbles with minor brown clay.

Grey calcareous clay with kunkar pebbles.

Borehole No. D4

<u>Depth (feet)</u>		<u>CaSO₄.2H₂O</u>
<u>From</u>	<u>To</u>	<u>(%)</u>

0	3	92.7
3	12	80.1
12	15	59.1
15	16½	27.4

Description

White flour gypsum over seed gypsum.

Pale orange-brown seed gypsum.

Pale orange-brown clayey and sandy seed gypsum.

Grey to yellow brown sandy clay with minor crystalline gypsum.

Borehole No. D5

<u>Depth (feet)</u>		<u>CaSO₄.2H₂O</u>
<u>From</u>	<u>To</u>	<u>(%)</u>

0	6	65.7
6	9	45.9

Description

Minor flour gypsum over light-brown seed with clay and some crystalline gypsum.

Crystalline gypsum and kunkar fragments in yellow-green clay.

Borehole No. E1

<u>Depth (feet)</u>		<u>CaSO₄.2H₂O</u>
<u>From</u>	<u>To</u>	<u>(%)</u>

0	3	78.1
3	9	83.0
9	12	73.5
12	18	77.6
18	21	51.0

Description

White flour over seed gypsum.

Seed gypsum, fine with some flour.

Seed gypsum, light brown.

Fine seed gypsum with flour.

Pale red-brwn clayey seed gypsum with kunkar fragments.

Borehole No. E2Depth (feet) $\text{CaSO}_4 \cdot 2\text{H}_2\text{O}$ From To (%)

0 6 83.4

6 9 79.6

9 12 65.0

12 14 24.7

Description

White flour gypsum.

Light brown seed gypsum with minor flour at top.

Light brown seed gypsum with sand.

Kunkar fragments with light brown clay, sand and seed gypsum.

Borehole No. E3Depth (feet) $\text{CaSO}_4 \cdot 2\text{H}_2\text{O}$ From To (%)

0 3 87.0

3 9 86.5

9 18 83.6

18 21 49.6

Description

Offwhite flour gypsum.

Pale brown fine seed gypsum.

As for 3 to 9 feet.

Pale brown seed gypsum with sand and minor kunkar fragments.

Borehole No. E4Depth (feet) $\text{CaSO}_4 \cdot 2\text{H}_2\text{O}$ From To (%)

0 3 84.7

3 9 40.7

9 12 29.2

Description

White flour gypsum over seed and crystalline gypsum.

Crystalline gypsum in pale yellow-brown sandy clay.

Yellow brown calcareous clay with crystalline gypsum.

Borehole No. F1Depth (feet) $\text{CaSO}_4 \cdot 2\text{H}_2\text{O}$ From To (%)

0 6 88.6

6 9 70.1

9 12 59.1

12 14 48.6

Description

Flour gypsum.

Flour over brown seed gypsum.

Orange brown clayey seed gypsum.

Brown seed gypsum with clay and minor kunkar fragments.

Borehole No. F2

<u>Depth (feet)</u>		$\text{CaSO}_4 \cdot 2\text{H}_2\text{O}$
<u>From</u>	<u>To</u>	<u>(%)</u>

0	3	82.1	Minor flour over seed gypsum.
3	6	83.4	Flour with minor seed gypsum.
6	9	78.9	Seed gypsum with minor flour.
9	12	53.1	Seed gypsum with sand and kunkar fragments.

Borehole No. F3

<u>Depth (feet)</u>		$\text{CaSO}_4 \cdot 2\text{H}_2\text{O}$
<u>From</u>	<u>To</u>	<u>(%)</u>

0	3	91.9	Flour gypsum.
3	12	72.0	Fine white to pale brown seed gypsum.
12	15	15.9	Calcareous clay with minor crystalline gypsum.

Borehole No. F4

<u>Depth (feet)</u>		$\text{CaSO}_4 \cdot 2\text{H}_2\text{O}$
<u>From</u>	<u>To</u>	<u>(%)</u>

0	3	74.3	Flour over fine seed gypsum.
3	6	69.8	Seed gypsum over crystalline gypsum in pale green-gray clay.
6	9	38.6	Crystalline gypsum in yellow-brown sandy and calcareous clay.

Borehole No. G1

<u>Depth (feet)</u>		$\text{CaSO}_4 \cdot 2\text{H}_2\text{O}$
<u>From</u>	<u>To</u>	<u>(%)</u>

0	3	70.8	Flour gypsum with nodules of seed gypsum.
3	6	65.0	Seed gypsum, clay at 6 feet.

Borehole No. 02Depth (feet) $\text{CaSO}_4 \cdot 2\text{H}_2\text{O}$

<u>From</u>	<u>To</u>	<u>(%)</u>
0	4	90.4
4	9	36.5
9	12	14.35

Description

Flour gypsum.

Clayey seed gypsum.

Kunkar fragments and yellow-brown clay with crystalline gypsum.

Borehole No. 03Depth (feet) $\text{CaSO}_4 \cdot 2\text{H}_2\text{O}$

<u>From</u>	<u>To</u>	<u>(%)</u>
0	12	91.1
12	15	39.2

Description

Pale brown coarse seed gypsum with minor flour on top.

Light brown seed over light green-grey clay.

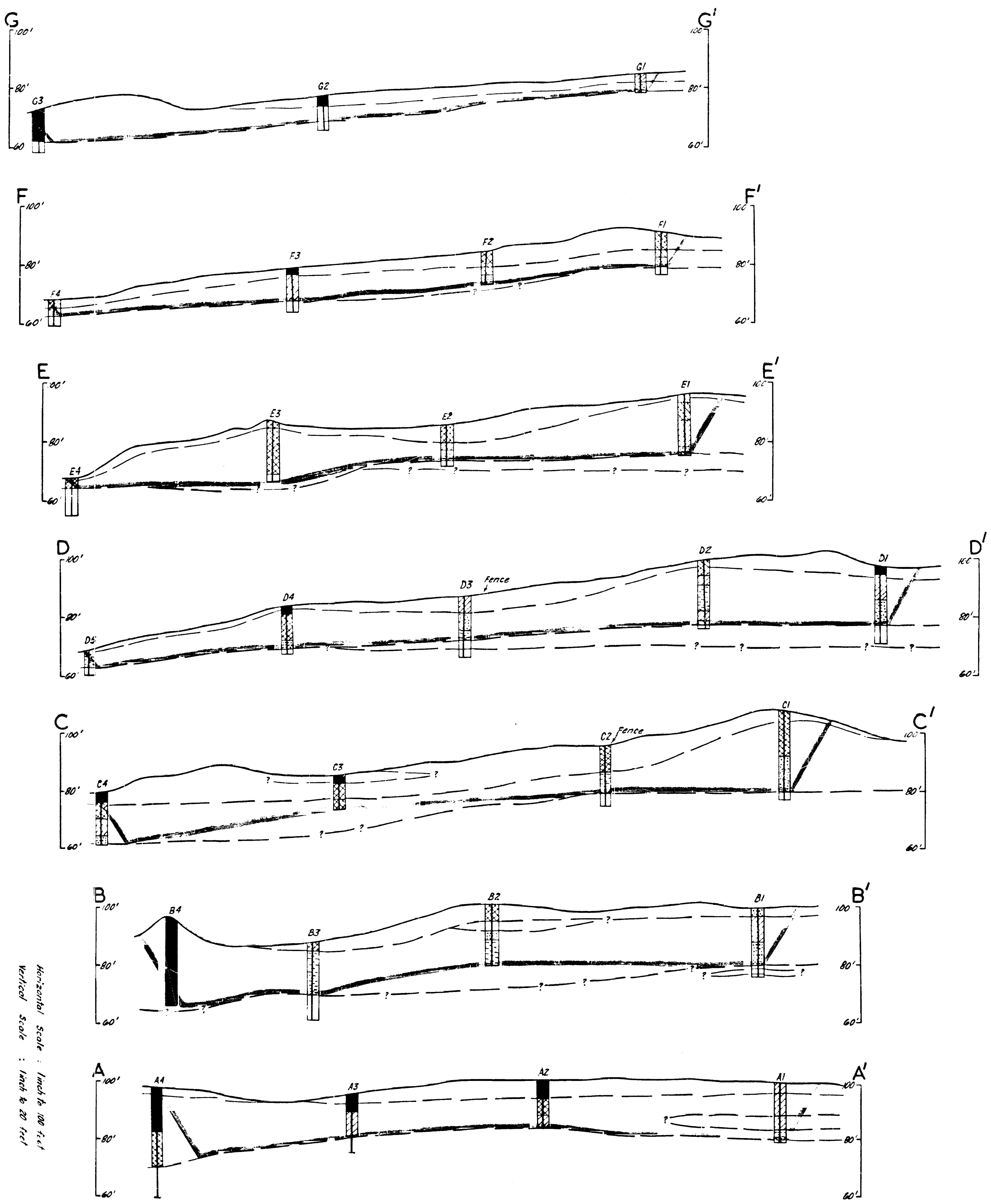
APPENDIX II
RESULTS OF PARTIAL
CHEMICAL ANALYSES

Bore	Sample	Depth (feet)		Gypsum $\text{CaSO}_4 \cdot 2\text{H}_2\text{O}$	Calc. Carb. CaCO_3	Insols.	Ferric Oxide Fe_2O_3	Salt NaCl
		From	To					
Pit								
Sample								
(1)	A3293/63	0	4	91.2	1.36	7.45	0.21	0.010
Pit								
Sample								
(2)	3294	0	3	94.3	1.31	4.40	0.17	0.015
A1	3295	0	4	76.1	7.34	14.0	0.62	0.025
	3296	4	11	70.8	4.22	23.1	4.06	0.150
	3297	11	16	77.5	4.27	16.5	0.52	0.175
	3298	16	20	63.4	11.1	21.5	1.26	0.230
A2	4022	0	6	91.10	2.70	9.40	0.17	0.19
	4023	6	12	84.55	4.45	16.20	0.13	0.16
	4024	12	16	74.20	5.40	26.40	0.96	0.23
A3	4025	0	6	90.60	3.25	10.45	0.26	0.18
	4026	6	14	73.05	3.40	26.85	0.71	0.17
A4	4027	0	3	97.25	1.95	3.50	0.08	0.12
	4028	3	15	95.75	1.20	4.50	0.16	0.06
	4029	15	27	87.45	2.50	13.05	0.33	0.13
B1	4063	0	3	59.1	9.55	25.8	1.06	0.23
	4064	3	12	76.3	5.25	15.55	0.59	0.16
	4065	12	18	58.75	8.15	27.9	1.37	0.26
	4066	18	24	42.75	28.80	22.7	1.64	0.27
B2	4067	0	6	84.55	2.55	11.45	0.29	0.09
	4068	6	9	37.25	5.0	50.3	1.94	0.34
	4069	9	12	52.95	6.45	34.7	1.49	0.39
	4070	12	21	63.3	4.65	28.7	0.83	0.18
B3	4071	0	3	80.7	3.1	14.0	0.36	0.16
	4072	3	12	69.0	4.0	24.45	0.59	0.21
	4073	12	18	65.5	5.7	27.1	0.57	0.15
	4074	18	21	48.55	9.7	39.75	0.65	0.15
	4075	21	24	25.85	34.8	36.0	1.14	0.16
	4076	24	27	17.6	36.7	38.9	1.68	0.51
B4	4077	0	9	93.7	1.65	4.03	0.15	0.02
	4078	9	21	94.5	1.45	4.12	0.15	0.06
	4079	21	30	93.0	1.23	4.95	0.17	0.07
C1	4080	0	3	83.85	2.6	11.40	0.17	0.01
	4081	3	15	81.9	1.8	14.3	0.29	0.10
	4082	15	21	59.9	4.93	29.25	1.21	0.23
	4083	21	27	55.1	10.7	26.76	1.45	0.26
	4084	27	30	48.4	25.6	19.0	1.6	0.18
C2	4085	0	10	85.7	4.73	6.85	0.4	0.15
	4086	10	15	60.75	6.75	25.35	1.5	0.32
	4087	15	21	39.7	7.83	42.85	2.37	0.54

Bore Sample	Depth (feet) From To	Gypsum		Calc. Carb.		Insols.	Ferric Oxide Fe ₂ O ₃	Salt NaCl
		CaSO ₄	2H ₂ O	CaCO ₃				
C3 A4088/63	0	3	92.3	1.78	5.7	0.17	0.06	
	4089	3	86.9	3.6	8.63	0.28	0.09	
	4090	9	83.2	4.13	10.8	0.43	0.17	
C4	4091	0	3	93.8	2.1	4.0	0.11	0.03
	4092	3	9	86.1	2.68	10.25	0.29	0.10
	4093	9	15	76.3	4.15	18.0	0.72	0.13
	4094	15	18	54.7	8.5	34.1	1.05	0.08
D1	4455	0	3	92.8	2.2	3.95	0.09	0.01
	4456	3	9	76.7	3.1	17.5	0.56	0.46
	4457	9	12	74.3	4.6	18.3	0.71	0.47
	4458	12	21	58.6	16.65	22.4	0.94	0.42
	4459	21	24	37.6	40.3	15.8	1.52	0.35
	4460	24	27	29.0	48.8	15.6	1.70	0.35
D2	4461	0	3	82.0	2.85	13.5	0.23	0.06
	4462	3	6	86.4	1.4	11.0	0.18	0.09
	4463	6	9	76.1	4.15	16.1	0.62	0.14
	4464	9	15	60.5	3.85	30.5	1.00	0.18
	4465	15	18	63.5	4.35	27.7	0.92	0.18
	4466	18	21	75.7	4.0	17.6	0.60	0.15
	4467	21	24	48.7	21.8	23.6	1.39	0.25
D3	4468	0	6	73.3	5.4	19.2	0.42	0.25
	4469	6	12	52.7	5.4	38.0	1.00	0.21
	4470	12	15	66.5	4.8	25.9	0.76	0.22
D4	4095	0	3	92.7	1.79	4.90	0.08	n11
	4096	3	12	80.1	2.70	14.8	0.23	0.23
	4097	12	15	59.8	7.57	28.8	0.33	0.15
	4098	15	16	27.4	17.6	48.4	0.71	0.47
D5	4099	0	6	65.7	9.25	21.8	0.29	0.08
	4100	6	9	45.9	35.6	17.5	0.37	0.06
E1	4471	0	3	78.1	2.25	18.1	0.29	0.03
	4472	3	9	83.0	2.7	13.0	0.30	0.14
	4473	9	12	73.5	4.7	19.4	0.58	0.14
	4474	12	18	77.6	4.75	16.0	0.36	0.12
	4475	18	21	51.0	19.9	25.2	0.98	0.27
E2	4476	0	6	83.4	3.95	11.8	0.29	0.18
	4477	6	9	79.6	5.4	11.9	0.44	0.22
	4478	9	12	65.0	7.05	23.7	1.14	0.31
	4479	12	14	24.7	50.1	19.3	1.29	0.35
E3	4480	0	3	87.0	2.45	9.0	0.20	0.02
	4481	3	9	86.5	2.2	9.8	0.25	0.18
	4482	9	18	83.6	2.15	13.1	0.35	0.12
	4483	18	21	49.6	11.2	36.1	1.09	0.23
E4	4484	0	3	84.7	3.75	9.3	0.35	0.03

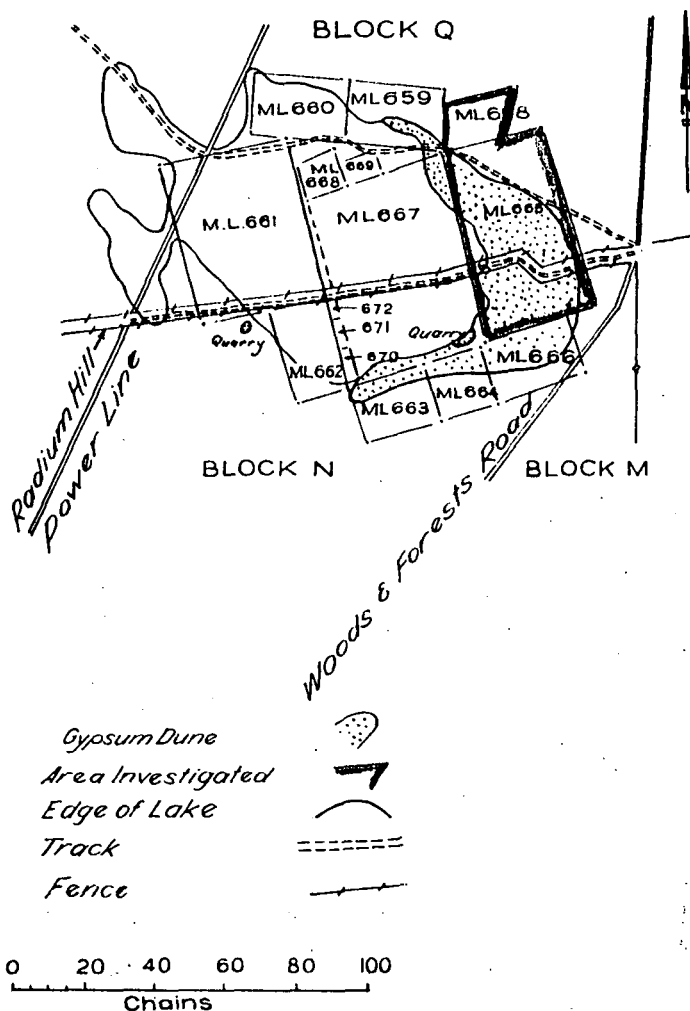
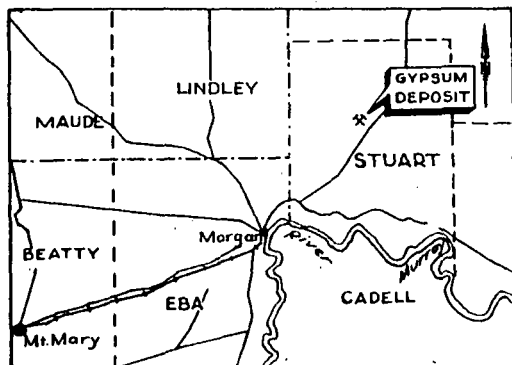
Bore Sample	Depth (feet)		CaSO ₄ ·2H ₂ O	CaCO ₃	Insols.	Fe ₂ O ₃	NaCl	
	From	To						
E4	4485	3	9	40.7	37.8	16.4	1.26	0.01
	4486	9	12	29.2	47.0	18.6	1.92	0.05
F1	4487	0	6	88.6	4.35	4.7	0.20	0.23
	4488	6	9	70.1	6.15	18.8	0.95	0.29
	4489	9	12	59.1	4.8	28.8	1.15	0.20
	4490	12	14½	48.6	13.5	31.05	1.45	0.28
F2	4491	0	3	82.1	1.8	12.9	0.30	0.23
	4492	3	6	83.4	2.5	11.6	0.29	0.31
	4493	6	9	78.9	4.0	14.0	0.58	0.26
	4494	9	12	53.1	21.4	21.1	1.00	0.25
F3	4495	0	3	91.9	2.75	3.6	0.10	0.38
	4496	3	12	72.0	4.2	20.95	0.60	0.19
	4497	12	15	15.9	37.1	38.9	1.74	0.13
F4	4505	0	3	74.3	9.95	13.8	0.44	0.02
	4506	3	6	69.8	16.9	11.3	0.48	0.01
	4507	6	9	38.6	37.3	18.9	1.35	0.02
G1	4498	0	3	70.8	5.3	17.8	1.29	0.29
	4499	3	6	65.0	6.65	22.3	1.38	0.23
G2	4500	0	4	90.4	3.8	3.6	0.10	0.33
	4501	4	9	36.5	24.25	34.0	1.18	0.36
	4502	9	12	14.35	44.4	33.4	1.69	0.51
G3	4503	0	12	91.1	2.6	4.9	0.21	0.07
	4505	12	15	39.2	19.6	37.4	0.93	0.05

Associated Drawing	No.	No.	Amendment	Exd.	Date
Req. No.	Completed from				
D.M.					
S.A. DEPT. OF MINES MORGAN GYPSUM DEPOSIT CROSS SECTIONS BLOCKS Q & N HD. STUART ML. 665 & 678 C.H. KUCHEL					
Approved	Passed	Dm. B.L.S.			
Director of Mines		Gf.			
Scale: As above		Date 2-1-61			
64-253					



- | | | |
|---|--|----------------------------------|
| % $\text{CaSO}_4 \cdot 2\text{H}_2\text{O}$ | | Gypsum flour |
| 90-100% | | Gypsum seed |
| 80-90 | | kunkar |
| 70-80 | | Clay, sand and gypseous in parts |
| 60-70 | | Sand and gravel |
| 50-60% | | |

- Reserves calculated from areas outlined
- Approximate Geological Boundary
- ? Inferred Geological Boundary



To accompany report by G. Oliver

S.A. DEPARTMENT OF MINES

Approved	Passed	Drn.	MORGAN GYPSUM DEPOSIT	D.M.	Scale <i>Various</i>
		Tcd. <i>G.M.</i>	HP STUART BLKS Q & N	Req.	53625
		Ckd.	LOCALITY PLAN		Gf1
Director		Exd.			Date 26.3.64