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COMMONWEALTH OF AUSTRALIA

DEPARTMENT OF
NATIONAL DEVELOPMENT

BUREAU OF MINERAL
RESOURCES, GEOLOGY
AND GEOPHYSICS

EVAPORITE DRILLING IN THE AMADEUS BASIN: GOYDER PASS, GARDINER RANGE AND LAKE AMADEUS, NORTHERN TERRITORY

by

A.T. Wells and P.J. Kennewell

Record 1972/36

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SUMMARY

As part of a program of exploration for minerals of economic value in evaporite deposits, three exploratory drill holes to 300 m and a fourth to 100 m were drilled by the Bureau of Mineral Resources in the Amadeus Basin in the southern part of the Northern Territory, central Australia. The holes were located on outcrops of gypsum within the late Precambrian Bitter Springs Formation to determine if other evaporites occurred at depth, and if they contained any economic deposits.

BMR Mount Liebig No. 1 was sited on a dome-like structure and penetrated anhydrite-dolomite-gypsum caprock before intersecting halite at 100 m. The halite was relatively pure and continued to total depth of 305 m.

BMR Lake Amadeus No. 3B penetrated contorted gypsum with minor dolomite to 250 m, then laminated evaporite rock consisting of gypsum, dolomitic anhydrite, and anhydrite to total depth of 305 m.

BMR Hermannsburg No. 40 was drilled on the Goyder Pass Structure and was prematurely abandoned after penetrating about 40 metres of Tertiary clastic rocks and about 60 metres of cavernous unconsolidated siltstone and pyritic chert.

BMR Alice Springs No. 3 has been described by Stewart (1969) and intersected 260 m of gypsum, anhydrite, and dolomite.

Analyses of the cores gave insignificant potassium values and no native sulphur was noted. The holes are now plugged and abandoned.

The results of the drilling program indicate that future exploration for both these minerals should, at first, be concentrated on deposits which show evidence of a diapiric origin. These types of deposits commonly contain sulphur deposits and possibly potash and are relatively inexpensively explored by shallow drilling techniques.

COMPLETION REPORT

BMR MOUNT LIEBIG NO. 1

by

P.J. Kennewell

INTRODUCTION

BMR Mount Liebig No. 1, the third in a series of four continuously cored holes drilled in the late Precambrian Bitter Springs Formation of the Amadeus Basin, was sited 210 km west of Alice Springs and 40 km west of Areyonga Native Settlement, in the southern part of the Northern Territory.

It is situated on an outcrop of gypsum 400 m across on the southern side of the Gardiner Fault, a major structural feature of the area. Outcrop immediately around the gypsum is obscured by alluvium, and the stratigraphic sequence near the drillsite could not be ascertained. The aim of the drilling was to investigate the mineralogy of the evaporites at depth, and in particular to see if any economic deposits, such as potassium and sulphur, were present.

The hole was drilled by the Petroleum Technology Section, BMR (E.H. Cherry, party leader) using a Mayhew 1000 drilling rig. Continuous coring using mainly rotary air drilling was used throughout. Water for all drilling and domestic purposes was obtained from Areyonga Native Settlement. Access to the drillsite from the Mereenie to Areyonga road is via 5 km of unmade track.

The hole was completed at a total depth of 305.87 m (1003'6").

WELL HISTORY

GENERAL DATA

Well name and number:	BMR Mount Liebig No. 1
Location:	Lat. 23°52'30"S; Long. 131°56'00"E
Title holder:	United Canso Oil and Gas (N.T.) Pty Ltd
Petroleum title number:	OP 56
Area:	Amadeus Basin, Northern Territory
Total depth:	Driller: 305.87 m (1003'6")
	Mibolog: 303.89 m (997'), 303.51 m (996')
Date drilling commenced:	4th August 1970
Date drilling completed:	11th September 1970
Date well secured:	15th September 1970
Date rig released:	15th September 1970
Drilling time to total depth:	Coring: 124¼ hr
	Reaming: 100½ hr
Elevations:	Rotary table: 1.20 m (4') above ground level
	Ground level: 817 m (2680') approx.
Status:	Plugged and abandoned

DRILLING DATA

Drilling by:	Bureau of Mineral Resources, Canberra, ACT
Drilling plant:	Make: Mayhew
	Type: 1000
	Rated capacity: 305 m (1000') with
	6.03 cm (2⅜") drill pipe
Mast:	Make: Mayhew
	Type: tubular, 7.01 m (23')
	Rated capacity: 18,140 kilograms
	(40,000 lbs)

Pumps:		Make: Gardner Denver
		Type: FG-FXG
		Size: 12.7 cm x 15.2 cm (5" x 6")
		Motors: as for rig.
Compressor:		Make: Gardner Denver
		Type: 2 stage reciprocating
		Model: WXH
		Motors: as for rig
Blowout preventor:		Make: Baash Ross
		Size: 15.2 cm x 6.03 cm (6" x $2\frac{3}{8}$")
		Model: Autolock
		Working pressure: 70 kgf/cm^2 (1000 psi)
Hole sizes:		0 to 42.98 m (0' to 141'): 25.4 cm (9 7/8")
		42.98 m to 305.87 m (141' to 1003'6"):
		15.8 cm ($6\frac{1}{4}$")
Casing strings:		Size: 20.3 cm x 0.47 cm wall (7" x 3/16" wall)
		Grade: water bore
		Weight: 32.3 kg/m (21.7 lb/ft)
		Set at: 42.98 m (141')
Casing cement:		Size: 20.3 cm (8")
		Sacks cement: 22
		Cement rise: to 28 m (90')
		Method: single stage, plug
Drilling fluid;	Coring:	Interval: 0 m to 305.87 m (0' to 1003'6")
		Type: air
	Reaming:	Interval: 0 m to 19.81 m (0' to 65')
		Type: air
		Interval: 19.81 m to 42.98 m (65' to 141')
		Type: salt saturated mud

Water supply:	Water from Areyonga Native Settlement was used for all purposes.
Perforation and shooting record:	Nil
Plugging back and squeeze cement jobs;	
Coring:	Nil
Reaming:	Depth: 25.30 m (83')
	Quantity: 5 bags
	Depth: 37.49 m (123')
	Quantity: 5 bags
	Depth: 40.23 m (132')
	Quantity: 5 bags
	Depth: 44.50 m (146')
	Quantity: 5 bags
Side-tracked hole:	Nil
Fishing operations:	Nil

PERSONNEL AND ADMINISTRATIVE

Shifts run:	Daily: 2
	Weekly: 12
Hours per shift:	12
Party Leader:	E. Cherry
Drillers:	A. Zoska
	L. Keast
Drillers Assistant:	E. Reid

LOGGING AND TESTING

Ditch Cuttings

A continuous sample of the dust produced by the drilling was obtained for the intervals 0 m to 75.59 m (0' to 235') and 89.92 m to 305.87 m (295' to 1003'6"). The dust was collected in a dry receptacle placed beneath the rotary table and directly beside the hole. The receptacle was emptied and duplicate samples taken on completion of each core, generally at 3.05 m (10') intervals. One set of samples is stored at the BMR Core and Cuttings Laboratory, Fyshwick, A.C.T. The duplicate set is stored at the Mines Branch, NTA at Alice Springs. Some difficulty was experienced in washing the cuttings. The coring bits produce a very fine powder, the greater part of which washed away or dissolved, leaving practically no sample. Accordingly it was decided not to wash the samples.

Cores

Continuous coring was maintained from 2.74 m (9') to total depth. The cores were cut with a 3.05 m (10') Triefus split inner tube core barrel using 10.0 cm (3 15/16") soft formation coreheads which cut 6.4 cm (2½") diameter cores. The rate of penetration in both the upper gypsum-bearing and lower halite-bearing zones was comparatively rapid. The texture throughout both these zones was uniform and no beds of hard rock were encountered.

Ninety nine cores were cut, all 6.4 cm (2½") diameter. Of a total depth of 305.87 m (1003'6"), 298.76 m (980'4") was cored. Total core recovery was 290.76 m (954'1"). The recovery over the intervals where coring was attempted was 97.3%, and core was obtained over 95.1% of the hole. Details of the cores are set out in Table I.

TABLE I Core Intervals and Recovery - BMR Mount Liebig No. 1

Core No.	From	To	Interval	Recovery	Percent
1	2.74	5.64	2.90	2.90	100
2	5.64	7.62	1.98	1.83	92
3	7.62	10.67	3.05	1.68	55
4	10.67	12.34	1.67	1.42	85
5	12.34	15.39	3.05	2.84	93
6	15.39	16.91	1.52	1.52	100
7	16.91	19.96	3.05	3.05	100
8	19.96	21.48	1.52	1.52	100
9	21.48	24.53	3.05	3.00	98
10	24.53	27.58	3.05	3.05	100
11	27.58	30.63	3.05	2.90	95
12	30.63	33.68	3.05	2.94	96
13	33.68	36.73	3.05	2.92	96
14	36.73	39.77	3.04	3.04	100
15	39.77	42.82	3.05	3.05	100
16	42.82	45.87	3.05	3.05	100
17	45.87	48.92	3.05	3.05	100
18	48.92	51.97	3.05	3.05	100
19	51.97	58.04	3.05	2.44	80
20	55.02	58.06	3.04	2.13	70
21	58.06	61.11	3.05	3.05	100
22	62.48	64.62	2.14	2.06	96
23	64. 62	67.97	3.35	2.74	82
24	67.97	71.02	3.05	3.05	100
25	71.02	75.59	4.57	3.35	73
26	75.59	78.64	3.05	2.74	90

Core No.	From	To	Interval	Recovery	Percent
27	78.64	80.77	2.13	2.13	100
28	82.30	86.87	4.57	3.35	73
29	86.87	98.92	3.05	3.05	100
30	89.92	92.96	3.04	3.04	100
31	92.96	96.01	3.05	3.05	100
32	96.01	99.06	3.05	3.05	100
33	99.06	102.11	3.05	3.05	100
34	102.11	105.16	3.05	3.05	100
35	105.16	108.20	3.04	3.04	100
36	108.20	111.25	3.05	3.05	100
37	111.25	114.30	3.05	3.05	100
38	114.30	117.35	3.05	3.05	100
39	117.35	120.40	3.05	3.05	100
40	120.40	123.44	3.04	3.04	100
41	123.44	126.49	3.05	3.05	100
42	126.49	129.54	3.05	3.05	100
43	129.54	132.59	3.05	3.05	100
44	132.59	135.64	3.05	3.05	100
45	135.64	138.68	3.04	3.04	100
46	138.68	141.73	3.05	3.05	100
47	141.73	144.78	3.05	3.05	100
48	144.78	147.83	3.05	3.05	100
49	147.83	150.88	3.05	3.05	100
50	150.88	153.92	3.04	3.04	100
51	153.92	156.97	3.05	3.05	100
52	165.97	160.02	3.05	3.05	100
53	160.02	163.07	3.05	3.05	100
54	163.07	166.12	3.05	3.05	100
55	166.12	169.16	3.04	3.04	100

Core No.	From	To	Interval	Recovery	Percent
56	169.16	172.21	3.05	3.05	100
57	172.21	175.26	3.05	3.05	100
58	176.48	179.53	3.05	3.05	100
59	179.53	182.58	3.05	3.05	100
60	182.58	185.62	3.04	3.04	100
61	185.62	188.67	3.05	3.05	100
62	188.67	191.72	3.05	3.05	100
63	191.72	194.77	3.05	3.05	100
64	194.77	197.82	3.05	3.05	100
65	197.82	200.86	3.04	3.04	100
66	200.86	203.91	3.05	3.05	100
67	203.91	206.65	2.74	2.52	92
68	206.65	209.70	3.05	3.05	100
69	209.70	212.75	3.05	3.05	100
70	212.75	215.80	3.05	3.05	100
71	215.80	218.85	3.05	3.05	100
72	218.85	221.89	3.04	3.04	100
73	221.89	224.94	3.05	3.05	100
74	225.25	228.30	3.05	3.05	100
75	228.30	231.34	3.04	3.04	100
76	231.34	234.39	3.05	3.05	100
77	234.39	237.44	3.05	3.05	100
78	237.44	240.49	3.05	3.05	100
79	240.49	243.54	3.05	3.05	100
80	243.54	246.58	3.04	3.04	100
81	246.58	249.63	3.05	3.05	100
82	249.63	254.20	4.57	4.27	93
83	254.20	257.25	3.05	3.05	100
84	257.25	250.30	3.05	3.05	100

Core No.	From	To	Interval	Recovery	Percent
85	260.30	263.35	3.05	3.05	100
86	263.35	266.40	3.05	3.05	100
87	266.40	269.44	3.04	3.04	100
88	269.44	272.49	3.05	3.05	100
89	272.49	274.54	3.05	3.05	100
90	275.54	278.59	3.05	3.05	100
91	278.59	281.64	3.05	3.05	100
92	281.64	284.68	3.04	3.04	100
93	284.68	287.73	3.05	3.05	100
94	287.73	290.78	3.05	3.05	100
95	290.78	293.83	3.05	3.05	100
96	293.83	296.88	3.05	3.05	100
97	296.88	299.92	3.04	3.04	100
98	299.92	302.97	3.05	3.05	100
99	302.97	305.86	2.89	2.79	97

NOTE: The metric figures in this table have been obtained by conversion of the original depths measured in feet and inches. Because the value of 10 ft in the metric system is precisely 3.0480 m, intervals of that length are calculated to values of both 3.05 m and 3.04 m.

Side-wall Sampling: Nil

Well-logging

The hole was logged by Mibolog Pty Ltd and the logs run are summarised in Table II. The logging contract called for the running of an integrated acoustic velocity log. A suitable logging tool was not available, and a density log was run in its place. A short discussion of the logs is given on page 38

TABLE II - Logging Details - BMR Mount Liebig No. 1

Log Type	Run No.	Depth Interval	Curves	Vertical Scale
Guard	1	54.25 m - 303.58 m (178' - 996')	Spontaneous Potential	1 cm = 2.40 m (1" = 20')
Guard	1	54.25 m - 303.58 m (178' - 996')	Resistivity	1 cm = 2.40 m (1" = 20')
Gamma Ray	1	42.06 m - 303.58 m (138' - 996')	Gamma Ray	1 cm = 2.40 m (1" = 20')
Neutron	1	42.06 m - 303.58 m (138' - 996')	Neutron	1 cm = 2.40 m (1" = 20')
Density	1	42.06 m - 303.28 m (138' - 995')	Density	1 cm = 2.40 m (1" = 20')
Caliper	1	42.06 m - 303.28 m (138' - 995')	Caliper	1 cm = 2.40 m (1" = 20')

Gas log: Nil

Formation testing: Nil

Deviation surveys: Nil

Other hole surveys: Nil

SUMMARY OF DRILLING OPERATIONS

Drilling commenced on BMR Mount Liebig No. 1 on 4/8/70. Rotary air methods were employed, using an 11.4 cm ($4\frac{1}{2}$") non-coring bit to a depth of 2.74 m. Coring then commenced using a 3.05 m (10') core barrel and continued to a depth of 61.11 m (200'6"). The hole was reamed to 11.4 cm ($4\frac{1}{2}$") diameter at 9.14 m (30') intervals.

Rotary air methods were attempted in reaming the hole to 25.3 cm (9 7/8") diameter so that 20.3 cm (8") water bore casing could be run. It was found that the compressor was not powerful enough to lift the cuttings above 19.81 m (65') because of the large diameter of the hole. Two 3.05 m (10') drill collars 13.5 m (5½") in diameter together with one 4.57 m (15') drill collar 11.4 cm (4½") in diameter were used with little success. Salt-saturated mud was mixed and reaming continued using this. Circulation was lost four times, at depths of 25.30 m (83'), 37.49 m (123'), 40.23 m (132') and 44.50 (146'), and the hole had to be cemented in each instance. 20.3 cm (8") water bore casing was then run to a depth of 42.98 m (141') and cemented in place.

Reaming to 11.4 cm (4½") using salt-saturated mud continued to 62.48 m (205'). Coring recommenced using a 3.05 m (10') barrel with reaming to 11.4 cm (4½") at 9.14 m (30') intervals. Coring was continuously maintained to total depth of 305.87 m (1003'6"). The hole was then reamed to 15.8 cm (6¼") diameter for electric logging.

GEOLOGY

SUMMARY OF PREVIOUS WORK

Geological

Early geological investigations in the area surrounding the drillsite were cursory (Wells et al.,1965; Ranford, 1969); regional mapping of the Amadeus Basin was only started by the Bureau of Mineral Resources in 1956, and continued from 1960 to 1964. This work is synthesized by Wells et al. (1970). The geology of the northwestern part of the basin, including the Mount Liebig No. 1 drillsite, was studied in 1961 (Wells, Forman & Ranford, 1965). Geological maps at 1:250,000 scale were produced for the whole of the Amadeus Basin, and the drillsite is located in the southeastern corner of the Mount Liebig Sheet area (SF/52-16). Explanatory notes to accompany the geological map have been compiled by Ranford (1969).

Two shallow trenches at right angles were cut by Magellan Petroleum (N.T.) Pty Ltd across the gypsum outcrop on which BMR Mount Liebig No. 1 was located and later used as roads. The aim of these trenches was to investigate the nature of the outcrop and their location can be seen on the sketch map (Fig. 5).

Geophysical

Magnetic

An airborne magnetic survey of the Amadeus Basin was made by BMR in 1965 (Young & Shelley, 1966), but the spacing of the flight lines was too wide to reveal any magnetic anomaly which could be related to the gypsum outcrop. The drillsite is on the southern edge of a magnetic basement depression which includes the deepest part of the Amadeus Basin. This depression contains about 11,600 m of sediments, and is aligned east-southeast, parallel to the northern margin of the basin. A minor lobe of the depression extends south and under the drillsite. The interpreted depth to magnetic basement beneath the drillsite is approximately 10,600 m.

Gravity

A gravity survey of the Amadeus Basin using helicopters was carried out by the BMR in 1961 and 1962 (Langron, 1962, Lonsdale & Flavelle, 1968). The spacing of the gravity stations was too large to reveal a gravity anomaly which could be related to the gypsum outcrop. On a regional scale, the drillsite is situated on the southern side of the large, asymmetric Amadeus Gravity Depression, which extends in an easterly direction across the northern Amadeus Basin. The gravity depression shows a minimum of -145 milligals north of the drillsite. This minimum is in roughly the same position as the closure on maximum depths to magnetic basement.

More detailed gravity surveys were carried out by Magellan Petroleum (N.T.) Pty Ltd (Froelich & Krieg, 1969) on the Missionary Plain, to the north of the drillsite. The traverses that cross the Gardiner Fault reveal a gravity gradient of 5 to 7 milligals with the southern upthrown side being positive.

Radiometric

An airborne radiometric survey of the Amadeus Basin was made by the BMR in conjunction with the 1965 airborne magnetic survey (Young & Shelley, 1966). The survey did not reveal an anomaly which could be related to the gypsum outcrop. On a regional scale the drillsite is on the northern edge of a zone of high radioactivity with an east-southeast axis which corresponds to that of the Gardiner Range Anticline. The zone of high radioactivity reflects the strike of the beds in the area. It is probably related to either the occurrence of phosphorites in the Larapinta Group sediments, which crop out on the southern flank of the anticline, or to beds of shale in the Pertaoorrta Group.

Seismic

The Missionary Plain, to the north of the drillsite, has been intensely investigated by Magellan Petroleum (N.T.) Pty Ltd using reflection seismic methods. One seismic traverse crossed the Gardiner Fault near the

gypsum outcrop. Three shot points were located on the south side of the fault, but no continuous seismic events were recorded from these shots. This was presumably due to the steep and irregular dip of the beds on the south side of the fault, and the proximity of the fault itself. Seismic investigations have been conducted by the BMR in the Gosses Bluff region (Moss, 1964). One traverse crossed the Gardiner Fault, demonstrating that it is an overthrust with a hade of 15 to 20 degrees to the south.

Drilling

No drilling had previously been carried out near the drillsite. The Bitter Springs Formation has been intersected in six petroleum exploration wells drilled in the Amadeus Basin. East Johnny Creek No. 1, Ochre Hill No. 1 and James Range "A" No. 1 were drilled in the central portion of the basin, 54 km and 64 km southwest, and 115 km east-southeast of BMR Mount Liebig No. 1 respectively. These intersected dolomite, limestone and shale in the Bitter Springs Formation, but no evaporites. Ooraminna No. 1, Mount Charlotte No. 1 and Erldunda No. 1 were drilled in the eastern portion of the basin, intersecting limestone, dolomite, beds of halite and minor gypsum and anhydrite in the Bitter Springs Formation at depths of 1200 to 2000 metres.

Seven petroleum exploration wells have been drilled on the Mereenie Anticline, 40 to 55 km south-southeast, one well in the centre of Gosses Bluff, 40 km east, and one well at Tyler, 48 km east-northeast. These all terminated either in Ordovician or Upper Cambrian sediments with the exception of East Mereenie No. 4. This well terminated in the Bitter Springs Formation but did not penetrate any evaporite section.

REGIONAL GEOLOGY

The Amadeus Basin is an intracratonic depression elongated east-west and covering 150,000 sq km (60,000 sq. miles).

In late Precambrian times sand occumulated in a very wide stable epicontinental shelf environment (Heavitree Quartzite) on an eroded surface of

Arunta Complex metamorphics. Probably as a result of mild epeirogeny, deposition became restricted and limited access to the sea gave conditions favourable for the deposition of evaporites (Gillen Member of the Bitter Springs Formation, - the beds penetrated by the drilling). Marine conditions then prevailed and the stromatolitic carbonates and shales of the Loves Creek Member accumulated. These rocks have an age of approximately 1100 m.y. (Wells et al., 1970).

The Aregonga Movement terminated deposition of the Bitter Springs Formation. An uplifted region south of the basin provided the source of 5000 m of clastic sediments deposited immediately to the north. The northern part of the basin was a shelf area on which 700 m of late Proterozoic shale and oolitic carbonate rocks were deposited. The tectonism must have caused some uplift and erosion of the Bitter Springs Formation, as in places it is unconformably overlain by the younger sediments.

In the late Proterozoic or early Cambrian the Petermann Ranges Orogeny uplifted and folded a large area in the southern part of the basin; its effects on the northern shelf area were small. The uplifted areas were the source of sediments of the Lower Palaeozoic Pertaoorrta and Larapinta Groups, each about 3000 m thick. These sediments include the Chandler Limestone, which also contains evaporites. Beds of halite up to 200 m thick have been intersected in this formation by oil wells.

Peneplanation and then deposition of Mereenie Sandstone followed before the next major tectonic event, the Alice Springs Orogeny, took place in the late Devonian. The major folding and faulting of the northern portion of the Amadeus Basin occurred, with synchronous deposition of the molasse deposits of the Pertnjara Group. The folding and faulting of sediments in the Gardiner Range occurred during this period.

It has been suggested by Wells et al. (1970) that this deformation took place by a décollement or plane of detachment which undoubtedly followed the evaporite beds in the Bitter Springs Formation. The incompetent evaporites acted as a 'lubricant' while the basement and Heavitree Quartzite remained undeformed.

Geophysical data suggests that the basement floor throughout the basin is very gently folded and is generally at depths in excess of 3000 m. The Bitter Springs Formation is exposed in eroded anticlinal cores and on fault planes but there are no associated outcrops of Heavitree Quartzite or basement. Gravity minima exist over many of these outcrops, suggesting a thickening of low density evaporite rocks, and seismic surveys show flat lying basement (Wells et al., 1970). Outcrops of the evaporite bearing formations show strong contortion and brecciation.

Stewart (pers. comm. in Wells et al., 1970) has suggested that in the northeast part of the basin large masses of sediment have moved possibly many miles south by sliding on décollement surfaces. Movement has taken place on both the Bitter Springs and Chandler Limestone evaporite horizons and in some places the detachment surface starts in the lower horizon and transgresses through intervening sediments into the upper horizon. A similar transgressive thrust zone may be present in the Gardiner Fault (see Fig. 52 in Wells et al., 1970).

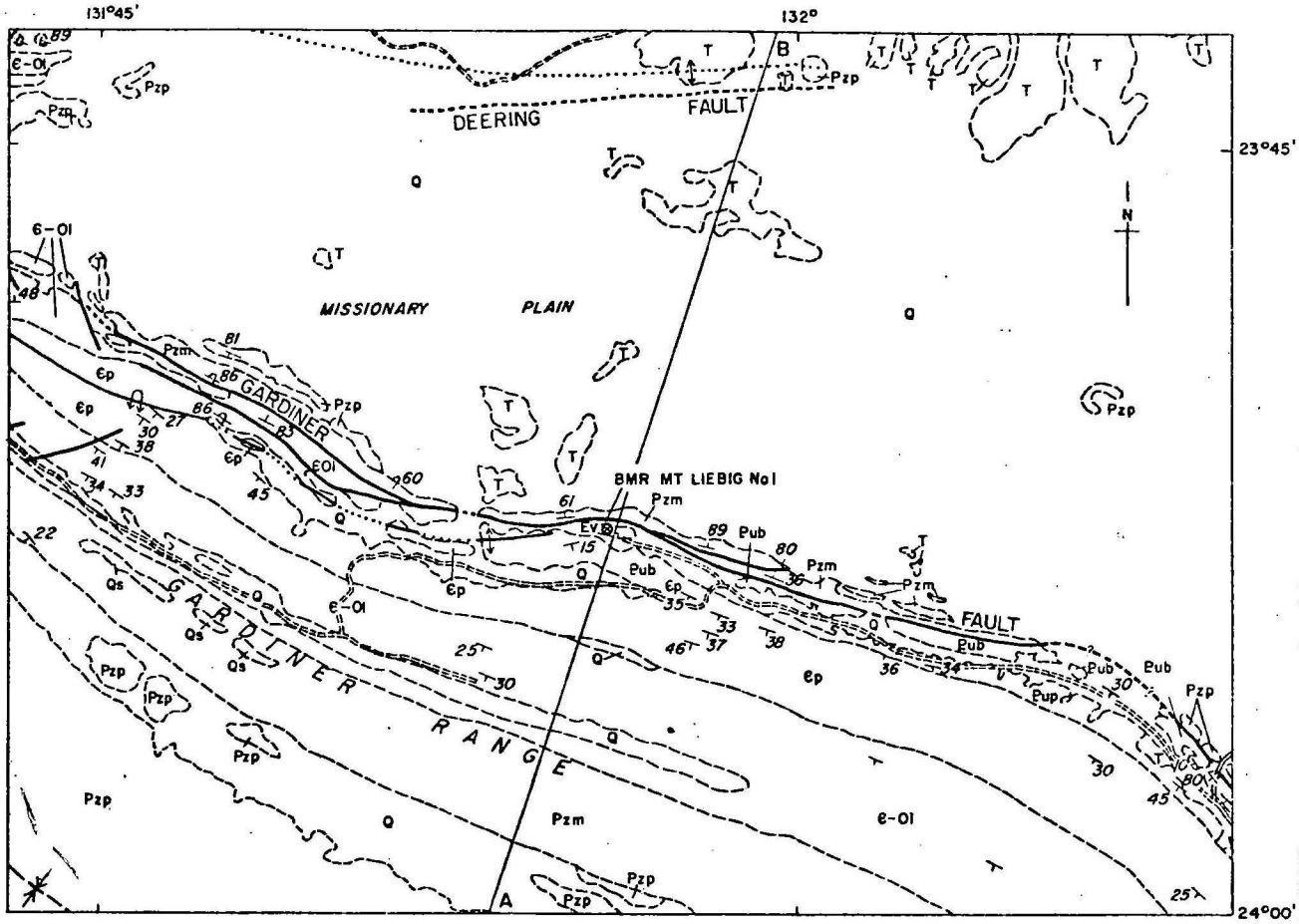
DRILLSITE GEOLOGY

The drillsite is situated on the north-east side of the Gardiner Range, which is a series of east-west ridges and valleys corresponding with hard and soft formations; relief is in the order of 300 m.

The Gardiner Fault, which crops out approximately 400 m north of the drillsite strikes east-west. It is a thrust fault with a hade of 15 to 20° (Moss, 1964) and a displacement of at least 6000m(Fig. 3). It was formed during the late Devonian by compressional forces of the Alice Springs Orogeny acting from the north-northeast. Sediments of the northern side were thrust underneath those of the south.

Fig. 1

GEOLOGICAL MAP OF GARDINER RANGE



QUATERNARY	Undifferentiated	Q	*Sand and alluvium*
TERTIARY	Undifferentiated	T	*Conglomerate, sandstone*
DEVONIAN to CARBONIFEROUS	Pertnjara Group	Pzp	*Sandstone, pebbly sandstone, siltstone*
SILURIAN ? to DEVONIAN	Mereenie Sandstone	Pzm	*White sandstone*
CAMBRIAN to ORDOVICIAN	Larapinta Group	Є-Ol	*Sandstone, siltstone, limestone*
CAMBRIAN	Pertaoorrta Group	Єp	*Sandstone, siltstone*
PROTEROZOIC	Pertatataka Formation	Pup	*Siltstone, shale, sandstone, limestone*
	Areyonga Formation	Pua	*Calcareous sandstone, siltstone, conglomerate*
	Bitter Springs Formation	Pub	*Dolomitic limestone, shale, evaporites*
	Heavitree Quartzite	Puh	*Quartzite, sandstone (Fig 2 only)*
PRECAMBRIAN	Arunta Complex	pEa	*Gneiss, schist, amphibolite, quartzite, granite (Fig 2 only)*

Fault

Geological boundary, position approximate

Fault, position approximate

Anticline

Strike and dip of strata

Anticline, position approximate

Overturned strata

Overturned anticline

Vehicle track

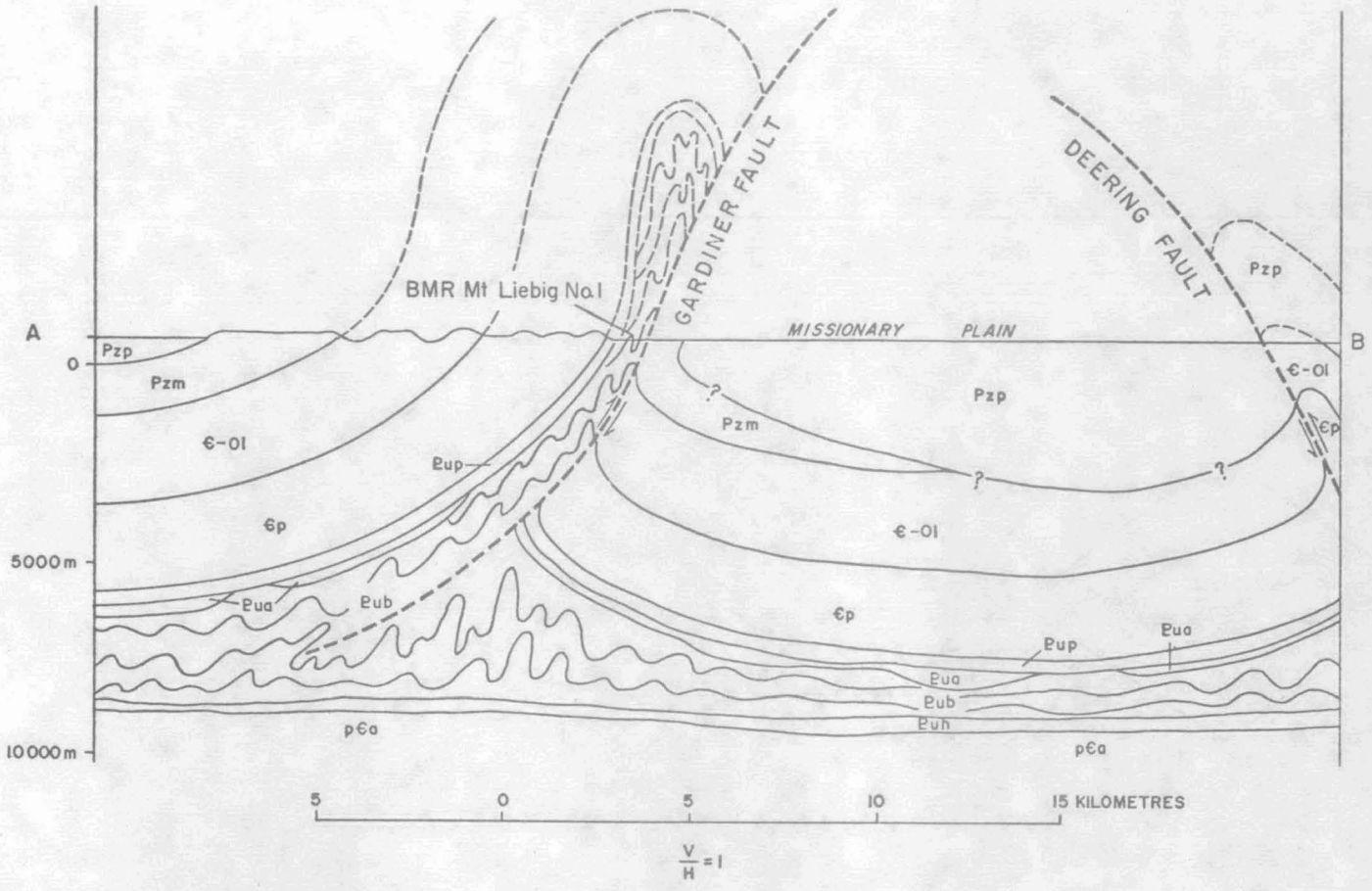
Syncline

Evp *Drill hole (evaporites)*

Geology by A.T. Wells et al. 1965. Compiled from 1:250,000 Geological Series. Mt Liebig SF 52-16 and Hermannsburg SF 53-13 Sheets

To Accompany Record 1972/36

NT/A342

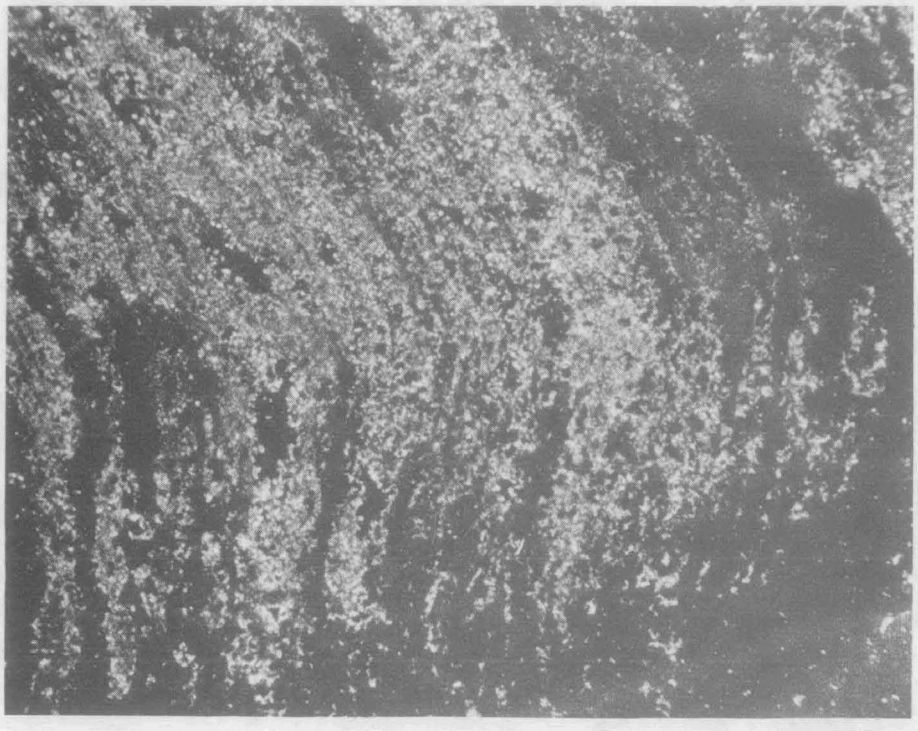


For legend see Fig 1

Fig 2 INFERRED CROSS SECTION OF GARDINER FAULT AREA

To Accompany Record 1972/36

NT/A343



M/1195-18

Fig. 3 Contorted laminae of finely crystalline quartz (white) and halite (black).
Thin Section 70-50-0123 Depth 253.39 m (831'4")
X nicols. 20X.

Geophysical surveys indicate that the basement underneath the fault zone is flat lying; all movement during the faulting apparently took place by décollement in the evaporite sequence of the Bitter Springs Formation with the basement remaining undisturbed. Bitter Springs Formation acted as a lubricant along the fault plane; it crops out immediately to the south of the fault along 50 km of its length.

Further south of the fault is a sequence of southwesterly dipping sediments of Proterozoic to ?Lower Carboniferous age. The Cambrian Eninta Sandstone crops out to the south of the drillsite as a prominent ridge of massive red sandstone dipping south at 35°.

To the north the Devonian Mereenie Sandstone is folded vertically against the fault plane forming a prominent ridge; in places it is slightly overturned (Fig. 2). North of the ridge is the Missionary Plain, where alluvium and Tertiary sediments conceal the underlying geology.

The gypsum outcrop (Fig. 5) occurs on a rise with relief in the order of 40 m. It is ellipsoidal in outline and 400 m across (Fig. 5). The surface is covered with secondary gypsum which in places is more than 0.5 m thick. A crust of coherent earthy gypsum up to 5 cm thick is underlain by white, friable earthy gypsum. Within this surface deposit there are secondary gypsum crystals which have been corroded along their cleavage planes by meteoric waters. They occur both as single crystals up to 15 cm long and as large masses of smaller crystals up to 2 cm across. Gypsum crops out as a coarsely crystalline, friable variety with an equigranular texture and brown and white mottling. Another variety is pink to brown, extremely coarsely crystalline and has a granular texture. The gypsum becomes fluted when weathered and in single crystals the fluting follows cleavage planes.

The gypsum outcrop is bordered on the south by a lenticular mass of breccia (Fig. 5). This thins to the east and the outcrop to the west is obscured by alluvium. The breccia contains white to grey laminated fragments

of slightly calcareous dolomite, dolomitic chert and chert up to 15 cm across. The reddish brown matrix consists of calcite, dolomite and quartz with a trace of chlorite.

A sinkhole occurs in the bed of the creek southwest of the drillsite (Fig. 5). It is 5 m across and has a small drainage hole 0.5 m diameter at its base. It probably formed when a ridge of more resistant rock dammed the creek as it flowed off the soft gypsum outcrop. The rubble in the creek bed is composed of gypsiferous travertine for some distance downstream from the gypsum outcrop.

Outcrop around the gypsum is sparse and concealed by alluvium. The composition of pebbles on the surface may indicate the underlying lithology and has been recorded on the outcrop map (Fig. 5). Shale is the dominant rock type on the western side, ferruginous sandstone on the south, and stromatolitic dolomite of the Bitter Springs Formation on the northeast.

An examination of 2X enlargements of air photographs (Mt Liebig R14/5160 and 5161) by C. Simpson revealed that the gypsum outcrop forms a low dome shaped topographic rise.

LITHOLOGICAL DESCRIPTION OF ROCK TYPES

Introduction

The classification of rock types shown on the composite log has been devised after a study of sixteen thin sections of core. These were selected to cover the range of rock types and to yield as much information as possible on texture and mineralogy.

Difficulties were encountered in preparing the thin sections. Many of the rock types were friable and had to be impregnated with resin to prevent their disintegration while being sectioned. Because halite occurs in variable amounts in most of the rocks, it was necessary to make all thin sections in kerosene. Most were prepared with quartz grains mounted around the edge of the rock slice to ensure uniform and standard thickness throughout.

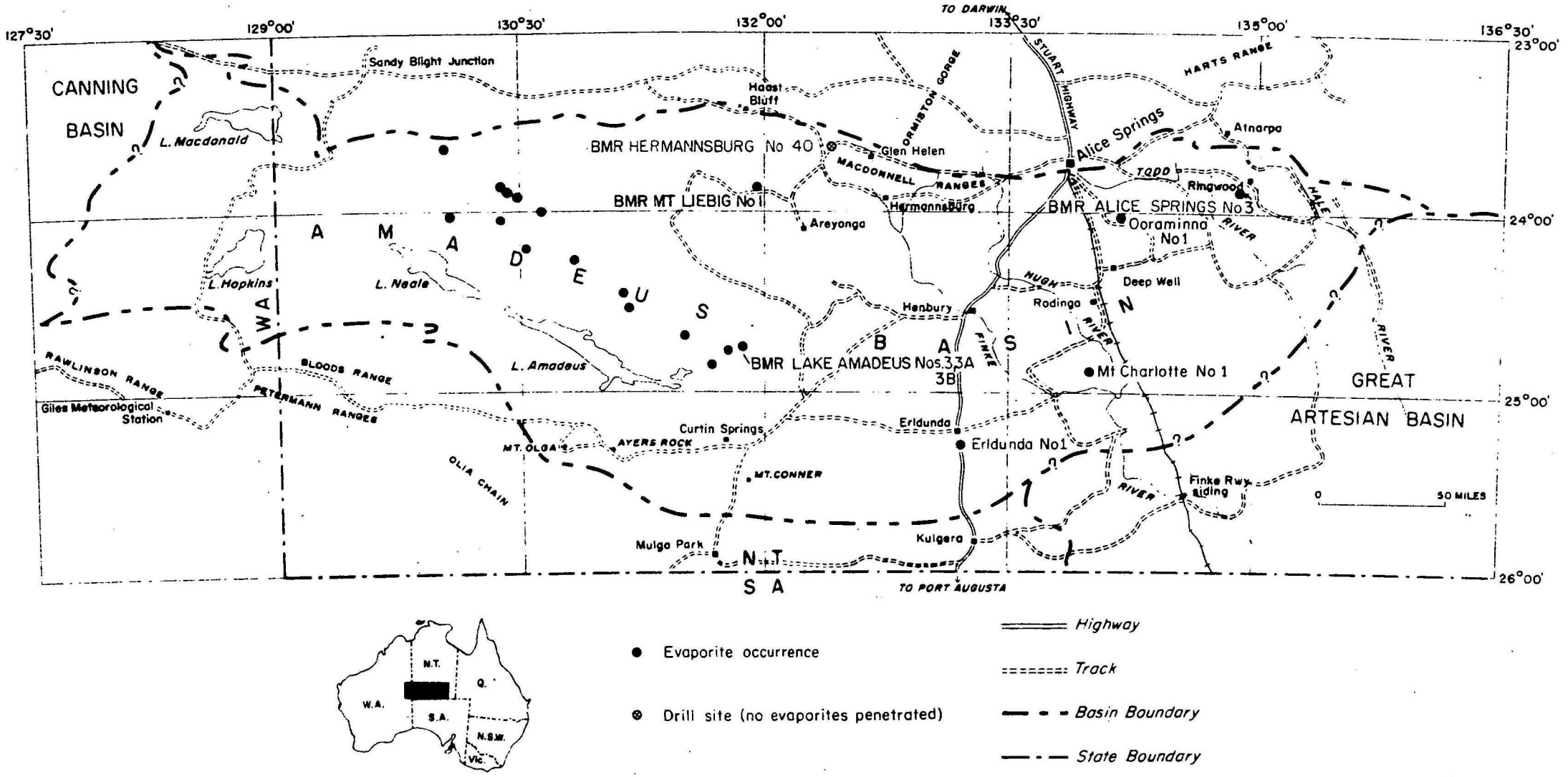


Fig. 4. Amadeus Basin showing location of BMR drillsites and position of known evaporite occurrences in Bitter Springs Formation

To Accompany Record 1972/36

NT/A344

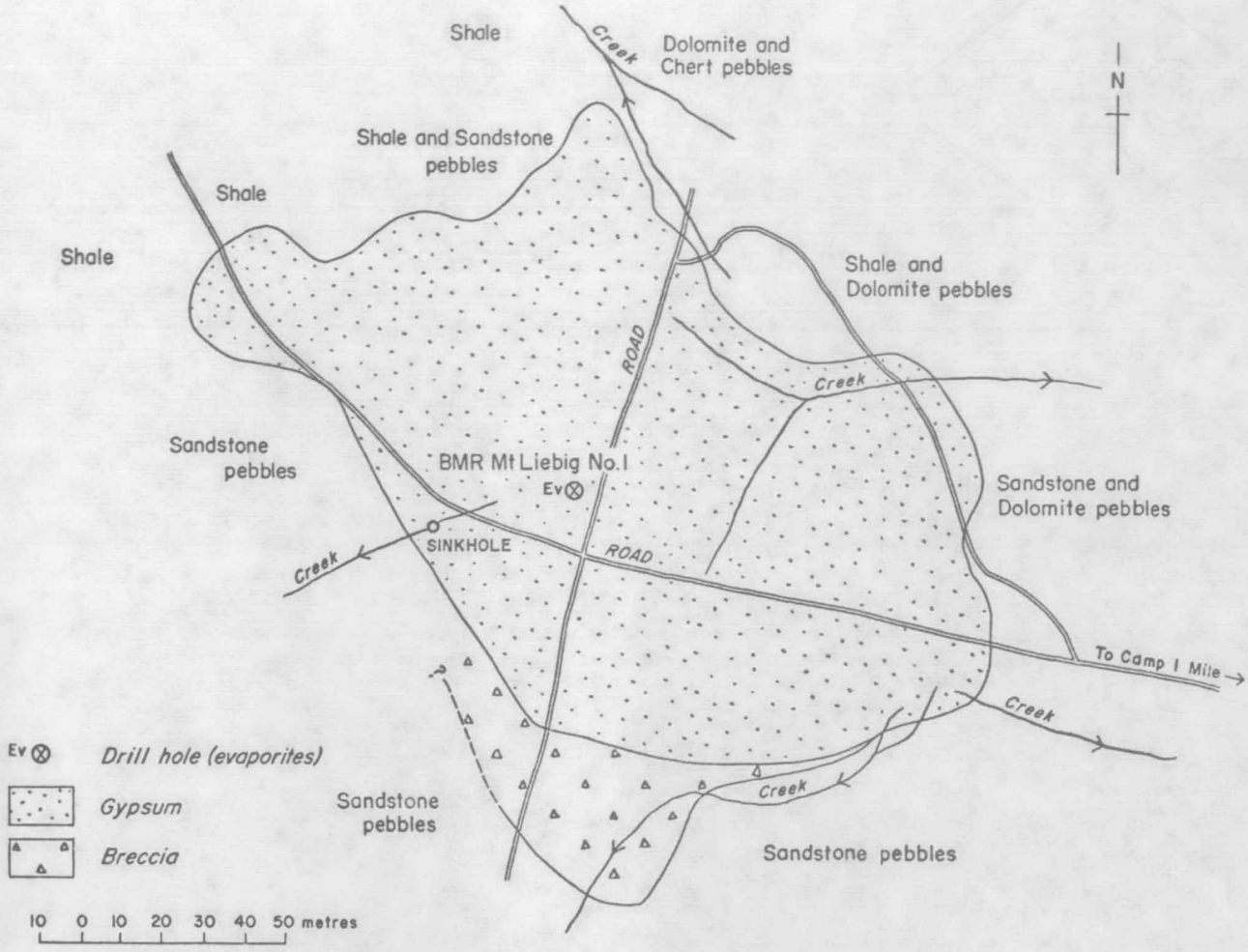
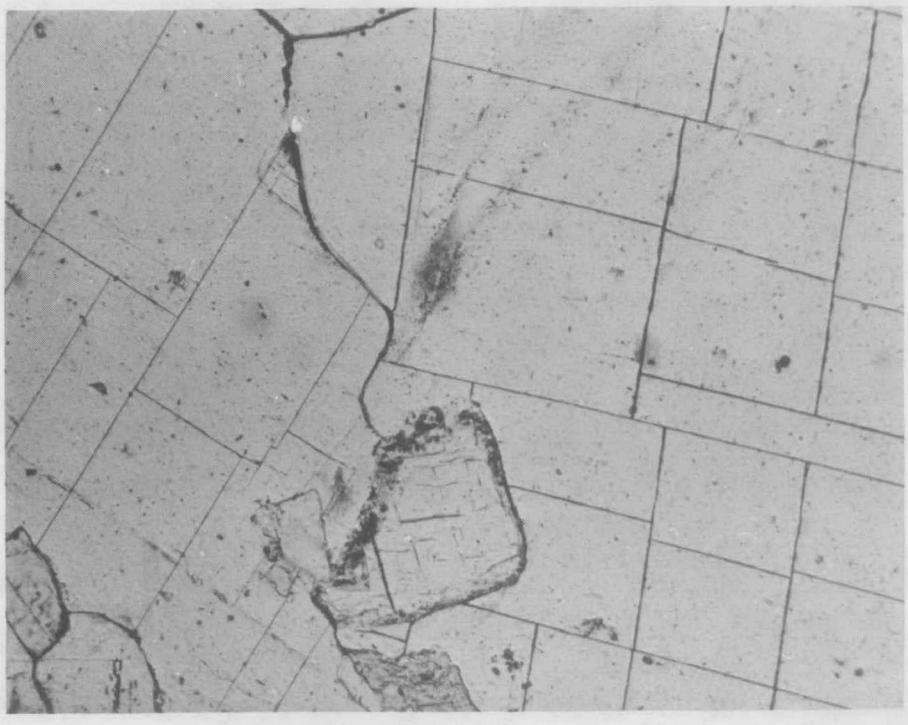


Fig 5 GEOLOGICAL SKETCH MAP, GARDINER RANGE GYPSUM OCCURRENCE F52/A16/27

To Accompany Record 1972/36



M/1195-23

Fig. 6 Halite, showing perfect cubic cleavage, irregular crystal boundaries, and crystal with anhydrite inclusions (lower centre). Thin Section 70-50-0123 Depth 253.39 m (931'4") Plane polarised light. 60X.

Identification of the minerals in twenty one samples was carried out by X-ray diffraction analyses. Nineteen samples were selected from the core, together with two samples from the breccia which crops out south of the drillsite. Many of the samples were selected from the same rock specimen from which a thin section had been prepared. This enabled most of the minerals present in the thin section to be positively identified.

Most minerals in the cores originated either as primary chemical precipitates or as a product of recrystallization. There are very few detrital minerals present. Therefore it is considered that rock classifications based on size of detrital grains are unsuitable. A crystal size classification for recrystallized carbonates has been suggested by Folk (1964). This has been adopted throughout this record and is shown below:-

Extremely coarsely crystalline	over 4.00 mm
Very coarsely crystalline	1.00 - 4.00 mm
Coarsely crystalline	0.25 - 1.00 mm
Medium crystalline	0.0625 - 0.25 mm
Finely crystalline	0.0156 - 0.0625 mm
Very finely crystalline	0.0039 - 0.0156 mm
Aphanocrystalline	under 0.0039 mm

It is not known whether the dolomite and quartz in the core have an evaporitic origin or not. For the purposes of this record they are discussed with the evaporite minerals.

Following common practice, a rock composed dominantly of a single mineral has been refered to throughout most of the record by the name used for the mineral. To avoid confusion in the chapters on lithological description of rock types and cores, "rock" has been used after the mineral name when reference is made to an aggregate of crystals composed dominantly of one mineral.

Detailed Lithology

Gypsum Rock

Gypsum rock is present in the core from the surface to a depth of about 90 m (295'). It is white and pink and in places light grey. The texture is granular, even, and generally coarsely crystalline, but crystal size is variable, ranging from medium crystalline to extremely coarsely crystalline. The gypsum rock occurs both as massive beds up to 1 m thick and as elongated fragments with their long axes oriented subvertically in a matrix of recrystallized evaporite breccia.

Minor impurities are present throughout the gypsum rock. Dolomite is irregularly distributed as fine anhedral crystals enclosed within the coarse gypsum crystals. The dolomite crystals are concentrated near irregular fractures and cleavage traces.

Sparse, very fine to medium quartz crystals are scattered throughout the gypsum rock. They are anhedral to euhedral and in places appear to be elongated with their long axes parallel to the gypsum cleavage planes. The mode of occurrence of both the quartz and dolomite suggests that they are of secondary origin. Recrystallization has affected the gypsum in places. Aggregates of medium crystals with a granular texture and similar optical orientation replace very coarse gypsum crystals.

Rarely, e.g. at 58 m (190'), veins of acicular gypsum rock infill fractures. These veins appear to be made up of numerous "fibres" of gypsum oriented at right angles to the walls of the vein. Microscopic examination reveals that the "fibres" are elongate single gypsum crystals. Acicular gypsum rock is sometimes referred to as satin spar.

Anhydrite Rock

Anhydrite is rare above 76 m (250'). From 76 m to 90 m (295') it coexists with gypsum; the texture suggests that gypsum is formed by hydration of anhydrite. From 90 m (295') to 92.05 m (301'11") no gypsum is present and anhydrite rock is abundant. Below 92.05 m (301'11") anhydrite is one of the constituents of evaporite rock.

Dolomite Rock

Dolomite rock is common throughout the upper 92.05 m (301'11") of the core. It grades from white to light grey and has an even, massive texture. Hardness varies considerably as a result of both the fine crystal size and the presence of thin integranular films of limonite and chlorite.

Dolomite rock occurs both as elongated fragments in a matrix of recrystallized evaporite breccia and as massive beds up to 1 m thick. The texture is granular with very fine to fine anhedral crystals. Minor amounts of quartz and gypsum and/or anhydrite are present, with traces of limonite and chlorite. It resembles siltstone in hand specimen, and this term was used in field descriptions.

Recrystallised Evaporite Breccia

Recrystallised evaporite breccia forms a matrix for fragments of gypsum, dolomite and anhydrite rock in the upper 92.05 m (301'11") of the core. It is light to dark brown, soft and friable, and is composed of fragments left after leaching of halite. It was further fragmented by later movement of the halite, and recrystallised by percolating meteoric waters. The breccia fragments range from 0.002 mm to 1 cm in diameter. The larger fragments are mostly composed of finely crystalline dolomite, gypsum or anhydrite rock. The smaller fragments consist of single crystals of quartz, dolomite and some haematite. Gypsum and anhydrite are rare.

Recrystallization to varying degrees has taken place and the resultant texture is neoporphyritic; fine to coarse secondary crystals have formed at the expense of the original fine to very fine crystals and fragments. Gypsum is apparently the first mineral to recrystallize, as it is rare as fragmented crystals. Even where recrystallization is slight, coarse to extremely coarse anhedral and subhedral secondary crystals of gypsum are present. These crystals occur in fractures between fragments and as inclusions in the fragments themselves. Secondary coarse euhedral crystals of dolomite, quartz, anhydrite and sparse haematite are present throughout the rock.

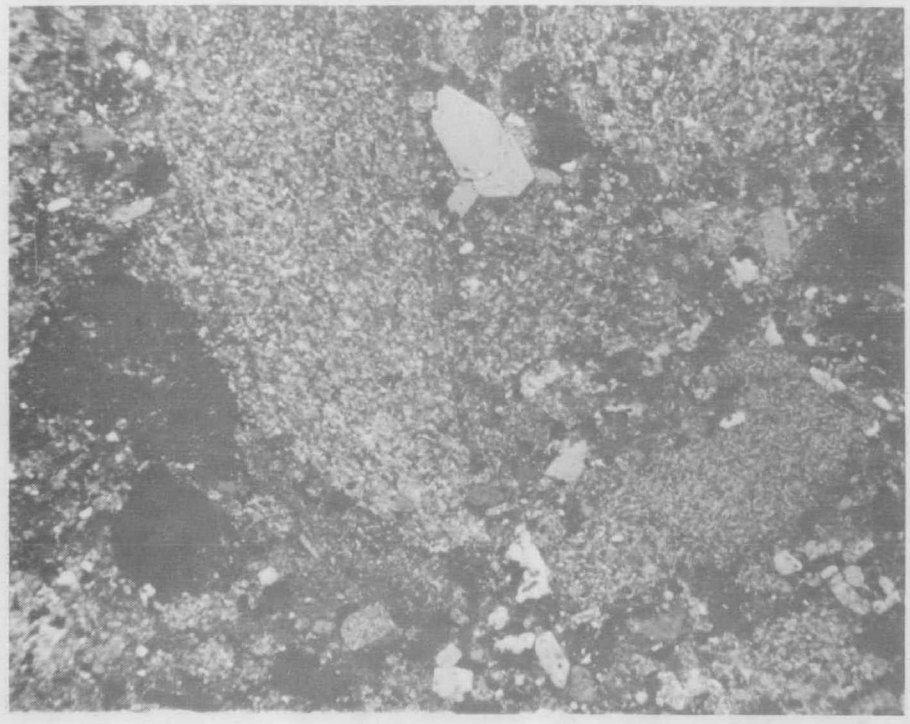
The degree of recrystallization varies from slight to almost complete. Remnants of the original brecciated texture consist of finely crystalline dolomite and quartz with intergranular limonite. These remnants occur as a matrix for the secondary crystals.

Gypsum partly replaced by bassanite is common in most of the thin sections. This is probably caused by heating of the rock during either drilling or grinding of the thin sections.

Halite Rock

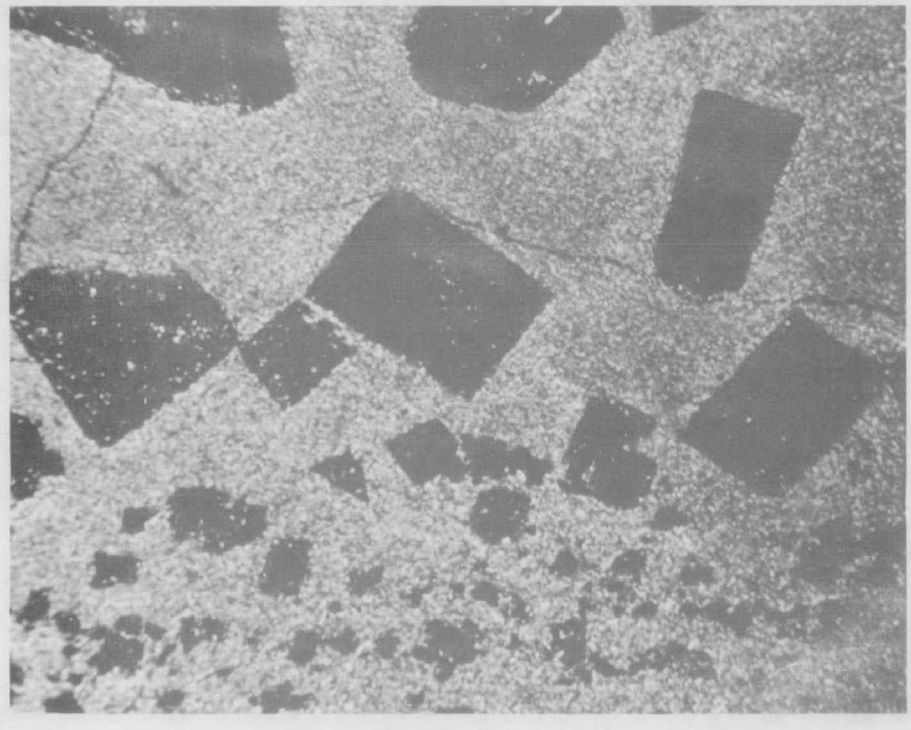
From 93.05 m (301'11") to total depth the core consists predominantly of halite rock. It is mostly orange-brown, dark brown, pink, or rarely colourless. It is compact, equigranular and extremely coarsely crystalline. In thin section the crystals are anhedral and exhibit perfect cubic cleavage with a regular lattice pattern. Sparse euhedral to subhedral medium crystalline anhydrite and very sparse anhedral medium crystalline dolomite are scattered throughout the halite. Some halite crystals contain lines of aphanocrystalline anhydrite and ?quartz inclusions approximately 0.02 mm wide, and 0.05 mm apart. The lines show no obvious relationship to the cleavage traces.

Rounded fragments of impure halite rock 0.25 mm to 15 cm across are scattered throughout parts of the halite rock. They contain generally 20 percent, and in places up to 80 percent very finely to coarsely crystalline anhydrite, together with sparse fine euhedral crystals of haemetite which have partly stained the halite light reddish brown. The staining gives the fragments a deep brown colour in hand specimen and distinguishes them from the paler halite matrix. Lines of liquid inclusions, curved in parts, are present in some crystals. These bear no obvious relationship to the cleavage planes and are not continuous across grain boundaries. The inclusions are less than 0.003 mm in diameter, and contain bubbles less than 0.001 mm in diameter which vibrate due to Brownian movement.



M/1195-29

Fig. 7 Fragments of dolomite - anhydrite rock in recrystallized evaporite breccia.
Thin Section 70-50-0115 Depth 91.52 m (300'3")
X nicols. 20X.



M/1195-27

Fig. 8 Euhedral halite crystals in matrix of finely crystalline anhydrite, dolomite and quartz.
Thin Section 70-50-0118 Depth 137.31 m (450'6")
X nicols. 20X.

The junction of the halite with the overlying recrystallised evaporite breccia at 93.03 m is horizontal but serrated. There is replacement of the halite rock by anhydritic recrystallised evaporite breccia at this contact.

Throughout the core halite rock is fractured into plates along horizontal planes; these have been referred to as fracture planes in the core descriptions. The spacing of fracture planes is variable and has been defined for the purposes of the core descriptions as follows:-

Finely spaced:	less than 2.5 cm
Medium spaced:	2.5 cm to 8 cm
Coarsely spaced:	greater than 8 cm

The fractures possibly result from the release of vertical pressure, and their formation has been aided by splitting of halite crystals along cleavage planes. The drilling may have relieved the confining pressure, or alternatively erosion may have relieved the pressure of overburden. The fractures have been accentuated by drilling, as the upper portion of each core is always finely fractured, while the lower portion is both finely and coarsely fractured.

Evaporite Rock (Medium Crystalline)

The medium crystalline evaporite rocks vary from white to light grey, light grey-green and light brown. The crystal size varies from 0.5 mm to 0.025 mm, but is mostly medium crystalline. Hardness varies from moderately hard to hard. The rocks occur as beds and fragments in a matrix of halite rock from 93.03 m (301'11") to total depth. Beds are up to 0.7 m thick, and fragments range from 1 cm to 8 cm in length; they are often elongated and their long axes are oriented in a near vertical position.

The rocks vary extremely in mineralogy and are composed of anhydrite, dolomite and quartz with minor halite, chlorite and haematite. In some specimens the minerals are present in equal quantities, while in others dolomite, anhydrite or quartz predominate and the other minerals are subordinate. No gypsum has been found in these rocks.

Microscopic examination revealed that the field subdivisions of these rocks, based on colour and hardness, bore no relation to mineralogy and little relation to grainsize. Colour depends on small amounts of haemetite, limonite and chlorite. Hardness is dependent not on the hardness of constituent minerals, but on the cohesion of the crystals. This is affected by minor amounts of intergranular limonite and chlorite. Coarser crystalline varieties generally contain smaller amounts of these minerals and are harder, while finer crystalline varieties contain larger amounts and are softer. No further subdivision of the medium crystalline evaporite rocks is possible without examination of individual thin sections.

The degree of recrystallisation of these rocks varies considerably. Anhydrite and quartz appear to recrystallise most readily, and there is very little recrystallisation of dolomite.

Evaporite Rock (Finely Crystalline)

Finely crystalline evaporite rocks vary from light grey to dark grey or chocolate brown. They are moderately soft to soft, and most specimens become plastic when wet. Texture is even, and laminated specimens are rare. Crystal size is mostly fine and rarely medium crystalline. Their physical characteristics closely resemble those of claystone or mudstone, and these names were used in field descriptions. Their mode of occurrence is similar to that of their medium crystalline associates, and they occur as beds to 0.3 m thick and as fragments from 1 mm to 5 cm across. The fragments are commonly elongated and their long axes are subvertical.

The mineral content varies considerably, but consists dominantly of dolomite, quartz and anhydrite with generally minor halite, limonite and chlorite. An average composition is dolomite with subordinate quartz and anhydrite and minor halite, limonite, haematite and chlorite. The variation in composition is not as extreme as that of the medium crystalline rocks, and only rarely are rocks composed dominantly of one mineral.

As in the case of their medium crystalline associates, the physical characteristics of the rocks depend on minor amounts of haemetite, limonite and chlorite. Subdivisions based on colour and hardness were used in field descriptions, but, after microscopic examination of the specimens, were found to be unusable. No further subidivision of the finely crystalline evaporite rocks is possible without examination of individual thin sections.

A comparison of the two groups of evaporite rocks shows that the finely crystalline varieties are darker, softer and mineralogically more uniform. They contain less anhydrite and more dolomite, haemetite, limonite and chlorite.

Table III - X-ray diffraction analyses of selected samples - BMR Mt Liebig No. 1

For each sample, the minerals are listed in their order of relative intensities.

Sample No.	Depth		Rock Type	Minerals Identified
70500290	Surface		Breccia Fragments	Quartz, dolomite, calcite (tr)
70500291	Surface		Breccia Matrix	Calcite, dolomite, quartz, chlorite (tr)
70500292	5.02m	16'6"	Recrystallised Evaporite Breccia	Dolomite, quartz, gypsum, chlorite
70500129	12.25m	40'6"	Recrystallised Evaporite Breccia	Gypsum, quartz, dolomite, chlorite, muscovite.
70500128	76.30m	250'4"	Gypsum	Gypsum, dolomite, quartz, chlorite, muscovite.
70500270	91.49 m	300'2"	Evaporite Rock (medium crystalline)	Anhydrite, dolomite, quartz, chlorite, muscovite (tr)
70500269	93.24m	305'11"	Evaporite Rock (medium crystalline)	Anhydrite, halite, dolomite, quartz, chlorite (tr)
70500271	106.76m	350'3"	Evaporite Rock (medium crystalline)	Anhydrite, halite, quartz, dolomite, chlorite
70500268	122.20m	400'11"	Evaporite Rock (medium crystalline)	Anhydrite, quartz, halite, chlorite, dolomite (tr)
70500159	131.06m-131.37m	430'431'	Halite	Halite, anhydrite, quartz (tr).
70500160	131.37m-131.67m	431'-432'	Halite	Halite, anhydrite, chlorite, quartz (tr).
70500161	131.67m-131.98m	432'-433'	Halite	Halite, anhydrite, chlorite, quartz (tr).
70500162	131.98m-132.28m	433'-434'	Halite	Halite, anhydrite, chlorite.
70500136	137.34m	450'7"	Evaporite Rock (medium crystalline)	Anhydrite, halite, dolomite, chlorite, quartz, muscovite.

Sample No.	Depth		Rock Type	Minerals Identified
70500135	140.87m	462'2"	Evaporite Rock (finely crystalline)	Dolomite, anhydrite, quartz, halite, chlorite, muscovite.
70500130	174.63m	572'11"	Halite	Halite, anhydrite, quartz (tr)
70500131	184.02m	603'9"	Evaporite Rock (medium crystalline)	Anhydrite, halite, dolomite, quartz, chlorite (tr)
70500132	270.89m	888'9"	Evaporite Rock (finely crystalline)	Anhydrite, dolomite, quartz, halite, chlorite, muscovite.
70500133	300.76m	986'9"	Evaporite Rock (finely crystalline)	Anhydrite, quartz, dolomite, chlorite, muscovite.
70500137	300.86m	987'1"	Evaporite Rock (finely crystalline)	Dolomite, quartz, chlorite, muscovite, anhydrite, halite.
70500134	301.10m	987'11"	Evaporite Rock (finely crystalline)	Anhydrite, halite, quartz, dolomite, chlorite, muscovite (tr).

Reference: BMR Laboratory Reports Nos 19, 40, 48 and 49

Analyst : G.H. Berryman

Table IV - Chemical Analyses - BMR Mt Liebig No. 1

Analyses by Semi-quantitative Emission Spectroscopy

All results in ppm. Detection limits in brackets.

NP: Not present in quantities greater than the detection limit.

Sample No.	Depth Metres	Depth Feet	K (5)	B (3)	Sr (50)	Fe (100)	Mn (10)	Ba (100)	Br (5)
70-50-0017	3.05-3.10m	10'0"-10'2"	800	5	80	3,000	20	100	
18	6.09-6.14m	20'0"-20'2"	100	3	60	800	15	100	
19	9.14-9.19m	30'0"-30'2"	20	3	60	600	10	100	
20	12.20-12.25m	40'0"-40'2"	1000	10	50	2½%	30	100	
21	15.24-15.29m	50'0"-50'2"	500	5	80	3,000	50	NP	
22	18.29-18.34m	60'0"-60'2"	300	3	50	2,000	15	NP	
23	21.33-21.38m	70'0"-70'2"	5000	100	50	2½%	100	100	
24	24.34-24.39m	80'0"-80'2"	500	3	60	2,000	80	NP	
25	27.13-27.58m	89'0"-90'6"	3000	10	NP	3,000	20	100	
26	27.58-28.04m	91'6"-92'0"	1500	30	50	2½%	50	NP	
27	30.48-30.53m	100'0"-100'2"	4000	50	50	2%	150	NP	NP
28	33.53-33.58m	110'0"-110'2"	200	3	60	1,500	40	NP	
29	36.58-36.63m	120'0"-120'2"	2000	30	NP	9,000	30	NP	
30	39.62-39.67m	130'0"-130'2"	700	10	150	3,000	25	800	
31	41.50-42.21m	136'0"-138'6"	500	5	50	800	10	NP	
32	42.21-42.98m	138'6"-141'0"	700	5	60	3,000	15	200	
33	45.72-45.77m	150'0"-150'2"	10000	30	50	2%	150	NP	
34	48.87-48.82m	160'0"-160'2"	2000	30	NP	1½%	80	NP	
35	51.36-51.97m	168'6"-170'6"	8000	30	NP	1½%	100	NP	

Sample No.	Depth Metres	Depth Feet	K	B	Sr	Fe	Mn	Ba	Br
70-50-0036	50.90-51.35m	167'0"-168'6"	5000	100	NP	1½%	80	NP	
37	52.58-52.73m	172'6"-173'0"	3000	15	50	1½%	120	NP	
38	54.86-54.91m	180'0"-180'2"	8000	40	60	1½%	150	NP	
39	57.91-57.96m	190'0"-190'2"	1000	25	NP	2%	15	NP	
40	60.69-60.74m	200'0"-200'2"	300	3	150	1,000	50	NP	NP
41	64.01-64.06m	210'0"-210'2"	700	30	100	1½%	100	200	
42	67.06-67.11m	220'0"-220'2"	3000	30	50	1½%	100	NP	
43	72.24-72.85m	237'0"-239'0"	1000	20	50	10,000	40	100	
44	74.07-74.37m	243'0"-244'0"	1000	25	NP	1½%	30	NP	
45	76.20-76.25m	250'0"-250'2"	3000	40	NP	1½%	100	NP	
46	79.25-79.30m	260'0"-260'2"	800	10	120	10,000	20	NP	
47	82.30-82.35m	270'0"-270'2"	8000	60	250	2%	80	2,000	
48	85.34-85.39m	280'0"-280'2"	1000	10	80	1½%	40	NP	
49	88.39-88.44m	290'0"-290'2"	20	5	100	1,000	10	NP	
50	91.44-91.49m	300'0"-300'2"	800	30	300	1½%	80	NP	NP
51	94.49-94.54m	310'0"-310'2"	2000	30	NP	1,500	NP	NP	170
52	97.53-97.60m	320'0"-320'2"	2000	30	50	1,500	NP	100	
53	100.58-100.63m	330'0"-330'2"	1000	30	NP	900	NP	NP	
54	104.55-104.68m	343'0"-343'5"	2000	30	NP	2,000	NP	NP	
55	104.68-104.75m	343'5"-343'8"	1500	30	NP	1,500	60	100	
56	104.75-104.83m	343'8"-343'11"	2000	30	NP	1,500	NP	NP	
57	104.83-104.93m	343'11"-344'3"	1000	30	NP	600	NP	NP	
58	104.93-105.03m	344'3"-344'7"	1500	3	NP	1,200	NP	100	
59	105.03-105.16m	344'7"-345'0"	1000	10	NP	1,000	NP	100	
60	106.68-106.73m	350'0"-350'2"	1000	10	NP	1,200	NP	NP	

Sample No.	Depth Metres	Depth Feet	K	B	Sr	Fe	Mn	Ba	Br
70-50-0061	110.95-111.05m	364'0"-364'4"	1500	10	NP	1,000	NP	NP	
62	110.05-111.15m	364'4"-364'8"	1500	10	NP	1,200	NP	NP	
63	111.15-111.25m	364'8"-365'0"	1000	100	NP	1,000	NP	NP	
64	111.25-111.35m	365'0"-365'4"	1000	100	NP	1,000	NP	NP	
65	111.35-111.45m	365'4"-365'8"	1500	100	50	2,000	NP	NP	
66	111.45-111.56m	365'8"-366'0"	1000	100	60	1,500	10	100	
67	115.82-115.87m	380'0"-380'2"	1500	100	NP	600	NP	NP	
68	118.87-118.92m	390'0"-390'2"	500	100	NP	400	NP	NP	
69	122.23-122.33m	401'0"-401'4"	1000	100	NP	800	NP	NP	170
70	122.33-122.43m	401'4"-401'8"	500	100	NP	600	NP	100	
71	122.43-122.53m	401'8"-402'0"	800	100	NP	1,000	NP	NP	
72	122.53-122.63m	402'0"-402'4"	500	100	NP	600	NP	NP	
73	122.63-122.73m	402'4"-402'8"	800	100	NP	1,200	NP	NP	
74	122.73-122.83m	402'8"-403'0"	500	100	NP	600	NP	NP	
75	125.58-125.88m	412'0"-413'0"	1000	100	50	1,000	NP	NP	
76	125.88-126.18m	413'0"-414'0"	300	100	NP	800	NP	100	
77	128.02-128.07m	420'0"-420'2"	1000	100	NP	1,000	NP	NP	
78	131.06-131.11m	430'0"-431'0"	1000	100	NP	2,000	NP	NP	
79	131.37-131.67m	431'0"-431'0"	2500	100	100	3,000	10	NP	170
80	131.67-131.98m	432'0"-433'0"	1500	100	150	2,000	10	NP	
81	131.98-132.28m	433'0"-434'0"	1000	100	50	2,500	NP	NP	
82	135.03-153.33m	443'0"-444'0"	2000	100	100	2,500	10	200	
83	135.33-135.64m	444'0"-445'0"	1500	100	NP	2,000	NP	NP	
84	140.21-140.26m	460'0"-460'2"	1000	100	NP	1,500	NP	NP	
85	145.09-145.38m	476'0"-477'0"	3000	100	250	1,500	30	NP	

Sample No.	Depth Metres	Depth Feet	K	B	Sr	Fe	Mn	Ba	Br
70-50-0086	145.39-145.69m	477'0"-478'0"	2000	100	150	3,000	10	NP	
87	149.05-149.35m	489'0"-490'0"	3000	100	150	3,000	10	NP	
88	149.35-149.66m	490'0"-491'0"	1000	100	50	1,500	NP	NP	
89	149.66-149.96m	491'0"-492'0"	1000	100	100	8,000	NP	NP	
90	152.40-152.45m	500'0"-500'2"	1000	100	NP	1,000	NP	NP	170
91	155.45-155.50m	510'0"-510'2"	300	100	NP	NP	NP	NP	
92	158.50-158.55m	520'0"-520'2"	1500	100	NP	1,000	NP	NP	
93	161.54-161.59m	530'0"-530'2"	1000	100	NP	1,000	NP	NP	
94	164.59-164.64m	540'0"-540'2"	300	100	NP	300	NP	NP	
95	167.64-167.69m	550'0"-550'2"	1500	100	NP	1,000	NP	NP	
96	170.69-170.74m	560'0"-560'2"	800	100	NP	1,000	NP	NP	
97	173.74-174.79m	570'0"-570'2"	1500	3	500	1,200	10	NP	
98	176.78-176.83m	580'0"-580'2"	2000	30	100	3,000	10	NP	
99	179.83-179.88m	590'0"-590'2"	600	100	NP	1,000	NP	NP	
100	182.88-182.93m	600'0"-600'2"	800	100	NP	1,200	NP	NP	160
145	182.88-182.93m	600'0"-600'2"	1500	3	300	1,500	30	NP	
146	185.93-185.98m	610'0"-610'2"	2000	100	NP	800	NP	NP	
147	188.98-189.03m	620'0"-620'2"	1000	100	NP	1,000	NP	NP	
148	192.03-192.08m	630'0"-630'2"	1500	3	NP	1,000	NP	NP	
149	195.07-195.12m	640'0"-640'2"	1000	100	80	1,000	NP	NP	
150	198.12-198.19m	650'0"-650'2"	1000	100	NP	NP	NP	NP	
151	201.17-201.22m	660'0"-660'2"	5000	100	100	10,000	10	NP	
152	204.22-204.27m	670'0"-670'2"	1500	3	NP	1,000	NP	NP	
153	207.26-207.31m	680'0"-680'2"	1000	100	NP	1,000	NP	NP	

Sample No.	Depth Metres	Depth Feet	K	B	Sr	Fe	Mn	Ba	Br
70-50-0154	210.31-210.36m	690'0"-690'2"	1000	100	50	300	NP	NP	
155	213.36-213.41m	700'0"-700'2"	1000	100	NP	4,000	10	NP	180
156	219.15-219.76m	718'0"-721'0"	500	100	NP	100	NP	NP	
157	224.03-224.64m	735'0"-737'0"	1000	100	NP	3,000	NP	NP	
158	227.38-227.99m	746'0"-748'0"	1500	100	NP	1,500	NP	NP	
173	230.73-231. 4m	757'0"-759'0"	1000	100	NP	2,000	10	NP	
174	231.34-231.65m	759'0"-760'0"	1000	100	50	1,500	10	NP	
175	234.69-234.74m	770'0"-770'2"	1500	100	NP	100	NP	NP	
176	237.74-237.79m	780'0"-780'2"	1000	100	80	1,200	10	NP	
177	240.79-240.84m	790'0"-790'2"	300	100	NP	NP	NP	NP	
178	243.84-243.89m	800'0"-800'2"	500	100	NP	NP	NP	NP	150
179	247.50-247.80m	812'0"-813'0"	500	100	NP	100	NP	NP	
180	247.80-248.11m	813'0"-814'0"	400	100	NP	NP	NP	NP	
181	249.94-249.99m	820'0"-820'2"	400	100	NP	100	NP	NP	
182	251.77-252.37m	826'0"-828'0"	500	100	NP	100	NP	NP	
183	252.37-252.98m	828'0"-830'0"	400	100	NP	NP	NP	NP	
184	256.03-256.09m	830'0"-830'2"	1500	100	300	3,000	10	200	
185	259.08-259.13m	850'0"-850'2"	500	5	800	300	30	NP	
186	263.35-263.96m	864'0"-866'0"	300	100	NP	300	NP	NP	
187	263.96-264.57m	866'0"-868'0"	800	100	150	2,000	30	100	
188	268.22-268.27m	880'0"-880'2"	500	100	NP	300	NP	NP	
189	271.27-271.32m	890'0"-890'2"	1000	100	300	800	30	NP	
190	274.32-274.37m	900'0"-900'2"	800	100	600	600	10	500	140

Sample No.	Depth Metres	Feet	K	B	Sr	Fe	Mn	Ba	Br
70-50-0191	277.37-277.42m	910'0"-910'2"	1000	100	100	1,500	NP	NP	
192	280.42-280.47m	920'0"-920'2"	500	100	NP	100	NP	NP	
193	283.46-283.51m	930'0"-930'2"	1000	100	NP	300	NP	NP	
194	286.51-286.56m	940'0"-940'2"	1000	100	250	600	20	NP	
195	289.56-289.61m	950'0"-950'2"	300	100	NP	200	NP	NP	
196	292.91-293.52m	961'0"-963'0"	1000	100	NP	300	NP	NP	
197	294.44-295.05m	966'0"-968'0"	500	100	100	2,500	20	NP	
198	295.95-295.66m	968'0"-970'0"	500	100	NP	1,000	NP	NP	
199	298.70-298.75m	980'0"-980'2"	1500	100	NP	2,000	NP	NP	
200	301.75-301.80m	990'0"-990'2"	1000	100	NP	100	NP	NP	
201	304.80-304.85m	1000'0"-1000'2"	2000	100	80	5,000	10	NP	200

Analyst: R.R. Robinson

Reference: Amdel Report AN4120/71

LITHOLOGICAL DESCRIPTION OF CORE

0-92.05 m (0-301'11")

The core from 0 to 92.05 m is brecciated, with fragments of gypsum, anhydrite and dolomite rock in a brown matrix of recrystallised evaporite breccia. The matrix itself contains fragments of various rock types up to 1 cm diameter. Most fragments are rounded and lenticular in outline, with their long axes near-vertical; they are elongated along shear planes.

The proportion of fragments varies greatly; in some places they make up the whole core, and in others they are absent. The proportion of gypsum or anhydrite rock fragments to dolomite rock fragments is extremely variable.

Anhydrite rock occurs only at the base of the interval, where little alteration of anhydrite to gypsum has taken place. Recrystallised evaporite breccia occurs as thin brown tracings between fragments, and as a matrix for the fragments. There are some zones in which the core is composed entirely of breccia.

The core contains cross-cutting veins of anicular gypsum rock in sparse zones throughout. At 57 m (180'6") there is a zone in which slickensiding is present, possibly indicating minor faulting after the main deformation and brecciation. Small solution cavities are present between 25 m and 60 m (80' and 195').

This bed is a caprock overlying the more soluble halite rock.

92.05 - 305.87 m (301'11" - 1003'6")

From 92.05 m to total depth the core is composed dominantly of halite rock. It is generally orange-brown, but in several beds up to 5 m thick it is pure, and grades to light pink or colourless. These beds occur between 215 m and 253 m (700' and 830').

Fragments of fine and medium crystalline evaporite rock are scattered throughout the halite rock. As in the overlying interval, the fragments are rounded and lenticular in outline, with their long axes subvertical. They are formed by brecciation of beds within the halite rock by shearing; the halite rock has acted as matrix, being easily deformed by movement along cleavage planes.

Twelve intervals of evaporite rock were noted in the core descriptions; their thickness ranges from 10 cm to 0.5 m. It is impossible to determine whether the evaporite rock occurs as beds or as large fragments or lenses which have the appearance of beds in the core. In some places the top and base of these inclusions are parallel, indicating that they are beds; in other instances top and base are at an angle, indicating that they are fragments. The contacts between the evaporite rock and halite rock dip at angles varying from horizontal to vertical.

Inclusions of evaporite rock rarely exceed 5% of the core. There are only two intervals, 252.88 - 258.61 m (829'8" - 848'5½") and 298.88 - 301.27 m (980'7" - 988'5") in which their percentage is large. These zones are probably remnants of beds of fine and medium crystalline evaporite rocks which were later deformed and brecciated. Throughout parts of the halite rock , particularly around 225 m (740'), there are impure brown halite rock fragments. They are rounded and ellipsoidal with their long axes subvertical; in places they contain tracings and inclusions of brown, finely crystalline evaporite rock. The dark brown colouration is caused by haematite. These fragments are produced by brecciation of impure halite rock beds.

At 140.87 m (462'2") a 10 cm fragment of hard, black pyritic dolomite occurs which closely resembles the "dolomitic siltstone" recorded throughout BMR Alice Springs No. 3 (Stewart, 1969). It is the only occurrence of this rock type in the core.

Surrounding the evaporite rock fragments in a few places is a layer of colourless, pure halite. This layer occurs mainly around the larger fragments, and can be up to 5 mm thick; it is the result of secondary recrystallisation of halite.

No vertical joints in the halite rock were noted anywhere in the core.

COMMENTS ON CHEMICAL ANALYSES (TABLE IV)

Potassium

The potassium analyses show that no commercial deposits of this element are present. Up to 10,000 ppm (1%) is present in the gypsum-anhydrite-dolomite rock, but all results in the halite are less than 5000 ppm (0.5%). High potassium values seem to co-incide with high iron concentrations.

The analyses suggest that, at least in the small section sampled, that deposition of evaporites had not reached the stage of precipitation of the more soluble potassium salts. The potassium in the mixed evaporite rocks may be derived from detrital minerals such as muscovite and feldspars.

Bromine

Less than 5 ppm bromine is present in the gypsum-anhydrite-dolomite rock.

The amount of bromine present in the crystal lattice of chlorides is an indication of the salinity of the brine from which the minerals were deposited. Bromine concentration increases with salinity and high values indicate highly saline brines.

The values recorded in the halite rock (140 to 200 ppm) are high, indicating that it formed at a late stage of halite deposition.

No meainingful increase or decrease of bromine content with depth is apparent.

Boron

Boron content is average for evaporite deposits. Throughout the gypsum-anhydrite-dolomite rock quantities range from 3 to 100 ppm, while instrumental difficulties limit detection in most of the halite to 100 ppm. At the top of the halite interval values range from 3 to 30 ppm.

Iron

Iron content of the core is high in sections which contain recrystallized evaporite breccia. This is due to the presence of brown limonite. Low values are recorded in beds composed dominantly of gypsum, dolomite, anhydrite or halite.

Low values are also recorded within the halite in zones in which it is colourless and pure.

Manganese

Manganese is present in very minor quantities throughout the halite, occurring only in samples with a high iron concentration. This suggests that both occur together as evaporite rock impurities.

Throughout the gypsum-anhydrite-dolomite rock, values range from 10 to 150 ppm. Kropachev (1960) reported averages of 120 ppm in anhydrite rocks and 370 ppm in epigenetic gypsum rocks (in - Stewart, 1963). The quantities detected in the core are typical for anhydrite rocks, and suggest that gypsum formed by hydration of the original anhydrite.

Barium

The lower limit of detection of barium was 100 ppm; the low values which are expected in evaporite minerals cannot be measured. Many analyses from the gypsum-anhydrite-dolomite rock and several from the halite record values in excess of 100 ppm. These are high for evaporite deposits. Barium replaces calcium in the crystal lattice of gypsum and anhydrite, and is much less abundant in halite (Stewart, 1963). High values recorded in the halite section could be due to its presence in fragments of anhydritic evaporite rock.

Strontium

Strontium replaces calcium in sulphates and carbonates (Stewart, 1963). Throughout the halite it occurs in those samples with manganese, suggesting that they both occur in evaporite rock impurities. Results range up to 800 ppm, indicating that the anhydrite in the evaporite rock has an average strontium content.

COMPARISON OF LOGS WITH CORE LITHOLOGY

Spontaneous Potential (Plate I)

The spontaneous potential curve shows irregular fluctuations throughout. Above 92.03 m (301'11") several prominent deflections are present because of the permeability present in the gypsum-dolomite-recrystallised evaporite breccia. Deflections are not sharp because there are no large differences in permeability. Below this depth the curve has minor fluctuations superimposed on a drift, at first in a positive direction around 158 m (520'), then in a negative direction with a maximum at 256 m (840'). This depth corresponds to the zone of slight conductivity shown on the resistivity curve. Drift is irregular below this depth.

Below 92.03 m (301'11") there is no relationship between the presence of minor amounts of evaporite rock and the variations in the SP curve. No deflection is present at the contact of the halite with the overlying bed. Drifting of the SP curve is expected in rocks in which no variations in permeability are present to give sharp deflections.

Resistivity (Plate I)

From the base of the casing at 43 m (141') to the top of the anhydrite bed at 90 m (295'), resistivity is low, with values between 5 and 10 ohm metres. High values at 46 m (151') and 51.5 m (169') correspond with beds of recrystallised evaporite breccia, while a low value at 53 m (175') correlates with a bed of gypsum. The curve is fairly smooth and variations reflect porosities; low resistivity is a result of interstitial water in the hole.

From 90 m (295') to 92.03 m (301'11") no gypsum is present; all calcium sulphate is present as anhydrite. There can be little interstitial water as this would be absorbed to hydrate the anhydrite. Resistivity in this bed increases from 12 ohms at the top to 100 ohms at the base.

A linear increase in resistivity is recorded over the next 36.6 m (120'). This is a phenomenon caused by the upper bridle electrode being in highly conductive gypsum while the zero guard log was in highly resistive halite.

Resistivity throughout most of the halite section of the core is 7500 ohm metres. This is virtually an infinite resistance and indicates that the hole is dry. The curve shows marked deflections from 226 to 230 m (742' to 756') and 249 to 257 m (817' to 844'); they are very prominent, but only reflect a change from an infinite resistivity to a very high resistivity of 200 ohm metres.

The deflections show little relationship to the lithology. The upper deflection coincides with a 4 cm bed of evaporite rock, while the top of the lower one is 3.85 m above a 5.72 m bed of brecciated evaporite rock. A similar bed at 301.27 m (988'5") does not give rise to irregularities in the curve indicating that the presence of this rock type is not the reason for the deflection. The evaporite rock is dry and contains no conductive minerals such as pyrite.

The caliper log shows 2 to 2.5 cm of caving, possibly caused by zones of weakness in the halite, over the less resistive intervals. Salty water could have seeped into the fractured rock associated with these zones, causing the formation to be slightly conductive.

The slight drift to the left throughout the graph may be a response to the increasing proximity of the conductive zones. Below 257 m (817') the drift is to the right.

Gamma Ray (Plate I)

The gamma ray log shows radioactivity varying from 10 to 120 API units. Above 92.03 m (301'11") the graph has values in excess of 70 API units with high values corresponding to beds of gypsum. Values are lower above the base of the casing at 43 m (141') due to its shielding effect.

Above 27 m (89') the graph becomes smoother and values smaller because cement behind the casing settled to this level before it set. In the halite values are approximately 60 API units above 152 m (500') and 20 API units below.

A peak in excess of 100 API units occurs from 131 to 132.6 m (430' to 435'). This was initially interpreted as a potassium-bearing zone, but chemical analyses have shown that only minor amounts of potassium are present. A series of regularly spaced peaks 3 to 4.25 m (10' to 14') apart occur from 119 to 169 m (390' to 550'). These may reflect sedimentary cycles.

There is no correlation between radioactivity and proportion of evaporite rock fragments. Both impure halite at the top of the bed and pure halite from 213 to 253 m (700' to 830') show radioactivity values higher than normal.

The gamma ray curve shows the highest deflection in zones of high potassium content. In some intervals it closely reflects variations in the potassium content revealed by chemical analyses.

Neutron (Plate I)

The neutron log from 0 to 42 m (0' to 138') was recorded through steel casing, and recorded values are anomalous. Below 18 m (60') smoother fluctuations result from the presence of water in the hole.

From 42 to 89 m (138' to 291') the log reflects the percentage of gypsum in the hole, and low counts at 49, 52, 61, 76 and 87 m (161', 171', 201', 250', and 286') result from gypsum beds. Gypsum gives low counts on the neutron log because hydrogen concentration is high due to water in the crystal lattice. Texture of the core from 61 to 75 m (202' to 248') is even, but the log shows the proportion of gypsum to be variable.

From 88 to 90 m (291' to 295') the curve shows a steep rise to a value of 870 cps due to the increasing amounts of unaltered anhydrite in the hole. Neither halite nor anhydrite contain water of crystallization and, as expected, no deflection was recorded at their boundary.

Deflections in two zones, from 224 to 229 m (735' to 750') and from 250 to 255 m (820' to 838') correlate with the zones of lower resistivity. They may represent either zones of infiltration of salt water into fractures, or beds of hydrous minerals. Core descriptions do not confirm the presence of any hydrous minerals; halite is the dominant mineral, with impurities of anhydrite, quartz and dolomite.

Caliper (Plate I)

The caliper log shows a sharp decrease in hole diameter corresponding to the base of the 20 cm (8") casing at 41.5 m (136'). This depth contrasts with the measured 43.0 m (141') of casing run by the drillers. The hole was reamed to 15.8 cm (6¼") diameter prior to electric logging. Throughout most of its length the hole is 15.8 to 15.4 cm (6¼" to 6½") diameter. Slight caving at 75.5 m (248') is attributed to a bed of soft dolomite. Caving to a diameter greater than 17.8 cm (7") is rare, but occurs at 228.5 m (750') and from 250 to 255.5 m (820' to 838'). It could be a result of either fractured zones or soft impurities in the halite.

Density (Plate I)

To a depth of 92.03 m (301'11") the apparent density is 2.2 gm/cc with fluctuations of up to 0.1 gm/cc. This figure is low, considering that the rock is composed of gypsum (density 2.3 gm/cc), dolomite (density 2.9 gm/cc) and quartz (density 2.7 gm/cc). Brecciation may have resulted in high porosity and low density. A sharp rise in recorded values occurs at the base of the casing. Peaks can be related to massive beds buttheir composition appears unimportant.

From 90 to 92 m (295' to 301'11") a bed containing anhydrite (density 2.9 to 3.0 gm/cc) occurs, but the expected increase in density is not recorded. This could be caused by the presence of halite (density 2.1 to 2.3 gm/cc), but the amounts involved would not offer a full explanation.

Below 92.03 m (301'11") apparent densities are 2.0 gm/cc, with variations from 1.8 to 2.3 gm/cc. These values are low for halite and the log may be calibrated to give low values. Variations of density up to 0.2 gm/cc occur over short intervals and do not appear to be related to the presence of evaporite rock fragments in the core. Two large peaks correlate with the sharp drops in resistivity. The cores showed little indication that the formation was denser across these intervals. A relationship may exist between these deflections in the density log and caving recorded over the same interval by the caliper log. Slight caving at 290 m (950') has an associated sharp density peak. Alternatively an increase in formation density may have caused deflections in both the caliper and density log.

The shape of the lower 213 m (700') of the density curve is basically similar to that of the gamma ray, resistivity and SP curves, with a decrease to 245 m (800') followed by a slight rise in values towards the bottom of the hole.

DISCUSSION AND CONCLUSIONS

ORIGIN OF DEPOSIT

It is well established that evaporite rocks form in an aqueous environment in which evaporation exceeds precipitation. Water containing dissolved salts replaces that lost by evaporation, giving a mechanism for the formation of thick sequences of evaporite minerals. The setting in which these processes take place is uncertain. A shallow embayment or lagoon to which the sea has restricted access because of a continuously rising bar is the classical model. Schmalz (1969) suggests a model in which thick evaporite deposits form in deep basin environments. He claims that deposition of an evaporite sequence 1200 m thick would require an initial basin depth of not less than 600 m.

Evaporite deposition is generally cyclic. The basal unit of a typical cycle is euxinic and bituminous. These beds are composed of carbonates or shale and sometimes contain sulphide minerals. The Kupferschiefer of the Zechstein Basin is an example. Evaporation causes concentration of salts and calcium sulphate precipitates as either gypsum or anhydrite. The mineral formed depends on the conditions at the time of deposition. The increase in temperature caused by depth of burial generally converts gypsum to anhydrite. Precipitation of relatively large amounts of halite follows before the more soluble salts become concentrated and are deposited.

Examples of most stages of the cycle are present in BMR Mount Liebig No. 1.

The initial euxinic stage of deposition is represented by several fragments of dolomite at 42.42 m (467'3"). The dolomite is black and pyritic; its presence as fragments within the halite demonstrates that considerable disruption of the original bedding has taken place.

The second stage is represented by anhydrite occuring in evaporite rock; this has been converted to gypsum in the upper parts of the core. Dolomite and quartz may also have been deposited during this stage. Minor amounts of mica may be either wind blown or metasomatic (Carozzi, 1960) in origin.

The third stage is represented by a considerable thickness of halite. The presence of beds of impure halite is shown by fragments containing anhydrite crystals and inclusions of evaporite rock. Deposition must have been interrupted before precipitation of the more soluble potassium salts, as these are not present in major amounts in the core.

Although most stages of the cycle are present, it is difficult to relate their stratigraphic positions in the hole to a cyclic succession as the deposit has been structurally disturbed. Décollement movement of at least 6000 metres has taken place on the evaporite horizon. This was followed by diapiric intrusion of halite into the overlying sequence along the Gardiner Fault. It is to be expected that the original bedding, showing cyclic deposition, has been destroyed by the accompanying brecciation and contortion. Zones up to 10 m thick in the halite contain fragments of evaporite rocks. These are probably brecciated remnants of single beds. This is the only recorded occurrence of the evaporite sequence of the Bitter Springs Formation along the length of the Gardiner Fault.

Solution of the halite by meteoric waters left a residue of anhydrite (evaporite rock) fragments above the halite, while the continuous upward movement caused more halite to be exposed to solution. By a process of solution and compensating upward movement, large amounts of halite were leached, leaving a residue of anhydrite fragments. The size of these fragments is very variable ranging from about 1 m diameter to single fine crystals. Upward movement caused brecciation of the fragments and gave them a subvertical orientation.

Percolating meteoric waters later converted anhydrite to gypsum and caused recrystallisation of the interstitial breccia of finer fragments. Gypsum, quartz and dolomite may have been leached from the coarser fragments and redeposited in the breccia.

The features observed in the core can be related to this explanation of the origin of the evaporite body. The contortion and brecciation of beds in the halite is a product of strong deformation by both décollement and diapiric movement. The horizontal contact of the anhydrite and halite showed that halite was being replaced by anhydrite, giving the contact a serrated appearance. A 2 m bed in which anhydrite is present occurs above the halite. As the fragments in this bed would not have been exposed to meteoric waters for a long period, conversion to gypsum would not have taken place. Above this bed is a zone which would have been exposed to water for longer periods, and contains both gypsum and anhydrite. This is overlain by a large bed in which all calcium sulphate is present as gypsum.

The contact of halite with the caprock would be expected to vary in depth slightly, but would be in the order of 100 m across the length of the outcrop of gypsum. The outcrop is situated on a rise which has about 40 m relief, giving the halite-caprock contact a depth of 60 m below the surrounding plain.

There is some evidence in the cores of stages of an evaporite cycle. Halite shows that the cycle was almost completed; none of the final stage bittern salts were found but the hole was still in halite at total depth. It also shows that an evaporitic depositional environment present throughout the Amadeus Basin in Bitter Springs time produced halite deposits over a much larger area than had been proved previously (Fig. 4).

No potassium salts have been discovered to date. As the area over which evaporites were deposited is very large, sub-basins in which brines

could have concentrated, and precipitated the more soluble salts and may have been present.

The halite deposits of the Bitter Springs Formation have only been sampled at three widely scattered points (Fig. 4). The available information is insufficient to discount the possibility that potassium salts were deposited in more restricted areas of the Bitter Springs sea.

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APPENDIX I

THIN SECTION DESCRIPTIONS - BMR MT LIEBIG NO. 1

Thin Section No. 70-50-0109

Texture: Surface Detritus infilling small cavities in very coarsely crystalline Gypsum.

Composition:

70% Gypsum, crystals 2 mm.
30% Surface Detritus
- 70% Limonite, brown.
- 15% Dolomite, crystals 0.01 mm.
- 15% Quartz, angular, grains 0.1 mm.

Depth: 3.07 m (10'1")

Thin Section No. 70-50-0110

Texture: Fragments of Gypsum - Dolomite Rock to 2 cm across in Recrystallised Evaporite Breccia

Composition:

70% Gypsum - Dolomite Rock
- 80% Dolomite, crystals 0.05 mm.
- 10% Gypsum, crystals 1 mm.
- 5% Quartz, crystals 0.05 mm
- 5% Chlorite, colourless, as matrix

20% Recrystallised Evaporite Breccia.
- 50% Gypsum, crystals 1 mm, infilling fractures
- 25% Dolomite, crystals 0.2 mm.
- 20% Chlorite, brown to colourless, as matrix.
- 5% Quartz, crystals 0.2 mm.

Depth: 5.03 m (16'6")

Thin Section No. 70-50-0111

Texture: Fragments of Gypsum - Quartz - Dolomite rock in matrix of Recrystallised Evaporite Breccia

Composition:

60% Recrystallised Evaporite Breccia
- 50% Gypsum, crystals 3 mm.
- 25% Dolomite, crystals 0.02 mm, sparse larger anhedral cyrstals.
- 15% Chlorite, light brown.
- 10% Quartz, crystals 0.03 mm.
- tr Anhydrite, crystals 0.2 mm.

40% Gypsum - Quartz - Dolomite rock
- 60% Dolomite, crystals 0.05 mm.
- 20% Quartz, crystals 0.05 mm.
- 19% Gypsum, as matrix
- 1% Haematite, opaque crystals.
- tr Chlorite

Depth: 12.32 m (40'5")

Thin Section No. 70-50-0112

Texture: Extremely coarsely crystalline Gypsum crystals with minor Dolomite and Quartz impurities.

Composition:

94% Gypsum, crystals 5 mm.
5% Dolomite, crystals 0.1 mm scattered near fractures.
1% Quartz, crystals 0.1 mm.

Depth: 42.65 m (139'11")

Thin Section No. 70-50-0113

Texture: Recrystallised Evaporite Breccia
Composition:
70% Dolomite, crystals 0.03 mm.
14% Chlorite, as matrix.
19% Gypsum, crystals 4 mm, polysynthetic twinning, replaced by dolomite in parts, infilling fractures.
5% Quartz, crystals 0.03 mm.
1% Haematite, opaque crystals 0.03 mm.
Depth: 76.28 m (250'3")

Thin Section No. 70-50-0114

Texture: Fragments of Quartz-Dolomite Rock and Dolomite-Anhydrite Rock in matrix of Recrystallised Evaporite Breccia.
Composition:
50% Dolomite-Anhydrite Rock
95% Anhydrite, crystals 0.1 mm.
5% Dolomite, crystals 0.02 mm.
40% Recrystallised Evaporite Breccia
80% Anhydrite, crystals 1 mm.
10% ? Halite, crystals 0.02 mm as matrix.
10% Dolomite, crystals 0.01 mm.
10% Quartz - Dolomite Rock
90% Dolomite, crystals 0.05 mm.
10% Quartz, crystals 0.05 mm.
tr Haematite, opaque crystals
Depth: 91.24 m (299'4")

Thin Section No. 70-50-0115

Texture: Fragments of Dolomite-Anhydrite Rock and Dolomite-Anhydrite-Chlorite Rock in matrix of Recrystallised Evaporite Breccia.
Composition:
65% Recrystallised Evaporite Breccia
50% Anhydrite, crystals 1 mm.
40% Dolomite, crystals 0.1 mm.
10% Chlorite, as matrix.
25% Dolomite-Anhydrite Rock
60% Anhydrite, crystals 0.1 mm.
30% Dolomite, crystals 0.1 mm.
10% Quartz, crystals 1 mm.
10% Dolomite-Anhydrite-Chlorite rock
40% Chlorite, as matrix.
30% Anhydrite, crystals 0.2 mm.
30% Dolomite, crystals 0.01 mm.
tr Haematite, opaque crystals.
Depth: 91.52 m (300'3")

Thin Section No. 70-50-0116

Texture: Junction of Halite with overlying Recrystallised Evaporite Breccia. Halite is being replaced by overlying bed.
Composition:
90% Halite, crystals 10 mm.
10% Recrystallised Evaporite Breccia.
60% Anhydrite, crystals 0.2 mm.
20% Quartz, crystals 0.02 mm.
10% Dolomite, crystals 0.02 mm.
5% Chlorite, as matrix.
5% Haematite, opaque crystals 0.02 mm.
Depth: 92.05 m (301'11")

Thin Section No. 70-50-0118

Texture: Fragments of Dolomite-Halite-Anhydrite Rock in Halite matrix.
Composition:
90% Dolomite-Halite-Anhydrite Rock
    55% Anhydrite, crystals from 0.1 to 0.02 mm.
    30% Halite, crystals 4 mm, as matrix.
    15% Dolomite, crystals 0.03 mm.
10% Halite, crystals 10 mm, as matrix.
Depth: 137.31 m (450'6")

Thin Section No. 70-50-0120

Texture: Anhydrite-Dolomite Rock with sparse veins of Halite
Composition:
85% Dolomite, crystals 0.1 mm, lamanated in parts.
 5% Anhydrite, crystals 0.3 mm.
 5% Halite, crystals 5 mm, as inclusions and infilling fractures.
 2% Quartz, crystals 0.2 mm.
 2% Chlorite, crystals 0.2 mm.
 1% Pyrite, opaque crystals 1 mm.
Depth: 142.42 m (467'3")

Thin Section No. 70-50-0117

Texture: Dolomite-Anhydrite Rock
Composition:
80% Anhydrite, crystals 0.5 mm.
15% Dolomite, crystals 0.05 mm.
 5% Halite, crystals 5 mm, as matrix.
 tr Quartz, crystals 0.05 mm.
Depth: 174.63 m (572'11")

Thin Section No. 70-50-0119

Texture: Fragments of Dolomite in matrix of Dolomite-Quartz-Anhydrite Rock.
Composition:
70% Dolomite-Quartz-Anhydrite Rock
    60% Anhydrite, crystals from 0.05 mm to 0.1 mm.
    20% Quartz, crystals 1 mm.
    10% Dolomite, crystals 0.1 mm.
    10% Halite, crystals 3 mm, as laminae and inclusions.
30% Dolomite
    95% Dolomite, crystals from 0.1 mm to 0.01 mm.
     5% Anhydrite crystals 0.05 mm.
Depth: 184.00 m (603'8")

Thin Section No. 70-50-0121

Texture: Halite with minor fragments of impure Halite and Anhydrite rock.
Composition:
98% Halite, crystals 4 mm.
 1% Anhydrite, crystals 0.2 mm as inclusions in Halite.
 1% Anhydrite Rock
    95% Anhydrite, crystals 0.1 mm.
     5% Dolomite, crystals 0.1 mm.
Depth: 229.21 m (752'0")

Thin Section No. 70-50-0122

Texture: Halite-Anhydrite-Quartz-Dolomite Rock, laminated in parts with extremely variable composition.

Composition:

35% Dolomite, crystals 0.03 mm.
30% Quartz, crystals 0.02 mm.
25% Anhydrite, crystals 0.1 mm.
10% Halite, crystals 0.1 mm.

Depth: 253 m (830'5")

Thin Section No. 70-50-0123

Texture: Fragments of Dolomite-Quartz Rock and Halite-Dolomite Rock in matrix of Anhydrite-Quartz-Dolomite-Halite Rock.

Composition:

40% Anhydrite-Quartz-Dolomite-Halite Rock
- 55% Halite, crystals 1 mm.
- 20% Dolomite, crystals 0.02 mm.
- 20% Quartz, crystals 2 mm.
- 5% Anhydrite, crystals 1 mm.

30% Dolomite-Quartz Rock
- 80% Quartz, crystals 0.05 mm.
- 20% Dolomite, crystals 0.05 mm.

30% Halite-Dolomite Rock
- 80% Dolomite, crystals 0.08 mm.
- 20% Halite, crystals 0.5 mm.

Depth: 253.39 m (831'4")

Thin Section No. 70-50-0124

Texture: Fragments of Anhydrite-Quartz-Halite-Dolomite Rock in Halite matrix.

Composition:

50% Halite
- 90% Halite, crystals 3 mm, strained in parts.
- 10% Anhydrite, crystals 2 mm.

50% Anhydrite-Quartz-Halite-Dolomite Rock
- 40% Dolomite, crystals 0.01 mm.
- 25% Halite, crystals 0.02 mm.
- 20% Quartz, crystals 0.02 mm.
- 10% Anhydrite, crystals 0.02 mm.
- 5% Haematite, opaque crystals 0.03 mm.

Depth: 300.89 m (987'2")

APPENDIX II

CORE DESCRIPTIONS - BMR MOUNT LIEBIG NO. 1

Cores 1 to 48 described by Dr S.K. Skwarko.

Cores 49 to 99 described by P.J. Kennewell.

Field names for most rock types have been changed after microscopic investigations. The core descriptions were extensively revised by P.J. Kennewell in April 1971.

CORE No. 1

Interval: 274 - 5.64 m (9'0" - 18'6")
Cut: 2.90 m (9'6") Recovered: 2.90 m (9'6")
Description:

2.74 - 3.33 m (9'0" - 10'11")
- 80% GYPSUM, stained deep red, medium to coarsely crystalline, loosely packed
- 15% RECRYSTALLISED EVAPORITE BRECCIA, red to chocolate-brown; fills spaces between aggregates of gypsum crystals
- 5% DOLOMITE, yellow; irregular inclusions to 2 cm across

3.33 - 3.94 m (10'11" - 12'11")
- 65% GYPSUM, stained deep red, medium to coarsely crystalline
- 15% RECRYSTALLISED EVAPORITE BRECCIA, chocolate-brown, calcareous
- 15% DOLOMITE, cream, calcareous

3.94 - 4.22 m (12'11" - 13'10")
- 65% GYPSUM, stained deep red, medium to coarsely crystalline
- 15% RECRYSTALLISED EVAPORITE BRECCIA, chocolate-brown, calcareous
- 15% DOLOMITE, cream, calcareous

Interval has a distinct layering of individual constituents which dip 35°

4.22 - 5.36 m (13'10" - 17'7")
- 95% DOLOMITE, cream, soft, slightly calcareous
- 5% RECRYSTALLISED EVAPORITE BRECCIA, yellow-brown, calcareous; fills fractures and joints

5.36 - 5.64 m (17'7" - 18'6")
- 100% GYPSUM, pink, extremely coarsely crystalline

CORE No. 2

Interval: 5.64 - 7.62 m (18'6" - 25'0")
Cut: 1.98 m (6'6") Recovered: 1.83 m (6'0")
Description:

5.79 - 6.40 m (19'0" - 21'0")
- 80% GYPSUM, pink and white, crystalline; solid aggregates, and veins
- 10% RECRYSTALLISED EVAPORITE BRECCIA, chocolate-brown to red, calcareous
- 10% DOLOMITE, cream, calcareous; fragments in breccia

6.40 - 6.65 m (21'0" - 21'10")
- 60% DOLOMITE, grey, soft, very calcareous
- 40% RECRYSTALLISED EVAPORITE BRECCIA, red to chocolate-brown, calcareous

6.65 - 6.88 m (21'10" - 22'7")
- 90% GYPSUM, colourless, crystalline, stained pink in part
- 10% RECRYSTALLISED EVAPORITE BRECCIA, red and grey

6.88 - 7.25 m (22'7" - 23'9")
- 60% GYPSUM, white and pink, massive, crystalline
- 40% RECRYSTALLISED EVAPORITE BRECCIA, grey and yellow, calcareous

7.24 - 7.62 m (23'9" - 25'0")
- 95% GYPSUM, white and pink, massive, crystalline
- 5% RECRYSTALLISED EVAPORITE BRECCIA, chocolate-brown and red; some grey fragments

CORE No. 3

Interval: 7.62 - 10.67 m (25'0" - 35'0")
Cut: 3.05 m (10'0") Recovered: 1.68 m (5'6")
Description:

8.99 - 9.22 m (29'6" - 30'3")
95% GYPSUM, grey, pink and white, crystalline
5% DOLOMITE and CHERT, dark grey and black; fragments to 2 cm across

9.22 - 9.47 m (30'3" - 31'1")
75% GYPSUM, grey, pink and white, crystalline
20% RECRYSTALLISED EVAPORITE BRECCIA, red to chocolate-brown, calcareous; proportion increases downwards
5% DOLOMITE and CHERT, dark grey to black; fragments

9.47 - 9.68 m (31'1" - 31'9")
80% DOLOMITE, yellow, grey and brown, calcareous in part; fragments to 2 cm across
15% GYPSUM, colourless, crystalline; in aggregates and veins
5% RECRYSTALLISED EVAPORATE BRECCIA, red to brown, very calcareous; in veins

9.68 - 9.75 m (31'9" - 32'0")
95% GYPSUM, white and pink, massive, crystalline
5% DOLOMITE, yellow

9.75 - 10.06 m (32'0" - 33'0")
40% GYPSUM, white and pink, massive, crystalline
30% DOLOMITE, yellow, strongly contorted
30% RECRYSTALLISED EVAPORITE BRECCIA, chocolate-brown, very calcareous, soft

10.06 - 10.49 m (33'0" - 34'5")
30% GYPSUM, white and pink, massive, crystalline
40% DOLOMITE, yellow, strongly contorted
30% RECRYSTALLISED EVAPORITE BRECCIA, red to chocolate-brown, very calcareous, soft

10.49 - 10.67 m (34'5" - 35'0")
30% GYPSUM, and DOLOMITE, yellow; in fragments
70% RECRYSTALLISED EVAPORITE BRECCIA, red to chocolate-brown

CORE No. 4

Interval: 10.67 - 12.34 m (35'0" - 40'0")
Cut: 1.67 m (5'6") Recovered: 1.42 m (4'8")
Descriptions:

10.92 - 11.18 m (35'10" - 36'8")
GYPSUM and DOLOMITE, grey; in fragments
RECRYSTALLISED EVAPORITE BRECCIA, chocolate-brown, calcareous

11.18 - 11.38 m (36'8" - 37'3")
70% DOLOMITE, grey-brown, slightly calcareous; in angular fragments to 5 cm across
20% RECRYSTALLISED EVAPORITE BRECCIA, reddish orange, calcareous
10% GYPSUM, colourless and white, crystalline

11.38 - 11.51 m (37'4" - 37'9")
40% DOLOMITE, pink, yellow; angular fragments to 2 cm across, slightly calcareous
30% DOLOMITE, grey, laminated
30% GYPSUM, white, crystalline
10% GYPSUM and RECRYSTALLISED EVAPORITE BRECCIA, red; in veins

11.51 - 11.58 m (37'9" - 38'0")
100% RECRYSTALLISED EVAPORITE BRECCIA, chocolate-brown, calcareous

11.58 - 11.71 m (38'0" - 38'5")
45% DOLOMITE, mauve, yellow and cream; in angular fragments to 2 cm across
35% GYPSUM, colourless, crystalline; fills veins
20% RECRYSTALLISED EVAPORITE BRECCIA, chocolate-brown, contorted; contains gypsum and dolomite fragments
11.71 - 12.34 m (38'5" - 40'6")
70% RECRYSTALLISED EVAPORITE BRECCIA, chocolate-brown
20% GYPSUM, in fragments and aggregates
10% DOLOMITE, in fragments
Texture of core is brecciated; layered and dips 30°

CORE No. 5

Interval: 12.34 - 15.39 m (40'6" - 50'6")
Cut: 3.05 m (10'0") Recovered: 2.84 m (9'4")
Description:
12.44 - 12.55 m (40'10" - 41'2")
95% DOLOMITE, grey, hard, non-calcareous
5% GYPSUM, mostly in dendritic veins between dolomite fragments; some crystalline aggregates
12.55 - 13.00 m (41'2" - 42'8")
75% DOLOMITE, grey, hard, non-calcareous
15% GYPSUM, mostly in dendritic veins between dolomite fragments; some crystalline aggregates
7% DOLOMITE, yellow, calcareous, occurs along dendritic cracks and fissures
3% DOLOMITE, as fragments
13.00 - 14.12 m (42'8" - 46'4")
75% RECRYSTALLISED EVAPORITE BRECCIA, chocolate-brown, calcareous; contains fragments of dolomite
15% GYPSUM, mostly in dendritic veins, some crystalline aggregates
10% DOLOMITE, cream, calcareous; in fragments to 2 cm across
14.12 - 14.78 m (46'4" - 48'6")
40-60% RECRYSTALLISED EVAPORITE BRECCIA, chocolate-brown, calcareous; some local changes in colour
20-40% DOLOMITE, cream
15-25% GYPSUM
14.78 - 15.39 m (48'6" - 50'6")
75% DOLOMITE, cream and pink; yellow calcareous dolomite veins; in fragments to 12 cm across
25% GYPSUM, colourless, crystalline; fills spaces between dolomite fragments

CORE No. 6

Interval: 15.39 - 16.91 m (50'6" - 55'6")
Cut: 1.52 m (5'0") Recovered: 1.52 m (5'0")
Description:
15.39 - 16.08 m (50'6" - 52'9")
75% DOLOMITE, in angular fragments to 10 cm across; calcareous; cut by veinlets of recrystallised evaporite breccia
25% GYPSUM, grey, crystalline; forms matrix between dolomite fragments
16.08 - 16.76 m (52'9" - 55'0")
60% RECRYSTALLISED EVAPORITE BRECCIA, chocolate-brown, calcareous; contains scattered crystals of gypsum
40% GYPSUM, light grey, crystalline; in large aggregates and thin stringers
Texture is strongly contorted and axes of most of elongate gypsum aggregates are at high angles to core axis; contains small patches of cream dolomite breccia as in overlying bed

16.76 - 16.91 m (55'0" - 55'6")
80% RECRYSTALLISED EVAPORITE BRECCIA, chocolate brown
20% GYPSUM, grey; randomly oriented thin stringers

CORE No. 7

Interval: 16.91 - 19.96 m (55'6" - 65'6")
Cut: 3.05 m (10'0") Recovered: 3.05 m (10'0")
Description:
16.91 - 19.96 m (55'6" - 65'6")
40% RECRYSTALLISED EVAPORITE BRECCIA, creamy grey to white; hardness variable with softer varieties calcareous; in beds and patches
30% RECRYSTALLISED EVAPORITE BRECCIA, chocolate-brown, calcareous; dips 45°; in irregular beds 1 cm across
30% GYPSUM, crystalline; in layers and veins in creamy grey to white recrystallised evaporite breccia; in irregular aggregates, ellipsoidal patches and lens shaped pieces; gypsum grey and pink below 17.53 m

CORE No. 8

Interval: 19.96 - 21.49 m (65'6" - 70'6")
Cut: 1.53 m (5'0") Recovered: 1.53 m (5'0")
Description:
19.96 - 21.34 m (65'6" - 70'0")
80% RECRYSTALLISED EVAPORITE BRECCIA, chocolate-brown, calcareous; contains scattered crystals of gypsum to 3 mm across
20% GYPSUM, light grey; crystals in subrounded, ellipsoidal and irregular aggregates and thin stringers to 8 cm across with random orientation; increases to 60% between 20.73 m and 21.34 m
21.34 - 21.51 m (70'0" - 70'6")
75% DOLOMITE, cream, mostly calcareous; in angular fragments to 2 cm across
25% GYPSUM, light grey, crystalline, forms matrix between crystal fragments

CORE No. 9

Interval: 21.49 - 24.54 m (10'6" - 80'6")
Cut: 3.05 m (10'0") Recovered: 3.00 m (9'10")
Description:
21.54 - 21.84 m (70'8" - 71'8")
60% DOLOMITE, cream, soft, calcareous
20% GYPSUM, colourless, crystalline; in veins and thin layers
15% RECRYSTALLISED EVAPORITE BRECCIA, chocolate-brown, calcareous; with aggregates and fragments of gypsum
5% DOLOMITE, yellow-orange, calcareous, soft; fills joints
Texture is contorted, steeply dipping, and grades into underlying bed
21.84 - 22.25 m (71'8" - 73'0")
80% DOLOMITE, pink, yellow, grey, hard
10% GYPSUM, fills interspaces between breccia fragments
10% DOLOMITE, calcareous, soft
22.25 - 22.86 m (73'0" - 75'0")
70% DOLOMITE, cream, soft, calcareous
25% GYPSUM, colourless, crystalline; in veins and thin layers
5% DOLOMITE, yellow-orange, calcareous, soft; fills cracks

22.86 - 23.16 m (75'0" - 76'0")
DOLOMITE, cream
RECRYSTALLISED EVAPORITE BRECCIA, chocolate-brown; percentage increases towards base
GYPSUM
Texture becomes steadily more contorted towards base of bed
23.16 - 24.54 m (76'0" - 80'6")
50% RECRYSTALLISED EVAPORITE BRECCIA, chocolate-brown, calcareous, contorted; contains fragments of crystalline gypsum and some cream dolomite
35% DOLOMITE, cream, hard, non-calcareous
15% GYPSUM, crystalline; compressed into irregular masses

CORE No. 10
Interval: 24.54 - 27.58 m (80'6" - 90'6")
Cut: 3.04 m (10'0") Recovered: 3.04 m (10'0")
Description:
24.54 - 27.58 m (80'6" - 90'6")
60-70% RECRYSTALLISED EVAPORITE BRECCIA, chocolate-brown, calcareous, contorted; contains gypsum fragments and occasional veins
20-30% GYPSUM, pink and white, crystalline; squeezed into irregular elongated masses to 8 cm long, stringers and aggregates
10% DOLOMITE, off-white, soft, calcareous

CORE No. 11
Interval: 27.58 - 30.63 m (90'6" - 100'6")
Cut: 3.05 m (10'0") Recovered: 2.90 m (9'6")
Description:
27.73 - 30.33 m (91'0" - 99'6")
40% RECRYSTALLISED EVAPORITE BRECCIA, chocolate-brown, contorted, calcareous; in stringers around gypsum aggregates
30% GYPSUM, white and grey; dip vertiical; in elongate ellipsoid aggregates to 15 cm across, and in stringers
30% DOLOMITE, cream, partly calcareous; in fragments to 2 cm across
30.33 - 30.63 m (99'6" - 100'6")
70% RECRYSTALLISED EVAPORITE BRECCIA, chocolate-brown, calcareous, uncontorted
30% GYPSUM, white and grey; dip vertical; in elongate ellipsoided aggregates to 15 cm across, and in stringers

CORE No. 12
Interval: 30.63 - 33.68 m (100'6" - 110'6")
Cut: 3.05 m (10'0") Recovered: 2.94 m (9'8")
Description:
30.83 - 31.57 m (101'2" - 103'7")
40% RECRYSTALLISED EVAPORITE BRECCIA, chocolate-brown; in stringers and infilling between fragments
30% GYPSUM, white to grey, crystalline; in aggregates to 10 cm long but mostly smaller, and in stringers
30% DOLOMITE, cream, non-calcareous, hard, ellipsoidal; in fragments to 8 cm across but generally smaller
Texture is steeply dipping and contorted

31.57 - 32.79 m (103'7" - 107'7")
50% RECRYSTALLISED EVAPORITE BRECCIA, chocolate-brown, calcareous, soft
40% DOLOMITE, grey-green, calcareous, soft
10% GYPSUM, colourless, crystalline; in veinlets
Mottled zone in red and greenish bodies to 12 cm across
32.79 - 33.07 m (107'7" - 108'6")
35-45% RECRYSTALLISED EVAPORITE BRECCIA, chocolate-brown, contorted; in stringers around gypsum aggregates
30-40% DOLOMITE, cream, partly calcareous; in fragments to 2 cm across
20% GYPSUM, white and grey, vertical dips
5% DOLOMITE, in small fragments
Texture is similar to 27.78 - 28.53 m but fragments and randomly oriented
33.07 - 33.68 m (108'6" - 110'6")
35-65% RECRYSTALLISED EVAPORITE BRECCIA, chocolate-brown
65-35% DOLOMITE, grey, hard, non-calcareous

CORE No. 13

Interval: 33.68 - 36.73 m (110'6" - 120'6")
Cut: 3.05 m (10'0") Recovered: 2.93 m (9'7")
Description:
33.81 - 34.03 m (110'11" - 111'8")
90% DOLOMITE, pink and yellow-cream; steeply dipping
10% GYPSUM, clear, colourless; in veins
34.03 m - 34.39 m (111'8" - 112'10")
40% RECRYSTALLISED EVAPORITE BRECCIA, chocolate-brown; forms matrix
40% DOLOMITE, grey, non-calcareous, hard; in fragments to 4 cm across
20% DOLOMITE, grey, yellow, calcareous, soft
34.39 - 34.69 m (112'10" - 113'10")
60% GYPSUM, grey, crystalline; in large fragments
40% RECRYSTALLISED EVAPORITE BRECCIA, chocolate-brown, calcareous; contains fragments of gypsum; forms matrix
34.69 - 35.05 m (113'10" - 115'0")
100% GYPSUM, grey-white, crystalline, massive
35.05 - 35.33 m (115'0" - 115'11")
60% GYPSUM, grey, crystalline; in large fragments
40% RECRYSTALLISED EVAPORITE BRECCIA, chocolate-brown, calcareous; contains fragments of gypsum; forms matrix
35.33 - 36.73 m (115'11" - 120'6")
50% RECRYSTALLISED EVAPORITE BRECCIA, chocolate-brown; forms matrix and in small fragments
35% DOLOMITE cream, soft, calcareous
10% DOLOMITE, grey, hard, non-calcareous
5% GYPSUM, colourless; in large crystals

CORE No. 14

Interval: 36.73 - 39.77 m (120'6" - 130'6")
Cut: 3.04 m (10'0") Recovered: 3.04 m (10'0")
Description:
36.73 - 39.77 m (120'6" - 130'6")
55-75% RECRYSTALLISED EVAPORITE BRECCIA, chocolate-brown; forms matrix
20-25% DOLOMITE, grey, non-calcareous; in elongated fragments up to 12 cm long
10-15% GYPSUM, white and grey; in ellipsoidal aggregates to 10 cm long, and in colourless stringers 10 cm long and 1 cm across

Texture is as follows-
36.73 - 37.95 m Mottled haphazardly
37.95 - 38.60 m Dips steeply
38.60 - 39.47 m Dips vertically
39.47 - 39.77 m Mottled haphazardly

CORE No. 15

Interval: 39.77 - 42.82 m (130'6" - 140'6")
Cut: 3.05 m (10'0") Recovered: 3.05 m (10'0")
Description:
39.77 - 41.30 m (130'6" - 135'6")
65% GYPSUM, crystalline, massive; in aggregates to 18 cm across, and in smaller aggregates, vertical dips
30% RECRYSTALLISED EVAPORITE BRECCIA, chocolate-brown, and dark grey, very calcareous; in matrix and filling interstices
5% DOLOMITE, orange, calcareous; lines fractures in gypsum
Texture is mottled
41.30 - 41.38 m (135'6" - 135'9")
100% RECRYSTALLISED EVAPORITE BRECCIA
41.38 - 41.73 m (135'9" - 136'11")
95% GYPSUM, grey, crystalline
5% RECRYSTALLISED EVAPORITE BRECCIA
41.73 - 42.09 m (136'11" - 138'1")
60% RECRYSTALLISED EVAPORITE BRECCIA
40% GYPSUM, in large fragments
42.09 - 42.55 m (138'1" - 139'7")
90% GYPSUM, grey-white, crystalline
5% RECRYSTALLISED EVAPORITE BRECCIA, chocolate-brown, soft, calcareous
5% DOLOMITE, orange, calcareous; lines cracks in gypsum
42.55 - 42.82 m (139'7" - 140'6")
65% RECRYSTALLISED EVAPORITE BRECCIA, chocolate-brown, calcareous, soft
35% GYPSUM, grey, crystalline

CORE No. 16

Interval: 42.82 - 45.87 m
Cut: 3.05 m (10'0") Recovered: 3.05 m (10'0")
Description:
42.82 - 43.08 m (140'6" - 141'4")
60% GYPSUM, white and pink, massive, crystalline
40% RECRYSTALLISED EVAPORITE BRECCIA, chocolate-brown, calcareous; contains gypsum fragments in part
43.08- 43.82 m (141'4" - 143'9")
70% RECRYSTALLISED EVAPORITE BRECCIA, chocolate-brown, calcareous; contains gypsum fragments in part
30% GYPSUM, white and pink, massive, crystalline
43.82 - 45.01 m (143'9" - 147'8")
70% GYPSUM, mainly white; in soild masses to 20 cm long
30% RECRYSTALLISED EVAPORITE BRECCIA, chocolate-brown; contains veins of gypsum; dips 70°
45.01 - 45.87 m (147'8" - 150'6")
80% RECRYSTALLISED EVAPORITE BRECCIA, chocolate-brown
10% DOLOMITE, grey, calcareous; in fragments to 1 cm long
10% GYPSUM, in fragments

CORE No. 17

Interval: 45-87 - 48.92 m (150'6" - 160'6")
Cut: 3.05 m (10'0") Recovered: 3.05 m (10'0")
Description:
45.87 - 46.05 m (150'6" - 151'1")
90% RECRYSTALLISED EVAPORITE BRECCIA, chocolate-brown to red, calcareous
5% DOLOMITE, grey, calcareous; in fragments to 1 cm across
5% GYPSUM, in fragments
46.05 - 46.65 m (151'1" - 153'1")
30% GYPSUM, in aggregates to 8 cm long
50% DOLOMITE, cream, soft, very slightly calcareous
20% RECRYSTALLISED EVAPORITE BRECCIA, orange-pink, fills cracks
46.65 - 47.29 m (153'1" - 155'2")
100% GYPSUM, grey, crystalline
47.29 - 48.92 m (155'2" - 160'6")
40-60% GYPSUM, crystalline; in ellipsoidal aggregates to 18 cm long
40-60% RECRYSTALLISED EVAPORITE BRECCIA, chocolate-brown and red, calcareous

CORE No. 18

Interval: 48.92 - 57.97 m (160'6" - 170'6")
Cut: 3.05 m (10'0") Recovered: 3.05 m (10'0")
Description:
48.92 - 49.78 m (160'6" - 163'4")
70% RECRYSTALLISED EVAPORITE BRECCIA, chocolate-brown; forms matrix
25% GYPSUM, white to grey; in aggregates to 8 cm across
5% DOLOMITE, grey, slightly calcareous; in aggregates to 1 cm across
49.78 - 50.14 m (163'4" - 164'3")
100% GYPSUM, white to grey
50.14 - 51.26 m (164'3" - 168'2")
60% RECRYSTALLISED EVAPORITE BRECCIA, chocolate-brown, calcareous
30% DOLOMITE, grey-brown, slightly calcareous; in fragments to 8 cm across
10% GYPSUM, in fragments
51.26 - 51.97 m (168'2" - 170'6")
65% RECRYSTALLISED EVAPORITE BRECCIA, chocolate-brown, calcareous
25% GYPSUM, white; steeply dipping oval aggregates to 15 cm long
10% DOLOMITE, yellow, calcareous, thin beds

CORE No. 19

Interval: 51.97 - 55.02 m (170'6" - 180'6")
Cut: 3.05 m (10'0") Recovered: 2.44 m (8'0")
Description:
52.58 - 52.62 m (172'6" - 172'8")
90% RECRYSTALLISED EVAPORITE BRECCIA, chocolate-brown, calcareous
10% GYPSUM, in fragments
52.62 - 54.03 m (172'8" - 177'3")
72% GYPSUM, white and pink, crystalline; in mottled layers and aggregates, steep dips
23% RECRYSTALLISED EVAPORITE BRECCIA, orange and pink, slightly calcareous
5% DOLOMITE, brown-grey; in stringers and aggregates; very calcareous

54.03 - 54.25 m (177'3" - 178'0")
60% RECRYSTALLISED EVAPORITE BRECCIA, chocolate-brown, calcareous; forms matrix
30% GYPSUM, orange-pink, crystalline; in irregular masses to 10 cm across
10% GYPSUM, clear, crystalline; in fragments to 2 cm across
54.25 - 54.45 m (178'0" - 178'8")
90% GYPSUM, pink; in fairly solid aggregates, crystalline
10% RECRYSTALLISED EVAPORITE BRECCIA, chocolate-brown, calcareous, fills interspaces
54.45 - 55.02 m (178'8" - 180'6")
40% GYPSUM, pink, mottled; in crystalline aggregates to 12 cm long; steep dips
40% RECRYSTALLISED EVAPORITE BRECCIA, chocolate-brown, calcareous
20% GYPSUM, white; in aggregates to 5 cm across

CORE No. 20

Interval: 55.02 - 58.06 m (180'6" - 190'6")
Cut: 3.04 m (10'0") Recovered: 2.13 m (7'0")
Description:
55.93 - 56.54 m (183'6" - 185'6")
35% GYPSUM, pink; in aggregates to 5 cm across
55% RECRYSTALLISED EVAPORITE BRECCIA, chocolate-brown, calcareous
10% GYPSUM, grey, crystalline; in small fragments
56.54 - 56.64 m (185'6" - 185'10")
35% GYPSUM, pink; in aggregates to 5 cm across
55% RECRYSTALLISED EVAPORITE BRECCIA, chocolate-brown, calcareous
10% DOLOMITE, dark grey, calcareous
56.64 - 57.15 m (185'0" - 187'6")
95% RECRYSTALLISED EVAPORITE BRECCIA, chocolate-brown, calcareous, slickensided; possibly a minor fault zone
15% GYPSUM, in ellipsoidal aggregates to 5 cm across
57.15 - 57.61 m (187'6" - 189'0")
100% DOLOMITE, grey-white, calcareous
57.71 - 57.84 m (189'4" - 189'9")
100% GYPSUM
57.84 - 58.06 m (189'9" - 190'6")
35% GYPSUM, colourless; in crystalline veins
45% DOLOMITE, cream, calcareous
20% DOLOMITE, pink-orange, yellow and very calcareous in basal 5 cm; fills cracks and fissures

CORE No. 21

Interval: 58.06 - 61.11 m (190'6" - 200'6")
Cut: 3.05 m (10'0") Recovered: 3.05 m (10'0")
Description:
58.06 - 58.16 m (190'6" - 190'10")
80% DOLOMITE, yellow, calcareous
20% RECRYSTALLISED EVAPORITE BRECCIA, chocolate-brown, calcareous
58.16 - 59.28 m (190'10" - 194'6")
90% GYPSUM, white-grey, mottled
5% DOLOMITE, dark grey, very calcareous
5% RECRYSTALLISED EVAPORITE BRECCIA, pink, yellow and orange, fills cracks in steeply dipping gypsum
59.28 - 59.59 m (194'6" - 195'6")
95% RECRYSTALLISED EVAPORITE BRECCIA, chocolate-brown, calcareous
5% GYPSUM, in single crystals and aggregates to 2 cm across

59.59 - 59.82 m (195'6" - 196'3")
80% GYPSUM, grey-white
15% RECRYSTALLISED EVAPORITE BRECCIA, chocolate-brown, calcareous
5% DOLOMITE, orange-pink
Mottled texture
59.82 - 59.97 m (196'8" - 196'9")
90% RECRYSTALLISED EVAPORITE BRECCIA, chocolate-brown
10% GYPSUM, in single crystals
59.77 - 60.43 m (196'9" - 198'3")
40% GYPSUM, grey, crystalline; in spheroidal and ellipsoidal aggregates and laminae; mottled
40% RECRYSTALLISED EVAPORITE BRECCIA, chocolate-brown
20% GYPSUM, reddish
Texture is mottled and steep dips
60.43 - 60.71 m (198'3" - 199'2")
60% GYPSUM, grey, crystalline; in spheroidal and ellipsoidal aggregates and laminae; mottled
30% GYPSUM, reddish
10% RECRYSTALLISED EVAPORITES BRECCIA, chocolate-brown; in steeply dipping laminae
60.71 - 61.11 m (199'2" - 200'6")
95% GYPSUM, grey-white; in densely packed aggregates to 15 cm long
5% RECRYSTALLISED EVAPORITE BRECCIA, orange-pink; in thin veins

CORE No. 22

Interval: 62.48 - 64.62 m (205'0" - 212'0")
Cut: 2.24 m (7'0") Recovered: 2.06 m (6'9")
Description:
62.55 - 63.17 m (205'3" - 207'3")
65% GYPSUM, grey and white, crystalline; in aggregates to 8 cm across, random orientation
25% RECRYSTALLISED EVAPORITE BRECCIA, chocolate-brown, calcareous; contains a high percentage of small fragments of gypsum
10% GYPSUM, reddish, mottled; with recrystallised evaporite breccia
63.17 - 63.29 m (207'3" - 207'8")
95% GYPSUM, grey-white and colourless, fractured in part
5% RECRYSTALLISED EVAPORITE BRECCIA, chocolate-brown, contains a high percentage of small fragments of gypsum
63.29 - 64.62 m (207'9" - 212'0")
35-45% GYPSUM, reddish, mottled
35-45% RECRYSTALLISED EVAPORITE BRECCIA, chocolate-brown, calcareous; forms matrix
20% GYPSUM, crystalline in grey irregular aggregates to 5 cm across; local concentrations of gypsum and recrystallised evaporite breccia

CORE No. 23

Interval: 64.62 - 67.97 m (212'0" - 223'0")
Cut: 3.35 m (11'0") Recovered: 2.74 m (9'0")
Description:
65.23 - 65.53 m (214'0" - 215'0")
100% RECRYSTALLISED EVAPORITE BRECCIA, chocolate-brown, calcareous; contains fragments of gypsum
65.83 - 65.97 m (215'0" - 216'5")
40% GYPSUM, grey and yellow, crystalline; in aggregates to 2 cm across and in stringers
20% GYPSUM, reddish, disseminated in stringers intermixed with fragments of grey gypsum
40% RECRYSTALLISED EVAPORITE BRECCIA, chocolate-brown, calcareous; forms matrix

65.97 - 67.97 m (216'5" - 223'0")
40-60% RECRYSTALLISED EVAPORITE BRECCIA, chocolate-brown, calcareous; forms matrix
30-40% GYPSUM, grey, crystalline; in aggregates to 5 cm across and stringers, dips at low angles
10-20% DOLOMITE, grey, calcareous; in bodies to 5 cm across

CORE No. 24

Interval: 67.97 - 71.02 m (223'0" - 233'0")
Cut: 3.05 m (10'0") Recovered: 3.05 m (10'0")
Description:
67.97 - 71.02 m (223'0" - 233'0")
35-65% GYPSUM, grey-white, crystalline; in aggregates to 10 cm across and stringers to 12 cm long and 1 cm wide
35-65% RECRYSTALLISED EVAPORITE BRECCIA, chocolate-brown, calcareous; forms matrix

CORE No. 25

Interval: 71.02 - 75.59 m (233'0" - 248'0")
Cut: 4.57 m (15'0") Recovered: 3.35 m (11'0")
Description:
72.24 - 73.74 m (237'0" - 241'11")
40-65% RECRYSTALLISED EVAPORITE BRECCIA, chocolate-brown, calcareous; forms matrix
30-55% GYPSUM, white-grey, crystalline; in round aggregates up to 10 cm across, and stringers to 8 cm long
5% DOLOMITE, grey, calcareous, soft
73.74 - 74.14 m (241'11" - 243'3")
60% GYPSUM, grey, crystalline; in aggregates
25% GYPSUM, reddish, disseminated; with fragments of grey gypsum
15% RECRYSTALLISED EVAPORITE BRECCIA, chocolate-brown, calcareous
74.14 - 75.39 m (243'3" - 247'4")
40-65% RECRYSTALLISED EVAPORITE BRECCIA, chocolate-brown, calcareous; forms matrix
30-55% GYPSUM, white-grey, crystalline; in rounded aggregates up to 10 cm across; and in stringers to 8 cm long
5% DOLOMITE, grey, calcareous, soft
75.39 - 75.59 m (247'4" - 248'0")
100% GYPSUM, grey-white, crystalline

CORE No. 26

Interval: 75.59 - 78.64 m (248'0" - 258'0")
Cut: 3.05 m (10'0") Recovered: 2.74 m (9'0")
Description:
75.59 - 76.05 m (248'0" - 249'6")
100% GYPSUM, grey-white, crystalline
76.05 - 76.73 (249'6" - 251'9")
100% RECRYSTALLISED EVAPORITE BRECCIA, pale grey and light brown, soft
76.73 - 77.06 m (251'9" - 252'10")
90% DOLOMITE, grey, hard, non-calcareous; contains cross cutting veins of gypsum
10% GYPSUM, vitreous; in veins
77.06 - 77.19 m (252'10" - 253'33")
100% GYPSUM, grey-white, crystalline
77.19 - 78.03 m (253'3" - 256'0")
90% RECRYSTALLISED EVAPORITE BRECCIA, intermixed dark chocolate-brown and grey, calcareous, soft
10% GYPSUM, grey-white; rare large aggregates to 10 cm across

78.03 - 78.23 m (256'0" - 256'8")
100% DOLOMITE, dark grey, calcareous

CORE No. 27

Interval: 78.64 - 80.77 m (258'0" - 265'0")
Cut: 2.13 m (7'0") Recovered: 2.13 m (7'0")
Description:
78.64 - 80.47 m (258'0" - 264'0")
54% RECRYSTALLISED EVAPORITE BRECCIA, grey-brown, calcareous; contains sand grains and numerous grains and pebbles of gypsum and rarer grey dolomite
35% GYPSUM, grey, crystalline; in aggregates to 5 cm across
80.47 - 80.67 m (264'0" - 264'8")
90% GYPSUM, grey crystalline
10% RECRYSTALLISED EVAPORITE BRECCIA, grey-brown, calcareous
80.67 - 80.77 m (264'8" - 265'0")
50% GYPSUM, grey-white; in aggregates
50% RECRYSTALLISED EVAPORITE BRECCIA, grey, hard, non-calcareous

CORE No. 28

Interval: 82.30 - 86.87 m (270'0" - 285'0")
Cut: 4.57 m (15'0")
Description:
82.30 - 84.48 m (270'0" - 277'2")
70% RECRYSTALLISED EVAPORITE BRECCIA, chocolate-brown, in part pastel green, soft, slightly calcareous; forms matrix
25% GYPSUM, orange and grey, crystalline; in aggregates up to 10 cm across, veins, or mottled
5% DOLOMITE, grey
84.48 - 85.37 m (277'2" - 280'1")
65% GYPSUM, orange and grey mottled, crystalline; in aggregates to 10 cm across; and in veins
35% RECRYSTALLISED EVAPORITE BRECCIA, chocolate-brown, calcareous
85.37 - 85.65 m (280'1" - 281'0")
100% RECRYSTALLISED EVAPORITE BRECCIA, pastel green and chocolate brown; contains some grains and pebbles of gypsum and dolomite

CORE No. 29

Interval: 86.87 - 89.92 (285'0" - 295'0")
Cut: 3.05 m (10'0") Recovered: 3.05 m (10'0")
Description:
86.87 - 87.20 m (285'0" - 286'1")
50% GYPSUM, grey or orange, crystalline; intermingled with dolomite
50% DOLOMITE, light grey, calcareous, soft
87.20 - 87.56 (286'1" - 287'3")
50% RECRYSTALLISED EVAPORITE BRECCIA, chocolate-brown
45% GYPSUM, grey, crystalline; in fragments
5% DOLOMITE, steel-grey; in bodies to 4 cm across
Texture is mottled
87.56 - 88.01 m (287'3" - 288'9")
95% GYPSUM, grey, crystalline
5% RECRYSTALLISED EVAPORITE BRECCIA, yellow, very calcareous; fills cracks

88.01 - 88.17 m (288'9" - 289'3")
50% RECRYSTALLISED EVAPORITE BRECCIA, chocolate-brown
45% GYPSUM, grey, crystalline; in fragments
5% DOLOMITE, steel-grey; in bodies to 4 cm across
Texture is mottled
88.17 - 88.14 m (289'3" - 290'6")
95% GYPSUM, yellow-grey, crystalline
5% RECRYSTALLISED EVAPORITE BRECCIA, yellow and chocolate brown, calcareous
88.54 - 89.92 m (290'6" - 295'0")
50% RECRYSTALLISED EVAPORITE BRECCIA, chocolate-brown
45% GYPSUM, grey, crystalline; in fragments
5% DOLOMITE, steel-grey; in bodies to 4 cm across
Texture is mottled with local concentrations of recrystallised evaporite breccia and gypsum

CORE No. 30

Interval: 89.92 m - 92.96 m (295'0" - 305'0")
Cut: 3.04 m (10'0") Recovered: 2.89 m (9'6")
Description:
89.92 - 91.59 m (295'6" - 300'6")
65% RECRYSTALLISED EVAPORITE BRECCIA, brown, calcareous, soft; forms matrix
35% ANHYDRITE, light grey to white, medium crystalline; in bodies generally 2 cm and rarely to 12 cm across with random orientation
91.59 - 92.03 m (300'6" - 301'11")
40% RECRYSTALLISED EVAPORITE BRECCIA, brown, calcareous, soft; forms matrix
40% ANHYDRITE, light grey to white, medium crystalline, in bodies 1 to 2 cm across
20% DOLOMITE, dark grey
Texture is mottled; junction with underlying bed is horizontal
92.03 - 92.96 m (301'11" - 305'0")
95% HALITE, pink-brown, coarsely crystalline, compact, brittle
5% EVAPORITE ROCK, grey and cream, medium crystalline, some slightly calcareous; in fragments

CORE No. 31

Interval: 92.96 - 96.01 m (305'0" - 315'0")
Cut: 3.05 m (10'0") Recovered: 3.05 m (10'0")
Description:
92.96 - 96.01 m (305'0" - 315'0")
93-96% HALITE, pink to light brown, coarsely crystalline, brittle, compact, contains inclusions of white medium crystalline evaporite rock to 10 cm across
4-7% EVAPORITE ROCK, dark brown and greenish; in fragments to 10 cm across but mostly smaller; brown evaporite rock is slightly calcareous; green evaporite rock, occurs as pebbles about 3 mm across

CORE No. 32

Interval: 96.01 - 99.06 m (315'0" - 325'0")
Cut: 3.05 m (10'0") Recovered: 3.05 m (10'0")
Description:
96.01 - 99.06 m (315'0" - 325'0")
93-96% HALITE, pink to light brown, coarsely crystalline, brittle, compact; contains inclusions of white, medium crystalline evaporite rock to 10 cm across
4-7% EVAPORITE ROCK, dark brown and greenish; in fragments to 10 cm across, but mostly smaller; brown evaporite rock is slightly calcareous; green evaporite rock occurs in aggregates about 3 mm across

CORE No. 33

Interval: 99.06 - 102.11 m (325'0" - 335'0")
Cut: 3.05 m (10'0") Recovered: 3.05 m (10'0")
Description:
99.06 - 102.11 m (325'0" - 335'0")
97% HALITE, pink to light brown, coarsely crystalline, brittle, compact; contains inclusions of white medium crystalline evaporite rock
3% EVAPORITE ROCK, brown, dark grey and greenish, finely and medium crystalline; in fragments to 1 cm across but usually smaller

CORE No. 34

Interval: 102.11 - 105.16 m (335'0" - 345'0")
Cut: 3.05 (10'0") Recovered: 3.05 m (10'0")
Description:
102.11 - 105.16 (335'0" - 345'0")
95% HALITE, pink to light brown and colourless, rarely white, compact, brittle
3% EVAPORITE ROCK, grey and greenish; contains inclusions of medium crystalline, white evaporite rock; as bodies to 5 cm across, medium crystalline and as stringers to 8 cm long, very slightly calcareous; stains yellow after treatment with hydrochloric acid
2% EVAPORITE ROCK, brown, finely crystalline, soft, slightly calcareous; occurs in fragments to 3 mm across, stains yellow after treatment with hydrochloric acid

CORE No. 35

Interval: 105.16 - 108.20 m (395'0" - 355'0")
Cut: 3.04 m (10'0") Recovered: 3.04 m (10'0")
Description:
105.16 - 108.20 m (345'0" - 355'0")
95% HALITE, pink to light brown and colourless, rarely white, coarsely crystalline, compact, brittle
5% EVAPORITE ROCK, dark brown, very slightly calcareous, soft; in rare stringers to 15 cm long, and rare bodies of non-calcareous grey evaporite rock up to 4 cm across

CORE No. 36

Interval: 108.20 - 111.25 m (355'0" - 365'0")
Cut: 3.05 m (10'0") Recovered: 3.05 m (10'0")
Description:
108.20 - 111.25 m (355'0" - 365'0")
90% HALITE, pink to light brown, and colourless, coarsely crystalline; compact, brittle
5% EVAPORITE ROCK, greenish cream and grey, medium crystalline, non-calcareous; in bodies to 2 cm across
5% EVAPORITE ROCK, chocolate brown, finely crystalline, soft, slightly calcareous; in bodies to 5 cm across

CORE No. 37

Interval: 111.25 - 114.30 m (365'0" - 375'0")
Cut: 3.05 m (10'0") Recovered: 3.05 m (10'0")
Description:
111.25 - 114.30 m (365'0" - 375'0")
90% HALITE, pink to light brown and colourless, coarsely crystalline, compact, brittle
5% EVAPORITE ROCK, cream, medium crystalline; in rare large ellipsoidal bodies to 10 cm across, non-calcareous
5% EVAPORITE ROCK, variously coloured, finely and medium crystalline; in fragments to 1 cm across

CORE No. 38

Interval: 114.30 - 117.35 m (375'0" - 385'0")
Cut: 3.05 m (10'0") Recovered: 3.05 m (10'0")
Description:
114.30 - 117.35 m (375'0" - 385'0")
95% HALITE, orange-brown, coarsely crystalline, brittle, compact
5% EVAPORITE ROCK, green and dark grey, finely and medium crystalline; in rare bodies to 5 cm across, randomly oriented

CORE No. 39

Interval: 117.34 - 120.40 m (385'0" - 395'0")
Cut: 3.05 m (10'0") Recovered: 1.98 m (6'6")
Description:
117.35 - 118.12 m (385'0" - 390'10")
95% HALITE, orange-brown, coarsely crystalline, brittle, compact
5% EVAPORITE ROCK, green and dark grey, finely and medium crystalline; in rare bodies to 5 cm across, randomly oriented
118.12 - 119.33 m (390'10" - 395'0")
55% HALITE, orange-brown, coarsely crystalline, brittle, compact
45% EVAPORITE ROCK, grey, hard, medium crystalline, non-calcareous

CORE No. 40

Interval: 120.40 - 123.44 m (395'0" - 405'0")
Cut: 3.04 m (10'0") Recovered: 3.04 m (10'0")
Description:
120.40 - 123.44 m (395'0" - 405'0")
94% HALITE, orange-brown, coarsely crystalline, compact, brittle
2% EVAPORITE ROCK, cream, medium crystalline, hard; in bodies to 2 cm across
2% EVAPORITE ROCK, light green, medium crystalline; in aggregates to 3 mm across
2% EVAPORITE ROCK, brown, finely crystalline, soft; in fragments and aggregates to 1 cm across

CORE No. 41

Interval: 123.44 - 126.49 m (405'0" - 415'0")
Cut: 3.05 m (10'0") Recovered: 3.05 m (10'0")
Description:
123.44 - 126.49 m (405'0" - 415'0")
92% HALITE, orange-brown, coarsely crystalline, compact, brittle
4% EVAPORITE ROCK, greyish green, light green and cream, medium crystalline; in round aggregates to 2 cm across, and ellipsoidal bodies to 5 cm across
4% EVAPORITE ROCK, brown, finely crystalline, soft; in bodies to 1 cm across

CORE No. 42

Interval: 126.49 - 129.54 m (415'0" - 425'0")
Cut: 3.05 m (10'0") Recovered: 3.05 m (10'0")
Description:
126.49 - 129.54 m (415'0" - 425'0")
92% HALITE, orange-brown, coarsely crystalline, compact, brittle
4% EVAPORITE ROCK, greyish green, light green and cream, medium crystalline; in round bodies to 3 cm across, and ellipsoidal bodies up to 7 cm across
4% EVAPORITE ROCK, brown, finely crystalline, soft; in bodies to 2 cm across

CORE No. 43

Interval: 129.54 - 132.59 m (425'0" - 435'0")
Cut: 3.05 m (10'0") Recovered: 3.05 m (10'0")
Description:
129.54 - 132.59 m (425'0" - 435'0")
92% HALITE, orange-brown, coarsely crystalline, compact, brittle
4% EVAPORITE ROCK, greyish green, light green and cream, medium crystalline; in rounded bodies to 3 cm across
4% EVAPORITE ROCK, brown, finely crystalline, soft; in bodies to 3 cm across

CORE No. 44

Interval: 132.59 - 135.64 m (435'0" - 445'0")
Cut: 3.05 m (10'0") Recovered: 3.05 m (10'0")
Description:
132.59 - 134.42 m (435'0" - 441'0")
92% HALITE, orange-brown, coarsely crystalline, compact, brittle
4% EVAPORITE ROCK, greyish green, light green and cream, medium crystalline; in rounded bodies to 3 cm across
4% EVAPORITE ROCK, brown, finely crystalline, soft; in bodies to 3 cm across
134.42 - 135.64 m (441'0" - 445'0")
90% HALITE, orange-brown, coarsely crystalline, compact brittle
7% EVAPORITE ROCK, brown, finely crystalline, soft; in bodies to 3 cm across
3% EVAPORITE ROCK, greenish grey; in two ellipsoidal bodies about 8 cm across

CORE No. 45

Interval: 135.64 - 138.68 m (445'0" - 455'0")
Cut: 3.04 m (10'0") Recovered: 3.04 m (10'0")
Description:
135.65 - 136.86 m (445'0" - 449'0")
85% HALITE, brown, coarsely crystalline, compact, brittle
10% EVAPORITE ROCK, chocolate-brown, finely crystalline, soft
5% EVAPORITE ROCK, greenish, medium crystalline; in rare ellipsoidal bodies to 8 cm across
136.86 - 137.47 m (449(0" - 451'0")
80% HALITE, brown, coarsely crystalline, compact, brittle
10% EVAPORITE ROCK, chocolate-brown, finely crystalline, soft; in bodies to 5 cm across
10% EVAPORITE ROCK, light green, medium crystalline; in bodies to 8 cm across
137.47 - 138.07 m (451'0" - 453'0")
90% HALITE, brown, grades to greyish-white towards base, coarsely crystalline, compact, brittle; contains small pebbles of greenish evaporite rock
10% EVAPORITE ROCK, black; in fragments to 8 cm long
138.07 - 138.68 m (453'0" - 455'0")
90% HALITE, grey-white, locally stained dark grey to black by evaporite rock, coarsely crystalline, compact, brittle
10% EVAPORITE ROCK, black; occurs in fragments to 4 cm across

CORE No. 46

Inverval: 138.68 - 141.73 m (455'0" - 465'0")
Cut: 3.05 m (10'0") Recovered: 3.05 m (10'0")
Description:
138.68 - 140.10 m (455'0" - 459'8")
87% HALITE, grey-white, in places stained black, coarsely crystalline, compact, brittle; contains small pebbles of green evaporite rock
3% EVAPORITE ROCK, chocolate brown, finely crystalline, soft; occurs in small fragments
140.10 - 140.90 m (459'8" - 462'3")
80% HALITE, grey-white; in places stained black, coarsely crystalline, compact, brittle; contains small pebbles of green evaporite rock
20% DOLOMITE, black, hard, finely crystalline; contains coarse crystals of pyrite and veins of reddish unidentified material
140.90 - 141.73 m (462'3" - 465'0")
85% HALITE, light orange; in places stained dark grey, coarsely crystalline, compact, brittle
8% EVAPORITE ROCK, cream, hard; in ellipsoidal bodies to 8 cm across
7% EVAPORITE ROCK, brown, soft; in bodies up to 2 cm across

CORE No. 47

Interval: 141.73 - 144.78 m (465'0" - 475'0")
Cut: 3.05 m (10'0") Recovered: 3.05 m (10'0")
Description:
141.74 - 143.26 m (465'0" - 470'0")
90% HALITE, orange-brown, coarsely crystalline, brittle, compact
6% EVAPORITE ROCK, brown, finely crystalline, non-calcareous, soft; in small fragments up to 1 cm across
4% EVAPORITE ROCK, green, occurs in small pebbles up to 3 mm across

143.26 - 148.78 m (470'0" - 475'0")
97% HALITE, orange-brown, coarsely crystalline, compact, brittle
3% EVAPORITE ROCK, brown, finely crystalline, soft; small fragments

CORE No. 48

Interval: 144.78 - 147.83 m (475'0" - 485'0")
Cut: 3.05 m (10'0") Recovered: 3.05 m (10'0")
Description:
144.78 - 144.85 m (475'0" - 475'7")
100% HALITE, orange-brown, coarsely crystalline, compact, brittle
144.85 - 145.69 m (475'7" - 478'0")
60% HALITE, orange-brown, coarsely crystalline, compact, brittle
30% EVAPORITE ROCK, brown, finely crystalline, soft; in aggregates and stringers
5% EVAPORITE ROCK, greenish; in fragments up to 2 cm across
5% DOLOMITE, grey; in angular fragments up to 2 cm across
146.61 - 147.22 m (481'0" - 483'0")
95% HALITE, orange-brown, coarsely crystalline, compact, brittle
5% EVAPORITE ROCK, brown, finely crystalline, soft
147.22 - 147.83 m (483'0" - 485'0")
97% HALITE, orange-brown, coarsely crystalline, compact, brittle
3% EVAPORITE ROCK, brown, finely crystalline, soft

CORE No. 49

Interval: 147.83 - 150.88 m (485'0" - 495'0")
Cut: 3.05 m (10'0") Recovered: 2.95 m (9'9")
Description:
147.93 - 149.25 m (485'4" - 489'8") Finely spaced fracture planes
90% HALITE, orange-brown, coarsely crystalline, compact, brittle
5% EVAPORITE ROCK, chocolate-brown, finely crystalline, soft; fragments to 1 cm across with random orientation
5% EVAPORITE ROCK, light brown, medium crystalline; in fragments to 4 cm across with random orientation
149.25 - 150.52 m (489'9" - 483'10") Coarsely spaced fracture planes
85% HALITE, orange-brown, coarsely crystalline, compact, brittle, clear; in 3 mm zones around evaporite rock fragments
8% EVAPORITE ROCK, white, medium crystalline, hard; fragments to 15 cm across with subvertical orientation
7% EVAPORITE ROCK, chocolate-brown, finely crystalline, soft; fragments to 2 cm across with subvertical orientation
150.52 - 150.88 m (493'10" - 495'0") Finely spaced fracture planes
97% HALITE, orange-brown, coarsely crystalline, compact, brittle
3% EVAPORITE ROCK, grey-brown, moderately soft, finely crystalline; fragments with random orientation

CORE No. 50

Interval: 150.88 - 153.92 m (495'0" - 505'02")
Cut: 3.04 m (10'0") Recovered: 3.04 m (10'0")
Description:
150.88 - 151.41 m (495'0" - 496'9") Finely spaced fracture planes
93% HALITE, orange-brown, coarsely crystalline, compact, brittle
7% EVAPORITE ROCK, chocolate-brown, soft, finely crystalline; fragments to 1 cm across with random orientation
151.41 - 152.12 m (496'9" - 499'1") Coarsely spaced fracture planes
95% HALITE, orange-brown, coarsely crystalline, compact, brittle

3% EVAPORITE ROCK, white to light grey-green, medium crystalline, hard; fragments to 15 cm across with vertical orientation
2% EVAPORITE ROCK, chocolate-brown, soft; fragments to 1 cm across, with random orientation

152.12 - 152.58 m (499'1" - 500'7") Coarsely spaced fracture planes
90% HALITE, orange-brown, coarsely crystalline, compact, brittle
5% EVAPORITE ROCK, white to light grey-green, medium crystalline, hard; fragments to 5 cm across with random orientation
5% EVAPORITE ROCK, chocolate-brown, soft, finely crystalline; fragments to 1 cm across, with random orientation

152.58 - 153.92 m (500'7" - 505'0") Coarsely spaced fracture planes
94% HALITE, orange-brown, coarsely crystalline, compact, brittle
4% EVAPORITE ROCK, chocolate-brown, soft, finely crystalline; fragments to 1 cm across with random orientation
2% EVAPORITE ROCK, light grey-green, moderately soft, medium crystalline; fragments to 2" across with random orientation

CORE No. 51

Interval: 153.92 - 156.97 m (505'0" - 515'0")
Cut: 3.05 m (10'0") Recovered: 3.05 m (10'0")
Description:

153.92 - 154.98 m (505'0" - 506'6") Medium spaced fracture planes
94% HALITE, orange-brown, coarsely crystalline, compact, brittle
4% EVAPORITE ROCK, chocolate-brown, soft, finely crystalline; fragments to 1 cm across with random orientation
2% EVAPORITE ROCK, light grey-green, moderately soft, medium crystalline; fragments to 5 cm across with random orientation

154.38 - 155.45 m (506'6" - 510'0") Coarsely spaced fracture planes
95% HALITE, dark brown, coarsely crystalline, compact, brittle
4% EVAPORITE ROCK, light grey-green, moderately soft, medium crystalline; fragments to 2 cm across with random orientation
1% EVAPORITE ROCK, chocolate-brown, soft, finely crystalline; fragments to 1 cm across with random orientation

155.45 - 155.60 m (510'0" - 510'6") Coarsely spaced fracture planes
100% HALITE, light orange, coarsely crystalline, compact, brittle

155.60 - 156.36 m (510'6" - 513'0") Coarsely spaced fracture planes
95% HALITE, dark-brown, coarsely crystalline, compact, brittle
4% EVAPORITE ROCK, light grey-green, moderately soft, medium crystalline; rounded fragments to 2 cm across with random orientation
1% EVAPORITE ROCK, chocolate-brown, soft, finely crystalline; fragments to 1 cm across with random orientation

156.36 - 156.61 m (513'0" - 513'0") Coarsely spaced fracture planes
100% HALITE, light orange to white, coarsely crystalline, compact, brittle

156.61 - 156.97 m (513'0" - 515'0") Coarsely spaced fracture planes
98% HALITE, dark orange-brown, coarsely crystalline, compact, brittle
2% EVAPORITE ROCK, grey-green, moderately soft, medium crystalline; fragments to 1 cm across with random orientation

CORE No. 52

Interval: 156.97 - 160.02 m (515'0" - 525'0")
Cut: 3.05 m (10'0") Recovered: 3.05 m (10'0")
Description:

156.97 - 157.15 m (515'0" - 515'7") Medium spaced fracture planes
98% HALITE, dark orange-brown, coarsely crystalline, compact, brittle

2% EVAPORITE ROCK, grey-green, moderately soft, medium crystalline; fragments to 1 cm across with random orientation

157.15 - 157.66 m (515'7" - 517'3") Medium spaced fracture planes
96% HALITE, orange, coarsely crystalline, compact, brittle
2% EVAPORITE ROCK, white, medium crystalline, hard; fragments to 2 cm across with vertical orientation
2% EVAPORITE ROCK, chocolate-brown, soft, finely crystalline; fragments to 4 cm across with vertical orientation

157.66 - 158.19 m (517'3" - 519'0") Medium spaced fracture planes
95% HALITE, orange, coarsely crystalline, compact, brittle
4% EVAPORITE ROCK, grey-green, moderately soft, medium crystalline; fragments to 2 cm across with subvertical orientation
1% EVAPORITE ROCK, chocolate-brown, soft, finely crystalline; fragments to 1 cm across with subvertical orientation

158.19 - 160.02 m (519'0" - 525'0") Coarsely spaced fracture planes
97% HALITE, orange, coarsely crystalline, compact, brittle
2% EVAPORITE ROCK, grey-green, moderately hard, medium crystalline; fragments to 2 cm across with subvertical orientation
1% EVAPORITE ROCK, chocolate brown, soft, finely crystalline; fragments to 1 cm across with subvertical orientation

CORE No. 53

Interval: 160.02 - 163.07 m (525'0" - 535'0")
Cut: 3.05 m (10'0") Recovered: 3.05 m (10'0")
Description:

160.02 - 163.07 m (525'0" - 535'0") Finely to medium spaced fracture planes
98% HALITE, orange-brown, coarsely crystalline, compact, brittle
1% EVAPORITE ROCK, white, medium crystalline, hard, grades to finely crystalline in parts; fragments to 5 cm across with subvertical orientation
1% EVAPORITE ROCK, grey-green, moderately hard, medium crystalline; fragments to 2 cm across with subvertical orientation

CORE No. 54

Interval: 163.07 - 166.12 m (535'0" - 545'0")
Cut: 3.05 m (10'0") Recovered: 3.05 m (10'0")
Description:

163.07 - 163.93 m (535'0" - 537'10") Finely spaced fracture planes
99% HALITE, light orange, coarsely crystalline, compact, brittle
1% EVAPORITE ROCK, dark grey, soft, finely crystalline; fragments to 5 mm across with random orientation

163.93 - 166.12 m (537'10" - 545'0") Coarsely spaced fracture planes
98% HALITE, orange-brown, coarsely crystalline, compact, brittle
2% EVAPORITE ROCK, dark grey, moderately soft; finely crystalline; rounded fragments to 2 cm across with random orientation

CORE No. 55

Interval: 166.12 - 169.16 m (545'0" - 555'0")
Cut: 3.04 m (10'0") Recovered: 3.04 (10'0")
Description:

166.12 - 167.37 m (545'0" - 549'1") Finely spaced fracture planes
96% HALITE, orange-brown, coarsely crystalline, compact, brittle
2% EVAPORITE ROCK, light grey, moderately hard, medium crystalline; fragments to 2 cm across with subvertical orientation
1% EVAPORITE ROCK, dark grey, moderately soft, finely crystalline; fragments to 2 cm across with random orientation
1% EVAPORITE ROCK, chocolate-brown, soft, finely crystalline; fragments to 2 cm across with random orientation

167.37 - 167.69 m (549'1" - 550'2") Coarsely spaced fracture planes
95% HALITE, orange-brown, coarsely crystalline, compact, brittle
3% EVAPORITE ROCK, grey, moderately hard, finely crystalline; fragments to 2 cm across with random orientation
1% EVAPORITE ROCK, white, medium crystalline, hard; fragments to 1 cm across with random orientation
1% EVAPORITE ROCK, chocolate-brown, soft, finely crystalline; fragments to 2 cm across with random orientation
167.69 - 168.08 m (550'2" - 551'5") Coarsely spaced fracture planes
93% HALITE, dark orange, coarsely crystalline, compact, brittle
5% EVAPORITE ROCK, chocolate-brown, soft, finely crystalline; fragments to 1 cm across with random orientation
2% EVAPORITE ROCK, grey-green, moderately soft, medium crystalline; fragments to 2 cm across with random orientation
168.08 - 169.16 m (551'5" - 555'0") Coarse spaced fracture planes
96% HALITE, light brown, coarsely crystalline, compact, brittle
2% EVAPORITE ROCK, grey-green, medium crystalline, soft; fragments to 2 cm across with random orientation
2% EVAPORITE ROCK, chocolate-brown, finely crystalline, soft; fragments to 2 cm across with random orientation

CORE No. 56

Interval: 169.16 - 172.21 m (555'0" - 565'0")
Cut: 3.05 m (10'0") Recovered: 3.05 (10'0")
Description:
169.16 - 169.75 m (555'0" - 556'11") Finely spaced fracture planes
99% HALITE, orange-brown, coarsely crystalline, compact, brittle
1% EVAPORITE ROCK, light grey, soft, medium crystalline; fragments with random orientation
169.75 - 172.21 m (556'11" - 565'0") Medium spaced fracture planes
97% HALITE, light orange to white; contains subrounded fragments of dark orange-brown impure halite to 2 cm across with random orientation
2% EVAPORITE ROCK, grey, moderately hard, finely crystalline; fragments to 2 cm across with random orientation
1% EVAPORITE ROCK, brown, moderately soft, medium crystalline; fragments to 2 cm across
Trace ?CARBONACEOUS MATTER, black, slightly salty, occurs as a finely crystalline single fragment 2 cm across at 172.14 m (564'9")

CORE No. 57

Interval: 172.21 - 175.26 m (565'0" - 575'0")
Cut: 3.05 m (10'0") Recovered: 3.05 m (10'0")
Description:
172.21 - 172.72 m (565'0" - 566'8") Finely spaced fracture planes
100% HALITE, light orange-pink, grades to colourless in part, coarsely crystalline, compact, brittle
172.72 - 174.27 m (566'8" - 571'9") Finely spaced fracture planes
97% HALITE, light orange-pink, coarsely crystalline, compact, brittle
1% EVAPORITE ROCK, white to light grey, medium crystalline, moderately soft; fragments to 2 cm across with vertical orientation
1% EVAPORITE ROCK, light grey-brown, moderately hard, medium crystalline; fragments with random orientation
1% EVAPORITE ROCK, chocolate-brown, soft, finely crystalline; fragments with random orientation

174.27 - 174.63 m (571'9" - 572'1") Medium spaced fracture planes
99% HALITE, light brown at top, grading to white at base, coarsely crystalline, compact, brittle
1% EVAPORITE ROCK, dark grey, moderately soft, finely crystalline; fragments to 2 cm across with random orientation
174.63 - 174.73 m (572'11" - 573'3") Coarsely spaced fracture planes
100% EVAPORITE ROCK, dark grey, moderately hard, medium crystalline
174.73 - 174.96 m (573'3" - 574'0") Finely spaced fracture planes
96% HALITE, white, coarsely crystalline, compact, brittle
4% EVAPORITE ROCK, dark grey, moderately hard, finely crystalline; fragments with random orientation
174.96 175.26 m (574'0" - 575'0") Medium spaced fracture planes
95% HALITE, white, coarsely crystalline, compact, brittle; contains rounded fragments to 1 cm across of orange, impure halite with random orientation
2% EVAPORITE ROCK, grey, moderately soft, finely crystalline; fragments to 2 cm across with random orientation
2% EVAPORITE ROCK, white, medium crystalline, moderately hard; fragments to 3 cm across with vertical orientation
1% EVAPORITE ROCK, chocolate-brown, soft, finely crystalline; fragments to 1 cm across with random orientation
Non coring bit from 175.26 m to 176.48 m (575'0" to 579'0")

CORE No. 58

Interval: 176.48 - 179.53 m (579'0" - 589'0")
Cut: 3.05 m (10'0") Recovered: 3.05 m (10'0")
Description:
176.48 - 176.63 m (579'0" - 579'6") Medium spaced fracture planes
95% HALITE, white, coarsely crystalline, compact, brittle; contains rounded fragments to 1 cm across of orange, impure halite with random orientation
2% EVAPORITE ROCK, grey, moderately hard, medium crystalline; fragments to 2 cm across with random orientation
2% EVAPORITE ROCK, white, medium crystalline, moderately hard; fragments to 4 cm across with vertical orientation
1% EVAPORITE ROCK, chocolate-brown, soft, finely crystalline; fragments to 1 cm across with random orientation
176.64 - 177.06 m (579'6" - 580'11") Finely spaced fracture planes
100% HALITE, light pink to clear, coarsely crystalline, compact, brittle
Trace ?CARBONACEOUS MATTER, black, finely disseminated throughout core
177.06 - 177.29 m (580'11" - 581'8") Coarsely spaced fracture planes
100% EVAPORITE ROCK, light grey, medium crystalline, hard, massive, regular fracture, even texture
177.29 - 179.53 m (581'8" - 589'0") Medium spaced fracture planes
98% HALITE, orange-brown, coarsely crystalline, compact, brittle
1% EVAPORITE ROCK, light grey-green, moderately soft, medium crystalline; fragments to 8 cm across with vertical orientation
1% EVAPORITE ROCK, chocolate-brown, soft, finely crystalline; fragments to 1 cm across with random orientation

CORE No. 59

Interval: 179.53 - 182.58 m (589'0" - 599'0")
Cut: 3.05 m (10'0") Recovered: 3.05 m (10'0")
Description:
179.53 - 179.98 m (589'0" - 590'6") Coarsely spaced fracture planes
99% HALITE, orange to pink, coarsely crystalline, compact, brittle
1% EVAPORITE ROCK, light grey, medium crystalline, moderately hard; random orientation

179.98 - 181.84 m (590'6" - 596'3") Medium spaced fracture planes
97% HALITE, orange-brown, coarsely crystalline, compact, brittle; contains fragments of impure brown halite to 1 cm across
2% EVAPORITE ROCK, grey-green, moderately hard, medium crystalline; fragments to 2 cm across with random orientation
1% EVAPORITE ROCK, chocolate brown, soft, finely crystalline; fragments to 1 cm across with random orientation
181.74 - 182.58 m (596'3" - 599'0") Finely to coarsely spaced fracture planes
97% HALITE, orange-brown, coarsely crystalline, compact, brittle, contains fragments to 1 cm across of impure brown halite containing evaporite rock fragments
2% EVAPORITE ROCK, grey-green, moderately hard, medium crystalline; fragments to 5 cm across with subvertical orientation
1% EVAPORITE ROCK, chocolate-brown, soft, finely crystalline; fragments to 1 cm across with subvertical orientation

CORE No. 60

Interval: 182.58 - 185.62 m (599'0" - 609'0")
Cut: 3.04 m (10'0") Recovered: 3.04 m (10'0")
Description:
182.58 - 183.22 m (599'0" - 601'1") Medium spaced fracture planes
98% HALITE, orange-brown, coarsely crystalline, compact, brittle
1% EVAPORITE ROCK, light grey-green, moderately soft, medium crystalline; fragments to 8 cm across with vertical orientation
1% EVAPORITE ROCK, chocolate-brown soft, finely crystalline; fragments to 1 cm across with random orientation
183.22 - 183.94 m (601'1" - 603'6") Medium spaced fracture planes
99% HALITE, light orange-pink to clear, coarsely crystalline, compact, brittle, contains fragments to 2 cm across of dark brown, impure halite, with subvertical orientation (20%)
1% EVAPORITE ROCK, chocolate-brown, soft, finely crystalline; fragments to 1 cm across with subvertical orientation
183.94 - 184.01 m (603'6" - 604'0") Coarsely spaced fracture planes
100% EVAPORITE ROCK, light grey, hard, massive, contorted; with chocolate brown evaporite rock tracings throughout; contact with overlying bed is slickensided and dips 45°
184.01 - 185.06 m (604'0" - 507'2") Medium spaced fracture planes
70% HALITE, light orange-brown, coarsely crystalline, compact, brittle; contains fragments to 1 cm across of brown impure halite with subvertical orientation
20% EVAPORITE ROCK, white, hard to moderately hard, medium crystalline; fragments to 6 cm across with subvertical orientation
10% EVAPORITE ROCK, light grey-green, moderately soft, medium crystalline; fragments to 2 cm across with subvertical orientation
185.06 - 185.62 m (607'2" - 609'0") Medium spaced fracture planes
98% HALITE, orange-brown, coarsely crystalline, compact, brittle; contains zone of clear halite to 1 cm thick around fragments of evaporite rock
1% EVAPORITE ROCK, light grey, hard, regular fracture, even texture, medium crystalline; fragments to 4 cm across
1% EVAPORITE ROCK, chocolate-brown, soft, finely crystalline; fragments to 1 cm across with random orientation

CORE No. 61

Interval: 185.62 - 188.67 m (609'0" - 619'0")
Cut: 3.05 m (10'0") Recovered: 2.97 (9'9")
Description:
185.7 - 186.64 m (609'3" - 612'4") Finely spaced fracture planes
98% HALITE, orange-brown, coarsely crystalline, compact, brittle, contains zones of clear halite to 1 cm thick around fragments of evaporite rock
1% EVAPORITE ROCK, light grey, hard, regular fracture, even texture, medium crystalline; fragments to 6 cm across
1% EVAPORITE ROCK, chocolate-brown, soft, finely crystalline; fragments to 1 cm across with random orientation
186.64 - 188.14 m (612'4" - 617'3") Coarsely spaced fracture planes
98% HALITE, orange-brown, coarsely crystalline, compact, brittle
1% EVAPORITE ROCK, light grey, moderately hard, medium crystalline; fragments to 2 cm across with random orientation
1% EVAPORITE ROCK, dark grey-brown, finely crystalline; fragments to 2 cm across with random orientation
188.14 - 188.28 m (617'3" - 617'9") Medium spaced fracture planes
70% HALITE, light orange-brown, grades to clear in part, coarsely crystalline, compact, brittle; junction with underlying bed is slickensided and dips 60°
30% EVAPORITE ROCK, grey-brown, moderately hard, regular fracture, medium crystalline; fragments to 10 cm across with subvertical orientation
188.28 - 188.42 m (617'9" - 618'2") Coarsely spaced fracture planes
70% EVAPORITE ROCK, light grey-brown, hard, regular fracture, medium crystalline; irregular junction with underlying bed
30% HALITE, clear to orange-brown, coarsely crystalline, compact, brittle
188.42 - 188.67 m (618'2" - 619'0") Finely spaced fracture planes
95% HALITE, orange-brown, coarsely crystalline, grades to white, medium crystalline evaporite rock in parts, compact, brittle
5% EVAPORITE ROCK, light grey-brown, hard, regular fracture, medium crystalline; fragments with subvertical orientation

CORE No. 62

Interval: 188.67 - 191.72 m (619'0" - 629'0")
Cut: 3.05 m (10'0") Recovered: 3.05 m (10'0")
Description:
188.67 - 189.67 m (619' " - 622'3") Finely spaced fracture planes
98% HALITE, light orange-brown, coarsely crystalline, compact, brittle
1% EVAPORITE ROCK, light grey, moderately hard, medium crystalline; fragments to 1 cm across with random orientation
1% EVAPORITE ROCK, chocolate-brown, soft, finely crystalline; fragments to 1 cm across with random orientation
189.67 - 189.97 m (622'3" - 623'3") Coarsely spaced fracture planes
97% HALITE, orange-brown, coarsely crystalline, compact, brittle
2% EVAPORITE ROCK, white, hard, medium crystalline; fragments to 2 cm across with random orientation
1% EVAPORITE ROCK, dark grey, moderately soft, finely crystalline; fragments to 1 cm across with random orientation
189.97 - 198.78 m (623'3" - 625'0") Coarsely spaced fracture planes
98% HALITE, dark grey-green to orange in part, coarsely crystalline, compact, brittle
1% EVAPORITE ROCK, light grey, moderately hard, medium crystalline; fragments to 1 cm across with random orientation
1% EVAPORITE ROCK, white, hard, medium crystalline; fragments to 2 cm across with subvertical orientation

Trace ?CARBONACEOUS MATTER, black, finely disseminated throughout core, giving grey appearance in part

198.79 - 191.72 m (625'2" - 629'0") Coarsely spaced fracture planes
98% HALITE, orange-brown, grades to clear in zones to 5 mm thick around fragments, coarsely crystalline, compact, brittle; contains fragments of brown impure halite (2%)
2% EVAPORITE ROCK, grey to grey-brown, hard, medium crystalline; irregular fragments to 10 cm across with random orientation

CORE No. 63

Interval: 191.72 - 194.77 m (629'0" - 639'0")
Cut: 3.05 m (10'0") Recovered: 3.05 m (10'0")
Description:
191.72 - 194.77 m (629'0" - 639'0") Coarsely spaced fracture planes
98% HALITE, orange-brown, clear in zones to 5 mm thick around fragments; coarsely crystalline, compact, brittle; contains fragments of brown impure halite (2%)
2% EVAPORITE ROCK, grey to grey-brown, hard, finely crystalline; irregular fragments to 10 cm across with random orientation

CORE No. 64

Interval: 194.77 - 197.82 m (639'0" - 649'0")
Cut: 30.05 m (10'0") Recovered: 2.21 m (7'3")
Description:
195.61 - 196.54 m (641'9" - 644'10") Finely spaced fracture planes
98% HALITE, orange-brown, coarsely crystalline, compact, brittle
2% EVAPORITE ROCK, dark grey to chocolate brown, finely crystalline; fragments to 5 mm across with random orientation
196.54 - 196.80 m (644'10" - 645'8") Finely spaced fracture planes
97% HALITE, orange-brown, coarsely crystalline, compact, brittle
2% EVAPORITE ROCK, white, medium crystalline, grades to medium crystalline halite in part; fragments to 2 cm across with random orientation
1% EVAPORITE ROCK, dark grey to chocolate-brown, finely crystalline; fragments with random orientation
196.80 - 197.82 m (645'8" - 649'0") Finely spaced fracture planes
98% HALITE, light orange-brown, coarsely crystalline, compact, brittle; contains fragments of impure brown halite (2%)
1% EVAPORITE ROCK, light grey, moderately hard, medium crystalline; fragments to 1 cm across with random orientation
1% EVAPORITE ROCK, dark grey, moderately soft, finely crystalline; fragments to 1 cm across with random orientation

CORE No. 65

Interval: 197.82 - 200.86 m (649'0" - 659'0")
Cut: 3.04 m (10'0") Recovered: 3.04 m (10'0")
Description:
197.82 - 198.10 m (649'0" - 649'11") Finely spaced fracture planes
95% HALITE, orange-brown, coarsely crystalline, compact, brittle
5% EVAPORITE ROCK, dark grey, moderately soft, finely crystalline; angular fragments to 5 mm across
198.10 - 198.37 m (649'11" - 650'9") Finely spaced fracture planes
100% HALITE, light pink to clear, coarsely crystalline, compact, brittle; bed dip 80°

198.37 - 199.69 m (650'9" - 655'2") Finely spaced fracture planes
97% HALITE, orange-brown, coarsely crystalline, compact, brittle
3% EVAPORITE ROCK, chocolate-brown, moderately soft, finely crystalline; fragments to 1 cm across with random orientation
199.69 - 199.92 m (655'2" - 655'11") Medium spaced fracture planes
99% HALITE, orange, coarsely crystalline, compact, brittle
1% EVAPORITE ROCK, chocolate-brown, moderately soft, finely crystalline; fragments to 1 cm across with random orientation
199.92 - 200.25 m (655'11" - 657'0") Finely spaced fracture planes
96% HALITE, orange, coarsely crystalline, compact, brittle; contains fragments of impure brown halite (20%)
3% EVAPORITE ROCK, dark grey, moderately hard, finely crystalline; fragments to 2 cm across with subvertical orientation
1% EVAPORITE ROCK, light grey, moderately hard, medium crystalline; fragments to 2 cm across with subvertical orientation
200.25 - 200.86 m (657'0" - 659'0") Medium spaced fracture planes
98% HALITE, light orange to white, coarsely crystalline, compact, brittle; contains fragments of impure brown halite with subvertical orientation to 2 cm across (20%)
2% EVAPORITE ROCK, dark grey-brown, moderately hard, finely crystalline; fragments with subvertical orientation

CORE No. 66

Interval: 200.85 - 203.91 m (659'0" - 669'0")
Cut: 3.05 m (10'0") Recovered: 30.5 (10'0")
Description:
200.96 - 202.13 m (659'0" - 665'0") Medium spaced fracture planes
97% HALITE, orange, coarsely crystalline, compact, brittle; contains fragments of impure brown halite to 2 cm across with random orientation (20%)
2% EVAPORITE ROCK, dark grey, moderately hard, finely crystalline; fragments with subvertical orientation
1% EVAPORITE ROCK, grey-green, moderately hard, medium crystalline; fragments to 1 cm across with subvertical orientation
202.13 - 203.53 m (666'5" - 667'9") Medium spaced fracture planes
100% HALITE, light orange, coarsely crystalline, compact, brittle
203.53 - 203.91 m (667'9" - 669'0") Medium spaced fracture planes
97% HALITE, light orange, coarsely crystalline, compact; contains fragments to 2 cm across of brown impure halite with random orientation (20%)
2% EVAPORITE ROCK, dark grey, moderately hard, finely crystalline; fragments to 2 cm across with subvertical orientation
1% EVAPORITE ROCK, grey-green, moderately hard, medium crystalline; fragments to 2 cm across with subvertical orientation

CORE No. 67

Interval: 203.91 - 206.65 m (669'0" - 678'0")
Cut: 2.75 m (9'0") Recovered: 2.52 m (8'3")
Description:
204.14 - 204.96 m (669'9" - 672'5") Finely spaced fracture planes
98% HALITE, orange-brown, coarsely crystalline, compact, brittle
1% EVAPORITE ROCK, chocolate-brown, soft, finely crystalline; fragments to 5 mm across with random orientation
1% EVAPORITE ROCK, white, medium crystalline, hard; fragments to 5 cm across with random orientation

204.96 - 205.72 m (672'5" - 674'11") Medium spaced fracture planes
97% HALITE, light orange-brown, coarsely crystalline, compact, brittle
3% EVAPORITE ROCK, grey, moderately hard; fragments to 4 cm across with subvertical orientation
205.72 - 206.10 m (674'11" - 676'2") Medium spaced fracture planes
100% HALITE, light pink, coarsely crystalline, compact, brittle; bed dips 70°
206.10 - 206.65 m (676'2" - 678'0") Medium spaced fracture planes
98% HALITE, orange-brown, coarsely crystalline, compact, brittle; contains fragments to 2 cm across of impure dark orange-brown halite with random orientation
1% EVAPORITE ROCK, light grey, moderately hard to moderately soft, medium crystalline; fragments to 2 cm across with random orientation
1% EVAPORITE ROCK, dark grey to grey-brown, moderately soft to soft, finely crystalline; angular fragments to 2 cm across with random orientation

CORE No. 68

Interval: 206.65 - 209.70 m (678'0" - 688'0")
Cut: 3.05 m (10'0") Recovered: 3.05 m (10'0")
Description:
206.65 - 209.70 m (678'0" - 688'0") Medium spaced fracture planes
98% HALITE, orange-brown, coarsely crystalline, compact, brittle
1% EVAPORITE ROCK, grey-brown, hard, medium crystalline; fragments to 3 cm across with random orientation
1% EVAPORITE ROCK, light grey, moderately hard, medium crystalline; fragments to 2 cm across with random orientation

CORE No. 69

Interval: 209.70 - 212.75 m (688'0" - 698'0")
Cut: 3.05 m (10'0") Recovered: 3.05 m (10'0")
Description:
98% HALITE, orange-brown, coarsely crystalline, compact, brittle
1% EVAPORITE ROCK, grey-brown, hard, medium crystalline; fragments to 4 cm across with random orientation
1% EVAPORITE ROCK, light grey, moderately hard, medium crystalline; fragments to 2 cm across with random orientation
210.20 - 211.43 m (689'8" - 693'8") Finely spaced fracture planes
99% HALITE, light orange, coarsely crystalline, compact, brittle; contains fragments of brown, impure halite to 1 cm across (10%)
1% EVAPORITE ROCK, light to dark grey, moderately hard to moderately soft, finely crystalline; fragments to 1 cm across with random orientation
211.43 - 212.55 m (693'0" - 697'3") Finely spaced fracture planes
100% HALITE, light pink, coarsely crystalline, compact, brittle
212.55 - 212.75 m (697'4" - 698'0") Finely spaced fracture planes
99% HALITE, light orange, coarsely crystalline, compact, brittle; contains fragments of orange impure halite to 1 cm across (10%)

CORE No. 70

Interval: 212.74 - 215.80 m (698'0" - 708'0")
Cut: 3.05 m (10'0") Recovered: 3.05 m (10'0")
Description:
212.75 - 213.24 m (698'0" - 699'7") Finely spaced fracture planes
97% HALITE, dark orange-brown, coarsely crystalline, compact, brittle
2% EVAPORITE ROCK, grey, moderately soft, finely crystalline; fragments to 2 cm across with random orientation
1% EVAPORITE ROCK, grey-brown, medium crystalline; fragments to 2 cm across with random orientation
213.25 - 213.82 m (699'7" - 701'6") Medium spaced fracture planes
97% HALITE, dark orange-brown, coarsely crystalline, compact, brittle; contains fragments of dark brown impure halite to 2 cm across (10%)
2% EVAPORITE ROCK, grey to dark grey, moderately hard to moderately soft, finely crystalline; fragments to 2 cm across with random orientation
1% EVAPORITE ROCK, chocolate-brown, soft, finely crystalline; fragments to 1 cm across with random orientation
213.82 - 213.90 m (701'6" - 701'10") Medium spaced fracture planes
90% EVAPORITE ROCK, light grey, moderately hard, regular fracture; regular junction with overlying and underlying beds; bed is horizontal
10% HALITE, light pink, coarsely crystalline, compact, brittle
213.90 - 214.15 m (701'10" - 702'7") Medium spaced fracture planes
70% HALITE, light pink, coarsely crystalline, compact, brittle
30% EVAPORITE ROCK, light grey, moderately hard, regular fracture, medium crystalline; fragments to 8 cm across with subvertical orientation
214.15 - 215.49 m (702'7" - 707'0") Medium spaced fracture planes
100% HALITE, light pink, coarsely crystalline, compact, brittle
215.49 - 215.80 m (707'0" - 708'0")
99% HALITE, light orange, coarsely crystalline, compact, brittle
1% EVAPORITE ROCK, chocolate-brown, soft, finely crystalline; fragments to 5 mm across with random orientation

CORE No. 71

Interval: 215.80 - 218.85 m (708'0" - 718'0")
Cut: 3.05 m (10'0") Recovered: 3.05 m (10'0")
Description:
215.80 - 217.20 m (708'0" - 712'7") Finely spaced fracture planes
100% HALITE, grades from light orange at top to light pink at base, coarsely crystalline, compact, brittle
271.20 - 218.44 m (712'7" - 716'8") Coarsely spaced fracture planes
100% HALITE, very light pink to clear, coarsely crystalline, compact, brittle
218.44 - 218.85 m (716'8" - 718'0") Medium spaced fracture planes
100% HALITE, clear, coarsely crystalline, compact, brittle

CORE No. 72

Interval: 218.85 - 221.89 m (718'0" - 728'0")
Cut: 3.05 m (10'0") Recovered: 3.05 m (10'0")
Description:
218.85 m - 220.14 m (718'0" - 722'3") Finely spaced fracture planes
100% HALITE, colourless grading to light pink at base, coarsely crystalline, compact, brittle
220.14 - 220.75 m (723'3" - 724'3") Medium spaced fracture planes
100% HALITE, light pink, coarsely crystalline, compact, brittle

220.75 - 221.89 m (724'3" - 728'0") Medium spaced fracture planes
98% HALITE, orange-brown, coarsely crystalline, compact, brittle; contains fragments of brown impure halite to 2 cm across with random orientation (10%)
2% EVAPORITE ROCK, chocolate-brown, soft, finely crystalline; fragments to 1 cm across with random orientation

CORE No. 73

Interval: 221.89 - 224.94 m (728'0" - 738'0")
Cut: 3.05 m (10'0") Recovered: 3.05 m (10'0")
Description:
221.89 - 223.01 m (728'0" - 731'8") Medium spaced fracture planes
97% HALITE, orange brown, coarsely crystalline, compact, brittle; contains fragments of 1 cm across with random orientation
223.01 - 224.08 m (731'8" - 735'2") Coarsely spaced fracture planes
100% HALITE, light orange-brown, coarsely crystalline, compact, brittle; contains fragments of brown impure halite to 2 cm across with random orientation
224.08 - 224.94 m (725'2" - 738'0") Coarsely spaced fracture planes
98% HALITE, light orange-brown, coarsely crystalline, compact, brittle; contains fragments of dark brown halite to 2 cm across with random orientation
2% EVAPORITE ROCK, chocolate brown, soft, finely crystalline; fragments to 2 cm across with random orientation
Non coring bit from 224.94 to 225.25 m (738'0" to 739'0")

CORE No. 74

Interval: 225.25 - 228.30 m (739'0" - 749'0")
Cut: 3.05 m (10'0") Recovered: 3.05 m (10'0")
Description:
225.25 - 225.70 m (739'0" - 740'6") Medium spaced fracture planes
98% HALITE, light orange, coarsely crystalline, compact, brittle; contains fragments of brown impure halite to 2 cm across with random orientation (10%)
1% EVAPORITE ROCK, grey-green, moderately hard, medium crystalline; fragments to 5 mm across with random orientation
1% EVAPORITE ROCK, chocolate-brown, soft, finely crystalline; fragments to 5 mm across with random orientation
225.70 - 228.12 m (740'6" - 742'0") Finely spaced fracture planes
100% HALITE, light orange, coarsely crystalline, compact, brittle; contains fragments of brown impure halite to 2 cm across
226.12 - 227.28 m (742'10" - 745'8") Medium spaced fracture planes
99% HALITE, light orange, coarsely crystalline, compact, brittle; contains fragments of impure orange-brown halite to 2 cm across with sub-vertical orientation
1% EVAPORITE ROCK, chocolate-brown, soft, finely crystalline; fragments to 1 cm across with subvertical orientation
277.28 - 228.30 m (745'8" - 749'0") Medium spaced fracture planes
99% HALITE, light orange to clear, coarsely crystalline, compact, brittle; contains fragments of impure brown halite to 2 cm across with subvertical orientation (30%)
1% EVAPORITE ROCK, chocolate-brown, soft, finely crystalline; irregular inclusions to 1 cm across in fragments of impure halite

CORE No. 75

Interval: 228.30 - 231.34 m (749'0" - 759'0")
Cut: 3.04 m (10'0") Recovered: 3.04 m (10'0")
Description:

228.30 - 228.55 m (749'0" - 748'10") Medium spaced fracture planes
99% HALITE, light orange to clear, coarsely crystalline, compact, brittle; contains fragments of impure brown halite to 2 cm across with subvertical orientation (30%)
1% EVAPORITE ROCK, chocolate-brown, soft, finely crystalline; irregular inclusions to 1 cm across in fragments of impure halite

228.55 - 228.78 m (749'10" - 750'7")
100% HALITE, light pink, coarsely crystalline, compact, brittle; contains fragments of impure brown halite to 2 cm across with subvertical orientation (30%)

228.78 - 229.31 m (750'7" - 752'4")
97% HALITE, light orange-brown, coarsely crystalline, compact, brittle; contains fragments of impure brown halite to 2 cm across (10%)
2% EVAPORITE ROCK, chocolate-brown, finely crystalline, soft; irregular inclusions to 1 cm across in fragments of impure halite
1% EVAPORITE ROCK, grey, finely crystalline, moderately soft; fragments to 1 cm across

229.31 - 229.85 m (752'4" - 754'1") Medium spaced fracture planes
99% HALITE, light orange, coarsely crystalline, compact, brittle; contains fragments of brown impure halite to 2 cm across with subvertical orientation
1% EVAPORITE ROCK, grey-green, medium crystalline, moderately soft, fragments to 2 cm across

229.85 - 230.48 m (754'1" - 756'2")
95% HALITE, light orange, coarsely crystalline, compact, brittle; contains fragments of impure brown halite to 2 cm across with subvertical orientation (20%)
3% EVAPORITE ROCK, chocolate-brown, finely crystalline, moderately soft; fragments to 2 cm across with subvertical orientation
1% EVAPORITE ROCK, grey, finely crystalline, moderately hard; fragments to 1 cm across with subvertical orientation
1% EVAPORITE ROCK, grey-brown, medium crystalline, hard; fragments to 2 cm across with subvertical orientation

230.48 - 230.52 m (756'2" - 756'3½") Finely spaced fracture planes
90% EVAPORITE ROCK, chocolate-brown, finely crystalline, friable
10% HALITE, light orange, coarsely crystalline, compact, brittle

230.52 - 231.34 m (756'3½" - 759'0") Coarsely spaced fracture planes
95% HALITE, light orange, coarsely crystalline, compact, brittle; contains fragments of impure brown halite to 2 cm across with subvertical orientation (20%)
3% EVAPORITE ROCK, chocolate-brown, finely crystalline, moderately soft; fragments to 2 cm across with subvertical orientation
1% EVAPORITE ROCK, grey, finely crystalline, moderately hard; fragments to 1 cm across with subvertical orientation
1% EVAPORITE ROCK, grey-brown, medium crystalline, hard; fragments to 2 cm across with subvertical orientation

CORE No. 76

Interval: 231.34 - 234.39 m (759'0" - 769'0")
Cut: 3.05 m (10'0") Recovered: 3.05 m (10'0")
Description:
231.34 - 232.18 m (759'0" - 761'9") Finely spaced fracture planes
97% HALITE, light orange, coarsely crystalline, compact, brittle; contains fragments of orange-brown impure halite to 2 cm across (5%)
2% EVAPORITE ROCK, chocolate-brown, soft, finely crystalline; fragments to 1 cm across with subvertical orientation
1% EVAPORITE ROCK, grey-brown, hard, finely crystalline; occurs in fragments to 2 cm across with subvertical orientation
232.18 - 232.54 m (761'9" - 762'11") Finely spaced fracture planes
100% HALITE, light pink to clear, coarsely crystalline, compact, brittle; contains fragments of orange-brown impure halite to 2 cm across with random orientation
232.54 - 233.20 m (762'11" - 765'1") Coarsely spaced fracture planes
98% HALITE, light orange-brown, coarsely crystalline, compact, brittle; contains fragments of orange-brown impure halite to 2 cm across (10%)
1% EVAPORITE ROCK, grey-green, moderately hard, medium crystalline; fragments to 1 cm across with subvertical orientation
1% EVAPORITE ROCK, chocolate brown, soft, finely crystalline; fragments to 2 cm across with subvertical orientation
233.20 - 245.39 m (765'1" - 769'0") Medium spaced fracture planes
97% HALITE, light orange-brown, coarsely crystalline, compact, brittle; contains fragments of orange-brown impure halite to 2 cm across with subvertical orientation
2% EVAPORITE ROCK, chocolate-brown, miderately soft, finely crystalline; fragments to 1 cm across with subvertical orientation
1% EVAPORITE ROCK, light grey-green, medium to finely crystalline; some fragments contain small halite inclusions; fragments with subvertical orientation

CORE No. 77

Interval: 224.39 - 237.44 m (769'0" - 779'0")
Cut: 3.05 m (10'0") Recovered: 3.05 m (10'0")
Description:
234.29 - 234.52 m (76'0" - 769'9") Finely spaced fracture planes
99% HALITE, light orange-brown, coarsely crystalline, compact, brittle; contains fragments of brown impure halite to 5 mm across with random orientation (10%)
1% EVAPORITE ROCK, chocolate-brown, soft, finely crystalline; fragments to 3 mm across with random orientation
234.52 - 234.95 m (769'9" - 770'10") Finely spaced fracture planes
100% HALITE, light pink, coarsely crystalline, compact, brittle
770'10" - 771'6" Finely spaced fracture planes
99% HALITE, light orange-brown, coarsely crystalline, compact, brittle; contains fragments of brown impure halite to 3 mm across with random orientation (10%)
1% EVAPORITE ROCK, dark grey, soft, finely crystalline; fragments to 3 mm across with random orientation

234.95 - 235.15 m (771'6" - 772'7") Finely spaced fracture planes
100% HALITE, orange, coarsely crystalline, compact, brittle
235.15 - 235.49 m (772'7" - 774'10") Finely spaced fracture planes
98% HALITE, light orange-brown, coarsely crystalline, compact, brittle; contains fragments of orange-brown impure halite to 2 cm across (10%)
1% EVAPORITE ROCK, white, medium crystalline; fragments to 4 cm across with random orientation
1% EVAPORITE ROCK, grey, moderately hard, finely crystalline; fragments to 2 cm across with random orientation
236.17 - 236.47 m (774'10" - 775'10") Finely spaced fracture planes
100% HALITE, orange, coarsely crystalline, compact, brittle
236.47 - 237.18 m (775'10" - 778'2") Medium spaced fracture planes
99% HALITE, light orange-brown, coarsely crystalline, compact, brittle; contains fragments of orange-brown impure halite to 1 cm across (10%)
1% EVAPORITE ROCK, medium grey-brown, hard, medium crystalline; fragments to 2 cm across with subvertical orientation
237.18 - 237.44 m (778'2" - 779'0") Finely spaced fracture planes
98% HALITE, light orange-brown, coarsely crystalline, compact, brittle
1% EVAPORITE ROCK, chocolate-brown, soft; fragments to 1 cm across with subvertical orientation
1% EVAPORITE ROCK, grey, moderatly hard, finely crystalline; fragments to 1 cm across with subvertical orientation

CORE No. 78

Interval: 237.44 - 240.49 m (779'0" - 789'0")
Cut: 3.05 (10'0") Recovered: 3.05 m (10'0")
Description:
237.44 - 237.82 m (779'0" - 780'3") Finely spaced fracture planes
98% HALITE, orange-brown, coarsely crystalline, compact, brittle
2% EVAPORITE ROCK, chocolate-brown, moderately soft, finely crystalline; fragments to 2 cm across with random orientation
237.82 - 238.79 m (780'3" - 783'5") Medium spaced fracture planes
99% HALITE, light orange, coarsely crystalline, compact, brittle; contains fragments of orange-brown impure halite to 1 cm across with random orientation (5%)
1% EVAPORITE ROCK, light grey, moderately hard, medium crystalline in part; fragments to 2 cm across with random orientation
238.79 - 239.37 m (783'5" - 785'4") Medium spaced fracture planes
100% HALITE, pink to light pink, coarsely crystalline, compact, brittle
239.37 - 240.21 m (785'4" - 788'1") Medium spaced fracture planes
99% HALITE, light orange to white, coarsely crystalline, compact, brittle; contains fragments of impure orange halite to 5 cm across (5%)
1% EVAPORITE ROCK, grey, moderately hard; fragments to 1 cm across with random orientation
240.21 - 240.49 m (788'1" - 789'0") Medium spaced fracture planes
100% HALITE, light pink to clear, coarsely crystalline, compact, brittle

CORE NO. 79

Interval: 240.49 - 243.54 m (789'0" - 799'0")
Cut: 3.05 m (10'0") Recovered: 3.05 m (10'0")
Description:
240.49 - 241.92
100% HALITE, light pink to clear, coarsely crystalline
241.92 - 242.57 m (793'11" - 795'10") coarsely spaced fracture planes
99% HALITE, light orange, coarsely crystalline, compact, brittle; contains fragments of orange impure halite to 1 cm across with random orientation (5%)

1% EVAPORITE ROCK, grey, moderately soft, finely crystalline; fragments to 1 cm across with random orientation

242.57 - 282.98 m (795'10" - 796'10") Coarsely spaced fracture planes
100% HALITE, light pink, coarsely crystalline, compact, brittle

242.87 - 243.03 m (796'10" - 797'4") Coarsely spaced fracture planes
99% HALITE, light orange-brown, coarsely crystalline, compact, brittle; contains fragments of orange impure halite to 5 mm across (5%)
1% EVAPORITE ROCK, grey, moderately hard, finely crystalline; grades to medium crystalline in part; fragments to 5 mm across with random orientation

243.03 - 243.54 m (797'4" - 799'0") Coarsely spaced fracture planes
100% HALITE, light pink to clear, coarsely crystalline, compact, brittle

CORE No. 80

Interval: 243.54 - 256.58 m (799'0" - 809'0")
Cut: 3.04 m (10'0") Recovered: 3.04 m (10'0")
Description:

243.54 - 295.92 m (799'0" - 806'10") Medium spaced fracture planes
100% HALITE, light pink to clear, coarsely crystalline, compact, brittle

245.92 - 246.10 m (806'10" - 807'5") Coarsely spaced fracture planes
96% HALITE, pink, coarsely crystalline, compact, brittle
4% EVAPORITE ROCK, light grey, moderately hard, medium crystalline; fragments to 2 cm across with random orientation

246.10 - 246.38 m (807'5" - 808'4") Coarsely spaced fracture planes
100% HALITE, light orange, coarsely crystalline, compact, brittle; contains fragments of impure orange halite to 1 cm across with random orientation (5%)

246.38 - 246.58 m (508'4" - 809'0") Finely spaced fracture planes
98% HALITE, light orange, coarsely crystalline, compact, brittle
1% EVAPORITE ROCK, white to light grey, hard, medium crystalline; fragments to 2 cm across with random orientation
1% EVAPORITE ROCK, dark grey, moderately soft, finely crystalline; fragments to 1 cm across with random orientation

CORE No. 81

Interval: 246.58 - 249.63 m (709'0" - 819'0")
Cut: 3.05 m (10'0") Recovered: 2.97 m (9'9")
Description:

246.66 - 246.89 m (809'3" - 810'0") Finely spaced fracture planes
99% HALITE, orange-brown, coarsely crystalline, compact, brittle
1% EVAPORITE ROCK, light grey-green, moderately hard, medium crystalline; fragments to 1 cm across with random orientation

246.89 - 249.10 m (810'0" - 817'3") Finely spaced fracture planes
100% HALITE, light pink, coarsely crystalline, compact, brittle

249.10 - 249.33 m (817'3" - 818'0") Finely spaced fracture planes
98% HALITE, light pink, coarsely crystalline, compact, brittle
2% EVAPORITE ROCK, white, medium crystalline; fragments to 4 cm across with subvertical orientation

249.33 - 249.63 m (818'0" - 819'0") Finely spaced fracture planes
100% HALITE, light pink, coarsely crystalline, compact, brittle

CORE No. 82

Interval: 249.62 - 254.20 m (819'0" - 834'0")
Cut: 3.57 m (15'0") Recovered: 4.27 m (14'0")
Description:

249.94 - 250.73 m (820'0" - 822'7") Finely spaced fractured planes
100% HALITE, light pink, coarsely crystalline, compact, brittle

250.73 - 251.16 m (822'7" - 824'0") Finely spaced fracture planes
98% HALITE, orange-brown, coarsely crystalline, compact, brittle
2% EVAPORITE ROCK, light grey to grey, moderately hard, finely to medium crystalline; fragments to 1 cm across with random orientation

251.16 - 251.44 m (824'0" - 824'11") Finely spaced fracture planes
96% HALITE, orange-brown, coarsely crystalline, compact, brittle
3% EVAPORITE ROCK, grey, moderately hard, finely crystalline; fragments to 2 cm across with random orientation
1% EVAPORITE ROCK, white, hard, medium crystalline; fragments to 2 cm across with subvertical orientation

251.44 - 252.22 m (824'11" - 827'6") Medium spaced fracture planes
100% HALITE, light pink, coarsely crystalline, compact, brittle

252.22 - 252.32 m (827'6" - 827'10") Medium spaced fracture planes
97% HALITE, light pink, coarsely crystalline, compact, brittle
3% EVAPORITE ROCK, grey, moderately hard, finely crystalline; fragments to 1 cm across, oriented 45°

252.32 - 252.88 m (827'10" - 829'8") Medium spaced fracture planes
100% HALITE, light pink, grades to clear at base, coarsely crystalline, compact, brittle

252.88 - 253.01 m (829'8" - 830'1") Coarsely spaced fracture planes
100% EVAPORITE ROCK, white, moderately hard to hard, medium crystalline; bedding contorted, regular fracture; bed dips 45°

253.01 - 253.27 m (830'1" - 830'11") Medium spaced fracture planes
40% EVAPORATE ROCK, white, moderately hard to hard, medium crystalline; bedding contorted; fragments to 10 cm across
35% EVAPORITE ROCK, dark grey, moderately hard to hard, medium crystalline; fragments to 10 cm across
25% HALITE, light orange to clear, coarsely crystalline, compact, brittle; matrix for fragments of finely and medium crystalline evaporite rock

253.27 - 253.44 m (830'11" - 831'6") Coarsely spaced fracture planes
70% EVAPORITE ROCK, white, moderately hard to hard, medium crystalline, bedding contorted; fragments to 10 cm across
30% HALITE, white to orange, coarsely crystalline, compact, brittle; matrix for fragments of evaporite rock

253.44 - 253.67 m (831'6" - 832'3") Medium spaced fracture planes
35% EVAPORITE ROCK, grey, medium crystalline; fragments to 5 cm across
35% EVAPORITE ROCK, white, moderately hard, medium crystalline; occurs as matrix for fragments of grey evaporite rock
30% HALITE, clear to orange, coarsely crystalline, compact, brittle; irregular veins filling fissure in evaporite rock

253.67 - 253.93 m (832'3" - 883'1") Finely spaced fracture planes
100% EVAPORITE ROCK, white, hard, medium crystalline, even texture, regular fracture

253.93 - 254.20 m (833'1" - 834'0") Medium spaced fracture planes
50% EVAPORITE ROCK, white, hard, medium crystalline, even texture, regular fracture; fragments to 10 cm across with random orientation
50% HALITE, clear to orange, coarsely crystalline, compact, brittle; matrix for fragments of evaporite rock

CORE No. 83

Interval: 254.20 - 257.25 m (834'0" - 844'0")
Cut: 3.05 m (10'0") Recovered: 3.05 m (10'0")
Description:

254.20 - 255.44 m (834'0" - 838'1") Coarsely spaced fracture planes
- 45% EVAPORITE ROCK, light grey, moderately hard, medium crystalline; angular fragments to 10 cm across with vertical orientation
- 45% EVAPORITE ROCK, white, medium crystalline, hard; fragments to 5 cm across (20%), and in matrix (25%)
- 10% HALITE, light orange to clear, coarsely crystalline, compact, brittle; matrix between fragments of grey and white evaporite rock, and in irregular veins to 10 cm long

255.94 - 255.70 m (838'1" - 838'22") Finely spaced fracture planes
- 90% EVAPORITE ROCK, grey, soft, finely crystalline; fragments to 2 cm across with random orientation
- 10% HALITE, orange, brown, coarsely crystalline, compact, brittle; fragments to 2 cm across, but generally less than 5 mm across with random orientation

255.70 - 255.96 m (838'11" - 839'9") Coarsely spaced fracture planes
- 30% EVAPORITE ROCK, white, medium crystalline; fragments to 1 cm across, and matrix for fragments of grey evaporite rocks
- 30% HALITE, orange brown to clear, coarsely crystalline, compact, brittle
- 25% EVAPORITE ROCK, grey to grey-green, moderately hard, medium crystalline; fragments to 4 cm across with subvertical orientation
- 15% EVAPORITE ROCK, light grey, moderately hard, medium crystalline; angular fragments to 2 cm across with subvertical orientation

255.96 - 256.31 m (839'9" - 840'11") Coarsely spaced fracture planes
- 90% EVAPORITE ROCK, white, hard, medium crystalline, contorted bedding
- 10% HALITE, orange-brown to clear, coarsely crystalline, compact, brittle; fills fractures to 1 cm long

256.31 - 256.64 m (840'11" - 832'0") Coarsely spaced fracture planes
- 40% EVAPORITE ROCK, light grey-green, moderately hard, finely crystalline, grades to medium crystalline in part; angular fragments to 4 cm across
- 10% EVAPORITE ROCK, white, medium crystalline, hard; fragments to 2 cm across with subvertical orientation
- 50% HALITE, orange to white, coarsely crystalline, compact, brittle; matrix for fragments of evaporite rock

256.64 - 256.87 m (842'0" - 842'9") Coarsely spaced fracture planes
- 94% HALITE, clear to grey, coarsely crystalline, compact, brittle; contains fragments of brown impure halite with random orientation (10%)
- 3% EVAPORITE ROCK, light grey, moderately hard, medium crystalline; fragments to 1 cm across with random orientation
- 3% EVAPORITE ROCK, chocolate-brown, moderately soft, finely crystalline; fragments to 2 cm across with random orientation

256.87 - 257.08 m (842'9" - 843'5") Coarsely spaced fracture planes
- 50% EVAPORITE ROCK, light grey-brown, medium crystalline; fragments to 10 cm across, becoming more dominant towards base
- 50% HALITE, clear with sparse light orange zones, coarsely crystalline, compact, brittle; matrix for fragments of evaporite rock

257.08 - 257.25 m (843'5" - 844'0") Medium spaced fracture planes
60% HALITE, clear to light pink, coarsely crystalline, compact, brittle; matrix for fragments of evaporite rocks
30% EVAPORITE ROCK, white, medium crystalline; fragments to 4 cm across with subvertical orientation
10% EVAPORITE ROCK, light grey, finely crystalline, grading to medium crystalline in part; angular fragments to 2 cm across with subvertical orientation

CORE No. 84

Interval: 257.25 - 260.30 m (844'0" - 854'0")
Cut: 3.05 m (10'0") Recovered: 2.94 m (8'8")
Description:
257.35 - 257.82 m (844'4" - 845'10½") Coarsely spaced fracture planes
90% EVAPORITE ROCK, white to light grey-green, medium crystalline, hard; fragments
9% HALITE, orange to clear, coarsely crystalline, compact, brittle; irregular bodies infilling fractures to 8 cm long
1% EVAPORITE ROCK, light brown, moderately soft, medium grained; discordant veins to 3 mm thick cutting white evaporite rock at 60°
257.82 - 258.30 m (845'10½" - 847'5") Coarsely spaced fracture planes
58% HALITE, orange, coarsely crystalline, compact, brittle; matrix for evaporite rock fragments
40% EVAPORITE ROCK, white to light grey-green, medium crystalline, hard; angular fragments to 10 cm across
2% EVAPORITE ROCK, dark brown, moderately hard, medium crystalline; in sinuous laminae to 5 mm thick in white evaporite rock fragments
258.30 - 258.61 cm (847'5" - 848'5½") Coarsely spaced fracture planes
90% EVAPORITE ROCK, white to light grey, medium crystalline, hard; laminated subvertically in parts
10% HALITE, orange, coarsely crystalline, compact, brittle; in veins infilling fractures, and irregular bodies throughout bed
258.61 - 258.81 m (848'5½" - 849'1") Coarsely spaced fracture planes
100% HALITE, light pink, coarsely crystalline, compact, brittle
258.81 - 259.08 m (849'1" - 850'0") Coarsely spaced fracture planes
97% HALITE, orange-brown, coarsely crystalline, compact, brittle
2% EVAPORITE ROCK, dark grey, moderately hard, finely crystalline; fragments to 2 cm across
1% EVAPORITE ROCK, light grey-green, moderately hard; fragments to 1 cm across with subvertical orientation
259.08 - 259.23 m (850'0" - 850'6") Coarsely spaced fracture planes
100% HALITE, light pink, coarsely crystalline, compact, brittle
259.23 - 259.74 m (850'6" - 852'2") Coarsely spaced fracture planes
97% HALITE, orange-brown, coarsely crystalline, compact, brittle
2% EVAPORITE ROCK, chocolate-brown to grey-brown, moderately soft, finely crystalline; fragments to 2 cm across with subvertical orientation
1% EVAPORITE ROCK, light grey, moderately hard, medium crystalline; angular fragments to 2 cm across with subvertical orientation
259.84 - 260.30 m (852'2" - 854'0") Medium spaced fracture planes
100% HALITE, light pink, coarsely crystalline, compact, brittle

CORE No. 85

Interval: 260.30 - 263.35 m (854'0" - 864'0")
Cut: 3.05 m (10'0") Recovered: 3.05 m (10'0")
Description:

260.40 - 261.31 m (854'0" - 857'4") Coarsely spaced fracture planes
- 96% HALITE, orange-brown, coarsely crystalline, compact, brittle
- 2% EVAPORITE ROCK, chocolate-brown, moderately soft, finely crystalline; fragments to 2 cm across with random orientation
- 2% EVAPORITE ROCK, light grey, moderately hard; fragments to 5 cm across with subvertical orientation containing euhedral crystals of orange-brown halite to 1 cm across

261.31 - 261.87 m (857'4" - 859'2") Coarsely spaced fracture planes
- 99% HALITE, orange-brown, coarsely crystalline, compact, brittle
- 1% EVAPORITE ROCK, light grey, hard, medium crystalline; fragments to 6 cm across with subvertical orientation

261.87 - 262.33 m (859'2" - 860'8") Coarsely spaced fracture planes
- 96% HALITE, orange-brown, coarsely crystalline, compact, brittle
- 4% EVAPORITE ROCK, light grey, hard, medium crystalline; fragments to 6 cm across with subvertical orientation

262.33 - 262.46 m (860'8" - 861'11") Coarsely spaced fracture planes
- 50% HALITE, orange, grades to clear around edges of fragments, coarsely crystalline, compact, brittle
- 30% EVAPORITE ROCK, light grey, grades to white in part, medium crystalline, hard; fragments to 8 cm across with random orientation; grades to finely crystalline in some fragments
- 20% EVAPORITE ROCK, grey, moderately hard, finely crystalline; fragments to 8 cm across with random orientation

262.46 - 263.35 m (861'1" - 864'0") Coarsely spaced fracture planes
- 97% HALITE, orange-brown, coarsely crystalline, compact, brittle
- 2% EVAPORITE ROCK, chocolate-brown, moderately soft, finely crystalline; fragments to 2 cm across with random orientation
- 1% EVAPORITE ROCK, light grey, moderately hard, medium crystalline; fragments to 2 cm across with random orientation

CORE No. 86

Interval: 263.35 - 266.40 m (964'0" - 874'0")
Cut: 3.05 m (10'0") Recovered: 3.05 m (10'0")
Description:

263.35 - 264.29 m (864'0" - 867'1") Coarsely spaced fracture planes
- 97% HALITE, orange-brown, coarsely crystalline, compact, brittle
- 2% EVAPORITE ROCK, light grey to light grey-brown, moderately hard, medium crystalline; fragments to 2 cm across with subvertical orientation
- 1% EVAPORITE ROCK, chocolate-brown, soft, finely crystalline; fragments to 2 cm across, but generally 5 mm across; subvertical orientation

264.29 - 264.41 m (867'1" - 867'6")
- 85% EVAPORITE ROCK, grey, hard, medium crystalline; large fragments to 12 cm across and smaller fragments to 2 cm across
- 13% HALITE, orange, grades to clear in 5 mm zones around fragments, coarsely crystalline, compact, brittle, forms matrix for fragments
- 2% EVAPORITE ROCK, light grey, finely crystalline, grades to medium crystalline in part; fragments to 2 cm across with random orientation

241.41 - 264.51 m (867'6" - 867'10") Coarsely spaced fracture planes
- 99% HALITE, light pink to clear, coarsely crystalline, compact, brittle
- 1% EVAPORITE ROCK, light grey to white, hard, medium crystalline; fragments to 1 cm across with random orientation

264.51 - 264.88 m (867'10" - 869'1") Coarsely spaced fracture planes
95% HALITE, orange-brown, coarsely crystalline, compact, brittle
6% EVAPORITE ROCK, light grey, hard, medium crystalline; fragments to 3 cm across with subvertical orientation
264.88 - 266.40 m (869'1" - 874'0") Coarsely spaced fracture planes
99% HALITE, orange-brown, coarsely crystalline, compact, brittle
1% EVAPORITE ROCK, light grey, moderately hard, medium crystalline; fragments to 1 cm across with subvertical orientation

CORE No. 87

Interval: 266.40 - 264.44 m (874'0" - 884'0")
Cut: 3.04 m (10'0") Recovered: 3.04 m (10'0")
Description:
266.40 - 266.88 m (874'0" - 875'7") Finely spaced fracture planes
96% HALITE, light orange, coarsely crystalline, compact, brittle
4% EVAPORITE ROCK, light grey, moderately soft, medium crystalline, grades to finely crystalline in part; fragments to 8 cm across but generally 2 cm across with random orientation
266.88 - 267.14 m (875'7" - 876'5") Finely spaced fracture planes
65% HALITE, light orange to clear, coarsely crystalline, compact, brittle
30% EVAPORITE ROCK, white, hard, medium crystalline; fragments to 2 cm across
5% EVAPORITE ROCK, grey, moderately hard, medium crystalline; fragments to 1 cm across with random orientation
267.14 - 268.58 m (876'5" - 881'2") Finely spaced fracture planes
97% HALITE, light orange, coarsely crystalline, compact, brittle; contains fragments of brown impure halite with subvertical orientation (5%)
3% EVAPORITE ROCK, light grey, moderately hard, medium crystalline; fragments to 2 cm across with subvertical orientation
268.58 - 268.71 m (881'2" - 881'7") Finely spaced fracture planes
80% HALITE, light orange, coarsely crystalline, compact, brittle; contains fragments of brown impure halite with subvertical orientation (5%)
20% EVAPORITE ROCK, white, hard, medium crystalline; fragments to 3 cm across with subvertical orientation
268.71 - 269.44 m (881'7" - 884'0") Medium spaced fracture planes
96% HALITE, orange-brown, coarsely crystalline, compact, brittle
3% EVAPORITE ROCK, chocolate-brown, moderately soft, finely crystalline; fragments to 1 cm across with random orientation
1% EVAPORITE ROCK, white, hard, medium crystalline; fragments to 1 cm across with random orientation

CORE No. 88

Interval: 269.44 - 272.49 m (884'0" - 894'0")
Cut: 3.05 m (10'0") Recovered: 3.05 m (10'0")
Description:
269.44 - 269.85 m (883'0" - 885'8") Finely spaced fracture planes
98% HALITE, light orange, coarsely crystalline, compact, brittle
2% EVAPORITE ROCK, dark grey, finely crystalline, moderately soft; fragments to 1 cm across with random orientation
269.95 - 270.71 m (885'8" - 888'2") Finely spaced fracture planes
96% HALITE, light orange, coarsely crystalline, compact, brittle
2% EVAPORITE ROCK, white, medium crystalline, hard; fragments to 2 cm across with random orientation
2% EVAPORITE ROCK, light grey, medium crystalline, moderately hard; fragments to 2 cm across with random orientation

270.71 - 271.05 m (888'2" - 889'3")
70% HALITE, light orange, coarsely crystalline, compact, brittle
30% EVAPORITE ROCK, white, medium crystalline, hard; fragments to 8 cm across with subvertical orientation
271.05 - 272.49 m (889'3" - 893'0") Finely spaced fracture planes
96% HALITE, light orange, coarsely crystalline, compact, brittle
3% EVAPORITE ROCK, white, medium crystalline, hard; fragments to 6 cm across with subvertical orientation
1% EVAPORITE ROCK, grey, finely crystalline, moderately soft; fragments to 2 cm across with random orientation

CORE No. 89

Interval: 272.49 - 275.54 m (894'0" - 904'0")
Cut: 3.05 m (10'0") Recovered: 3.05 m (10'0")
Description:
272.49 - 272.80 m (894'0" - 895'0") Finely spaced fracture planes
90% HALITE, light pink to clear, coarsely crystalline, compact, brittle
10% EVAPORITE ROCK, white, hard, medium crystalline; fragments to 2 cm across with subvertical orientation
272.80 - 274.40 m (895(0" - 900'3") Finely spaced fracture planes
97% HALITE, light pink coarsely crystalline, compact, brittle
3% EVAPORITE ROCK, white, hard, medium crystalline; fragments to 5 cm across with subvertical orientation
274.40 - 274.83 m (900'3" - 901'8") Finely spaced fracture planes
94% HALITE, light pink, coarsely crystalline, compact, brittle
6% EVAPORITE ROCK, white, hard, medium crystalline; fragments to 2 cm across with subvertical orientation
274.83 - 275.36 m (901'8" - 903'5") Medium spaced fracture planes
97% HALITE, light pink, coarsely crystalline, compact, brittle
3% EVAPORITE ROCK, white, hard, medium crystalline; fragments to 2 cm across with subvertical orientation
275.36 - 275.54 m (903'5" - 904'0") Finely spaced fracture planes
99% HALITE, light pink, coarsely crystalline, compact, brittle
1% EVAPORITE ROCK, dark grey, moderately soft, finely crystalline; fragments to 5 mm across with random orientation

CORE No. 90

Interval: 275.54 - 278.59 m (904'0" - 914'0")
Cut: 3.05 m (10'0") Recovered: 3.05 m (10'0")
Description:
275.54 - 276.20 m (904'0" - 906'2") Finely spaced fracture planes
98% HALITE, light orange, coarsely crystalline, compact, brittle
2% EVAPORITE ROCK, dark grey to grey-brown, moderately soft, finely crystalline; fragments to 5 mm across with random orientation
276.20 - 277.21 m (906'2" - 909'6") Medium spaced fracture planes
95% HALITE, orange, coarsely crystalline, compact, brittle
3% EVAPORITE ROCK, dark grey, moderately hard, finely crystalline; fragments to 4 mm across with subvertical orientation
2% EVAPORITE ROCK, white, hard, medium crystalline; fragments to 2 cm across with subvertical orientation
277.21 - 278.03 m (909'6" - 912'2") Medium spaced fracture planes
90% HALITE, orange, grades to clear in 5 mm zone around fragments, coarsely crystalline, compact, brittle
10% EVAPORITE ROCK, white to light grey-brown, hard, medium crystalline, grades to finely crystalline on edges of fragments, massive; angular fragments to 10 cm across with random orientation; some fractures in fragments filled with halite

278.03 - 278.59 m (912'2" - 914'0") Finely spaced fracture planes
95% HALITE, light orange, grading to clear in part, coarsely crystalline, compact, brittle
3% EVAPORITE ROCK, white, medium crystalline, hard; angular fragments to 2 cm across with random orientation
2% EVAPORITE ROCK, dark grey, moderately hard, finely crystalline; fragments to 2 cm across with random orientation

CORE No. 91

Interval: 278.59 - 281.64 m (914'0" - 924'0")
Cut: 3.05 m (10'0") Recovered: 3.05 m (10'0")
Description:
278.59 - 278.92 m (914'0" - 915'1") Finely spaced fracture planes
95% HALITE, light orange, grades to clear in part, coarsely crystalline, compact, brittle
3% EVAPORITE ROCK, white, medium crystalline, hard; angular fragments to 2 cm across with random orientation
2% EVAPORITE ROCK, dark grey, moderately hard, finely crystalline; fragments to 2 cm across with random orientation
278.92 - 279.48 m (915'1" - 916'11") Finely spaced fracture planes
93% HALITE, light orange, grades to clear in part, coarsely crystalline, compact, brittle
5% EVAPORITE ROCK, white, medium crystalline, hard; fragments to 3 cm across with subvertical orientation
2% EVAPORITE ROCK, dark grey, moderately soft, finely crystalline; fragments to 1 cm across with subvertical orientation
279.48 - 280.16 m (916'11" - 919'2") Medium spaced fracture planes
98% HALITE, light orange, coarsely crystalline, compact, brittle
2% EVAPORITE ROCK, dark grey to dark grey-brown, moderately hard, finely crystalline; fragments to 1 cm across with subvertical orientation
280.16 - 281.03 m (919'2" - 922'0") Medium spaced fracture planes
96% HALITE, light orange, coarsely crystalline, compact, brittle; contains fragments of orange-brown impure halite to 5 cm across (3%)
2% EVAPORITE ROCK, dark grey, moderately hard, finely crystalline; fragments to 1 cm across with subvertical orientation
2% EVAPORITE ROCK, white to light brown, medium crystalline; fragments to 9 cm across with subvertical orientation
281.03 - 281.11 m (922'0" - 922'3") Coarsely spaced fracture planes
90% EVAPORITE ROCK, white medium crystalline, hard, even texture
10% HALITE, orange, grades to clear at contacts with evaporite rock, coarsely crystalline, compact, brittle
281.11 - 281.43 m (922'3" - 923'4") Medium spaced fracture planes
85% HALITE, light orange, grades to clear at contacts with evaporite rock, coarsely crystalline, compact, brittle
15% EVAPORITE ROCK, white, medium crystalline, hard; fragments to 4 cm across, oriented at 45°
291.43 - 281.64 m (923'4" - 924'0") Finely spaced fracture planes
85% HALITE, light orange, coarsely crystalline, compact, brittle
15% EVAPORITE ROCK, white, medium crystalline; fragments to 4 cm across oriented 45°

CORE No. 92

Interval: 281.64 - 284.68 m (924'0" - 934'0")
Cut: 3.04 m (10'0") Recovered: 3.05 m (10'0")
Description:
281.64 - 282.40 m (924'0" - 926'6") Finely spaced fracture planes
95% HALITE, light orange, coarsely crystalline, compact, brittle
3% EVAPORITE ROCK, white, medium crystalline, hard; fragments to 2 cm across with random orientation
3% EVAPORITE ROCK, dark grey, moderately hard, finely crystalline; fragments to 2 cm across with random orientation
282.40 - 283.10 m (926'6" - 928'10") Finely spaced fracture planes
97% HALITE, orange, coarsely crystalline, compact, brittle
3% EVAPORITE ROCK, dark grey, moderately hard, finely crystalline; fragments to 2 cm across with random orientation
282.10 - 283.02 m (928'10" - 913'10") Finely spaced fracture planes
95% HALITE, light orange, coarsely crystalline, compact, brittle
2% EVAPORITE ROCK, white, medium crystalline, hard; fragments to 2 cm across with random orientation
2% EVAPORITE ROCK, dark grey, moderately soft, finely crystalline; fragments to 1 cm across with random orientation
284.02 - 284.68 m (931'10" - 934'0") Finely spaced fracture planes
97% HALITE, light orange, coarsely crystalline, compact, brittle
3% EVAPORITE ROCK, dark grey, moderately hard, finely crystalline; fragments to 2 cm across with random orientation

CORE No. 93

Interval: 284.68 - 286.56 m (934'0" - 944'0")
Cut: 3.05 m (10'0") Recovered: 3.05 m (10'0")
Description:
284.68 - 286.56 m (934'0" - 940'2") Finely spaced fracture planes
97% HALITE, pink, grades to light orange in part, coarsely crystalline, compact, brittle
2% EVAPORITE ROCK, white, medium crystalline, hard; fragments to 2 cm across with subvertical orientation
1% EVAPORITE ROCK, dark grey, moderately hard, finely crystalline; fragments to 2 cm across subvertically orientated
286.56 - 287.32 m (940'2" - 942'8") Finely spaced fracture planes
96% HALITE, light orange to white, coarsely crystalline, compact, brittle; contains fragments of impure brown halite to 1 cm across (10%)
2% EVAPORITE ROCK, white, medium crystalline, hard; fragments to 2 cm across with subvertical orientation
1% EVAPORITE ROCK, dark grey, moderately hard, finely crystalline; fragments to 2 cm across subvertically oriented
287.32 - 287.53 m (842'9" - 843'4") Finely spaced fracture planes
95% HALITE, light orange, coarsely crystalline, compact, brittle
5% EVAPORITE ROCK, white, hard, medium crystalline; fragments to 1 cm across with subvertical orientation
287.53 - 287.73 m (843'4" - 844'0") Finely spaced fracture planes
99% HALITE, light orange, coarsely crystalline, compact, brittle
1% EVAPORITE ROCK, white, hard, medium crystalline; fragments to 5 mm across with random orientation

CORE No. 94

Interval: 284.68 - 287.73 m (944'0" - 954'0")
Cut: 3.05 m (10'0") Recovered: 3.05 m (10'0")
Description:
284.68 - 286.56 m (944'0" - 946'7") Finely spaced fracture planes
98% HALITE, orange, coarsely crystalline, compact, brittle
2% EVAPORITE ROCK, white, medium crystalline; fragments to 4 cm but generally 5 mm across
288.52 - 290.78 m (946'7" - 954'0") Medium spaced fracture planes
97% HALITE, light orange, grades to white in part, coarsely crystalline, compact, brittle
3% EVAPORITE ROCK, dark grey, moderately soft, finely crystalline; fragments to 2 cm across with vertical orientation

CORE No. 95

Interval: 290.78 - 293.83 m (954'0" - 964'0")
Cut: 3.05 m (10'0") Recovered: 3.05 m (10'0")
Description:
290.78 - 291.84 m (954'0" - 957'6") Finely spaced fracture planes
97% HALITE, orange, coarsely crystalline, compact, brittle
3% EVAPORITE ROCK, light grey, moderately hard, medium crystalline; fragments to 1 cm across with random orientation
291.84 - 292.23 m (957'6" - 958'9") Medium spaced fracture planes
95% HALITE, light pink, coarsely crystalline, compact, brittle
5% EVAPORITE ROCK, white, medium crystalline; fragments to 8 cm across with random orientation
292.23 - 292.79 m (958'9" - 960'7") Medium spaced fracture planes
80% EVAPORITE ROCK, white to light grey-brown, hard, medium crystalline; fragments with contorted bedding to 13 cm across
20% HALITE, light pink, coarsely crystalline, compact, brittle; matrix infilling fractures in evaporite rock, and irregular aggregates to 1 cm across in evaporite rock
292.79 - 293.11 m (960'7" - 961'8") Medium spaced fracture planes
99% HALITE, light pink, coarsely crystalline, compact, brittle
1% EVAPORITE ROCK, white, medium crystalline, hard; fragments to 1 cm across with vertical orientation
293.11 - 293.32 m (961'8" - 962'4") Medium spaced fracture planes
96% HALITE, light orange to white, coarsely crystalline, compact, brittle
4% EVAPORITE ROCK, light grey to grey-green, moderately soft, medium crystalline; fragments to 2 cm across with subvertical orientation
293.32 - 293.83 m (962'4" - 964'0") Finely spaced fracture planes
95% HALITE, light orange to white, coarsely crystalline, compact, brittle; contains fragments of brown, impure halite to 2 cm across (10%)
2% EVAPORITE ROCK, light grey to grey-green, moderately soft, medium crystalline; fragments to 2 cm across with random orientation
2% EVAPORITE ROCK, dark grey, moderately soft, finely crystalline; fragments to 2 cm across with random orientation

CORE No. 96

Interval: 293.83 - 296.88 m (964'0" - 974'0")
Cut: 3.05m(10'0") Recovered: 2.79 m (9'2")
Description:
294.08 - 294.38 m (964'10" - 965'10") Finely spaced fracture planes
98% HALITE, light pink, coarsely crystalline, compact, brittle
2% EVAPORITE ROCK, light grey, moderately hard, medium grained fragments to 2 cm across with random orientation
294.38 - 294.74 m (965'10" - 967'0") Finely spaced fracture planes
100% HALITE, light orange, coarsely crystalline, compact, brittle
294.74 - 294.94 m (967'0" - 967'8") Finely spaced fracture planes
98% HALITE, light pink, coarsely crystalline, compact, brittle
2% EVAPORITE ROCK, light grey, moderately hard, medium crystalline; fragments to 2 cm across with random orientation
294.94 - 295.15 m (967'8" - 968'4") Finely spaced fracture planes
100% HALITE, orange, coarsely crystalline, compact, brittle
295.15 - 295.58 m (968'4" - 969'9") Finely spaced fracture planes
97% HALITE, light orange to white, coarsely crystalline, compact, brittle
2% EVAPORITE ROCK, light grey, moderately hard, medium crystalline; fragments to 1 cm across with random orientation
295.58 - 296.88 m (969'9" - 974'0") Medium spaced fracture planes
99% HALITE, light pink, coarsely crystalline, compact, brittle; contains fragments of brown impure halite to 1 cm across (5%)
1% EVAPORITE ROCK, grey to white, moderately hard, medium crystalline fragments to 2 cm across with random orientation

CORE No. 97

Interval: 296.88 - 299.92 m (974'0" - 984'0")
Cut: 3.04 m (10'0") Recovered: 3.04 m (10'0")
Description:
296.99 - 297.38 m (974'0" - 975'8") Finely spaced fracture planes
70% HALITE, light orange to clear, coarsely crystalline, compact, brittle
28% EVAPORITE ROCK, light grey-green, hard, medium crystalline; fragments to 2 cm across with random orientation
2% EVAPORITE ROCK, dark grey, moderately soft, finely crystalline; fragments to 2 cm across with random orientation
297.38 - 297.54 m (975'8" - 976'2") Finely spaced fracture planes
95% EVAPORITE ROCK, white, grades to light grey-green at base, hard, medium crystalline
5% HALITE, light orange to clear, coarsely crystalline, compact, brittle; infills fractures and irregular bodies in evaporite rock
297.54 - 297.19 m (976'2" - 976'8") Finely spaced fracture planes
100% HALITE, light pink, coarsely crystalline, compact, brittle; bed dips subvertically
297.69 - 297.97 m (976'8" - 977'7") Medium spaced fracture planes
97% HALITE, orange to white, coarsely crystalline, compact, brittle; contains fragments of brown impure halite to 2 cm across (10%)
3% EVAPORITE ROCK, light grey-green; fragments to 1 cm across with subvertical orientation
297.97 - 298.34 m (977'7" - 928'10") Finely spaced fracture planes
100% HALITE, light pink, coarsely crystalline, compact, brittle
298.34 - 298.88 m (978'10" - 980'7") Medium spaced fracture planes
98% HALITE, orange to white, coarsely crystalline, compact, brittle; contains fragments of brown impure halite to 2 cm across
1% EVAPORITE ROCK, light grey-green, moderately hard, medium crystalline; fragments to 1 cm across with subvertical orientation

1% EVAPORITE ROCK, chocolate-brown, soft, finely crystalline; irregular bodies to 5 mm across in impure halite fragments

298.88 - 299.16 m (980'7" - 981'6") Coarsely spaced fracture planes

55% HALITE, white to orange, coarsely crystalline, compact, brittle; matrix, and veins infilling fractures in fragments

40% EVAPORITE ROCK, chocolate brown, moderately soft, finely crystalline; subrounded fragments to 3 cm across

5% EVAPORITE ROCK, light grey-green, moderately hard, medium crystalline; fragments to 3 mm across, mainly in lower 1 cm of bed; dips subvertically

299.16 - 299.92 m (981'6" - 984'0") Coarsely spaced fracture planes

85% EVAPORITE ROCK, white, grades to light grey-green in part, medium crystalline, hard; fragments to 15 cm across with vertical orientation

15% HALITE, light pink, coarsely crystalline; veins in fractures, and irregular bodies to 2 cm across in evaporite rock

CORE No. 98

Interval: 299.92 - 302.97 m (984'0" - 994'0")
Cut: 3.05 m (10'0") Recovered: 3.02 m (9'11")
Description:

299.95 - 300.26 m (984'1" - 985'1") Medium spaced fracture planes

65% HALITE, orange, grades to clear in zones around fragments, coarsely crystalline, compact, brittle

33% EVAPORITE ROCK, grades from grey-green to grey-brown, hard, finely crystalline; angular fragments to 3 cm across with random orientation

2% EVAPORITE ROCK, grey, moderately hard, finely crystalline; fragments to 1 cm across with random orientation

300.26 - 300.94 m (985'1" - 987'4") Finely spaced fracture planes

65% HALITE, orange to white, coarsely crystalline, compact, brittle

30% EVAPORITE ROCK, grey-green, moderately hard, medium crystalline; fragments to 2 cm across with random orientation

5% EVAPORITE ROCK, chocolate-brown, moderately soft, finely crystalline; fragments to 2 cm across with random orientation

300.94 - 30.112 m (987'4" - 987'11") Medium spaced fracture planes

60% EVAPORITE ROCK, white to light grey-green, medium crystalline, hard; fragments to 4 cm across

40% HALITE, orange to clear, coarsely crystalline, compact, brittle; matrix, and irregular veins infilling fractures in evaporite rock

301.12 - 301.27 m (987'11" - 988'5") Medium spaced fracture planes

85% EVAPORITE ROCK, white, hard, medium crystalline; fragments to 3 cm across with random orientation

12% HALITE, pink, coarsely crystalline, compact, brittle; irregular inclusions in evaporite rock

3% EVAPORITE ROCK, light grey-green, moderately hard, medium crystalline; fragments to 1 cm across with random orientation

301.27 - 301.93 m (988'5" - 990'7") Finely spaced fracture planes

100% HALITE, pink, coarsely crystalline, compact, brittle

301.93 - 302.21 m (990'7" - 991'6") Finely spaced fracture planes

98% HALITE, orange, coarsely crystalline, compact, brittle

1% EVAPORITE ROCK, chocolate-brown, moderately soft, finely crystalline; fragments 5 mm across with subvertical orientation

1% EVAPORITE ROCK, grey-green, moderately hard, medium crystalline; fragments to 5 mm across with subvertical orientation; bed dips 70°

302.21 - 302.49 m (991'6" - 992'5") Finely spaced fracture planes
100% HALITE, pink, coarsely crystalline, compact, brittle
302.49 - 302.97 m (992'5" - 994'0") Medium spaced fracture planes
70% HALITE, pink to white, coarsely crystalline, compact, brittle
30% EVAPORITE ROCK, white to light grey-green, hard, medium crystalline; fragments to 3 cm across with subvertical orientation

CORE No. 99

Interval: 302.97 - 305.86 m (994'0" - 1903'6")
Cut: 2.89 m (9'6") Recovered: 2.79 m (9'2")
Description:
95% HALITE, orange-brown, coarsely crystalline, compact, brittle
5% EVAPORITE ROCK, light grey, moderately hard, medium crystalline; fragments to 2 cm across with random orientation
303.41 - 304.24 m (995'5" - 998'2") Finely spaced fracture planes
97% HALITE, orange-brown, coarsely crystalline, compact, brittle
2% EVAPORITE ROCK, light grey, moderately hard, medium crystalline; fragments to 1 cm across with subvertical orientation
1% EVAPORITE ROCK, chocolate-brown, moderately soft, finely crystalline; fragments to 5 mm across with subvertical orientation
304.24 - 305.86 m (998'2" - 1003'6") Medium spaced fracture planes
96% HALITE, orange to white, coarsely crystalline, compact, brittle; contains fragments of impure orange halite to 2 cm across (10%)
2% EVAPORITE ROCK, light grey-green, moderately hard, medium crystalline; fragments to 2 cm across with vertical orientation
2% EVAPORITE ROCK, chocolate-brown, moderately soft, finely crystalline; fragments to 5 mm across with vertical orientation

End of Hole

COMPLETION REPORTS

BMR LAKE AMADEUS NOS. 3, 3A and 3B

by

P.J. Kennewell

INTRODUCTION

BMR Lake Amadeus No. 3B was the last of a planned series of three continuously cored holes to about 300 metres drilled in the late Precambrian Bitter Springs Formation of the Amadeus Basin. Two preceeding holes, BMR Lake Amadeus 3, and 3A nearby were prematurely abandoned at shallow depths for various reasons.

The drillsite is located 230 km southwest of Alice Springs and 60 km north of Curtin Springs Homestead on an outcrop of gypsum 120 m across. The surrounding geology is mostly concealed by sand dunes and silcrete capping and no accurate assessment of the stratigraphic sequence in the area could be made.

The hole was drilled by the Petroleum Technology Section of the Bureau of Mineral Resources (Mr E.H. Cherry, party leader) using a Mayhew 1000 drilling rig. Continuous coring was maintained from a depth of 42.7 m (140') using both air and salt saturated water as drilling fluids.

Water was obtained from East Lake, 40 km to the southwest, Parrarra Well, 70 km to the south, and Curtin Springs Homestead. Access to the drillsite from the Ayers Rock road was by 90 km of poor track from Curtin Springs. The final 30 km had to be graded for heavy vehicles to gain access to the site.

The hole was completed at a total depth of 305.87 m (1003'6").

WELL HISTORY - BMR LAKE AMADEUS NO. 3

GENERAL DATA

Well name and number:	BMR Lake Amadeus No. 3
Location:	Lat. 24°46'36"S
	Long. 131°53'24"E
Title holder:	None
Petroleum title number:	None
Area:	Amadeus Basin, Northern Territory
Total depth:	Driller: 48.77 m (160')
Date drilling commenced:	1st October 1970
Date drilling completed:	6th October 1970
Date well secured:	6th October 1970
Date rig released:	6th October 1970
Drilling time to total depth:	Coring: 27 hr
	Reaming: 29 hr
	Actual drilling: ½ hr
Elevations:	Rotary table: 1.20 m (4') above ground level
	Ground level: 515 m (1690') approx.
Status:	Plugged and abandoned

DRILLING DATA

Drilling by:	Bureau of Mineral Resources, Canberra, ACT
Drilling plant:	Make: Mayhew
	Type: 1000
	Rated capacity: 305 m (1000') with 6.03 cm (2⅜") drill pipe
Mast:	Make: Mayhew
	Type: tubular, 7.01 m (23')
	Rated capacity: 18,140 kilograms (40,000 lbs)
Pumps:	Make: Gardner Denver
	Type: FC-FXG
	Size: 12.7 cm x 15.2 cm (5" x 6")

	Motors: as for rig
Compressor:	Make: Gardner Denver
	Type: 2 stage reciprocating
	Model: WXH
	Motors: as for rig
Blowout preventor:	Make: Baash Ross
	Size: 15.2 cm x 6.03 cm (6" x $2\frac{3}{8}$")
	Model: Autolock
	Working pressure: 70 kgf/cm^2 (1000 psi)
Hole sizes:	0m to 39.32 m (0' to 129'): 25.4 cm (9 7/8"),
	39.32 m to 48.77 m (129' to 160'): 11.4 cm ($4\frac{1}{2}$")
Casing strings:	None
Casing cement:	None
Drilling fluid; Coring:	Air
Reaming:	Air
Water supply:	No water was used in drilling this hole
Perforation and shooting record:	Nil
Plugging back and szueeze cement jobs;	
Coring:	Nil
Reaming:	Nil
Side-tracked hole:	Nil
Fishing operations:	Nil

PERSONNEL AND ADMINISTRATIVE

Shifts run:	Daily: 2
	Weekly: 12
Hours per shift:	12
Party Leader:	E. Cherry
Drillers:	A. Zoska
	L. Keast
Drillers Assistant:	E. Reid

LOGGING AND TESTING

Ditch Cuttings

A continuous sample of the dust produced by the drilling was obtained at 3.05 m (10') intervals throughout the hole. The dust was collected in a dry receptacle placed beneath the rotary table and directly beside the hole. The samples were not washed. Two sets of samples were taken; one is stored at the Mines Branch, NTA, and the other at the BMR Core and Cuttings Laboratory, Fyshwick, ACT.

Cores

Continuous coring was maintained from 3.05 m (10') to total depth. The cores were cut with a 3.05 m (10') Triefus split inner tube core barrel using 10.0 cm (3 15/16") soft formation coreheads which cut 6.4 cm (2½") diameter cores. The rate of penetration was fast, and fifteen cores were cut. Of a total depth of 48.77 m (160'), 45.72 m (150') were cored. Total core recovery was 43.62 m (113'6"). Average recovery in the cored intervals was 76%, or core was obtained over 66% of the hole. Details of the cores are set out in Table V. The cores are stored at the BMR Core and Cuttings laboratory.

Table V - Core Intervals and Recovery

BMR Lake Amadeus No. 3

Core No.	From	To	Interval	Recovered	Percent
1	3.05 m	6.10 m	3.05 m	3.00 m	98
2	6.10	9.14	3.04	2.57	84
3	9.14	12.19	3.05	2.57	84
4	12.19	15.24	3.05	2.30	75
5	15.24	18.29	3.05	0.76	25
6	18.29	21.33	3.04	0.46	15
7	21.33	24.38	3.05	1.06	35
8	24.38	27.43	3.05	3.05	100

Core No.	From	To	Interval	Recovered	Percent
9	27.43 m	30.48 m	3.05 m	3.05 m	100
10	30.48	33.53	3.05	3.05	100
11	33.53	36.58	3.05	2.95	97
12	36.58	39.62	3.04	3.04	100
13	39.62	42.67	3.05	2.95	97
14	42.67	45.72	3.05	1.83	60
15	45.72	48.77	3.05	1.98	65

Side-wall sampling: Nil

Well logging: Nil

Gas log: Nil

Formation testing: Nil

Deviation surveys: Nil

Other hole surveys: Nil

SUMMARY OF DRILLING OPERATIONS

Drilling commenced on 1/10/70 on BMR Lake Amadeus No. 3, using rotary air methods with an 11.4 cm ($4\frac{1}{2}$") non-coring bit to a depth of 2.74 m (9'). Coring then commenced and continued with a 3.05 m (10') core barrel to a depth of 48.77 m (160'). The hole was reamed to 11.4 cm ($4\frac{1}{2}$") diameter at intervals of 9.14 m (30'). On completion of coring, an attempt was made to ream the hole to 25.3 cm (9 7/8") diameter in order to run 20.3 cm (8") water bore casing. Because of the large diameter and the inadequacy of the two compressors, no return of cuttings was obtained below 39.32 m (129') and reaming had to cease. As a result of this a 76 cm (2'6") cavity which had been intersected at 43.43 m (142'6") could not be sealed off. The hole had deflected slightly and was falling in with the result that a decision was made to abandon it on 6/10/70.

WELL HISTORY - BMR LAKE AMADEUS NO. 3A

GENERAL DATA

Well name and number:	BMR Lake Amadeus No. 3A
Location:	Lat. 24°46'36"S
	Long. 131°53'24"E
Title holder:	None
Petroleum title number:	None
Area:	Amadeus Basin, Northern Territory
Total depth:	Driller: 38.7 m (127')
Date drilling commenced:	7th October 1970
Date drilling completed:	8th October 1970
Date well secured:	8th October 1970
Date rig released:	8th October 1970
Drilling time to total depth:	Coring: $4\frac{3}{4}$ hr
	Reaming: $\frac{3}{4}$ hr
	Actual drilling: $7\frac{1}{2}$ hr
Elevations:	Rotary table: 1.20 m (4') above ground level
	Ground level: 515 m (1690') approx.
Status:	Plugged and abandoned

DRILLING DATA

Drilling by:	Bureau of Mineral Resources, Canberra, ACT
Drilling plant:	Make: Mayhew
	Type: 1000
	Rated capacity: 305 m (1000') with 6.03 cm ($2\frac{3}{8}$") drill pipe
Mast:	Make: Mayhew
	Type: tubular, 7.01 m (23')
	Rated capacity: 18,140 kilograms (40,000 lbs)
Pumps:	Make: Gardner Denver
	Type: FG-FXG
	Size: 12.7 cm x 15.2 cm (5" x 6")
	Motors: as for rig

Compressor:	Make: Gardner Denver
	Type: 2 stage reciprocating
	Model: WXH
	Motors: as for rig
Blowout preventor:	None
Hole sizes:	0 m to 38.7 m (0' to 127'): 11.4 cm (4½")
Casing strings:	None
Casing cement:	None
Drilling fluid; Coring:	Air
Reaming:	Air
Water supply:	No water was used in drilling this hole
Perforation shooting record:	Nil
Plugging back and squeeze cement jobs;	
Coring:	Nil
Reaming:	Nil
Side-tracked hole:	Nil
Fishing operations:	Nil

PERSONNEL AND ADMINISTRATIVE

Shifts run:	Daily: 2
	Weekly: 12
Hours per shift:	12
Party Leader:	E. Cherry
Drillers:	A. Zoska
	L. Keast
Drillers Assistant:	E. Reid

LOGGING AND TESTING

Ditch Cuttings

A continuous sample of the dust produced by the drilling was obtained at 1.53 m (5') intervals throughout the hole. The dust was collected in a dry receptacle placed beneath the rotary table and directly beside the hole. The samples were not washed. Two sets of samples were taken; one is stored at the Mines Branch, NTA, and the other at the BMR Core and Cuttings Laboratory, Fyshwick, ACT.

Cores

Two cores were taken with the same barrel used in BMR Lake Amadeus No. 3 over the intervals 13.72 - 16.77 m (45' - 55') and 27.43 - 30.48 m (90' - 100'). Of a total depth of 38.71 m (127') total core recovery was 2.15 m (7'3"). The average recovery in the cored intervals was 36.3%, or core was obtained over 5.7% of the hole. Details of the cores are given in Table VI. The cores are stored at the BMR Core and Cuttings Laboratory.

Table VI - Core Intervals and Recovery

BMR Lake Amadeus No. 3A

Core No.	From	To	Interval	Recovered	Percent
1	13.72 m	16.77 m	3.05 m	1.06 m	35
2	27.43	30.48	3.05	1.09	36

Side-wall sampling: Nil

Well logging: Nil

Gas log: Nil

Formation testing: Nil

Deviation surveys: Nil

Other hole surveys: Nil

SUMMARY OF DRILLING OPERATIONS

Drilling of BMR Lake Amadeus No. 3A commenced on 7/10/70. The hole was drilled with a 11.4 cm ($4\frac{1}{2}$") non-coring bit, with the exception of the intervals 13.72 m to 16.76 m (45' to 55') and 27.43 m to 30.48 m (90' to 100'), in which cores were taken. Dampness was encountered from 27.43 m (90') to total depth, and the hole was falling in from 34.14 m (112').

As no solid evaporite rock had been penetrated by 38.71 m (127'), the hole was abandoned at that depth on 8/10/70.

WELL HISTORY - BMR LAKE AMADEUS NO. 3B

GENERAL DATA

Well name and number:	BMR Lake Amadeus No. 3B
Location:	Lat. 24°46'36"S
	Long. 131°53'24"E
Title holder:	None
Petroleum title number:	None
Area:	Amadeus Basin, Northern Territory
Total depth:	Driller: 305.87 m (1003'6")
	Mibolog: 305.41 m (1002')
Date drilling commenced:	8th October 1970
Date drilling completed:	4th December 1970
Date well secured:	7th December 1970
Date rig released:	7th December 1970
Drilling time to total depth:	Coring: 161¼ hr
	Reaming: 106 hr
	Actual drilling: 7½ hr
Elevations:	Rotary table: 1.20 m (4') above ground level
	Ground level: 515 m (1690') approx.
Status:	Plugged and abandoned

DRILLING DATA

Drilling by:	Bureau of Mineral Resources, Canberra, ACT
Drilling plant:	Make: Mayhew
	Type: 1000
	Rated capacity: 305 m (1000') with
	6.03 cm (2⅜") drill pipe
Mast:	Make: Mayhew
	Type: tubular, 7.01 m (23')
	Rated capacity: 18,140 kilograms (40,000 lbs)
Pumps:	Make: Gardner Denver
	Type: FG-FXG

Size: 12.7 cm x 15.2 cm (5" x 6")

Motors: as for rig

Compressor:

Make: Gardner Denver

Type: 2 stage reciprocating

Model: WXH

Motors: as for rig

Blowout preventor:

Make: Baash Ross

Size: 15.2 cm x 6.03 cm (6" x $2\frac{3}{8}$")

Model: Autolock

Working pressure: 70 kgf/cm^2 (1000 psi)

Hole sizes:

0 m to 45.7 m (0' to 150'): 25.4 cm (9 7/8"):

45.7 m to 305.87 m (160' to 1003'6"): 14 cm ($5\frac{1}{2}$")

Casing strings:

Size: 20.3 cm x 0.47 cm wall (8" x 3/16" wall)

Grade: water bore

Weight: 32.3 kg/m (21.7 lb/ft)

Set at: 43.60 m (143')

Casing cement:

Size: 20.3 cm (8")

Sacks cement: NA

Cement rise: to surface

Method: single stage, plug

Drilling fluid; Coring:

Interval: 0 m to 90.22 m (0' to 296')

Type: air

Interval: 90.22 m to 98.45 m (296' - 323')

Type: water

Interval: 98.45 m 164.59 m (323' - 540')

Type: air

Interval: 164.59 m to 305.87 m (540' - 1003'6")

Type: salt saturated water

Reaming:

Interval: 0 m to 36.58 m (0' to 120')

Type: air

Interval: 36.58 m to 45.70 m (120' to 150')

Water supply: Drilling: East Lake, Parrarra Well and Curtin Springs Homestead

Domestic: Parrarra Well

Perforation and shooting record: Nil

Plugging back and squeeze cement jobs;

Coring: Depth: 81.4 m (267')
Quantity: NA
Depth: 90.2 m (296')
Quantity: NA
Depth: 98.5 m (323')
Quantity: 15 bags
Depth: 99.7 m (327')
Quantity: NA
Depth: 103.9 m (341')
Quantity: NA
Depth: 164.6 m (540')
Quantity: NA
Depth: 195.1 m (640')
Quantity: Bentonite-Diesolene Injection
Depth: 195.1 m (640')
Quantity: NA

Reaming: Depth: 45.7 m (150')
Quantity: NA

Side-tracked hole: Nil

Fishing operations: Lower portion of barrel fished out at 300.1 m (984'6")

NA - information not available

PERSONNEL AND ADMINISTRATIVE

Shifts run:	Daily: 2
	Weekly: 12
Hours per shift:	12
Party Leader:	E. Cherry
Drillers:	A. Zoska
	L. Keast
Drillers Assistant:	E. Reid

LOGGING AND TESTING

Ditch Cuttings

A continuous sample of the dust produced by the drilling was obtained every 3.05 m (10') for the intervals 0 - 42.67 m (0' - 140') and 90.22 - 98.45 m (296' - 323'). The dust over the first interval was collected in a dry receptacle placed beneath the rotary table and directly beside the hole. It was not washed. The cuttings over the second interval were sieved from the water circulating in the hole during drilling. It was not possible to collect samples throughout the remainder of the hole. No return of cuttings was obtained when drilling with air because of dampness in the hole. When drilling with water a very fine powder which quickly blocked the sieve was produced by the coring bits. This powder took three days to dry out and formed a solid chalky block when dry.

Two sets of samples were taken in each interval; one set is sorted at the Core and Cuttings Laboratory, BMR, at Fywhwick, ACT, and the duplicate set is sorted at the Mines Branch NTA, at Alice Springs.

Cores

Two cores were taken with the same barrel used in BMR Lake Amadeus No. 3 over the intervals 12.19 - 14.63 m (40' to 48') and 31.39 - 33.53 m (103' to 110') before continuous coring, within the limits of drilling practice, commenced at 42.67 m (140'). No cores were obtained over the

interval 90.22 - 98.45 m (296' to 323') because of a large flow of water, and from 161.54 - 164.59 m (530' to 540') because of an error in depth measurements.

Eighty one cores were cut, with fast penetration throughout the gypsum and anhydrite, but very slow penetration through the tough black dolomite beds. Of the total depth of 305.87 m (1003'6"), 257.05 m (843'1") were cored. Total core recovery was 220.99 m (725'0"). The recovery over the intervals that coring was attempted was 85.9%, or core was obtained over 72.3% of the hole. Details of the cores are set out in Table VII.

Table VII - Core Intervals and Recovery

BMR Lake Amadeus No. 3B

Core No.	From	To	Interval	Recovery	Percent
1	12.19 m	14.63 m	2.54 m	2.13 m	84
2	31.39	33.53	2.24	0.46	20
3	42.67	45.72	3.05	2.87	74
4	45.72	48.46	2.74	2.74	100
5	48.46	51.36	2.90	2.90	100
6	51.36	53.95	2.59	2.56	99
7	53.95	57.00	3.05	3.05	100
8	57.00	60.05	3.05	3.05	100
9	60.05	62.79	2.74	2.36	89
10	62.79	65.84	3.05	3.05	100
11	65.84	68.88	3.04	3.04	100
12	68.88	71.93	3.05	0.62	20
13	71.93	74.98	3.05	3.02	99
14	74.98	77.87	2.89	2.79	97
15	77.87	80.92	3.05	3.05	100
16	81.38	84.42	3.04	2.97	98
17	84.42	87.33	2.91	2.74	94
18	87.48	90.22	2.84	2.62	92

Core No.	From	To	Interval	Recovery	Percent
19	98.45 m	100.28 m	1.83 m	0.79 m	43
20	100.89	103.94	3.05	1.75	57
21	103.94	106.99	3.05	1.22	40
22	106.99	108.20	1.21	1.13	94
23	108.51	111.56	3.05	2.82	92
24	111.56	114.61	3.05	1.86	59
25	114.91	117.96	3.05	3.00	98
26	117.96	121.01	3.05	2.89	95
27	121.01	124.05	3.04	1.93	97
28	124.05	125.58	1.53	1.42	93
29	125.58	128.63	3.05	2.82	92
30	128.63	131.67	3.04	2.92	96
31	131.67	134.72	3.05	3.05	100
32	134.72	137.16	2.44	2.44	100
33	137.16	140.21	3.05	1.27	42
34	140.21	143.26	3.05	2.52	83
35	143.26	146.30	3.04	1.14	38
36	146.30	149.35	3.05	0.79	26
37	149.35	152.40	3.05	3.05	100
38	152.70	155.45	3.05	2.97	97
39	155.45	158.50	3.05	2.90	95
40	158.50	161.54	3.04	2.84	93
41	164.59	167.64	3.05	2.74	90
42	167.64	170.69	3.05	2.26	74
43	170.69	173.74	3.05	1.65	54
44	173.74	176.78	3.04	2.67	88
45	176.78	179.83	3.05	0.71	23
46	179.83	182.88	3.05	2.16	71
47	182.88	185.93	3.05	2.57	84

Core No.	From	To	Interval	Recovery	Percent
48	185.93 m	188.98 m	3.05 m	2.47 m	81
49	188.98	192.02	3.04	2.01	67
50	192.02	195.02	3.05	1.75	57
51	195.07	196.90	1.83	1.27	70
52	196.90	199.95	3.05	2.94	97
53	199.95	203.00	3.05	2.49	82
54	203.00	206.05	3.05	1.83	60
55	206.05	208.18	2.13	2.06	97
56	208.18	211.23	3.05	2.77	91
57	211.23	214.27	3.04	3.04	100
58	214.27	217.32	3.05	2.79	91
59	217.32	220.37	3.05	0.91	30
60	220.37	223.42	3.05	2.44	80
61	223.42	226.47	3.05	3.05	100
62	226.47	228.91	3.44	3.44	100
63	228.91	233.56	4.65	4.65	100
64	233.56	238.20	4.64	4.64	100
65	238.20	242.85	4.65	4.62	99
66	242.85	247.50	4.65	3.65	78
67	247.50	252.14	4.64	4.64	100
68	252.14	256.79	4.65	4.57	98
69	256.79	261.44	4.65	4.65	100
70	261.44	266.09	4.65	4.65	100
71	266.09	270.66	4.65	4.65	97
72	270.66	275.23	4.57	4.57	100
73	275.23	279.88	4.65	4.62	99
74	279.88	284.53	4.65	4.65	100
75	284.53	289.18	4.65	4.57	98
76	289.18	293.83	4.65	4.52	98

Core No.	From	To	Interval	Recovery	Percent
77	293.83 m	298.40 m	4.57 m	4.47 m	98
78	298.40	300.07	1.67	1.67	100
79	300.07	300.68	1.61	0.56	35
80	300.68	303.13	2.45	2.45	100
81	303.13	305.87	2.74	2.74	100

Side-wall sampling: Nil

Well logging:

BMR Lake Amadeus No. 3B was logged by Mibolog Pty Ltd and the logs run are summarised in Table VIII. The logging contract called for the running of an integrated acoustic velocity log. A suitable logging tool was not available and a density log was run in its plance. A short discussion of the logs is given on page 209.

Table VIII - Logging Details

BMR Lake Amadeus No. 3B

Log Type	Run No.	Depth Interval	Curves	Vertical Scale
Guard	1	58.22 - 304.80 m (191' - 1000')	Spontaneous Potential	1cm = 2.40m (1" = 20')
Guard	1	58.22 - 304.80 m (191' - 1000')	Resistivity	1cm = 2.40m (1" = 20')
Gamma Ray	1	0 - 305.10 m (0' - 1001')	Gamma Ray	1cm = 2.40m (1" = 20')
Neutron	1	0 - 305.10m (0' - 1001')	Neutron	1cm = 2.40m (1" = 20')
Density	1	44.50 - 304.80 m (146' - 1000')	Density	1cm = 2.40m (1" = 20')
Caliper	1	44.50 - 304.80 m (146' - 1000')	Caliper	1cm = 2.40m (1" = 20')

Gas Log: Nil

Formation testing: Nil

Deviation surveys: Nil

Other hole surveys: Nil

SUMMARY OF DRILLING OPERATIONS

Drilling commenced on BMR Lake Amadeus No. 3B on 8/10/70. An 11.4 cm (4½") non-coring bit was used to a depth of 42.67 (140') with the exception of the intervals 12.19m to 14.63m (40' to 48'), 31.39m to 33.53m (103' to 110') and 42.67m to 45.72m (140' to 150') in which cores were taken. A flow of water of approximately 90 litres per hour (20 gallons per hour) was encountered below 43.59 m (143'). Conventional methods were attempted in reaming the hole to 25.3 cm (9 7/8") diameter, but were ineffective below 36.58 m (120'). Mist drilling, in which an atomised mixture of detergent and water is blown down the hole, had to be used to complete reaming. 43.77 m (143'7") of 20.3 cm (8") waterbore casing was run and cemented in place, with cement sealing the interval 43.59 m to 45.70 m (143' to 150') and hence stopping the inflow of water.

Coring then continued to a depth of 74.98 m (246'), with the hole being reamed 11.4 cm (4½") diameter at 9.14 m (30') intervals. At 71.93 m (236') a flow of water of approximately 1800 litres per hour (400 gallons per hour) had been encountered, and the hole was cemented from 74.98 m to the base of the casing. Coring, with reaming at 9.14 m (30') intervals again proceeded until a large flow of water at a rate of approximately 45,000 litres per hour (10,000 gallons per hour) was encountered at a depth of 90.22 m (296'). An attempt was made to cement the flow off but it recurred after a further 15 cm (6") had been drilled. The water appeared to be originating from small cavities in the rock and it was decided to drill ahead with the 14.0 cm (5½") non coring bit until the cavernous zone had been penetrated. This seemed to have been achieved at 98.45 m (323'), and the hole was successfully cemented at that depth. Coring proceeded to 103.94 m (341') despite another flow of water at 4,500 litres per hour (1,000 gallons per hour) at 100.58 m (330'). The hole was again reamed and cemented.

Coring, with reaming at 9.14 m (30') intervals, continued to 164.59 m (540') when the cement which was sealing off the water at approximately 11.44 m (300') fractured giving an initial flow of 22,700 litres per hour (5,000 gallons per hour), rising to approximately 72,000 litres per hour (15,000 gallons per hour) within thirty minutes. The hole was again cemented to the base of the casing, and it was decided to commence drilling with salt saturated mud. This was aimed at minimising the pressure, due to the large head of water, on the cement at 91.44 m (300'). Very sparse traces of salt were found in the core above 195.07 m (640') and an attempt was made to seal the hole in preparation for air drilling. Diesoline-bentonite injection was used, but the pressure necessary broke the cement seal at 91.44 m at (300'), and the hole had to be cemented again. Coring continued using salt saturated mud to total depth. At 228.91 m (751') a successful attempt was made to use the 4.51 m (15') core barrel, and its use was continued to 300.08 m (984'6") when a welded joint broke and the lower portion had to be fished out. The hole was completed with the 3.05 m (10') core barrel, and reamed to 14 cm ($5\frac{1}{2}$") diameter for electric logging. Drilling ceased on 4th December, 1970 and the hole was logged on 7th December, 1970.

GEOLOGY

SUMMARY OF PREVIOUS WORK

Geological

The first geological investigations of the general area of the drillsite were made in the well exposed George Gill Range, 50 km to the north (Cook, 1968). In 1959 Frome Broken Hill Pty Ltd (Leslie, 1960 unpubl.) mapped the eastern part of the Lake Amadeus Sheet area in the course of investigations for petroleum. A sedimentological study of the Stairway Sandstone which included study of outcrops near the drillsite was carried out by Cook (1966).

Regional mapping of the Amadeus Basin by the Bureau of Mineral Resources began in 1956 and continued from 1960 to 1964 (Wells et al., 1970). The geology of the central part of the basin, in which the drillsite is situated, was studied in 1962 (Ranford, Cook & Wells, 1966). Geological maps at 1:250,000 scale have been produced for the whole of the basin, and the drillsite is located in the south-eastern corner of the Lake Amadeus Sheet area (SG/52-4). Explanatory notes to accompany the geological map of the sheet have been compiled by Cook (1968).

Geophysical

Magnetic

An airborne magnetic survey of the Amadeus Basin was made by BMR in 1965 (Young & Shelley, 1966). The spacing of the flight lines was too great to reveal any magnetic anomalies which could be directly related to the gypsum outcrop. The drillsite is on the southeastern extremity of a depression in the magnetic basement. This depression has a northwest-trending axis and its maximum depth is estimated at 11,000 m. The depth to magnetic basement at the drillsite is estimated to be 7,300 m.

Gravity

A gravity survey of the Amadeus Basin using helicopters was carried out by BMR in 1961 and 1962 (Lonsdale & Flavelle, 1963), (Langron, 1962).

The gravity stations are too widely spaced to reveal any gravity anomaly which could be related to the gypsum outcrop, although results indicate that regionally the drillsite is situated on the gravity gradient between the Angus Downs Gravity Ridge to the south, and the Amadeus Gravity Depression to the north. Both of these features trend in an easterly direction, parallel to the axis of the Amadeus Basin, and extend across its length.

Radiometric

An airborne radiometric survey of the Amadeus Basin was made by BMR in conjunction with the 1965 airborne magnetic survey (Young & Shelley, 1966). The drillsite is located in a zone of low radioactivity (12.5 cps to 25 cps), situated between two zones of higher radioactivity (25 cps to 50 cps). These zones trend east-southeast parallel to the structural trends in the area. The low radioactivity zone is interpreted as an anticlinal core of Bitter Springs Formation. The flanks of the anticline consist of soft Inindia Beds overlain by more resistant Winnall Beds. These formations give rise to the zones of higher radioactivity, possibly because of their higher clay contents.

Seismic

No seismic investigations have been carried out at or near the drillsite.

Drilling

There has been no previous drilling near the drillsite. The Bitter Springs Formation has been intersected in six petroleum exploration wells drilled in the Amadeus Basin. East Johnny Creek No. 1, Ochre Hill No. 1 and James Range "A" No. 1 were drilled in the central portion of the basin, 80 km, and 90 km north-northwest, and 130 km northeast of Lake Amadeus No. 3B, respectively. These intersected dolomite, limestone and shale in the Bitter Springs Formation, but no evaporites. Ooraminna No. 1, Mount Charlotte No. 1 and Erldunda No. 1 were drilled in the eastern portion of the basin, intersecting limestone, dolomite, beds of halite, and minor gypsum and anhydrite in the Bitter Springs Formation.

Seven wells on the Mereenie Anticline, 100 km north-northwest, and one at Johnny Creek 80 km north-northeast have been drilled. The wells terminated in either Ordovician or Upper Cambrian sediments and one on the Mereenie Anticline, East Mereenie No. 4 terminated in the Bitter Springs Formation.

BMR drilled DD AP4 13 km south, in the course of its search for pelletal phosphorites in 1963 (Barrie, 1964). This hole penetrated Ordovician Stairway Sandstone to its total depth of 103.3 m.

REGIONAL GEOLOGY

See Regional Geology, completion report, BMR Mount Liebig No. 1.

DRILLSITE GEOLOGY

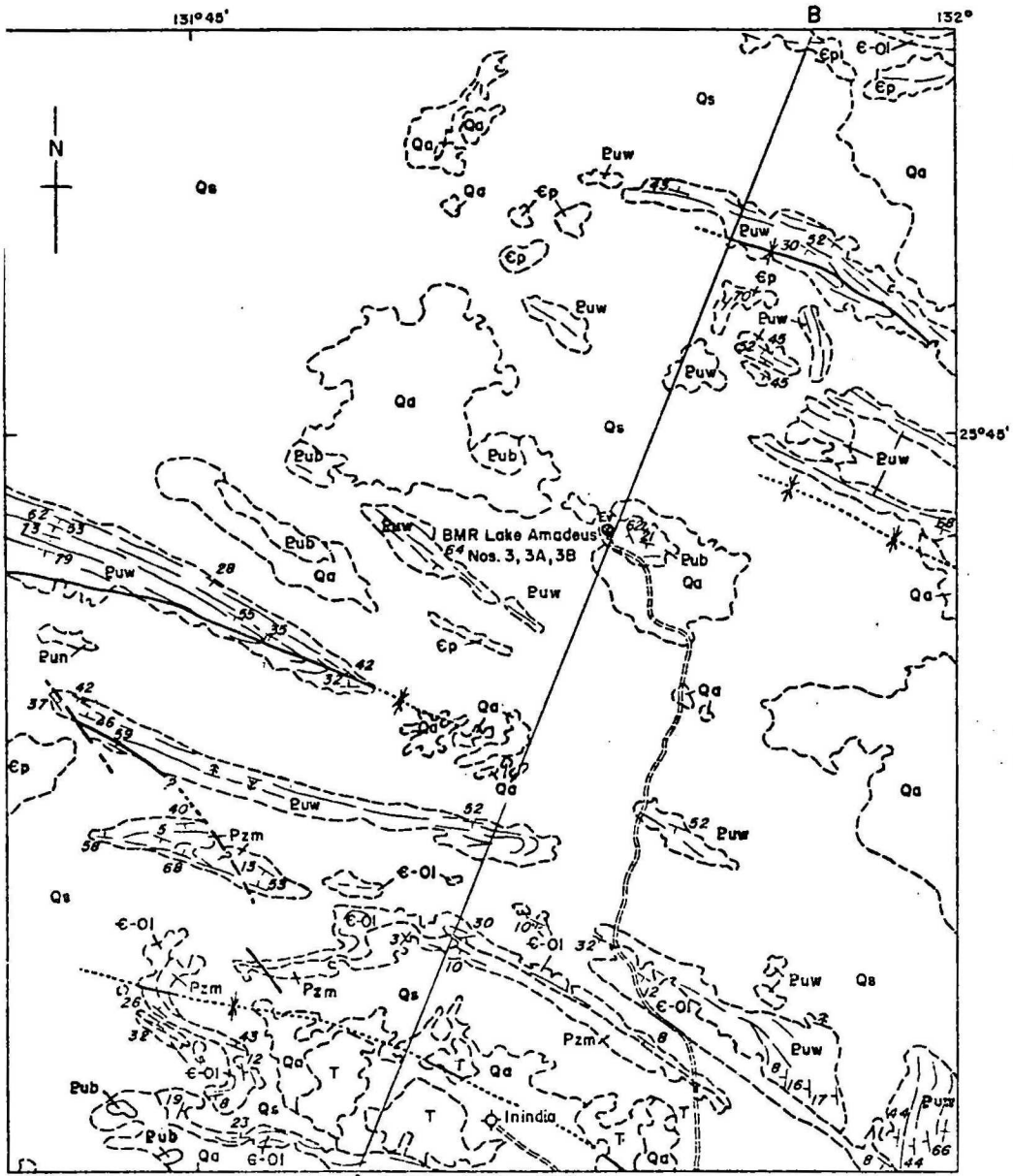
BMR Lake Amadeus Nos. 3, 3A and 3B were drilled near an isolated outcrop of Late Precambrian Bitter Springs Formation (Fig. 10). The outcrop is surrounded by Quaternary sand dunes and no other rocks crop out for a distance of 8 km. It occurs at the eastern end of a northwest-trending series of gypsum outcrops of Bitter Springs Formation (Fig. 4) which is unconformably overlain by both the Inindia Beds and the Winnall Beds in the surrounding area (Fig. 9).

A detailed examination of 2x enlargements of air photographs of the area (Lake Amadeus R13/5087 and 5088) was carried out by C. Simpson. This showed a scarp of resistant rock striking northwest and curving towards west-northwest in the south with a moderate but variable dip - only two dips were measured in the outcrop, 21° and 62° to the southwest. The dominant rock type is partly silicified dolomite with several smaller isolated outcrops of gypsum on the north side of the ridge.

Another less well defined scarp with a similar strike is visible about 100 m further north. The gypsum outcrops appear to be situated in a bifurcation of the northernmost scarp giving the appearance of a lenticular body of evaporites within the dolomite.

Fig.9

GEOLOGICAL MAP OF AREA SURROUNDING BMR LAKE AMADEUS Nos 3,3A,3B



QUATERNARY		Qs	*Aeolian Sand*
		Qa	*Alluvium*
TERTIARY	Undifferentiated	T	*Limestone, sandstone, conglomerate*
SILURIAN? to DEVONIAN	Mereenie Sandstone	Pzm	*White sandstone*
CAMBRIAN to ORDOVICIAN	Larapinta Group	E-Ol	*Sandstone, siltstone, minor limestone*
CAMBRIAN	Pertaoorrta Group	Ep	*Sandstone, siltstone, minor limestone*
PROTEROZOIC	Winnall Beds	Puw	*Sandstone, siltstone*
	Inindia Beds	Pun	*Siltstone, shale, sandstone*
	Bitter Springs Formation	Pub	*Dolomite, limestone, siltstone, evaporites*

Geological boundary

Syncline

Fault. Where location of boundaries, folds and faults is approximate, line is broken; where inferred, queried; where concealed, boundaries and folds are dotted, faults are shown by short dashes.

Strike and dip of strata

Dip 15°–45°; air-photo interpretation

Trend lines

Vehicle track, position approximate

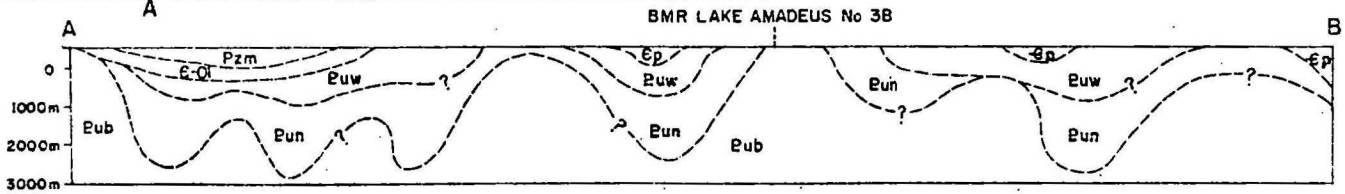
Drill hole (evaporites)

Abandoned bore

5 0 5 10 15 KILOMETRES

5 0 5 10 MILES

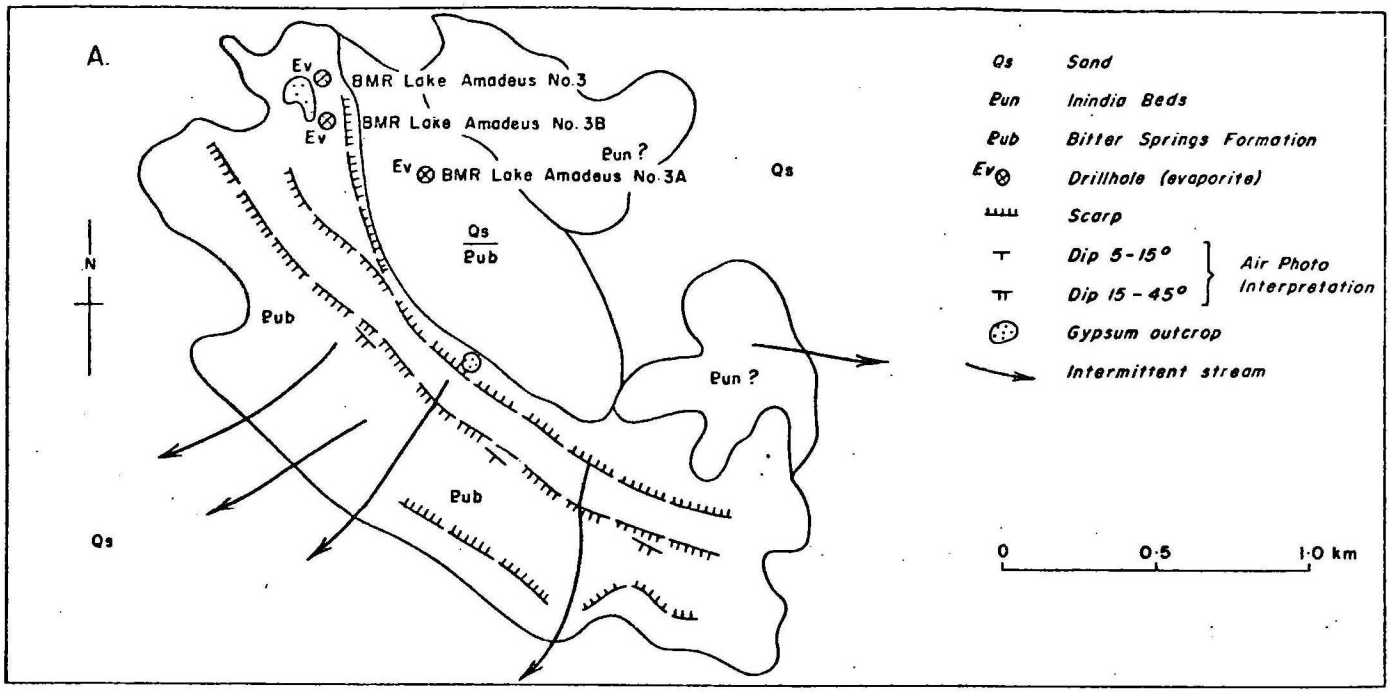
Geology by A.T. Wells et al, 1965. Compiled from 1:250,000 Geological Series Lake Amadeus SG52-4 Sheet



Section AB
(Cainozoic Omitted)
$\frac{V}{H} = 1$

To Accompany Record 1972/36

G52/A4/28



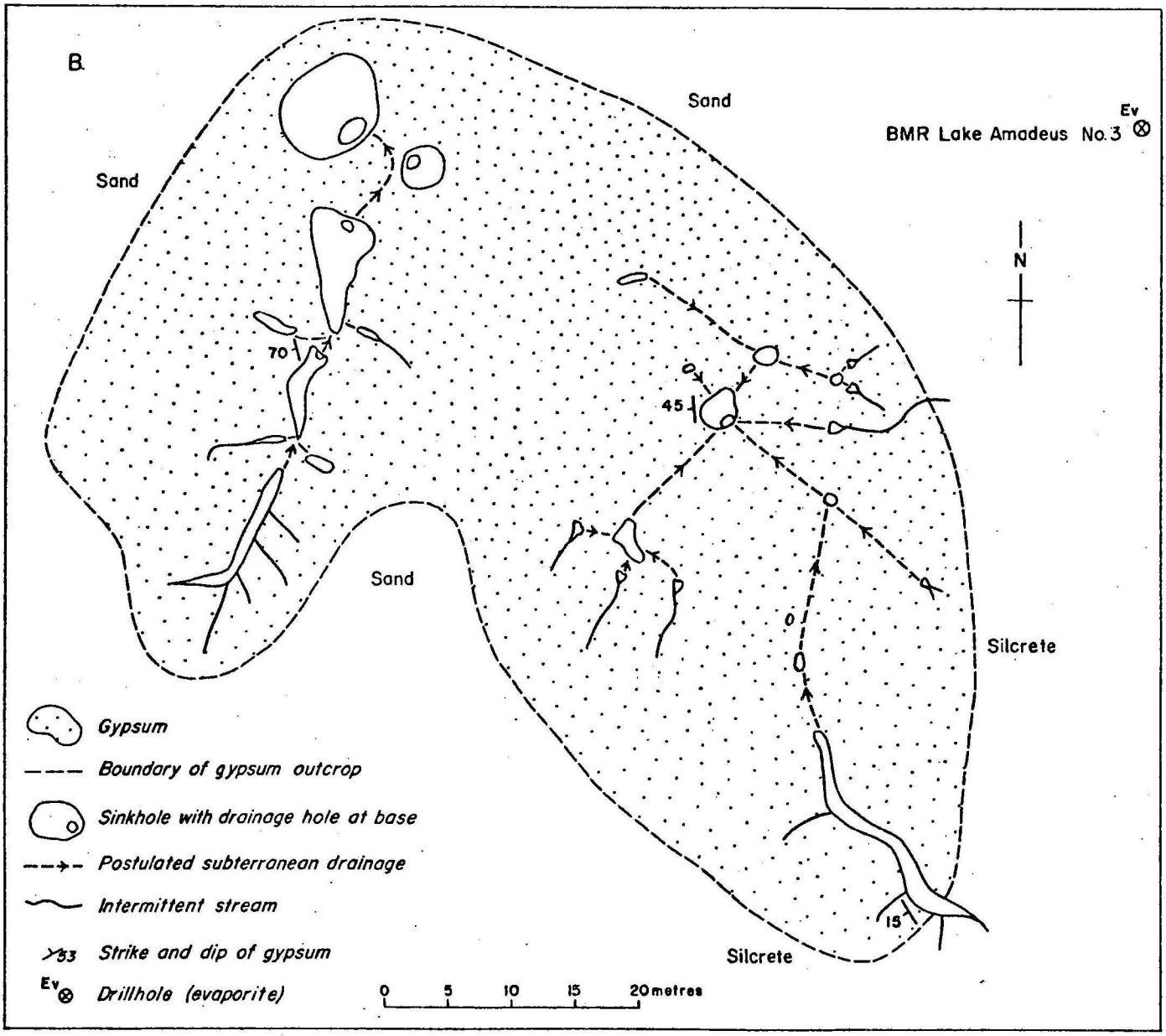


Fig. 10 GYPSUM OCCURRENCE AND DRILLHOLE LOCATIONS, SOUTHEAST LAKE AMADEUS SHEET AREA

A. Position of drillholes relative to gypsum outcrop.

B. Sketch map of gypsum outcrop showing drainage pattern and sinkholes.

Rounded low hills composed of siltstone with a silcrete capping extend northwesterly across the northern edge of the outcrop. The siltstone and minor interbeds of sandstone dips gently to the northwest and appear to unconformably overlie the dolomite of the Bitter Springs Formation. The siltstone is probably part of the Inindia Beds.

The gypsum outcrop near the drillholes is irregular in outline and 120 m across. The gypsum is coarsely crystalline and contains laminae of gypsiferous dolomite up to 1 mm diameter throughout. To a depth of at least 10 cm the laminated gypsum has been softened by rainwater dissolving away some crystals, leaving the rock very porous. A surface crust of earthy gypsum over 15 cm thick covers the entire outcrop and in places contains single crystals up to 15 cm across. These have been corroded in parts by rainwater.

The gypsum dips in a north-northwesterly direction, steepening gradually from 15° on the eastern extreme of the outcrop to 70° in the western sinkhole (Fig. 10B). This is not in accordance with the strikes measured elsewhere in the area, both on the ground and on air photographs, and may be due to contortion on a large scale. Laminae in the outcrops are contorted and in many places small overthrusts are visible. Boudinage structure is present in dolomite laminae in places. All these features are attributed to an increase in volume by hydration of anhydrite.

There are two main drainage systems on the outcrop which both terminate in large sinkholes (Fig. 10). Larve V shaped channels up to 5 m deep have been incised into the outcrop. These drain by means of subterranean channels into the two main sinkholes. The westernmost is circular in outline and approximately 10 m diameter. It is 12 m deep and drains through a small opening into a cave 5 m deep with a loose rubble floor. Several small passages can be seen in the sides; one of these must have been intersected by BMR Lake Amadeus No. 3, as the sound of drilling in this hole could be heard clearly in the cave. The easternmost sinkhole is only 3 m across and 4 m deep, but drains through a small hole into a cave 2 m diameter and 15 m deep.

At a depth of 90 m (296') in BMR Lake Amadeus No. 3B a flow of water at approximately 45,000 litres/hr (10,000 gals/hr) was encountered. The water was flowing from small solution cavities in the gypsum. Water obtained at this depth contained fragments of charcoal up to 2 cm across. These were very friable, partly decomposed and appeared to have been in the water for a long time. It is postulated that the charcoal was washed into the sinkholes, which are 120 m away on the surface, and was transported through cavities into the zone of saturation. Some fragments were coated with a crust of gypsum. Long cylinders of gypsum were present and these are thought to have been formed by crystallization around elongate fragments which later decomposed, leaving the gypsum crust.

Gypsum crystals with the appearance of cones with a large apical angle joined at the base were also obtained from the water. They are up to 2 mm diameter and are possibly caused by slow recrystallisation around an opaque nucleus in a constantly moving solution. Crystal faces can be seen on the sharp periphery. Several single crystals up to 1 cm diameter which had been partly redissolved were also obtained.

Two samples of water from BMR Lake Amadeus No. 3B were analysed and the results set out in Table IX. The analyses showed a high percentage of dissolved calcium sulphate which makes the water unfit for human consumption.

Outcrop is obscured in many places by silcrete capping and sand dunes. Depth to bedrock is very variable. BMR Lake Amadeus No. 3 was spudded in gypsum, while No. 3A penetrated alluvium to a depth of 38.2 m (127') and No. 3B, situated 60 m from the gypsum outcrop, encountered 42.5 m (135') of alluvium.

Table IX - Water Analyses - BMR Lake Amadeus No. 3B

Depth	71.9 m (236')	90.5 m (297')
Na	935 ppm	1120 ppm
K	95 ppm	92 ppm
Ca	733 ppm	721 ppm
Mg	169 ppm	233 ppm
Fe	3.6 ppm	0.3 ppm
Cl	1520 ppm	1820 ppm
SO_4	2360 ppm	2620 ppm
NO_3	71 ppm	7 ppm
HCO_3	93 ppm	110 ppm
F	2.3 ppm	3.6 ppm
SiO_2	28 ppm	33 ppm
P_2O_5	1 ppm	1 ppm
Conductivity	7810 micromhos/cm^2	8690 micromhos/cm^2
Total dissolved solids	6200 ppm	6920
pH	6.5	6.6
Hardness, total	2530	2760
Hardness, temporary	76	90
Hardness, permanent	2454	2670
Alkalinity	76	90

Remarks: Unsuitable for human consumption or stock use.

Analyses by Northern Territory Administration Water Resources Branch.

LITHOLOGICAL DESCRIPTION OF ROCK TYPES

Introduction

The classification of rock types shown on the composite log has been devised after a study of seventeen thin sections of core from BMR Lake Amadeus No. 3B and nine thin sections from BMR Lake Amadeus No. 3. These were selected to cover the range of rock types and to yield as much information as possible on texture and mineralogy.

The methods used in preparation of the thin sections, mineralogical analyses, and the crystal size classification adopted, have already been described in the report on BMR Mt Liebig No. 1.

Detailed Lithology

Anhydrite Rock

Anhydrite rock occurs in the core below approximately 250 m (820'). It grades from white to light brown, interlaminated with dolomite-anhydrite rock throughout. Laminae are gently folded, but dip is generally near vertical. It is assumed that this is the true dip of sediments in the drillhole, and that anomalous dips recorded throughout the gypsum are due to later contortion.

Anhydrite rock is generally medium crystalline with some finely crystalline varieties. Crystals are euhedral to subhedral and texture grades from equigranular to aligned-felted (Maiklem, Bebout and Glaister, 1969). Orientation of laths is parallel to thin laminae of dolomite and dolomitic anhydrite rock. Coarsely crystalline laths are associated with dolomite rock fragments at 284.66 m (993'11").

Zones of medium crystalline anhydrite cut across the finely crystalline varieties in places. Many crystals are euhedral, suggesting that the anhydrite in these zones is secondary.

Throughout the core anhydrite is altering to gypsum. In the upper parts the alteration has gone to completion, but in many places below 250 m (820') the two minerals coexist. The alteration takes place by formation of

euhedral gypsum crystals which can be extremely coarsely crystalline (see Fig. 13). These are either scattered evenly throughout the anhydrite rock, giving it a spotted appearance or, more commonly, form along minute fractures which transgress the laminations. The thickness of the recrystallized zone varies, depending on the amount of dolomite scattered throughout the anhydrite rock. In pure anhydrite rock this zone can be up to 2 cm thick, but it is rarely over 5 mm thick in impure laminae.

It is very difficult to determine whether anhydrite is primary or not. Alignment of the laths parallel to dolomitic laminae and regular lamination with only slight folding suggest that it is primary.

Dolomitic Anhydrite Rock

Interlaminated with anhydrite rock is dolomitic anhydrite rock. This grades from light brown to brown in colour and in some parts of the core below 250 m (820') is the dominant rock type. It is moderately hard to hard, gently folded, and dips are generally near vertical.

Texture is aligned-felted, with fine auhedral dolomite crystals evenly disseminated throughout medium crystalline anhydrite. The percentage of dolomite is variable, but generally between 20% and 60%.

In laminae which contain high percentages of dolomite, anhydrite is finely crystalline and a few opaque crystals are present. Fine crystals of dolomite are disseminated throughout. This rock type does not appear to recrystallize as readily as pure anhydrite.

Gypsum Rock

Gypsum rock is the dominant rock type throughout much of the core. It is white, coarsely to very coarsely crystalline and moderately hard. Laminae of dolomitic gypsum rock are very common, giving a light grey appearance in parts. These laminae are commonly very contorted, and in many places the core has been strongly brecciated and fragments with contorted laminae are present.

Texture is felted in most parts, and crystals commonly contain scattered fine anhedral dolomite and rare fine to medium anhydrite crystals. Fine euhedral quartz and medium subhedral dolomite crystals occur in parts and are probably of secondary origin. Traces of limonite and sparse very coarse calcite crystals are present near the surface. Some coarse gypsum crystals contain inclusions of fine acicular gypsum. This is probably recrystallisation caused by percolating meteoric waters. Bassanite ($2CaSO_4.H_2O$) is present, but is produced by heating of the rock during preparation of thin section.

Acicular Gypsum Rock

Acicular gypsum rock occurs in veins up to 2 cm thick in many parts of the core. These are composed of numerous "fibres" of gypsum generally oriented at right angles to the fractures they infill. Where slight movement has occurred along the fractures the "fibres" are not perpendicular to the walls. Microscopic examination shows that the "fibres" are elongated gypsum crystals. Some fractures are infilled with crystals which have grown from both walls and the line of junction of the two sets of crystals is apparent along the centre of the vein. Acicular gypsum rock is sometimes referred to as "satin spar".

Gypsiferous Dolomite Rock

Laminae of gypsiferous dolomite rock occur throughout the gypsum. They rarely exceed 1 mm in thickness and are often contorted. Colour is light grey and they are moderately hard.

The percentage of dolomite varies greatly but is mostly above 50%. Dolomite is anhedral, finely crystalline and disseminated in a matrix of finely crystalline gypsum. Limonite is common and is associated with dolomite. Sparse finely crystalline remnants of anhydrite crystals are present with dolomite in parts.

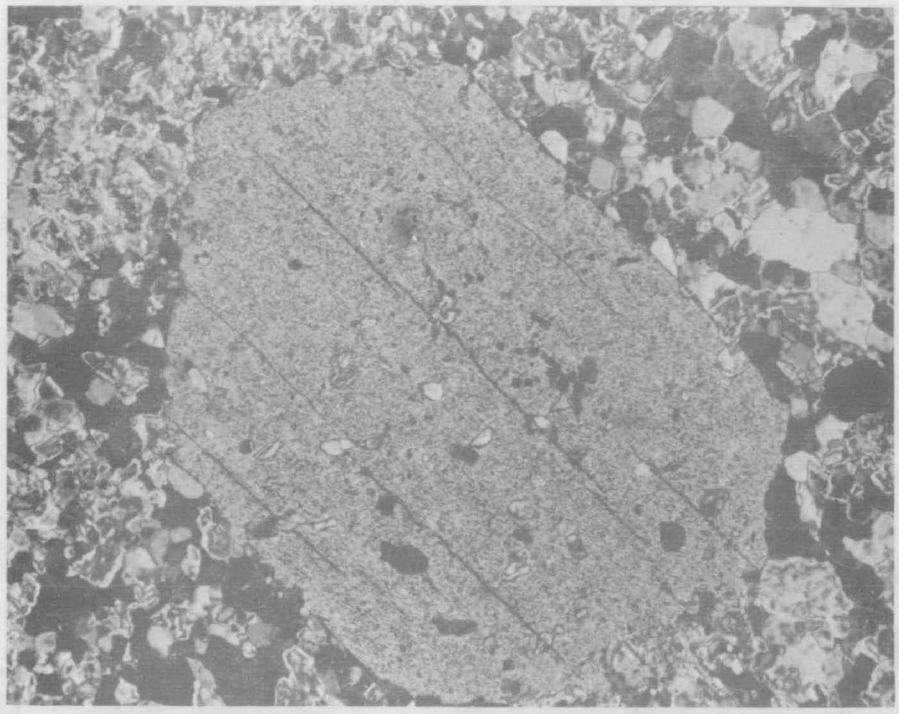
Although dolomite is predominant in these laminae its X-ray diffraction pattern is weak, whereas chlorite and quartz show a strong pattern although thin sections show only very minor amounts of these minerals.

M/1195-36

Fig. 11 Gypsum (light grey to black) showing felted texture and sparse dolomite crystals (grey, rounded).
Thin Section 70-50-0105. Depth 33.91 m (111'3")
X nicols. 60X

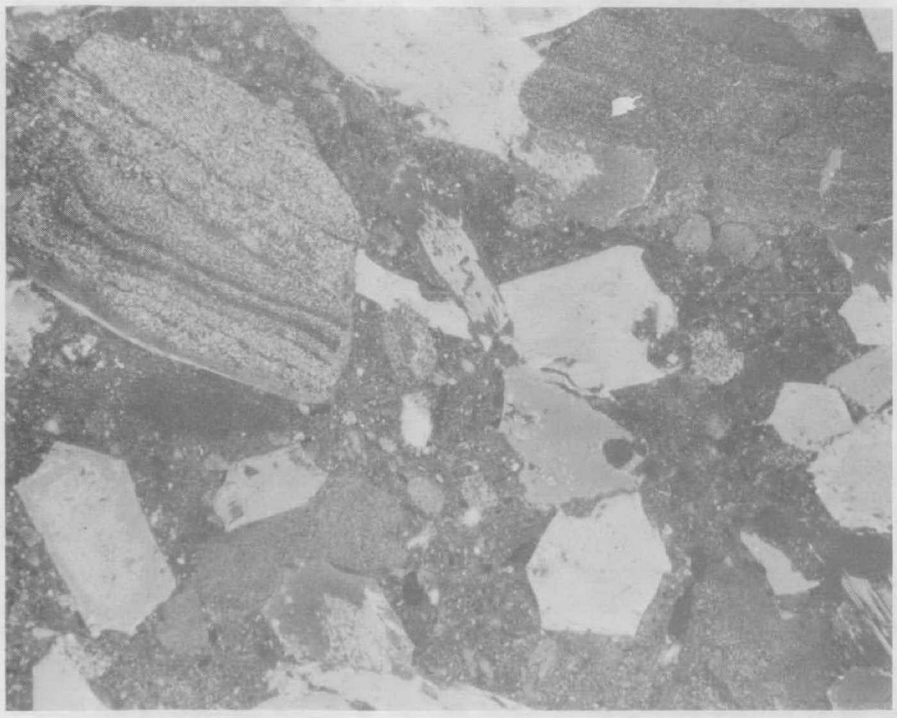
M/1195-2

Fig. 12 Gypsum (light grey), and fine dolomite crystals (small, dark, rounded)
Thin Section 70-50-0285 Depth 303.7 m (994' 4")
X nicols. 60X



M/1195-12

Fig. 13 Medium crystalline anhydrite (white to black), showing granular texture, being replaced by very coarse euhedral gypsum crystal (centre). Note anhydrite inclusions in gypsum.
Thin Section 70-50-0277. Depth 253.34 m (831'2")
X nicols. 20X



M/1195-14

Fig. 14 Coarse euhedral gypsum crystals (white to light grey) and laminated dolomite fragments in very finely crystalline dolomite matrix.
Thin Section 60-50-0274. Depth 150.54 m (493'11")
Plane polarised light. 20X

The laminae probably originated as dolomitic anhydrite rock and have been converted to dolomitic gypsum rock when hydration took place.

Black Tough Dolomite Rock

This variety of dolomite rock occurs as beds and fragments in several zones up to 2 m thick. It grades from dark brown to black and is very tough.

Texture is equigranular with interlocking fine anhedral crystals. At 125.61 m (412'1") it is laminated, with fine and medium crystalline laminae; these are separated in parts by traces of limonite. In several other places, as at 284.63 m (993'9"), it is composed of laminated finely crystalline fragments up to 1 cm diameter in a matrix of finely crystalline dolomite. Gypsum is rarely present in the matrix. The fragments were possibly formed by re-sedimentation of laminated fragments in a dolomitic matrix.

Much of the dolomite rock is pure and this is the reason for its toughness. In some places a few fine crystals of quartz and traces of limonite are present and in others the fine dolomite crystals are contained within very coarse poikiloblasts of gypsum. Some dolomite rock fragments have a slight salty taste.

Light Brown Tough Dolomite Rock

This variety occurs as beds up to 1 m thick and as fragments throughout the core. It grades from light brown to grey-brown and grey and from moderately tough to tough.

Texture in hand specimen appears to be even but in thin section the rock is heterogeneous consisting dominantly of finely crystalline anhedral dolomite with a varying proportion of fine to very coarsely crystalline gypsum. Minor amounts of limonite are associated with the dolomite and sparse unaltered medium crystals of anhydrite are present.

Dolomite constitutes about 60% of the rock and is generally evenly disseminated through felted gypsum. In zones of very high dolomite concentration the texture is laminated with both alternating crystal sizes, and crystals of different mineralogy.

The rock resembles siltstone in hand specimen and was given that name in field descriptions.

Grey Friable Dolomite Rock

This rock type occurs as regular and irregular laminae up to 5 mm across in gypsum, as matrix for gypsum fragments and as beds up to 15 m (50') thick. It grades from light to dark grey and from moderately soft to soft and friable.

In occurrences as laminae and matrix it is anhedral and very finely crystalline. Texture is equigranular, and finely crystalline euhedral to subhedral quartz, anhydrite and gypsum are commonly present. Traces of limonite, muscovite and opaques have been noted. Feldspar was recorded in X-ray diffraction analyses, but was not seen in thin sections. The percentage of dolomite present is variable, but almost always in excess of 60%.

In occurrences as thick beds, texture is brecciated, with fragments of finely to very finely crystalline dolomite rock, sparse fragments of finely crystalline evaporite rock and coarse euhedral gypsum crystals in a matrix of very finely crystalline dolomite. Dolomite rock fragments are laminated in part due to variations in both composition and crystal size. Fine crystals of quartz, muscovite and gypsum are present in amounts less than 20%.

Evaporite rock fragments consist of fine crystals of euhedral to anhedral dolomite, quartz, gypsum, and limonite with minor opaques and muscovite. Halite, chlorite and feldspar were detected in minor amounts in the X-ray diffraction analyses, but were not noted in thin sections. The proportion in which the constituent minerals occur in evaporite rock is extremely variable.

The coarse euhedral gypsum crystals are almost all recrystallized in the centre. This may be an original feature of the crystals, but is more probably produced during processing of thin sections.

This rock resembles claystone in hand specimen and was given that name in field descriptions.

Siltstone

Siltstone occurs in the alluvium intersected in the upper 41.1 m (135') of BMR Lake Amadeus No. 3B and has been observed only in cuttings. It grades from white to brown and pink, is soft and friable, and is composed of silt sized quartz grains in a white matrix. X-ray diffraction analyses demonstrate the presence of quartz, gypsum, kaolinite and muscovite with a trace of chlorite. Calcite is also present in some samples, as they effervesce when HCl is added.

Sandy Siltstone

This rock type is similar to siltstone in appearance and occurrence, but contains up to 35% aand sized quartz grains. These are well rounded and grade from colourless to brown.

Claystone

Claystone occurs in the alluvium intersected in the upper 41.1 m (135') of BMR Lake Amadeus No. 3B and has been observed only in cuttings. It grades from white to brown, is soft and friable, and closely resembles the matrix in siltstone. Sparse fine silt sized quartz grains are present in parts.

Silcrete

Silcrete occurs between 30.5 m and 39.6 m (110' and 130') in the alluvium in BMR Lake Amadeus No. 3B. It grades from light brown to brown and is hard and tough. Texture shows medium sand sized quartz grains in a ?siliceous matrix.

Sandstone

Sandstone is orange-brown, fine grained and well sorted. It effervesces strongly when HCl is added and contains up to 60% coarsely crystalline gypsum in most parts. The cement contains a high proportion of limonite. The sandstone is probably an infilling of solution cavities in the rock, and contains a large amount of surface detritus.

Table X - X-ray Diffraction Analyses of Selected Samples - BMR Lake Amadeus No. 3 & 3B

For each sample, the minerals are listed in their order of relative intensities

Sample No.	Depth		Rock Type	Minerals Identified
70500126	4.16 m	13'8"	Gypsum (orange)	Gypsum, quartz (tr)
70500127	23.77 m	78'0"	Dolomitic limestone	Calcite, dolomite, quartz
70500144	38.40 m	126'0"	Gypsum	Gypsum
70500143	38.43 m	126'1"	Lamina of gypsiferous dolomite	Gypsum, quartz, chlorite (tr)
70500139	38.50 m	126'4"	Brown tough dolomite	Dolomite, gypsum, quartz
70500141	38.55 m	126'6"	Lamina of gypsiferous dolomite	Gypsum, dolomite (tr), quartz (tr)
70500138	38.58 m	126'7"	Brown tough dolomite	Dolomite, quartz, gypsum
70500140	38.65 m	126'10"	Lamina of gypsiferous dolomite	Gypsum, quartz (tr), chlorite (tr)
70500142	38.73 m	127'1"	Lamina of gypsiferous dolomite	Gypsum, quartz (tr)
70500286	0-3.05 m	0' -10'0"	Siltstone	Quartz, chlorite (tr), Kaolinite (tr)
70500289	12.19-15.24 m	40'0"-50'0"	Siltstone	Quartz, gypsum, kaolinite, muscovite
70500254	66.04 m	216'8"	Gypsum	Gypsum, dolomite, quartz (tr)
70500255	68.17 m	223'8"	Brown tough dolomite	Gypsum, quartz, dolomite
70500256	84.96 m	278'9"	Grey friable dolomite	Dolomite, quartz (tr), gypsum (tr) chlorite (tr
70500257	89.00 m	282'0"	Brown tough dolomite	Gypsum, dolomite, quartz, chlorite (tr)
70500258	125.62 m	412'2"	Black tough dolomite	Dolomite, gypsum, quartz (tr)

Sample No.	Depth		Rock Type	Minerals Identified
70500259	125.80 m	412'9"	Grey friable dolomite	Dolomite, quartz, gypsum (tr), chlorite (tr), muscovite (tr)
70500260	150.52 m	493'10"	Grey friable dolomite	Gypsum, quartz, chlorite, muscovite, dolomite
70500261	150.52 m	493'10"	Evaporite rock fragment in grey friable dolomite	Quartz, dolomite, hematite, chlorite, muscovite, halite (tr)
70500262	150.52 m	493'10"	Acicular gypsum	Gypsum
70500263	150.52 m	493'10"	Evaporite rock fragment in grey friable dolomite	Dolomite, quartz, gypsum, feldspar, chlorite, muscovite
70500264	155.19 m	509'2"	Gypsum	Gypsum, quartz (tr)
70500265	169.09 m	554'9"	Brown tough dolomite	Gypsum, dolomite, quartz (tr)
70500266	227.08 m	745'0"	Friable dolomite	Gypsum, dolomite, quartz, chlorite (tr), muscovite (tr), feldspar (tr)
70500293	260.12 m	853'5"	Dolomitic anhydrite	Anhydrite, quartz, dolomite
70500267	303.07 m	994'4"	Black tough dolomite	Gypsum, dolomite, anhydrite, quartz (tr)

(tr = trace)

Analyst: G.H. Berryman

Reference: BMR Laboratory Reports Nos 26, 41, 47 and 51 (1971)

Note: Sample Nos 70500126 to 70500144 from BMR Lake Amadeus No. 3

Sample Nos 70500254 to 70500293 from BMR Lake Amadeus No. 3B

LITHOLOGICAL DESCRIPTION OF CORE

BMR Lake Amadeus No. 3

0-48.8 m (0'-160')

Lithology is uniform throughout most of this hole, consisting of gypsum rock with laminae of gypsiferous dolomite rock and grey friable dolomite rock. Strong contortion and brecciation has taken place throughout and veins of acicular gypsum rock are common (see Fig. 15).

In several zones throughout the core there are beds of highly calcareous orange-brown claystone, siltstone and fine sandstone. These consist mainly of surface detritus washed into solution cavities.

At about 21 m (70') a zone of beds and fragments of dolomite rock occur in a matrix of grey friable dolomite rock, and at 24.4 m (80') a bed of soft friable dolomite rock with fragments of light grey tough calcareous dolomite rock is present.

BMR Lake Amadeus No. 3A

0-38.7 m (0-127')

This hole penetrated unconsolidated detritus throughout and only two cores were taken from 13.7 m to 16.8 m (45' to 55') and from 27.4 m to 30.5 m (90' to 100'). The upper core consisted of soft, white claystone with limestone fragments. The lower core consisted of grey tough dolomite rock, grey soft siltstone and white soft claystone.

BMR Lake Amadeus No. 3B

0-41.1 m (0'-135')

Cuttings reveal that to a depth of 41.1 m (135') the hole penetrated siltstone and claystone of possible Tertiary age. Siltstone, sandy in parts, is the dominant rock type to 18.3 m (60'). A core taken at 12.2 m (40') showed that texture was even with very coarse secondary gypsum crystals scattered throughout. From 18.3 m to 41.1 m the rock type is claystone. A core taken at 31.3 m (103') showed an even texture with very coarse secondary gypsum crystals throughout. Silcrete occurs between 33.5 m and 39.6 m (110' and 130'). The cores taken in this interval have a weathered appearance.

GA/4319

Fig. 15 Slabbed section of core showing contorted laminae of gypsiferous dolomite (black) and fragments of light brown tough dolomite (grey) in brecciated and contorted gypsum. Depth 38.31 m (126'6"). 1X.

GA/4787

Fig. 16 Steeply dipping lamina of light brown, tough dolomite (grey), in gypsum, showing boudinage structure. Fractures are infilled with acicular gypsum. Depth 73.51 m (241'2") ½X.

41.1-149.4 m (135'-490'0")

Gypsum rock is dominant throughout this interval. It is strongly contorted throughout and brecciated in parts. Laminae of gypiferous dolomite rock occur throughout, while irregular laminae, lenses and sparse beds to 1 m thick of grey friable dolomite rock are present. Beds and fragments of black tough dolomite rock and light brown tough dolomite rock occur in parts. Veins of acicular gypsum rock are common.

At 71.9 m (236') a very prominent subvertical joint with limonitic clay on its surface was encountered. This may be a small fault zone of indeterminate displacement. A flow of water originated from the joint. Solution cavities occur between 90.2 and 100.6 m (296' and 330').

149.4-164.6 m (490'0"-540'0")

Grey friable dolomite rock is dominant in this interval. Texture is generally even, with fragments of gypsum rock disseminated throughout. Small fragments of dolomite rock and evaporite rock are visible, and small veins of acicular gypsum rock are present in places.

164.6-250.8 m (540'0"-822'10")

Texture throughout this interval is heterogeneous, and the core consists dominantly of fragments of gypsum rock in a matrix of grey friable dolomite rock. Numerous beds of gypsum rock with contorted laminae of gypsiferous dolomite rock up to 3 m thick and beds of grey friable dolomite rock up to 2 m thick occur throughout. Both light brown tough dolomite rock and black tough dolomite rock are present as beds up to 2 m thick and as fragments. Veins of acicular gypsum rock are present in most parts.

250.8-305.9 m (822'10"-1003'6")

Anhydrite rock is dominant throughout this interval, and is interbedded and interlaminated with dolomitic anhydrite rock. Dip is generally vertical, with gently folding visible in parts.

The anhydrite-dolomitic anhydrite rock shows alteration to gypsum rock throughout the interval. The alteration grades from negligible to complete and gypsum crystals can be seen along bedding planes, fractures in the rock and at points enclosed within massive anhydrite rock. Veins of acicular gypsum rock are commonly concordant with lamination.

Beds of grey friable dolomite rock up to 2 m thick are present, and in places contain fragments of gypsum, anhydrite and light brown tough dolomite rock.

Below 283.5 m (930') black tough dolomite rock occurs as sparse fragments and, more commonly as beds up to 2 m thick.

Table No. XI - Chemical Analyses - BMR Lake Amadeus No. 3

Semi-quantitative Emission Spectrographic Analyses

Sample No.	Metres	Feet	K	B
70-50-0006	3.05 - 6.10 m	10'0" - 20'0"	800 ppm	1900 ppm
7	30.48 - 33.53 m	100'0" - 110'0"	1600	700
8	33.53 - 36.58 m	110'0" - 120'0"	1400	1100
9	4.19 - 4.27 m	13'9" - 14'0"	600	1100
10	10.44 - 10.52 m	34'3" - 34'6"	300	1700
11	13.04 - 13.14 m	42'9" - 43' 1"	900	600
12	24.30 - 24.38 m	79'9" - 80'0"	1000	1000
13	30.31 - 30.39 m	99'5" - 99'8"	1300	1000
14	36.40 - 36.53 m	119'5" - 119'10"	1800	500
15	45.26 - 45.34 m	148'6" - 148'9"	1600	700
16	47.37 - 47.42 m	155'5" - 155'8"	700	700

Reference: Amdel Report AN2661/71

Note: Samples 70-50-0006 to 0008 are from cuttings.

Table No. XII - Chemical Analyses - BMR Lake Amadeus No. 3B

All results in ppm. Analyses by Semi-quantitive Emission Spectroscopy

NP: Not Present in detectable amounts

Sample No.	Metres	Feet	K	Ba	Sr	Mn	B
70500217	46.94-46.99 m	154'0"-154'2"	650	10	100	65	100
18	51.46-51.51 m	178'10"-179'0"	1,400	10	100	65	165
19	58.22-58.27m	191'0"-191'2"	650	7	200	65	165
220	62.48-62.53 m	205'0"-205'2"	1,400	30	100	130	230
21	68.58-68.63 m	225'0"-225'2"	1,400	7	200	40	230
22	76.58-76.63 m	251'3"-251'5"	1,400	10	100	65	165
23	86.82-86.87 m	284'10"-285'0"	650	10	100	20	100
24	106.32-106.37 m	348'10"-349'0"	10,000	30	60	130	500
25	110.59-110.64 m	362'10"-363'0"	650	3	300	65	300
26	115.90-115.95 m	380'3"-380'5"	1,400	200	600	65	230
27	122.45-122.50 m	401'9"-401'11"	400	3	300	40	165
28	124.05-124.10 m	407'0"-407'2"	2,000	7	60	130	500
29	151.49-151.54 m	497'0"-497'2"	20,000	200	200	40	300
30	158.11-158.16 m	518'11"-519'1"	1,400	70	200	65	230
31	161.49-161.54 m	529'10"-530'0"	2,000	70	100	130	500
32	166.70-166.75 m	546'11"-547'1"	1,400	7	200	40	230

Sample No.	Metres	Feet	K	Ba	Sr	Mn	B
70500233	172.52-175.57 m	575'10"-576'0"	650	7	100	20	300
34	190.50-190.55 m	625'0"-625'2"	1,400	7	200	40	300
35	191.97-192.02 m	629'10"-630'0"	1,400	10	300	65	300
36	196.24-196.29 m	643'10"-644'0"	2,000	10	300	65	500
37	202.67-202.72 m	644'11"-665'1"	2,000	10	300	20	100
38	209.95-210.00 m	688'10"-689'0"	1,400	10	100	65	500
39	213.00-213.05 m	698'10"-699'0"	650	7	60	65	165
240	215.72-215.77 m	707'9" -707'11"	20,000	200	20	65	500
41	218.21-218.24 m	715'11"-716'0"	2,000	7	200	65	230
42	220.98-221.05 m	725'0"-725'3"	1,400	10	200	20	30
43	227.91-227.99 m	747'9"-748'0"	200	10	600	20	50
44	235.00-235.05 m	771'0"-771'2"	200	7	600	40	165
45	249.58-249.68 m	818'10"-819'2"	650	7	600	20	230
46	256.34-256.39 m	841'0" -841'2"	400	3	300	20	100
47	267.16-267.21 m	876'6" -876'8"	400	1	300	20	10
48	270.96-271.01 m	889'0" -889'2"	200	NP	300	20	10
49	286.51-286.56 m	940'0"- 940'2"	200	NP	600	2	10

Sample No.	Metres	Feet	K	Ba	Sr	Mn	B
250	287.99-288.04 m	994'10"-945'0"	400	3	300	40	30
51	290.12-290.17 m	951'10"-952'0"	650	3	200	40	30
52	300.56-300.61 m	986'1" -986'3"	200	3	200	200	30
53	305.84-305.87 m	1003'5" -1003'6"	200	3	600	20	100

Analyst: J. Weekes

Reference: BMR Laboratory Report No. 55 (1971).

COMMENTS ON CHEMICAL ANALYSES

BMR Lake Amadeus No. 3

Potassium

The analyses (Table XI) show that no commercial deposits of this element are present. Amounts range from 300 to 1800 ppm and are similar to those obtained in gypsum in other parts of the Amadeus Basin, and in Lake Amadeus No. 3B.

Boron

Figures for boron analyses are comparatively very high, ranging from 500 to 1900 ppm (0.19%). They are much higher than those from BMR Lake Amadeus No. 3B, and may indicate a concentration of boron in the near surface gypsum zones. Limonitic staining was present in some laminae in this hole and fissures and cavities are infilled with surface detritus, suggesting that some concentration of weathering products may have taken place.

BMR Lake Amadeus No. 3B

Potassium

Results of potassium analyses vary from 200 to 20,000 ppm (Table XII). The two samples with 20,000 ppm (2%) potassium were grey friable dolomite; the mode of occurrence of the element is not known. Feldspar was recorded in some X-ray diffraction analyses of this rock type; this mineral may be potassium rich.

Results throughout most of the hole are similar to those of BMR Lake Amadeus No. 3, BMR Mount Liebig No. 1 and BMR Alice Springs No. 3 (Stewart, 1969). In the anhydrite-dolomitic anhydrite rock results are low, suggesting that potassium has been introduced in zones in which percolating meteoric water has caused recrystallization.

Boron

Boron analyses throughout the gypsum show very high results up to 500 ppm. These bear little relationship to the lithology.

Within the anhydrite - dolomitic anhydrite rock results are low, suggesting that boron, like potassium, has been introduced by the percolating meteoric water which causes recrystallization. The sample within the anhydrite at 305.84 m (100 ppm) was composed of gypsum. Apart from this, all samples below 267 m contain less than 30 ppm boron. These results are typical of anhydrite deposits (Stewart, 1963).

Manganese

Manganese content of the core is similar to that in the caprock of BMR Mount Liebig No. 1. Amounts vary from 2 to 130 ppm and are generally low towards the base of the hole. The figures are very low for epigenetic gypsum rock, and slightly low for epigenetic anhydrite. This may indicate that initial deposition of calcium sulphate was as anhydrite; gypsum was formed by later hydration, and retained an initially low manganese content.

Barium

Barium commonly replaces calcium in anhydrite and gypsum (Stewart, 1963). In this hole, however, it occurs mostly in grey friable dolomite. Amounts in beds of this rock type are between 70 and 300 ppm. These are comparable with high values found in salt clays in German evaporites. Amounts throughout the remainder of the core are below 30 ppm. These figures are slightly high for evaporite deposits, which contain on the average 3-10 ppm barium (Stewart, 1963).

Strontium

Strontium occurs in amounts between 20 and 600 ppm, and appears to be more abundant towards the base of the hole. Noll (1934) found that gypsum which had replaced earlier anhydrite at ordinary temperatures cannot always retain all the strontium of the anhydrite, and so celestite is formed (Stewart, 1963). This may explain the generally higher strontium values in the anhydrite. The results of the analyses obtained are as expected in gypsum rock, but below average in anhydrite rock.

COMPARISON OF LOGS WITH CORE LITHOLOGY

Spontaneous Potential (Plate II)

Throughout most of its length the spontaneous potential curve shows minor irregularities superimposed on an irregular drift. This is expected in rocks with little contrast in porosities, such as those in the drillhole.

A minor deflection occurs at 91.5 m (300') which may be related to the presence of either water or cement infilling cavities. The maximum deflection to the right at 122 m (400') corresponds to a zone of very high resistivity. To a depth of 152 m (500') the spontaneous potential curve is similar to the resistivity curve. Beds of friable dolomite produce deflections to the left. The slight deflection at 141.7 m (465') corresponds to such a bed, while the large bed from 149.4 m (490') to 164.6 m (540') produces a large deflection.

The drop in resistivity below 213.4 m (799') corresponds to a shift in the spontaneous potential curve. A friable dolomite bed occurs at 216.4 m (710'), and 3 m core loss below 218.3 m (715') may be due to a similar bed.

Below 229 m (750') the curve is featureless. This is due to vertical lamination producing few sharp variations in lithology.

Resistivity (Plate II)

Resistivity above 139 m (455') is high, generally above 1500 ohm metres, and shows no deflection over the non-cored interval 90.2 m to 98.5 m (296' to 323'), indicating that its lithology is similar to that above and below.

From this depth to 149 m (490') the resistivity declines sharply due to dolomite in the gypsum. Resistivities within the bed of friable dolomite from 149 m (490') to 165 m (540') are relatively low, between 50 and 100 ohm metres. It is difficult to explain why the minimum resistance in the hole occurs at 166 m (545') within a bed of gypsum.

Interbedded gypsum, friable dolomite and light brown tough dolomite give resistivities in the order of 150 ohm metres between 168 m and 177 m (550' and 580'). Similar lithology to 256 m (840') shows restivities around 1500 ohm metres with a sharp drop to less than 100 ohm metres from 215.8 to

223.1 m (708' to 732'). This can only be partly explained by the presence of beds of friable dolomite in the gypsum between 213 m and 222 m (700' and 730'). Similar beds in other parts of the core do not produce similar deflections.

Below 256 m (840') the resistivity shows few sharp variations because of uniform lithology and vertical dip, but gradually increases in value to almost 2000 ohm metres at the base of the hole.

Resistivity throughout most of the hole is extremely high; the two zones in which prominent deflections occur only represent a change from extremely high to very high resistivity.

Both the spontaneous potential and resistivity logs (guard log) end at 58.8 m (193') because the upper bridle electrode was not submersed in fluid. Fluid level was at 23.8 m (78') as per neutron log and the distance from bridle electrode to zero guard log, 35 m (115'), results in a cut-off level of 58.8 m (193') for the guard log.

Gamma Ray (Plate II)

To 244 m (800') the gamma ray curve is irregular with sharp peaks, and recorded values generally range from 25 to 100 API units. It is difficult to correlate the peaks with any particular rock type. Above 23.8 m (78') the peaks are less marked because there is no fluid present in the hole.

From 149 m to 165 m (490' to 540') recorded values range from 75 to 150 API units in a bed of friable dolomite. This correlates with an increase in potassium content recorded by the chemical analyses over this interval. Values up to 20,000 ppm (2%) potassium were recorded. A similar zone with values between 60 and 100 API units occurs between 212.1 m and 223.7 m (696' and 734'). Both these beds have a low resistivity.

Below 244 m (800') recorded values are generally higher, between 60 and 120 API units. This increase is attributed to the presence of anhydrite in the core. The low values recorded at 290 m (950') correlate with a bed of friable dolomite. This does not agree with the gamma ray response in other dolomite beds.

Neutron (Plate II)

To a depth of 232 m (760') the neutron log shows numerous fluctuations but is essentially uniform, with values between 300 and 500 cps. An increase in recorded values to over 1000 cps occurs above 23.8 m (78') because there is no fluid present in the hole. There is no correlation between the fluctuations in the curve and the lighology.

From 232 m (760') to 256 m (840') the curve becomes smoother because the lithology is more uniform. Values gradually increase to about 600 cps, possibly as a result of increasing amounts of anhydrite in the core.

Below 256 m (840') values fluctuate between 500 and 700 cps and probably reflect the degree to which recrystallization of anhydrite to gypsum has taken place. The higher values are a result of a dominantly anhydritic lithology; lower values below 302 m (990') result from the presence of gypsum.

Caliper (Plate II)

The caliper log shows a decrease in hole diameter from 20.3 cm (8") to 15.2 cm (6") at 43.6 m (143'). This corresponds to the base of the casing. Very little caving has been recorded in the hole. If it were present above 195 m (640') it would have been infilled by the cementing operations.

Hole diameter exceeds 15.2 cm (6") only between 92.7 m and 96.3 m (304' and 316') in the zone of solution cavities, and in several places between 146 m and 165 m (480' and 540') in the bed of friable dolomite.

Density (Plate II)

Density measurements were not possible above 23.8 m (78') because no fluid was present in the hole. From this depth to 36.6 m (120') densities are low, in the order of 1.9 gm/cc. This may be due to either the shielding effect of the casing or the lower density of alluvium, which was penetrated to a depth of 41.1 m (135'). Anomalous values as low as 1.5 gm/cc occur between 39.6 m and 53.3 m (130' and 175') and may be related to the presence of the casing, as lithology is uniform below 42.7 m (140').

Densities to a depth of 244 m (800') are generally in the range 2.1 to 2.35 gm/cc. These are the expected values in rock composed dominantly of gypsum (density 2.3 gm/cc).

A zone of slightly lower density occurs from 91.4 m to 103.6 m (300' to 340') which may be related to either solution cavities in the rock, or cement infilling cavities.

Low densities (2.05 gm/cc) are recorded in the beds of friable dolomite at 141.7 m (465'), between 149.4 m and 164.6 m (490' and 540') and from 213.7 m to 217.0 m (701' and 712'). High densities would be expected in dolomite beds (density 2.9 gm/cc); the discrepancy must be due to either porosity of the dolomite or the presence of gypsum.

From 244 m (800') densities gradually increase and from 250 m (820') are between 2.4 and 2.6 gm/cc. The increase is due to the presence of anhydrite (density 2.9 to 3.0 gm/cc) in the core. The lower values recorded in the basal 3 m (10') are due to the presence of gypsum.

DISCUSSION AND CONCLUSIONS

The origin of evaporite deposits with respect to cyclic deposition has been discussed in the completion report for BMR Mount Liebig No. 1. Examples of several stages of the depositional cycle are present in BMR Lake Amadeus No. 3B.

The initial euxinic stage is represented by black tough dolomite. In some fragments cubic cavities are present. These initially contained crystals of either halite or, more probably pyrite, which have decomposed. Pyrite is an indicator of euxinic conditions.

The light brown tough dolomite and grey friable dolomite possibly represents an intermediate stage between the deposition of dolomite and calcium sulphate, as both are present in varying proportions in these rocks. The presence of mica and feldspar indicate that some detrital material was deposited at this time.

The regularly laminated texture of the anhydrite-dolomitic anhydrite rock, results of chemical analyses and texture in thin section suggest that initial deposition of calcium sulphate was as anhydrite. To produce interlaminated anhydrite and dolomitic anhydrite, as occurs in the lower portion of the core, deposition of dolomite at irregular intervals synchronous with the deposition of anhydrite is necessary. The presence of dolomite may indicate that deposition in the rocks encountered in the drill hole did not progress beyond the initial part of the calcium sulphate stage. Silica was deposited either as chert, which later recrystallized, or as detrital grains, throughout all stages.

Gypsum in the core formed later by hydration of anhydrite. Recrystallization can be seen throughout the massive anhydrite rock which occurs below 250 m (820'). An increase in volume should occur where individual coarse gypsum crystals are forming at the expense of anhydrite. There is no evidence in the core of a volume change associated with the recrystallization; this means that excess gypsum is being transported away from the crystals by percolating water. It is this gypsum which recrystallizes along bedding planes in fissures, forming veins of acicular gypsum.

Above 250 m (820') in the zone in which almost complete conversion of anhydrite has taken place, strong contortion and brecciation of gypsum is produced by the increase in volume of the mass of rock. Where regular, competent beds occur, such as the dolomite in Fig. 16, they are subjected to tension. This is caused by the overlying and underlying beds increasing in volume (and length) and fracturing the competent bed, giving boundinage structure. The fractures formed are infilled with acicular gypsum. Compressional features, such as miniature overthrusts, and small reverse faults are also present. They are caused by compressional forces produced by an increase in volume.

Laminae of dolomite present in the original anhydrite are preserved in a contorted and sometimes brecciated form in the gypsum (see Fig. 15).

There is a possibility that the dips measured in the area of the sinkholes were produced by large scale contortion on hydration of anhydrite as they are not in accord with regional trends.

The drilling has demonstrated that laminated and bedded anhydrite occurs at depth beneath the gypsum outcrop. The annhydrite dips near vertically and is only gently folded. Inspection of air photographs suggests that it occurs as a lenticular body interbedded with the surrounding sediments.

There is little indication that a salt dome is present in the area. The only evidence which could support this idea is the vertical dip of the anhydrite, which could be produced on the flanks of a dome. There is no evidence of brecciation and only slight folding of the anhydrite. This indicates that the strong deformation associated with diapiric intrusion is not present. Neither gypsum nor anhydrite has the structure of a caprock which might be overlying a halite body.

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APPENDIX III - BMR LAKE AMADEUS NO. 3B

CUTTINGS DESCRIPTIONS

0-3.05 m (0' to 10'0")
- 70% SILTSTONE, white, tough to moderately friable, slightly calcareous, quartz grains to 0.02 mm in kaolinitic matrix.
- 20% QUARTZ, brown, fine grained, rounded
- 10% GYPSUM, colourless, crystals up to 2 mm across.

3.05-6.10 m (10'0"-20'0")
- 65% SILTSTONE, white, tough to moderately friable, quartz grains to 0.02 mm in kaolinitic matrix
- 35% QUARTZ colourless to brown, fine to coarse grained, rounded

6.10-9.14 m (20'0"-30'0")
- 80% SILTSTONE, white to grey-brown, quartz grains in matrix of clay and gypsum.
- 20% QUARTZ, colourless, fine to medium grained, rounded

9.14-12.19 m (30'0"-40'0")
- 85% SILTSTONE, grades to fine SANDSTONE in parts, white to brown, consists of coarse silt sized and fine sand sized quartz grains in matrix of fine silt sized quartz grains, clay, finely crystalline gypsum and calcite.
- 15% GYPSUM, colourless, coarse grained, fragments of large cyrstals

12.19-15.24 m (40'0"-50'0")
- 100% SILTSTONE, white to brown, friable, consists of grains of quartz in matrix of clay, very finely crystalline gypsum and calcite, tough

15.24-18.29 m (50'0"-60'0")
- 95% SILTSTONE, white grades to brown and pink, friable, contains grains of quartz in matrix of clay, very finely crystalline gypsum and calcite
- 5% GYPSUM colourless, coarse grained, fragments of large crystals

18.29-21.33 m (60'0"-70'0")
- 100% CLAYSTONE, white to brown, friable, consists of a very finely crystalline mixture of clay, gypsum, calcite and sparse very fine silt sized quartz grains.

21.33-24.38 m (70'0"-80'0")
- 100% CLAYSTONE, white to brown, friable, consists of a very finely crystalline mixture of clay, gypsum, calcite and sparse very fine silt sized quartz grains.

24.38-27.43 m (80'0"-90'0")
- 100% CLAYSTONE, white to brown, friable, consists of a very finely crystalline mixture of clay, calcite, gypsum and sparse very fine silt sized quartz grains

27.43-30.48 m (90'0"-100'0")
- 95% CLAYSTONE, brown to white, friable, consists of a very finely crystalline mixture of clay, calcite, gypsum and sparse very fine silt sized quartz grains
- 5% DOLOMITE, dark grey, hard, compact finely crystalline

30.48-33.53 m (100'0"-110'0")
- 100% CLAYSTONE, brown, friable, consists of a very finely crystalline mixture of calcite, clay, gypsum and sparse very fine silt sized quartz grains

33.53-36.58 m (110'0"-120'0")
- 80% CLAYSTONE, brown, friable, consists of a very finely crystalline mixture of clay, gypsum, calcite and very fine silt sized quartz grains
- 20% SILCRETE, brown, consists of medium grained quartz grains cemented by impure ? siliceous matrix

36.58-39.62 m (120'0"-130'0")

60% CLAYSTONE, brown, friable, consists of finely crystalline mixture of clay, gypsum, calcite and a few very fine silt sized quartz grains

20% SILTSTONE, white, moderately soft, consists of grains of quartz in matrix of clay, very finely crystalline gypsum and calcite

10% SILCRETE, light brown, tough, consists of fine grained quartz grains in impure ? siliceous matrix

10% GYPSUM, grey, laminated, hard, finely crystalline

39.62-42.67 m (130'0"-140'0")

50% CLAYSTONE, brown, friable, consists of a very finely crystalline mixture of clay, calcite and gypsum with sparse very fine silt sized quartz grains

40% GYPSUM, grey, hard, laminated, finely crystalline

10% SILTSTONE, white, moderately soft, consists of grains of quartz in matrix of clay, very finely crystalline gypsum and calcite

90.22-91.44 m (296'0"-300'0")

95% GYPSUM, grey, fine grained, hard, laminated

5% GYPSUM, colourless, coarsely crystalline, crystals to 2 cm across, corroded in parts

Tr CHARCOAL, black, soft, friable, fragments to 1 cm across

91.44-92.96 m (300'0"-305'0")

90% GYPSUM, grey to grey-brown, finely crystalline, laminated

10% GYPSUM, colourless, coarse grained, fragments of large crystals

Tr CHARCOAL, black, soft, friable, fragments to 1 cm across

92.96-94.49 m (305'0"-310'0")

90% GYPSUM, grey to white, coarsely crystalline, laminated

9% GYPSUM, colourless, coarse grained, fragments of large crystals

1% CHARCOAL, black, soft, friable, fragments to 1 cm across

94.49-96.01 m (310'0"-315'0")

90% GYPSUM, grey to white, coarsely crystalline, laminated

7% GYPSUM, colourless, very coarse grained, coarse fragments of large crystals and as single euhedral crystals to 3 mm across

2% GYPSUM, orange, finely crystalline, as fragmented and complete cylinders, possibly formed by concretion around organic matter that has since decomposed.

1% CHARCOAL, black, soft, friable, fragments to 1 cm across

96.01-98.45 m (315'0"-323'0")

80% GYPSUM, grey to white, coarsely crystalline, laminated

17% GYPSUM, colourless, very coarse grained, coarse fragments of large crystals and single euhedral crystals to 3 mm across

2% GYPSUM, orange, finely crystalline, as fragmented and complete cylinders

1% CHARCOAL, black, soft, friable, fragments to 1 cm diameter

Note: Charcoal was identified in the cuttings where partly filled cavities were penetrated during drilling. The charcoal fragments gained entry to these cavities from the surface by means of two large sinkholes located approximately 100 metres from the drill site.

APPENDIX IV

CORE DESCRIPTIONS - BMR LAKE AMADEUS NO. 3

Cores 1 to 9 and 14 to 15 described by A.T. Wells.
Cores 10 to 13 described by P.J. Kennewell
Field names for most rock types were extensively revised in May 1971 after microscopic investigations.

CORE No. 1

Interval: 3.05 - 6.10 m (10' - 20')
Cut: 3.05 m (10') Recovered: 3.0 m (9'10")
Description:

Consists mostly of steeply dipping interbedded grey and some pink GYPSUM and minor crystalline and light yellow-brown and some cream soft DOLOMITE. The GYPSUM appears to be mostly interbedded but some thin veins cut the folded beds. A few thin bands of the GYPSUM are slightly calcareous. A poorly sorted orange-brown SANDSTONE bed is present from 5.64 - 5.87 m (18'6" - 19'3").

The upper part of the core consists of -

60% GYPSIFEROUS DOLOMITE, in laminae
40% GYPSUM, grey, crystalline

Soft GYPSIFEROUS DOLOMITE is interlaminated with minor yellow-brown and rust coloured CLAY; bedding is mostly steep and in places either overturned brecciated or contorted. The contorted beds are cut by veins of interpenetrating acicular GYPSUM. The lithology of the core is similar over its whole length with persistant steep dips, tight folding, and veins of GYPSUM. The proportion of GYPSUM varies slightly; at 4.67 m (15'4") there is a 5 cm (2") bed of grey GYPSUM and from 4.37 m (14'4") downwards the GYPSUM content increases to about 60%. The GYPSUM laminae are in most places slightly calcareous.

5.49 - 5.64 m (18' - 18'6")

The core is brecciated with fragments of EVAPORITE ROCK partly cemented by GYPSUM

5.64 - 5.79 m (18'6" - 19')

SANDSTONE, orange-brown, mostly silty, fine-grained, poorly sorted, gypsiferous; some grains up to 1 mm across. Interbedded sandstone persists to total depth. Lower part of core contains the following varieties of gypsum. GYPSUM, pink, calcareous, sandy, clayey; grey, crystalline; pale grey to yellow grey, massive, compact; all steeply dipping

CORE No. 2

Interval: 6.10 - 9.14 m (20' - 30')
Cut: 3.05 m (10') Recovered: 2.57 m (8'5"); 6.58 - 9.14 m (21'7" - 30')
Description:

6.58 - 66.6 m (21'7" - 25'6")

70% GYPSUM, crystalline, tough, pink, grey, and fawn
10% DOLOMITE, dark grey; in sparse small angular fragments and one piece to 15 cm (6") across
20% GYPSIFEROUS DOLOMITE yellow-brown, limonitic, contorted laminae surround grey gypsum pods or "augen"; and contains interlaminated gypsum

Core is strongly folded. Some very coarse, crystalline GYPSUM occurs in vugs about 3 cm across. The pink gypsum is highly calcareous but remainder of core is only slightly calcareous

7.77 - 9.14 m (25'6" - 30')
40% SANDSTONE, strongly calcareous, orange-brown; mostly fine-grained and well sorted
60% GYPSUM, coarsely crystalline (2-3 mm); some angular white fragments about 1 cm across with sand and cream clay but not abundant

CORE No. 3

Interval: 9.14 - 12.19 m (30' - 40')
Cut: 3.05 m (10') Recovered: 2.57 m (8'5")
Description:
9.63 - 12.19 m (31'7" - 40')
GYPSUM, crystalline, lustrous, dark grey; partly in white veins and interpenetrating irregular bodies
DOLOMITE, dark grey to black
Minor yellow brown EVAPORITE ROCK and some pink coarse-grained GYPSUM are interlaminated. One vein of weathered and calcareous SAND near the base of the core.
Core has overall light grey to mid-grey colour, tightly folded and brecciated
11.46 - 10.09 m (37'7" - 33'1") approx.
60% GYPSUM, grey, steeply dipping; interlaminated with -
40% GYPSIFEROUS DOLOMITE, grey and pale grey-brown; and in breccia fragments
10.09 - 12.19 m (33'1" - 40')
80% GYPSUM, dark grey, crystalline; white veinlets and masses
20% GYPSIFEROUS DOLOMITE and DOLOMITE, dark grey and black; interlaminated, but mostly in fragments and irregular lenses. Whole of core is slightly calcareous but sandstone and pink sandy gypsum are strongly calcareous

CORE No. 4

Interval: 12.19 - 15.24 m (40' - 50')
Cut: 3.05 m (10') Recovered: 2.31 m (7'7"); 12.93 - 15.24 m (42'5" - 50')
Description:
12.93 - 14.15 m (42'5" - 46'5")
75% GYPSUM, light and dark grey, strongly contorted as shown by folding of interlaminated GYPSIFEROUS DOLOMITE and grey friable DOLOMITE. Mostly crystalline; some veins of acicular gypsum, but mostly crystalline
25% GYPSIFEROUS DOLOMITE, dark grey to black, laminated; some interlaminated yellow-brown clay
3.54 - 13.72 m (43'5" - 45'), medium-grained and coasted with red iron oxide. Interval is mostly coherent and tough
14.17 - 15.24 m (46'6" - 50')
40% GYPSUM, grey and white, contorted; common in acicular veins to 2 cm thick
15% GYPSIFEROUS DOLOMITE, interlaminated with gypsum
45% GYPSIFEROUS DOLOMITE, grey and some pink, laminated strongly calcareous
Core is slightly calcareous, throughout

CORE No. 5

Interval: 15.24 - 18.29 m (50' - 60')
Cut: 3.05 m (10') Recovered: 0.76 m (2'6")
Description:
17.52 - 18.29 m (57'6" - 60')
GYPSUM, light grey, crystalline, contorted; with interlaminated light grey GYPSIFEROUS DOLOMITE as above

17.78 - 17.91 m (58'4" - 58'9")
DOLOMITE, chocolate, soft, friable
GYPSUM, abundant crystals scattered throughout dolomite; very calcareous
17.91 - 18.29 m (58'9" - 60')
GYPSUM, coarsely crystalline
EVAPORITE ROCK, forms matrix; very calcareous, light grey, massive

CORE No. 6

Interval: 18.29 - 21.34 m (60' - 70')
Cut: 3.05 m (10') Recovered: 0.45 m (1'6")
Description:
50% DOLOMITE, light grey, fine-grained; discontinuous thin beds lenses and patches
50% DOLOMITE, matrix; grey, soft, friable, calcareous; more friable than light grey dolomite
A large proportion of the matrix has been eroded from core. Small pieces of angular grey chert are present in the remainder of the fragmented core

CORE No. 7

Interval: 21.34 - 24.38 m (70' - 80')
Cut: 3.05 m (10') Recovered: 1.6 m (3'6"); 23.31 - 24.39 m (76'6" - 80')
Description:
24.05 - 24.38 m (78'11" - 80')
65% GYPSUM, light grey and white, crystalline, prismatic; in veins about 1 cm across, mainly interlaminated with dark grey GYPSIFEROUS DOLOMITE, but a large proportion occurs in irregular masses, blebs, patches, lenses and other irregular aggregates
35% GYPSIFEROUS DOLOMITE, dark grey to black; mainly interlaminated with gypsum, or in some places in irregular patches and streaks. Mostly soft, swells in water, slightly calcareous
23.31 - 24.05 m (76'6" - 78'11")
DOLOMITE, mostly light grey, friable, calcareous; two pieces of light grey and yellow vuggy CALCAREOUS DOLOMITE about 8 cm long. Friable DOLOMITE contains some very fine white powdery micaceous form of GYPSUM. GYPSUM constitutes 60% of the silty part of the core

CORE No. 8

Interval: 24.38 - 27.43 m (80' - 90')
Cut: 3.05 m (10') Recovered: 3.05 m (10')
Description:
60%-70% GYPSUM, interlaminated light grey and white, in some interpenetrating prismatic veins about 1 cm thick
30%-40% GYPSIFEROUS DOLOMITE, light grey to black, mostly coarsely crystalline
GYPSIFEROUS DOLOMITE, mostly interlaminated in GYPSUM, but in places balled up into irregular masses 5-8 cm across; mostly friable. Core is slightly calcareous and from 24.38 - 25.30 m (80' - 83') is traversed by fracture filled with light grey calcareous GYPSIFEROUS DOLOMITE. The laminae in the core are nearly all steeply dipping and the texture is partly brecciated with angular pieces of laminated gypsum and GYPSIFEROUS DOLOMITE cemented by light grey secondary gypsum, strongly contorted in a few places. Light grey laminae of GYPSIFEROUS DOLOMITE are more common in the core from 25.15 - 25.45 m (82'6" - 83'6") and this interval is broken into several pieces.

GYPSIFEROUS DOLOMITE appears to be mostly a secondary infilling of vugs and cavities. Prismatic GYPSUM is very common in parts of the core and is mostly parallel to the bedding in veins about 1 cm thick

CORE No. 9

Interval: 27.43 - 30.48 m (90' - 100')
Cut: 3.05 m (10') Recovered: 3.05 m (10')
Description:

50% GYPSUM, interlaminated with -
50% GYPSIFEROUS DOLOMITE, black to dark grey

Mostly tightly folded and in places brecciated. Texture is uniform throughout (See Fig. of core in interval from about 27.43 - 36.58 m (90' - 120'). The dips are mostly steep; only rarely do the beds remain intact for more than a few centimetres of the core; mostly interlaminated GYPSUM and black GYPSIFEROUS DOLOMITE in fragments varying from a fraction of a centimetre to several centimetres across are cemented by recrystallised coarse grained GYPSUM. Some pieces of laminated black GYPSIFEROUS DOLOMITE are up to 4 cm across. A few thin veins of acicular GYPSUM cut the brecciated mass. There is little prefered orientation to the brecciated fragments.

5 cm of predominantly black GYPSIFEROUS DOLOMITE occurs at about 29.19 m (92'6"). There are rare thin interbeds of light grey calcareous tough DOLOMITE 6-25 mm thick in the GYPSUM and the GYPSIFEROUS DOLOMITE. The tough DOLOMITE occurs at 27.74 m (91'), 28.24 m (92'8") and 28.80 m (94'6"); it comprises less than 5% of the core

CORE No. 10

Interval: 30.48 - 33.53 m (100'0" - 110'0")
Cut: 3.05 m (10'0") Recovered: 3.05 m (10'0")
Description:

30.48 - 31.09 m (100'0" - 102'0")

70% GYPSUM, white, coarsely crystalline, laminated, very contorted; veins of acicular gypsum (10%)
30% GREY FRIABLE DOLOMITE, moderately soft; contorted laminae (20%), and fragments to 2 cm across (10%)

31.09 - 31.67 m (102'0" - 103'11")

60% GYPSUM, white, grades to black in parts (15%), coarsely crystalline; contains several contorted veins of acicular gypsum to 2 cm thick (15%)
40% CLAYSTONE, orange, soft; irregular contorted laminae to 5 mm thick and fragments to 3 cm across

31.67 - 32.05 m (103'11" - 105'2")

85% GYPSUM, light brown, coarsely crystalline, contorted and laminated; contains veins of acicular gypsum (5%)
15% CLAYSTONE, orange, moderately soft; contorted laminae in gypsum (10%), and light grey moderately soft fragments to 5 mm across (5%)

32.05 - 32.31 m (105'2" - 106'6")

60% GYPSUM, white, coarsely crystalline; contains laminae of acicular gypsum to 2 mm thick (10%), and grains of gypsum in the claystone (5%)
30% CLAYSTONE, orange, moderately soft; appears to be filling a solution cavity

32.31 - 33.20 m (106'0" - 108'11")

80% GYPSUM, white to light grey, laminated, contorted, coarsely crystalline; contains laminae of acicular gypsum to 2 mm thick (10%)
20% GREY FRIABLE DOLOMITE, moderately hard; contorted laminae and fragments to 2 cm across

33.20 - 33.36 m (105'11" - 109'5")
60% GYPSUM, white to light grey, coarsely crystalline; contains laminae of acicular gypsum to 5 mm thick (20%), and grains of coarsely crystalline gypsum in the claystone (5%)
40% CLAYSTONE, orange, soft; irregular bodies filling solution cavities to 5 cm across (35%), and contorted laminae in gypsum (5%)
33.36 - 33.53 m (109'5" - 110'0")
85% GYPSUM, light grey, coarsely crystalline, laminated; contains contorted laminae of acicular gypsum to 5 mm thick (20%)
15% CLAYSTONE, orange, moderately soft; contorted laminae in gypsum

CORE No. 11

Interval: 33.53 - 36.58 m (110'0" - 120'0")
Cut: 3.05 m (10'0") Recovered: 2.94 m (9'8")
Description:
33.53 - 33.83 m (110'0" - 111'0")
85% GYPSUM, light grey, coarsely crystalline, laminated; contains laminae of acicular gypsum to 5 mm thick (20%)
15% GYPSIFEROUS DOLOMITE, orange, moderately soft; contorted laminae in gypsum
33.83 - 34.49 m (111'0" - 113'2")
65% GYPSUM, white, coarsely crystalline, laminated and contorted; contains veins of acicular gypsum to 1 cm thick (2%)
15% GREY TOUGH DOLOMITE, moderately hard, even texture; fragments to 3 cm across with random orientation
20% DARK GREY FRIABLE DOLOMITE, contorted laminae to 2 mm thick (5%), and fragments to 1 cm across
34.49 - 34.69 m (113'2" - 113'10") (0.05 m) (2")
60% GYPSUM, white, coarsely crystalline, laminated and contorted
40% CLAYSTONE, orange, soft, friable; filling solution cavities
34.69 - 35.18 m (113'10" - 115'5")
85% GYPSUM, white, coarsely crystalline, regularly laminated, dips 30°; contains veins of acicular gypsum to 5 mm thick in basal 18 cm (10%)
15% GYPSIFEROUS DOLOMITE, orange, laminated
35.18 - 34.41 m (115'5" - 116'2") (0.05 m) (2")
50% GYPSUM, light brown, coarsely crystalline; contains fine friable saccharoidal gypsum (5%), and very coarsely crystalline gypsum in the claystone (5%)
50% CLAYSTONE, orange soft, friable; fills solution cavities whole long axes dip 60°
34.41 - 36.58 m (116'2" - 120'0")
40% GYPSUM, white, regularly laminated, dips sub-horizontally; contains laminae of acicular gypsum to 1 cm thick (20%), and fragments in brecciated zones to 1 cm across (5%)
30% GYPSIFEROUS DOLOMITE, orange-brown, moderately hard; laminae in gypsum (10%), and matrix in vertical brecciated zone enclosing fragments of light brown gypsiferous dolomite and gypsum to 1 cm across
30% CLAYSTONE, light orange-brown, moderately soft; fragments to 5 cm across, and laminae in gypsum

CORE No. 12

Interval: 36.58 - 39.62 m (120'0" - 130'0")
Cut: 3.05 m (10'0") Recovered: 3.05 m (10'0")
Description

36.58 - 37.42 m (120'0" - 122'9")
60% GYPSUM, white to light grey, coarsely crystalline; contains laminae of acicular gypsum to 2 mm thick, mostly dips 30°; contorted in part
30% GYPSIFEROUS DOLOMITE, grey to orange, moderately hard, laminae contorted; dips 30° in part
37.42 - 37.85 m (122'9" - 124'2")
70% GYPSUM, white to light grey, laminated, contorted; fragments to 3 cm across
30% GYPSIFEROUS DOLOMITE, light grey to light brown, moderately soft, contorted laminae; and matrix for fragments
37.85 - 38.50 m (124'2" - 126'4")
70% GYPSUM, white to light grey, coarsely crystalline, laminated, contorted, mostly dips 45°; contains veins of acicular gypsum to 5 mm thick (10%)
29% GYPSIFEROUS DOLOMITE, light grey, moderately soft, laminae dip 45°, contorted in part; and elongated fragments to 3 cm across
1% GREY TOUGH DOLOMITE, hard medium crystalline; fragments to 2 cm across, contains tracings of calcite
38.50 - 38.79 m (126'4" - 127'3")
60% GYPSUM, white, laminated, extremely contorted and brecciated; contains laminae of acicular gypsum to 3 mm thick in part (20%)
39% GYPSIFEROUS DOLOMITE, grey, moderately soft, brecciated; fragments to 2 cm across (20%), and contorted laminae in gypsum (19%)
1% GREY TOUGH DOLOMITE, medium crystalline, hard; fragments
38.79 - 39.62 m (127'3" - 130'0")
70% GYPSUM, white, coarsely crystalline, laminated and contorted; some dips to 30°, brecciated in part, laminae of acicular gypsum to 1 cm thick
30% GYPSIFEROUS DOLOMITE, light grey, moderately soft; laminae contorted in part

CORE No. 13

Interval: 39.62 - 42.67 m (130'0" - 140'0")
Cut: 3.05 m (10'0") Recovered: 2.94 m (9'8")
Description:
39.72 - 42.37 m (130'4" - 139'0")
65% GYPSUM, white to light grey, coarsely crystalline, laminated, contorted and slightly brecciated in part; contains laminae of acicular gypsum to 2 mm diameter (25%)
35% GYPSIFEROUS DOLOMITE, grey, moderately soft; laminae (30%); and angular fragments to 2 cm across (15%)
42.37 - 42.40 m (139'0" - 139'1")
70% GYPSIFEROUS DOLOMITE, grey, moderately soft friable; dips 45°, possibly filling an inclined shear plane
30% ACICULAR GYPSUM, white; randomly oriented fragments
42.40 - 42.60 m (139'1" - 139'9")
90% GYPSUM, black grading to white; coarsely crystalline, saccharoidal texture in part; sparse veins of acicular gypsum in dolomite (5%)
10% GYPSIFEROUS DOLOMITE, grey, moderately soft; laminae (5%), and tracings (5%)
42.60 - 42.67 m (139'9" - 140'0")
80% GYPSIFEROUS DOLOMITE, grey, moderately soft, friable; even texture
15% ACICULAR GYPSUM, white; fragmented laminae throughout dolomite
5% GYPSUM, black, coarsely crystalline, saccharoidal texture; fragments

CORE No. 14

Interval: 42.67 - 45.72 m (140-150')
Cut: 3.05 m (10') Recovered: 1.83 m (6')
Description:
43.89 - 43.97 m (144' - 144'3")
GYPSIFEROUS DOLOMITE, light grey-brown, interbedded with -
CALCAREOUS DOLOMITE, fragmental, grey, tough and -
DOLOMITE, grey, brown tough
A grey crystalline GYPSUM vein occurs on one side of core
43.97 - 44.09 m (144'3" - 144'8")
GYPSUM, light grey, crystalline, slightly calcareous; in irregular massive with joints separating bodies filled with yellow-brown silty claystone with abundant gypsum crystals
44.09 - 44.23 m (144'8" - 145'1")
DOLOMITE, light grey, friable, steeply dipping laminae 6 mm thick; separated by laminae 2-3 mm thick of
GYPSIFEROUS DOLOMITE, dark grey, non-calcareous
44.23 - 44.65 m (145'1" - 146'6")
75% GYPSUM, light grey, tough, crystalline, slightly calcareous, steeply dipping; interbedded with -
15% DOLOMITIC GYPSUM, grey to black; thin laminae
CALCAREOUS DOLOMITE, pale grey-brown, tough; as minor irregular fragments
GYPSIFEROUS SILTSTONE, yellow brown; probably cave filling
44.65 - 44.84 m (146'6" - 147'1")
GYPSIFEROUS SILTSTONE, coarse, friable; poor recovery, cut by -
GYPSUM, clear, irregular veins about 6 mm across, non calcareous, probably cave filling
44.84 - 45.09 m (147'1" - 147'11")
GYPSUM, clear, large crystals which are continuous across the core
GYPSUM, minor, interlaminated, fine-grained, saccharoidal in lower part of this interval
45.09 - 45.72 m (147'11" - 150')
75% GYPSUM, white and light grey, tightly folded, partly brecciated, crystalline
25% GYPSIFEROUS DOLOMITE, dark grey, thin laminae
DOLOMITE, pale grey, tough, minor fragments, no continuous beds
Some veins about 6 mm across of acicular gypsum near the base of the interval. Core is slightly calcareous in part

CORE No. 15

Interval: 45.72 - 48.77 m (150' - 160')
Cut: 3.05 m (10'0 Recovered: 1.98 m (6'6")
Description:
46.78 - 47.75 m (153'6" - 156'8")
60% GYPSUM, brecciated, grey, steep dip; varies from coarse- to fine-grained
GYPSIFEROUS DOLOMITE, dark grey to black
Steeply dipping and brecciated parts of the core alternate as follows -
46.78 - 46.94 m (153'6" - 154') steeply dipping
46.94 - 47.14 m (154' - 154'8") brecciated
47.14 - 47.32 m (154'9" - 155'3") steeply dipping
47.32 - 47.75 m (155'3" - 156'8") brecciated
ACICULAR GYPSUM, common in veins about 1 cm thick in the steeply dipping portions of the core
DOLOMITE, minor angular pieces up to about 25-40 mm across; some elongated parallel to the bedding
DOLOMITE, friable, in one fragment about 25 mm across

47.75 - 48.16 m (156'8" - 158')
SILTY CLAY, light yellow-brown
GYPSUM, abundant, crystalline; thin clear veins cutting the silty clay
GYPSUM, thin veins of crystalline secondary deposits in vugs
48.16 - 48.36 m (158' - 158'8")
GYPSUM, tough, crystalline, steeply dipping; interbedded with -
GYPSIFEROUS DOLOMITE, dark grey
CLAY, as described in previous interval; yellow brown, fills vugs
DOLOMITE, dark grey, fine grained, minor; at base of interval
48.36 - 48.77 m (158'8" - 160')
Deeply weathered section
GYPSUM, crystalline, interlaminated with -
GYPSIFEROUS DOLOMITE, dark
DOLOMITE, light grey, some smoky grey, tough; in fragments
SILTY CLAY, yellow-brown and -
GYPSUM, coarsely crystalline; fills vugs
Core is mostly broken
Most of core is slightly calcareous

APPENDIX V

CORE DESCRIPTIONS - BMR LAKE AMADEUS NO. 3A

Cores 1 and 2 described by P.J. Kennewell

CORE No. 1

Interval: 13.72 - 16.76 m (45'0" - 55'0")
Cut: 3.05 m (10'0") Recovered: 1.06 m (3'6")
Description:

15.70 - 15.95 m (51.6" - 52'4")
- 90% CLAYSTONE, white, soft, vuggy, very calcareous
- 10% LIMESTONE, white, medium crystalline; hard fragments to 10 cm across

15.95 - 16.00 m (52'4" - 52'6")
- 100% DOLOMITE, black, hard, contains numerous solution cavities to 5 cm across with minor secondary calcite growth on walls

16.00 m - 16.23 m (52'6" - 53'3")
- 80% CLAYSTONE, white, soft, friable, very calcareous
- 20% LIMESTONE, white, hard, fine to medium crystalline; fragments to 10 cm across with contorted laminae of claystone to 5 mm thick

16.23 m - 16.69 m (53'3" - 54'9")
- 100% CLAYSTONE, white, soft, friable; contains several joints at 60°, very calcareous

16.69 - 16.76 m (54'9" - 55'0")
- 70% CLAYSTONE, white, soft, friable, very calcareous
- 30% LIMESTONE, white, medium crystalline; fragments to 5 cm across

CORE No. 2

Interval: 27.43 - 30.48 m (90'0" - 100'0")
Cut: 3.05 m (10'0") Recovered: 1.09 m (3'7")
Description:

29.39 - 29.87 m (96'5" - 98'0")
- 90% DOLOMITE, grey, hard, medium crystalline; several solution cavities to 4 mm wide with their long axes dipping at about 30°, contain secondary growth on walls; brecciated in parts with calcite filling fractures
- 10% CLAYSTONE, white, soft, friable, very calcareous; filling fractures

29.87 - 30.05 m (98'0" - 98'7")
- 80% CLAYSTONE, grey, soft, friable; contains abundant silty grains possibly of calcite
- 20% DOLOMITE, grey, medium crystalline, hard, slightly calcareous; fragments to 1 cm across in claystone matrix

30.05 - 30.12 m (98'7" - 98'10")
- 80% DOLOMITE, grey, medium crystalline, hard; contains abundant contorted calcite tracings
- 20% CLAYSTONE, grey, soft, friable; contains abundant silty grains of ?calcite

30.12 - 30.48 m (98'10" - 100'0")
- 100% CLAYSTONE, white, soft, friable, very calcareous

APPENDIX VI

CORE DESCRIPTIONS - BMR LAKE AMADEUS NO. 3B

Cores 1 and 2 described by A.T. Wells

Cores 3 to 81 described by P.J. Kennewell

CORE No. 1

Interval: 12.19 - 14.63 m (40' - 48')
Cut: 3.05 (10') Recovered: 2.13 m (7')
Description:
12.50 - 14.63 m (41' - 48')
SILTY CLAY, deeply weathered, mostly light grey, some mottled, purplish-brown and orange-brown
GYPSUM, secondary, colourless, coarsely crystalline; irregular anastomosing bodies
GYPSIFEROUS SAND, white, poorly sorted, silty; forms upper 8-10 cm of the core, angular sand grains

CORE No. 2

Interval: 31.39 - 33.53 m (103' - 110')
Cut: 3.05 m (10') Recovered: 0.45 m (1'6")
Description:
70% SILT, pale yellow-brown, strongly calcareous, crumbly . unconsolidated
30% GYPSIFEROUS LIMESTONE, white, secondary, vuggy, friable; several interbeds in silt. Minor GYPSUM some as secondary, yellow, medium grained crystals

CORE No. 3

Interval: 42.67 - 45.72 m (140'0" - 150'0")
Cut: 3.05 m (10') Recovered: 2.87 m (9'5")
Description:
42.85 m - 43.28 m (140'7" - 142'0")
70% GYPSUM, light grey, coarsely crystalline, laminated, contorted and generally dips at 60°; contains numerous laminae of acicular gypsum to 5 mm thick which are highly contorted and discordant in part (30%)
30% GYPSIFEROUS DOLOMITE, grey, laminated and contorted, moderately soft; in sparse lenses to 3 mm thick
43.28 m - 44.89 m (142'0" - 147'3")
70% GYPSUM, light grey, coarsely crystalline, laminated and brecciated; fragments from 3-6 mm across, abundant veins and fragments of acicular gypsum to 1 cm thick (50%)
30% GYPSIFEROUS DOLOMITE, grey, moderately hard; matrix for brecciated fragments of gypsum and in shear planes to 1 mm across
44.89 m - 45.72 m (147'3" - 150'0")
70% GYPSUM, white, hard, coarsely crystalline; rounded fragments to 10 cm across and contorted laminae generally dip at about 70°; acicular gypsum (20%) in numerous veins, a few fragments to 2 cm across, and as matrix
30% GYPSIFEROUS DOLOMITE, grey, moderately hard; interlaminated with gypsum, and as matrix for fragments

CORE No. 4

Interval: 45.72 - 48.46 m (150'0" - 159'0")
Cut: 2.74 m (9'0") Recovered: 2.74 m (9'0")
Description:

48.08 - 48.46 m (157'9" - 159'0")
- 80% GYPSUM, white, coarsely crystalline; concordant, slightly contorted, laminae of acicular gypsum dip about 70° (10%)
- 20% GYPSIFEROUS DOLOMITE, grey, moderately hard; interlaminated with gypsum

45.72 - 46.71 m (150'0" - 153'3")
- 50% GREY FRIABLE DOLOMITE, moderately soft; as matrix for fragments of gypsum; contains small fragments of gypsum to 3 mm across
- 40% GYPSUM, white, coarsely crystalline; fragments to 10 cm across, interlaminated with gypsiferous dolomite, contorted in part
- 10% GYPSIFEROUS DOLOMITE, grey, moderately hard; contorted laminae in gypsum

Bed terminated at base by shear plane at 45°

46.71 - 47.22 m (153'3" - 154'11")
- 45% GREY FRIABLE GYPSUM, moderately soft; matrix for fragments of gypsum, contains small fragments of gypsum to 2 mm across
- 45% GYPSUM, white to grey; fragments to 10 cm across (20%), contorted laminae in matrix, and intermixed with dolomite as acicular fragments to 2 mm across
- 10% LIGHT BROWN TOUGH DOLOMITE, moderately hard, medium crystalline; fragments to 6 cm across

47.22 - 47.49 m (154'11" - 155'10")
- 80% GYPSUM, white, coarsely crystalline; dips uniformly at 60°
- 20% GYPSIFEROUS DOLOMITE, grey, moderately hard; laminae to 2 mm thick in gypsum

47.49 - 48.08 m (155'10" - 157'9")
- 55% GYPSUM, white, coarsely crystalline; fragments to 5 cm across (20%), extremely contorted laminae in matrix (35%), and interlaminated and intermixed with grey friable dolomite
- 45% GREY FRIABLE DOLOMITE, moderately soft; matrix for gypsum fragments, contorted to extremely contorted; part of base contains abundant gypsum fragments to 4 mm across

Bed terminated at base by shear plane

48.08 - 48.46 m (157'9" - 159'0")
- 80% GYPSUM, white, coarsely crystalline; concordant laminae of acicular gypsum (10%); laminae slightly contorted and dip about 70°
- 20% GYPSIFEROUS DOLOMITE, grey, moderately hard; interlaminated with gypsum

CORE No. 5

Interval: 48.46 - 51.36 m (159'0" - 168'6")
Cut: 2.98 m (9'6") Recovered: 2.89 m (9'6")
Description:

48.46 - 48.82 m (159'0" - 160'2")
- 70% GYPSUM, white to light grey, coarsely crystalline, laminated; dips about 10°, veins of acicular gypsum dip 45°; concordant laminae of acicular gypsum to 5 mm thick at 48.61 m (159'6") (10%)
- 30% GYPSIFEROUS DOLOMITE, grey, hard, laminae to 2 mm thick

48.82 - 49.25 m (160'2" - 161'7")
- 65% GYPSUM, white to light grey, laminated, contorted, coarsely crystalline; concordant laminae of acicular gypsum to 4 mm thick (20%)

30% GYPSIFEROUS DOLOMITE, grey, moderately hard; interlaminated with gypsum; some zones to 2 cm thick with fragments of acicular gypsum to 4 mm across

5% LIGHT BROWN TOUGH DOLOMITE, moderately hard; fragments to 2 cm across

49.25 - 49.68 m (161'7" - 163'0")

50% GYPSUM, white, coarsely crystalline; fragments to 4 cm to 5 mm across, with contorted gypsiferous dolomite laminae; acicular veins to 1 cm thick

40% GYPSIFEROUS DOLOMITE, grey, moderately hard; contorted laminae in gypsum, and matrix for fragments; contains fragments of gypsum to 1 cm across

10% GREY FRIABLE DOLOMITE, soft, calcareous; contorted laminae and tracings

49.25 - 51.13 m (161'7" - 167'9")

60% GYPSUM, white to light grey, coarsely crystalline; fragments to 5 cm across, laminated and contorted in part, and as acicular crystals to 5 mm across in dolomite matrix; 30% acicular gypsum in matrix and veins to 2 cm thick

30% GYPSIFEROUS DOLOMITE, grey, moderately hard; forms matrix; extremely contorted, contains crystals of gypsum

5% LIGHT BROWN TOUGH DOLOMITE, moderately hard; fragments to 2 cm across occur near base

5% GYPSIFEROUS DOLOMITE, grey; contorted laminae in gypsum

51.13 - 51.36 m (167'9" - 168'6")

80% GYPSUM, white to light grey, coarsely crystalline laminated; generally dips 45°; occurs as concordant and discordant brecciated laminae of acicular gypsum (30%)

10% GYPSIFEROUS DOLOMITE, light grey, moderately hard; laminae in gypsum

10% GREY FRIABLE DOLOMITE, moderately soft; forms matrix, contains fragments of acicular gypsum

CORE No. 6

Interval: 51.36 - 53.95 m (168'6" - 177'0")
Cut: 2.89 m (9'6") Recovered: 2.87 m (9'5")
Description:

51.39 - 51.66 m (168'7" - 169'6")

80% GYPSUM, white, coarsely crystalline; uniform dip of 45°, laminated, contains concordant laminae of acicular gypsum to 1 cm across

15% GYPSIFEROUS DOLOMITE, grey, moderately hard; laminae in gypsum to 5 mm thick

5% GREY TOUGH DOLOMITE, moderately hard; fragments to 5 cm across

51.66 - 53.39 m (169'6" - 175'2")

60% GYPSUM, white, coarsely crystalline, brecciated, laminated fragments to 8 cm across with vertical long axes

40% GREY FRIABLE DOLOMITE, moderately hard to soft, slightly calcareous; matrix for fragments

53.39 - 53.57 m (175'2" - 175'9")

50% GREY TOUGH DOLOMITE, medium crystalline, hard, even texture; fragments to 8 cm across

35% GYPSUM, white, prismatic; veins to 1 cm thick around fragments

15% GREY FRIABLE DOLOMITE, moderately hard; matrix for gypsum

53.57 - 53.95 m (175'9" - 177'0")

50% GYPSUM, white, coarsely crystalline, laminated; dips about 70°, fragmented in part, contains laminae of acicular gypsum to 1 cm thick

20% GYPSIFEROUS DOLOMITE, grey, moderately hard; laminae in gypsum

30% GREY FRIABLE DOLOMITE, moderately soft, slightly calcareous; forms matrix in fragmented zones, contains fragments of acicular gypsum to 1 cm across

CORE No. 7

Interval: 53.95 - 57.00 m (177'0" - 187'0")
Cut: 3.05 m (10'0") Recovered: 3.05 m (10'0")
Description:
53.95 - 54.25 m (177'0" - 178'0")
50% GYPSUM, white, coarsely crystalline; fragments to 8 cm across with laminae of gypsiferous dolomite, and veins of acicular gypsum to 4 mm thick
45% GREY FRIABLE DOLOMITE, moderately soft, friable; forms matrix for fragments, more dominant towards base of core, broken in part
5% GYPSIFEROUS DOLOMITE, grey, moderately hard; laminae in gypsum to 4 mm thick
54.25 - 55.17 m (178'0" - 181'0")
60% GYPSUM, white, coarsely crystalline, laminated; extremely contorted in part, contains laminae of gypsiferous dolomite and acicular gypsum to 4 mm thick
30% GYPSIFEROUS DOLOMITE, light grey, moderately hard; contorted laminae to 4 mm thick
5% GREY FRIABLE DOLOMITE, soft; fragments to 2 cm across elongated parallel to laminae
5% GREY TOUGH DOLOMITE, moderately hard; contains laminae of gypsiferous dolomite in part
55.17 - 56.47 m (181'0" - 185'3")
85% GYPSUM, white, coarsely crystalline; dip grades from 70° at top to 30° at base; contains generally concordant laminae of fibrous gypsum to 5 mm thick (20%)
15% GYPSIFEROUS DOLOMITE, light grey, moderately hard; laminae to 4 mm thick in gypsum
56.47 - 56.89 m (185'3" - 186'8")
50% GYPSUM, white, coarsely crystalline; laminae and beds of acicular gypsum to 2 cm thick interlaminated with grey friable dolomite
50% GREY FRIABLE DOLOMITE, moderately hard; laminae and fragments between the laminae to 5 cm across
56.89 - 57.00 m (186'8" - 187'00")
50% GYPSUM, white, coarsely crystalline; as large fragments from 1-10 cm across. Contains laminae of gypsiferous dolomite and disseminated fragments to 1 mm across of grey friable dolomite. Fragments set in matrix composed of prismatic gypsum fragments to 4 mm across dispersed in grey friable dolomite
40% GREY FRIABLE DOLOMITE, moderately soft; as matrix for gypsum fragments
10% GYPSIFEROUS DOLOMITE, grey, moderately hard; laminae in gypsum

CORE No. 8

Interval: 57.00 - 60.05 m (187'0" - 197'0")
Cut: 3.05 m (10'0") Recovered: 3.05 m (10'0")
Description:
57.00 - 58.80 m (187'0" - 192'11")
50% GYPSUM, white, coarsely crystalline; large fragments from 1-10 cm across with laminae of gypsiferous dolomite and disseminated grey friable dolomite, and fragments of prismatic gypsum to 4 mm across dispersed in a grey friable dolomite
40% GREY FRIABLE DOLOMITE, moderately soft; matrix for fragments
10% GYPSIFEROUS DOLOMITE, grey, moderately hard; laminae in gypsum fragments

58.80 - 60.05 r (192'11" - 198'0")
80% GYPSUM, white, coarsely crystalline, regularly laminated; dips 0-45°, contains concordant and discordant laminae of acicular gypsum to 1 cm thick (30%)
15% GYPSIFEROUS DOLOMITE, grey, moderately hard; laminae to 4 mm thick in gypsum
5% GREY FRIABLE DOLOMITE, moderately soft; elongated fragments generally occurring with acicular gypsum

CORE No. 9

Interval: 60.05 - 62.79 m (197'0" - 206'0")
Cut: 2.74 m (9'0") Recovered: 2.36 m (7'9")
Description:
60.43 - 60.84 m (198'3" - 199'7")
70% GYPSUM, white, coarsely crystalline, laminated; contains concordant and discordant veins of acicular gypsum to 4 mm thick (30%)
30% GYPSIFEROUS DOLOMITE, moderately hard to moderately soft, laminae in gypsum to 5 mm thick
60.84 - 60.99 m (199'7" - 200'1")
50% GREY FRIABLE DOLOMITE, moderately hard; forms matrix, contorted in part
30% GREY TOUGH DOLOMITE, hard, laminated; contains grey friable dolomite laminae, fragments from 5mm-4cm across
20% GYPSUM, white, prismatic; laminae to 4 mm thick in fragments of grey dolomite, and in matrix
60.99 - 62.02 m (200'1" - 203'6")
70% GYPSUM, white, coarsely crystalline, laminated and contorted throughout; dips from 45°-90°, contains sparse veins of acicular gypsum
25% GYPSIFEROUS DOLOMITE, white, grey, moderately hard; laminae to 4 mm thick in gypsum
5% GREY FRIABLE DOLOMITE, lenticular laminae to 1 cm thick, contorted; contact with underlying bed dips 45°
62.02 - 62.07 m (203'6" - 203'8")
100% GYPSUM, clear, extremely coarsely crystalline; shows numerous cleavage planes, possibly formed in solution cavity, contains 1 cm bed of grey friable dolomite at top
62.07 - 62.79 m (203'8" - 206'0")
65% GYPSUM, white, coarsely crystalline, laminated; contains sparse veins of acicular gypsum 1 cm thick
30% GREY FRIABLE DOLOMITE, moderately hard; irregular bodies to 10 cm across, contorted in part
5% GYPSIFEROUS DOLOMITE, grey; laminae in gypsum

CORE No. 10

Interval: 62.79 - 65.84 m (206'0" - 216'0")
Cut: 3.05 m (10'0") Recovered: 3.05 m (10'0")
Description:
62.79 - 64.09 m (206'0" - 210'3")
80% GYPSUM, white to black, coarsely crystalline, laminated; dips 80-90°, slightly contorted in part, no acicular forms
20% GYPSIFEROUS DOLOMITE, light grey, moderately hard; laminae in gypsum
64.09 - 64.31 m (210'3" - 211'0")
65% GYPSUM, white, coarsely crystalline, laminated; dips grade from 70° at top to 30° at base

30% GREY FRIABLE DOLOMITE, moderately soft; elongated fragments to 10 cm across, tracings of calcite and gypsum
15% GYPSIFEROUS DOLOMITE, laminae in gypsum

64.31 - 64.49 m (211'0" - 211'7")
65% GYPSUM, white, clear, extremely coarsely crystalline; cleavage planes prominent, largest fragments 10 cm across, those dispersed in matrix to 4 mm across
35% GREY FRIABLE DOLOMITE, moderately soft; matrix for gypsum fragments

64.49 - 64.62 m (211'7" - 212'0")
90% GREY TOUGH DOLOMITE, moderately hard to hard; dips about 30°
10% GYPSUM, irregular veins in dolomite to 5 mm thick

64.62 - 65.84 m (212'0" - 216'0")
70% GYPSUM, white, coarsely crystalline, laminated; dips 60-90°, contorted in part, sparse veins of acicular gypsum to 4 mm thick
20% GREY FRIABLE GYPSUM, very irregular elongated fragments to 4 cm across
10% GYPSIFEROUS DOLOMITE, grey, moderately hard; laminae in gypsum

CORE No. 11

Interval: 65.84 - 68.88 m (216'0" - 226'0")
Cut: 3.05 m (10'0") Recovered: 3.05 m (10'0")
Description:

65.84 - 67.49 m (216'0" - 221'5")
70% GYPSUM, white, laminated; dips 60-90°, sparse veins of acicular gypsum to 4 mm thick, fragments to 1 cm across at base of bed
20% GREY FRIABLE DOLOMITE, moderately soft; very irregular elongated fragments to 4 cm across
10% GYPSIFEROUS DOLOMITE, grey, moderately hard; laminae in gypsum

67.49 - 67.56 m (221'5" - 221'8")
70% GREY FRIABLE DOLOMITE, moderately soft, friable
30% GYPSUM, white, generally very coarse grained; fragments in grey friable dolomite matrix to 2 cm across; consists of granular prismatic and very coarsely crystalline gypsum fragments in equal proportion

67.56 - 68.15 m (221'8" - 223'7")
50% GYPSUM, white, coarsely crystalline; fragments of saccharoidal and acicular gypsum to 5 cm across
30% BLACK TOUGH DOLOMITE, hard; fragments to 10 cm across containing veins of acicular gypsum and calcite
15% GREY FRIABLE DOLOMITE, moderately soft, forms matrix, fragments of tough and light brown dolomite, moderately hard to hard

68.15 - 68.22 m (223'7" - 223'10")
70% GREY FRIABLE DOLOMITE, soft; forms matrix
30% GYPSUM, clear, extremely coarsely, crystalline; fragments to 1 cm across with cleavage planes prominent

68.22 - 68.88 m (223'10" - 226'0")
70% GYPSUM, white, coarsely crystalline, laminated, contorted and fragmented in part; fragments to 2 cm across
25% GREY FRIABLE DOLOMITE, moderately soft; matrix for gypsum fragments and as irregular elongated fragments in gypsum
5% GYPSIFEROUS DOLOMITE, light grey, moderately hard; contorted laminae in gypsum

CORE No. 12

Interval: 68.88 - 71.93 m (226'0" - 236'0")
Cut: 3.05 m (10'0") Recovered: 0.71 m (2'4")
Description:

71.22 - 71.73 m (233'8" - 235'4")
- 70% GYPSUM, white to black, coarsely crystalline, laminated; very contorted and brecciated in part
- 15% GREY FRIABLE DOLOMITE, soft; laminae to 4 mm thick, extremely contorted in part
- 15% LIGHT BROWN DOLOMITE, hard; fragments to 2 cm across, and irregular beds to 2 cm thick

71.73 - 71.93 m (235'4" - 236'0")
- 70% GYPSUM, white, generally medium crystalline; large proportion of soft gypsum with saccharoidal texture which appears to weather light brown where in contact with claystone; minor coarsely crystalline gypsum with prominent cleavage planes
- 30% GREY FRIABLE DOLOMITE, moderately soft; contorted laminae and fragments to 5 mm diameter; this bed has slightly weathered appearance which may be in part caused by the presence of water which was encountered near the base of this core

CORE No. 13

Interval: 7.193 - 74.98 m (236'0" - 246'0")
Cut: 3.05 m (10'0") Recovered: 3.02 m (9'11")
Description:

71.96 - 72.16 m (236'1" - 236'9")
- 60% GYPSUM, white to clear; abundant irregular contorted laminae of acicular gypsum, and fragments of massive gypsum to 2 cm across
- 10% LIGHT BROWN TOUGH DOLOMITE, hard; fragments to 2 cm across
- 30% GREY FRIABLE DOLOMITE, moderately soft to soft; stained with limonite on joints and fractures

72.16 - 72.24 m (236'9" - 237'0")
- 70% GYPSUM, clear crystals to 10 cm across showing prominent cleavage, stained brown in parts by limonite
- 15% LIGHT BROWN TOUGH DOLOMITE, moderately hard; fragments to 1 cm across, and breccia in prominent vertical joints which intersect bed
- 15% GREY FRIABLE DOLOMITE, vuggy; contains fragments of dolomite, weathered in part

72.24 - 73.08 m (237'0" - 239'9")
- 80% GYPSUM, white to black, laminated; dips 70° at top grading to 45° at base; laminae slightly contorted, contains sparse irregular veins of acicular gypsum to 4 mm thick
- 18% GREY FRIABLE DOLOMITE, grey, weathers to brown near joints, contorted laminae and tracings of gypsum
- 2% LIGHT GREY TOUGH DOLOMITE, fragments to 2 cm across. The upper 0.50 m (1'8") of core contains a very prominent joint dipping at 80° and intersecting the top three beds; the joint is filled with weathered brown clay 5 mm thick and may be a minor fault with a small indeterminate displacement, along which the large influx of water occurred

73.08 - 73.25 m (239'9" - 240'4")
- 70% GYPSUM, white, coarsely crystalline; fragments to 5 cm across, contorted laminae in part, and as very sparse veins of acicular gypsum
- 20% GREY FRIABLE DOLOMITE, moderately soft; contorted laminae to 2 cm thick

5% GYPSIFEROUS DOLOMITE, grey, moderately hard; laminae in gypsum
5% GREY TOUGH DOLOMITE, hard; fragments to 2 cm across with calcite tracings

73.25 - 74.01 m (240'4" - 242'10")
80% GYPSUM, white, coarsely crystalline, brecciated
18% GREY FRIABLE DOLOMITE, stained brown by limonite; in most parts as filling of fractures in gypsum and solution cavities to 2 cm across
20% LIGHT BROWN TOUGH DOLOMITE, fragments to 1 cm across; bed contains solution cavities 5 cm across at 73.56 m (241'4") and 12 cm diameter at 73.94 m (242'7")

74.01 - 74.25 m (242'10" - 243'7")
40% GYPSUM, white, coarsely crystalline; massive fragments to 5 cm across
55% GREY FRIABLE DOLOMITE, matrix for gypsum, possibly filling solution cavities, contains sparse veins of acicular gypsum and calcite
5% GYPSUM, clear, extremely coarsely crystalline; fragments to 1 cm across in dolomite

74.25 - 74.55 m (243'7" - 244'7")
80% GYPSUM, white, coarsely crystalline, brecciated
18% GREY FRIABLE CLAYSTONE, stained brown by limonite; for most parts fills fractures in gypsum and solution cavities to 2 cm across
2% LIGHT BROWN TOUGH DOLOMITE, fragments to 1 cm across

74.55 - 74.57 m (244'7" - 244'8")
100% GYPSUM, clear; single crystals growing on irregular surface of underlying bed

74.57 - 74.81 m (244'8" - 245'5")
60% BROWN FRIABLE DOLOMITE, stained by limonite, weathered and washed away in part
40% GYPSUM, white; fragments of massive gypsum to 2 cm across and soft saccharoidal coarsely crystalline gypsum to 2 cm across, and larger fragments to 5 mm across of extremely coarsely crystalline gypsum with prominent cleavage planes. This bed is strongly brecciated and may be a fault zone with indeterminate displacement

74.81 - 74.98 m (245'5" - 246'0")
80% GYPSUM, white, coarsely crystalline, brecciated
18% GREY FRIABLE DOLOMITE, stained brown by limonite in part; fills fractures and solution cavities in gypsum
2% LIGHT BROWN TOUGH DOLOMITE, fragments to 1 cm across

CORE No. 14

Interval: 74.98 - 77.87 m (246'0" - 255'6")
Cut: 3.05 m (10'0") Recovered: 2.79 m (9'2")
Description:

75.08 - 75.23 m (246'4" - 246'10")
80% GYPSUM, white, saccharoidal texture, brecciated in part
15% BROWN FRIABLE DOLOMITE, soft, stained by limonite; tends to freton exposure, contorted laminae and irregular fragments to 1 cm across
5% LIGHT BROWN TOUGH DOLOMITE, hard; fragments to 2 cm across

75.23 - 75.29 m (246'10" - 247'0")
50% GREY FRIABLE DOLOMITE, soft, calcareous; tends to fret slightly,
25% GYPSUM, white to grey, coarsely crystalline; fragments to 5 mm across
25% LIGHT BROWN TOUGH DOLOMITE, hard; fragments to 5 mm across

75.29 - 76.91 m (247'0" - 252'4")
75% GYPSUM, white to black, brecciated; fragments to 10 cm across, sparse laminae of acicular gypsum (5%)
20% GREY FRIABLE DOLOMITE, laminae, tracings; and matrix for gypsum fragments, cut in places by veins of acicular gypsum to 4 mm thick
5% LIGHT BROWN TOUGH DOLOMITE, hard; fragments to 2 cm across; bed contains solution cavities 4 cm across at 76.65 m (251'6")
76.41 - 77.39 m (252'4" - 253'11")
55% GYPSUM, white, coarsely crystalline; rounded fragments to 5 mm across (25%), and laminae and fragments of acicular gypsum generally dip regularly at 30°
45% GREY FRIABLE DOLOMITE, matrix for gypsum fragments and as beds
77.39 - 77.87 m (253'11" - 255'6")
70% GYPSUM, white, coarsely crystalline; saccharoidal fragments to 4 cm across (30%); and uniform laminae of acicular gypsum to 6 mm thick dipping regularly at 30°
30% GREY FRIABLE DOLOMITE, matrix for fragments and laminae to 5 mm thick

CORE No. 15

Interval: 77.87 - 80.92 m (255'6" - 265'6")
Cut: 3.05 m (10'0") Recovered: 3.05 m (10'0")
Description:
77.87 - 78.38 m (255'6" - 257'2")
80% GYPSUM, white to black; fragments to 2 cm across; laminated in part; irregular veins of acicular gypsum to 7 mm thick (30%)
15% LIGHT BROWN TOUGH DOLOMITE, hard; fragments with laminae of gypsiferous dolomite to 2 cm across
5% GREY FRIABLE DOLOMITE, laminae and tracings
78.38 - 78.48 m (257'2" - 257'6")
90% GYPSUM, fine to medium grained, grey; poorly laminated in part, dips 45°
10% GREY FRIABLE DOLOMITE, grades to brown, moderately soft; laminae and tracings in gypsum
78.48 - 78.54 m (257'6" - 257'8")
60% GREY FRIABLE DOLOMITE, vuggy; forms matrix
40% GYPSUM, white; fragments to 1 cm across (10%), regular and fragmented laminae of acicular gypsum to 5 mm thick, and extremely coarse crystals with prominent cleavage planes to 5 mm across (10%)
78.53 - 79.20 m (257'8" - 260'2")
85% GYPSUM, white, brecciated in part; fragments to 5 cm across
15% GREY FRIABLE DOLOMITE, soft; tends to fret when exposed to water, irregular laminae and fills fractures; generally dips 45°
79.20 - 79.70 m (260'2" - 261'6")
90% GYPSUM, grey to black, massive, generally medium crystalline, laminated; dips 70°
10% GYPSIFEROUS DOLOMITE contorted laminae (5%), and in bed 2 cm thick showing boundinage structure with acicular gypsum filling tensional fractures; dips 70°
79.70 - 80.04 m (261'6" - 262'7")
85% GYPSUM, white to black; angular fragments to 10 cm across
15% GREY FRIABLE DOLOMITE, tends to fret on exposure to water; irregular laminae in gypsum matrix
80.04 - 80.92 m (262 7" - 265'6")
75% GYPSUM; white to light grey, laminated in part, brecciated in part; contains laminae of acicular gypsum to 4 mm thick (10%)
15% GREY FRIABLE DOLOMITE, tends to fret on exposure to water; laminae dip 30-60°
5% GYPSIFEROUS DOLOMITE, moderately hard; laminae in gypsum, slightly contorted in part

5% LIGHT BROWN TOUGH DOLOMITE, laminated in part; fragments to 9 cm across

Non-coring bit from 80.92 - 81.38 m (265'6" - 267'0")

CORE No. 16

Interval: 81.38 - 84.43 m (267'0" - 277'0")
Cut: 3.05 m (10'0") Recovered: 2.97 m (9'9")
Description:

81.46 - 82.45 m (267'3" - 270'6")
- 60% GYPSUM, black, coarsely crystalline; fragments to 10 cm across and sparse veins of acicular gypsum to 2 mm across
- 10% GYPSIFEROUS DOLOMITE, laminae in gypsum fragments
- 20% GREY FRIABLE DOLOMITE, matrix for fragments, and irregular fragments to 2 cm across
- 10% DARK BROWN TOUGH DOLOMITE, laminated in part; hard fragments to 10 cm across

82.45 - 83.01 m (270'6" - 272'4")
- 95% GYPSUM, black, coarsely crystalline, massive, slightly laminated, and contorted in part; generally dips 60°
- 5% GYPSIFEROUS DOLOMITE, laminae to 2 mm thick in gypsum

83.01 - 84.02 m (272'4" - 275'8")
- 70% GYPSUM, black, coarsely crystalline, laminated; in part as fragments to 12 cm across but generally smaller, and veins of acicular gypsum (15%) in matrix, and cement for fragments of gypsum
- 30% GREY FRIABLE DOLOMITE, matrix, and irregular fragments to 2 cm across

84.02 - 84.43 m (275'8" - 277'0")
- 70% GYPSUM, generally black, coarsely crystalline, massive; with concordant veins of acicular gypsum to 4 mm thick (5%)
- 30% GYPSIFEROUS DOLOMITE, grey, moderately soft; laminae to 4 mm thick dip 0-30°

CORE No. 17

Interval: 84.43 - 87.32 m (277'0" - 286'6")
Cut: 2.89 m (9'6") Recovered: 2.74 m (9'0")
Description:

84.58 - 84.88 m (277'6" - 278'6")
- 70% GYPSUM, generally black, coarsely crystalline, massive in part; contains concordant veins of acicular gypsum to 4 mm thick (5%)
- 30% GYPSIFEROUS DOLOMITE, grey, moderately soft; laminae in gypsum

84.88 - 85.01 m (278'6" - 278'11")
- 60% GREY FRIABLE DOLOMITE, contains very contorted tracings of gypsum
- 40% GYPSUM, white, medium crystalline; contains very contorted laminae of gypsiferous dolomite to 4 mm thick, and fragments to 10 cm across in matrix

84.88 - 85.34 m (278'6" - 280'0")
- 85% GYPSUM, black, massive in part, laminated in part, slightly contorted; dips 0-30°, contains laminae of acicular gypsum to 4 mm thick (10%)
- 15% GYPSIFEROUS DOLOMITE, grey, moderately hard; laminae in gypsum

85.34 - 85.93 m (280'0" - 281'11")
- 75% GYPSUM, white to dark grey, massive, coarsely crystalline; fragments from 5-10 cm across
- 23% GREY FRIABLE DOLOMITE, matrix for gypsum fragments
- 2% LIGHT BROWN TOUGH DOLOMITE, fragments to 2 cm across

85.93 - 86.44 m (281'11" - 283'7")
60% GYPSUM, white, coarsely crystalline, extremely contorted and brecciated in part; contain concordant and discordant laminae of prismatic gypsum to 5 mm thick
40% BLACK FRIABLE GYPSUM, moderately soft; laminae to 5 mm thick, slightly contorted, and matrix for fragments
86.44 - 87.32 m (283'7" - 286'6")
70% GYPSUM, white, laminated, coarsely crystalline, contorted and brecciated; in several zones, dips 45°
20% GREY FRIABLE DOLOMITE, calcareous; irregular laminae filling shear planes, and fragments to 2 cm across
10% GYPSIFEROUS DOLOMITE, dark grey; contorted laminae in gypsum

CORE No. 18

Interval: 87.48 - 90.22 m (287'0" - 296'0")
Cut: 2.74 m (9'0") Recovered: 2.62 m (8'7")
Description:
87.61 - 87.93 m (287'5" - 288'6")
75% GYPSUM, light grey, very coarsely crystalline, laminated; vertical dip
25% GYPSIFEROUS DOLOMITE, light grey; laminae in gypsum
87.93 - 88.64 m (288'6" - 290'10")
89% GYPSUM, black, massive; contains fragmented laminae of gypsiferous dolomite
10% GYPSIFEROUS DOLOMITE, grey to brown, moderately hard; laminae in gypsum
1% LIGHT BROWN TOUGH DOLOMITE, calcareous, very hard; rounded fragments to 2 cm across
88.64 - 88.90 m (290'10" - 291'8")
75% GYPSUM, light grey, coarsely crystalline, regularly laminated; vertical dip
25% GYPSIFEROUS DOLOMITE, light grey; laminae in gypsum
88.90 - 89.10 m (291'8" - 292'4")
40% GREY FRIABLE DOLOMITE, slightly calcareous; matrix
40% GREY TOUGH DOLOMITE, very calcareous; contains tracings of gypsiferous dolomite; fragments to 12 cm across
20% GYPSUM, white, acicular; veins to 2 cm thick cut dolomite, contains irregular dolomite inclusions to 1 cm across
89.10 - 90.22 m (292'4" - 296'0")
65% GYPSUM, white to grey, coarsely crystalline, regularly laminated; dips 80° at top, contains concordant laminae of acicular gypsum to 5 mm thick (10%), weathered and saccharoidal in basal 5 cm of interval
25% GYPSIFEROUS DOLOMITE, grey, moderately hard; laminae to 5 mm thick in gypsum
10% GREY FRIABLE DOLOMITE, matrix, irregular laminae and fragments to 2 cm across towards base
Note: Non-coring bit from 90.22 - 98.45 m (296'0" - 323'0")

CORE No. 19

Interval: 98.45 - 100.28 m (323'0" - 329'0")
Cut: 1.83 m (6'0") Recovered: 0.79 m (2'7")
Description:
99.19 - 100.17 m (325'5" - 328'8")
50% GYPSUM, white, coarsely crystalline; laminated fragments, contain numerous concordant and discordant laminae of acicular gypsum to 4 mm thick (10%)
30% GREY FRIABLE DOLOMITE, moderately hard, white streak; interlaminated with gypsum, and elongated fragments to 5 cm across

18% GREY FRIABLE DOLOMITE, grades to black, soft; contorted laminae to 5 mm thick
2% LIGHT BROWN TOUGH DOLOMITE, fragments to 2 cm across

100.17 - 100.28 m (328'8" - 329'0")
60% GREY FRIABLE DOLOMITE, frets on exposure to water; matrix (40%), and irregular fragments to 1 cm across (20%)
30% GYPSUM, white, coarsely crystalline; fragments (30%) and fragmented veins of acicular gypsum to 4 mm thick

Note: Non-coring bit from 100.28 m - 100.89 m (329'0" - 331'0")

CORE No. 20

Interval: 100.89 - 103.94 m (331'0" - 341'0")
Cut: 3.05 m (10'0") Recovered: 1.75 m (5'9")
Description:

102.19 - 102.31 m (335'3" - 335'8")
70% GYPSUM, white, coarsely crystalline, laminated; vertical dip
30% GYPSIFEROUS DOLOMITE, white to dark grey, moderately hard; laminae in gypsum

102.31 - 102.44 m (335'8" - 336'1")
60% GYPSUM, white, coarsely crystalline; laminated fragments to 4 cm across
40% GREY FRIABLE DOLOMITE, very soft; frets and washes away when exposed to water

102.44 - 103.00 m (336'1" - 337'11")
70% GYPSUM, white, coarsely crystalline, laminated throughout; vertical dip
30% GYPSIFEROUS DOLOMITE, light to dark grey, moderately hard; laminae in gypsum
Core is broken by horizontal joints with associated solution cavities up to 2 cm across

103.00 - 103.12 m (337'11" - 338'4")
60% GYPSUM, white, coarsely crystalline; laminated fragments to 4 cm acorss
40% GREY FRIABLE DOLOMITE, frets and washes away when exposed to water

103.12 - 103.56 m (338'4" - 339'9")
60% GYPSUM, white to black; finely interspersed with claystone in matrix (48%), laminae in dolomite (10%), and laminae of acicular gypsum to 8 mm thick (2%)
30% BLACK FRIABLE DOLOMITE, matrix
10% GREY TOUGH DOLOMITE, moderately hard; contains laminae of gypsum; fragments to 3 cm across
Bed is extremely weathered, friable in part, and contains several very prominent joints at 70°; possibly a minor fault zone

103.56 - 103.76 m (339'9" - 340'5")
70% GYPSUM, white, coarsely crystalline, laminated throughout; vertical dip
30% GYPSIFEROUS DOLOMITE, light to dark grey, moderately hard; laminae in gypsum

103.76 - 103.78 m (340'5" - 340'6")
50% GREY FRIABLE DOLOMITE, matrix
50% GYPSUM, white, weathered; saccharoidal texture (35%), irregular veins of acicular gypsum (15%), and as fragments in dolomite to 1 cm diameter
Bed is extensively weathered and tends to fret on exposure to water; may be a small fault zone

103.78 - 103.94 m (340'6" - 341'0")
60% GYPSUM, white, laminated dips 45°
30% GYPSIFEROUS DOLOMITE, light grey, moderately hard; laminae in gypsum
10% BLACK FRIABLE DOLOMITE, contorted laminae

CORE No. 21

Interval: 103.94 m - 106.99 m (341'0" - 351'0")
Cut: 3.05 m (10'0") Recovered: 1.22 m (4'0")
Description:
105.77 - 106.17 m (347'0" - 348'4")
70% GYPSUM, white, coarsely crystalline; very irregular laminae, fragmented in part, contains laminae of acicular gypsum
25% GYPSIFEROUS DOLOMITE, light grey, moderately hard; very contorted, fragmented and laminae in gypsum
5% GREY FRIABLE DOLOMITE, very contorted laminae, and fragments to 2 cm across
106.17 - 106.32 m (348'4" - 348'10")
60% GREY FRIABLE DOLOMITE, frets on exposure to water; laminae in gypsum (5%), laminae forms matrix (30%), and fragments to 2 cm across (25%)
40% GYPSUM, white to light grey, coarsely crystalline; fragments to 3 cm across containing laminae of dolomite (20%), and as veins of acicular gypsum to 5 mm across; bed is very friable and broken
106.32 - 106.99 m (348'10" - 351'0")
55% GREY FRIABLE DOLOMITE, tends to fret on exposure to water; contains contorted beds, and fragments to 5 cm across of laminated gypsum and irregular veins of acicular gypsum to 1 cm thick
45% GYPSUM, white, laminated; contorted beds, fragments, and veins of acicular gypsum to 1 cm across

CORE No. 22

Interval: 107.29 - 108.20 m (352'0" - 355'0")
Cut: 0.91 m (3'0") Recovered: 0.84 m (2'9")
Description:
107.37 - 107.90 m (352'3" - 354'0")
60% GYPSUM, white to black, laminated; very contorted and fragmented in part (40%), and black in pure gypsum with finely disseminated grey dolomite (20%)
20% GREY FRIABLE DOLOMITE, disseminated in gypsum
20% GYPSIFEROUS DOLOMITE, light grey, moderately hard; contorted laminae in gypsum
A solution cavity 3 cm across at 107.37 m (352'3") is filled with soft vuggy grey dolomite (80%), and a lens of prismatic gypsum crystals (20%)
107.90 - 108.20 m (354'0" - 355'0")
80% GYPSUM, white, coarsely crystalline, regularly laminated (70%); and dips 20°, and acicular gypsum veins filling fault plane (10%)
20% GYPSIFEROUS DOLOMITE, dark grey, moderately hard; laminae to 8 mm thick; bed contains a reverse fault with a displacement of 5 cm dipping at 60° with fault zone 1 cm wide filled with acicular gypsum

CORE No. 23

Interval: 108.51 - 111.56 m (356'0" - 366'0")
Cut: 3.05 m (10'0") Recovered: 2.82 m (9'3")
Description:
108.74 - 109.67 m (356'9" - 359'10")
65% GYPSUM, white, coarsely crystalline, laminated, contorted and fragmented in part towards base; contains laminae of acicular gypsum to 4 mm thick
25% GYPSIFEROUS DOLOMITE, light grey; contorted laminae in gypsum
10% GREY FRIABLE DOLOMITE, irregular lenses and fragments

109.67 - 110.64 m (359'10" - 363'0")
70% GYPSUM, white, coarsely crystalline, regularly laminated slightly contorted; dips 45-90°
15% SHALE, light grey, moderately hard; laminae in gypsum
10% GREY FRIABLE DOLOMITE, vuggy; contorted and very irregular fragments to 5 cm across
5% LIGHT BROWN TOUGH DOLOMITE, hard; angular fragments at top of bed to 2 cm across grading to 15 cm
Interval contains sub-horizontal joints widened by solution and filled with grey friable dolomite and lenses of gypsum crystals at 109.91 m (360'7") 110.18 m (361'6") 110.34 m (362'0") and 110.64 m (363'0")

110.64 - 111.15 m (364'8")
60% GYPSUM, white, coarsely crystalline, regularly laminated; dip 45°, contains sparse veins of acicular gypsum filling fractures
20% GYPSIFEROUS DOLOMITE, light grey, modrately hard; laminae in gypsum
20% GREY FRIABLE DOLOMITE, laminae and beds in gypsum to 3 cm thick

111.15 - 141.83 m (364'8" - 465'4")
50% GYPSUM, white, acicular; matrix for fragments of dolomite and fills fractured zones
50% GREY FRIABLE DOLOMITE, fragments to 5 cm across; generally even texture but contains tracings of gypsum in part

141.83 - 111.56 m (365'4" - 366'0")
80% GYPSUM, white, coarsely crystalline, laminated; dips regularly at 20°
20% GYPSIFEROUS DOLOMITE, light grey, moderately hard; laminae in gypsum

CORE No. 24

Interval: 111.56 - 114.61 m (366'0" - 376'0")
Cut: 3.05 m (10'0") Recovered: 1.86 m (6'1")
Description:

112.75 - 114.18 m (369'11" - 374'7")
70% GYPSUM, white, coarsely crystalline, laminated and contorted, brecciated in part
30% GYPSIFEROUS DOLOMITE, light grey, moderately hard; laminae in gypsum, and finely disseminated with fine gypsum fragments to form breccia matrix for gypsum fragments

114.18 - 114.61 m (374'7" - 376'0")
60% GYPSUM, white, coarsely crystalline, laminated and contorted, brecciated in part
30% SHALE, light grey, moderately hard; laminae in gypsum and fine fragments forming a brecciated matrix for gypsum
10% GREY TOUGH DOLOMITE, fragments to 5 cm across with discordant irregular veins of acicular gypsum to 5 mm across

CORE No. 25

Interval: 114.91 - 117.96 m (377'0" - 387'0")
Cut: 3.05 m (10'0") Recovered: 2.99 m (9'10")
Description:

114.96 - 115.19 m (377'2" - 377'11")
60% GYPSUM, white, coarsely crystalline, laminated and contorted, brecciated in part
30% GYPSIFEROUS DOLOMITE, light grey; laminae in gypsum and finely disseminated fragments which form matrix for gypsum fragments
10% GREY TOUGH DOLOMITE, fragments to 5 cm across; contains discordant irregular veins of acicular gypsum

115.19 - 115.29 m (377'11" - 378'3")
60% GREY FRIABLE DOLOMITE, bed dips 45°
30% GYPSUM, white, coarsely crystalline, slightly laminated; rounded fragments to 3 cm across
10% GREY TOUGH DOLOMITE, fragments to 1 cm across
115.29 - 115.65 m (378'3" - 379'5")
70% GYPSUM, white, coarsely crystalline, regularly laminated; dips 45°
30% GYPSIFEROUS DOLOMITE, moderately hard, light grey; laminae in gypsum
Bed terminated at base by shear plane
115.65 - 116.00 m (379'5" - 380'7")
50% GYPSUM, white, coarsely crystalline, regularly laminated; dips 70°
50% GREY FRIABLE DOLOMITE, laminae in gypsum
116.00 - 116.46 m (380'7" - 382'1")
70% GYPSUM, white, coarsely crystalline, regularly laminated
30% GYPSIFEROUS DOLOMITE, moderately hard; laminae in gypsum; dip 70°
116.46 - 116.82 m (382'1" - 383'3")
60% GYPSUM, white, coarsely crystalline, regularly laminated; horizontal, contains laminae of acicular gypsum to 1 cm thick generally concordant with bedding
30% GYPSIFEROUS DOLOMITE, light grey, moderately hard laminae in gypsum
10% GREY TOUGH DOLOMITE, hard; generally even texture with slightly laminated parts; fragments subrounded to 10 cm across
116.82 - 117.35 m (383'3" - 385'0")
80% GYPSUM, white, coarsely crystalline; rounded regularly laminated fragments to 10 cm across in matrix of gypsum with contorted and discontinuous laminae of gypsiferous dolomite and grey friable dolomite
15% GYPSIFEROUS DOLOMITE, grey; moderately hard laminae in gypsum
5% GREY FRIABLE DOLOMITE, irregular laminae and very irregular fragments to 2 cm across
117.35 - 117.96 m (380'0" - 387'0")
65% GYPSUM, white, coarsely crystalline; rounded regularly laminated fragments to 10 cm across in matrix of gypsum with contorted and discontinuous laminae of shale and claystone
25% GYPSIFEROUS DOLOMITE, light grey, moderately hard laminae in gypsum
10% GREY TOUGH DOLOMITE, irregular laminae and very irregular fragments to 2 cm across

CORE No. 26

Interval: 117.96 - 121.01 m (387'0" - 397'0")
Cut: 3.05 m (10'0") Recovered: 2.89 m (9'6")
Description:
118.11 - 118.80 m (387'6" - 389'9")
65% GYPSUM, white, coarsely crystalline; fragments to 2 cm across but generally smaller, and concordant and discordant veins of acicular gypsum to 5 mm across, brecciated and discontinuous in part
30% GREY FRIABLE DOLOMITE, soft, puggy; matrix for gypsum fragments and as irregular bodies to 2 cm across
5% LIGHT BROWN TOUGH DOLOMITE, hard, laminated; fragments to 2 cm across
118.80 - 119.61 m (389'9" - 392'5")
60% GYPSUM, white, coarsely crystalline, laminated in part; fragments to 5 cm across
30% GREY FRIABLE DOLOMITE, matrix for gypsum fragments and as laminae and irregular bodies to 2 cm across
10% GYPSIFEROUS DOLOMITE, light grey, soft; laminae in gypsum
119.61 - 121.01 m (392'5" - 397'0")
75% GYPSUM, white, coarsely crystalline, laminated; either slightly contorted or, brecciated in part, with fragments to 12 cm across in a matrix of fine gypsum fragments
25% GREY FRIABLE DOLOMITE, lenticular laminae in gypsum, irregular bodies to 5 cm across, and disseminated in finely brecciated gypsum matrix

CORE No. 27

Interval: 121.01 - 124.05 m (397'0" - 407'0")
Cut: 3.05 m (10'0") Recovered: 1.93 m (6'4")
Description:

122.12 - 122.66 m (400'8" - 402'5")
- 75% GYPSUM, white, coarsely crystalline, laminated and slightly contorted; fragmented in part
- 25% GREY FRIABLE DOLOMITE, lenticular laminae in gypsum, and irregular bodies to 5 mm across, finely disseminated in finely brecciated gypsum matrix

122.66 - 123.22 m (402'5" - 404'3")
- 60% GYPSUM, white, coarsely crystalline, laminated, contorted in part; fragments to 10 cm across, in matrix of finely brecciated gypsum
- 30% GYPSIFEROUS DOLOMITE, light grey, moderately hard; laminae to 5 mm thick in gypsum
- 10% GREY FRIABLE DOLOMITE, laminae and irregular bodies to 2 cm across in matrix of finely brecciated gypsum

123.22 - 124.05 m (404'3" - 307'0")
- 70% GYPSUM, white, coarsely crystalline, brecciated; fragments to 5 cm across, slightly contorted (50%), and as matrix of finely brecciated gypsum with sparse acicular gypsum surrounding dolomite fragments
- 20% GREY FRIABLE DOLOMITE, disseminated in gypsum matrix
- 9% GYPSIFEROUS DOLOMITE, light grey, moderately hard; laminae in gypsum
- 1% LIGHT BROWN TOUGH DOLOMITE, one fragment 10 cm across

CORE No. 28

Interval: 124.05 - 125.58 m (407'0" - 412'0")
Cut: 1.52 m (5'0") Recovered: 1.42 m (4'8")
Description:

124.16 - 124.44 (407'4⅓" - 408'3")
- 80% DARK GREY TOUGH DOLOMITE, regularly, laminated very hard; angular fragments to 5 cm across, and beds at base 2 cm across dip 20°
- 15% GYPSUM, white, acicular; veins filling fractures to 1 cm thick to form matrix, and filling tension fractures in bed of dolomite
- 5% GREY FRIABLE DOLOMITE, finely disseminated in matrix and very irregular bodies to 5 mm across

124.44 - 124.76 m (408'3" - 409'4")
- 40% GYPSUM, white to black; matrix of finely brecciated black gypsum fragments with disseminated dolomite (20%), and irregular veins of acicular gypsum to 5 mm thick
- 30% GREY FRIABLE DOLOMITE, beds to 2 cm thick dip 45°, and lenticular but irregular bodies to 2 cm thick elongated parallel to bedding, and disseminated in matrix
- 30% LIGHT BROWN TOUGH DOLOMITE, regularly laminated; beds up to 2 cm thick

Interval terminated at base by shear plane dipping 20°

124.76 - 125.30 m (409'4" - 411'1")
- 80% GYPSUM, white, coarsely crystalline, regularly laminated, dip 45° at top to 90° at base
- 18% GYPSIFEROUS DOLOMITE, grey, moderately soft; regular laminae to 5 mm thick, slightly contorted at base
- 2% BLACK TOUGH DOLOMITE, very hard; subrounded fragments to 3 cm across containing irregular black soft dolomite tracings

125.30 - 125.58 m (411'1" - 412'0")
- 100% BLACK TOUGH DOLOMITE, very hard, medium crystalline; contains tracings of soft black dolomite, beds very irregular in top 18 cm but dips regularly at 45° below 123.48 m

CORE No. 29

Interval: 125.58 - 128.63 m (412'0" - 422'0")
Cut: 3.05 m (10'0") Recovered: 2.82 m (9'3")
Description:

125.58 - 125.88 m (412'0" - 413'0")
100% BLACK TOUGH DOLOMITE, very hard, medium crystalline; contains tracings of black soft dolomite and sparse crystals of gypsum to 3 mm across in 3 cm thick bed at 125.73 m (412'6")
Base of bed dips 45°

125.88 - 125.96 m (413'0" - 413'3")
100% GYPSUM, black, coarsely crystalline, massive, even texture; bed dips 45°

125.96 - 127.84 m (413'3" - 419'5")
70% GYPSUM, white, regularly laminated, coarsely crystalline; dips from 45° to 90°, contains 15 cm brecciated zone from 127.18 m (417'3") to 127.33 m (417'9") with rounded fragments to 5 cm across, contains concordant laminae of acicular gypsum to 5 mm thick (10%)
30% GYPSIFEROUS DOLOMITE, grey, moderately soft; regular laminae

127.84 - 128.10 m (419'5" - 420'3")
50% BLACK TOUGH DOLOMITE, very hard, massive; rounded fragments to 10 cm across
45% GYPSUM, white, coarsely crystalline, finely brecciated
5% GREY FRIABLE DOLOMITE, moderately hard, tracings, and fragments disseminated in matrix to 5 mm across

128.10 - 128.40 m (420'3" - 421'3")
65% GYPSUM, white, coarsely crystalline, laminated, contorted in part, slightly brecciated towards top
30% GYPSIFEROUS DOLOMITE, black, moderately hard; laminae and tracings
5% GREY FRIABLE DOLOMITE, tracings in gypsum

CORE No. 30

Interval: 128.63 - 131.67 m (422'0" - 432'0")
Cut: 3.05 m (10'0") Recovered: 2.92 m (9'7")
Description:

128.81 - 129.64 m (422'7" - 425'4")
65% GYPSUM, white, coarsely crystalline, laminated, contorted, slightly brecciated in part
30% GYPSIFEROUS DOLOMITE, black, moderately hard; laminae and tracings
5% GREY FRIABLE DOLOMITE, tracings

129.64 - 130.18 m (425'4" - 427'1")
60% GYPSUM, white, coarsely crystalline, regularly laminated; dips 30°, contains concordant laminae of acicular gypsum to 5 mm thick
20% GREY TOUGH DOLOMITE, hard; regular beds to 2 cm thick, with sparse gypsum laminae to 5 mm thick
20% GYPSIFEROUS DOLOMITE, dark grey; laminae to 2 cm thick

130.18 - 130.63 m (427'1" - 428'7")
60% GYPSUM, white, coarsely crystalline, laminated, contorted in part, slightly brecciated in top 20 cm; contains sparse irregular veins of acicular gypsum
20% GYPSIFEROUS DOLOMITE, grey, moderately hard; contorted laminae
20% GREY FRIABLE DOLOMITE, tracings and irregular lenticular bodies in gypsum

130.63 - 131.06 m (428'7" - 430'0")
70% GYPSUM, white, coarsely crystalline, regularly laminated, dips 30°
20% GREY TOUGH DOLOMITE, laminated; contains veins of acicular gypsum to 2 mm filling tension fractures
10% GYPSIFEROUS DOLOMITE, grey, moderately hard; laminae to 2 mm thick

131.06 - 136.67 m (430'0" - 432'0")
90% GYPSUM, white, coarsely crystalline, regularly laminated; dips 30°, composed dominantly of laminae of acicular gypsum to 5 mm thick
5% GYPSIFEROUS DOLOMITE, grey, moderately hard; tracings and sparse laminae in gypsum
5% GREY FRIABLE DOLOMITE, lenticular laminae in gypsum to 5 mm thick

CORE No. 31

Interval: 131.67 - 134.72 m (432'0" - 442'0")
Cut: 3.05 m (10'0") Recovered: 3.05 m (10'0")
Description:
131.67 - 132.43 m (432'0" - 434'6")
90% GYPSUM, white, coarsely crystalline, regularly laminated; dips 20°, composed dominantly of laminae of acicular gypsum to 5 mm thick
5% GYPSIFEROUS DOLOMITE, moderately hard, grey; tracings and sparse laminae in gypsum
5% GREY FRIABLE DOLOMITE, soft; lenticular laminae in gypsum
132.43 - 133.07 m (434'6" - 436'7")
60% GYPSUM, white, coarsely crystalline, laminated, contorted and fragmented in part
40% GREY FRIABLE DOLOMITE, contorted laminae to 5 mm thick in gypsum, and irregular elongated fragments
133.07 - 133.50 m (436'7" - 438'0")
85% GYPSUM, white, coarsely crystalline, regularly laminated; dips from 60° at top to 10° at base
15% GYPSIFEROUS DOLOMITE, moderately hard; laminae and tracings in gypsum
133.50 - 134.09 m (438'0" - 439'11")
70% GYPSUM, white, coarsely crystalline, even texture, massive; and veins of acicular gypsum filling fractures in dolomite
20% BLACK TOUGH DOLOMITE, very hard; fragments to 15 cm across; contains contorted laminae of black soft dolomite
10% GREY FRIABLE DOLOMITE, soft; irregular lenticular bodies to 12 cm across
134.09 - 134.72 m (439'11" - 442'0")
65% GYPSUM, white, coarsely crystalline, laminated, brecciated and fragmented
33% GREY FRIABLE DOLOMITE, extremely contorted tracings and laminae to 2 mm thick, and fragments to 2 cm across towards top
2% BLACK TOUGH DOLOMITE, very hard; fragments to 2 cm across towards top

CORE No. 32

Interval: 134.72 - 137.16 m (442'0" - 450'0")
Cut: 2.44 m (8'0") Recovered: 2.44 m (8'0")
Description:
134.72 - 135.33 m (442'0" - 444'0")
80% GYPSUM, white; generally even texture but laminated in part with fractures and slightly contorted laminae, and veins of acicular gypsum to 2 cm thick with subvertical orientation.
15% GREY FRIABLE DOLOMITE, subvertical laminae and beds to 1 cm thick, and irregular tracings
5% GYPSIFEROUS DOLOMITE, dark grey; laminae in gypsum to 5 mm thick
135.33 - 135.43 m (444'0" - 444'4")
70% GREY FRIABLE DOLOMITE, frets on exposure to water; dips 45°
30% GYPSUM, white; irregular veins of acicular gypsum to 4 mm thick, fragmented in part (20%), and fragments of coarsely crystalline gypsum to 5 mm across

135.43 - 135.69 m (444'4" - 445'2")
60% GYPSUM, white, coarsely crystalline; dips 90°, contains sparse discordant veins of acicular gypsum
40% GYPSIFEROUS DOLOMITE, very dark grey to black moderately hard as laminae to 5 mm diameter

135.69 - 136.19 m (445'2" - 446'10")
75% GYPSUM, white, coarsely crystalline, laminated and contorted in part, and as sparse veins of acicular gypsum; laminae sparse in basal 12 cm of bed
20% GYPSIFEROUS DOLOMITE, black, moderately hard; contorted and discontinuous laminae to 2 mm thick
5% BLACK TOUGH DOLOMITE, very hard, medium crystalline; fragments to 2 cm across, contains sparse veins of acicular gypsum to 1 mm thick

136.19 - 136.30 m (446'10" - 447'2")
95% BLACK TOUGH DOLOMITE, very hard, medium crystalline; bed dips 30°
5% GYPSUM, white, prismatic; filling veins normal to bedding

134.77 - 136.91 m (442'2" - 449'2")
80% GYPSUM, white; generally even texture, laminated in part
10% GYPSIFEROUS DOLOMITE, light grey, moderately hard; contorted and discontinuous laminae
8% GREY FRIABLE DOLOMITE, moderately soft, lenticular laminae to 5 mm thick and irregular fragments to 2 cm across
2% BLACK TOUGH DOLOMITE, medium crystalline, very hard; fragments to 2 cm across

136.91 - 137.06 m (449'2" - 449'8")
70% GREY FRIABLE DOLOMITE, frets on exposure to water, bed dips 45°
30% GYPSUM, white; irregular veins of acicular gypsum to 2 mm thick, fragmented in part (20%), and fragments of coarsely crystalline gypsum to 5 mm across

137.06 - 137.16 m (449'8" - 450'0")
90% GYPSUM, white, coarsely crystalline, laminated
10% GYPSIFEROUS DOLOMITE, grey; laminae and tracings to 2 mm thick

CORE No. 33

Interval: 137.16 - 140.21 m (450'0" - 460'0")
Cut: 3.05 m (10'0") Recovered: 1.27 m (4'2")
Description:

138.93 - 140.21 m (455'10" - 460'0")
65% GYPSUM, white to light grey, laminated; fragments to 10 cm across in matrix of acicular gypsum veins to 5 mm thick, and as very fine fragments
15% GYPSIFEROUS DOLOMITE, light grey, moderately hard; laminae and tracings in gypsum fragments
20% GREY FRIABLE DOLOMITE, finely disseminated through gypsum matrix, fragments to 2 cm across, and irregular lenticular laminae

CORE No. 34

Interval: 104.21 - 143.26 m (460'0" - 470'0")
Cut: 3.05 m (10'0") Recovered: 2.52 m (8'3")
Description:

140.21 - 141.10 m (460'0" - 462'11")
85% GYPSUM, white, coarsely crystalline, regularly laminated; dips from 20° at top to 45° at base
15% GYPSIFEROUS DOLOMITE, light grey, moderately hard; regular laminae

141.10 - 141.30 m (462'11" - 463'7")
60% GREY FRIABLE DOLOMITE, moderately soft matrix
40% GYPSUM, white, coarsely crystalline; fragments to 10 cm across but generally less than 1 cm (30%), and irregular veins of acicular gypsum in matrix to 2 mm thick
141.30 - 141.63 (463'7" - 464'8")
70% GYPSUM, white, coarsely crystalline, laminated; dips 45°
30% GYPSIFEROUS DOLOMITE, grey, moderately hard; laminae to 2 mm thick
141.63 - 141.93 m (464'8" - 465'8")
70% GYPSUM, white, laminated, finely fragmented in part (40%), and acicular gypsum veins to 2 cm thick (30%)
30% GYPSIFEROUS DOLOMITE, grey, moderately soft; fragments to 2 cm across
141.93 - 142.73 m (465'8" - 468'3")
70% GREY FRIABLE DOLOMITE, frets on exposure to water
29% GYPSUM, white, coarsely crystalline; elongated fragments to 3 cm across in dolomite, slightly laminated in part
1% BLACK TOUGH DOLOMITE, hard; sparse fragments to 2 cm across

CORE No. 35

Interval: 143.26 - 146.30 m (470'0" - 480'0")
Cut: 3.05 m (10'0") Recovered: 1.14 m (3'9")
Description:
145.17 - 145.39 m (476'3" - 477'0")
80% GYPSUM, white, coarsely crystalline; laminated fragments to 10 cm across in matrix of finely brecciated gypsum
15% GREY FRIABLE DOLOMITE, moderately soft, finely disseminated through gypsum and as laminae
5% GYPSIFEROUS DOLOMITE, light grey, moderately hard; laminae in gypsum fragments
145.39 - 145.49 m (477'0" - 477'4")
80% GREY FRIABLE DOLOMITE, matrix
20% GYPSUM, irregular veins of acicular gypsum to 5 mm thick, fragmented in part
145.49 - 145'64 m (477.4" - 477'10")
60% GREY FRIABLE DOLOMITE, matrix
40% GYPSUM, coarsely crystalline; fragments to 3 cm across (10%), and irregular and fragmented veins of acicular veins to 5 mm thick (30%)
145.64 - 145.84 m (477'10" - 478'6")
50% LIGHT BROWN TOUGH DOLOMITE, laminated and contorted in part; fragments to 3 cm across
50% DARK GREY TOUGH DOLOMITE, hard; elongated fragments to 3 cm across
145.84 - 146.05 m (478'6" - 479'2")
70% GYPSUM, white, coarsely crystalline; regularly laminated fragments to 10 cm across; contain veins of acicular gypsum to 5 mm thick of dolomite surrounding and cross-cutting fragments
20% GYPSIFEROUS DOLOMITE, light grey; contorted tracings and laminae in gypsum
8% BLACK TOUGH DOLOMITE, very hard, medium crystalline, laminated; sparse tracings of gypsum
2% LIGHT BROWN TOUGH DOLOMITE, hard; fragments to 1 cm across
146.05 - 146.20 m (479'2" - 479'8")
70% GYPSUM, white, coarsely crystalline, regularly laminated; dips 30°, contains sparse laminae of acicular gypsum to 2 mm thick
30% GYPSIFEROUS DOLOMITE, grey, moderately hard laminae
146.20 - 146.30 m (479'8" - 480'0")
60% GREY FRIABLE DOLOMITE, matrix
40% GYPSUM, coarsely crystalline, laminated; fragments to 3 cm across (10%), and irregular and fragmented veins of acicular gypsum to 5 mm thick

CORE No. 36

Interval: 146.30 - 149.35 m (480'0" - 490'0")
Cut: 3.05 m (10'0") Recovered: 0.79 m (2'7")
Description:

148.57 - 148.77 m (487'5" - 488'1")
- 50% BLACK TOUGH DOLOMITE, very hard; angular fragments to 2 cm across
- 40% GYPSUM, white; matrix of acicular veins to 5 mm thick between fragments
- 10% LIGHT BROWN TOUGH DOLOMITE, moderately hard; fragments to 1 cm across

148.77 - 148.87 m (488'1" - 488'5")
- 70% GYPSUM, white, coarsely crystalline; laminated fragments to 2 cm across in sparse matrix of brecciated gypsum, and irregular veins of acicular gypsum to 2 mm thick (10%)
- 15% GREY FRIABLE DOLOMITE, finely disseminated through gypsum matrix
- 15% LIGHT BROWN TOUGH DOLOMITE, hard, laminated; fragments to 1 cm across

148.87 - 149.08 m (488'5" - 489'1")
- 90% GREY FRIABLE DOLOMITE, moderately soft, becomes white when dry, broken at top and base
- 10% GYPSUM, white to black, coarsely crystalline; angular fragments to 1 cm across in dolomite matrix

149.08 - 149.23 m (489'1" - 489'7")
- 70% GYPSUM, white, coarsely crystalline; laminated fragments to 2 cm across in sparse matrix of brecciated gypsum, and irregular veins of acicular gypsum to 5 mm thick (10%)
- 30% GREY FRIABLE DOLOMITE, disseminated through gypsum matrix

149.23 - 149.35 m (489'7" - 490'0")
- 84% BROWN FRIABLE DOLOMITE, soft in top 50 cm, contains angular fragments of soft dolomite from dark orange-brown to light grey and grey-green, random orientation (20%)
- 15% GYPSUM, white, coarsely crystalline, even texture; subrounded fragments to 2 cm across (8%), veins of acicular gypsum to 5 mm thick cutting dolomite and surrounding fragments (2%), and finely disseminated grains to 3 mm across throughout dolomite (5%)
- 1% GREY TOUGH DOLOMITE, hard, slightly laminated; fragments to 2 cm across

CORE No. 37

Interval: 149.35 - 152.40 m (490'0" - 500'0")
Cut: 3.05 m (10'0") Recovered: 3.05 m (10'0")
Description:

149.35 - 150.80 m (490'0" - 494'9")
- 84% DARK BROWN FRIABLE DOLOMITE, soft in top 50 cm; contains angular fragments of dolomite from dark orange-brown to light grey and grey-green; random orientation (20%)
- 15% GYPSUM, white, coarsely crystalline; subrounded fragments to 2 cm across with even texture (8%), veins of acicular gypsum to 5 mm thick cutting dolomite and surrounding fragments (2%), and finely disseminated grains throughout friable dolomite to 3 mm across (5%)
- 1% GREY TOUGH DOLOMITE, hard, slightly laminated; fragments to 2 cm across

150.80 - 150.93 m (494'9" - 495'2")
- 60% GYPSUM, white, coarsely crystalline, even texture; rounded fragments to 5 cm across (40%), and grains to 5 mm across (20%)
- 40% GREY FRIABLE DOLOMITE, moderately soft; matrix

150.93 - 152.40 m (495'2" - 500'0")
- 85% DARK BROWN FRIABLE DOLOMITE, soft in part; contains angular fragments of dolomite from dark orange-brown to light grey and grey-green, random orientation (20%)
- 15% GYPSUM, white, coarsely crystalline; subrounded fragments to 2 cm across, and single fragments 20 cm across from 151.75 m (497'10")

to 151.97 m (498'7") with even texture (8%), veins of acicular gypsum to 5 mm thick cutting dolomite in part (2%), and finely diseminated grains to 3 mm across throughout dolomite (5%)

CORE No. 38

Interval: 152.40 - 155.45 m (500'0" - 510'0")
Cut: 3.05 m (10'0") Recovered: 2.97 m (9'9")
Description:
152.48 - 152.99 m (500'3" - 501'11")
50% LIGHT BROWN FRIABLE DOLOMITE, contains sparse fragments of orange-brown to grey-green dolomite to 1 cm across
50% GYPSUM, white, coarsely crystalline; rounded poorly laminated fragments to 10 cm across (45%), and small grains to 5 mm across in dolomite (5%)
152.99 - 154.53 m (501'11" - 507'0")
70% GREY-BROWN FRIABLE DOLOMITE, moderately soft; contains fragments of soft dolomite to 1 cm across (20%)
30% GYPSUM, white, coarsely crystalline; rounded fragments to 10 cm across (20%), and coarse grains max. 5 mm across (10%), and fragments 15 cm across from 154.10 - 154.26 m (505'7" - 506'1")
154.53 - 155.24 m (507'0" - 509'4")
50% GREY-BROWN FRIABLE DOLOMITE, moderately soft; contains sparse fragments of orange-brown to grey-green soft dolomite to 1 cm across
50% GYPSUM, white, coarsely crystalline; rounded laminated fragments to 10 cm across (45%), and small grains to 5 mm across in dolomite (5%)
155.24 - 155.45 m (509'4" - 510'0")
90% GREY FRIABLE DOLOMITE, contains grains of orange-brown to grey-green soft dolomite to 3 mm across
10% GYPSUM, white, coarsely crystalline; laminated fragments to 5 cm across but mostly 1 cm (8%), and grains to 5 mm across (2%)

CORE No. 39

Interval: 155.45 - 158.50 m (510'0" - 520'0")
Cut: 3.05 m (10'0") Recovered: 2.89 m (9'6")
Description:
155.60 - 158.17 m (510'6" - 518'11")
84% GREY FRIABLE DOLOMITE, soft, in part contains fragments of soft dolomite generally grey-green to 2 cm across (10%)
15% GYPSUM, white, coarsely crystalline; fragments generally 4 cm across (10%), grains in dolomite matrix to 5 mm across (5%), and minor veins of acicular gypsum to 2 mm across in dolomite
1% GREY TOUGH DOLOMITE, laminated in part; fragments
158.17 - 158.50 m (518'11" - 520'0")
99% GREY FRIABLE DOLOMITE, puggy when wet; contains angular fragments of soft dolomite generally grey-green to 2 cm across
1% GYPSUM, white, coarsely crystalline; angular fragments to 5 mm across throughout dolomite

Cores Nos. 38 and 39 were pieced together after wind blew over core container and there may be slight inaccuracies in descriptions

CORE No. 40

Interval: 158.50 - 161.54 m (520'0" - 530'0")
Cut: 3.05 m (10'0") Recovered: 2.84 m (9'4")
Description:
158.70 - 160.41 m (520'8" - 526'3")
90% GREY FRIABLE DOLOMITE, soft; from 158.93 - 159.41 m (521'6" - 523'0") contains fragments of soft dolomite, from red-brown to grey-green
9% GYPSUM, white, coarsely crystalline; fragments to 2 cm across more prominent towards top (6%), and grains in soft dolomite matrix to 5 mm across (4%), and minor veins of acicular gypsum to 2 mm thick
1% GREY TOUGH DOLOMITE, laminated in part
160.41 - 161.11 m (526'3" - 528'7")
79% LIGHT BROWN FRIABLE DOLOMITE, soft in part; contains fragments of soft dolomite, mostly grey-green, to 2 cm across (20%)
20% GYPSUM, white, coarsely crystalline; fragments to 10 cm across but mostly about 4 cm (10%), and grains in friable dolomite matrix to 5 mm across (10%), and minor veins of acicular gypsum to 2 mm thick
1% GREY TOUGH DOLOMITE, laminated in parts
161.11 - 161.54 m (528'7" - 530'0")
58% GYPSUM, white, coarsely crystalline, laminated; rounded fragments to 10 cm across
40% GREY FRIABLE DOLOMITE, moderately soft; contains fragments of grey-green to olive brown soft dolomite (10%)
2% GYPSIFEROUS DOLOMITE, light grey, moderately hard; laminae
Note: Non coring bit from 161.54 - 164.59 m (530'0" - 540'0")
Lithology probably grey friable dolomite

CORE No. 41

Interval: 164.59 - 167.64 m (540'0" - 550'0")
Cut: 3.05 m (10'0") Recovered: 2.74 m (9'0")
Description:
164.90 - 165.54 m (541'0" - 543'1")
40% GYPSUM, white, coarsely crystalline, laminated and contorted; in part as tightly isoclinally folded bed 30 cm thick
40% GYPSIFEROUS DOLOMITE, light grey, moderately hard; laminae to 5 mm thick
20% GREY FRIABLE DOLOMITE, moderately soft; laminae, and irregular bodies throughout gypsum; contains fragments of gypsum to 3 cm across possibly filling shear planes
165.54 - 166.37 m (543'1" - 545'10")
70% GYPSUM, white, coarsely crystalline, fragments to 4 cm across laminated
20% GREY FRIABLE DOLOMITE, moderately soft; matrix for gypsum fragments, contains small grains of gypsum to 3 mm across, and fragments to 10 cm across with fine crystals of gypsum and veins of acicular gypsum throughout
10% GYPSIFEROUS DOLOMITE, moderately hard; laminae in gypsum, contorted in part
166.37 - 167.06 m (545'10" - 548'1")
70% GYPSUM, white, coarsely crystalline; regularly laminated, dips 90°
30% GYPSIFEROUS DOLOMITE, light grey, moderately hard; laminae in gypsum
167.06 - 167.64 m (548'1" - 550'0")
65% GYPSUM, white, coarsely crystalline, regularly laminated; dip from 60° at top to 30° at base
25% GYPSIFEROUS DOLOMITE, light grey; laminae to 1 cm thick, broken into fragments in part (boundinage structure), with acicular gypsum filling fractures
10% GREY FRIABLE DOLOMITE, laminae to 5 mm thick

CORE No. 42

Interval: 167.64 - 170.69 m (550'0" - 560'0")
Cut: 3.05 m (10'0") Recovered: 2.26 m (7'5")
Description:

168.43 - 168.58 m (552'7" - 553'1")
- 40% GYPSUM, white, laminated; fragments to 2 cm across
- 40% DARK GREY-BROWN DOLOMITE, hard, fragments to 10 cm across (20%), and laminae to 5 mm thick in gypsum fragments (20%)
- 20% GREY FRIABLE DOLOMITE, moderately hard; matrix and irregular bodies to 1 cm across containing small grains of gypsum to 3 mm across

168.58 - 169.57 m (553'1" - 556'4")
- 80% GREY-BROWN TOUGH DOLOMITE, moderately hard, slightly calcareous, regularly laminated, dips 45° at top at 90° at base
- 20% GYPSUM, white, coarsely crystalline; laminae in dolomite to 3 mm thick

169.57 - 169.87 m (556'4" - 537'4")
- 60% GYPSUM, very coarsely crystalline; grains to 1 mm across
- 40% GREY FRIABLE DOLOMITE, moderately hard; matrix for gypsum grains, and contorted tracings in part

169.87 - 170.11 m (557'4" - 558'1")
- 90% GREY-BROWN TOUGH DOLOMITE, moderately hard, massive; generally even texture
- 10% GYPSUM, white; laminae and irregular veins of acicular gypsum dip 30°

170.11 - 170.69 m (558'1" - 560'0")
- 50% GYPSUM, white, coarsely crystalline; regular bed 3 cm thick dips 70° at top (10%), laminated fragments to 2 cm across throughout (25%), grains to 3 mm across in matrix (10%), and irregular veins of acicular gypsum cutting fragments and matrix (5%)
- 30% GREY TOUGH DOLOMITE, moderately hard; fragments to 2 cm across, with irregular cross-cutting veins of acicular gypsum
- 20% GREY FRIABLE DOLOMITE, moderately hard to moderately soft; irregular tracings and lenticular laminae throughout bed (5%), and matrix, with finely disseminated gypsum grains for fragments

CORE No. 43

Interval: 170.69 - 173.74 m (560'0" - 570'0")
Cut: 3.05 m (10'0") Recovered: 1.65 m (5'5")
Description:

172.09 - 172.26 m (564'7" - 565'2")
- 50% GREY TOUGH DOLOMITE, moderately hard, laminated, gypsiferous in part, contorted in part; fragments to 10 cm across
- 40% GYPSUM, white, coarsely crystalline; contorted bed 2 cm thick, and grains to 3 mm across in dolomite matrix
- 10% GREY FRIABLE DOLOMITE, osft; matrix, dominant towards top of bed

172.26 - 173.53 m (565'2" - 569'4")
- 95% GREY FRIABLE DOLOMITE, contains fragments of red-brown to grey-green soft dolomite generally 5 mm across, few fragments to 2 cm across
- 5% GYPSUM, white, coarsely crystalline; laminated fragments to 3 cm across (3%), and grains in dolomite to 3 mm across (2%), and minor thin veins of acicular gypsum to 2 mm thick around some large dolomite fragments

173.53 - 173.74 m (569'4" - 570'0")
- 65% GREY FRIABLE DOLOMITE, even texture, soft
- 30% GYPSUM, white, coarsely crystalline laminated; fragments to 3 cm across
- 5% GYPSIFEROUS DOLOMITE, grey-brown, moderately hard; laminae in gypsum

CORE No. 44

Interval: 173.74 - 176.78 m (570'0" - 580'0")
Cut: 3.05 m (10'0") Recovered: 2.67 m (8'9")
Description:
173.74 - 174.40 m (570'0" - 572'2")
70% GYPSUM, white, coarsely crystalline, regularly laminated; dips 80°, contains a small fault dipping 20° with 1 cm displacement at 174.48 m (572'5")
30% GYPSIFEROUS DOLOMITE, grey to dark grey, moderately hard; laminae in gypsum
174.40 - 174.80 m (572'2" - 573'6")
80% GREY FRIABLE DOLOMITE, moderately hard, poorly laminated in part
18% GYPSUM, white; fragments to 1 cm across (5%), and irregular laminae and veins of acicular gypsum to 5 mm generally dip 80°
2% GREY TOUGH DOLOMITE, moderately hard; fragments to 2 cm across
174.80 - 174.96 m (573'6" - 574'0")
70% GYPSUM, white, coarsely crystalline, laminated in basal 8 cm of core, dips 60°
30% GYPSIFEROUS DOLOMITE, light grey, moderately hard; laminae in gypsum
175.26 - 175.80 m (575'0" - 576'9")
45% GYPSUM, white, coarsely crystalline; fragments to 1 cm across (10%), and laminae and veins of prismatic gypsum (30%)
45% GREY TOUGH DOLOMITE, moderately hard; fragments to 3 cm across with cross-cutting veins of acicular gypsum, and contorted laminae to 5 mm thick in gypsum
8% BLACK TOUGH DOLOMITE, hard; very irregular fragments to 2 cm across
2% GREY FRIABLE DOLOMITE, moderately soft, irregular laminae throughout bed
175.80 - 176.40 m (576'9" - 578'9")
80% GYPSUM, white, regularly laminated; vertical dips, saccharoidal texture in part
15% GREY TOUGH DOLOMITE, bed to 1 cm thick, laminated near base
5% GYPSIFEROUS DOLOMITE, light grey, moderately hard; laminae contorted near top
The basal 1.22 m (4') of core is coated with a 3 mm layer of soft dolomite indicating that most of the loss within this core was due to washing away of dolomite

CORE No. 45

Interval: 176.78 - 179.83 m (580'0" - 590'0")
Cut: 3.05 m (10'0") Recovered: 0.71 m (2'4")
Description: 179.12 - 179.83 m (587'8" - 590'0")
45% GREY TOUGH DOLOMITE, moderately hard, regularly laminated; fragments to 10 cm across
40% GYPSUM, white, coarsely crystalline; fragments with regular and contorted laminae throughout (30%), and veins of acicular gypsum to 2 mm thick (10%)
5% GREY FRIABLE DOLOMITE, soft; matrix, and irregular bodies containing a few small fragments to 5 mm across of prismatic gypsum and tough dolomite

CORE No. 46

Interval: 179.83 - 182.88 m (590'0" - 600'0")
Cut: 3.05 m (10'0") Recovered: 2.16 m (7'1")
Description:

180.72 - 181.05 m (592'11" - 594'0")
60% GYPSUM, coarsely crystalline, regularly laminated, and slightly contorted and brecciated in part (55%); and irregular veins of acicular gypsum generally in dolomite fragments (5%)
20% GYPSIFEROUS DOLOMITE, light grey-brown; laminae in gypsum
20% GREY TOUGH DOLOMITE, slightly laminated; fragments to 3 cm across
181.05 - 181.25 m (594'0" - 594'8")
60% BLACK TOUGH DOLOMITE, moderately hard to hard, very poorly laminated, contorted; mild salty taste, contains sparse very small cubic cavities to 1 mm across caused by solution of small crystals of halite? by drilling mud; fretted in part possibly due to solution of very small crystals, contorted bed 5 cm thick dips 80° in centre but at 45° at top and base
30% LIGHT BROWN TOUGH DOLOMITE, fragments to 2 cm across along top and base of bed
10% GYPSUM, white; acicular veins and matrix
181.25 - 182.88 m (594'8" - 600'0")
50% GYPSUM, white, coarsely crystalline; fragments to 2 cm across (20%), poorly laminated in part, and as grains to 1 mm across in dolomite (25%), and irregular discordant veins of acicular gypsum in matrix and fragments (5%)
30% GREY FRIABLE DOLOMITE, matrix
15% LIGHT GREY TOUGH DOLOMITE, fragments to 2 cm grading to 5 cm at top of bed; regularly laminated, very slight salty taste in part
5% GYPSIFEROUS DOLOMITE, light grey; laminae in gypsum and dolomite

CORE No. 47

Interval: 182.88 - 185.93 m (600'0" - 610'0")
Cut: 3.05 m (10'0") Recovered: 2.57 m (8'5")
Description:
183.37 - 184.18 m (601'7" - 604'3")
70% GREY FRIABLE DOLOMITE, moderately hard to soft; matrix
30% GYPSUM, white; angular fragments to 2 cm across (10%), irregular veins of prismatic gypsum to 3 mm thick (10%), and grains to 1 mm across finely disseminated in dolomite matrix (10%)
184.18 - 185.77 m (604'3" - 609'6")
60% GYPSUM, white, coarsely crystalline, contorted to regularly laminated; fragments to 15 cm across
30% GYPSIFEROUS DOLOMITE, light grey-brown; laminae in gypsum
10% GREY FRIABLE DOLOMITE, irregular bodies to 3 cm across, and irregular lenticular laminae throughout core
185.77 - 185.93 m (609'6" - 610'0")
80% GYPSUM, white, coarsely crystalline, even texture in part, laminated horizontally in other parts, and as sparse vertical veins of acicular gypsum to 5 mm thick
20% GYPSIFEROUS DOLOMITE, grey, moderately hard; laminae

CORE No. 48

Interval: 185.93 - 188.98 m (610'0" - 620'0")
Cut: 3.05 m (10'0") Recovered: 2.47 m (8'1")
Description:
186.51 - 188.01 m (611'11" - 616'10")
60% GYPSUM, white, coarsely crystalline; fragments to 2 cm across, laminated in part (10%), and finely brecciated matrix with disseminated dolomite (50%)
33% GREY FRIABLE DOLOMITE, very irregular fragments to 5 cm across (5%), and finely disseminated in matrix causing slight fretting in part when exposed to water

5% GREY TOUGH DOLOMITE, laminated; fragments to 3 cm across towards base
2% GYPSIFEROUS DOLOMITE, light grey-brown; laminae in gypsum and dolomite fragments to 3 mm thick

188.01 - 188.34 m (616'10" - 617'11")
100% GREY FRIABLE DOLOMITE, even texture, slight fissility, puggy when wet; bed has been compressed and forced to flow around core above and below interval during drilling

188.34 - 188.42 m (617'11" - 618'2")
65% GYPSUM, white, regularly laminated; dips 45°-60°
35% GREY FRIABLE DOLOMITE, moderately hard; laminae in gypsum

188.34 - 188.98 m (617'11" - 620'0")
60% GYPSUM, white, coarsely crystalline; fragments to 5 mm across in friable dolomite
15% GREY TOUGH DOLOMITE, regularly laminated; fragments to 2 cm across near top of bed
25% GREY FRIABLE DOLOMITE, fragments to 2 cm across (5%), and matrix (20%)

CORE No. 49

Interval: 188.98 - 192.02 m (620'0" - 630'0")
Cut: 3.05 m (10'0") Recovered: 2.01 m (6'7")
Description:

190.02 - 192.02 m (623'5" - 630'0")
65% GYPSUM, white, coarsely crystalline; sparse fragments to 2 cm across (5%), finely brecciated matrix of fragments to 5 mm across (60%), and minor veins of acicular gypsum
20% GREY TOUGH DOLOMITE, moderately hard, irregular laminae; fragments to 5 cm across (10%), and fine grains to 5 mm across in matrix (10%)
15% GREY FRIABLE DOLOMITE, moderately soft; irregular fragments to 2 cm across (5%), and finely disseminated fragments to 5 mm across in matrix (10%)

CORE No. 50

Interval: 192.02 - 195.07 m (630'0" - 640'0")
Cut: 3.05 m (10'0") Recovered: 1.75 m (5'9")
Description:

193.3 - 193.90 m (634'3" - 636'2")
60% GYPSUM, white, coarsely crystalline; fragments with contorted laminae to 5 cm across
39% GREY FRIABLE DOLOMITE, soft; irregular fragments to 2 cm across (20%), and irregular tracings and matrix for gypsum (19%)
1% LIGHT BROWN TOUGH DOLOMITE, moderately hard, laminated; fragments to 2 cm across

193.90 - 194.19 m (636'2" - 637'1")
60% GREY FRIABLE DOLOMITE, moderately soft
40% GYPSUM, white; irregular veins of acicular gypsum to 5 mm across throughout dolomite, generally vertical dips (35%), and regularly laminated elongated fragments to 10 cm across (5%)

194.19 - 194.97 m (637'1" - 639'8")
80% GYPSUM, white, coarsely crystalline, laminated, brecciated in part
10% GYPSIFEROUS DOLOMITE, light grey, moderately hard; laminae
10% GREY FRIABLE DOLOMITE, very irregular fragments to 2 cm across, and irregular laminae

194.97 - 195.07 m (639'8" - 640'0")
50% GYPSUM, white, coarsely crystalline, laminated, dips 90°
50% GYPSIFEROUS DOLOMITE, grey, moderately soft; laminae in gypsum

CORE No. 51

Interval: 195.07 - 196.90 m (640'0" - 646'0")
Cut: 1.83 m (6'0") Recovered: 1.27 m (4'2")
Description:
195.07 - 196.09 m (640'0" - 643'4")
60% GYPSUM, white, laminated, contorted, and brecciated throughout; fragments up to 12 cm across
35% GREY FRIABLE DOLOMITE, very irregular fragments to 2 cm across, and irregular laminae throughout
5% GYPSIFEROUS DOLOMITE, light grey; laminae in gypsum
196.09 - 196.34 m (643'4" - 644'2")
60% GREY FRIABLE DOLOMITE, moderately soft; swells on exposure to water
40% GYPSUM, white, coarsely crystalline; angular fragments to 1 cm across (10%), veins of acicular gypsum to 5 mm across throughout (20%), and small fragments of acicular gypsum to 3 mm across (10%)

CORE No. 52

Interval: 196.90 - 199.95 m (646'0" - 656'0")
Cut: 3.05 m (10'0") Recovered: 2.94 m (9'8")
Description:
197.00 - 197.41 m (646'4" - 647'8")
30% GYPSUM, white, coarsely crystalline; laminated fragments to 8 cm across
30% GREY TOUGH DOLOMITE, moderately hard, even texture; fragments to 2 cm across but mostly smaller
35% GREY FRIABLE DOLOMITE, soft; matrix, irregular fragments, and laminae
5% GYPSIFEROUS DOLOMITE, light grey; laminae
197.41 - 197.92 m (647'8" - 649'4")
40% GYPSUM, white, coarsely crystalline; laminated fragments to 5 cm across (10%), veins, and irregular masses of acicular gypsum to 1 cm across forming matrix (30%)
30% GREY TOUGH DOLOMITE, laminated; fragments to 2 cm across
30% BROWN FRIABLE DOLOMITE, soft; matrix, and irregular laminae
197.92 - 198.17 m (649'4" - 650'2")
90% LIGHT BROWN TOUGH DOLOMITE, moderately hard, poorly laminated in bed, dips 45°
10% GYPSUM, white; prismatic veins filling tension gashes normal to bedding
198.17 - 198.56 m (650'2" - 651'5")
40% GYPSUM, white to light grey, coarsely crystalline; regularly laminated and contorted fragments of gypsum to 3 cm across (20%), irregular veins and bodies of acicular gypsum to 5 mm thick and 2 cm across respectively (20%)
40% BLACK TOUGH DOLOMITE, matrix; contains disseminated fragments of acicular gypsum and dolomite throughout
20% BROWN TOUGH DOLOMITE, laminated; fragments to 2 cm across (10%), and finely disseminated fragments to 3 mm across in matrix (10%)
198.56 - 199.26 m (651'5" - 653'9")
60% GYPSUM, white, coarsely crystalline, regularly laminated, dips 45°, contorted and slightly brecciated towards top
35% GYPSIFEROUS DOLOMITE, moderately hard; laminae
5% DARK GREY FRIABLE DOLOMITE, moderately soft; irregular laminae and fragments
199.26 - 199.95 m (653'9" - 656'0")
50% GREY TOUGH DOLOMITE, fragments to 20 cm across but generally smaller, and finely disseminated grains in matrix
45% GYPSUM, white, coarsely crystalline; fragments to 2 cm across with contorted laminations (15%), irregular veins and bodies to 2 cm across of acicular gypsum with vertical dip (20%), and fragments and grains to 3 mm across (5%)

5% GREY FRIABLE DOLOMITE, lenticular bodies to 5 cm thick, and finely disseminated grains in matrix

CORE No. 53

Interval: 199.95 - 203.00 m (656'0" - 666'0")
Cut: 3.05 m (10'0") Recovered: 2.49 m (8'2")
Description:
170.02 - 170.48 m (557'10" - 559'4")
45% GREY FRIABLE DOLOMITE, moderately soft; fragments with tracings of gypsum (10%), contorted beds to 2 cm thick (25%), and matrix (10%)
40% GYPSUM, white, coarsely crystalline; laminated fragments to 2 cm across, and medium crystalline with tracings in dolomite
15% GREY TOUGH DOLOMITE, laminae up to 8 mm thick in gypsum (5%), laminated fragments to 3 cm across (5%), and finely disseminated grains in matrix (5%)
170.48 - 170.74 m (559'4" - 560'2")
80% BLACK TOUGH DOLOMITE, laminated, fragmented in part, bed dips 45°, small infilled solution cavities parallel to bedding at 170.53 m (559'6")
10% GREY FRIABLE DOLOMITE, broken, (possibly washed away by drilling fluid), fills cavity at 170.53 m (559'6") sparse black tracings throughout dolomite
10% GYPSUM, white, prismatic; irregular laminae to 2 cm thick above claystone, secondary recrystallization in cavity (5%), and crystals to 5 mm across in dolomite matrix
170.74 - 171.63 m (560'2" - 563'1")
90% GREY TOUGH DOLOMITE, hard, massive, very strongly contorted near base, fractured throughout
10% GYPSUM, white, prismatic, fills fractures to 5 mm thick
202.11 - 203.00 m (663'1" - 666'0")
60% GYPSUM, white, coarsely crystalline, brecciated, contorted and laminated in part (55%), and grains of acicular gypsum in dolomite (5%)
30% DARK GREY FRIABLE DOLOMITE, moderately soft; irregular bodies to 2 cm across irregular tracings in gypsum (20%), and 3-5 cm beds at 196.34 m (644'5") and 196.49 m (644'8")
10% GYPSIFEROUS DOLOMITE, grey; as laminae in gypsum
Interval has a small fault at 202.21 m (663'5") dipping subvertically with soft friable dolomite on surface as gouge; displacement indeterminable

CORE No. 54

Interval: 199.95 m - 206.05 m (656'0" - 676'0")
Cut: 3.05 m (10'0") Recovered: 1.83 m (6'0")
Description:
204.22 - 204.83 m (670'0" - 672'0")
40% GYPSUM, white to light grey; elongated laminated fragments to 5 cm across (20%), irregular veins of acicular gypsum cutting matrix and fragments in part (10%), and finely dispersed grains to 5 mm across in matrix (10%)
30% GREY TOUGH DOLOMITE, fragment to 1 cm across (10%), laminae in gypsum fragments (10%), and finely disseminated grains in matrix to 5 mm across (10%)
30% BLACK FRIABLE DOLOMITE, moderately hard; matrix

CORE No. 55

Interval: 206.05 - 208.18 m (676'0" - 683'0")
Cut: 2.13 m (7'0") Recovered: 2.06 m (6'9")
Description:
206.05 - 206.20 m (676'0" - 676'6")
40% GYPSUM, elongated, laminated fragments to 5 cm across (20%), irregular veins of acicular gypsum cutting matrix and fragments in part (10%), and finely disseminated grains to 5 mm across in matrix (10%)
30% LIGHT GREY TOUGH DOLOMITE, fragments to 1 cm across (10%), laminae in gypsum (10%), and finely disseminated grains to 5 mm across in matrix (10%)
30% BLACK FRIABLE DOLOMITE, moderately hard; matrix
206.20 - 206.90 m (676'6" - 678'10")
80% GYPSUM, white, coarsely crystalline, regularly laminated; dips 0-45°
20% GYPSIFEROUS DOLOMITE, light grey, moderately hard; laminae
206.90 - 207.04 m (678'10" - 679'3")
80% BLACK TOUGH DOLOMITE, hard, laminated in part
18% GYPSUM, white, regularly laminated; fragments to 3 cm across in dolomite
2% GYPSIFEROUS DOLOMITE, moderately hard; laminae in gypsum
207.04 - 207.24 m (679'3" - 679'11")
100% BLACK TOUGH DOLOMITE, regularly laminated; dips 45°
207.24 - 208.10 m (679'11" - 682'9")
60% GYPSUM, white; matrix, discontinuously laminated in part (55%), and irregular veins of acicular gypsum (5%)
30% DARK GREY FRIABLE DOLOMITE, finely disseminated with gypsum as matrix
10% BLACK TOUGH DOLOMITE, hard, laminated; fragments to 2 cm across
208.00 - 208.05 m (682'5" - 682'7")
90% GREY FRIABLE DOLOMITE, matrix
10% GYPSUM, white; irregular discordant prismatic veins (8%), and small grains to 2 mm across in dolomite (2%)

CORE No. 56

Interval: 208.18 - 211.23 m (683'0" - 693'0")
Cut: 3.05 m (10'0") Recovered: 2.77 m (9'1")
Description:
208.46 - 208.94 m (683'11" - 685'6")
60% GYPSUM, white, coarsely crystalline, laminated near base; dips 45°, brecciated at top
20% LIGHT BROWN TOUGH DOLOMITE, laminated; fragments to 2 cm across
10% GYPSIFEROUS DOLOMITE, light grey; laminae
10% GREY FRIABLE DOLOMITE, irregular lenses to 2 cm thick (5%), and finely disseminated in gypsum (5%)
208.94 - 209.27 m (685'6" - 686'7")
40% DARK GREY FRIABLE DOLOMITE, matrix
30% GYPSUM, white, coarsely crystalline; lenticular fragments to 5 cm across (15%), and crystals to 4 mm across in matrix (15%)
30% LIGHT BROWN TOUGH DOLOMITE, lenticular, laminated fragments to 5 mm across (10%), and fragments to 2 cm across in matrix (20%)
209.27 - 209.85 m (686'7" - 688'6")
70% GYPSUM, white, coarsely crystalline, contorted
15% GYPSIFEROUS DOLOMITE, light grey, moderately hard; contorted and discontinuous laminae in gypsum
10% DARK GREY FRIABLE DOLOMITE, irregular laminae, and fragments to 1 cm across
5% LIGHT BROWN TOUGH DOLOMITE, laminated; angular fragments to 1 cm across

209.85 - 210.19 m (688'6" - 689'7")
50% GYPSUM, white, coarsely crystalline, saccharoidal texture, slightly weathered and soft; fragments to 2 cm across
50% GREY FRIABLE DOLOMITE, matrix, and irregular fragments to 2 cm across in gypsum
210.19 - 210.34 m (689'7" - 690'1")
90% GYPSUM, white, coarsely crystalline, saccharoidal texture
5% GREY FRIABLE DOLOMITE, irregular tracings in gypsum
5% GYPSIFEROUS DOLOMITE, round; irregular tracings in gypsum
210.34 - 210.46 m (690'1" - 690'6")
90% GREY FRIABLE DOLOMITE, laminated; dips 45°
10% GYPSUM, white; laminae to 5 mm thick and fragments to 1 cm across of acicular gypsum
210.46 - 210.82 m (690'6" - 691'8")
90% GYPSUM, white, coarsely crystalline, saccharoidal texture
7% GREY FRIABLE DOLOMITE, irregular tracings in gypsum
3% BLACK TOUGH DOLOMITE, angular fragments to 2 cm across
210.82 - 211.23 m (691'8" - 693'0")
65% DARK GREY FRIABLE DOLOMITE, laminated, dips 70°
35% GYPSUM, white; irregular fragments with saccharoidal texture to 2 cm across (15%), and irregular veins of acicular gypsum to 5 mm thick (20%)

CORE No. 57

Interval: 211.23 - 214.27 m (693'0" - 703'0")
Cut: 3.05 m (10'0") Recovered: 3.05 m (10'0")
Description:
211.23 - 211.68 m (693'0" - 694'6")
95% GYPSUM, white, coarsely crystalline, saccharoidal texture
5% GREY FRIABLE DOLOMITE, tracings throughout gypsum, and lenticular bodies to 1 cm thick
Bed contains solution cavity 5 cm across at 211.61 m (694'3")
211.68 - 211.81 m (694'6" - 694'11")
40% BLACK TOUGH DOLOMITE, hard, laminated; rounded fragments to 6 cm across
40% GYPSUM, white, coarsely crystalline, saccharoidal texture; fragments to 2 cm across (20%), and veins of acicular gypsum to 5 mm thick (20%)
20% LIGHT GREY FRIABLE DOLOMITE, very soft; matrix
211.81 - 213.70 m (694'11" - 701'1")
85% GYPSUM, white, coarsely crystalline; oval fragments with saccharoidal texture separated by tracings of soft dolomite giving core a mottled texture, and sparse veins of acicular gypsum
10% DARK GREY FRIABLE DOLOMITE, tracings in gypsum (5%), and thin lenses and regular bodies between rounded gypsum fragments (5%)
5% BLACK TOUGH DOLOMITE, laminated; fragments to 10 cm across
213.70 - 213.75 m (701'1" - 701'3")
90% GREY FRIABLE DOLOMITE, matrix
10% GYPSUM, white, acicular; irregular vertical fragments to 5 mm across in dolomite matrix
213.75 - 214.27 m (701'3" - 703'0")
60% GYPSUM, white, coarsely crystalline; fragments with saccharoidal texture to 5 cm across
40% LIGHT GREY FRIABLE DOLOMITE, white, soft, laminated in part; fragmented laminated beds to 2 cm thick dip 45°, and irregular tracings, laminae and lenticular bodies in gypsum

CORE No. 58

Interval: 214.27 - 217.32 m (703'0" - 713'0")
Cut: 3.05 m (10'0") Recovered: 2.79 m (9'2")
Description:
214.52 - 214.88 m (703'10" - 705'0")
50% GYPSUM, white, coarsely crystalline, saccharoidal texture; fragments to 3 cm across, and sparse veins of acicular gypsum
50% DARK GREY FRIABLE DOLOMITE, soft, matrix; dip 45°
214.88 - 215.32 m (705'0" - 706'5")
80% GYPSUM, white, saccharoidal texture, coarsely crystalline; fragments to 2 cm across
20% GREY FRIABLE DOLOMITE, tracings and laminae
215.32 - 216.96 m (706'5" - 711'10")
80% GREY FRIABLE DOLOMITE, matrix
15% GYPSUM, white, soft and friable in part; veins and irregular bodies of acicular gypsum to 2 cm across
5% LIGHT BROWN TOUGH DOLOMITE, laminated; fragments to 5 cm across
216.96 - 217.32 m (711'10" - 713'0")
70% GYPSUM, white, coarsely crystalline, saccharoidal texture; fragments to 2 cm across, but generally smaller
30% BLACK FRIABLE DOLOMITE, tracings and irregular bodies to 3 cm across in gypsum

CORE No. 59

Interval: 217.32 - 220.37 m (713'0" - 723'0")
Cut: 3.05 m (10'0") Recovered: 0.91 m (3'0")
Description:
217.32 - 217.40 m (713'0" - 713'3")
95% BLUE-GREY FRIABLE DOLOMITE, puggy; contains fragments of grey soft dolomite 2 cm across
5% GYPSUM, white; irregular veins, acicular
217.40 - 218.06 m (713'3" - 715'5")
80% GYPSUM, white, coarsely crystalline; fragments to 1 cm across with saccharoidal texture
20% GREY FRIABLE DOLOMITE, soft; tracings and irregular bodies to 1 cm across
218.06 - 218.24 m (715'5" - 716'0")
50% GREY FRIABLE DOLOMITE, as matrix
50% GYPSUM, white, irregular bodies to 2 cm across, and veins to 5 mm thick of acicular gypsum throughout dolomite
Core loss 218.24 - 220.37 (716'6" - 723'0") is presumed to be in friable dolomite at base of interval

CORE No. 60

Interval: 220.37 - 223.42 m (723'0" - 733'0")
Cut: 3.05 m (10'0") Recovered: 2.44 m (8'0")
Description:
220.98 - 221.49 m (725'0" - 726'8")
80% GYPSUM, white, coarsely crystalline, saccharoidal texture; oval fragments to 18 cm across
20% BLACK FRIABLE DOLOMITE, soft; tracings and irregular bodies to 2 cm across, more common near base
221.49 - 221.79 m (726'8" - 727'5")
85% GREY FRIABLE DOLOMITE, contains angular fragments of blue-white and grey dolomite to 2 cm across (15%)
15% GYPSUM, white, coarsely crystalline; laminated fragments to 2 cm across (5%), fragments of acicular gypsum to 5 mm across (5%), and a bed of acicular gypsum to 1 cm thick at 221.54 m (726'10") dips 45°

221.72 - 222.37 m (727'5" - 729'7")
80% GYPSUM, white, coarsely crystalline, saccharoidal texture; oval fragments
20% BLACK FRIABLE DOLOMITE, tracings and irregular bodies to 2 cm across, and beds 2 cm thick dip 45°

222.37 - 222.65 m (729'7" - 730'6")
70% DARK GREY FRIABLE DOLOMITE, laminated in part; matrix
15% GYPSUM, light grey, coarsely crystalline; fragments to 5 cm across (5%), and grains to 3 mm across in matrix (10%)
15% GYPSUM, white, acicular; irregular bodies to 4 cm across (5%), irregular veins to 5 mm thick (5%), and fragments of acicular gypsum to 5 mm across (5%)

222.65 - 223.19 m (730'6" - 732'3")
70% GYPSUM, white, coarsely crystalline, lenticular in part; fragments to 2 cm across
30% GREY FRIABLE DOLOMITE, tracings and irregular laminated fragments to 2 cm across

223.19 - 223.42 m (732'3" - 733'0")
85% BLACK TOUGH DOLOMITE, regularly laminated fragments to 10 cm across, and fragmented beds with contorted laminae
13% GYPSUM, white, coarsely crystalline; irregular inclusions of contorted and brecciated gypsum (8%), and irregular veins of acicular gypsum to 3 mm thick filling fractures in dolomite
2% DARK GREY FRIABLE DOLOMITE, tracings in gypsum

CORE No. 61

Interval: 223.42 - 226.47 m (733'0" - 743'0")
Cut: 3.05 m (10'0") Recovered: 3.05 m (10'0")
Description:

223.42 - 224.16 m (733'0" - 735'5")
96% GYPSUM, white, coarsely crystalline, hard, massive; mostly even texture
3% GREY FRIABLE DOLOMITE, tracings in top 0.08 m (3") and basal 0.38 m (1'3")
1% BLACK TOUGH DOLOMITE, fragments to 1 cm across in 3 cm zone at 223.77 m (734'2")

224.16 - 224.64 m (735'5" - 737'0")
60% GYPSUM, white, coarsely crystalline, laminated (45%); veins of acicular gypsum filling fractures in dolomite (5%), and in zones to 5 mm thick around dolomite fragments (10%)
40% BLACK TOUGH DOLOMITE, hard; angular fragments to 15 cm across; contains laminae and thin beds of brecciated dolomite to 1 cm thick fragmented at 224.03 m (735'8"), contains small fault with 3 mm displacement

224.64 - 226.47 m (737'0" - 743'0")
70% GYPSUM, white, coarsely crystalline, even texture; fragments to 5 cm across, massive beds 10 cm thick at 222.83 m (740'11"), and 2 cm vein of acicular gypsum at 225.07 m (738'5")
23% GREY FRIABLE DOLOMITE, tracings throughout core, and irregular bodies to 2 cm across
2% GREY TOUGH DOLOMITE, hard, laminated; generally elongated fragments to 2 cm across

CORE No. 62

Interval: 226.47 - 228.91 m (743'0" - 751'0")
Cut: 2.44 m (8'0") Recovered: 2.44 m (8'0")
Description:
226.47 - 226.92 m (743'0" - 744'6")
70% GYPSUM, white, coarsely crystalline, even texture; fragments to 5 mm across, and sparse veins of acicular gypsum
20% GREY FRIABLE DOLOMITE, tracings throughout core, and irregular bodies to 2 cm across
5% BLACK TOUGH DOLOMITE, hard, laminated; fragments generally elongated to 2 cm
226.92 - 227.13 m (744'6" - 745'4")
50% GYPSUM, white, acicular; matrix for fragments, veins to 5 mm thick, and irregular bodies to 2 cm across
30% LIGHT BROWN TOUGH DOLOMITE, moderately hard, even texture, fragments to 2 cm across
20% GREY FRIABLE DOLOMITE, moderately soft; tends to fret on exposure to water; fragments to 3 cm across
227.13 - 227.41 m (745'2" - 746'3")
75% GYPSUM, white, coarsely crystalline, saccharoidal texture; fragments to 2 cm across but generally less, separated by tracings of friable dolomite, and irregular veins of acicular gypsum near base
25% GREY FRIABLE DOLOMITE, soft; tracings in gypsum, and irregular bodies to 2 cm across
227.41 - 227.66 m (746'3" - 746'11")
50% GREY FRIABLE DOLOMITE, soft; matrix
50% GYPSUM, white, coarsely crystalline; fragments with dolomite tracings (20%), and irregular veins of acicular gypsum to 1 cm thick (30%)
227.66 - 228.91 m (746'11" - 751'0")
70% GYPSUM, white, coarsely crystalline, saccharoidal texture, extremely brecciated; fragments to 1 cm across separated by dolomite tracings
15% LIGHT BROWN TOUGH DOLOMITE, moderately hard; fragments to 5 mm across (10%), and laminated fragments to 5 cm across (5%)
15% GREY FRIABLE DOLOMITE, tracings, irregular bodies to 2 cm across, and 1 cm bed containing gypsum fragments dips 40° at 224.82 m (737'7") and 228.63 m (750'1")

CORE No. 63

Interval: 228.91 - 233.56 m (751'0" - 766'3")
Cut: 4.65 m (15'3") Recovered: 4.65 m (15'3")
Description:
228.91 - 231.29 m (751'0" - 758'10")
70% GYPSUM, white, coarsely crystalline, saccharoidal texture; oval fragments to 2 cm across mostly less, grades to gypsiferous dolomite in part (5%)
28% DARK GREY FRIABLE DOLOMITE, soft; tracings, and irregular bodies to 1 cm across, tends to fret on exposure to water
2% LIGHT BROWN TOUGH DOLOMITE, moderately hard; elongated laminated fragments to 2 cm across
231.29 - 231.54 m (758'10" - 759'8")
65% GREY FRIABLE DOLOMITE, puggy; matrix
35% GYPSUM, white, coarsely crystalline; rounded fragments to 10 cm across with sparse dolomite tracings (20%), veins of acicular gypsum to 1 cm thick dip 45° (17%), and small grains to 3 mm across in matrix (3%)

231.54 - 237.73 m (759'8" - 760'3")
90% GYPSUM, white, coarsely crystalline, laminated; grades to gypsiferous dolomite in part (20%), and dips 45°
10% DARK GREY FRIABLE DOLOMITE, soft; tracings in gypsum and irregular bodies to 1 cm across

231.73 - 231.98 m (760'3" - 761'1")
65% GREY FRIABLE DOLOMITE, soft, puggy; matrix
35% GYPSUM, white; rounded fragments to 10 cm across (20%), veins of acicular gypsum dip 45° (17%), and small grains to 3 mm across in matrix (3%)

231.98 - 232.49 m (761'1" - 762'9")
70% GYPSUM, white, coarsely crystalline, saccharoidal texture; oval fragments to 2 cm across generally less, grades to dolomitic gypsum in part (5%)
28% DARK GREY FRIABLE DOLOMITE, tracings and irregular bodies to 1 cm across; tends to fret on exposure to water
2% BLACK TOUGH DOLOMITE, hard; elongated fragments to 2 cm across

232.49 - 232.61 m (762'9" - 763'2")
60% GYPSUM, white, acicular; veins to 1 cm thick generally concordant, and as matrix
20% GREY FRIABLE DOLOMITE, moderately hard, grades to gypsiferous dolomite in part, laminated; beds to 2 cm thick dip 60°
20% LIGHT BROWN TOUGH DOLOMITE, moderately hard; laminae near base to 2 cm thick

232.61 - 233.56 m (763'2" - 766'3")
70% GYPSUM, white, coarsely crystalline, regularly laminated; dip 60° at top to 40° at base (45%), and veins of acicular gypsum to 5 mm thick mostly parallel to bedding (20%)
27% GYPSIFEROUS DOLOMITE, grey, soft; tracings and laminae throughout gypsum, and lenticular bodies to 5 cm across at 233.32 m (765'6")
3% BLACK TOUGH DOLOMITE, very irregular laminae and beds to 3 cm thick, bed dips 20° at 233.00 m (764'5")

CORE No. 64

Interval: 233.56 m - 238.20 m (766'3" - 781'6")
Cut: 4.65 m (15'3") Recovered: 4.65 m (15'3")
Description:

233.56 - 235.41 m (766'3" - 772'4")
70% GYPSUM, white, coarsely crystalline; regularly laminated; beds to 10 cm thick dips 45°, mostly brecciated in fragments from 1-5 cm across (55%), and concordant and discordant veins of acicular gypsum to 1 cm thick (15%)
25% DARK GREY FRIABLE DOLOMITE, soft; tracings and irregular bodies to 2 cm across, and an irregular bed 2 cm thick at 234.09 m (768'0")
5% LIGHT BROWN TOUGH DOLOMITE, laminated, moderately hard; grades to black dolomite in part; fragments to 10 cm across concordant in places

235.41 - 236.35 m (772'4" - 775'5")
50% GREY FRIABLE DOLOMITE, contains fragments of blue-grey dolomite to 2 cm across (5%)
45% GYPSUM, white, coarsely crystalline, laminated and contorted (35%), and irregular veins of acicular gypsum to 5 mm thick (10%), and regularly laminated fragments to 12 cm across at 2.35.74 m (773'5")
5% GYPSIFEROUS DOLOMITE, light grey, moderately hard; laminae in gypsum

236.35 - 237.01 m (775'5" - 777'7")
70% GYPSUM, white, regularly laminated, dips 30° (65%), and mostly concordant veins of acicular gypsum to 5 mm thick
30% GYPSIFEROUS DOLOMITE, light grey, moderately hard; laminae
237.01 - 237.31 m (777'7" - 778'7")
80% DARK GREY FRIABLE DOLOMITE, regularly laminated; dips 30°, grades to gypsiferous dolomite in part
20% GYPSUM, white; vertical veins of acicular gypsum to 1 cm across, and sparse concordant veins to 3 mm thick
237.31 - 237.87 m (778'7" - 780'5")
90% GYPSUM, white to light grey, coarsely crystalline, regularly laminated, dips 30°, slightly dolomitic (75%), and veins of acicular gypsum to 1 cm thick (15%)
10% GYPSIFEROUS DOLOMITE, grey, moderately hard; laminae
237.87 - 238.20 m (780'5" - 781'6")
65% GYPSIFEROUS DOLOMITE, white, coarsely crystalline; irregular fragments to 1 cm across containing numerous dolomite tracings (50%), and irregular contorted veins of acicular gypsum to 3 mm thick (15%)
35% DARK GREY FRIABLE DOLOMITE, irregular tracings, and finely disseminated grains to 3 mm across in gypsum

CORE No. 65

Interval: 238.20 - 242.85 m (781'6" - 786'9")
Cut: 4.65 m (15'3") Recovered: 4.62 m (15'2")
Description:
242.85 - 240.82 m (781'6" - 790'1")
75% GYPSUM, white, coarsely crystalline, brecciated; fragments to 2 cm across (65%), and veins of acicular gypsum to 3 mm thick (10%)
20% GREY FRIABLE DOLOMITE, matrix, and irregular tracings and bodies to 5 mm across
5% LIGHT BROWN TOUGH DOLOMITE, laminated; fragments to 5 cm across, grades to gypsiferous dolomite in part
Interval contains solution cavity 2 cm across at 238.89 m (783'9")
240.82 - 241.35 m (790'1" - 791'10")
85% GYPSUM, white, coarsely crystalline, saccharoidal texture; fragments to 10 cm across
10% GREY FRIABLE DOLOMITE, tracings and matrix
5% LIGHT GREY TOUGH DOLOMITE, moderately hard; rounded fragments to 2 cm across, grades to gypsiferous dolomite in part
241.35 - 242.06 m (791'10" - 794'2")
60% GYPSUM, white, coarsely crystalline; fragments to 3 cm across with irregular dolomite tracings
35% DARK GREY FRIABLE DOLOMITE, osft; tracings, irregular fragments to 2 cm across, and matrix
5% LIGHT GREY TOUGH DOLOMITE, laminated; fragments to 2 cm across
242.06 - 242.32 m (794'2" - 795'0")
60% GREY FRIABLE DOLOMITE, grades to blue-grey in part (20%), soft, laminated; fragments to 3 cm across
40% GYPSUM, white, acicular; matrix for dolomite veins to 8 mm thick
242.32 - 242.85 m (795'0" - 796'9")
60% GYPSUM, white, coarsely crystalline; fragments to 3 cm across with irregular dolomite tracings
35% GREY FRIABLE DOLOMITE, soft; tracings and irregular tracings to 2 cm thick
5% LIGHT GREY TOUGH DOLOMITE, laminated; fragments to 2 cm across

CORE No. 66

Interval: 242.85 - 247.50 m (796'9" - 812'0")
Cut: 4.65 m (15'3") Recovered: 3.60 m (11'10")
Description:

243.89 - 244.15 m (800'2" - 801'0")
- 60% GYPSUM, white, coarsely crystalline; fragments with dolomite tracings to 5 cm thick but generally less (50%), and fine-grained in matrix (10%)
- 40% GREY FRIABLE DOLOMITE, matrix tracings, and irregular bodies to 2 cm across in gypsum

244.15 - 244.63 m (801'0" - 802'7")
- 60% GREY FRIABLE DOLOMITE, matrix
- 40% GYPSUM, white, acicular; veins to 2 cm thick dip 45° (30%), and fragments of acicular gypsum to 1 cm across (10%)

244.63 - 245.21 m (802'7" - 804'6")
- 60% GYPSUM, white, coarsely crystalline; fragments to 5 cm across but generally less, and fine-grained in matrix
- 40% DARK GREY FRIABLE DOLOMITE, tracings, and irregular bodies to 2 cm across

245.21 - 245.46 m (804'6" - 805'4")
- 90% GYPSUM, white, coarsely crystalline; contains irregular dolomite tracings
- 10% DARK GREY FRIABLE DOLOMITE, irregular tracings, and sparse irregular bodies to 2 cm across

245.46 - 245.92 m (805'4" - 806'10")
- 60% DARK GREY FRIABLE DOLOMITE, plastic in part; matrix
- 40% GYPSUM, white; veins and lentiçular bodies of acicular gypsum to 5 cm thick (30%), and fragment of regularly laminated gypsum 10 cm across at 245.49 m (805'5")

245.92 - 246.63 m (806'10" - 809'2")
- 60% GYPSUM, white, coarsely crystalline; fragments to 5 cm across but generally less, and fine-grained in matrix
- 40% GREY FRIABLE DOLOMITE, tracings, and irregular bodies to 2 cm across

246.63 - 247.50 m (809'2" - 812'0")
- 50% GYPSUM, white, regularly laminated, dips 45o (30%), and veins of acicular gypsum to 1 cm thick dip 45°
- 50% DARK GREY FRIABLE DOLOMITE, laminae and tracings in gypsum (5%), beds to 2 cm thick dip 45° (40%), and irregular bodies to 2 cm across (5%)

CORE No. 67

Interval: 247.50 m - 252.15 m (812'0" - 827'3")
Cut: 4.65 m (15'3") Recovered: 4.65 m (15'3")
Description:

247.50 - 248.26 m (812'0" - 814'6")
- 50% GYPSUM, white, coarsely crystalline; fragments to 1 cm across with finely disseminated dolomite (25%), and concordant veins of acicular gypsum dip 60° (25%)
- 50% DARK GREY FRIABLE DOLOMITE, lenticular laminae to 1 cm thick, and tracings and finely disseminated grains in gypsum fragments

248.26 - 249.48 m (814'6" - 818'6")
- 65% GYPSUM, white, coarsely crystalline; laminated fragments to 2 cm across elongated at 60° (40%), and veins of acicular gypsum to 3 mm thick mostly concordant with laminae (15%), and fragments to 5 mm acorss in dolomite (10%)
- 25% DARK GREY FRIABLE DOLOMITE, tracings, and sparse beds containing small fragments of gypsum to 2 cm thick, dip 60°
- 10% GYPSIFEROUS DOLOMITE, grey, moderately hard, dipping at 60°; laminae and beds to 2 cm thick fragmented in part

294.48 - 250.75 m (818'6" - 822'8")
60% GYPSUM, white, coarsely crystalline; fragments to 1 cm thick elongated at 60° (30%), and veins of acicular gypsum to 5 mm thick dip 60°
20% DARK GREY FRIABLE DOLOMITE, tracings and laminae to 5 mm thick dip 60°
20% GYPSIFEROUS DOLOMITE, grey-brown, moderately hard; fragments to 1 cm across grades to gypsum in part

250.75 - 250.80 m (822'8" - 822'10")
50% BLACK TOUGH DOLOMITE, laminated; fragmented bed dips 45°, with angular fragments to 2 cm across
45% GYPSUM, coarsely crystalline; small grains to 3 mm across (30%), and veins of acicular gypsum to 2 cm across (15%)
5% GREY FRIABLE DOLOMITE, tracings in gypsum

250.80 - 251.08 m (822'10" - 823'9")
95% ANHYDRITE, white, moderately hard, massive, mostly medium crystalline; contains very coarse euhedral crystals of gypsum with finely disseminated friable dolomite grains to 5 mm across (5%), and discordant veins of coarsely crystalline gypsum to 5 mm across
3% GREY FRIABLE DOLOMITE, finely disseminated throughout bed
2% BLACK TOUGH DOLOMITE, hard; irregular fragments to 1 cm across, gypsiferous in part

251.08 - 251.66 m (823'9" - 825'8")
65% GYPSUM, white, coarsely crystalline, contorted and brecciated bed towards top grading to regularly laminated and dips 35° at base (45%), fragments with irregular friable dolomite tracings in part, and contorted veins of acicular gypsum to 3 mm across
15% DARK GREY FRIABLE DOLOMITE, soft; matrix in brecciated zones
15% GYPSIFEROUS DOLOMITE, light grey-brown; laminae in gypsum
5% BLACK TOUGH DOLOMITE, hard; irregular fragments to 2 cm across

251.66 - 251.85 m (825'8" - 826'3")
40% DARK GREY FRIABLE DOLOMITE, laminated; grades to gypsiferous in part, fragments to 2 cm across
60% GYPSUM, white; irregular veins of acicular gypsum to 5 mm thick matrix

251.85 - 252.15 m (826'3" - 827'3")
65% GYPSUM, white; contorted and brecciated beds dip 45°, and contorted veins of acicular gypsum
35% DARK GREY FRIABLE DOLOMITE, matrix in brecciated zones

CORE No. 68

Interval: 252.15 - 256.79 m (827'3" - 842'6")
Cut: 4.65 m (15'3") Recovered: 4.57 m (15'0")
Description:

252.22 - 253.06 m (827'6" - 830'3")
60% GYPSUM, white, coarsely crystalline, laminated, contorted; generally dips 60-90° (50%), fragments to 1 cm across (5%), and concordant veins of acicular gypsum to 5 mm thick (5%)
30% DARK GREY FRIABLE DOLOMITE, soft to moderately hard, laminated in part; fragments to 2 cm across (20%), tracings in gypsum (5%), and fragments of light grey friable dolomite to 3 cm across (5%)
10% GYPSIFEROUS DOLOMITE, light grey, moderately hard; laminae in gypsum

253.06 - 254.45 m (830'3" - 834'10")
80% ANHYDRITE, white, generally medium crystalline, regularly laminated, dips from 60-90° gently folded, contains concordant veins of acicular gypsum to 1 cm thick (3%); recrystallized along fractures and along edges of acicular gypsum veins to very coarsely crystalline gypsum with friable dolomite tracings; very coarse euhedral crystals of gypsum scattered throughout; irregular zone of coarsely crystalline gypsum from 100.92 m (331'1") - 101.65 m (333'6") plane of fold

20% DOLOMITIC ANHYDRITE, light grey, moderately hard; laminae in anhydrite to 5 mm thick

254.45 - 254.76 m (834'10" - 835'10")

90% GREY FRIABLE DOLOMITE, laminated in part; bed dips 70°, terminated at top by shear plane

10% GYPSUM, white, acicular; concordant and discordant veins to 5 mm thick

254.76 - 255.04 m (835'10" - 836'9")

80% ANHYDRITE, white, generally medium crystalline, recrystallized to coarsely crystalline gypsum, in part contains sparse veins of acicular gypsum

20% DOLOMITIC ANHYDRITE, light grey; laminae in anhydrite to 5 mm thick

255.04 - 255.81 m (836'9" - 839'3")

60% ANHYDRITE, white, medium crystalline, laminated, contorted and brecciated to 255.60 m (838'7"), and dips 30° below (40%)

20% GYPSUM, white, acicular; irregular and concordant veins to 5 mm thick (20%)

40% DARK GREY FRIABLE DOLOMITE, regular and irregular tracings throughout bed, and matrix throughout top

255.81 - 256.18 m (839'3" - 840'6")

90% ANHYDRITE, white, medium crystalline, regularly laminated, gently folded; dip 70-90°

10% DARK GREY FRIABLE DOLOMITE, soft; tracings and laminae to 1 mm thick throughout

256.18 - 256.47 m (840'6" - 841'5")

70% GYPSUM, white, coarsely crystalline, regularly laminated, (40%), brecciated beds to 1 cm thick with fragments to 5 mm across (10%), and contains concordant veins of acicular gypsum to 5 cm thick

30% DARK GREY FRIABLE DOLOMITE, tracings and matrix

256.47 - 256.57 m (841'5" - 842'6")

80% GYPSUM, white, fragments to 3 mm across

20% DARK GREY FRIABLE DOLOMITE, tracings between fragments of gypsum, and irregular bodies to 5 mm across

CORE No. 69

Interval: 256.57 - 261.44 m (842'6" - 857'9")
Cut: 4.65 m (15'3") Recovered: 4.65 m (15'3")
Description:

256.57 - 257.53 m (842'6" - 844'11")

55% GYPSUM, white, coarsely crystalline; particles to 3 mm across, and beds dip 70°, and contorted at base to 2 cm across

35% GREY FRIABLE DOLOMITE, laminated; beds to 2 cm thick grade to gypsiferous dolomite in part (40%); finely disseminated grains in gypsum beds (5%)

257.53 - 257.79 m (844'11" - 845'9")

60% GREY FRIABLE DOLOMITE, puggy; matrix (40%), and fragments of dark grey laminated friable dolomite (20%)

40% GYPSUM, white; veins of acicular gypsum to 2 cm thick

257.79 - 258.40 m (845'9" - 847'9")

90% LIGHT GREY-BROWN DOLOMITE, laminated, fragments to 3 cm across of an initially single bed dip 80°

5% GYPSUM, white, acicular; irregular veins and fragments

5% DARK GREY FRIABLE DOLOMITE, irregular tracings

258.40 - 258.72 m (847'9" - 848'10")

70% GYPSUM, light grey, coarsely crystalline; fragments to 1 cm across

30% DARK GREY FRIABLE DOLOMITE, tracings and irregular and lenticular bodies to 1 cm across

258.72 - 259.99 m (848'10" - 853'10")
60% DOLOMITIC ANHYDRITE, light to dark grey, laminated; beds to 16 cm thick, dip 60°, gently folded, contorted and brecciated in part, slightly recrystallized to coarsely crystalline gypsum (2%), in 3 cm bed dips 45° at 259.30 m
37% ANHYDRITE. white, medium crystalline; laminae to 1 cm thick in beds of gypsiferous anhydrite
3% ACICULAR GYPSUM, concordant veins to 5 mm thick

259.99 - 261.29 m (853'0" - 857'3")
60% GYPSUM, white, coarsely crystalline; fragments to 2 cm across, generally smaller (20%), laminated beds dip vertical (30%), and irregular veins of acicular gypsum to 2 mm thick, generally in dolomite beds (10%)
10% GYPSIFEROUS DOLOMITE, moderately hard; laminae
30% GREY FRIABLE DOLOMITE, laminated; beds to 2 cm thick, brecciated in part (25%) and irregular bodies to 2 cm across (5%)

261.29 - 261.44 m (857'3" - 857'9")
70% ANHYDRITE, white, medium crystalline, laminated, dips 20°
20% DOLOMITIC ANHYDRITE, light grey, moderately hard, grades to anhydrite; laminae to 5 mm thick
10% ACICULAR GYPSUM, concordant veins to 2 mm thick

CORE No. 70

Interval: 261.44 - 266.09 m (857'9" - 873'0")
Cut: 4.65 m (15'3") Recovered: 4.65 m (15'3")
Description:

266.09 - 262.94 m (857'9" - 862'8")
60% DOLOMITIC ANHYDRITE, light grey, moderately hard, grades to anhydrite, in part as a laminated bed dip 90° but concordant in part
30% DOLOMITIC ANHYDRITE, white, medium crystalline; laminae to 1 cm thick in dolomitic anhydrite bed; recrystallized to gypsum in several fragmented zones (5%)
5% ACICULAR GYPSUM, white; concordant veins to 1 cm thick in fractured zones
5% GREY FRIABLE DOLOMITE, soft; laminae to 1 mm thick throughout

262.94 - 263.65 m (862'8" - 865'0")
70% GYPSUM, white, coarsely crystalline; fragments to 8 cm across containing soft dolomite tracings (50%), and irregular acicular gypsum veins (20%)
30% DARK GREY FRIABLE DOLOMITE, irregular tracings and fragments to 1 cm across

263.65 - 266.09 m (865'0" - 873'0")
60% ANHYDRITE, white, some light brown, medium crystalline, laminated; dominant near top; dips 90°, slightly folded, grades to dolomitic anhydrite in some laminae; some pure anhydrite altered to coarsely crystalline gypsum in laminae, fractures and anhedral to euhedral inclusions to 5 mm across
30% DOLOMITIC ANHYDRITE, light grey to grey, moderately hard; laminae and beds to 2 cm thick
10% DARK GREY FRIABLE DOLOMITE, white, soft; irregular tracings in recrystallized coarse crystalline gypsum and throughout bed

CORE No. 71

Interval: 266.09 - 270.66 m (873'0" - 888'0")
Cut: 4.65 m (15'3") Recovered: 4.55 m (14'11")
Description:
266.12 - 267.14 m (873'1" - 876'5")
65% DOLOMITIC ANHYDRITE, light grey, laminated; bed vertical, slightly contorted in part, grades to anhydrite, recrystallized to coarsely crystalline gypsum in part (30%)
20% ANHYDRITE, white to light grey; medium crystalline, laminae in dolomitic anhydrite to 1 cm thick, recrystallized to gypsum in part (10%)
10% ACICULAR GYPSUM, concordant laminae to 1 cm thick
5% LIGHT GREY FRIABLE DOLOMITE, soft; tracings in matrix
267.14 - 268.30 m (876'5" - 880'3")
90% DOLOMITIC ANHYDRITE, light grey to grey, moderately hard, grades to anhydrite in part, regularly laminated, bed dips 80-90°, gently folded, recrystallized in part to coarsely crystalline gypsum
5% ANHYDRITE, white, medium crystalline; laminae to 1 cm thick near base
5% ACICULAR GYPSUM white; concordant vein 1 cm thick, dipping 70° at base of bed
268.30 - 269.14 m (880'3" - 883'0")
35% DOLOMITIC ANHYDRITE, light grey, dominated; vertical recrystallized to coarsely crystalline gypsum in part
60% ANHYDRITE, white, regularly laminated, medium crystalline, vertical, recrystallized to gypsum in part (35%)
5% ACICULAR GYPSUM, veins to 2 cm thick
Bed terminated at base by small shear plane
269.14 - 269.75 m (883'0" - 885'0")
75% ANHYDRITE, white, medium crystalline, laminated; fragments near base
15% GREY FRIABLE DOLOMITE, soft; irregular tracings throughout brecciated zones, and irregular tracings in laminated beds
5% ACICULAR GYPSUM, veins to 3 mm thick
5% DOLOMITIC ANHYDRITE, light grey, moderately hard; laminae to 5 mm thick
269.75 - 270.66 m (885'0" - 888'0")
70% ANHYDRITE, white, medium crystalline, laminated; vertical bed, slightly contorted in part, contains several horizontal joints filled with acicular gypsum and a few veins of acicular gypsum to 3 mm thick along bedding; recrystallized to gypsum in part along contact with acicular veins
30% DOLOMITIC ANHYDRITE, light grey; laminae to 3 mm thick

CORE No. 72

Interval: 270.66 - 275.23 m (888'0" - 903'0")
Cut: 5.57 m (15'0") Recovered: 4.57 m (15'0")
Description:
270.66 - 273.08 m (888'0" - 985'11")
50% ANHYDRITE, white, medium crystalline, laminated; dips 70°, slightly contorted in part, recrystallized to coarsely crystalline gypsum along fractures and laminae (10%)
45% DOLOMITIC ANHYDRITE, light grey, moderately hard; laminae and beds recrystallized to gypsum in part
5% ACICULAR GYPSUM, concordant and discordant laminae to 1 cm thick

273.08 - 273.76 m (895'11" - 898'2")
35% ANHYDRITE, medium crystalline, laminae to 4 cm thick
40% DARK GREY FRIABLE DOLOMITE, moderately hard; matrix
10% GYPSUM, grains disseminated in matrix
10% DOLOMITIC ANHYDRITE, light grey, moderately hard; laminae in anhydrite fragments
5% ACICULAR GYPSUM, white; veins to 2 cm thick

273.76 - 274.98 m (898'2" - 902'2")
40% DOLOMITIC ANHYDRITE, light grey, laminated; laminae in fragments of anhydrite, and fragments to 10 cm across
40% ANHYDRITE, white, medium crystalline, laminated; laminated fragments to 10 cm across, smaller near base, recrystallized to gypsum in basal 30 cm of interval (30%)
10% ACICULAR GYPSUM, white; veins to 1 cm thick, and grains in soft dolomite (10%)
10% GREY FRIABLE DOLOMITE, light grey, moderately soft; matrix

274.98 - 275.27 m (902'2" - 903'0")
60% ANHYDRITE, white to light grey, medium crystalline, laminated, dips 60°, brecciated near top
30% DOLOMITIC ANHYDRITE, light grey, moderately hard; laminae in anhydrite to 5 mm thick
10% ACICULAR GYPSUM, irregular veins between fragments to 5 mm thick

CORE No. 73

Interval: 275.23 - 279.89 m (903'0" - 918'3")
Cut: 4.65 m (15'3") Recovered: 4.62 m (15'2")
Description:

275.26 - 276.55 m (903'1" - 904'4")
65% ANHYDRITE, white to light grey, medium crystalline, regularly laminated, slightly contorted in part; dips 45-90°, recrystallized to gypsum along laminae and fractures especially near base (3%)
35% DOLOMITIC ANHYDRITE, light grey, moderately hard; grades to grey friable dolomite in part; laminae
5% GYPSUM, acicular; vertical veins to 2 cm thick from 275.84 m (905'0") - 276.65 m (906'0")

275.64 - 276.94 m (904'4" - 908'7")
40% GREY FRIABLE DOLOMITE, moderately hard; matrix
30% GYPSUM, white; irregular veins of acicular gypsum to 1 cm thick, and irregular bodies to 3 cm across (20%), and finely disseminated grains in matrix (10%)
20% DOLOMITIC ANHYDRITE, white to dark grey, moderately hard; laminae (10%), and fragments to 2 cm across (10%)
10% ANHYDRITE, white; laminated fragments to 2 cm across; dip 70°

276.94 - 277.45 m (908'7" - 910'3")
70% GREY FRIABLE DOLOMITE, moderately hard to moderately soft, regularly laminated; vertical bed
20% ANHYDRITE, moderately hard, laminated bed 3 cm thick, dip vertical
10% ACICULAR GYPSUM, white; branching veins 1 cm thick between dolomite and anhydrite

277.45 - 277.77 m (910'3" - 911'4")
85% DOLOMITIC ANHYDRITE, light grey-brown; bed dips 45°, brecciated in part, slightly contorted, recrystallized to gypsum (10%)
13% GYPSUM, white, irregular veins of acicular gypsum to 2 mm thick, and irregular bodies to 5 cm across
2% LIGHT BROWN TOUGH DOLOMITE, fragments to 1 cm across at base

277.77 - 278.31 m (911'4" - 913'1")
80% ANHYDRITE, white to light grey, medium crystalline, laminated, contorted in part, dips 45°, recrystallized to gypsum in part (20%), particularly near base, fragmented in part
4% ACICULAR GYPSUM, irregular veins and bodies in basal 15 cm
16% DOLOMITIC ANHYDRITE, light grey; laminae
278.31 - 279.89 m (913'1" - 918'3")
40% ANHYDRITE, white to light grey, laminated; bed dips 70-90°, brecciated with angular fragments to 13 cm across
40% DOLOMITIC ANHYDRITE, light to dark grey, grades to grey friable dolomite in part, moderately hard to moderately soft; laminae to 2 mm thick
20% ACICULAR GYPSUM, white; veins to 5 mm thick form matrix

CORE No. 74

Interval: 279.89 - 284.54 m (918'3" - 933'6")
Cut: 4.65 m (15'3") Recovered: 4.65 m (15'3")
Description:
279.89 - 280.42 m (918'3" - 920'0")
60% GYPSUM, white to light grey, regularly laminated; bed dips 70°, brecciated with fragments to 10 cm across in part, contains remnants of anhydrite (10%)
30% DOLOMITIC ANHYDRITE, light to dark grey, moderately hard; laminae and irregular tracings
10% ACICULAR GYPSUM, irregular veins to 5 mm thick between fragments
280.42 - 281.16 m (920'0" - 922'5")
90% DOLOMITIC ANHYDRITE, light grey, moderately hard, regularly laminated; bed dips 90°, grades to anhydrite in part, slightly recrystallized to gypsum towards base (10%)
10% ACICULAR GYPSUM, white; concordant (3%), and discordant (7%) veins to 1 cm thick
281.16 - 282.22 m (922'5" - 925'11")
85% DOLOMITIC ANHYDRITE, dark grey, moderately soft, slightly laminated in part, dips 80-90°
15% ACICULAR GYPSUM, irregular concordant (10%), and discordant (5%) veins to 5 mm thick
282.22 - 282.45 m (925'11" - 926'8")
80% GYPSUM, white, laminated; dips 45°, coarsely crystalline, contains residual fragments of anhydrite to 2 cm across (20%), and irregular veins of acicular gypsum to 3 mm thick at base (5%)
20% GYPSIFEROUS DOLOMITE, grey; laminae in gypsum
282.45 - 282.55 m (926'8" - 927'0")
100% DARK GREY FRIABLE DOLOMITE, soft, laminated in part, grades to gypsiferous dolomite in part, dips 45°
282.55 - 282.98 m (927'0" - 928'5")
70% DARK GREY FRIABLE DOLOMITE, moderately soft; grades to gypsiferous dolomite in part, regularly laminated dips 45°
30% GYPSUM, white; recrystallized laminae in dolomite to 1 cm thick (10%), and veins of acicular gypsum filling fractures to 2 cm across; dips 70° (20%)
282.98 - 283.46 m (928'5" - 930'4")
80% ANHYDRITE, white, regularly laminated, medium crystalline; dips 45°, recrystallized in part particularly near base (40%)
20% DOLOMITIC ANHYDRITE, light grey, grades to grey friable dolomite; laminae to 3 mm thick
283.46 - 283.56 m (930'0" - 930'4")
95% DARK GREY FRIABLE DOLOMITE, moderately soft, regularly laminated, dips 45°
5% GYPSUM, white, coarsely crystalline; as laminae in dolomite

283.56 - 283.82 m (930'4" - 931'2")
50% BLACK TOUGH DOLOMITE, irregular fragments
50% GREY FRIABLE DOLOMITE, matrix

283.82 - 284.00 m (931'2" - 931'9")
60% GYPSUM, white; coarsely crystalline laminated fragments to 2 cm across (20%), and irregular veins of acicular gypsum to 3 mm thick (40%)
40% DARK GREY FRIABLE DOLOMITE, grades to gypsiferous dolomite, in part as matrix, moderately hard

284.00 - 284.27 m (931'9" - 932'8")
90% BLACK TOUGH DOLOMITE, fragments of dolomite to 2 cm across in dolomite matrix
8% DOLOMITIC ANHYDRITE, laminated; dips 90°, fragments to 5 cm across
2% ACICULAR GYPSUM, white; irregular veins to 3 mm thick, and fragments to 1 cm across in dolomitic anhydrite and dolomite

287.37 - 287.61 m (942'10" - 943'7")
99% BLACK TOUGH DOLOMITE, hard; fragments to 1 cm across in dolomite matrix; contains bed of darker dolomite 5 cm from top with traces of pyrite at junction with lighter coloured dolomite
1% ACICULAR GYPSUM, white; irregular veins near base

287.61 - 288.44 m (943'7" - 946'4")
60% ANHYDRITE, white, medium crystalline, regularly laminated; dips 30-60°, recrystallized in part (10%)
15% DOLOMITIC ANHYDRITE, light grey; laminae
15% DARK GREY FRIABLE DOLOMITE, moderately soft, laminated; laminated fragments in 10 cm interval at 287.69 cm (945'0") and 3 cm interval at 288.04 m (945'0")
5% ACICULAR GYPSUM, veins to 2 cm thick
5% BLACK TOUGH DOLOMITE, 2 cm bed dips 60° at 288.04 m (945'0")

288.44 - 288.78 m (946'4" - 947'5")
60% LIGHT GREY FRIABLE DOLOMITE, moderately soft; laminated beds dip 60-90°, contorted at top and brecciated at base
20% ANHYDRITE, white, medium crystalline; laminae to 3 mm thick in dolomite (10%), and laminated fragments near base (10%)
20% ACICULAR GYPSUM, white; veins to 5 mm thick

288.78 - 289.18 m (947'5" - 948'9")
80% ANHYDRITE, white, medium crystalline, laminated, slightly contorted in part; vertical dip
15% DOLOMITIC ANHYDRITE, light grey, moderately hard; laminae
5% GREY FRIABLE DOLOMITE, soft, irregular bodies, and laminae at base

284.27 - 284.53 m (932'8" - 933'6")
80% BLACK TOUGH DOLOMITE, fragments of dolomite in dolomite matrix
20% GYPSUM, white coarsely crystalline, regularly laminated, vertical bed dips 90°; grains of dolomite to 2 mm across in some laminae, veins of acicular gypsum to 3 mm thick throughout dolomite (5%)

CORE No. 75

Interval: 284.53 - 289.10 m (933'6" - 948'6")
Cut: 4.65 m (15'3") Recovered: 4.57 m (15'0")
Description:

284.61 - 284.71 m (933'9" - 934'1")
80% BLACK TOUGH DOLOMITE, hard; fragments to 1 cm across in dolomite matrix
20% GYPSUM, white, coarsely crystalline, regularly laminated (15%), and veins to 3 mm thick in dolomite dip 30° (5%)

284.71 - 287.37 m (934'1" - 942'10")

95% ANHYDRITE, white, mostly medium crystalline, regularly laminated, slightly contorted in part; dips vary, mostly from 70° at top to 10° at base; recrystallized to gypsum along horizontal fractures in the following proportions:-

284.71 - 285.44 m	10%
285.44 - 286.08 m	30%
286.08 - 286.26 m	60%
286.26 - 287.37 m	10%

4% DOLOMITIC ANHYDRITE, moderately hard; laminae

1% GREY FRIABLE DOLOMITE, irregular tracings in recrystallized zone

CORE No. 76

Interval: 289.18 - 293.83 m (948'9" - 964'0")
Cut: 4.65 m (15'3") Recovered: 4.52 m (14'10")
Description:

289.31 - 289.36 m (949'2" - 949'4")

80% DARK GREY FRIABLE DOLOMITE, moderately soft, regularly laminated, dips 45°

15% ANHYDRITE, white to light grey, grades to dolomitic anhydrite, laminated, dips 45°

5% ACICULAR GYPSUM, irregular veins to 5 mm thick

289.36 - 289.76 m (949'4" - 950'8")

70% DARK GREY FRIABLE DOLOMITE, grades from moderately soft at top to soft at base; matrix

30% GYPSUM, white, coarsely crystalline, even texture, fragments to 2 cm across (15%), grains to 3 mm across (10%), and irregular veins of acicular gypsum to 5 mm thick (5%)

289.76 - 290.25 m (950'8" - 952'3")

50% DOLOMITIC ANHYDRITE, light grey, regularly laminated, moderately soft, gently contorted in part; dips 0-90°

40% ANHYDRITE, light grey, moderately hard, medium crystalline; laminate to 1 cm thick, recrystallized in part (20%)

10% DARK GREY FRIABLE DOLOMITE, soft; laminae

290.25 - 291.97 m (952'3" - 957'11")

60% DARK GREY FRIABLE DOLOMITE, moderately soft to soft at top, laminae mostly vertical but contorted and brecciated in part

20% ANHYDRITE, white; irregular laminae dip 9-90°, medium crystalline, recrystallized in part (10%)

10% DOLOMITIC ANHYDRITE, light grey, moderately hard, grades to anhydrite in part, laminated; vertical dips

10% ACICULAR GYPSUM, irregular veins to 5 mm thick, dips up to 90°

291.97 - 292.53 m (957'11" - 959'9")

95% ANHYDRITE, white, medium crystalline, regularly laminated; dips 80°, recrystallized to very coarse euhedral gypsum crystals (5%), and irregular fragments of coarsely crystalline gypsum to 3 cmm across at top (5%)

292.53 - 293.83 m (959'9" - 964'0")

30% ANHYDRITE, white, regularly laminated; dips 70°, medium crystalline, to gypsum in part (15%)

50% DOLOMITIC ANHYDRITE, light grey, moderately hard, laminae to 1 cm thick

20% ACICULAR GYPSUM, white; veins to 5 mm thick

CORE No. 77

Interval: 293.83 - 298.40 m (964'0" - 979'0")
Cut: 4.57 m (15'0") Recovered: 4.47 m (14'8")
Description:

293.93 - 295.28 m (964'4" - 968'9")
- 50% DOLOMITIC ANHYDRITE, regularly laminated, moderately hard, medium crystalline, dips 70-90° to 294.77 m (967'1") and vertical to 295.28 m (968'9"), terminated at base by shear plane dipping 30°
- 40% ANHYDRITE, white, coarsely crystalline, laminated, recrystallized to gypsum in part (20%)
- 10% ACICULAR GYPSUM, white, concordant and irregular veins to 1 cm thick

295.28 - 296.16 m (968'9" - 971'8")
- 75% GREY FRIABLE DOLOMITE, soft to moderately soft, laminated at top and brecciated near base
- 20% GYPSUM, white, concordant veins of acicular gypsum dip 70° (15%), coarsely crystalline fragments to 5 cm diameter near base (5%)
- 5% DOLOMITIC ANHYDRITE, dark grey, moderately hard, even texture; fragments to 5 cm across towards base

Base of bed dips 60°

296.16 - 296.52 m (971'8" - 972'10")
- 90% GYPSUM, white, coarsely crystalline, laminated; dips 0-30° recrystallized, contains inclusions of medium crystalline anhydrite (20%)
- 10% GYPSIFEROUS DOLOMITE, light grey, moderately hard; laminae and tracings

296.52 - 296.70 m (972'10" - 973'5")
- 60% DARK GREY FRIABLE DOLOMITE, soft, grades to gypsiferous dolomite in irregular network of veins to 1 mm thick (5%)
- 30% DOLOMITIC ANHYDRITE, dark grey, laminated; fragments to 10 cm across
- 10% GYPSUM, white; fragments to 5 mm across in dolomite (3%), irregular veins of acicular gypsum (3%), and laminae in gypsiferous dolomite (4%)

297.21 - 297.67 m (975'1" - 976'7")
- 50% DOLOMITIC ANHYDRITE, dark grey, moderately hard, regularly laminated; dips 45° at top to 90° at base, slightly contorted in part
- 50% GYPSUM, white, coarsely crystalline, recrystallized in laminae to 1 cm thick (40%), and concordant and irregular veins of acicular gypsum (10%)

297.67 - 298.17 m (976'7" - 978'3")
- 95% GYPSUM, white, coarsely crystalline, recrystallized throughout, massive
- 5% GREY FRIABLE DOLOMITE, finely disseminated grains and tracings; dips 70°

298.17 - 298.40 m (978'3" - 979'0")
- 40% DARK BROWN TOUGH DOLOMITE, hard; beds vertical, slightly contorted in part
- 58% ANHYDRITE, white, medium crystalline, laminated; vertical dip, recrystallized to gypsum in part (30%)
- 2% GREY FRIABLE DOLOMITE, finely disseminated grains, and tracings; vertical dip

CORE No. 78

Interval: 298.40 - 300.07 m (979'0" - 984'6")
Cut: 1.67 m (5'6") Recovered: 1.67 m (5'6")
Description:

298.40 - 298.78 m (979'0" - 980'3")
- 70% GYPSUM, white, coarsely crystalline, laminated, dips 70°, recrystallized
- 20% GYPSIFEROUS DOLOMITE, grey; laminae
- 10% DARK BROWN TOUGH DOLOMITE, grades to 1 mm across in gypsum

298.78 - 298.95 m (980'3" - 980'10")
70% BLACK TOUGH DOLOMITE, fragments to 5 cm across, angular in part
15% DARK GREY FRIABLE DOLOMITE, grades to black; fragments to 5 cm across
15% ACICULAR GYPSUM, white; irregular veins to 3 mm thick, and bodies to 2 cm across
298.95 - 299.82 m (980'10" - 983'8")
90% ANHYDRITE, white to light grey, coarsely crystalline, massive, saccharoidal texture, in part recrystallized with gypsum along horizontal fractures, and in small fragments to 5 mm across (10%)
5% GREY FRIABLE DOLOMITE, finely disseminated in gypsum, and tracings
5% BLACK TOUGH DOLOMITE, grains in contorted zones to 5 mm across near base
299.82 - 300.07 m (983'8" - 984'6")
95% DOLOMITE, dark brown, poorly laminated in part; contains fragments of gypsum to 1 cm across
5% ACICULAR GYPSUM, white; veins to 5 mm thick

CORE No. 79

Interval: 300.07 - 300.68 m (984'6" - 986'6")
Cut: 0.64 m (2'1") Recovered: 0.55 m (1'10")
Description:
300.02 - 300.68 m (984'4" - 986'6")
90% BLACK TOUGH DOLOMITE, poorly laminated in part, contains fragments of gypsum to 1 cm across
10% GYPSUM, white, coarsely crystalline; laminae in 10 cm fragments of dolomite at 300.44 m (985'9") (5%), and veins of acicular gypsum to 2 mm thick (5%)

CORE No. 80

Interval: 300.68 - 303.12 m (986'6" - 994'6")
Cut: 2.44 m (8'0") Recovered: 2.44 m (8'0")
Description:
300.68 - 301.22 m (986'6" - 988'3")
96% BLACK TOUGH DOLOMITE, hard, massive; fragments to 2 cm across in dolomite matris
2% PRISMATIC GYPSUM, white; irregular veins to 2 mm thick
2% BLACK FRIABLE DOLOMITE, moderately soft; matrix for dolomite fragments in 5 cm interval at 300.97 m (987'5")
301.22 - 301.55 m (988'3" - 989'4")
65% BLACK FRIABLE DOLOMITE, moderately soft to slightly soft, poorly laminated, vertical dip
30% BLACK TOUGH DOLOMITE, hard, massive; fragments to 10 cm across
5% GYPSUM, white; impure coarsely crystalline fragments to 1 cm across in dolomite matrix (3%), and irregular and concordant veins of acicular gypsum (2%)
301.55 - 301.75 m (989'4" - 990'0")
98% BLACK TOUGH DOLOMITE, hard, faint vertical laminae; grades to grey friable dolomite in part; contact with underlying bed dips 45°
2% PRISMATIC GYPSUM, white; veins
301.75 - 302.06 m (990'0" - 991'0")
90% DARK GREY FRIABLE DOLOMITE, soft, regularly laminated; dips 80°, grades to gypsiferous dolomite in part
9% GYPSUM, white; laminae to 1 mm thick in dolomite (3%), concordant veins of acicular gypsum to 5 mm thick (6%)
1% BLACK TOUGH DOLOMITE, hard; fragments to 2 cm across at base

302.06 - 302.16 m (991'0" - 991'4")
70% DARK GREY TOUGH DOLOMITE, hard; irregular fragments to 5 cm across, grades to light brown in part
28% GYPSUM, white, coarsely crystalline, recrystallized, slightly dolomitic in part; matrix for dolomite (20%), and irregular veins of acicular gypsum (8%)
2% DARK GREY FRIABLE DOLOMITE, irregular fragments to 1 cm across, and irregular tracings
302.16 - 303.12 m (991'4" - 994'6")
90% ANHYDRITE, white to light grey, medium crystalline, regularly laminated, dips 60-90°, recrystallized to gypsum in part along horizontal fracture planes (10%)
7% DOLOMITIC ANHYDRITE, light grey, moderately hard; laminae and tracings
3% BLACK TOUGH DOLOMITE, hard; fragments to 2 cm across

CORE No. 81

Interval: 303.12 - 305.87 m (994'6" - 1003'6")
Cut: 2.74 m (9'0") Recovered: 2.74 m (9'0")
Description:
303.12 - 303.86 m (994'6" - 996'11")
95% BLACK TOUGH DOLOMITE, fragments of dolomite in darker dolomite matrix
5% GYPSUM, white; irregular bodies to 1 cm across (1%), and irregular veins of acicular gypsum to 1 cm thick
303.86 - 304.05 m (996'11" - 997'7")
95% DARK GREY FRIABLE DOLOMITE, moderately hard, regularly laminated, bed dips 70°
5% GYPSUM, white; concordant veins of acicular gypsum to 5 mm thick
304.05 - 304.73 m (997'7" - 999'9")
80% GYPSUM, white, coarsely crystalline; recrystallized throughout, regularly laminated; dips 70-90°, contains irregular veins of acicular gypsum to 2 mm thick (5%)
10% DARK GREY FRIABLE DOLOMITE, bed to 1 cm thick, and laminated fragments to 3 cm across
10% GYPSIFEROUS dolomite, light brown to light grey; laminae in gypsum
304.73 - 305.86 m (999'9" - 1003'6")
55% GYPSUM, white, coarsely crystalline, recrystallized, laminated and fragmented throughout, slightly dolomitic in part, contains irregular veins of acicular gypsum near top (10%)
45% DARK GREY FRIABLE DOLOMITE, moderately soft to moderately hard, laminated; fragments to 10 cm across

END OF HOLE

COMPLETION REPORT

BMR HERMANNSBURG NO. 40

by

A.T. Wells

SUMMARY

BMR Hermannsburg No. 40 (Goyder Pass), a shallow exploratory drill-hole in the core of the Goyder Pass Structure, is situated in the MacDonnell Ranges about 148 kilometres (92 miles) west of Alice Springs. The well was sited a few metres east of outcrops of the late Precambrian Bitter Springs Formation. The aims of the test drilling were to examine the lithology of the formation at depth and to determine if it contained any evaporites. It was proposed to obtain continuous core in any evaporite section and ascertain it's mineralogy, particularly it's potash and sulphur content.

The well was drilled to a total depth of 91.4 metres (300 feet) in the period 18th to the 27th July 1970. The hole was rotary drilled and cored with air and salt saturated drilling fluid, using the Mayhew-1000 rig of the Bureau of Mineral Resources. Coring commenced at about 4 metres (13') and a total of 18 cores were obtained to total depth. Continuous coring was attempted but proved impracticable because of caving hole conditions. Coring was attempted over 66.6 metres (218'6") and 28.7 metres (94'3") of core was recovered which is 43% recovery over the interval that coring was attempted, or core was obtained over 31% of the hole.

The drill-hole penetrated about 17 metres of friable, medium-grained sandstone, and 24 metres of silty sandstone, sandy siltstone and claystone with the clay and other fine-grained components increasing proportionately with depth. From 42 metres to 79 metres, core recovery was very poor and caving hole conditions were encountered; the core recovered consisted mostly of light grey to black, unconsolidated clay with abundant light to dark grey, vuggy and massive-chert particles either with pyrite filled fractures, or with small clusters of encrusted pyrite crystals. Some discrete aggregates of pyrite crystals occur in the clay matrix.

Below 79 metres to total depth (91.4 metres) no core or cuttings were recovered with the exception of a 15 cm (6") core obtained over the last interval cored from 86.9 to 91.4 m (285'-300'). The poor returns were caused by cavities in the sequence and the resultant loss of fluid circulation.

There are several possible explanations for the origin of the sequence penetrated below 40 metres but the most likely hypothesis is that the chert and fine clay are residual materials filling cavities remaining after dissolution of salt from the Gillen Member of the Bitter Springs Formation.

It was decided to abandon the drill-hole at 91.4 metres (300 feet) because of the difficult drilling conditions and also because no evaporites had been encountered to that depth. The hole is now plugged and abandoned. The drill was then moved to an alternative site on the north side of the Gardiner Range, 58 kilometres in a direct line to the southwest, where BMR Mount Liebig No. 1 (Gardiner Range) was drilled).

The Goyder Pass Structure is not recommended for further shallow drilling as the depth to the top of the evaporite sequence cannot be predicted with any certainty.

INTRODUCTION

BMR Hermannsburg No. 40 (Goyder Pass) was a shallow exploratory drill-hole situated in the core of the Goyder Pass Structure. The structure is located in the MacDonnell Ranges, about 148 kilometres west of Alice Springs in the southern part of the Northern Territory. The drill hole lies about 32 kilometres southwest of Glen Helen Homestead and is within the station boundaries. The drill site can be reached by road from Alice Springs, the first 45 kilometres bitumen, and the remaining 103 kilometres a graded earth and gravel surface. A short access track of about 4 kilometres connects the drill site with the formed road which lies to the north.

The drill hole was initially proposed as the second of three test holes in evaporite sequences of the late Precambrian Bitter Springs Formation, which lies above the basal Heavitree Quartzite of the Amadeus Basin succession. The objectives were to determine if evaporites occurred in the formation at depth in the Goyder Pass Structure, to obtain continuous core in the evaporites and to determine their mineralogy and economic potential. The first hole in the BMR programme to explore the late Precambrian evaporites, BMR, Alice Springs No. 3, was located at the Ringwood Dome in the north-eastern part of the Amadeus Basin (Stewart, 1969) and here the drill reached a total depth of 260 metres.

The drilling of BMR Hermannsburg No. 40 was carried out by a party under the leadership of Mr E.H. Cherry of the Petroleum Technology Section, Bureau of Mineral Resources, using a Mayhew-1000 rig. The first 78.4 m (257') of the hole was drilled with air, but the last 13.1 m (43') was drilled using salt saturated drilling mud. Water for drilling and camp use was obtained from Boomerang Bore about 3 kilometres to the north. 30.48 cm (12") casing was set and cemented to a depth of 3.05 m (10') to prevent loose boulders at the surface falling into the hole. As completed the hole sizes are approximately 35.6 cm (14") from surface to 0-4 m (13'), 14.0 cm (5½") from 4 m (13') to 84.5 m (277') and 10.0 cm (3 15/16") from 84.5 m (277') to 91.4 m (300') T.D. Core was obtained with a 4.572 metre (15') core barrell with a split inner tube and the size of the core was 6.35 cm (2½") diameter throughout.

WELL HISTORY

General data

Well name and number:	BMR Hermannsburg No. 40 (Goyder Pass)
Location:	Lat. 23° 38.3' } (approx.) Long. 132° 27' } (approx.) Hermannsburg Sheet area, SF/53-13
Title holder:	United Canso Oil & Gas Co. (N.T.) Pty Ltd
Petroleum title number:	OP56, N.T.

Area: Amadeus Basin, Northern Territory

Total depth: Driller: 91.4 metres (300 feet)

Date drilling commenced: 18 July, 1970

Date drilling completed: 27 July, 1970

Drilling time to total depth: 43 hours

Elevation: 698 metres approx. (ground level)

Status: Plugged and abandoned. Cement plug to 7.6 m (25')

Drilling data

Drilling by: Bureau of Mineral Resources, Canberra, A.C.T.

Drilling plant: Make: Mayhew

Type: '1000'

Rated capacity: 304.8 m (1,000') with 60.3 mm ($2\frac{3}{8}$") drill pipe

Motors: AEC 600 and Leyland E.U. 400

Mast: Make: Mayhew

Type: tubular, 7.01 m (23')

Rated capacity: 18,144 kg (40,000 lbs)

Pumps: Make: Gardner Denver

Type: FG-FXG

Size: 12.7 cm x 15.2 cm (5" x 6")

Motors: as for rig

Compressor: Make: Gardner Denver

Type: 2-stage reciprocating

Model: WXH

Motors: as per rig

Blowout Preventor: Make: Baash Ross

Size: 15.2 cm x 6.0 cm (6" x $2\frac{3}{8}$")

Model: 'Autolock'

Working pressure: 70 kgf/cm^2 (1000 p.s.i.)

Hole sizes:	Surface to: 25.6 cm (0-13':14")
	4-84.5 m : 14.0 cm (13'to 277' : 5½")
	84.5 - 91.4 m : 10.0 cm (277 to 300' : 3 15/16")
Casing strings:	Size: 30.5 cm x 9.5 mm (12" x ⅜") wall
	Grade: Water bore
	weight: 71.5 kg/metre (48.06 lbs/ft)
	set at: 3.05 m (10')
Casing cement:	size: 30.5 cm (12")
	sacks cement: 8
	cement rise: to surface
	method: single stage
Drilling fluid:	interval: surface to 78.4 m (257')
	type: air
	interval: 78.4 m - TD (277' to TD)
	type: salt water based starch fluid
Water supply:	water from Boomerang Bore
	about 3 km to the north of the well site

Perforation & shooting record: nil

Plugging back & squeeze cement jobs: nil

Fishing operations: nil

Logging and Testing

Ditch Cuttings

Samples of drill cuttings were collected by placing a dry bucket beneath the rotary table next to the hole during air drilling or by using a fine sieve placed in the same position during mud drilling. Cuttings were collected over 1.5 metre (5') intervals and duplicate samples were taken. One set of samples is housed at the Mines Branch, Northern Territory Administration at Alice Springs, and the other set is housed in the Core and Cuttings Laboratory of the Bureau of Mineral Resources, Canberra A.C.T. Because core recovery was good to a depth of about 42 metres (138'), there was no reason to wash the

cuttings. Below 42 metres core recovery was poor and most of the cuttings samples from this depth to 91.4 metres (300') T.D. were washed. Descriptions of the washed cuttings are set out in Appendix VII.

Cores

Continuous coring was attempted and coring commenced at a depth of 4 metres (13'). The cores were cut with a 4.6 metres (15') Triefus split inner tube core barrel using a 10 cm (3 15/15") Triefus tungsten corehead which cut 6.4 cm (2½") core. Eighteen cores were cut, and all were 6.4 cm (2½") in diameter. 28.7 metres (94'3") of core was recovered and 66.6 metres (218'6") of coring was attempted. Recovery over the interval where coring was attempted was 43% and the ratio of total length of core to total depth of the drill hole was 31%. Details of the core are set out in Table XIII and descriptions of the cores are set out in Appendix VIII.

TABLE XIII - CORE INTERVALS AND RECOVERY

BMR Hermannsburg No. 40

Core No.	Cored Interval metres (feet)		Core Recovery	
	From to	Cored length	Length	Percent
1	4.42 - 7.16 (14'6" - 23'6")	2.74 (9')	2.13 (7')	77.7
2	7.62 - 12.19 (25' - 40')	4.57 (15')	2.64 (8'8")	57.8
3	12.19 - 16.03 (40' - 52'7")	3.84 (12'7")	1.06 (3'6")	27.6
4	16.03 - 18.77 (52'7"- 61'7")	2.74 (9')	2.13 (7')	77.7
5	18.77 - 23.31 (61'7" - 76'6")	4.55 (14'11")	3.66 (12')	80.4
6	23.31 - 27.74 (76'6" - 91')	4.42 (14'6")	0.99 (3'3")	22.4
7	27.74 - 29.26 (91' - 96')	1.52 (5')	1.30 (4'3")	85.52
8	29.26 - 33.22 (96' - 109')	3.96 (13')	3.66 (12')	92.4
9	33.22 - 36.88 (109' - 121')	3.66 (12')	2.89 (9'6")	79.0
10	36.88 - 41.45 (121' - 136')	4.57 (15')	2.13 (7')	46.6
11	50.90 - 55.47 (167' - 182')	4.57 (15')	1.06 (3'6")	23.2
12	56.23 - 60.35 (184'6"0 198')	4.11 (13'6")	0.55 (1'10")	13.4
13	60.35 - 64.92 (198' - 213')	4.57 (15')	0.76 (2'6")	16.6

Core No.	Cored Interval metres (feet)			Core Recovery	
	From	to	Cored length	Length	Percent
14	64.92	69.49	3.57	0.76	16.6
	(213'	228')	(15')	(2'6")	
15	69.49	72.54	3.05	1.22	40.0
	(288'	238')	(10')	(4')	
16	73.76	75.29	1.52	0.76	50.0
	(242'	247')	(5')	(2'6")	
17	75.29	78.33	3.05	0.84	27.5
	(247'	257')	(10')	(2'9")	
18	86.87	91.44	4.57	0.15	3.3
	(285'	300')	(15')	(6")	

Well Surveys

No electric logs were run in the hole firstly because the drilling was prematurely abandoned well before the projected total depth and secondly because the primary objective, the intersection and coring of the evaporite sections in the Bitter Springs Formation, was not achieved. No side wall sampling, gas logs, formation testing, deviation surveys or other well surveys were carried out.

GEOLOGY

Summary of Previous Work

Geological

Prichard and Quinlan (1962) mapped the southern half of the Hermannsburg Sheet area and described the outcrop of disrupted beds at Goyder Pass (Fig. 18) as being a cross-section of a diapiric structure with the Bitter Springs Formation constituting the mobile beds. The lensing out of the lower member of the Mereenie Sandstone against the domed Larapinta Group was given as evidence for structural growth during Mereenie Sandstone deposition and the lack of thinning and disruption of the beds after the deposition of the basal member of the Pertnjara Group as evidence for the age of cessation of growth of the structure. Prichard and Quinlan state that the Goyder Pass Structure developed during the period of tectonism which formed the steep dips along the northern flank of the Missionary Plain Syncline although they suggest that the location of the structure was controlled by earlier tectonic effects not now apparent. McNaughton et al (1967) also considered Goyder Pass to be a diapiric structure but Quinlan and Forman (1968) consider that because thrusting between two décollement horizons has been demonstrated elsewhere in the basin, it was possible that the structure may have been caused by thrusting upwards from the Bitter Springs Formation into a possible salt horizon within the Pertaoorrta Group. Both hypotheses concerning the origin of the Goyder Pass Structure are reviewed in Wells et al (1970).

Geophysical

The Bureau of Mineral Resources has carried out regional aeromagnetic, gravity and radiometric surveys in the area of Goyder Pass. The spacing of flight lines and observation points is too large to show if any anomalies can be directly related to the Goyder Pass Structure.

One seismic line was surveyed by the BMR between the Gardiner Range and Goyder Pass and many seismic lines in the Missionary Plains area were conducted by Magellan Petroleum Corporation and reported by Froelich and Krieg (1969). The latter surveys presented evidence to show that the disrupted beds at Goyder Pass can be continued in the subsurface westwards towards the Deering Fault and Carmichael Structure. The thrust on the east side of the structure, appears to split into several planes between Goyder Pass and the Carmichael Structure. They estimate that in places the minimum vertical displacement is about 3,500 metres (11,500'). Thinning of sedimentary section has also taken place on the flanks of the Carmichael Structure and indicates structural growth throughout the Ordovician.

Drilling

The closest petroleum exploration well to the Goyder Pass Structure is Tyler No. 1 sited about 14 kilometres to the south of BMR Hermannsburg No. 40. The well reached a total depth of 3,830 metres (12,565 feet) (Huckaba and Magee, 1969) and penetrated Devono-Carboniferous?, and Ordovician sediments of similar lithology and thickness to the formations exposed in the Goyder Pass Structure. The formations penetrated in ascending order and their thicknesses are - Stairway Sandstone, 299.9+ m (984'+); Stokes Siltstone 479.9 m (1,545'); Mereenie Sandstone, 838.2 m (2,750'); Parke Siltstone, 48.5 m (159'); Hermannsburg Sandstone, 847.6 m (2,781') and Brewer Conglomerate, 1,324.7+ m (4,346'+).

The closest wells that have reached the Bitter Springs Formation are East Mereenie No. 4 and James Ranges 'A' No. 1. No evaporites were encountered in the formation in these wells but further east Precambrian evaporites were penetrated in Ooraminna No. 1, Mount Charlotte No. 1 and further south Erldunda No. 1. Lower Cambrian evaporites were encountered in Alice No. 1 and also in Mount Charlotte No. 1. In the well sections the evaporites in the Bitter Springs

Formation consist mostly of halite with minor amounts of anhydrite and gypsum. A petrological description of the well section in Ooraminna No. 1 and Erldunda No. 1 are given in Schmerber (1966a and b) and for Mount Charlotte No. 1 by Schmerber and Ozimic (1966).

Regional Geology

The Goyder Pass Structure lies in the Western MacDonnell Ranges about 148 kilometres west of Alice Springs. A geological map and cross section of the area around the drill site is shown in Figure 17. The Ranges consist of a series of roughly east-west trending sandstone and quartzite ridges separated by valleys that have been carved in the more easily eroded shale and siltstone. The structure of the late Precambrian and Palaeozoic sediments of the Amadeus Basin exposed along the southern front of the MacDonnell Ranges is essentially homoclinal. Precambrian crystalline metamorphic and igneous rocks occur to the north of the basin margin and form the higher parts of the Ranges.

The sediments in the northern part of the basin consist essentially of a sequence of miogeosynclinal deposits of a shallow water shelf facies. Sedimentation began in the late Precambrian with clean well sorted sandstones of the Heavitree Quartzite deposited unconformably on the eroded Precambrian crystalline basement rocks. The basal quartzite was overlain by thick dolomite, limestone, shale and evaporites of the Bitter Springs Formation. From well information it is known that the evaporites occur in the lower Gillen Member of the formation. This formation is overlain disconformably by tillite of the Areyonga Formation and then by several thousand metres of essentially conformable, marine, late Precambrian, Cambrian and Ordovician sediments. Deposition was then interrupted by several diastrophic events which occurred at intervals during the deposition of the Devono-Carboniferous continental deposits. During this period the northern margin of the Amadeus Basin was formed. A large elongated belt of crystalline basement rocks and overlying sediments was upwarped in several phases. The sediments were eventually stripped completely and during the last stages of deposition in the basin the basement was exposed and rapidly denuded.

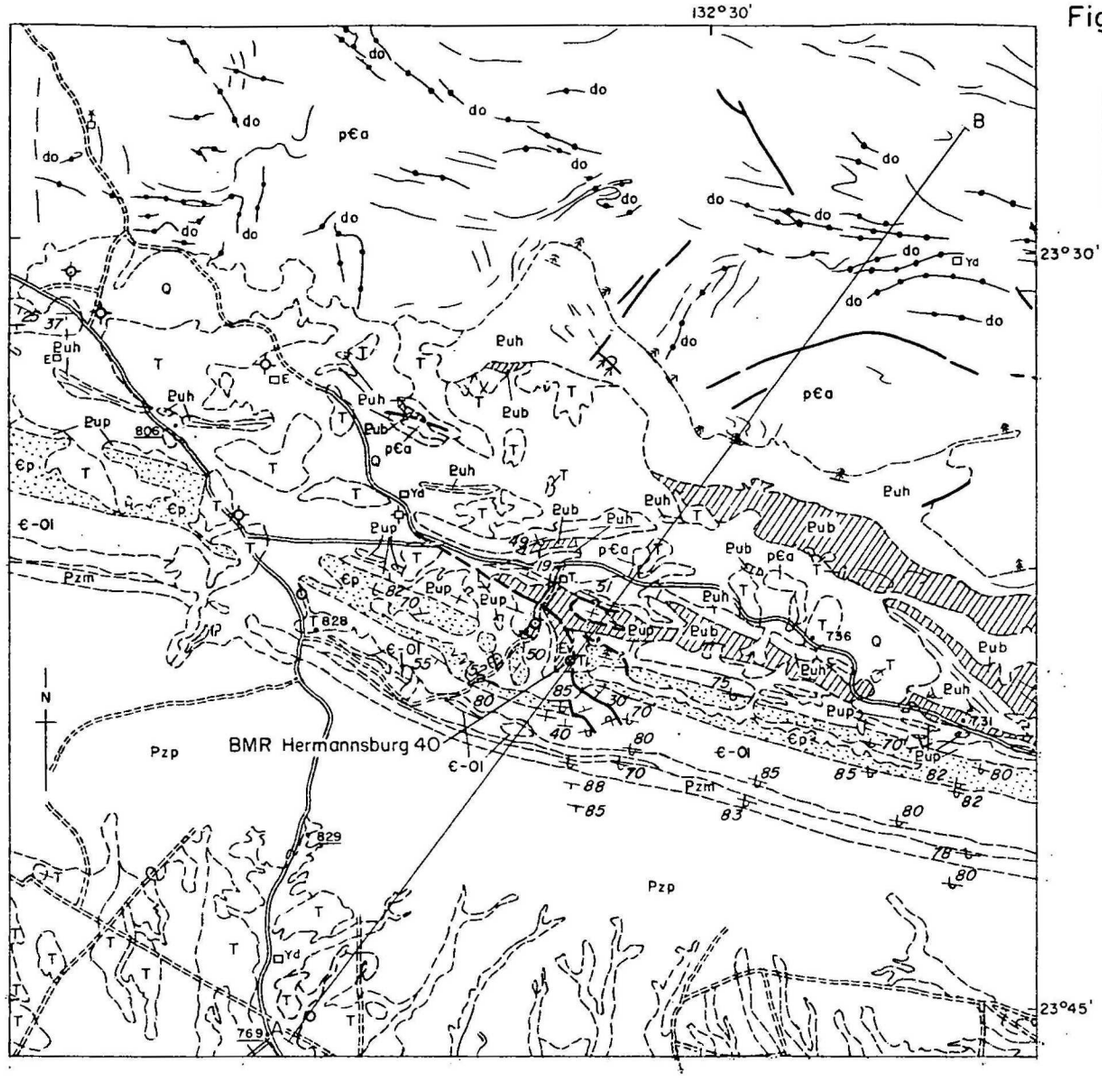
The last major diastrophic event, the Alice Springs Orgeny, caused tight folding of the sediments and the basal formations (Bitter Springs Formation and Heavitree Quartzite) were in places infolded with the basement rocks to form thrust nappes. A décollement formed in the incompetant Bitter Springs Formation and the overriding sediments were subjected to a different style of folding to that experienced by the older rocks. This style of deformation was facilitated by the presence of evaporites in the Bitter Springs Formation and a second lubricant layer with evaporites is found as well in places in the basal part of the Cambrian sequence. In several structures it has been found (Wells et al, 1967) that thrusts originating in the Bitter Springs Formation commonly migrate up section and form an upper thrust plane in the younger sequence. Such a mechanism, known as listric thrusting, has been suggested as a possible explanation for the origin of the Goyder Pass Structure. Supporting evidence which partly substantiates this type of origin is its structural setting in front of the Ormiston Nappe Complex.

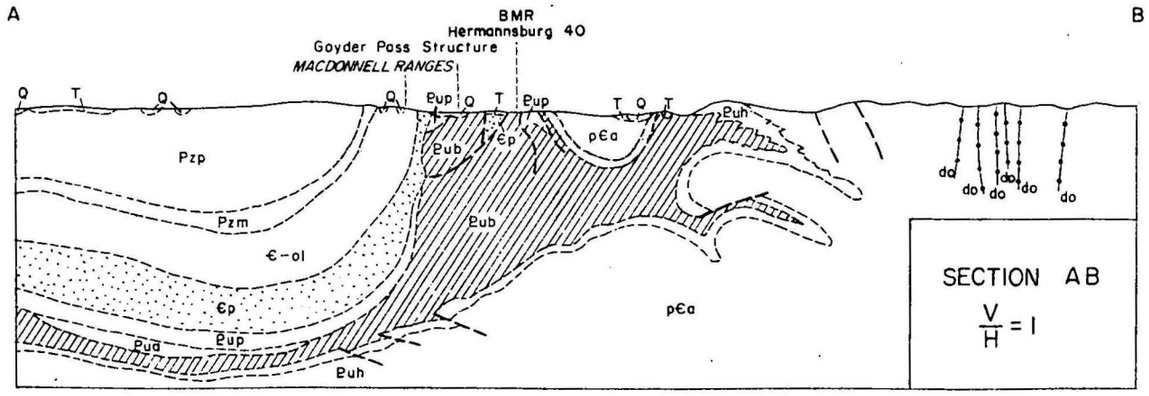
The various theories on the origin of the Goyder Pass Structure have already been mentioned (see p. 215). It appears likely that during the formation of the structure a combination of the various mechanisms that have been described were in operation and that there is no one unique solution to its origin. It was considered that because diapirism played some part in the origin of the Goyder Pass Structure then evaporites would be encountered at shallow depth in its core.

Lithological Descriptions

Predominantly arenaceous rocks compose the upper 21.3 m (70 feet) of section penetrated in the hole and lutaceous rocks are predominant from about 21.3 - 42.7 m (70 to 140 feet). The poor core recovery below 42.7 m (140 feet) to total depth made it impossible to accurately describe the succession in this interval. No cuttings were recovered over most of this interval because of lost circulation undoubtedly caused mostly by cavities in the sequence.

Fig.17 GEOLOGICAL MAP AND CROSS SECTION OF AREA AROUND BMR HERMANNSBURG 40 DRILL HOLE, WESTERN MACDONNELL RANGES





CAINOZOIC	QUATERNARY			Q — *Alluvium, sand, travertine, conglomerate*
	TERTIARY			T — *Sandstone, sandy clay, sandy siltstone, lignite, conglomerate*
PALAEOZOIC	DEVONIAN TO CARBONIFEROUS?	Pertnjara Group		Pzp — *Calcareous conglomerate, calcareous sandstone, red-brown silty sandstone, pebbly sandstone, siltstone, minor limestone*
	DEVONIAN?		Mereenie Sandstone	Pzm — *Sandstone*
	CAMBRIAN TO ORDOVICIAN	Larapinta Group		E-Ol — *Fossiliferous sandstone, siltstone, shale, limestone*
	CAMBRIAN	Pertaoorrta Group		Ep — *Sandstone, siltstone, shale, limestone*
PRECAMBRIAN	PROTEROZOIC		Pertatataka Formation	Pup — *Siltstone, sandstone, limestone*
			Areyonga Formation	Pua — *Calcareous sandstone, tillitic siltstone conglomerate. (Section only)*
			Bitter Springs Formation	Pub — *Dolomitic limestone, shale, siltstone, evaporites*
			Heavitree Quartzite	Puh — *Quartzite, sandstone*
			Arunta Complex	pEa — *Gneiss, schist, amphibolite, quartzite granite, dolerite, pegmatite*

- *Geological boundary, position approximate*
- *Overturned syncline*
- *Fault*
- 78° *Dip and strike of strata*
- *Vertical strata*
- 42° *Overturned strata*
- *Dip < 15°*
- *Dip 15° - 45°*
- *Dip > 45°*
- *Trend lines*
- *Dyke, do-dolerite*
- Ev *Drill hole, Ev-evaporites*
- *Bore*
- *Abandoned bore*
- *Well*
- *Abandoned well*
- *Wind pump*
- T *Water tank*
- E *Earth tank*
- Yd *Yard*
- *Road*
- *Vehicle track*
- 806 *Height in metres, instrument levelled* (Datum: mean sea level)
- 828 *Height in metres, barometric*

5 0 5 10 KILOMETRES
5 0 5 10 MILES

Geology from Hermannsburg 1:250,000 Geological Sheet, first edition.

F53/A13/36

To Accompany Record 1972/36

Fig. 18 VERTICAL AIR PHOTO MOSAIC OF THE GOYDER PASS STRUCTURE

For explanation of symbols see fig. 17

⊗ *Drill site*

To Accompany Record 1972/36

The first 3.7 m (12 feet) of section penetrated is an extremely coarse unconsolidated deposit with fragments of sandstone up to 60 cm (2 feet) across in a matrix of orange and red stained, well rounded and subrounded, coarse grained, quartz sand. The sandstone of the fragments is siliceous, tough, medium grained and in part glauconitic. It is lithologically identical to the Pacoota Sandstone and is undoubtedly derived from the scarps of this formation which comprise the first arcuate line of outcrops to the south of the drill site.

The sandstone sequence below the upper unconsolidated gravel layer is mostly medium-grained, friable, poorly bedded, sub-angular, porous, moderately poorly sorted, with shades of brown commonly in the upper layers grading to grey in the lower beds. Compaction and the clay content increase with depth and friability decreases proportionately.

Thin sections of the sandstone show a bimodal texture, and the majority of the quartz grains are subangular and average about 0.15mm (0.006") across. As well there is a uniform scattering of coarser subrounded grains, averaging about 3 mm (0.12") across that show remnant grain boundaries preserved beneath secondary thin silica overgrowths. Similar grains are common in the Lower Palaeozoic sandstones in nearby outcrops. The coarse grains compose about 10% of the rock. Limonitic clay and fine grained quartz comprise the matrix.

Sandstone grades into siltstone from about 16.8 - 21.3 m (55 to 70 feet) and the sediments gradually become finer grained and claystone is dominant from 30.5 - 40.2 m (100 to 132 feet). The siltstone is white to light grey, mostly poorly sorted, contains variable proportions of sand and is generally massive. The underlying claystone which occurs in the interval 33.5 - 40.2 m (110 to 132 feet) is semiplastic, breaks with an imperfect conchoidal fracture and has a greasy lustre.

The sequence from 41.4 - 91.4 m (136 to 300 feet) (total depth) can only be surmised from the scant recovery of cores and cuttings. However the uniform composition of the recovered material suggest that the sequence, is similarly also fairly homogeneous throughout. A study of the drillers logs indicates also

that there are gaps in the sequence caused by deep weathering and leaching and has resulted in the formation of caverns.

The evidence available suggests that the sequence from 41.5 - 91.4 m (136 to 300 feet) consists mainly of plastic dark siltstone and clay together with dark grey and black pyritic and oolitic chert. The only sedimentary structures visible are poorly preserved laminae present in some of the chert pieces which suggests that they are silicified siltstone. The cores show no structure and the relationship between the chert and claystone is not apparent. If the material is primarily a residual deposit then it may consist of an open framework of chert layers and irregular veins with intervening spaces partly filled with clay and silt. The drilling conditions indicate that the size of the interspaces is variable and may be one or two metres across and a few even larger.

Anatase is common in both the sandstone and siltstone of the upper part of the sequence (Table XIV) as well in some of the chert from the lower part. The anatase has probably formed authigenically in the sediments.

TABLE XIV - MINERALS IDENTIFIED IN CORE SAMPLES FROM BMR HERMANNSBURT NO. 40 BY X-RAY DIFFRACTION

Registered No.	Depth	Core No.	Minerals Identified
70.50.0166	27.13 m (89'0")	6	Quartz, kaolinite, anatase
70.50.0167	28.96 m (95'0")	7	Quartz, kaolinite, anatase, muscovite
70.50.0168	35.20 m (115'6")	9	Kaolinite, quartz, muscovite, anatase (tr)
70.50.0169	39.62 m (130'0")	10	Quartz, kaolinite, muscovite, anatase (tr)
70.50.0170	50.90-55.47 m (167'0"-182'0")	11	Quartz, kaolinite, anatase
70.50.0171a	72.54 m (238'0")	15	Quartz, kaolinite, muscovite
70.50.0172	91.28-91.44 m (299'6"-300'0")	18	Quartz, kaolinite, muscovite

Discussion and Conclusions

The clastic rocks penetrated in the interval 3.05 - 41.1 m (10-135 feet) in the well are Tertiary in age. Lithologically similar sequences are exposed in measas along the MacDonnell Ranges as well as in nearby outcrops to the east of the drillsite. The rocks exposed in the mesas consist of friable, kaolinitic siltstone and sandstone usually with high level gravels forming a cap on the sediments. These coarse gravels are composed chiefly of phenoclasts of resistant silicified sandstone of the Heavitree Quartzite and were deposited as piedmont gravels. They are now isolated on top of the dissected mesas as a result of recent rejuvenated stream incision. The gravels forming the first 3.05 m (10 feet) in Hermannsburg No. 40 have a different composition with phenoclasts chiefly of Phanerozoic sandstone. They undoubtedly have a more recent origin and have been deposited by modern streams. Gravels similar to those in the well section are present in the bed load of nearby drainage channels. Davenport Creek, the largest stream draining the Goyder Pass area flows northwards past the drillsite. This creek and its tributaries are incised in folded Palaeozoic rocks and the weathered products have been transported northwards in their beds.

The Tertiary deposits are mainly lacustrine and fluviatile in origin and lie unconformably on the eroded upturned edges of the folded Palaeozoic rocks.

The interpretation of the age and origin of the sequence below 41.1 m (135 feet) is more problematic. Chert and dark shales are known in the late Precambrian Bitter Springs Formation and pyritic sediments are also common in the formation. The possible modes of origin envisaged for this deposit are:-

1. Residual erosion products on bedrock composed of the Bitter Springs Formation.
2. Breccia in a fault crush zone. A fault, near the drillsite, separates outcrops of the Bitter Springs Formation and the Cambrian Pertaoorrta Group, and its position is shown on Figure 17.

3. Residual material filling cavities remaining after dissolution of salt from the Gillen Member of the Bitter Springs Formation.

Cavities were encountered during the drilling of the test hole and similar cavities occur in drill holes that have penetrated evaporites in the Bitter Springs Formation. In addition pyritic chert and black shale are common in the evaporitic sequences of the Bitter Springs Formation and these two facts suggest that mode 3 outlined above is the more likely explanation for the origin of the deposit. However the other two explanations cannot be entirely ruled out and further test drilling in the area would be necessary to prove the presence of evaporites. The area is not recommended for further shallow test drilling of evaporites as the depth of weathering is not known and hence the top of the evaporite sequence cannot be predicted with any certainty. There are also many other localities in the Amadeus Basin where evaporites of the Bitter Springs Formation occur in outcrop and offer better targets for shallow test holes within the range of the Mayhew 1000 drilling rigs that are in present use by the Bureau to investigate shallow evaporite deposits.

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APPENDIX VII

BMR HERMANNSBURG NO. 40 - CUTTINGS DESCRIPTIONS

0-1.52 m (0-5')
QUARTZ, coarse, well rounded in part, stained orange
SANDSTONE, white, tough siliceous, medium grained, well rounded; boulders of sandstone 30-60 cm across, in first metre of soil, probably derived from Pacoota Sandstone

1.52 - 3.05 m (5-10')
QUARTZ, stained red, some clear, subangular, coarse
SANDSTONE, medium-grained, siliceous, glauconitic in part, tough; minor fragments of ferruginous, tough, medium-grained, glauconitic sandstone

3.05 - 4.57 m (10-15')
QUARTZ, coarse and medium-grained, subrounded, and subangular, clear, and lightly orange stained with iron oxide; about 10% coarse rounded quartz
SANDSTONE, white, tough silicified; fragments to 1 cm across, clear grained

4.57 - 6.10 m (15-20')
QUARTZ, medium-grained, minor fine grained, mostly clear, some light orange to pale amber, subangular, moderately well sorted

17.10 - 71.63 m (230-235')
CHERT, mid-grey and light grey, pyritic, vuggy; pyrite occurs as small fracture fillings; vuggy appearance is caused by weathering of abundant pyrite
SILTSTONE, white, silicified, minor; contains some fine pyrite

71.63 - 73.15 m (235-240')
CHERT, as above; pyritic, vuggy, banded in part

73.15 - 74.68 m (242-245')
As above
CHERT, as before
SILTSTONE, white, tough, minor; sacchoroidal texture probably caused by weathering of fine-grained pyrite content

74.68 - 76.20 m (245-250')
As above

71.20 - 77.72 m (250-255')
As above
CHERT, one fragment shows pyritic grey chert, together with white fine-grained chert which shows interlacing of clear quartz in radiating patterns

77.72 - 79.25 m (255-260')
As above
Contains nodules of PYRITE. Some of fine-grained grey CHERT shows box work textures caused by weathering of pyrite. Some chert shows distinct banding

APPENDIX VIII - BMR HERMANNSBURG NO. 40

Core Descriptions

CORE No. 1

Interval: 4.42 - 7.16 m (14'6" - 23'6")
Cut: 2.74 m (9') Recovered: 2.13 m (7')
Description:
5.03 - 7.16 m (16'6" - 23'6")
SANDSTONE, white and light orange-brown, poorly sorted, very porous and friable, very fine to coarse grained, subangular; very fine grained matrix

CORE No. 2

Interval: 7.62 - 12.19 m (25' - 40')
Cut: 4.57 m (15') Recovered: 2.64 m (8'8")
Description:
9.55 - 12.19 m (31'4" - 40')
SANDSTONE, pale brown lower 15 cm orange-brown, mostly medium-grained moderately poorly sorted, subangular to subrounded, porous, friable, poorly bedded, fine matrix with minor clay, some vugs up to 6 mm

CORE No. 3

Interval: 12.19 - 16.03 m (40' - 52'7")
Cut: 3.84 m (12'7") Recovered: 1.07 m (3'6")
Description:
14.96 - 16.03 m (49'1" - 52'7")
SANDSTONE, red-brown and pale brown, upper 15 cm rusty brown, mostly medium-grained, some coarse grained, poorly sorted, subangular to subrounded, porous, friable; slightly more ferruginised than core No. 2

CORE No. 4

Interval: 16.03 - 18.77 m (52'7" - 61'7")
Cut: 2.74 m (9') Recovered: 2.13 m (7')
Description:
16.64 - 17.25 m (54'7" - 56'7")
SANDSTONE, white, minor ferruginous; as above, but more compact, less friable, and contains slightly more clay; grain size as before
17.25 - 18.77 m (56'7" - 61'7")
SANDSTONE, white, medium-grained, poorly sorted, poorly bedded, faint horizontal bedding; fine matrix composes 25% of the rock; proportion of white clay increases with depth

CORE No. 5

Interval: 18.7 - 23.32 m (61'7" - 76'6")
Cut: 4.55 m (14'11") Recovered: 3.66 m (12'0")
Description:
19.66 - 23.31 m (64'6" - 76'6")
SILTY SANDSTONE, at top, pale grey non-bedded, poorly sorted, very silty, grades downwards, to -
SILTSTONE, sandy, pale grey and white, mostly medium and fine-grained with few coarse grains; bedding probably still horizontal

CORE No. 6

Interval: 23.32 - 27.74 m (76'6" - 91')
Cut: 4.42 m (14'6") Recovered: 1.30 m (4'3")
Description:
26.75 - 27.74 m (87'9" - 91')
SILTSTONE, white; contains about 15% medium and some coarse-grained sand, non-indurated, poorly sorted, no bedding evidence, cracks into small pieces

CORE No. 7

Interval: 27.74 - 29.26 m (91' - 96')
Cut: 1.52 m (5') Recovered: 1.30 m (4'3")
Description:
27.97 - 29.26 m (91'9" - 96')
SILTSTONE, white, poorly sorted, with fine to medium-grained, sand, and minor coarse sand, very fine silt and clay in matrix no bedding visible, dissintergrates into small pieces

CORE No. 8

Interval: 29.26 - 33.22 m (96' - 109')
Cut: 3.96 m (13') Recovered: 3.66 m (12')
Description:
29.57 - 32.46 m (97' - 106'6")
SANDSTONE, light grey, friable, medium and fine-grained, contains about 50% sand and 50% silt and clay, as above; that contains for sand and is no more coherent than cores below
32.46 - 33.22 m (106'6" - 109')
CLAYSTONE, light grey, silty; contains fine sand; veryfine-grained matrix

CORE No. 9

Interval: 33.22 - 36.88 m (109' - 121')
Cut: 3.66 m (12') Recovered: 2.90 m (9'6")
Description:
33.98 - 36.88 m (111'6" - 121')
CLAYSTONE, pale brown to grey, silty, contains minor fine sand, slicken-sided in places, plastic, conchoidal fracture; no bedding visible, generally massive, greasy lustre

CORE No. 10

Interval: 36.88 - 41.45 m (121' - 136')
Cut: 4.57 m (15') Recovered: 2.13 m (7')
Description:
39.32 - 40.23 m (129' - 132')
CLAYSTONE, pale grey-brown, greasy lustre, semi-plastic, brittle; contains about 5% medium to coarse-grained sand
40.23 - 41.15 m (132' - 135')
SILTSTONE, cream, contains fine and some coarse-grained sand, minor clay, moderately well indurated, tough, poorly sorted; contains large proportion of clay
41.15 - 41.40 m (135' - 135'10")
SILTSTONE, cream, as above, with coarse sand becoming more common
41.40 - 41.45 m (135'10" - 136')
SANDSTONE, medium-grained, indurated, tough, quartzitic
No recovery from coring over interval 41.45 - 50.90 m (136' - 167')

CORE No. 11

Interval: 50.90 - 55.47 m (167'-182')
Cut: 4.57 m (15') Recovered: 1.07 m (3'6")
Description:
54.40 - 55.47 m (178'6" - 182')
SILTSTONE, grey, clayey, some patches of pink clay in joints crossing the core, and some inclusions of coarse angular grey chert

CORE No. 12

Interval: 56.23 - 60.35 m (184'6" - 198')
Cut: 4.11 m (13'6") Recovered: 0.56 m (CA 22')
Description:
59.79 - 60.35 m (196'2" - 198')
SILTSTONE, grey, clayey, tough, purple-brown, claystone, sandy
CHERT, grey vuggy, tough, angular fragments in clay siltstone
Washed core fragments 59.79 - 60.35 m (196'2" - 198') show the following residue -
CHERT, grey, some patches of red, angular fragments, to 3 cm across very vuggy

CORE No. 13

Interval: 60.35 - 64.92 m (198' - 213')
Cut: 4.57 m (15') Recovered: 0.71 m (CA 30")
Description:
CLAYSTONE, grey, sandy and silty
CHERT, dark grey; vuggy fragments to 3 cm across
Core mostly fragmented, and very little indurated material remains
Washed fragments core 13 yielded -
60% CHERT, light grey, vuggy in part
40% SILTSTONE, white

CORE No. 14

Interval: 64.92 - 69.49 m (213' - 228')
Cut: 4.57 m (15') Recovered: 0.76 m (CA 30")
Description:
68.73 - 69.49 m (225'6" - 228')
CHERT, dark and light grey; angular fragments 1 cm across, pyritic chert nodules to 5 cm across
CLAY, dark grey, fine-grained silty; forms matrix
Washed fragments core 14 yielded -
CHERT, light grey to dark grey, angular fragments, mostly pyritic; nodules of PYRITIC CHERT to 3 cm across; PYRITE in crystals, and fine veins traversing chert

CORE No. 15

Interval: 69.49 - 72.54 m (228' - 238')
Cut: 3.05 m (10') Recovered: 1.22 m (4')
Description:
71.32 - 72.54 m (234' - 238')
CLAY, unconsolidated, interlaminated, light grey and black; abundant pyritic chert nodules to 3 cm across
Lower 8 cm of core consists of black carbonaceous clay with some angular chert fragments

CORE No. 16

Interval: 73.76 - 75.29 m (242' - 247')
Cut: 1.52 m (5') Recovered: 0.76 m (2'6")
Description:
74.52 - 75.29 m (224'6" - 247')
CLAY, unconsolidated, light grey; contains abundant fragments of angular chert, and laminated solicified siltstone to 3 cm across but mostly 3-6 mm across

CORE No. 17

Interval: 75.29 - 78.33 m (247' - 257')
Cut: 3.05 m (16') Recovered: 0.84 m (2'9")
Description:
57.50 - 78.33 m (254'3" - 257')
CLAY, light grey; with interspersed angular fragments of grey chert, to 3 cm across
Washed fragments core 17 yielded -
CHERT, fragments, and grey masses; white, sugary, pyritic
CHERT, large laminated and banded fragments, partly pyritic vuggy; probably solicified siltstone
CHERT, fragments, saccharoidal, flakrey, banded, siliceous, pyritic; probably leached and solicified siltstone
Cave in hole encountered 78.33 - 84.43 m (257' - 277') with minor hard intervals

CORE No. 18

Interval: 86.87 - 91.44 m (285' - 300')
Cut: 1.52 m (5') Recovered: 0.15 m (CA 6")
Description:
CLAY, purplish-grey to dark grey; forms lower 10 cm
CHERT, grey fragments to 3 cm across, pyritic in part; minor oolitic grey chert (similar to Bitter Springs Formation)

RECOMMENDATIONS

There appears to be two structural modes of occurrence of evaporite minerals intersected by drilling in the Bitter Springs Formation of the Amadeus Basin. Bedded deposits were drilled by BMR Alice Springs No. 3 and BMR Lake Amadeus No. 3B, and deposits of probable diapiric origin were intersected by BMR Mount Liebig No. 1.

The chances of intersecting halite in bedded deposits where the drill is spudded in gypsum appears to be low. None was intersected in either Alice Springs No. 3 or Lake Amadeus No. 3B, although elsewhere several oil wells have penetrated halite beds at depth within the formation. Hydration of anhydrite to gypsum has taken place at depths from 100 to over 300 m and percolating ground water would be expected to leach halite occurring at shallower depths in most deposits. A 300 m drill hole may effectively sample only a small interval of the stratigraphic sequence, if the beds are steeply dipping incompetantly folded and if an inclined hole is drilled the leached interval will be correspondingly thicker.

The halite intersected by the drilling was in a structure of probable diapiric origin. The outcrop over the structure is also gypsum but the potential of these deposits is much greater than that of bedded deposits because in the majority of cases halite is necessary for their formation. If a caprock is present, halite is expected at depths generally less than 300 m. The drilling results, together with surface studies of the outcrops have provided criteria for determination of the mineralogy of gypsum caprocks.

A weathered surface crust of earthy gypsum with discrete crystals to 15 cm across is common to all deposits and can be over 1 m thick. In claypan and salt lake deposits this variety would be expected to be present at depth.

At the BMR Mount Liebig No. 1 drillsite outcrops overlying the halite body are composed of brecciated caprock. The weathered surface crust is underlain by very coarsely crystalline, massive, generally brown gypsum with an equigranular texture.

The gypsum deposits on which BMR Alice Springs No. 1 and BMR Lake Amadeus No. 3B were drilled are bedded and have quite a different appearance on the surface. They are coarsely crystalline, but have a laminated and in parts contorted texture which is distinctive. Tracings and laminae of gypsiferous dolomite give a grey appearance to the rock.

Detailed examination of enlarged air-photographs gave information on the relationship of the gypsum body to the surrounding sediments. Diapiric movement of a halite body produces a circular or oval outcrop which may be surrounded by one formation. A circular ridge uplifted by the halite, may be preserved around the outcrop, while the gypsum may have shallow dips away from the centre. Conversely the concondant nature of bedded deposits may be apparent on the air-photographs and therefore distinguishable from diapiric bodies.

Further drillsites can be selected by using these criteria to distinguish caprock gypsum. In cases where the bedrock gypsum is obscured by a thick weathered crust, the crust should be penetrated by either shallow drilling or trenching to determine the mode of occurrence of the underlying gypsum and allow an assessment of the nature of the deposit.

Gravity surveys over surface evaporite occurrences may provide data on the presence and extent of halite bodies, but the cost involved may be similar to that of drilling several shallow stratigraphic holes in the deposit, and the relative costs and benefits should be closely compared before hand.

The next stage of the evaporite investigations in the Amadeus Basin should consist of reassessment of all known gypsum occurrences. Deposits which appear to be of diapiric origin should be investigated by a program of shallow drilling to a depth of about 20 m and occurrences which appear to be underlain by caprock should be drilled to a depth of at least 300 m to assess the intrusive core.

It is in deposits of diapiric origin that the probability of intersecting halite and associated potassium salts at relatively shallow depths is greatest and, in addition, most of the worlds native sulphur deposits occur in the caprock of salt domes.

COMPOSITE LOG

PLATE I.

OPERATOR: BUREAU OF MINERAL RESOURCES

NAME AND NUMBER: BMR MOUNT LIEBIG No.1.

STATE: NORTHERN TERRITORY. 1:250,000 SHEET: MOUNT LIEBIG SF 52-16. BASIN: AMADEUS. WELL STATUS: PLUGGED AND ABANDONED

DRILLING DATA

LOCATION: Lat 23°52'30"S Long 131°56'E
ELEVATION: Ground level 817m (2680') approx
DATE SPUDDED: 4-8-70
DATE DRILLING STOPPED: 11-9-71
DATE RIG OFF: 15-9-71
TOTAL DEPTH: driller 305·87m (1003'6")
mibolog 303·89m (997'), 303·51m (996')

HOLE SIZE DIAMETER	FROM	TO
25·4cm (9 7/8")	0m (0')	42·98m (141')
15·8cm (6 1/4")	42·98m (141')	305·87m (1003'6")

CASING:

DIA	WT	GR	DEPTH	CMT	CMT'D TO
20·3cm (8")	32·3Kg/m (21·7lb/ft)	W/bore	42·98m (141')	22sx.	28m (90')

CEMENT PLUGS SURFACE
PERFORATIONS: NIL
DRILLED BY: BUREAU OF MINERAL RESOURCES
WELL HEAD FITTINGS: none
CEMENTED BY: driller
LOGGED BY: mibolog
DRILLING METHOD: air rotary
LITHOLOGY BY: P.J. Kennewell
DRILLING DATA BY: J.M. Henry

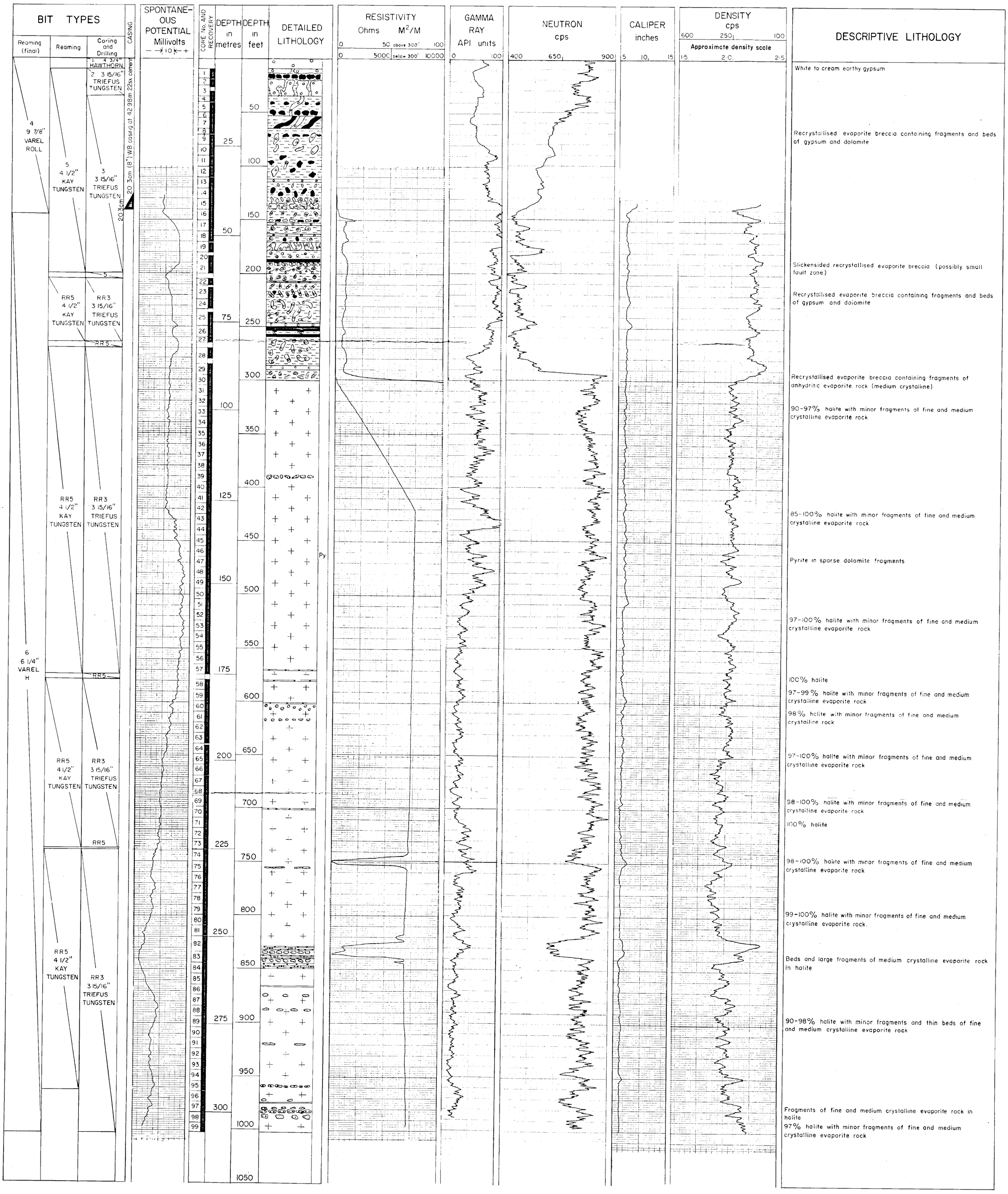
LOG DATA

LOG TYPE	SPONTANEOUS POT.	RESISTIVITY	GAMMA RAY	NEUTRON	CALIPER	DENSITY
DATE	15-9-70	15-9-70	15-9-70	15-9-70	15-9-70	15-9-70
RUN No.	1/1	1/1	1/1	1/1	1/1	1/1
DEPTH-DRILLER	305·87m	305·87m	305·87m	305·87m	305·87m	305·87m
DEPTH-LOGGER	303·89m	303·89m	303·89m	303·89m	303·51m	303·51m
BTM LOG INTERVAL	303·51m	303·51m	303·51m	303·51m	303·21m	303·21m
TOP LOG INTERVAL	92·06m	92·06m	0 m	0 m	92·06m	92·06m
CASING-DRILLER	20·3cm at 42·98m	20·3cm at 42·98m	20·3cm at 42·98m	20·3cm at 42·98m	20·3cm at 42·98m	20·3cm at 42·98m
CASING-LOGGER	42·06m	42·06m	42·06m	42·06m	42·06m	42·06m
BIT SIZE	15·3cm	15·3cm	15·3cm	15·3cm	15·3cm	15·3cm
TYPE FLUID IN HOLE	SALT WATER and BENTONITE	SALT WATER and BENTONITE	SALT WATER and BENTONITE	SALT WATER and BENTONITE	SALT WATER and BENTONITE	SALT WATER and BENTONITE
DENS / VISC.	N.A. / N.A.	N.A. / N.A.	N.A. / N.A.	N.A. / N.A.	N.A. / N.A.	N.A. / N.A.
PH / FLUID LOSS	N.A. / N.A.	N.A. / N.A.	N.A. / N.A.	N.A. / N.A.	N.A. / N.A.	N.A. / N.A.
SOURCE OF SAMPLE	—	—	—	—	—	—
Rm at MEAS TEMP	0·04 at 92°F	0·04 at 92°F	0·04 at 92°F	0·04 at 92°F	0·04 at 92°F	0·04 at 92°F
Rmf at MEAS TEMP	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
Rmc at MEAS TEMP	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
SOURCE Rmf Rmc	N.A. / N.A.	N.A. / N.A.	N.A. / N.A.	N.A. / N.A.	N.A. / N.A.	N.A. / N.A.
Rm at B.H.T.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
TIME SINCE CIRC	approx. 10 hrs.	approx. 10 hrs.	approx. 10 hrs.	approx. 10 hrs.	approx. 10 hrs.	approx. 10 hrs.
MAX. REC. TEMP.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
EQUIP / LOCATION	T101 / PER	T101 / PER	T101 / PER	T101 / PER	T101 / PER	T101 / PER
INSTRUMENTS SURFACE	E1-GL1	E1-GL1	GO-RMM-204	GO-RMM-204	GO-RMM-204	GO-RMM-204
INSTRUM DOWN HOLE	EL-GLS	EL-GLS	GRN 1"	GRN 1"	FDC 1 11/16-Ce	FDC 1 11/16-Ce
TOOL POSITION	FREE	FREE	FREE	FREE	FREE	FREE
RECORDED BY	CRAWFORD					
WITNESSED BY	KENNEWELL					

LITHOLOGICAL REFERENCE

Gypsum; Halite; Evaporite Rock (medium crystalline); Evaporite Rock (finely crystalline); Recrystallised Evaporite Breccia; Dolomite

Py—pyritic



DESCRIPTIVE LITHOLOGY

White to cream earthy gypsum

Recrystallised evaporite breccia containing fragments and beds of gypsum and dolomite

Slickensided recrystallised evaporite breccia (possibly small fault zone)

Recrystallised evaporite breccia containing fragments and beds of gypsum and dolomite

Recrystallised evaporite breccia containing fragments of anhydritic evaporite rock (medium crystaline)

90-97% halite with minor fragments of fine and medium crystalline evaporite rock

85-100% halite with minor fragments of fine and medium crystaline evaporite rock

Pyrite in sparse dolomite fragments

97-100% halite with minor fragments of fine and medium crystalline evaporite rock

100% halite

97-99% halite with minor fragments of fine and medium crystalline evaporite rock

98% halite with minor fragments of fine and medium crystalline rock

97-100% halite with minor fragments of fine and medium crystalline evaporite rock

98-100% halite with minor fragments of fine and medium crystalline evaporite rock

100% halite

98-100% halite with minor fragments of fine and medium crystalline evaporite rock

99-100% halite with minor fragments of fine and medium crystalline evaporite rock.

Beds and large fragments of medium crystalline evaporite rock in halite

90-98% halite with minor fragments and thin beds of fine and medium crystaliine evaporite rock

Fragments of fine and medium crystalline evaporite rock in halite
97% halite with minor fragments of fine and medium crystalline evaporite rock

COMPOSITE LOG

PLATE II

OPERATOR: BUREAU OF MINERAL RESOURCES

NAME AND NUMBER: BMR LAKE AMADEUS No. 3B.

STATE: NORTHERN TERRITORY. 1:250,000 SHEET: LAKE AMADEUS SG 52-4. BASIN: AMADEUS. WELL STATUS: PLUGGED AND ABANDONED

DRILLING DATA

LOCATION: Lat. 24°46'36" S. Long. 131°53'24" E
ELEVATION: Ground level 512 m (1690') approx.
DATE SPUDDED: 8-10-70
DATE DRILLING STOPPED: 4-12-70
DATE RIG OFF: 7-12-71
TOTAL DEPTH: driller: 305·86 m (1003'6")
mibolog: 305·41 m (1002')

HOLE SIZE:

DIAMETER	FROM	TO
25·3 cm (9 7/8")	0 m (0')	45·72 m (150')
14·0 cm (5 1/2")	45·72 m (150')	305·86 m (1003'6")

CASING:

DIA.	WT.	GR.	DEPTH	CMT.	CMT'D TO
20·3 cm (8")	32·3 Kg/m (21·7 lb/ft)	W/bore	45·72 m (144')	N.A.	surface

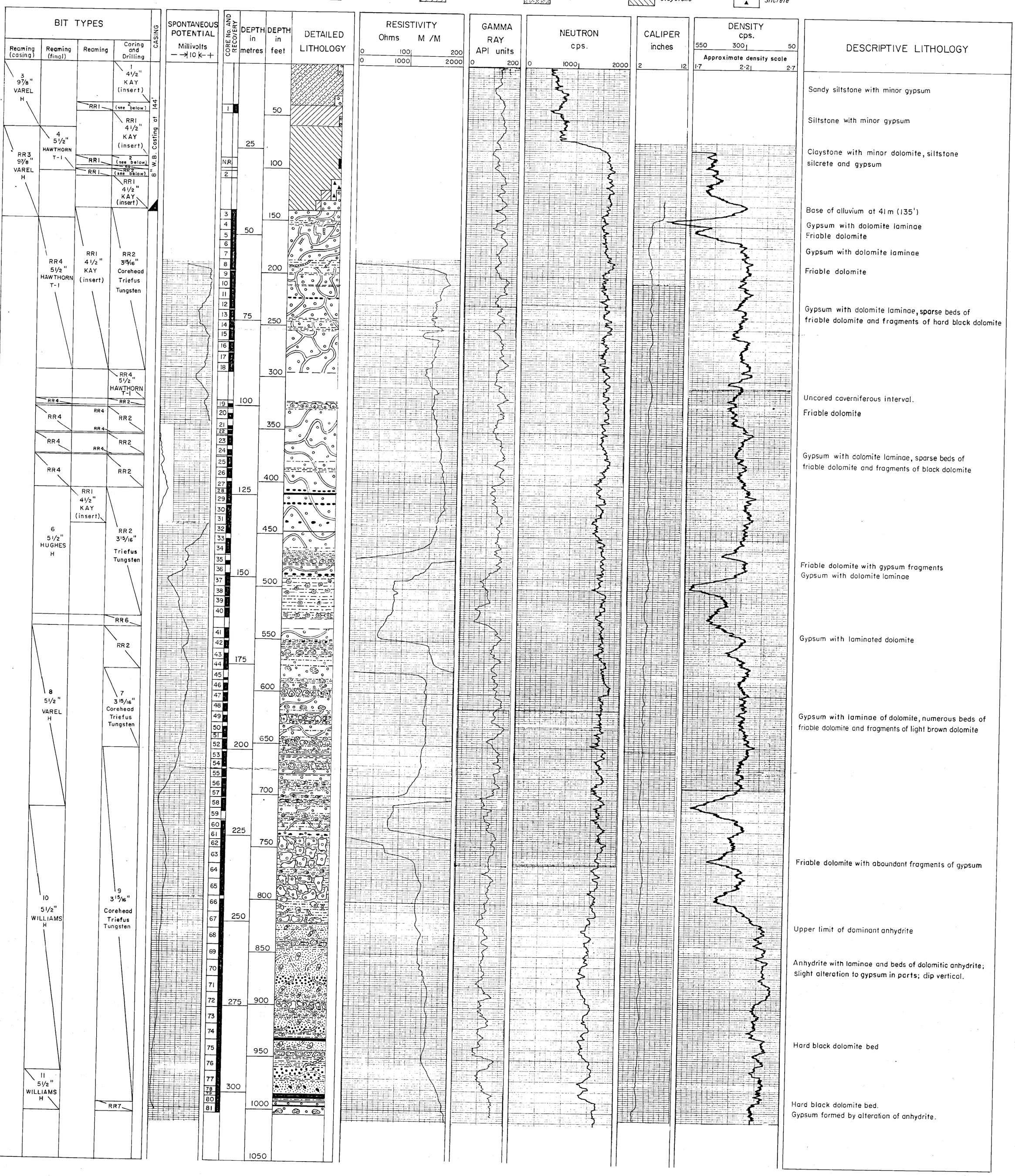
CEMENT PLUGS SURFACE
PERFORATIONS: NIL
DRILLED BY: BUREAU OF MINERAL RESOURCES
WELL HEAD FITTINGS: none
CEMENTED BY: driller
LOGGED BY: mibolog
DRILLING METHOD: air rotary
LITHOLOGY BY: P.J. Kennewell
DRILLING DATA BY: J.M. Henry

LOG DATA

LOG TYPE	SPONTANEOUS POT.	RESISTIVITY	GAMMA RAY	NEUTRON	CALIPER	DENSITY
DATE	7·12·70	7·12·70	7·12·70	7·12·70	7·12·70	7·12·70
RUN No.	1/1	1/1	1/1	1/1	1/1	1/1
DEPTH - DRILLER	305·86 m	305·86 m	305·86 m	305·86 m	305·86 m	305·86 m
DEPTH - LOGGER	305·41 m	305·41 m	305·41 m	305·41 m	305·41 m	305·41 m
BTM. LOG INTERVAL	304·80 m	304·80 m	305·10 m	305·10 m	304·80 m	304·80 m
TOP LOG INTERVAL	59·64 m	59·64 m	0 m	0 m	44·49 m	44·49 m
CASING - DRILLER	20·3 cm at 43·59 m	20·3 cm at 43·59 m	20·3 cm at 43·59 m	20·3 cm at 43·59 m	20·3 cm at 43·59 m	20·3 cm at 43·59 m
CASING - LOGGER	44·49 m	44·49 m	44·49 m	44·49 m	44·49 m	44·49 m
BIT SIZE	14·0 cm	14·0 cm	14·0 cm	14·0 cm	14·0 cm	14·0 cm
TYPE FLUID IN HOLE	SALT WATER and BENTONITE	SALT WATER and BENTONITE	SALT WATER and BENTONITE	SALT WATER and BENTONITE	SALT WATER and BENTONITE	SALT WATER and BENTONITE
DENS. / VISC.	N.A. / N.A.	N.A. / N.A.	N.A. / N.A.	N.A. / N.A.	N.A. / N.A.	N.A. / N.A.
PH / FLUID LOSS	N.A. / N.A.	N.A. / N.A.	N.A. / N.A.	N.A. / N.A.	N.A. / N.A.	N.A. / N.A.
SOURCE OF SAMPLE	—	—	—	—	—	—
Rm at MEAS. TEMP.	0·03 at 84°F	0·03 at 84°F	0·03 at 84°F	0·03 at 84°F	0·03 at 84°F	0·03 at 84°F
Rmf at MEAS. TEMP.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
Rmc at MEAS. TEMP.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
SOURCE Rmf Rmc	N.A. / N.A.	N.A. / N.A.	N.A. / N.A.	N.A. / N.A.	N.A. / N.A.	N.A. / N.A.
Rm at B.H.T.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
TIME SINCE CIRC.	1 Day	1 Day	1 Day	1 Day	1 Day	1 Day
MAX. REC. TEMP.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
EQUIP. / LOCATION	T101 / PER	T101 / PER	T101 / PER	T101 / PER	T101 / PER	T101 / PER
INSTRUMENTS SURFACE	LM464	LM464	RMM 204	RMM 204	RMM 204	RMM 204
INSTRUM. DOWN HOLE	LS-235	LS-235	GRN 1"	GRN 1"	FDC-1 11/16 - Ce	FDC-1 11/16 - Ce
TOOL POSITION	FREE					
RECORDED BY	CRAWFORD					
WITNESSED BY	KENNEWELL					

LITHOLOGICAL REFERENCE

Gypsum · Acicular Gypsum · Anhydrite · Dolomitic Anhydrite · Laminae of Dolomitic Anhydrite · Black tough Dolomite · Light brown tough Dolomite · Grey friable Dolomite · Laminae of Gypsiferous Dolomite · Siltstone · Sandy Siltstone · Claystone · Silcrete



DESCRIPTIVE LITHOLOGY

Sandy siltstone with minor gypsum

Siltstone with minor gypsum

Claystone with minor dolomite, siltstone silcrete and gypsum

Base of alluvium at 41 m (135')

Gypsum with dolomite laminae
Friable dolomite

Gypsum with dolomite laminae

Friable dolomite

Gypsum with dolomite laminae, sparse beds of friable dolomite and fragments of hard black dolomite

Uncored caverniferous interval.

Friable dolomite

Gypsum with dolomite laminae, sparse beds of friable dolomite and fragments of black dolomite

Friable dolomite with gypsum fragments
Gypsum with dolomite laminae

Gypsum with laminated dolomite

Gypsum with laminae of dolomite, numerous beds of friable dolomite and fragments of light brown dolomite

Friable dolomite with aboundant fragments of gypsum

Upper limit of dominant anhydrite

Anhydrite with laminae and beds of dolomitic anhydrite; slight alteration to gypsum in parts; dip vertical.

Hard black dolomite bed

Hard black dolomite bed.
Gypsum formed by alteration of anhydrite.

COMPOSITE LOG

OPERATOR: BUREAU OF MINERAL RESOURCES

NAME AND NUMBER: BMR HERMANNSBURG No 40

STATE: NORTHERN TERRITORY 1:250,000 SHEET: HERMANNSBURG SF/53-13 BASIN: AMADEUS
WELL STATUS: PLUGGED AND ABANDONED

DRILLING DATA

LOCATION: Lat 23° 38·3 S Long 132° 27'E, Grid reference 562 055 (10,000 yards)
ELEVATION: Ground level about 698 metres (2290 feet)
DATE SPUDDED: 18 7 70
DATE DRILLING CEASED: 27 7 70
DATE RIG OFF: 28 7 70
TOTAL DEPTH: 91·4 metres (300 feet)

HOLE SIZE	DIAMETER	FROM	TO
	14"	0'	13'
	5½"	13'	277'
	3 15/16"	277'	300'

CASING	DIAMETER	WT	GR	DEPTH	CMT	CMT'D TO
	30·5cm(12")	48·06lb/ft 11·5kg/m	W/Bore	3·05m(10')	8 bags	Surface to 7·62m (25')

CEMENT PLUGS: SURFACE TO 7·62m (25')
PERFORATIONS: NIL
DRILLED BY: BUREAU OF MINERAL RESOURCES
WELL HEAD FITTINGS: none
CEMENTED BY: driller
LOGGING: none
DRILLING METHOD: rotary air and mud
LITHOLOGY BY: A T Wells
DRILLING DATA BY: J M Henry

LITHOLOGICAL REFERENCE

Conglomerate | Coarse grained sandstone | Medium or fine grained sandstone | Siltstone | Claystone | Chert fragments, pyritic in part

c gr	coarse grained	gl	glauconitic
m gr	medium grained	py	pyritic
f gr	fine grained	fe	ferruginous
		si	silicified

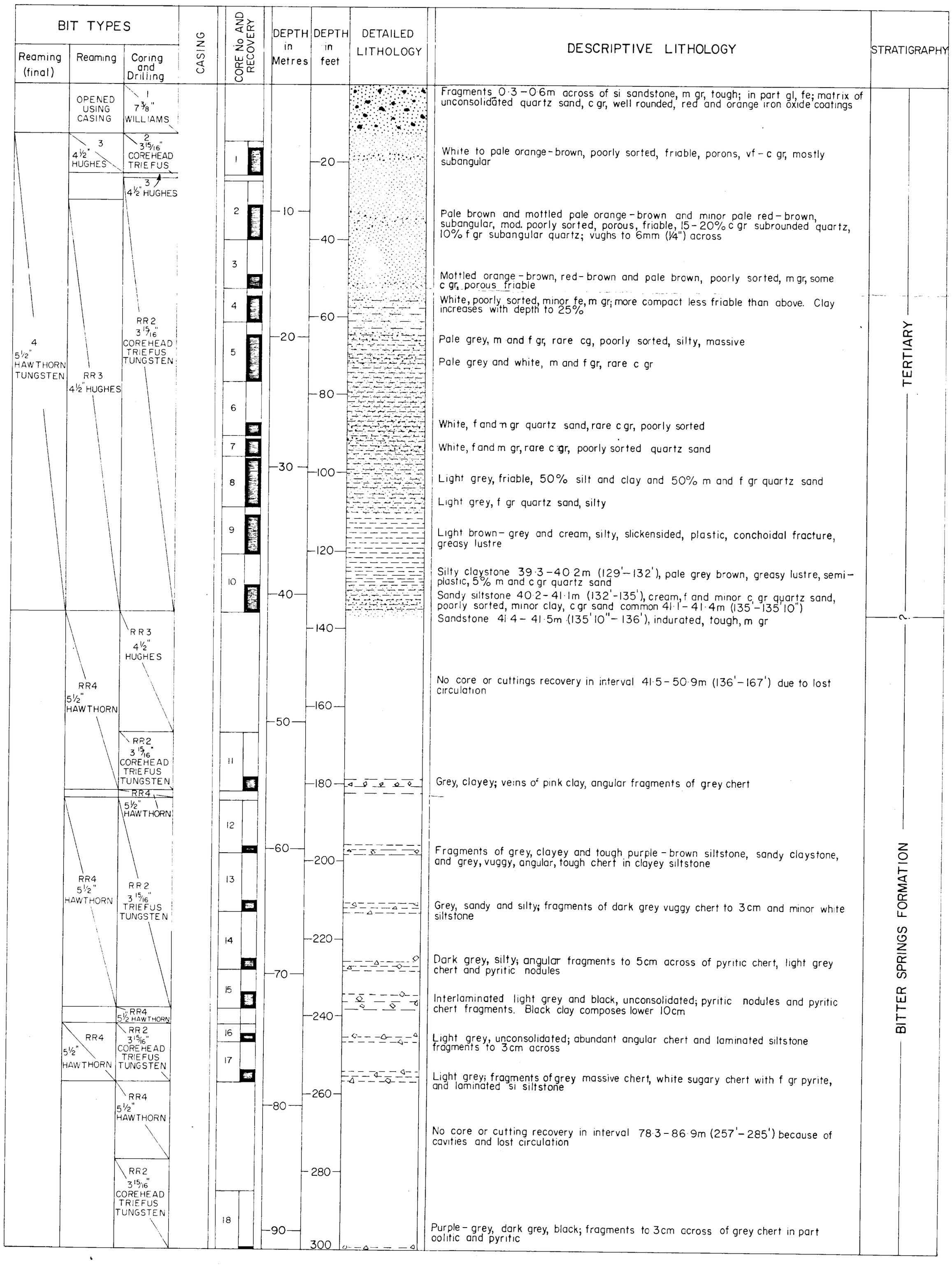


PLATE IV

RESULTS OF CHEMICAL ANALYSES – BMR MOUNT LIEBIG No 1

Analyses by Emission Spectroscopy (K, B, Sr, Mn, Ba, Fe) and Wet Chemical Methods (Br)

⊖ Not present in detectable amounts

*6 Average of 6 analyses

LITHOLOGICAL REFERENCE

Gypsum | Halite | Evaporite rock (medium crystalline) | Evaporite rock (finely crystalline) | Recrystallised evaporite breccia | Dolomite

Depth in metres | Depth in feet | Detailed Lithology | Gamma Ray 0 API units 200 | Potassium (ppm) 0 2000 4000 6000 8000 1% 10,000 | Boron (ppm) 0 100 200 | Strontium (ppm) 0 400 800 | Manganese (ppm) 0 100 200 | Barium (ppm) 0 1000 2000 | Iron (ppm) 0 10,000 20,000 3% 30,000 | Bromine (ppm) 0 100 200

Boron analyses below 100m can only be recorded as less than 100ppm, as a high proportion of sodium in the samples causes interference to the boron lines.

No 4982-8A wide, hazy and diffuse B 2496-8A, in second order 2497-7A

M(S) 176

To Accompany Record 1972/36

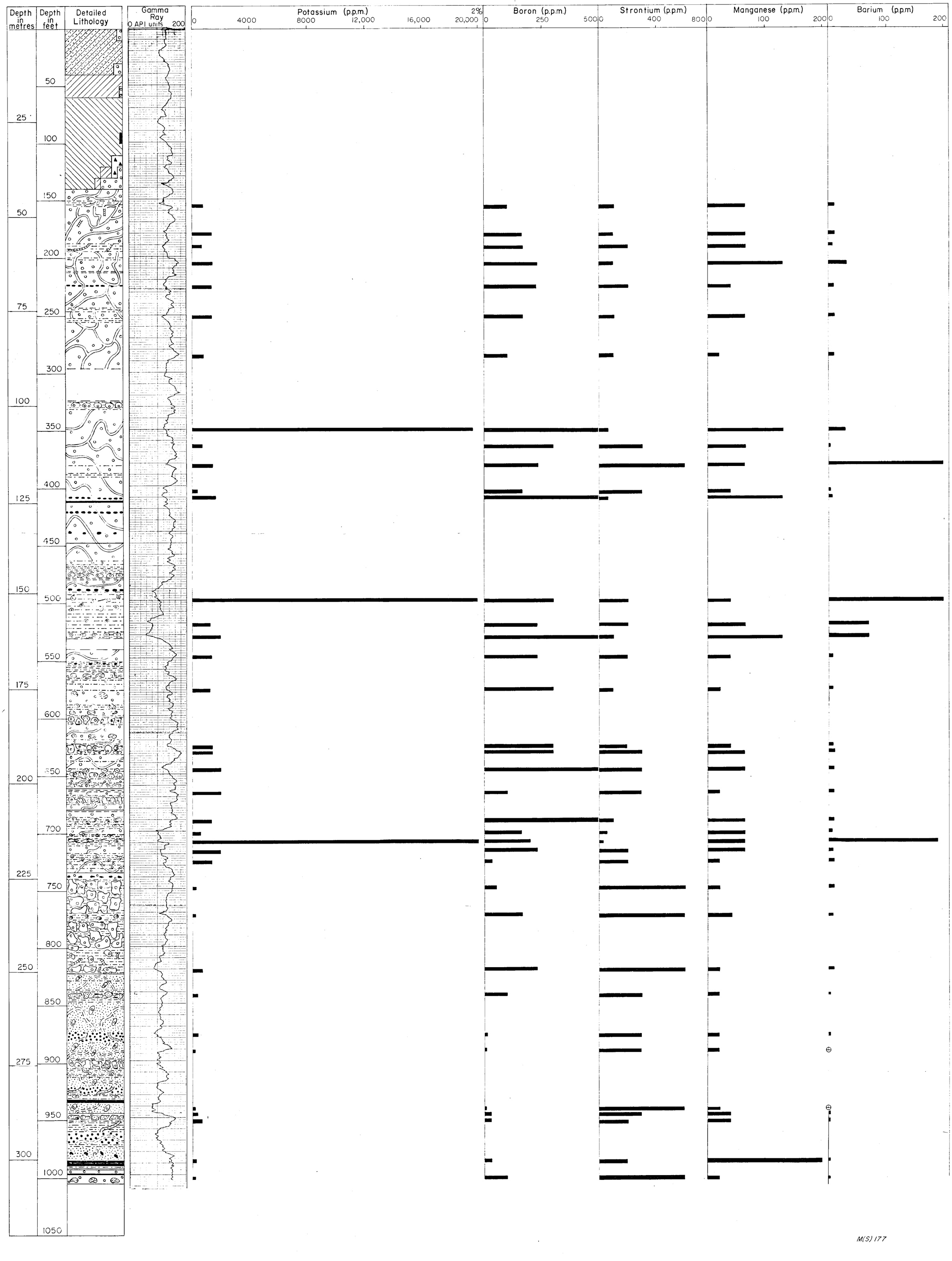
RESULTS OF CHEMICAL ANALYSES — BMR LAKE AMADEUS No. 3B

Analyses by Emission Spectroscopy

⊕ Not present in detectable amounts

LITHOLOGICAL REFERENCE

Gypsum
Acicular gypsum
Anhydrite
Dolomitic anhydrite
Laminae of dolomitic anhydrite
Black tough dolomite
Light brown tough dolomite
Grey friable dolomite
Laminae of gypsiferous dolomite
Siltstone
Sandy siltstone
Claystone
Silcrete

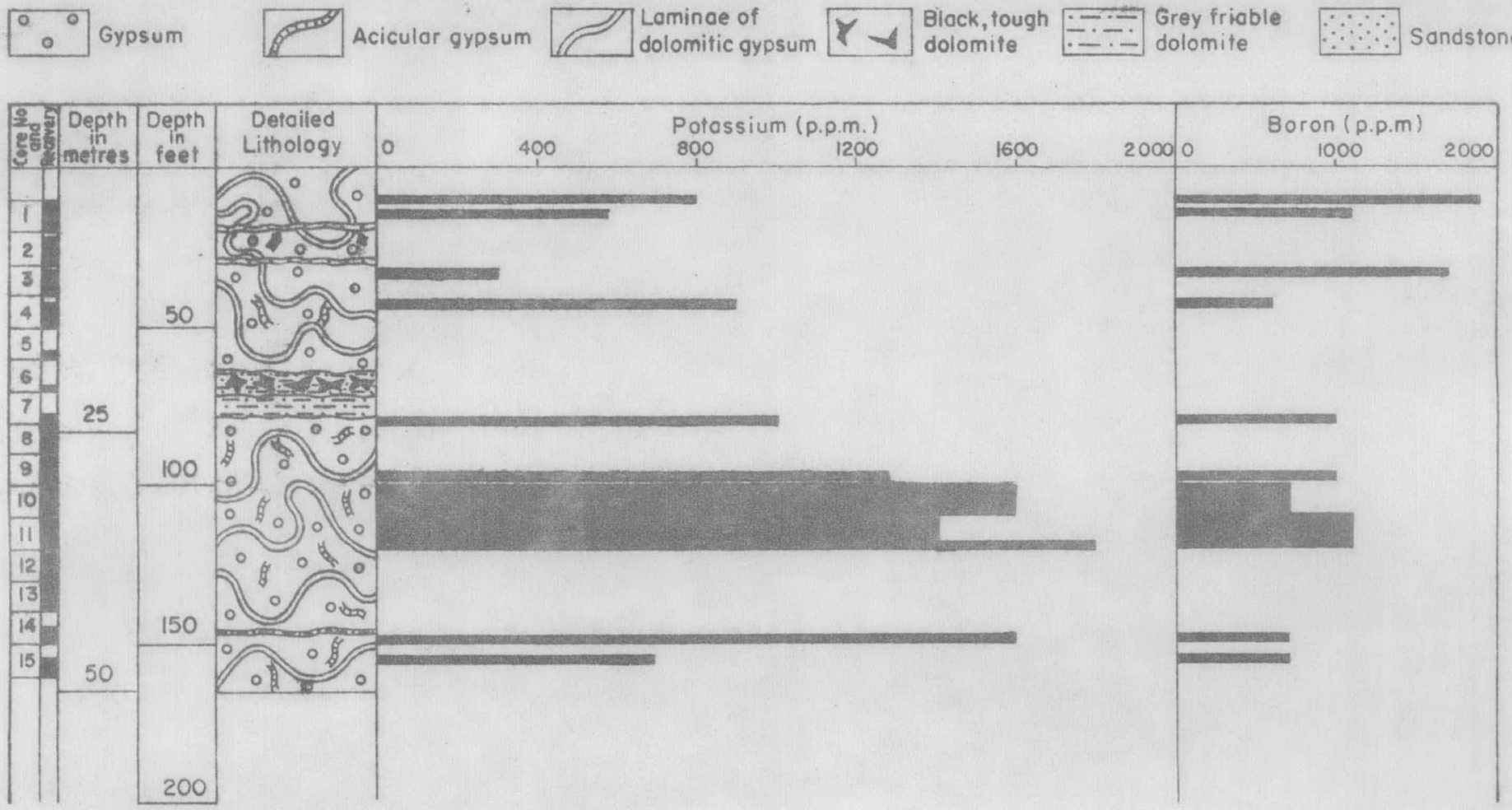


M(S) 177

To Accompany Record 1972/36

PLATE VI

GRAPHIC LOG AND RESULTS OF CHEMICAL ANALYSES
BMR LAKE AMADEUS No 3
Analyses by Emission Spectroscopy



To Accompany Record 1972/36

M(S)169