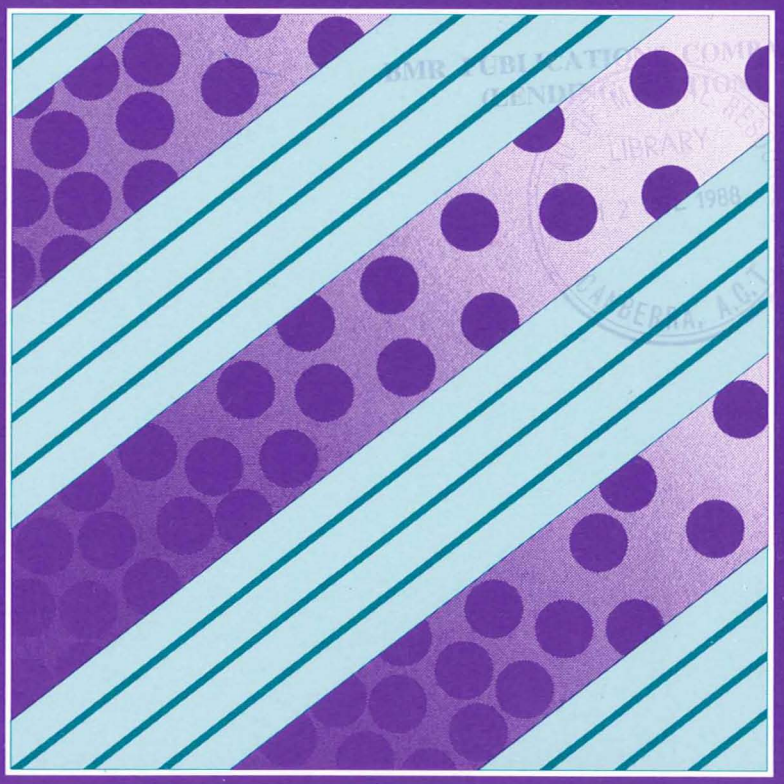
GROUNDWATER 11

Studies in Hydrogeology

SEDIMENTARY PETROLOGY OF BMR DRILL CORES AND SHALLOW VIBROCORES FROM PLAYAS IN THE SOUTHERN AMADEUS BASIN, NORTHERN TERRITORY

A.V. ARAKEL



BUREAU OF MINERAL RESOURCES, GEOLOGY & GEOPHYSICS

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BUREAU OF MINERAL RESOURCES
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SEDIMENTARY PETROLOGY OF BMR DRILL CORES AND SHALLOW VIBROCORES FROM PLAYAS IN THE SOUTHERN AMADEUS BASIN, NORTHERN TERRITORY

by

A.V. Arakel

Applied Sedimentology and Environmental Geology
Research Unit
Department of Applied Geology
Queensland Institute of Technology
Brisbane, Queensland

CONTENTS

SUMMARY

Lithology of two BMR drillholes and five shallow vibrocores, obtained from playas in the Curtin Springs area of the Southern Amadeus Basin, N.T., is presented. Detailed petrological description of core samples and their thin sections, X-ray diffraction and scanning electron microscopy have been used to characterise the playa sediments and mineral types.

The core samples include a variety of chemically precipitated silicate, carbonate and evaporite minerals that have been emplaced in the clay-sand lacustrine sediments of the Lake Amadeus drainage basin. These sediments are of Quaternary age. The vertical distribution of the chemical facies, and morphological features of the evaporite mineral types, reflect the hydrogeology of the basin and the geochemical evolution of near-surface brines in the playa beds. The occurrence of zeolites in this sequence, and the identification of sylvite in efflorescent playa crusts, indicate the desirability of further investigations to assess the possible economic significance of the central Australian playa deposits.

INTRODUCTION

Drillcores and vibrocores described in this report were obtained as part of a 3-year BMR project (1984-87) on the hydrogeological assessment of the Amadeus Basin. Auger cores P6 and P13 were obtained using the specially adapted salt-lake drilling rig of the Australian National University SLEADS project in November 1984. Five shallow cores (LDH1, LDH2, LDH3, GLO1 and GLO2) were also obtained from playa beds in October 1986, during a field reconnaissance by BMR officers and the author.

The locations of the cores are shown in Figure 1.

Drill core P6 was taken from the southern margin of the groundwater-discharge playa known as "Spring Lake", and drillhole P13 was about 1300 m south in a vegetated playa ("Samphire Lake"). These two drillholes are located on a NNW-SSE transect, joining drillholes AR7, 8 and 9, which penetrated calcrete to depths of 9, 5 and 4 m respectively (Jacobson & Warne, 1986). A cross section, showing the vertical distribution of sedimentary facies in the Spring Lake area is shown in Figure 2.

Shallow cores LDH1, 2 and 3 were taken along a north-south transect in Spring Lake, extending towards the lake centre (Fig. 1).

Cores GLO1 and GLO2 were taken from Glauberite Lake, a small salt-crusted playa located southeast of Spring Lake (Fig. 1).

Laboratory investigations were carried out at the Applied Sedimentology and Environmental Geology Research Unit, Department of Applied Geology, QIT, Brisbane. Work involved core preparation (splitting, impregnation, photography) and detailed microscopic description of sample material, aided by x-ray diffraction and scanning electron microscopy. The x-ray diffraction analysis results are listed in Table 1. In order to assess the time framework of geochemical process-product relationships in the playa lakes, selected core samples were dated using ESR dating facilities of the Institute of Geology, Beijing Bureau of Seismology, China. The available ESR dating results are listed in Table 2. Table 3 summarises the sedimentary and environmental characteristics of chemical facies identified in the drill cores; the drillcore petrological descriptions are provided in Appendix 1.

SEDIMENTARY CHARACTERISTICS OF PLAYA LAKE CHEMICAL FACIES IN THE SOUTHERN AMADEUS BASIN

Core observations indicate that the upper 10 m of the clay-sand deposits of the playa system at Curtin Springs, incorporate a wide variety of chemical facies, namely halides, sulphates, carbonates and silicates. The sedimentary and depositional characteristics of these facies are listed in Table 3. A zeolite-bearing dolomite bed was intersected in the lowermost sections of drillholes P6 and P13, and possibly relates to an ancestral lacustrine phase of sedimentation (? Tertiary). The other chemical sediments have developed in the Quaternary within a remarkably short time span (see Table 2, for ESR dates). Hence it is feasible to relate these facies to prevailing environmental conditions and geochemical characteristics of playas at Curtin Springs.

Sulphates, mainly in the form of gypsum deposits, are volumetrically the most abundant evaporite types in the cores examined. Based on consideration of textural and fabric features, gypsites have been subdivided into "phreatic" and "vadose" varieties (Arakel & McConchie, 1982). Glauberite nodules and lensoid pockets are confined to the groundwater level fluctuation zone in terminal playas, i.e. lowermost playas acting as final drainage sumps. Halite and, to a lesser extent, sylvite occur in these terminal playas mainly as efflorescent crusts.

Fine-grained (micritic) dolomite, incorporating zeolite minerals (Tables 1 and 3) and clays, were recorded from the lowermost sections of cores P6 and P13. Zeolite minerals were identified by their optical properties, x-ray diffraction and SEM. Further work on characterisation of the zeolites is underway. Because of the few cores obtained the lateral distribution and zonation of the zeolite-bearing dolomitic facies are not known.

CONCLUSIONS

1. Petrographic features of seven drill cores have been described by microscopic observation, X-ray diffraction and scanning electron microscopy. The drill cores contain variable assemblages of chemically precipitated minerals in playa sediments.

2. The cores reflect the geochemical evolution of playa brines, which has influenced the vertical and lateral distribution of the chemical sediment facies.

3. Further cores and field observations will be required for a better understanding of the subsurface distribution of zeolite-bearing dolomite in the Spring Lake area.

ACKNOWLEDGMENTS

Professor Y. Chen of the Beijing Institute of Geology, China, is thanked for undertaking age determination work related to this project. Research officers at QIT Applied Sedimentology and Environmental Geology Research Unit (ASEGRU) are also thanked for their technical support. The drilling at Spring Lake was funded by the Department of Resources and Energy under the Federal Water Resources Assistance Program.

REFERENCES

ARAKEL, A.V. & McCONCHIE, D., 1982 - Classification and genesis of calcrete and gypsite lithofacies in palaeodrainage systems of inland Australia and their relationship to carnotite mineralisation. Journal of Sedimentary Petrology, 52, 1149-1170.

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TABLE 1 - X-RAY DIFFRACTION ANALYSIS OF CORE SAMPLES

(All values given are in weight %)

Core	Lab. Reference Number	Depth (cm)	Quartz	K-Feldspars	Clays	Gypsum	Dolomite	Other Minerals
P6	AO(A)/19	6-10	60	15	35	M		Halite (T)
"	AO(B)/20	20-23	70	M		30		Halite (T)
"	AO(C)/21	42-45	60	5		35		
"	AO(D)/22	56-60	90	10				
"	A1(A)/ 1	77-80	90	10	M			Plagioclase (M)
"	A2(A)/2	108-113	85	5	10			"
"	A2(B)/3	128-131	30	10	60			
"	A3(A)/4	117-180	50	10	40			Plagioclase (M)
"	A4(A)/5	211-215	40	10	50			Orthoclase
"	A5(A)/6	257-261	45	5	50			"
"	A6(A)/7	313-317	60	5	35			
"	A7(A)/8	377-381	70	10	20	M		
"	A8(A)/9	422-426	70	5	25			
"	A9(A)/10	456-461	70	5	25			Plagioclase (M)
"	A11(A)/12	559-565	60	5	35			
"	A12(A)/13	616-621	45	10	40		5	
"	A13(A)/14	647-650	60	10	30			
"	A14(A)/15	710-715	35	10	50		5	Plagioclase (M)
"	A15(A)/16	755-760	30	M	70		M	Calcite (M)
"	A16(A)/17	796-800	20	5	75			
"	A19(A)/18	942-946		T	30		60	Zeolites (10%)
P13	D2(A)/23	50-54	10			90		Halite (T)
"	D2(B)/24	74-78	M			100		"
"	D2(B)/25	101-106	5			95		
"	D3(A)/26	116-121	15	M		85		
"	D4(A)/28	152-160	10			90		
"	D4(B)/29	177-183	20	M	5	75		
"	D5(A)/30	194-198	10	5	5	80		
"	D6(A)/32	242-247	15	5	40	40		
"	D7(A)/33	296-302	30	M	70	M		
"	D10(A)/34	442-448	30	5	65			
"	D12(A)/35	550-555	50	10	40			
LDH	LDH1-1	7	25		T	85		Halite (M)
"	LDH1-2	27	20					Halite (80)
"	LDH1-3	54.5	80		15			Halite (5)
"	LDH1-4	78	85		5	10		" (5)
"	LDH1-5	88	85		10	5		" (5)
"	LDH1-6	100.5	80		10			" (10)
"	LDH1-7	115	80		10	5		" (5)
LDH2	LDH2-1	5	15			85		" (10)
"	LDH2-2	26	10			85		" (5)
"	LDH2-3	42.5	80		10			" (10)
"	LDH2-4	68.5	80		15			" (5)
"	LDH2-5	84	10			80		" (10)
LDH3	LDH3-1	5	5			85		" (10)
"	LDH3-2	21	15			80		" (5)
"	LDH3-3	35	15			80		" (5)
"	LDH3-4	50	10		5	80		Halite (5) Sylvite (T)
"	LDH3-5	57.5	15		5	80		Halite and Sylvite (T)
GLO1	GLO-1	3.5	85					Halite (15)
"	GLO1-2	17	80					Glauberite (15) Halite (5)
"	GLO1-3	30	80		5			Halite (15)
"	GLO1-4	47	85		10			Halite (5)
"	GLO2-1	2	20					Halite (80)
"	GLO2-2	17	10			5		Glauberite (80) Halite (5)
"	GLO2-3	34.5	20		10			Glauberite (60) Halite (10)
"	GLO2-4	51.5	80		10			Halite (10)

M = minor T - trace

TABLE 2 - ABSOLUTE AGES OF GYPSITE SAMPLES IN CORES P6 AND P13 AS DETERMINED BY ELECTRON SPIN RESONANCE TECHNIQUE

Core	Lab Reference No.	Depth Interval (m)	ESR Age ($x10^3$ years)
P6	A6(A) /7	3.13 - 3.17	37.5 ± 11.3
P6	A8(A) /9	4.22 - 4.26	14.6 ± 4.4
P6	A9(A) /10	4.56 - 4.61	12.5 ± 3.6
P6	A10(A)/11	5.15 - 5.20	33.3 ± 10
P6	A12(A)/13	6.16 - 6.21	14.6 ± 4.4
P6	A13(A)/14	6.47 - 6.50	14.6 ± 4.4
P13	D2(B/A)/24	0.50 - 0.54	8.3 ± 2.5
P13	D2(B/A)/25	1.01 - 1.06	10.4 ± 3.1

TABLE 3 - SEDIMENTARY CHARACTERISTICS AND DEPOSITIONAL ENVIRONMENTS OF PLAYA CHEMICAL FACIES, SOUTHERN AMADEUS BASIN

CHEMICAL FACIES	MINERAL TYPES	SEDIMENTARY CHARACTERISTICS	DEPOSITIONAL ENVIRONMENTS
HALIDES	Halite and Sylvite	Mainly as surface encurstation, but also diagenetically formed in playa surficial sediments	Mainly as playa surface efflorescent curse, subject to a periodic dissolution by rain and flood waters
SULPHATES	Hexa-hydrite, Epsomite and Thenardite	Minor diagenetic emplacement in surficial clayey sand sediments of the playa beds, and also possibly due to replacement of $CaSO_4$ minerals (identified mainly by x-ray diffraction).	Playa surficial beds containing brines deficient in Ca ion.
	Glauberite	Nodular to lensoidal pockets of discoidal crystals emplaced in gypsiferous clay-sand playa beds. The glauberite nodules are confined mainly to present water-level fluctuation zone in playas representing the most down-gradient hydrologic units in the sequence of a playa system.	Best developed in the existing water level fluctuation zone, within upper 0.5 m of the playa marginal and central sedimentary units.
	Gypsites	"Phreatic gypsites" assemblages of acicular and/or discoidal gypsum crystals, showing massive, clotted and tubular-directed microstructures. The fabric is intergrown in interlocking.	Groundwater precipitated crystal aggregates, commonly confined to fenestral partings and pore spaces in the non-gypseous host playa
		"Vadose Gypsites", assemblages of tightly to loosely packed gypsum crystals, crystallites and corroded/abraded cleavage fragments. A variety of packstone and grainstone fabrics are evident (depend on degree of incorporating non-gypseous clastic material).	Located above the present water level in the playa beds, and most deposits exhibit some degree of vadose modification by leaching, dehydration, syntaxial crystal overgrowth and wind reworking processes.
		"Gypcretes", surficial gypsiferous duricrusts, few decimeters to several metres thick. Consist of massive to (graded) bedded deposits of corroded to abraded gypsum crystallites of different genetic varieties, cemented together by neomorphic gypsum cements. Minor sand/silt size clastic material present as impurities.	Developed mainly in the playa margins, extending several metres above the present groundwater level. Their development probably related to precipation from meteoric water moving through soil zone. Thick gypcrete in and around playas, have more complex origin, with wind reworking as a major modifying agent.
CARBONATES	Dolomite	Massive to incipiently bedded micritic deposits, incorporating zeolite minerals. Dolomite was recorded at bottom 0.3 - 0.4 m of cores P6 and P13, well below the standing water level in Spring Lake.	Possibly related to ancestral lacustrine hydrology. Available field information not sufficient.
SILICATES	Potassium Feldspar and Zeolites	Zeolite minerals namely analcime, phillipsite, mordenite and chabazite have been identified in a dolomitic mass, by thin section study, x-ray diffraction and on the basis of their morpholoties by SEM-EDAX. Analcime is the most dominant mineral type, forming up to 10% wt. of the sediment mode by XRD analysis (see Table 1). K-feldspar is also present in minro (0-15% wt) quantities.	Mostly authigenic pore filling and lining crystals in a dolomitic groundmass. Insufficient core data for determination of lateral mineral zonation.

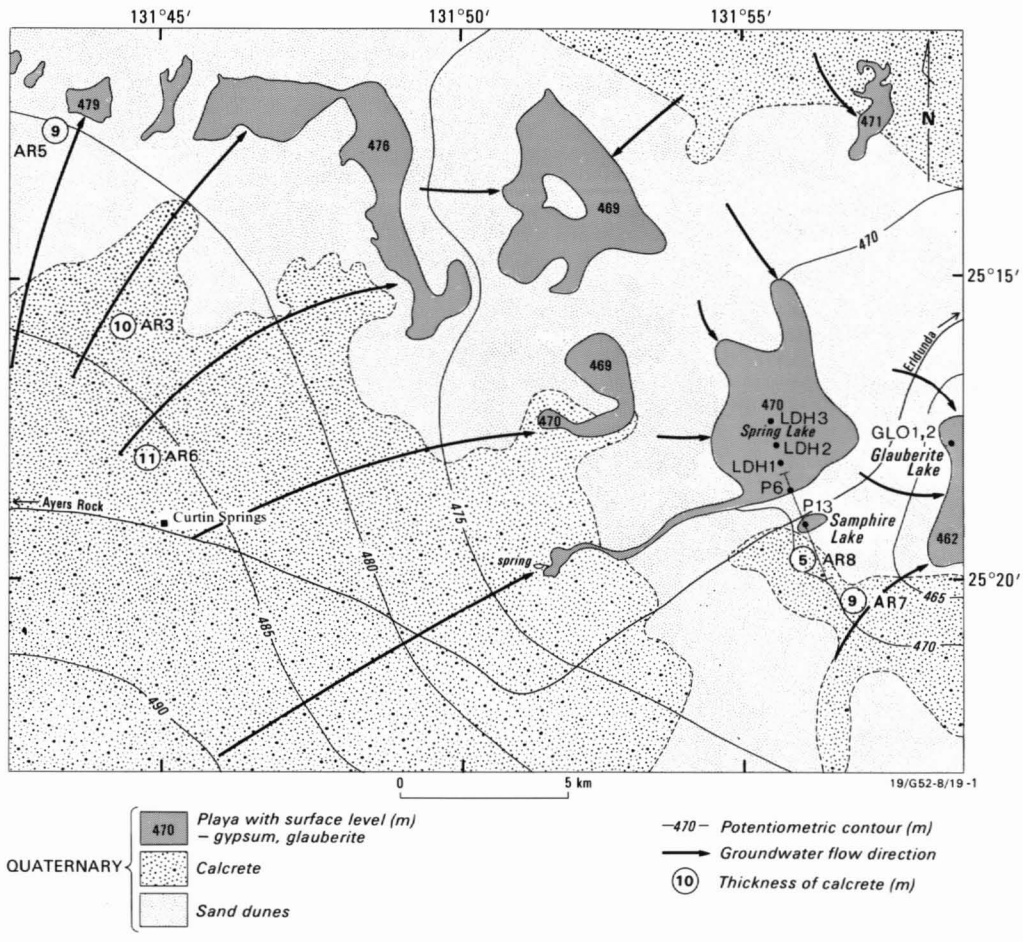

Figure 1. Location plan

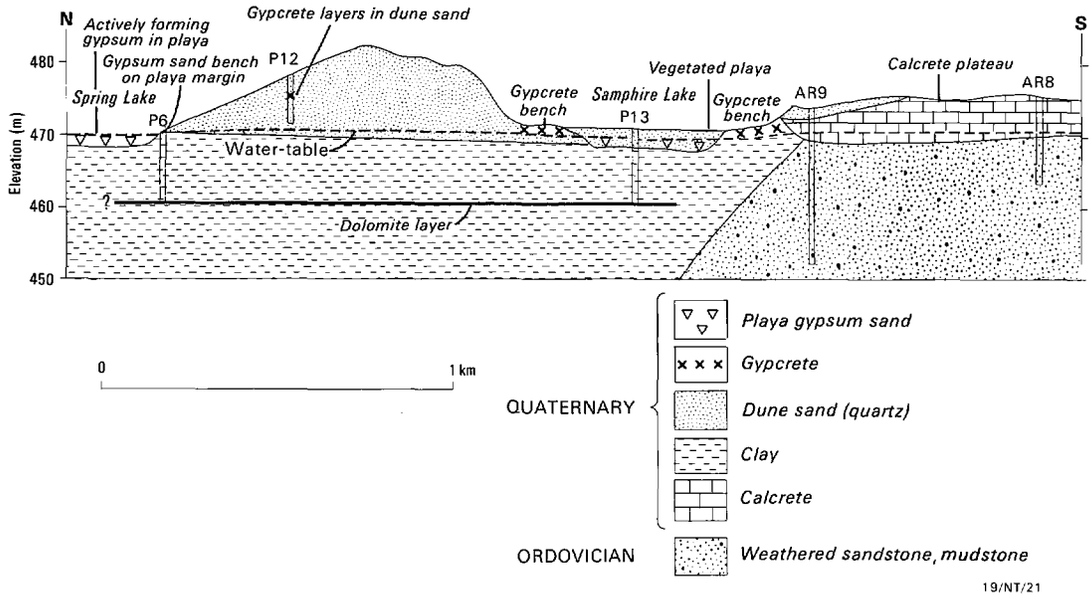

Figure 2. Cross-section of Spring Lake and Samphire Lake at drilling locations

BUREAU OF MINERAL RESOURCES, GEOLOGY AND GEOPHYSICS
PETROLOGICAL DESCRIPTION OF DRILL CORES

LOCATION OF BORE
1:100 000 SHEET CURTIN SPRINGS
SHEET NO 5247 **GRID REF** E795580, N7198640

R.N. _____
I.N. _____

DRILLING METHOD: AUGER TUBE

DRILLING DATE: NOVEMBER 1984

DEPTH (m)	GRAPHIC LOG	CORE PRINT
0		
0.8		
1.0		

PETROGRAPHIC DESCRIPTION

(6 - 10 cm)

Gypsiferous clayey sand Dark greenish grey; massive to incipiently banded. Distinct hemipyramidal gypsum crystals emplaced in clayey sand matrix.

(20 - 23 cm)

Gypsum lens in a 6 cm thick brownish silt layer. Hemipyramidal gypsum crystals enclosed in a fine quartzose silt with minor clay intercalations.

(42 - 46 cm)

Gypsum band, brownish colour, 4cm thick set in clayey groundmass. Gypsum as above, but the individual hemipyramids are much larger and show some solution pits.

(50 - 60 cm)

Quartzose silt, brownish in colour with minor clay and sugary gypsum. Quartz grains include both clear (rounded) and stained brownish varieties (mostly monocrystalline). Some root tubules present. Sample partially cemented by late diagenetic gypsum cement. The cement shows some degree of late-stage dissolution pitting.

(77 - 80 cm)

Quartzose aeolian sand; yellowish-brown; massive with minor gypsum grains. Highly variable in sorting and rounding. The larger grains mostly stained with iron-oxides. Few dark (opaque) minerals.

(108 - 113)

Clayey silt, brown in colour; massive with minor coarse quartzose grains and gypsum crystals. Loose to partial cementation. Highly unsorted, angular to sub-rounded quartz grain assemblage. Some white (calcitic) coating of the grains.

LOG DESCRIPTIONS BY: A. ARAKEL

BMR HOLE NUMBER P6

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SHEET NO 5247 GRID REF E 795580, N 7198640

R.N. _____
I.N. _____

DRILLING METHOD: AUGER TUBE

DRILLING DATE: NOVEMBER 1984

DEPTH (m)	GRAPHIC LOG	CORE PRINT
1.5		
1.9		

PETROGRAPHIC DESCRIPTION

(128 - 131 cm)

Silty clay; dark brown to yellowish; partially gypsiferous. Quartz grains highly unsorted, angular to sub-angular. Few large polycrystalline quartz grains present. Overall, mottley in appearance.

(177 - 180 cm)

Gritty clayey silt; dark brown, massive, regolithic, kaolinitic clay material with a variably size quartz grains (some fully rounded) as ground-mass. Some fine sand size euhedral heavy-mineral grains. Gypsum present as a secondary cement material.

(211 - 215 cm)

Gritty clay; dark coffee brown, massive, kaolinitic clay; loosely cemented by secondary gypsum.

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BMR HOLE NUMBER P6

BUREAU OF MINERAL RESOURCES, GEOLOGY AND GEOPHYSICS

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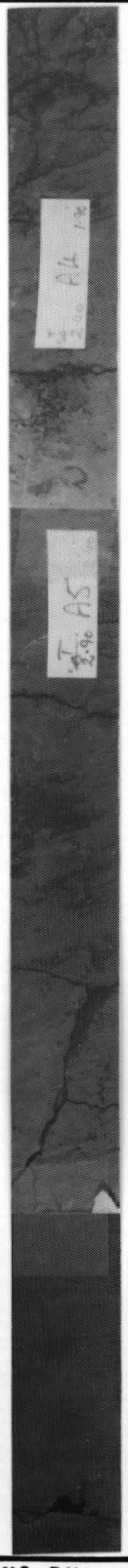
E 795580, N 7198640

R.N.
I.N.

DRILLING METHOD: AUGER TUBE

DRILLING DATE: NOVEMBER 1984

DEPTH (m)	GRAPHIC LOG	CORE PRINT	PETROGRAPHIC DESCRIPTION
2.4			(257 - 261 cm) Gritty clay; dark brown, as above.
2.9			(313 - 317 cm) Clayey silt, dark brown, massive, as above.

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R.N. _____
I.N. _____

DRILLING METHOD:

DRILLING DATE:

DEPTH (m)	GRAPHIC LOG	CORE PRINT	PETROGRAPHIC DESCRIPTION
3.4			(377 - 381 cm) Clayey silt, dark brown, incipiently layered clayey silt; angular to sub-angular quartzose grains, well sorted. Minor gypsum present as secondary cement. Few very fine sand size dark (opaque) minerals present. Patchy cementation by late gypsum cementation.
3.9			

LOG DESCRIPTIONS BY:
A. ARAKEL

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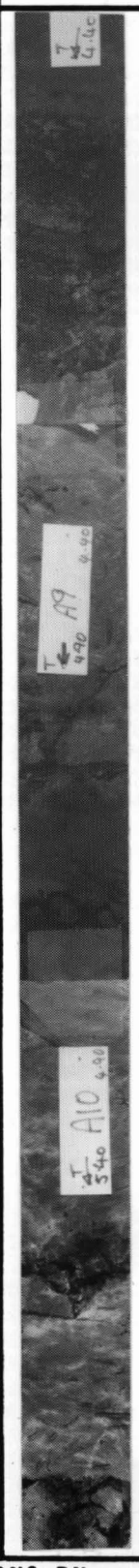
DRILLING METHOD:

DRILLING DATE:

DEPTH (m)	GRAPHIC LOG	CORE PRINT	PETROGRAPHIC DESCRIPTION
4.4			(422 - 426 cm) Gritty sand band, dark brownish, 5cm thick, set in a clayey mud matrix. Quartz grains highly rounded. Some mica flakes present. Powdery (white yellowish) gypsum as a secondary cement. (456 - 461 cm) Gritty sand in clayey matrix; massive; dark brown in colour. Quartz grains highly unsorted and variably rounded. Gypsum as a secondary cement. Small percentage of very coarse sand and gravel size particles also present.
4.9			(515 - 520 cm) Kaolinitic clay, yellowish with green tan; massive and stiff. Minor degree of gypsification. Motley in surface appearance.

LOG DESCRIPTIONS BY:
A. ARAKEL

BMR HOLE NUMBER P6

SHEET 5 OF 24

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PETROLOGICAL DESCRIPTION OF DRILL CORES

LOCATION OF BORE 1:100 000 SHEET CURTIN SPRINGS N.T.
SHEET NO 5247 GRID REF E 795580, N 7198640

R.N. _____
I.N. _____

DRILLING METHOD: AUGER TUBE

DRILLING DATE: NOVEMBER 1984

DEPTH (m)	GRAPHIC LOG	CORE PRINT	PETROGRAPHIC DESCRIPTION
4.9			(559 - 565 cm) Kaolinitic clay, dark brown, as above but with higher percentage of quartzose silt.
5.9			(616 - 621 cm) Clayey silt, coffee brown in colour; massive with some whitish patches of gypsum and/or dolomite.
6.4			(647 - 650 cm) Clayey silt, dark brown, massive as above.

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BUREAU OF MINERAL RESOURCES, GEOLOGY AND GEOPHYSICS

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DRILLING METHOD: AUGER TUBE

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DEPTH (m)	GRAPHIC LOG	CORE PRINT	PETROGRAPHIC DESCRIPTION
6.9			(710 - 715 cm) Gritty clay, greenish brown in colour, massive with minor mottles of dolomite. Minor degree of gypsification. The silt size quartzose particles highly unsorted.
7.4			(755 - 760 cm) Gritty clay, light brownish with greenish tint, massive to incipiently banded. Medium to fine unsorted quartzose silt particles. Highly gypsiferous in places. Minor amount of subrounded dark (opaque) minerals.
7.7			(796 - 800 cm) Clayey sand, light greenish-brown, massive. Gypsum as a secondary cement.

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BMR HOLE NUMBER P6

BUREAU OF MINERAL RESOURCES, GEOLOGY AND GEOPHYSICS
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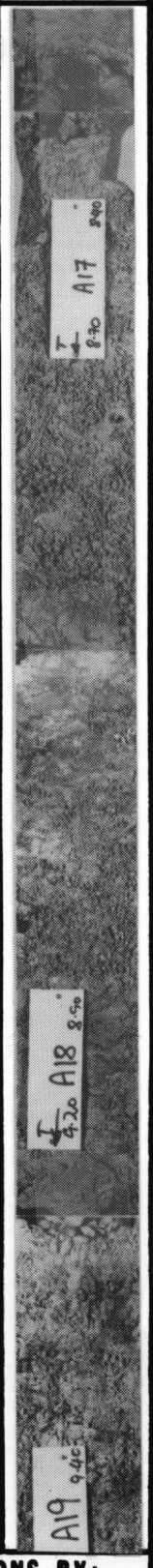
R.N. _____
I.N. _____

DRILLING METHOD: AUGER TUBE

DRILLING DATE: NOVEMBER 1984

DEPTH (m)	GRAPHIC LOG	CORE PRINT
8.4		
8.9		
9.4		



PETROGRAPHIC DESCRIPTION

(948 - 952 cm)

Dolomitic clay; yellowish green to light grey. Mottley in appearance. Analcime [$Na\ Al\ (SiO_3)_2.H_2$] forms 10-30% of the crystalline mode and appears to be associated with dolomite.

LOG DESCRIPTIONS BY: A. ARAKEL

BMR HOLE NUMBER P6

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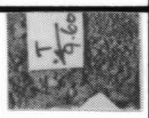
PETROLOGICAL DESCRIPTION OF DRILL CORES

LOCATION OF BORE CURTIN SPRINGS
1:100 000 SHEET N.T.
SHEET NO 5247 **GRID REF** E 795830, N 7198640

R.N. _____
I.N. _____

DRILLING METHOD: AUGER TUBE

DRILLING DATE: NOVEMBER 1984

DEPTH (m)	GRAPHIC LOG	CORE PRINT	PETROGRAPHIC DESCRIPTION
9.6			

LOG DESCRIPTIONS BY: A. ARAKEL

BMR HOLE NUMBER P6

BUREAU OF MINERAL RESOURCES, GEOLOGY AND GEOPHYSICS
PETROLOGICAL DESCRIPTION OF DRILL CORES

LOCATION OF BORE 1:100 000 SHEET CURTIN SPRINGS N.T.
SHEET NO 5247 GRID REF E 795580, E7197280

R.N. _____
I.N. _____

DRILLING METHOD: AUGER TUBE

DRILLING DATE: NOVEMBER 1984

DEPTH (m)	GRAPHIC LOG	CORE PRINT	PETROGRAPHIC DESCRIPTION
0			
1.4			

(50 - 54 cm)

Gypsum sand, light brown in colour; massive with minor quartzose silt and clay material intercalation. Gypsum is mainly hemipyramidal and includes the full spectrum of euhedral crystals, cleavage flake, basal pinacoids and some loose crystallites that indicate solution pitting. Gypsum acts also as a secondary cement.

(74 - 78 cm)

Gypsite; light brown; massive to grossly bedded gypsum sand with very minor clay and oxide (yellowish brown) contamination. Gypsum occurs in 2 modes (i) coarse hemipyramidal and elongate (prismatic ?) crystals set in a fine sand size, sugary gypsum groundmass, and (ii) gypsum overgrowth and twins (rossettes), which commonly show some degree of dissolution and physical (aeolian) reworking.

LOG DESCRIPTIONS BY: A. ARAKEL

BMR HOLE NUMBER P13

BUREAU OF MINERAL RESOURCES, GEOLOGY AND GEOPHYSICS
PETROLOGICAL DESCRIPTION OF DRILL CORES

LOCATION OF BORE CURTIN SPRINGS
1:100 000 SHEET N.T.
SHEET NO 5247 GRID REF
E 795830, N 7197280

R.N.
I.N.

DRILLING METHOD:

DRILLING DATE:

DEPTH (m)	GRAPHIC LOG	CORE PRINT	PETROGRAPHIC DESCRIPTION
1.1			(115 - 121 cm) Gypsite, light greyish yellow; massive, with oxidized motley patches. Gypsum sand exhibits a variety of crystal morphologies, and the assemblages include cleavage flakes, crystallites, basal pinacoids, twinning flakes, chevron particles etc. (133 - 138 cm) Gypsite, greyish in colour; massive to bedded gypsite, as above but less evidence of subaerial oxidation and reworking.
1.4			(152 - 160 cm) Gypsite, as above. Gypsum grains larger and blocky in appearance. Both varieties of hemipyramidal and prismatic gypsum present. Also higher percentage of quartzose silt and clay intercalations. (177 - 183 cm) Gypsite, massive to incipiently bedded; greyish to brown in colour. Larger percentages of silt and clay impurities. Gypsum present as lenses displacively formed in a muddy groundmass; also, large number of twinning and basal pinacoids present.

LOG DESCRIPTIONS BY:
A. ARAKEL

BMR HOLE NUMBER P 13

BUREAU OF MINERAL RESOURCES, GEOLOGY AND GEOPHYSICS
PETROLOGICAL DESCRIPTION OF DRILL CORES

LOCATION OF BORE 1:100 000 SHEET CURTIN SPRINGS N.T.
SHEET NO 5247 GRID REF E 795830, N 7197280

R.N. _____
I.N. _____

DRILLING METHOD: AUGER TUBE

DRILLING DATE: NOVEMBER 1984

DEPTH (m)	GRAPHIC LOG	CORE PRINT
1.9		
2.4		
2.9		

PETROGRAPHIC DESCRIPTION

(194 - 198 cm)

Gypsite, brownish in colour, clayey matrix/groundmass. Hemipyramidal gypsum crystals appear, in some cases, to be grown displacively in kaolinitic clay matrix. Clay includes specs of feldspar and minor quartzose silt particles. Some evidence of alteration of feldspar to dolomite.

(212 - 218 cm)

Dolomitic clay, brownish in colour, massive with minor quartzose silt load. The quartzose particles are commonly well rounded and dolomite is evenly distributed within the kaolinitic clay groundmass. Small parches of gypsum and traces of powdery calcite randomly distributed in dolomitic-clay groundmass.

(242 -247)

Silty clay, dark brown; massive, with small pods of powdery gypsum. Gypsum in the pods is nodular to massive in appearance, and composed of hemipyramidal crystals that are mostly intergrown and welded.

LOG DESCRIPTIONS BY: A. ARAKEL

BMR HOLE NUMBER P 13

BUREAU OF MINERAL RESOURCES, GEOLOGY AND GEOPHYSICS
PETROLOGICAL DESCRIPTION OF DRILL CORES

LOCATION OF BORE 1:100 000 SHEET CURTIN SPRINGS N.T.
SHEET NO 5247 GRID REF E 795830, N 7197280

R.N. _____
I.N. _____

DRILLING METHOD: AUGER TUBE

DRILLING DATE: NOVEMBER 1984

DEPTH (m)	GRAPHIC LOG	CORE PRINT
3.4		
3.9		
4.4		

PETROGRAPHIC DESCRIPTION

(296 - 302 cm)

Sandy silt and mud, dark brownish; massive. The quartzose grains are well rounded (aeolian reworking; wind blown sand), with minor alteration in their colour to light grey. Few silt size heavy minerals present.

(442 - 448 cm)

As above, very dark brown.

LOG DESCRIPTIONS BY:
A. ARAKEL

BMR HOLE NUMBER P 13

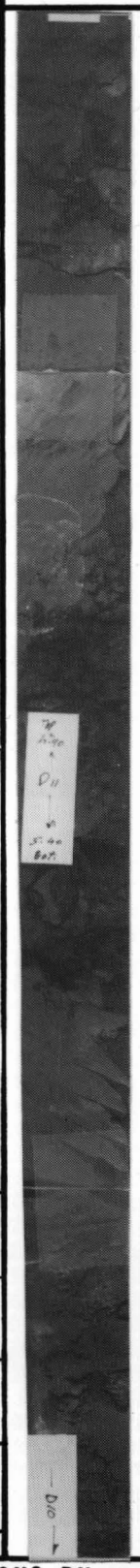
BUREAU OF MINERAL RESOURCES, GEOLOGY AND GEOPHYSICS
PETROLOGICAL DESCRIPTION OF DRILL CORES

LOCATION OF BORE CURTIN SPRINGS
1:100 000 SHEET N.T.
SHEET NO 5247 **GRID REF** E 795830, N 7197280

R.N. _____
I.N. _____

DRILLING METHOD: AUGER TUBE

DRILLING DATE: NOVEMBER 1984

DEPTH (m)	GRAPHIC LOG	CORE PRINT
4.9		
5.4		

PETROGRAPHIC DESCRIPTION

(550 - 555 cm)
As above, dark to very dark brown.

LOG DESCRIPTIONS BY: A. ARAKEL

BMR HOLE NUMBER P 13

BUREAU OF MINERAL RESOURCES, GEOLOGY AND GEOPHYSICS
PETROLOGICAL DESCRIPTION OF DRILL CORES

LOCATION OF BORE CURTIN SPRINGS
1:100 000 SHEET N.T.
SHEET NO 5247 **GRID REF**
E 795830, N 7197280

R.N.
I.N.

DRILLING METHOD: AUGER TUBE

DRILLING DATE: NOVEMBER 1984

DEPTH (m)	GRAPHIC LOG	CORE PRINT	PETROGRAPHIC DESCRIPTION
5.9			
6.4			
6.9			

LOG DESCRIPTIONS BY:
A. ARAKEL

BMR HOLE NUMBER P 13

BUREAU OF MINERAL RESOURCES, GEOLOGY AND GEOPHYSICS
PETROLOGICAL DESCRIPTION OF DRILL CORES

LOCATION OF BORE CURTIN SPRINGS
1:100 000 SHEET N.T.
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E 795830, N 7197280

R.N.
I.N.

DRILLING METHOD: AUGER TUBE

DRILLING DATE: NOVEMBER 1984

DEPTH (m)	GRAPHIC LOG	CORE PRINT
7.3		
7.8		
8.4		

PETROGRAPHIC DESCRIPTION

(744 - 750 cm)
As above; very stiff kaolinitic clay.

LOG DESCRIPTIONS BY:
A. ARAKEL

BMR HOLE NUMBER P 13

BUREAU OF MINERAL RESOURCES, GEOLOGY AND GEOPHYSICS
PETROLOGICAL DESCRIPTION OF DRILL CORES

LOCATION OF BORE 1:100 000 SHEET CURTIN SPRINGS N.T.
SHEET NO 5247 GRID REF E 795830, N 7197280

R.N. _____
I.N. _____

DRILLING METHOD: AUGER TUBE

DRILLING DATE: NOVEMBER 1984

DEPTH (m)	GRAPHIC LOG	CORE PRINT
8.0		
9.4		
9.5		

PETROGRAPHIC DESCRIPTION

(942 - 946 cm)

Dolomite sand, greenish-white in colour; massive with minor clay-feldspar remains. Analcime [$NaAl(SiO_3)_2.H_2O$], a hydrated Na-bearing zeolite has been identified in thin-section, XRD and SEM as forming 10-30% of the mineral mode in dolomite.

LOG DESCRIPTIONS BY: A. ARAKEL

BMR HOLE NUMBER P 13

BUREAU OF MINERAL RESOURCES, GEOLOGY AND GEOPHYSICS
PETROLOGICAL DESCRIPTION OF DRILL CORES

LOCATION OF BORE: CURTIN SPRINGS N.T.
1:100 000 SHEET
SHEET NO 5247 GRID REF -

R.N. _____
I.N. _____

DRILLING METHOD: TUBE INSERTION

DRILLING DATE: OCTOBER 1986

DEPTH (m)	GRAPHIC LOG	CORE PRINT	PETROGRAPHIC DESCRIPTION
0			(0 - 17 cm) Gypsite, dark brownish; massive. Large, gravel-size, gypsum crystals set in dark brownish quartzose silty mud groundmass.
0.3		TOP ↑ LDH1 A.	(17 - 44 cm) Gypsite, as above. Gypsiferous quartzose silt; highly reduced clay as the matrix.
			(44 - 58 cm) Gypsiferous silty mud, massive, brown in colour. Gypsum grains mostly sand size and smaller partially carbonated. Sharp lower contact.
0.7		TOP ↑ LDH1 B.	(58 - 81 cm) Gypsiferous silty mud, massive to banded. Gravel size gypsum crystals. Traces of illite clay and evidence of soil zone bioturbation. Partial comentation by oxides.

LOG DESCRIPTIONS BY: A. ARAKEL

BMR HOLE NUMBER LDH 1

BUREAU OF MINERAL RESOURCES, GEOLOGY AND GEOPHYSICS
PETROLOGICAL DESCRIPTION OF DRILL CORES

LOCATION OF BORE: CURTIN SPRINGS N.T.
1:100 000 SHEET
SHEET NO 5247 GRID REF -

R.N.
I.N.

DRILLING METHOD: TUBE INSERTION
DRILLING DATE: OCTOBER 1986

DEPTH (m)	GRAPHIC LOG	CORE PRINT	PETROGRAPHIC DESCRIPTION
1.05			(81 - 100 cm) As above (100 - 115 cm) Quartzose silty clay; mostly massive quartzose silt with minor amounts of kaolinitic clay and loose gypsum (seed) grains. (115 - 124.5 cm) As above but with large percentage of highly ferruginous rounded grains.
1.25			

LOG DESCRIPTIONS BY: A. ARAKEL

BMR HOLE NUMBER LDH 1

BUREAU OF MINERAL RESOURCES, GEOLOGY AND GEOPHYSICS
PETROLOGICAL DESCRIPTION OF DRILL CORES

LOCATION OF BORE CURTIN SPRINGS N.T.
1:100 000 SHEET _____
SHEET NO 5247 **GRID REF** -

R.N. _____
I.N. _____

DRILLING METHOD: TUBE INSERTION

DRILLING DATE: OCTOBER 1986

DEPTH (m)	GRAPHIC LOG	CORE PRINT
0		
0.15		
0.3		
0.45		
0.6		
0.85		

PETROGRAPHIC DESCRIPTION

(0 - 5 cm)

Gypsum sand, massive, dark brown; incorporating silt and clay material. Halite as efflorescent material

(5 - 20 cm)

Gypsum sand, dark brown massive gypsum set in quartzose silt and clay groundmass. Gypsum is motley and also secondary gypsum as cement in patches of silt and clay. Some of the gypsum grains are highly pitted, indicating near-surface dissolution. They are also broken and frosted. Mostly hemipyramidal coarse sand size particles.

(20 - 41 cm)

Gypsite, massive, dark greyish brown; gravel size gypsum crystals (euhedral to anhedral) and crystallites in greyish clayey quartzose silt.

(41 - 65 cm)

Gypsum sand set in quartzose silt and kaolinitic clay. Massive and brownish in colour. Gypsum grains highly variable in size (coarse sand to gravel size) and mostly broken with ample surficial dissolution features.

(65 - 82 cm)

Quartzose silty clay, dark brownish colour; massive; with dark ferrugi-nised grains and some soil forming features. Minor degree of gypsification. Clay is mostly illite.

LOG DESCRIPTIONS BY:
A. ARAKEL

BMR HOLE NUMBER LDH 2

SHEET 20 **OF** 24

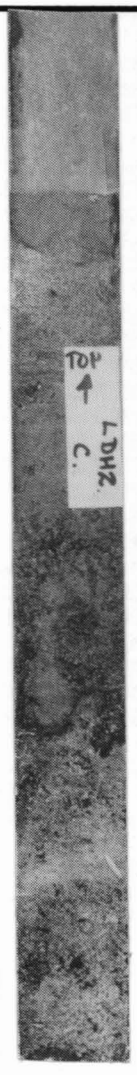
BUREAU OF MINERAL RESOURCES, GEOLOGY AND GEOPHYSICS
PETROLOGICAL DESCRIPTION OF DRILL CORES

LOCATION OF BORE CURTIN SPRINGS N.T.
1:100 000 SHEET —
SHEET NO 5247 **GRID REF** -

R.N. —
I.N. —

DRILLING METHOD: TUBE INSERTION

DRILLING DATE: OCTOBER 1986

DEPTH (m)	GRAPHIC LOG	CORE PRINT	PETROGRAPHIC DESCRIPTION
1.0			(82 - 84 cm) Gypsite sand, incipient, brown. Sugary hemipyramidal gypsum crystals, including some quartzose silt material. (84 - 102 cm) Quartzose silty clay, brownish; massive. Large percentage of dark brown-grey ferruginised grains which together with quartzose (clear) sand grains are set in a dark brown clayey matrix. Gypsum a very minor constituent; as a late-stage cementing medium. (102 - 112 cm) As above but with no traces of gypsum. (112 - 117 cm) As above, but more carbonated. (117 - 123.5 cm) As above, no gypsum.
1.15			
1.3			
1.38			

LOG DESCRIPTIONS BY: A. ARAKEL

BMR HOLE NUMBER LDH 2

BUREAU OF MINERAL RESOURCES, GEOLOGY AND GEOPHYSICS

PETROLOGICAL DESCRIPTION OF DRILL CORES

LOCATION OF BORE: CURTIN SPRINGS N.T.

1:100 000 SHEET _____

SHEET NO 5247 GRID REF -

R.N. _____

I.N. _____

DRILLING METHOD: TUBE INSERTION

DRILLING DATE: OCTOBER 1986

DEPTH (m)	GRAPHIC LOG	CORE PRINT
0		LDH3 B. TOP
0.15		
0.3		
0.45		LDH3 A. TOP
0.6		
0.68		

PETROGRAPHIC DESCRIPTION

(0 - 18 cm)

Gypsum sand, massive, dark brown in colour. Hemipyramidal gypsum crystals and crystallites, forming an assemblage with minor quartzose silt and clay intercalations. Halite present as efflorescent material. Gypsum crystals are commonly broken and partially pitted because of surface dissolution. Gypsum also present as a secondary cement.

(18 - 39 cm)

Gypsite, massive to mottled, greyish brown, gravel sized gypsum crystals within a quartzose silty and clay groundmass. Gypsum crystals mostly euhedral to subhedral and show some degree of solution pitting. Cleavage particles of the hemipyramidal crystals common to prevalent. Secondary gypsum also act as a cement medium in clayey mottles.

(39 - 54 cm)

As above; but gypsum grains finer and have more distinct dissolution features. Clay is mainly illite.

(54 - 68 cm)

As above. Both fine sand and gravel size gypsum particles present (crystals, crystallites, cleavage flakes, basal pinacoids and combinations, etc.). Minor dissolution features. Clay is mainly illite.

LOG DESCRIPTIONS BY: A. ARAKEL

BMR HOLE NUMBER LDH 3

BUREAU OF MINERAL RESOURCES, GEOLOGY AND GEOPHYSICS
PETROLOGICAL DESCRIPTION OF DRILL CORES

LOCATION OF BORE CURTIN SPRINGS
1:100 000 SHEET N.T.
SHEET NO 5247 **GRID REF** -

R.N. _____
I.N. _____

DRILLING METHOD: TUBE INSERTION

DRILLING DATE: OCTOBER 1986

DEPTH (m)	GRAPHIC LOG	CORE PRINT
0		
0.15		
0.3		
0.45		
0.6		

PETROGRAPHIC DESCRIPTION

(0 - 3 cm)

Quartzose silt, dark grey in colour; quartzose grains highly angular but well sorted. Minor clay and oxide content. Few sugary gypsum grains also present. Halite, as efflorescence material, present on top of the core.

(3 - 27 cm)

Quartzose silty sand, greyish to dark greyish in colour. Incipiently banded medium to coarse sand size quartzose sand incorporating glauberite nodules. Glauberite crystals in the nodules are euhedral, platy to subhedral. Minor clay and traces of organic material and crystal shards also present.

(27 - 37 cm)

Quartzose silty clay, dark brown; massive to motley. Quartzose grains partially rounded and incorporate oxidised clay patches. Some large and highly angular quartz sand grains also present. Both illite and kaolinite clays present.

(37 - 60 cm)

As above, but the whole groundmass is highly oxidized and clay fraction is mostly illitic. Loosely cemented quartzose grains are highly unsorted and variable in rounding. Some small, well-rounded dark (opaque) grains also present.

LOG DESCRIPTIONS BY:
A. ARAKEL

BMR HOLE NUMBER GL 01

BUREAU OF MINERAL RESOURCES, GEOLOGY AND GEOPHYSICS
PETROLOGICAL DESCRIPTION OF DRILL CORES

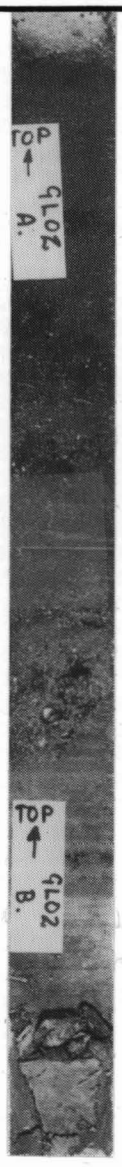
LOCATION OF BORE CURTIN SPRINGS N.T.
1:100 000 SHEET _____
SHEET NO 5247 **GRID REF** -

R.N. _____
I.N. _____

DRILLING METHOD: TUBE INSERTION

DRILLING DATE: OCTOBER 1986

DEPTH (m)	GRAPHIC LOG	CORE PRINT
0		
0.15		
0.3		
0.45		
0.57		



PETROGRAPHIC DESCRIPTION

(0 - 3 cm)

Gypsum band, whitish in colour, massive. Minor halite and sylvite percentage as efflorescent material.

(3 - 30 cm)

Glauberite nodules, very dark grey to black, massive to nodular. Dark glauberite nodules emplaced in gypsiferous clayey mud groundmass. Glauberite crystals mostly euhedral and much larger than accompanying gypsum crystals. Quartzose sand grains as a minor constituent.

(30 - 42 cm)

As above but lighter in colour and some degree of oxidation in the porous zones.

(42 - 57 cm)

Quartzose clay, brownish in colour, clay (kaolinite) mostly motley, and incorporates some sugary gypsum crystals.

LOG DESCRIPTIONS BY:
A. ARAKEL

BMR HOLE NUMBER GL 02

SHEET 24 **OF** 24