RB 54/54

DEPARTMENT OF MINES
SOUTH AUSTRALIA

GEOLOGICAL SURVEY

NON-METALLIC SECTION

Report on

DIAMOND DRILLING OPERATIONS - ROADSIDE DOLOMITE

(AGGREGATE SOURCES - MARALINGA)

by

R. K. Johns
Senior Geologist

NON-METALLIC SECTION

Plan No.	Title	Scale
61-841	Aggregate Sources - Maralinga	Locality plan - 1 inch = 4 miles Quarry site - 1 inch = 100 ft.

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INTRODUCTION

A deposit of dolomite situated adjacent to the road at Roadside, north of Maralinga has been tested by diamond drilling to assess reserves available for quarrying and to test its suitability for concrete and road aggregate. At the present time supplies of crushed and screened limestone are obtained from a quarry atWatson. Following a reconnaissance in August 1961 recommendations were made for diamond drilling to test the Roadside deposit (Johns, unpublished report).

Diamond drilling was undertaken during the period 20/10/61 to 10/11/61. The cores were logged, split and submitted to the laboratory of the Highways and Local Government Department for aggregate tests. This report describes geological features of the deposits, drilling results and incorporates laboratory tests undertaken on the cores.

GEOLOGY

The Nullarbor limestone of Miocene age extends over the whole surface of the Nullarbor Plain and is exposed in the extensive quarry at Watson (elevation approximately 400 ft.). The plain is margined to the north by sand dunes which rise to 935 ft. at Mt. Beadell. These dunes extend far away to the northwest, north and north east and constitute part of the Great Victoria Desert. The sand dunes are absent locally eg. on Tietken Plain (elevation about 600 ft.) on which Roadside is located. The only rock outcrops noted in this area are of kunkar and dolomite.

The boring of a number of bores for water supplies in the region north of Nullarbor Plain has disclosed a variable thickness of Recent to Tertiary sands, clays, calcarenites and silts. These succeed Permian sands

and grits which generally rest on basement rocks of the Adelaide System (Marinoan siltstones, mudstones, shales and dolomite). One bore intersected diorite. The subsurface stratigraphy of this area has been recorded by Ludbrook. *

*Ludbrook N.H. (1961) "Subsurface Stratigraphy of the Meralinga Area, South Australia". Trans. Roy. Soc. S. Aust. 84 pp. 51-59.

THE DOLOMITE DEPOSITS

A study of bore logs disclosed that in water boring operations only three bores intersected hard dense dolomite at or near the surface - these are

Marcoo bore	A1	0-19 ft. "hard white and buff limestone"
" "	A2	0-16 ft. "white limestone"
Roadside	3B	0-13 ft. "very hard pink limestone".
		- 21 ft. 6 ins. "buff limestone".

The Marcoo bores are situated some nine miles north westerly from Roadside.

South of Roadside (about two miles south from bore 3B) a quarry approximately 100 ft. x 200 ft. and 15 ft. deep has exposed hard dense buff dolomite. This is traceable for some distance in outcrop beyond the quarry and is undoubtedly the formation penetrated at bore 3B. At bore 3B the dolomite forms a capping to a well defined tableland dissected to the northeast so that bore 3A several hundred yards distant and located in a depression failed to intersect dolomite. Tietken's Well is beyond the limits of this formation.

It is obvious that dolomite outcrops in a number of outliers but the limits are difficultto define because of the development of kunkar at the surface. Local developments of chert in nodules and irregular masses give a fragmentary appearance to near surface material at the quarry site.

The dolomite is buff to grey in colour, oolitic in parts and may be dense and massive or more commonly has a brecciated structure. Penecontemporaneous desiccation breccias and rounded and elongate brecciola pellets point to shallow water, probably lacustrine, sedimentation - the various occurrences marking the sites of former lakes or lagoons. A species of coxiella is sparsely distributed. The dolomites are similar lithologically to those of the Lake Eyre region though equivalence in age has not been verified. The age of these dolomitic sediments has not been determined but they are possibly of late?Tertiary age.

A sample from the quarry was submitted for partial chemical analysis with results as follow:

$CaCO_3$	$MgCO_3$	SiO_2	Fe_2O_3	P_2O_5
53.8	42.8	0.62	0.19	0.006

DIAMOND DRILLING

Ten diamond drill holes were completed in the period 20/10/61 to 10/11/61 to prove extensions of dolomite beyond the quarry, to ascertain its thickness and to procure samples for testing. The holes were all vertical; four penetrated the full thickness of the dolomite formation.

Depths and core recovery are summarised in the following table:

Bore No.	Depth (ft.)	Overall Core Recovery %	Dolomite Core Recovery %	Remarks
1	37	79.5	88.1	+ 30ft. quarryable stone. Full thickness penetrated.
2	21	47.6		Dolomite rather broken reflecting poor recovery.
3	14	63.1		"
4	33	97.0		33 ft. quarryable stone. Full thickness disclosed.
5	16	28.1		Dolomite rather broken, reflecting poor recovery.
6	35	50.0		"
7	30½	75.4		Dolomite broken particularly 0-9 ft.
8	32	91.4	100	31 ft. quarryable stone. Full thickness penetrated.
9	30	77.5		+ 30 ft. quarryable stone.
10	30	61.1		+ 30 ft. quarryable stone

The topmost few feet generally comprise nodular to massive kunkar

and contain irregular fragments of dolomite; chert nodules are present over a small area. The underlying dolomite may be buff or grey in colour, oolitic in part, and may be dense and massive or more typically display penecontemporaneous breccia structures. The dolomite in the cores below a depth variable from 4 to 12 ft. is invariably etched and shows narrow irregular solution tubes. A species of coxiella is present but no other macrofossils were observed.

The dolomite bed is at least 30ft. thick and is underlain by green-brown clays - these were penetrated in bores 1, 4 and 8.

LABORATORY INVESTIGATIONS

The cores were split and submitted to the laboratory of the Highways and Local Government Department for aggregate tests to determine the suitability of the material for road construction and concrete aggregate.

Two samples were submitted - comprising bulked cores from

1) Bores 1, 3, 4, 8, 9 and 10

2) Bores 2, 5, 6, and 7.

Their report is as follows:

"Both samples were crushed in the Laboratory to - ¾ inch and the following tests carried out

Los Angeles Abrasion test
Specific Gravity (to give water absorption)
Bitumen stripping Test
Sulphate Soundness Test.

Results were

Sample 1 (612 - A - 1873)

Los Angeles Abrasion Test	29%
Specific Gravity -	
Bulk apparent S.G. on saturated surface dry basis	2.63
" " " " dry basis	2.57
Apparent specific gravity	2.74
Water absorption	2.4%

Bitumen stripping - resistance to stripping is comparable with Linwood and Tailem Bend screenings.

Sodium Sulphate Test -	
Loss after five cycles	24%

Sample 2 (612 - A - 1874)

Los Angeles Abrasion Test	24%
Specific Gravity -	
Bulk apparent S.G. on saturated surface dry basis	2.59
" " " " dry basis	2.52
Apparent specific gravity	2.70
Water absorption	2.7%
Bitumen stripping - resistance to stripping is comparable with Linwood and Tailem Bend screenings	
Sodium Sulphate Test -	
Loss after five cycles	47%

CONCLUSIONS

Diamond drilling undertaken at the site of the Roadside quarry has outlined reserves of 190,000 cub. yds. of dolomite in a bed which maintains a thickness of 30 ft. Extensions beyond this area have not been delineated but large reserves are here assured.

Core recovery varied from 28% to almost 100% - the poor recovery in several holes being a reflection of the broken nature of the stone.

The stone is hard, generally brittle and from the Los Angeles Test shows an adequate measure of resistance to both impact and abrasion.

A disquieting feature disclosed in laboratory work is the high loss with the Sulphate Soundness Test - a determination of the resistance of an aggregate to weathering action. The loss is least in Sample 1 which comprises bulked cores from bores 1, 3, 4, 8, 9 and 10. For this reason and because these showed better quality stone (reflected in higher core recovery) it is recommended that the quarry be extended in a northerly direction to embrace the area outlined by these bores.

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SENIOR GEOLOGIST
NON-METALLIC SECTION

RKJ:AGK
9/3/62

APPENDIX - DIAMOND DRILL LOGS

BARALINGA BORE 1

From	To	Recovery	Log
0	2'0"	1'2"	Brown and buff nodular kunkar as matrix to irregular fragments of buff dolomite.
2'0"	5'8"	1'3"	Brown and buff nodular kunkar as matrix to irregular fragments of buff dolomite.
5'8"	30'0"	24'0"	Buff, hard and generally dense fine grained dolomite. Oolitic throughout and occasional gaxiella. Pseudo brecciated structure (penecontemporaneous desiccation breccias) and brecciola structures. From 12 ft. thin irregular solution cavities.
30'0"	30'9"	0'9"	Green-brown clayey dolomite.
30'9"	35'0"	1'0"	Buff-brown dense fine grained dolomite.
35'0"	37'0"	5"	Green-brown clayey dolomite.

Logged by R.K. Johns
23/11/61.

BARALINGA BORE 2

From	To	Recovery	Log
0	2'0"	1'4"	Nodular kunkar passing down into hard dense kunkar with unreplaced buff dolomite.
2'0"	4'0"	1'0"	Gritty kunkar with irregular fragments of dolomite.
4'0"	6'0"	1'5"	Gritty kunkar with irregular fragments of dolomite.
6'0"	8'0"	1'2"	Gritty kunkar with irregular fragments of dolomite.
8'0"	10'0"	1'0"	Gritty kunkar with irregular fragments of dolomite.
10'0"	12'0"	0'9"	Dense fine grained hard grey dolomite.
12'0"	16'0"	1'10"	" " " " " "
16'0"	21'0"	1'6"	" " " " " " somewhat leached from 12 ft.

Logged by R.K. Johns
23/11/61

MARALINGA BORE 3

Log

From	To	Recovery	
0	2'0"	1'2"	Brown nodular kunkar.
2'0"	3'6"	1'9"	Fragments grey dolomite cemented by kunkar.
3'6"	4'6"	1'2"	" " " " " "
4'6"	5'0"	0'6"	" " " " " "
5'0"	7'0"	1'3"	" " " " " "
7'0"	8'6"	0'6"	" " " " " "
8'6"	10'0"	1'0"	Dolomite breccia, numerous grey ? cherty fragments.
10'0"	14'0"	1'6"	Dense grey fine grained dolomite, occasional solution holes.

Logged by R.K. Johns
23/11/61.

MARALINGA BORE 4

Log

From	To	Recovery	
0	2'0"	1'2"	Brown nodular kunkar with fragments of buff dolomite.
2'0"	4'3"	2'0")	Buff to grey hard dolomite "breccia" oolitic in part - fragments rounded and subangular, narrow solution cavities from 4'0".
4'3"	5'0"	0'6")	
5'0"	31'0"	26'0")	
31'0"	31'3"	0'3"	Green brown clayey dolomite.
31'3"	33'0"	2'1"	Dense fine grained brown to buff dolomite
33'0"			Green brown clay.

Logged by R.K. Johns
23/11/61

MARALINGA BORE 5

Log

From	To	Recovery	
0	2'0"	0'10"	Nodular to massive kunkar.
2'0"	4'0"	1'0"	Buff dolomite fragments cemented by kunkar.
4'0"	5'0"	0'10")	Buff to grey oolitic dolomite "breccia", hard and dense with narrow solution cavities.
5'0"	8'0"	0'6")	
8'0"	11'0"	1'3")	
11'0"	16'0"	0'1")	

Logged by R.K. Johns
23/11/61

MARALINGA BORE 6

Log

From	To	Recovery	
0	2'0"	1'7"	Modular to massive kunkar with fragments grey dolomite.
2'0"	3'0"	1'0"	Buff and grey dolomite, generally hard and dense. "Breccia" structure throughout; in part oolitic and occasional oxiella. Solution cavities apparent from 5'0".
3'0"	5'0"	1'4"	
5'0"	6'6"	0'6"	
6'6"	8'6"	1'3"	
8'6"	10'0"	0'4"	
10'0"	12'9"	2'3"	
12'9"	14'0"	0'3"	
14'0"	15'0"	0'6"	
15'0"	16'6"	0'9"	
16'6"	18'0"	0'9"	
18'0"	19'2"	1'0"	
19'2"	20'0"	0'10"	
20'0"	21'6"	0'6"	
21'6"	23'0"	1'0"	
23'0"	24'6"	1'0"	
24'6"	26'6"	1'6"	
26'6"	28'6"	1'4"	
28'6"	30'6"	1'4"	
30'6"	35'0"	1'6"	

Logged by R.K. Johns
23/11/61

MARALINGA BORE 7

Log

From	To	Recovery	
0	3'3"	1'6"	Modular to massive kunkar with dolomite fragments.
3'3"	5'0"	0'4"	Buff dolomite
5'0"	7'0"	0'2"	Soft to hard buff dolomite
7'0"	9'0"	0'6"	Hard dense fine grained dolomite
9'0"	29'6"	20'0"	Hard dense buff to grey fine grained dolomitic "breccia"; solution cavities apparent from 11'0". Occasional oxiella apparent.
29'6"	30'6"	0'6"	Leached oxiella dolomite.

Logged by R.K. JOHNS
23/11/61

MARALINGA BORE 8

Log

From	To	Recovery	
0	5'0"	2'3"	Massive brown kunkar passing into hard dense buff fine grained dolomite.
5'0"	27'0"	22'0"	Hard dense fine grained buff to grey dolomite "breccia", oolitic in part. "Breccia" fragments rounded to subangular. Solution cavities throughout.
27'0"	31'0"	4'0"	Leached coxiella bearing dolomite, generally hard.
31'0"	32'0"	1'0"	Green brown clay, dolomitic, with occasional quartz grit.

Logged by R.K. Johns
23/11/61

MARALINGA BORE 9

Log

From	to	Recovery	
0	1'3"	1'0"	Nodular to massive kunkar with dolomite fragments.
1'3"	3'0"	1'3"	Buff dolomite with little kunkar, cementing fragments.
3'0"	30'0"	21'0"	Hard, dense fine grained buff to grey dolomite "breccia", small solution cavities throughout; occasional coxiella discernible.

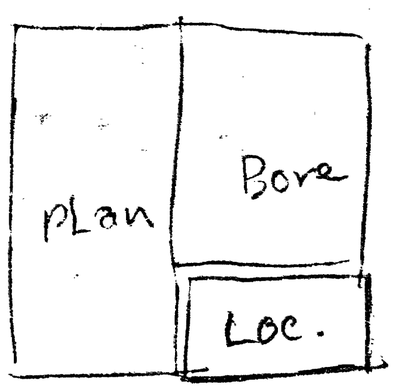
Logged by R. K. Johns
23/11/61

MARALINGA BORE 10

Log

From	To	Recovery	
0	3'0"	1'4"	Nodular to massive kunkar.
3'0"	4'0"	0'11"	Kunkar with nodules of grey and white chert.
4'0"	5'0"	1'0"	Gritty kunkar with some unreplaced buff dolomite fragments.
5'0"	30'0"	22'0"	Fine grained hard buff dolomite "breccia" - somewhat broken and leached from 13'0".

Logged by R. K. Johns
23/11/61



Tietken's Well.

Bore 3B

Roadside

Quarry Site
(See Enlargement)

N

Maralinga
Village.

Mt. Beadell.

Lake
Yarle

Plain

Nullarbor

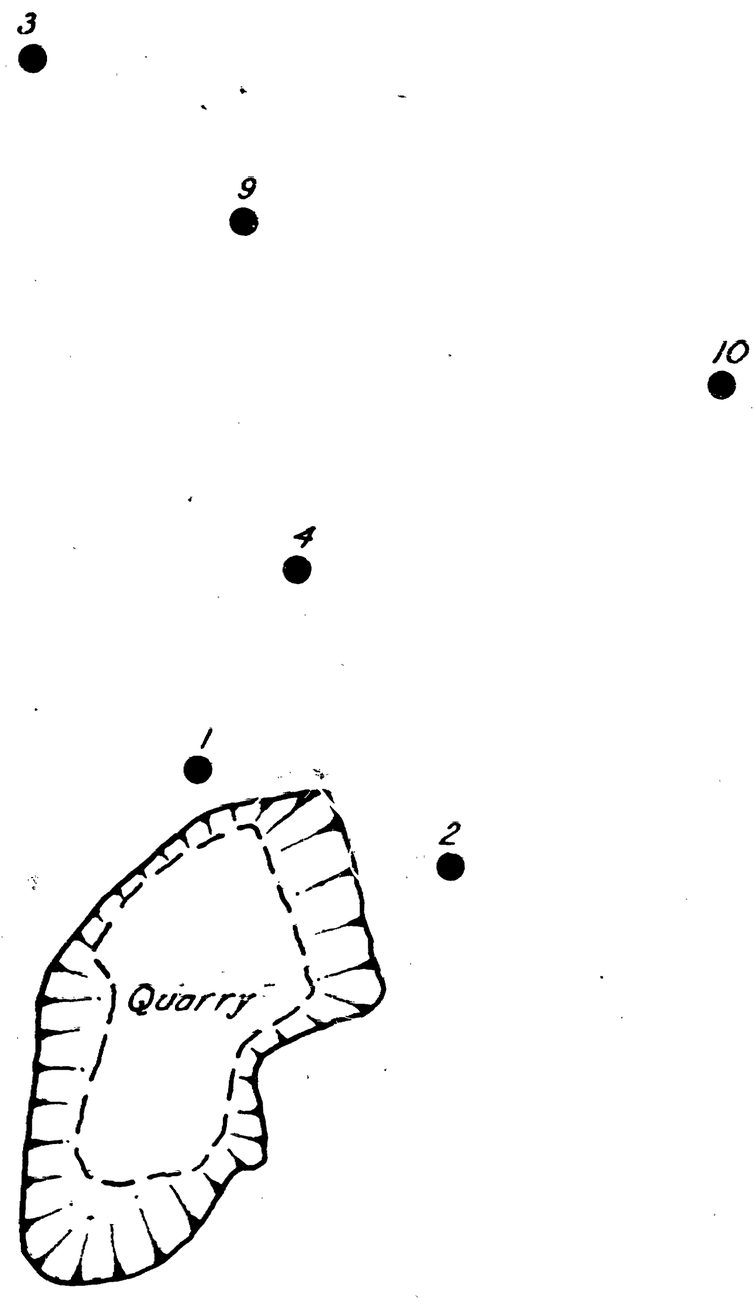
Transcontinental Railway

Watson

Quarry

E. to W.

Scale: 1inch to 4miles.



LEGEND

Diamond Drill Holes..... 10

Scale: 1inch to 100 feet.

To accompany report by R.K. Johns.

53-54

Amendment	Exd.	Date

S.A. DEPARTMENT OF MINES

AGGREGATE SOURCES
MARALINGA

Approved	Passed		Scales: As shown
		Drn.	
		Tcd. C.F.	61-841 Ac.
		Ckd. R.R.	
Director		Exd.	Date 28-11-61

2.61 3805